ERID-241083

LA-UR-13-22536
April 2013
EP2013-0065

Results of 2012 Sediment Monitoring in the Water Canyon and Cañon de Valle Watershed

Los Alamos
NATIONAL LABORATORY
EST. 1943

Prepared by the Environmental Programs Directorate

EP2013-0065

Results of 2012 Sediment Monitoring in the Water Canyon and Cañon de Valle Watershed

April 2013

Responsible project manager:

Steve Veenis	*[signature]*	Project Manager	Environmental Programs	4-24-13
Printed Name	Signature	Title	Organization	Date

Responsible LANS representative:

Jeff Mousseau	*[signature]* for JM	Associate Director	Environmental Programs	4/24/13
Printed Name	Signature	Title	Organization	Date

Responsible DOE representative:

Peter Maggiore	*[signature]* for	Assistant Manager	DOE-NA-00-LA	4-26-2013
Printed Name	Signature	Title	Organization	Date

CONTENTS

Figures

Tables

Appendix

1.0 INTRODUCTION

This report presents the results obtained from geomorphic characterization and sediment samples collected in Water Canyon and Cañon de Valle in 2012. Together, these drainage systems and their tributaries comprise the Water Canyon and Cañon de Valle watershed. Water Canyon and Cañon de Valle are the largest drainages within the watershed and are the only canyons in the watershed that head on the flanks of the Sierra de los Valles rather than on the Pajarito Plateau. Cañon de Valle is tributary to Water Canyon; therefore, the Water Canyon watershed refers to Water Canyon, Cañon de Valle, and their tributaries. These field activities satisfy a requirement within the New Mexico Environment Department's (NMED's) notice of approval dated October 11, 2012 (NMED 2012, 521359) of the Reconnaissance Survey Report for Post–Las Conchas Fire Flooding in Water Canyon and Cañon de Valle (LANL 2012, 223032), which, in turn, fulfilled the NMED's notice of disapproval for the investigation report (IR) for Water Canyon/Cañon de Valle, dated February 14, 2012 (NMED 2012, 211217). The approval of the reconnaissance survey accepted Los Alamos National Laboratory's (the Laboratory's) recommendation for continued, post–monsoon season sediment sampling to assess potential impacts from additional flooding on the potential for erosion and downcanyon transport of contaminants (NMED 2012, 521359). In lieu of a Phase II investigation report, the approval of the reconnaissance survey also included a requirement to provide the results of annual sampling in a report to the NMED by April 30, 2013, and April 30, 2014. This report satisfies that requirement for sampling conducted in 2012.

NMED's notice of approval included the following additional recommendations: (1) monitoring surface water, springs, and alluvial groundwater at a frequency of no less than twice annually and in accordance with the current Interim Facility-Wide Groundwater Monitoring Plan (LANL 2012, 225493); (2) monitoring storm water at stations located both upgradient and downgradient of the Laboratory; (3) deferring consideration of the need for the permeable reactive barriers (PRBs) and replacing destroyed alluvial wells until 2014 and continuing to monitor storm water at existing boundary stations because of the potential for continued flood damage for the next several years; and (4) making every effort to garner approval to utilize the filters currently located at several Technical Area 16 (TA-16) springs (NMED 2012, 521359). Monitoring of surface water, springs, and alluvial groundwater has been conducted twice annually, and these results are reported in a periodic monitoring report following the sampling event (LANL 2012, 232283). Monitoring results for storm water samples collected up- and downgradient of the Laboratory at the boundary stations are reported in the Storm Water Individual Permit Annual Report (LANL 2013, 237680). Additionally, the surface water, springs, alluvial groundwater, and storm water monitoring results will also be presented in the Laboratory's 2012 Environmental Report, which will be issued later in 2013. Evaluation of the PRBs and replacement of the alluvial wells continue to be deferred until 2014. The Laboratory has met with regulatory agencies to gain approval to activate the filters at the TA-16 springs (LANL 2012, 222838). Approval to activate the filters has not been granted, but the Laboratory will continue to pursue the recommendation.

In June and July 2011, the Las Conchas fire burned the headwaters of Cañon de Valle and Water Canyon west of NM 501 (Figure 1.0-1). Approximately 16.9 km^2 of the Water Canyon and Cañon de Valle watershed was within the burn perimeter, comprising 34% of the watershed. Within that burn perimeter, 46% was classed as high- or moderate-severity burn, and 54% was identified as low-severity burn or unburned (LANL 2011, 206488). The upper Cañon de Valle watershed was burned more intensely than the upper Water Canyon watershed. Sixty percent of the Cañon de Valle watershed was classified as high- or moderate-severity burn, whereas only 36% of the upper Water Canyon watershed was severely burned (LANL 2011, 206488). Floods in July 2012, August 2012, and October 2012 impacted both canyons, causing localized scouring in parts of the canyons and sediment deposition in downgradient areas. This report focuses on the effect of floods on the geomorphology and sediment chemistry following the 2012 monsoon season.

1.1 Background

Previous sediment investigations, including geomorphic mapping, associated geomorphic characterization, and sediment sampling, were conducted in 25 investigation reaches in 2010 and 2011 using methods described in the Water Canyon/Cañon de Valle IR (LANL 2011, 207069). Fourteen of the 25 investigation reaches are located below areas of the Water Canyon/Cañon de Valle watershed that burned during the Las Conchas fire. These data represent a baseline from which post–Las Conchas flood effects can be evaluated.

Field activities were conducted in the summer and fall of 2011 and in the summer of 2012 in the 14 reaches located downstream of the area that burned during the Las Conchas fire to evaluate post–Las Conchas fire effects from 2011 monsoon season flood events on the Water Canyon/Cañon de Valle watershed. The effects of the first year of post–Las Conchas floods were documented in the "Reconnaissance Survey Report for Post–Las Conchas Fire Flooding in Water Canyon and Cañon de Valle" (LANL 2012, 223032).

Nine of the reaches located downstream of the area that burned during the Las Conchas fire were revisited in the fall of 2012 and winter of 2013 to evaluate post–Las Conchas fire effects from 2012 monsoon season flood events. Fine-grained sediment samples were collected from eight of these reaches. One reach (WA-5) was visited during a field reconnaissance but was not sampled because fine sediment of significant thickness (0.5 to 1 cm thick or more) was absent in the reach in 2013.

2.0 FIELD ACTIVITIES

2.1 Samples Collected and Analyses Performed

Field activities completed in the fall 2012 and winter 2013 included collecting post–Las Conchas fire fine-grained sediment samples from five of the original investigation reaches, plus two upstream baseline reaches above the Laboratory boundary and one reach downstream of the Laboratory boundary, just above the confluence with the Rio Grande. Sampling followed the methods used for the 2011 post-flood sediment sampling campaign (LANL 2012, 223032). Figure 1.0-1 shows the 2011 and 2012 sampling locations in the Water Canyon watershed. Table 2.1-1 presents the requested analytical suites for each sample collected from Water Canyon and Cañon de Valle in 2012. The majority of samples collected were fine-grained sediment and contained ash derived from the Las Conchas burn areas (Tables 2.1-1 and 2.1-2).

Analytical results for the sediment samples from the Water Canyon watershed are included as Appendix A (on CD). Tables 2.1-3 and 2.1-4 present the 2012 sample results above sediment background values (BVs) (LANL 1998, 059730) for inorganic chemicals and detected results for organic chemicals within the Water Canyon and Cañon de Valle watershed, respectively. Relevant historical data are also presented to compare post-fire data with the historical range of concentrations of key chemicals of potential concern (COPCs) (see section 3.3).

2.2 Geomorphic Cross-Section Surveying

A series of cross-sections was established and surveyed within the investigation reaches in 2010 and 2011 (LANL 2011, 207069; LANL 2012, 223032). In 2012, five cross-sections were surveyed to document erosion or deposition and to depict the geomorphic context of 2012 sediment samples (Figures 2.2-1 to 2.2-5). Geomorphic characterization followed the methods used for the 2011 post-flood sediment sampling campaign (LANL 2012, 223032).Cross-sections were surveyed using a hand level, tape measure, and stadia rod. Post-2012 monsoon season cross-sections are compared with pre-2012 monsoon season cross-sections to determine erosion and deposition from post-fire flood events at discrete locations within the sediment investigation reaches (Figures 2.2-1 to 2.2-5). Previously completed cross-sections were reoccupied using rebar installed at the starting and ending points of all cross-sections surveyed during the June 2012 field investigation. The new cross-section in reach CDV-2E was also monumented using rebar and metal tags. The thickness and extent of 2011 and 2012 sediment deposits on the CDV-2E section were determined based on stratigraphic relationships and measurements collected during the fall 2012 and winter 2013 field investigation. Post–Las Conchas erosion was determined based on the comparison between the 2012 surveyed profile and pre-2011 geomorphic mapping (LANL 2011, 207069).

3.0 RESULTS

3.1 Post-Fire Surface Flow Changes

Data on stream discharge after wildfires indicate peak discharge can increase up to several orders of magnitude relative to pre-fire conditions and that the largest post-fire floods typically occur within the first 3 yr after a fire. The time period in which runoff remains elevated varies between watersheds and between fires as a function of burn severity, the rate and nature of watershed recovery, and the occurrence of high-intensity rainfall events. Table 3.1-1 presents annual maximum discharges from 1994 to 2012 for gages in watersheds affected by the May 2000 Cerro Grande fire, indicating peak annual discharge increased up to several orders of magnitude relative to pre-fire conditions. At these gages, peak discharges returned to at or near pre-fire conditions after 1 to 7 yr, although some elevated discharges were not entirely related to hydrologic changes caused by the Cerro Grande fire (e.g., Pueblo Canyon where townsite-generated runoff is a factor). Excluding Pueblo Canyon, flows commonly remained elevated for up to 3 yr, indicating watersheds affected by the June 2011 Las Conchas fire could experience significantly greater flows through 2013.

Supporting information on the effects of wildfires on the hydrology of streams on the Pajarito Plateau is provided by studies of Frijoles and Capulin Canyons in Bandelier National Monument after the June 1977 La Mesa fire and the April 1996 Dome fire (Veenhuis 2002, 082605). After these fires, peak flows increased to about 160 times the maximum recorded before the fire. By the third year, maximum annual peak flows had decreased to about 3 to 5 times the pre-fire maximums as the watersheds recovered. The frequency of larger stream flows also increased after the La Mesa and Dome fires, remaining elevated for the first 3 yr. The data from Frijoles and Capulin Canyons support the inference that significantly altered hydrologic conditions could persist through 2013 in watersheds affected by the Las Conchas fire.

Maximum discharge in Water Canyon after the Cerro Grande fire was estimated at 840 cubic feet per second (cfs) measured at gaging station E252 above NM 501 and decreased downstream to 274 cfs at gaging station E265 below NM 4. Maximum discharge in Cañon de Valle was estimated at 740 cfs, measured at gaging station E253 above NM 501. A larger discharge flood event occurred on August 21, 2011, following the Las Conchas fire. Total precipitation for the August 21 event was 2.52 in., with a maximum 30-min intensity of 1.55 in. recorded at gaging station E257. The E252, E253, and E265 stream gages were destroyed during this flood event; however, peak-flow estimates were made using the area-slope method, based on cross-sections measured between high-water lines and the stream gradient. Flow estimates for the August 21, 2011, flood event ranged from 1450 cfs for Cañon de Valle above NM 501 to 1500–1600 cfs for Water Canyon above NM 501. Combined discharge in Water Canyon below NM 4, downstream of the confluence of Cañon de Valle and Water Canyon, was estimated at approximately 2400 cfs (Table 3.1-3).

The maximum 2012 flood discharge, recorded on July 11, 2012, at the reconstructed stream gages, was much lower than the 2011 maximum discharge: 135 cfs at gaging station E253 for Cañon de Valle above NM 501 and 118 cfs at gaging station E252 for Water Canyon above NM 501. Combined discharge in Water Canyon below NM 4, downstream of the confluence of Cañon de Valle and Water Canyon was 250 cfs at gaging station E265 during the July 11 event. Total precipitation for the July 11 event was 1.89 in., with a maximum 30-min intensity of 1.77 in. recorded at gaging station E253. Although the maximum 2012 discharge is much less than the maximum 2011 discharge, it was more than an order of magnitude higher than the maximum discharge observed in non-fire-affected years (during or within 3 yr of major fires).

3.2 Geomorphic Evaluation

Cross-sections from reaches sampled in 2012 (exclusive of baseline reaches and reach WA-6, upstream of the Water Canyon-Rio Grande confluence) depicting areas of erosion, sediment deposition, or minor bank erosion and deposition on adjacent floodplain surfaces are shown in Figures 2.2-1 to 2.2-5 and are described below. Figure 3.2-1 shows an example of 2012 fine sediments overlying 2011 coarse sediments on a former (pre-Las Conchas fire) c3 surface.

Cross-sections were surveyed at or near sampling locations in reaches CDV-1C, CDV-2E, CDV-4, WA-3, and WA-4. With the exception of reach CDV-2E, all cross-sections reoccupied previous cross-section locations. These cross-sections provide a transect of the Cañon de Valle/Water Canyon drainage from below NM 501 to the Laboratory boundary above NM 4. The cross-section located farthest upstream in the Cañon de Valle/Water Canyon drainage, cross-section in reach CDV-1C, shows erosion of pre-1943 alluvium below the active channel and erosion of part of the 2011 coarse-grained sediment deposits, along with deposition of fine-grained 2012 sediment deposits on a post-1942 floodplain (f1) surface (Figure 2.2-1). The cross-section in reach CDV-2E shows deposition of 2011 and 2012 post–Las Conchas sediment deposits on all post-1942 geomorphic surfaces as well as on a former pre-1943 fluvial terrace (Figure 2.2-2). Some erosion of pre-1943 alluvium and post-1942 sediment deposits occurred in 2011 and/or 2012 floods. The reach CDV-4 cross-section shows erosion of pre-1943 alluvium below the active channel, erosion of part of a post-1999 post-1942 channel (c2) deposit, and deposition of fine-grained 2012 sediment deposits on an f1 surface (Figure 2.2-3). The reach WA-3 cross-section shows deposition across most of the section, with up to 55 cm of coarse sediment on c2 and up to 30 cm of fine sediment on f1 surfaces (Figures 2.2-4). Some minor erosion of 2011 sediment deposits and pre-1943 alluvium also occurred. The deposition along the cross-section in reach WA-3 is likely the result of its location above a prominent log jam noted in the post-2011 monsoon investigation (LANL 2012, 223032). The reach WA-4 cross-section shows only minor changes at this location because of the 2012 floods. A small amount of erosion occurred in coarse-grained c1 and fine-grained f1 sediment deposits, and a small amount of deposition occurred on a former Quaternary terrace (Qt) surface (Figure 2.2-5).

The overall trend observed in the cross-sections surveyed following the 2012 monsoon season is one that includes erosion of pre-1943 alluvium and post-1942 deposits next to the active stream channel. This condition would result in downstream transport of sediment from geomorphic units with typically low concentrations of key constituents (c1, c2), while units with typically higher concentrations (c3, f1) remain generally intact. A similar trend of erosion of coarse-grained c1 and c2 units and preservation of fine-grained f1 units was observed in the post-2011 monsoon/pre-2012 monsoon investigation (LANL 2012, 223032). In four of the five cross-sections, 2012 sediment deposits are thin (less than 10 cm) and occur on all surfaces. Localized conditions, such as the log jam in reach WA-3, can result in localized aggradation of fine- and coarse-grained sediment deposits, as shown in Figure 2.2-4.

3.3 Post-Fire Sediment Contaminant Evaluation

Barium, RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine), and polychlorinated biphenyl (PCBs) have been identified as key COPCs in Water Canyon and Cañon de Valle (LANL 2011, 207069). Data from post–Las Conchas fire sediment samples collected in Water Canyon and Cañon de Valle (Table 2.1-1) are used to evaluate the sources of these COPCs in post-fire flood deposits. Samples collected in the fall of 2012 include deposits from the 2012 monsoon season flood events. The fall of 2012 sample results are compared to samples from the 2011 monsoon season flood events (LANL 2012, 223032) and pre-2011 samples collected for the investigation report (LANL 2011, 207069).

Barium is elevated above the sediment BV (127 mg/kg) in 2011 post–Las Conchas fire baseline sediment samples (reaches CDV-0 and WA-0 above NM 501; Figure 3.3-1) as a result of elevated barium in Las Conchas fire ash. Barium concentrations in 2012 baseline samples are above the sediment BV in two samples (containing ash) and below the sediment BV in two samples (both lacking ash). The variation in barium concentrations in background samples is likely related to ash concentrations (presence of ash corresponds to higher barium concentrations) and particle size (finer-grained samples correspond to higher barium concentrations [LANL 2011, 207069]). Barium concentrations in post-fire sediment samples increase in reaches below the TA-16 260 Outfall (reach CDV-2E) associated with the partial remobilization of contaminated sediment deposits and decreases downstream (Figure 3.3-1). These resultant barium concentrations are, however, well within the concentration distribution documented in the Water Canyon/Cañon de Valle IR (LANL 2011, 207069; Figure 3.3-2). Below NM 4 (reaches WA-5 and WA-6), barium concentrations in post-fire sediment samples are below concentrations reported in the 2011 baseline samples; therefore, barium from Laboratory sources is indistinguishable from barium derived from Las Conchas fire ash in these downgradient areas.

PCB congeners from sediment or water samples can be grouped together into 10 homologs, based on the number of chlorine atoms on the biphenyl rings, which allows visual comparison of similarities or differences between samples or groups of samples (Reneau et al. 2007, 102886). Figure 3.3-3 shows average homolog percentages in each of the sediment samples from Water Canyon and Cañon de Valle collected in 2011 and 2012. The 2012 PCB congener data are consistent with the 2011 and previous sediment data, indicating several PCB sources with at least two sources in the Cañon de Valle watershed (one possibly the 260 Outfall above reach CDV-2E and another above reach CDV-1C) and at least one other source in the Water Canyon watershed above the confluence with Cañon de Valle (LANL 2011, 207069; LANL 2012, 223032).

Total PCB concentrations are low (less than 0.004 mg/kg) in the sediment samples collected upstream of NM 501 in 2011 (reaches WA-0 and CDV-0) (Figure 3.3-4), reflecting baseline conditions and regional atmospheric sources. PCB concentrations increase downstream from Laboratory sources, with maximum values in single samples ranging between 0.008 mg/kg and 0.011 mg/kg in reaches CDV-2E, CDV-4, and WA-3 (Figure 3.3-4). Downstream of reach WA-3 the total PCB concentration decreases to less than 0.002 mg/kg in reach WA-5 and less than 0.001 mg/kg in reach WA-6, near the Rio Grande. The 2011 and 2012 total PCB concentrations are at the very low end of the concentration distribution documented in the Water Canyon/Cañon de Valle IR (LANL 2011, 207069; Figure 3.3-5).

RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) was not detected in any of the 2012 post monsoon samples. Low concentrations of HMX (octahydro-1,3,5,7-tetranitro-1,3,5,7 tetrazocine) and TATB (triaminotrinitrobenzene) were detected in reaches CDV-4 and WA-4 (Table 2.1-4). Measured concentrations of HMX and TATB were at the low end of the concentration distribution reported in the Water Canyon/Cañon de Valle IR (LANL 2011, 207069; Figures 3.3-6 and 3.3-7).

4.0 SUMMARY

The maximum 2012 flood discharge was approximately an order of magnitude lower than the maximum 2011 discharge but was more than an order of magnitude higher than the maximum discharge observed in non-fire-affected years (during or within 3 yr of major fires). Floods during the 2012 monsoon season resulted in preferential erosion of pre-1943 alluvium and post-1942 deposits next to the active stream channel. This condition would result in downstream transport of sediment from geomorphic units with typically low concentrations of key COPCs (c1, c2), while units with typically higher concentrations (c3, f1) are generally intact. This pattern was also observed in the post-2011 monsoon season investigation (LANL 2012, 223032).

Barium, high explosives (HMX, TATB), and PCB concentrations in fine-grained post–Las Conchas sediment deposits show decreasing concentrations downstream from Laboratory source areas and are well within the concentration distribution documented in the Water Canyon/Cañon de Valle investigation report (LANL 2011, 207069).

5.0 RECOMMENDATIONS

The Water Canyon watershed was subjected to significant burn impacts to headwater areas of Water Canyon and Cañon de Valle west of the Laboratory. Two large flood events damaged structures in August 2011, and several significant flood events occurred in July through October 2012. The resultant flood deposits show very low concentrations of the key COPCs, consistent with or less than pre-fire concentrations and substantially less than residential and recreational soil screening levels (SSLs) (LANL 2012, 228733; NMED 2012, 219971). Because the large post-fire floods in August 2011 and July through October 2012 resulted in no significant transport of Laboratory-derived contaminants in sediment to downstream reaches, there is no indication of the need for mitigation actions to reduce sediment transport during future floods.

Both the sediment and storm water data from the Cañon de Valle and Water Canyon yield a conceptual site model in which COPCs such as barium and PCBs are mobilized from non-Laboratory-affected burn areas above the Laboratory property and locally from affected areas within the Laboratory. COPCs from these two source areas likely mix, and for most key constituents, Laboratory contributions are indistinguishable from contributions derived from fire-affected areas. Depositional areas yield concentrations substantially lower in key COPCs, such as barium, than in reaches evaluated for risk before the 2011 fires. Thus, potential risks in depositional reaches are much lower than for reaches evaluated in the investigation report (LANL 2011, 207069).

To fulfill NMED's requirement for a Phase II work plan to characterize the post-flood contaminant distribution, the Laboratory will conduct a post–monsoon season sediment sampling effort in fall 2013 to assess the potential impacts from additional flooding. Sampling for the 2013 post-flood sediment sampling campaign will follow the methods described in this report. Consistent with the approved recommendation from the previous post-fire investigation report (LANL 2012, 223032), the Laboratory will prepare a summary report on the results of the 2013 sediment sampling effort. This summary report will be submitted by April 30, 2014.

6.0 REFERENCES

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

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

LANL (Los Alamos National Laboratory), September 22, 1998. "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at Los Alamos National Laboratory," Los Alamos National Laboratory document LA-UR-98-4847, Los Alamos, New Mexico. (LANL 1998, 059730)

LANL (Los Alamos National Laboratory), September 2011. "Las Conchas Wildfire Effects and Mitigation Actions in Affected Canyons," Los Alamos National Laboratory document LA-UR-11-4793, Los Alamos, New Mexico. (LANL 2011, 206488)

LANL (Los Alamos National Laboratory), September 2011. "Investigation Report for Water Canyon/Cañon de Valle," Los Alamos National Laboratory document LA-UR-11-5478, Los Alamos, New Mexico. (LANL 2011, 207069)

LANL (Los Alamos National Laboratory), July 2012. "Reconnaissance Survey Report for Post–Las Conchas Fire Flooding in Water Canyon and Cañon de Valle," Los Alamos National Laboratory document LA-UR-12-23405, Los Alamos, New Mexico. (LANL 2012, 223032)

LANL (Los Alamos National Laboratory), August 2012. "Interim Facility-Wide Groundwater Monitoring Plan for the 2013 Monitoring Year, October 2012–September 2013," Los Alamos National Laboratory document LA-UR-12-21331, Los Alamos, New Mexico. (LANL 2012, 225493)

LANL (Los Alamos National Laboratory), September 2012. "Semiannual Progress Report for Corrective Measures Evaluation/Corrective Measures Implementation for Consolidated Unit 16-021(c)-99," Los Alamos National Laboratory document LA-UR-12-24595, Los Alamos, New Mexico. (LANL 2012, 222838)

LANL (Los Alamos National Laboratory), October 2012. "Technical Approach for Calculating Recreational Soil Screening Levels for Chemicals, Revision 3," Los Alamos National Laboratory document LA-UR-12-25447, Los Alamos, New Mexico. (LANL 2012, 228733)

LANL (Los Alamos National Laboratory), November 2012. "Periodic Monitoring Report for the Technical Area 16 260 Monitoring Group, July 10–July 25, 2012," Los Alamos National Laboratory document LA-UR-12-26144, Los Alamos, New Mexico. (LANL 2012, 232283)

LANL (Los Alamos National Laboratory), March 2013. "Storm Water Individual Permit Annual Report, Reporting Period: January 1–December 31, 2012, NPDES Permit No. NM0030759," Los Alamos National Laboratory document LA-UR-13-20566, Los Alamos, New Mexico. (LANL 2013, 237680)

NMED (New Mexico Environment Department), February 2012 (updated June 2012). "Risk Assessment Guidance for Site Investigations and Remediation," Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program, Santa Fe, New Mexico. (NMED 2012, 219971)

NMED (New Mexico Environment Department), February 14, 2012. “Notice of Disapproval, Investigation Report for Water Canyon/Cañon de Valle,” New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M.J. Graham (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2012, 211217)

NMED (New Mexico Environment Department), October 11, 2012. “Approval, Reconnaissance Survey Report for Post-Las Conchas Fire Flooding in Water Canyon and Cañon De Valle,” New Mexico Environment Department letter to P. Maggiore (DOE-LASO) and J.D. Mousseau (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2012, 521359)

Reneau, S.L., D. Katzman, G.A. Kuyumjian, A. Lavine, and D.V. Malmon, February 2007. “Sediment Delivery After a Wildfire,” *Geology,* Vol. 35, No. 2, pp. 151–154. (Reneau et al. 2007, 102886)

Veenhuis, 2002. “Effects of Wildfire on the Hydrology of Capulin and Rito de Los Frijoles Canyons, Bandelier National Monument, New Mexico,” U.S. Geological Survey Water-Resources Investigations Report 02-4152, Albuquerque, New Mexico. (Veenhuis 2002, 082605)

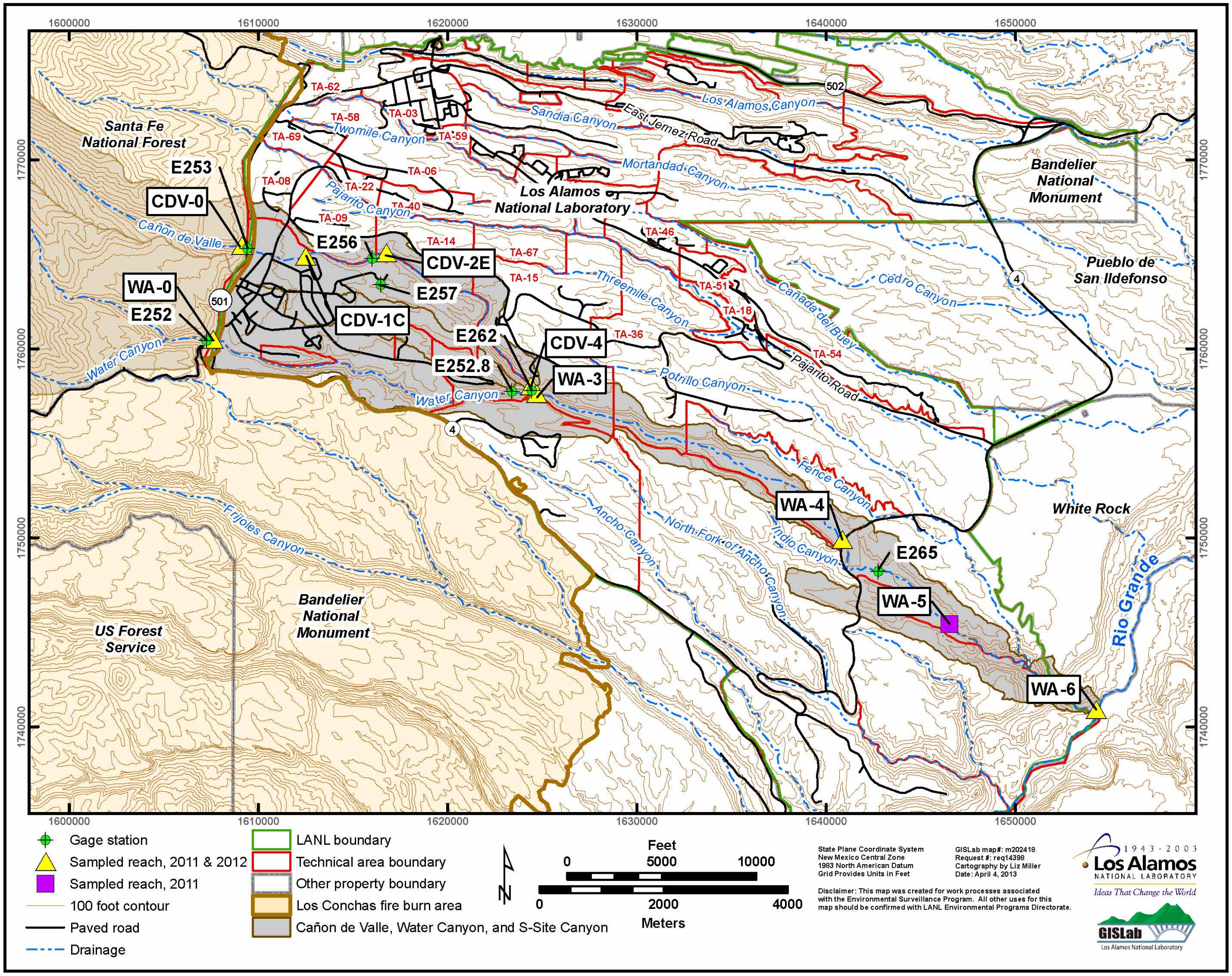

Figure 1.0-1 Sediment sampling locations in the Water Canyon and Cañon de Valle watershed in 2011 and 2012

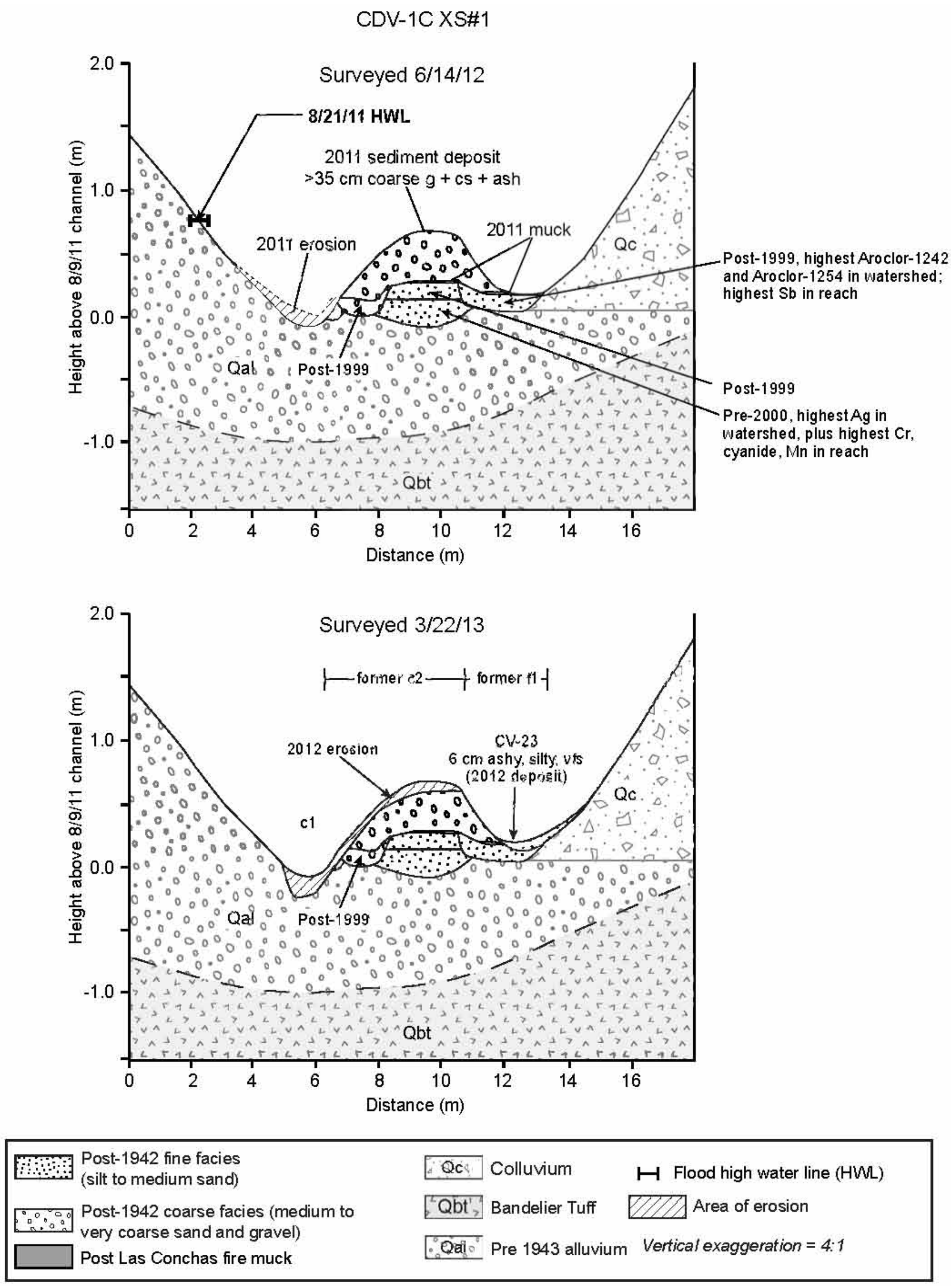

Figure 2.2-1 Geomorphic cross-sections showing post-fire erosion and deposition in reach CDV-1C

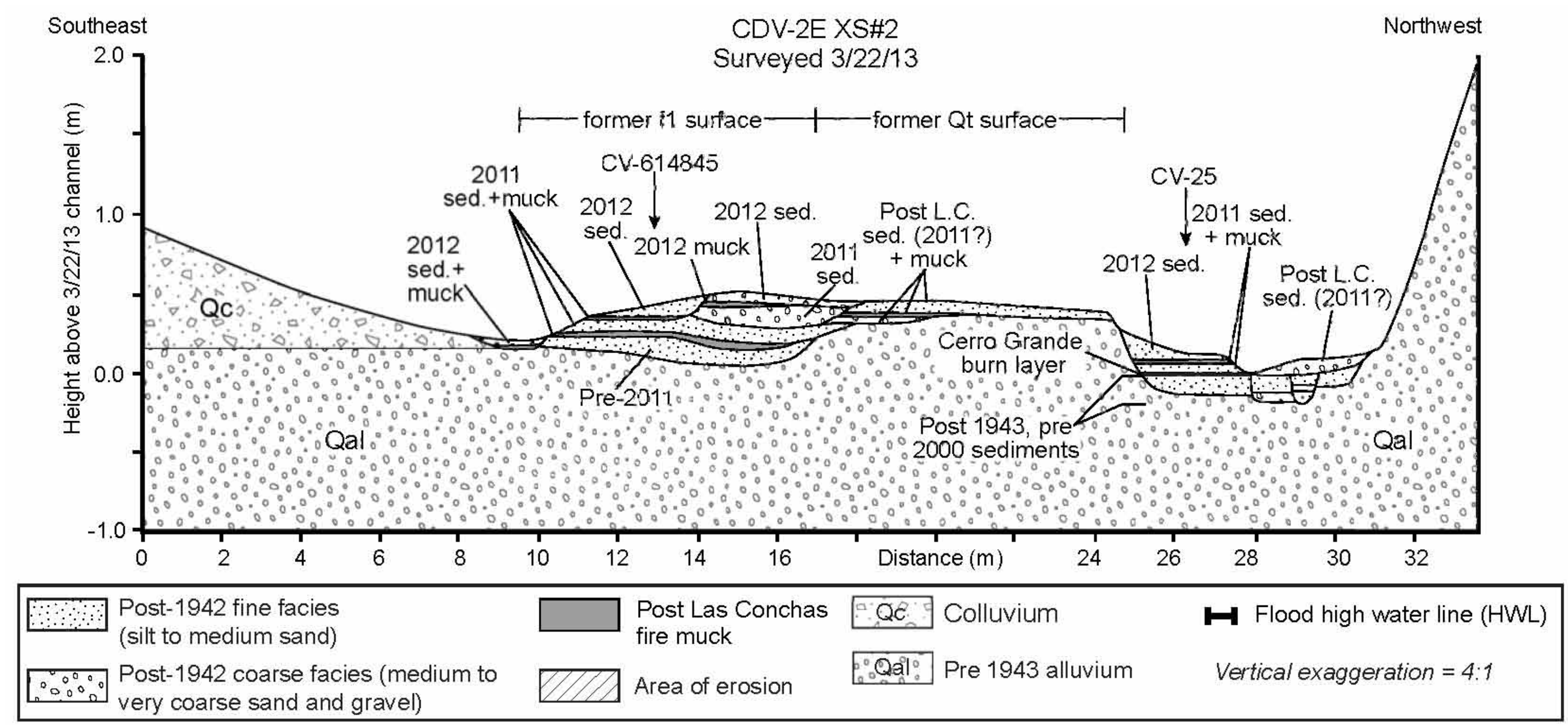

Figure 2.2-2 Geomorphic cross-sections showing post-fire erosion and deposition in reach CDV-2E

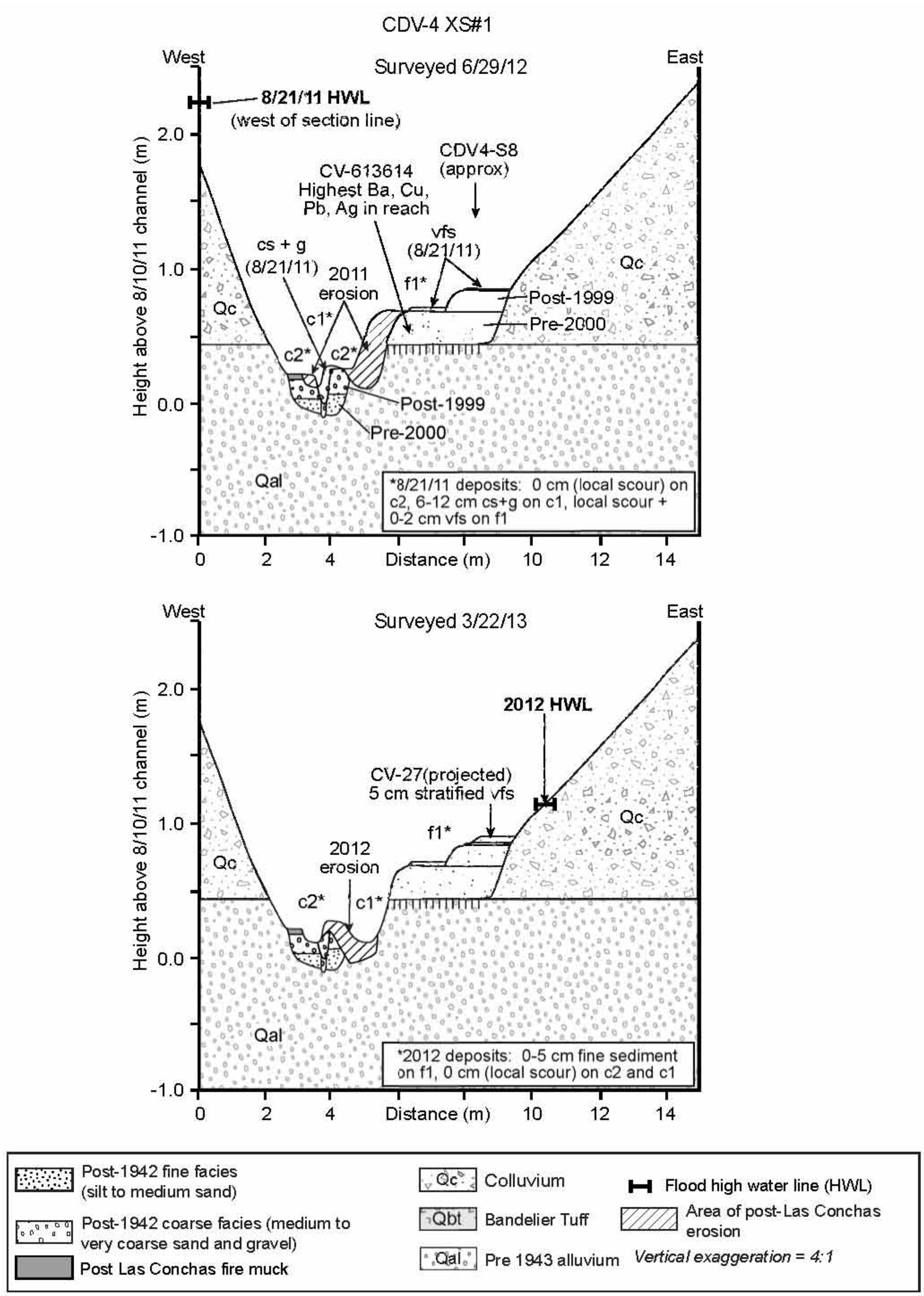

Figure 2.2-3 Geomorphic cross-sections showing post-fire erosion and deposition in reach CDV-4

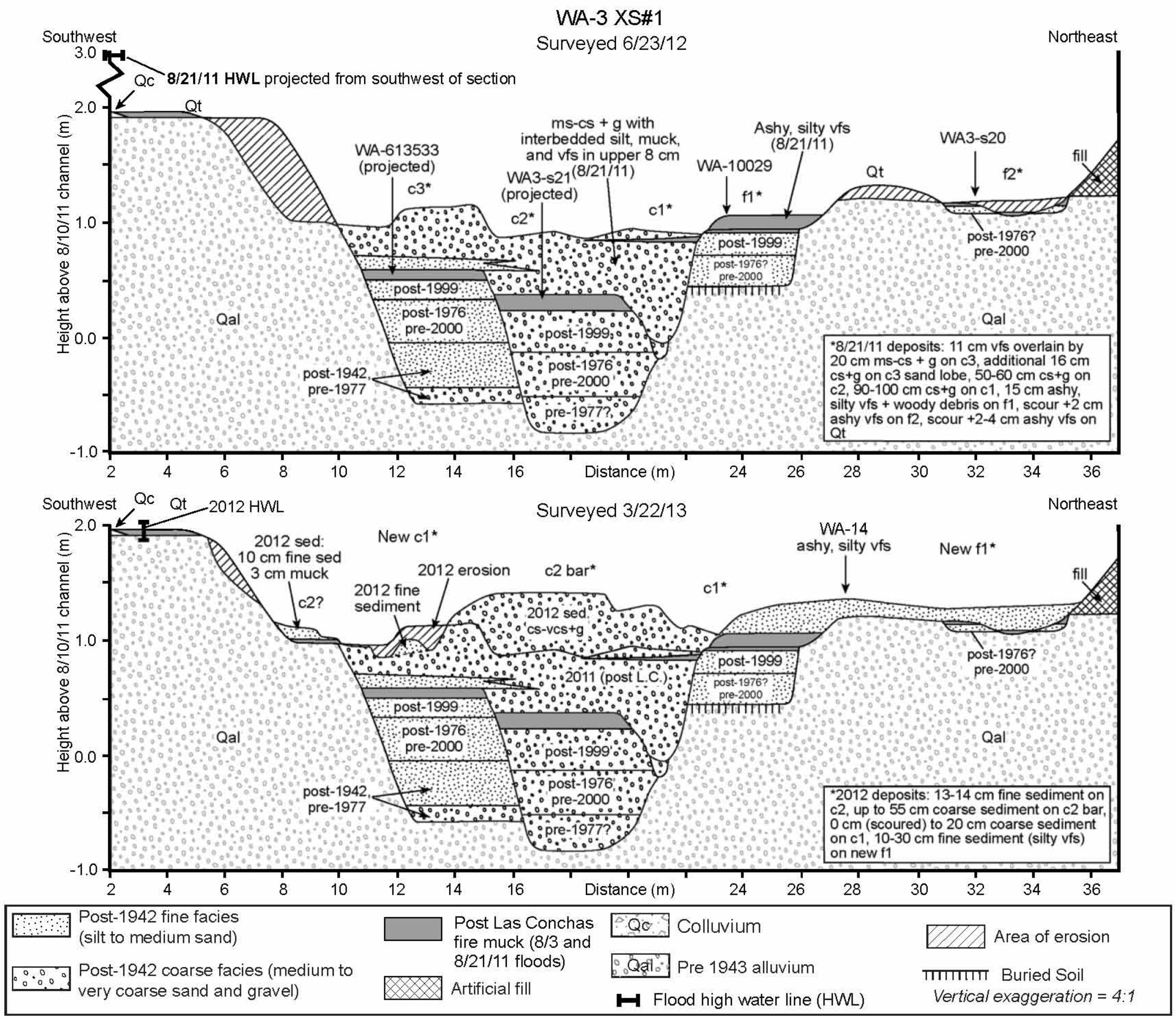

Figure 2.2-4 Geomorphic cross-sections showing post-fire erosion and deposition in reach WA-3

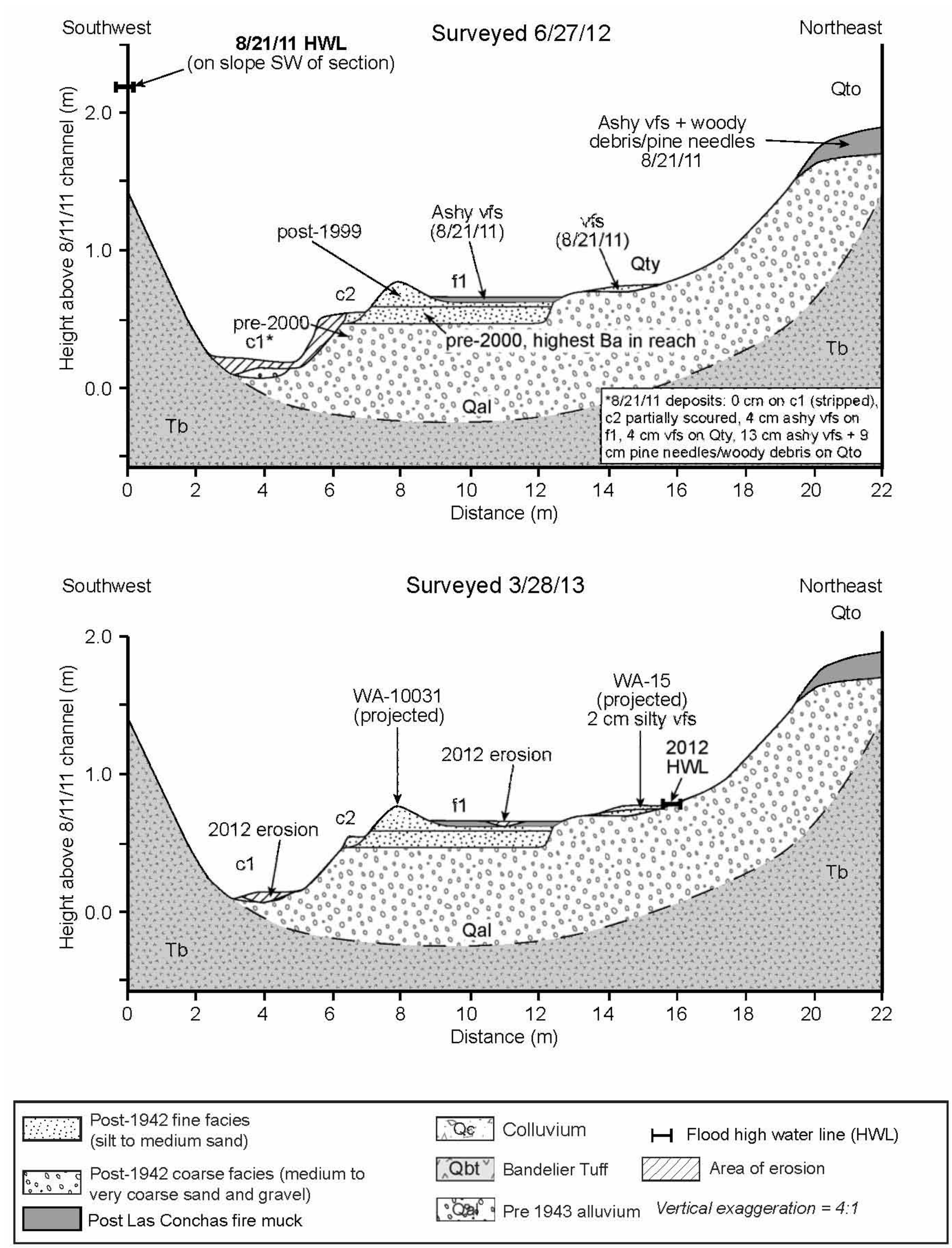

Figure 2.2-5 Geomorphic cross-sections showing post-fire erosion and deposition in reach WA-4

Figure 3.2-1 Photo showing 13-cm of 2012 fine sediment with 3-cm muck at base overlying 2011 coarse sediment

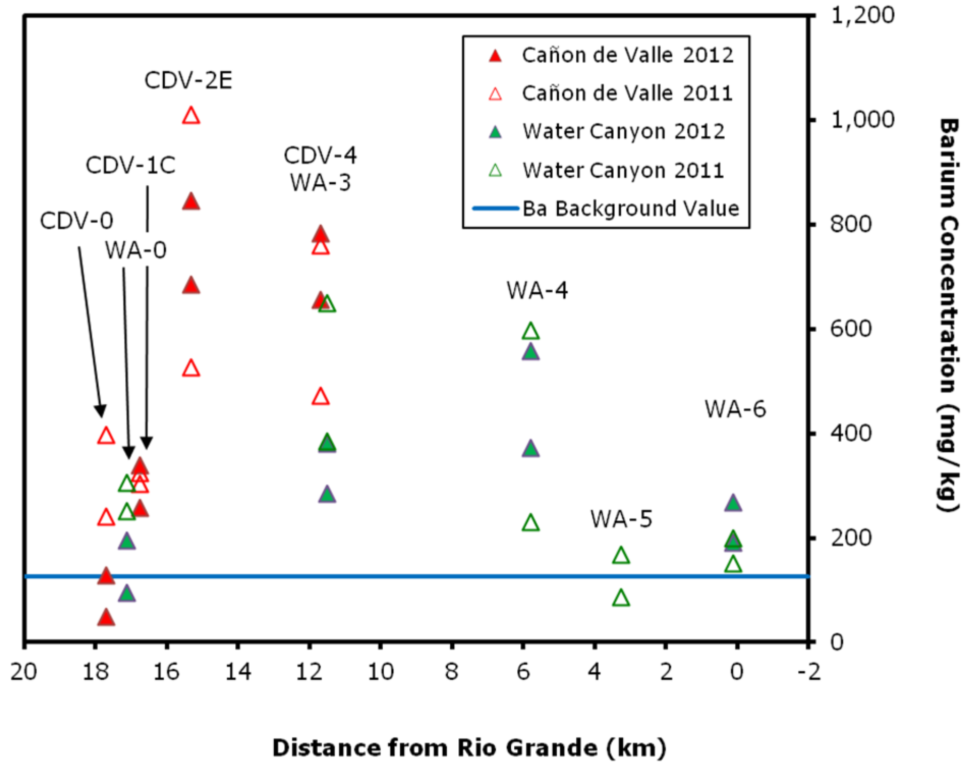

Figure 3.3-1 Post-fire barium concentrations as a function of distance from the Rio Grande

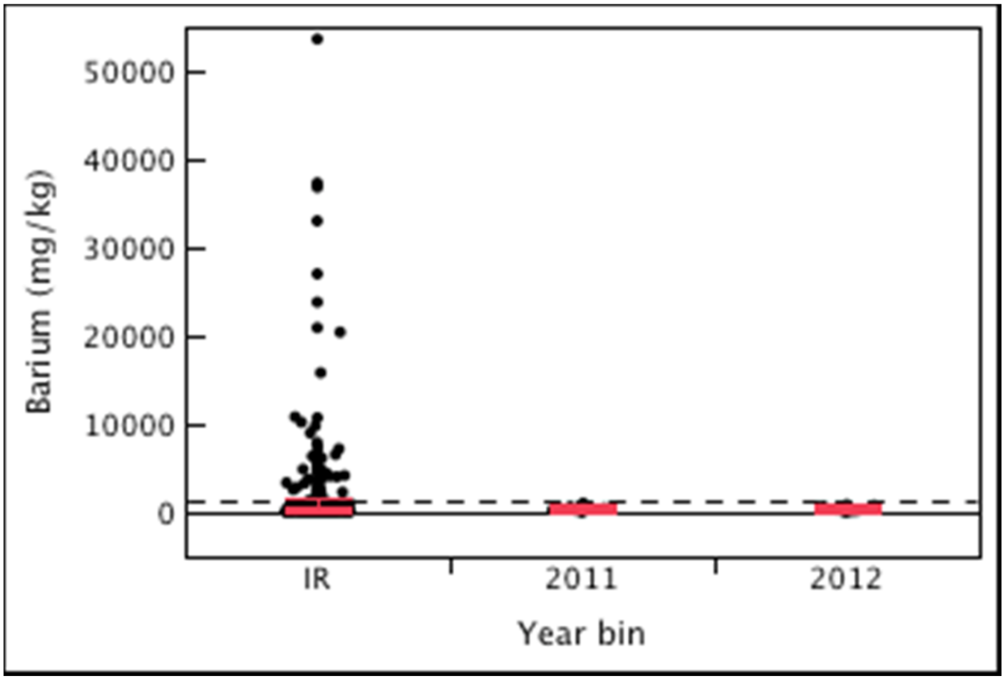

Figure 3.3-2 **Barium concentrations in 2011, 2012, and the Water Canyon and Cañon de Valle IR sediment samples. The dashed line is the maximum barium concentration in Cerro Grande ash, and the solid line is the barium sediment BV. The box plots include the 25th percentile, the median, and the 75th percentile. The 10th and 90th percentiles are shown as lines above and below the boxes. Some of these data groups have a very compressed range, and the box plots and lines overlap and appear to be a single thick line.**

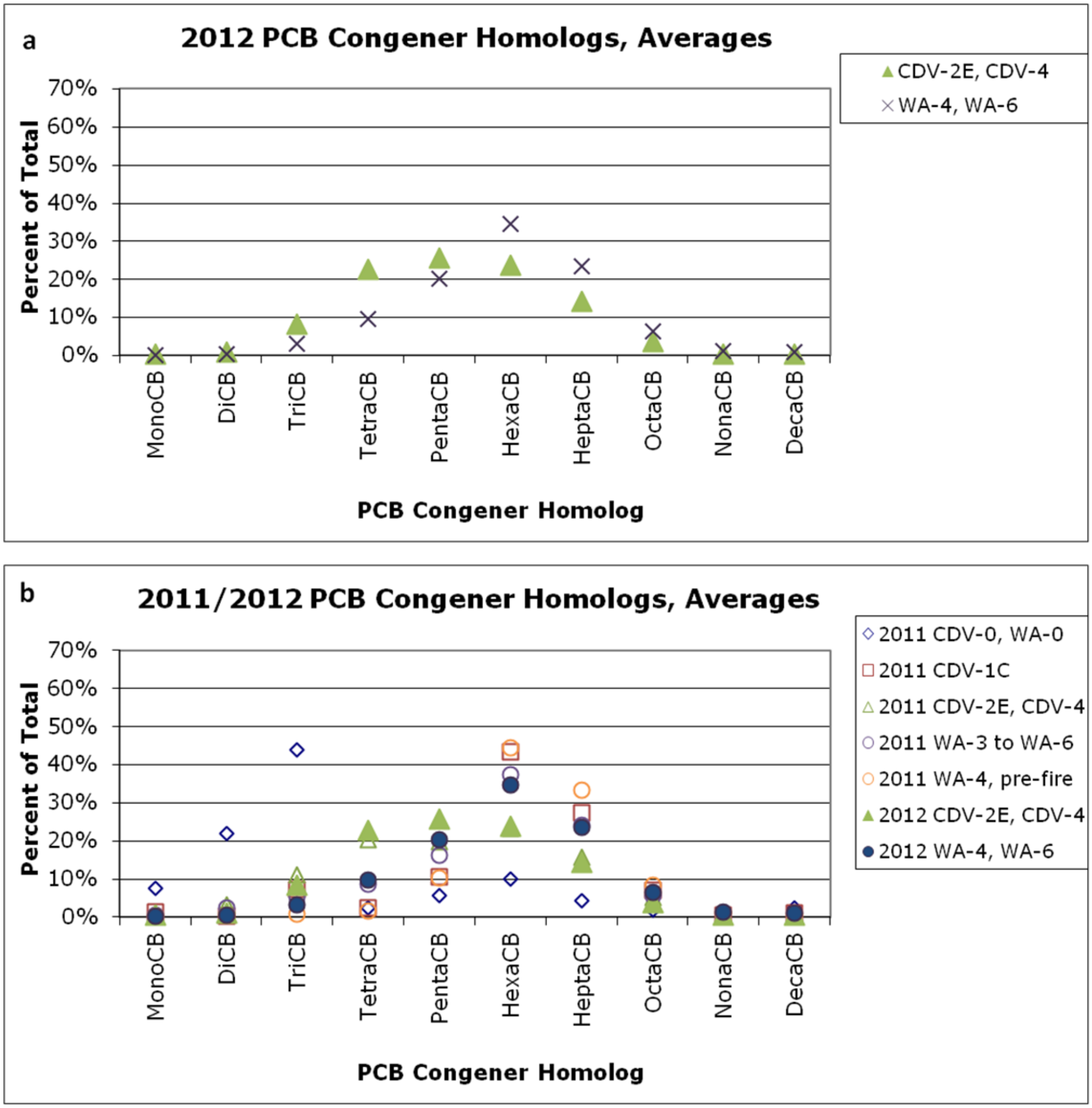

Figure 3.3-3 **Plots of PCB congener homologs averages in (a) 2012 samples collected downstream from solid waste management units (SWMUs) and areas of concern (AOCs) in the Water Canyon and Cañon de Valle watershed, (b) 2011 and 2012 samples collected downstream from SWMUs and AOCs in the Water Canyon and Cañon de Valle watershed.**

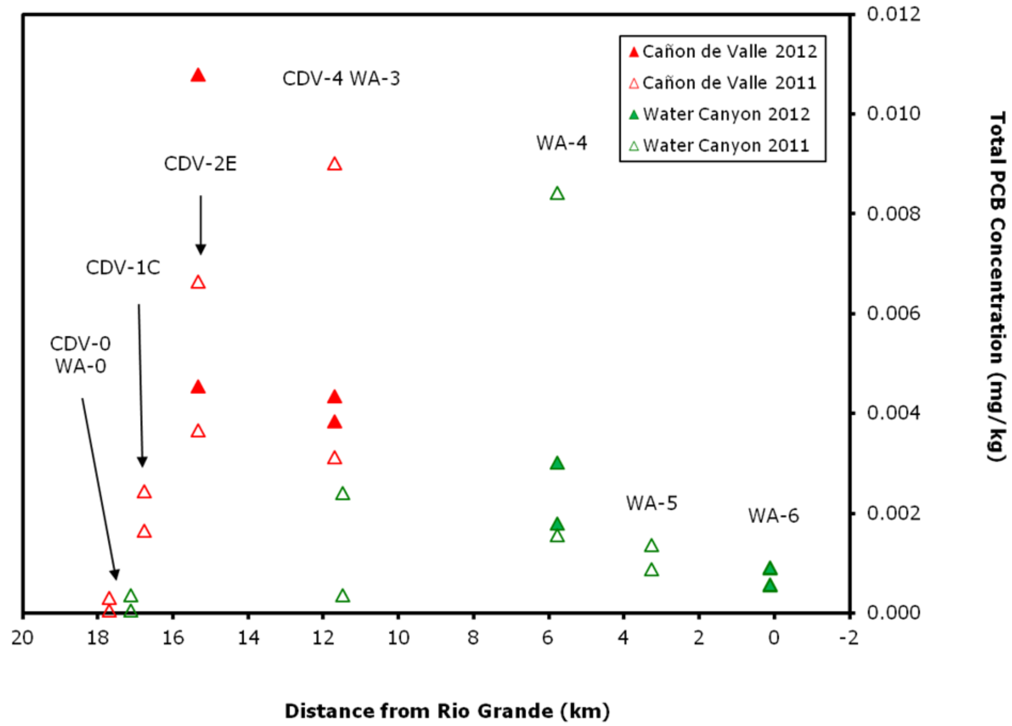

Figure 3.3-4 Post-fire total PCB concentrations as a function of distance from the Rio Grande

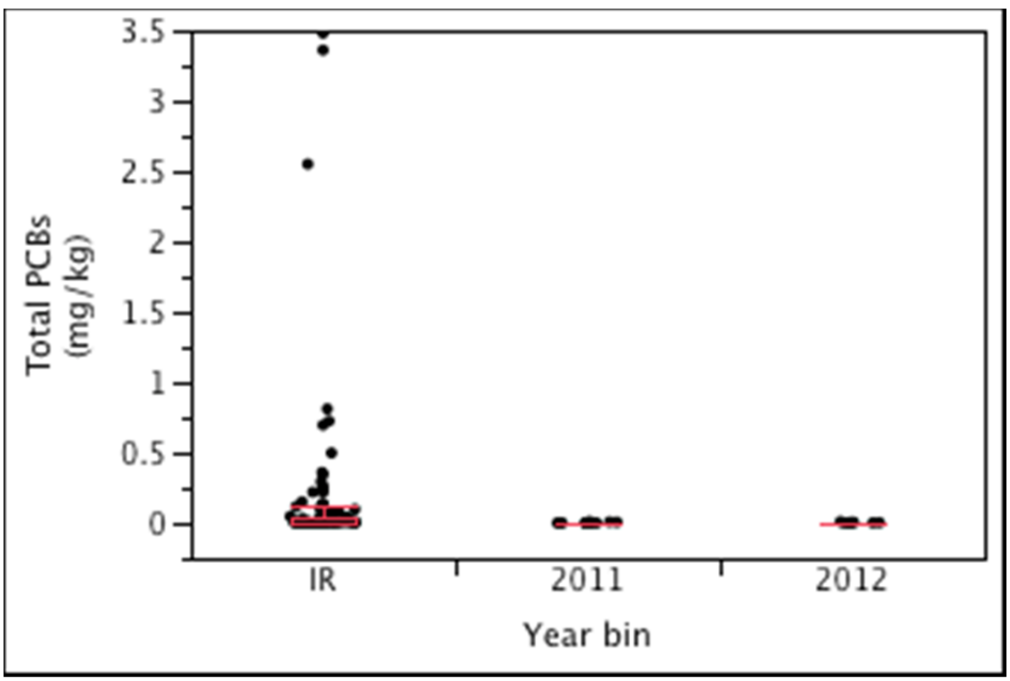

Figure 3.3-5 Total PCB concentrations in 2011, 2012, and the Water Canyon and Cañon de Valle IR sediment samples. The box plots include the 25th percentile, the median, and the 75th percentile. The 10th and 90th percentiles are shown as lines above and below the boxes. Some of these data groups have a very compressed range and the box plots, and lines overlap and appear to be a single thick line.

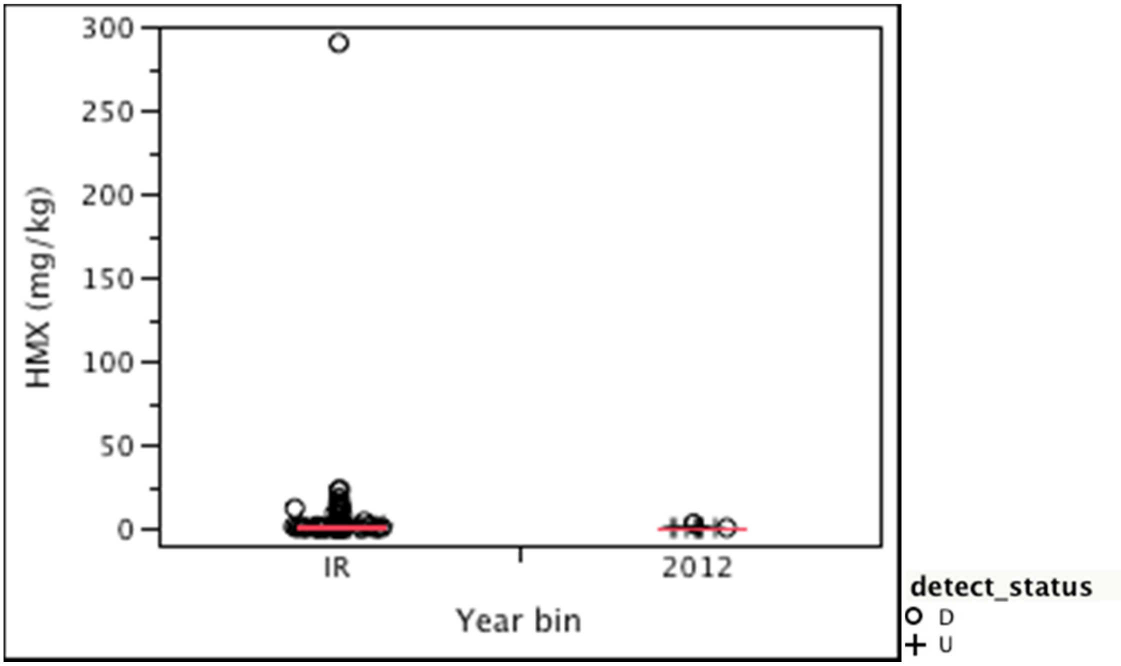

Figure 3.3-6 **HMX concentrations in 2012, and Water Canyon and Cañon de Valle IR sediment samples. The box plots include the 25th percentile, the median, and the 75th percentile. The 10th and 90th percentiles are shown as lines above and below the boxes. Some of these data groups have a very compressed range and the box plots, and lines overlap and appear to be a single thick line.**

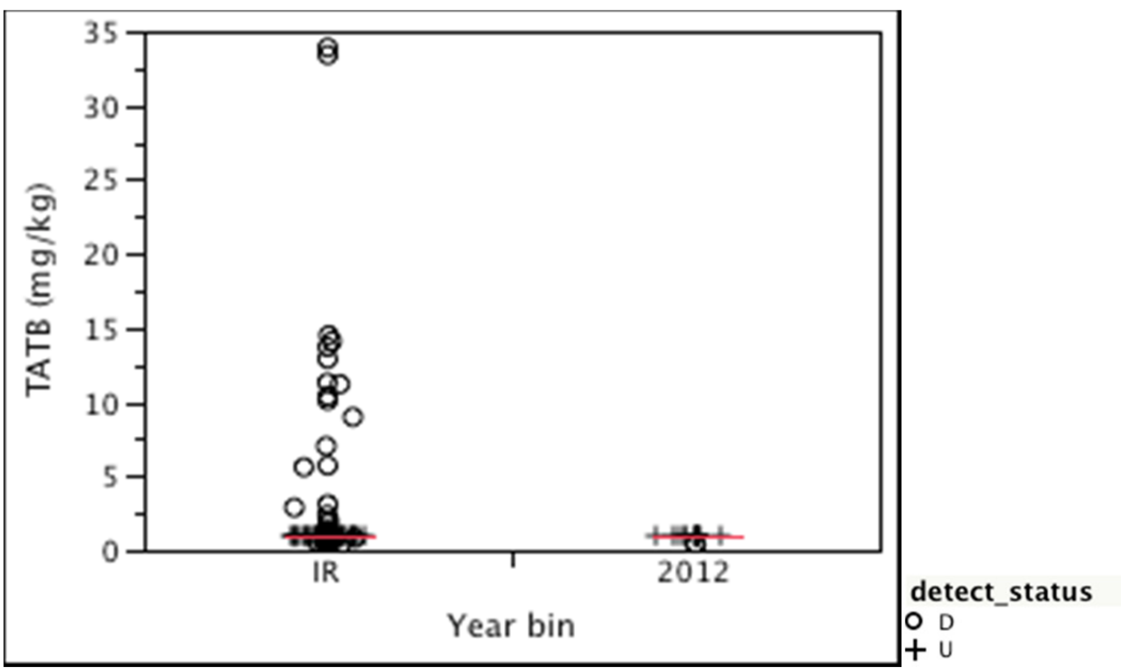

Figure 3.3-7 **TATB concentrations in 2012 and Water Canyon and Cañon de Valle IR sediment samples. The box plots include the 25th percentile, the median, and the 75th percentile. The 10th and 90th percentiles are shown as lines above and below the boxes. Some of these data groups have a very compressed range and the box plots, and lines overlap and appear to be a single thick line.**

Table 2.1-1
Summary of Sediment Samples Collected from the Water Canyon and Cañon de Valle Watershed and Analyses Requested in 2012

Sample ID	Reach	Location ID	Depth (cm)	Sediment Facies	Explosive Compounds	Target Analyte List Metals	PCB Congeners (EPA Method 1668A)	Particle Size
CACV-13-24689	CDV-0	CV-21	0-6	Fine	X[a]	X	—[b]	X
CACV-13-24690	CDV-0	CV-22	0-3	Fine	X	X	—	X
CACV-13-24691	CDV-1C	CV-23	0-6	Fine	X	X	—	X
CACV-13-24692	CDV-1C	CV-24	0-4	Fine	X	X	—	X
CACV-13-24693	CDV-2E	CV-25	0-2	Fine	X	X	X	X
CACV-13-24694	CDV-2E	CV-26	0-5	Fine	X	X	X	X
CACV-13-24695	CDV-4	CV-27	0-5	Fine	X	X	X	X
CACV-13-24696	CDV-4	CV-28	0-4	Fine	X	X	X	X
CAWA-13-24699	WA-0	WA-11	0-1	Fine	X	X	—	X
CAWA-13-24700	WA-0	WA-12	0-6	Fine	X	X	—	X
CAWA-13-24701	WA-3	WA-13	0-2	Fine	X	X	—	X
CAWA-13-24702	WA-3	WA-14	0-7	Fine	X	X	—	X
CAWA-13-24703	WA-4	WA-15	0-2	Fine	X	X	X	X
CAWA-13-24704	WA-4	WA-16	0-1	Fine	X	X	X	X
CAWA-13-24707	WA-6	WA-19	0-5	Fine	X	X	X	X
CAWA-13-24708	WA-6	WA-20	0-4	Fine	X	X	X	X

[a] X = Analysis requested.

[b] — = Analysis not requested.

Table 2.1-2
Particle-Size Data from 2012 Water Canyon and Cañon de Valle Watershed Sediment Samples

Sample ID	Reach	Location ID	Depth (cm)	Geomorphic Unit	Gravel; >2 mm (weight %)	Very Coarse Sand; 2.0–1.0 mm (weight %)	Coarse Sand; 1.0–0.5 mm (weight %)	Medium Sand; 0.5–0.25 mm (weight %)	Fine Sand; 0.25–0.125 (weight %)	Very Fine Sand; 0.125–0.0625 mm (weight %)	Coarse Silt; 62.5–15 µm (weight %)	Fine Silt; 15–2 µm (weight %)	Clay; <2 µm (weight %)	Median Particle Size Class*	% Silt + Clay
CACV-13-24689	CDV-0	CV-21	0–5	c2	1.6	11	30	21.2	7.4	4.6	9.5	7.4	8.8	ms	25.7
CACV-13-24690	CDV-0	CV-22	0–6	c1	0.4	2.3	15	35.3	23.9	9.9	5.1	2.8	5.9	ms	13.8
CACV-13-24691	CDV-1C	CV-23	0–6	f1	1.4	0.3	5.8	12.7	9.5	9.5	31.4	15.7	14.8	csi	61.9
CACV-13-24692	CDV-1C	CV-24	0–6	Qc	0.2	1.4	9.2	14.6	11.2	12.5	29.5	10.3	11.2	csi	51
CACV-13-24693	CDV-2E	CV-25	0–4	f1	0.2	0	0.8	1.5	2.2	5.7	47.4	28.6	13.7	csi	89.7
CACV-13-24694	CDV-2E	CV-26	0–8	f1	0.6	5.1	22.6	34.8	13.8	6.3	9.4	3.3	4.5	ms	17.2
CACV-13-24695	CDV-4	CV-27	0–1	f1	0	0	0.9	8.2	20.8	24.5	33.8	5.8	6	vfs	45.6
CACV-13-24696	CDV-4	CV-28	0–2	f1	0	0.5	4.1	1.4	1.1	1.1	18.6	48.8	24.5	fs	91.9
CAWA-13-24699	WA-0	WA-11	0–5	c1	0	0	0.6	1.1	3.2	11.9	48.5	18.8	15.8	csi	83.1
CAWA-13-24700	WA-0	WA-12	0–6	c2	0.1	1.2	3.1	15.2	35.2	19.6	12.9	4.3	8.3	fs	25.5
CAWA-13-24701	WA-3	WA-13	0–4	c2	0.1	0	0.3	0.4	0.3	1.2	37.9	44	15.9	fs	97.8
CAWA-13-24702	WA-3	WA-14	0–7	Qt	0	0	0.2	0.6	2.7	10.2	51.5	22.4	12.4	csi	86.3
CAWA-13-24703	WA-4	WA-15	0–2	f1	0.1	0.2	0.5	1.7	2.4	5.4	52.8	24.6	12	csi	89.4
CAWA-13-24704	WA-4	WA-16	0–1	f1	0.1	0.1	0.9	4.2	5.1	8.2	56.2	16.3	9	csi	81.5
CAWA-13-24707	WA-6	WA-19	0–5	c2	0	0.1	0.3	0.4	3	31.3	39.8	9.8	15.3	csi	64.9
CAWA-13-24708	WA-6	WA-20	0–4	c2?(c1?)	0.1	0.7	3.4	9.8	15.8	14.5	30.2	13	12.7	csi	55.9

* ms = medium sand; csi = coarse silt; vfs = very fine sand; fs = fine sand.

Table 2.1-3
Inorganic Chemicals above Sediment BVs in 2012 Water Canyon and Cañon de Valle Watershed Sediment Samples

Sample ID	Reach	Location ID	Depth (cm)	Media	Antimony	Barium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Nickel	Selenium	Silver	Vanadium	Zinc
Sediment BV[a]					**0.83**	**127**	**0.4**	**4420**	**10.5**	**4.73**	**11.2**	**13800**	**19.7**	**2370**	**543**	**9.38**	**0.3**	**1**	**19.7**	**60.2**
Recreational SSL[b]					**248**	**124000**	**465**	**na[c]**	**927000[d]**	**186**	**24800**	**433000**	**1350**	**na**	**14800**	**12400**	**3100**	**3100**	**3100**	**186000**
Residential SSL[e]					**31.3**	**15600**	**70.3**	**na**	**117000[d]**	**23[f]**	**3130**	**54800**	**400**	**na**	**1860**	**1560**	**391**	**391**	**391**	**23500**
CACV-13-24689	CDV-0	CV-21	0–5	Sediment	1.07 (U)	128	—[g]	4830 (J-)	—	—	—	—	—	—	645 (J+)	—	1.09 (U)	—	—	—
CACV-13-24690	CDV-0	CV-22	0–6	Sediment	1.01 (U)	—	—	—	—	—	—	—	—	—	—	—	1.01 (U)	—	—	—
CACV-13-24691	CDV-1C	CV-23	0–6	Sediment	1.14 (U)	338	—	4900 (J-)	—	—	26.8	—	—	—	706 (J-)	62.7	1.16 (U)	57.2 (J)	—	—
CACV-13-24692	CDV-1C	CV-24	0–6	Sediment	1.01 (U)	257	—	—	—	—	20.2	—	—	—	—	88.8	1.02 (U)	63.9	—	—
CACV-13-24693	CDV-2E	CV-25	0–4	Sediment	1 (U)	844	—	6920	—	5.1	17	—	22.6	—	987	—	1.04 (U)	1.19	—	—
CACV-13-24694	CDV-2E	CV-26	0–8	Sediment	0.991 (U)	685	0.495 (U)	—	—	—	—	—	—	—	—	—	0.955 (U)	3.99	—	—
CACV-13-24695	CDV-4	CV-27	0–1	Sediment	1 (U)	656	—	—	—	—	—	—	—	—	—	—	1.02 (U)	1.59	—	—
CACV-13-24696	CDV-4	CV-28	0–2	Sediment	1.07 (U)	782	0.415 (J)	10900	—	7.1	21.7	13900	27.8	2440	1420	9.95	0.579 (J)	—	22.4	67.6
CAWA-13-24699	WA-0	WA-11	0–5	Sediment	1.13 (U)	194	—	4520	—	5.7	—	—	—	—	650	—	1.11 (U)	—	—	—
CAWA-13-24700	WA-0	WA-12	0–6	Sediment	1.11 (U)	—	—	—	—	—	—	—	—	—	—	—	1.16 (U)	—	—	—
CAWA-13-24701	WA-3	WA-13	0–4	Sediment	1.11 (U)	379	—	6530	—	7	14.5	—	20	2400	904	9.58	1.11 (U)	—	22.4	—
CAWA-13-24702	WA-3	WA-14	0–7	Sediment	1.08 (U)	283	—	5620	—	5.7	—	—	—	—	708	—	1.09 (U)	—	—	—
CAWA-13-24703	WA-4	WA-15	0–2	Sediment	0.999 (U)	371 (J+)	—	—	—	—	—	—	—	—	554 (J+)	—	0.976 (U)	1.45	—	—
CAWA-13-24704	WA-4	WA-16	0–1	Sediment	1.02 (U)	556	—	5040	—	—	12.6	—	21	—	818	—	0.954 (U)	1.89	—	—
CAWA-13-24707	WA-6	WA-19	0–5	Sediment	0.967 (U)	191	—	16400	11.4	6.2	15.7	14600	—	3470	—	11.8 (J+)	1.01 (U)	—	29.7	—
CAWA-13-24708	WA-6	WA-20	0–4	Sediment	0.977 (U)	268	—	—	—	—	—	—	—	—	—	—	1.01 (U)	—	—	—

Notes: Units are mg/kg. U = The analyte was analyzed for but not detected. J = The analyte was positively identified, and the associated numerical value is estimated to be more uncertain than would normally be expected for that analysis. J- = The analyte was positively identified, and the result is likely to be biased low.

[a] BVs from LANL (1998, 059730).

[b] SSLs from LANL (2012, 228733).

[c] na = Not available.

[d] SSLs for chromium (III)

[e] SSLs from NMED (2012, 219971).

[f] SSL from EPA regional tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

[g] — = Not detected or not detected above BV.

Table 2.1-4
Organic Chemicals Detected in 2012 Water Canyon and Cañon de Valle Watershed Sediment Samples

Sample ID	Reach	Location ID	Depth (cm)	Media	HMX	PCB-1	PCB-105	PCB-107	PCB-108/PCB-124	PCB-110/PCB-115	PCB-114	PCB-118	PCB-12/PCB-13	PCB-123	PCB-128/PCB-166	PCB-129/PCB-138/PCB-163	PCB-130	PCB-132
Recreational SSL[a]					**31000**	**na[b]**	**4.88**	**na**	**na**	**na**	**4.88**	**4.88**	**na**	**4.88**	**na**	**na**	**na**	**na**
Residential SSL[c]					**3910**	**na**	**1.14**	**na**	**na**	**na**	**1.14**	**1.14**	**na**	**1.14**	**na**	**na**	**na**	**na**
CACV-13-24693	CDV-2E	CV-25	0–4	Sediment	—[d]	3.82E-006 (J)	1.60E-04	1.73E-005 (J)	1.11E-005 (J)	5.14E-04	4.16E-006 (J)	2.81E-04	2.74E-005 (J)	5.53E-006 (J)	4.41E-05	4.66E-04	1.95E-05	1.59E-04
CACV-13-24694	CDV-2E	CV-26	0–8	Sediment	—	—	9.23E-05	7.08E-006 (J)	—	2.41E-04	—	1.61E-04	—	—	2.43E-05	2.47E-04	8.21E-006 (J)	7.17E-05
CACV-13-24695	CDV-4	CV-27	0–1	Sediment	2.92E+00	—	9.09E-05	7.39E-006 (J)	—	2.06E-04	—	1.48E-04	—	—	3.40E-05	2.90E-04	1.14E-05	7.92E-05
CACV-13-24696	CDV-4	CV-28	0–2	Sediment	—	3.9E-006 (J)	7.18E-05	—	—	2.02E-04	—	1.27E-04	1.01E-04	—	2.81E-05	2.63E-04	1.02E-05	7.04E-05
CAWA-13-24703	WA-4	WA-15	0–2	Sediment	3.59E-01 (J)	9.1E-007 (J)	5.62E-05	5.68E-06	3.4E-006 (J)	1.48E-04	—	1.00E-04	2.21E-05	—	2.92E-05	2.39E-04	9.14E-06	6.20E-05
CAWA-13-24704	WA-4	WA-16	0–1	Sediment	—	—	2.53E-05	1.8E-006 (J)	—	7.73E-05	—	4.92E-05	—	—	1.54E-05	1.59E-04	4.29E-06	4.05E-05
CAWA-13-24707	WA-6	WA-19	0–5	Sediment	—	—	9.89E-06	—	—	3.56E-05	—	1.22E-05	—	—	9.69E-06	8.36E-05	1.64E-006 (J)	1.07E-05
CAWA-13-24708	WA-6	WA-20	0–4	Sediment	—	—	1.58E-05	—	—	4.43E-05	—	3.05E-05	—	—	8.46E-06	8.68E-05	8.07E-007 (J)	1.65E-05

Table 2.1-4 (continued)

Sample ID	Reach	Location ID	Depth (cm)	Media	PCB-134	PCB-135/PCB-151	PCB-136	PCB-137	PCB-141	PCB-144	PCB-146	PCB-147/PCB-149	PCB-15	PCB-153/PCB-168	PCB-156/PCB-157	PCB-158	PCB-16	PCB-164
Recreational SSL[a]					**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**
Residential SSL[c]					**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**
CACV-13-24693	CDV-2E	CV-25	0–4	Sediment	1.88E-05	2.00E-04	6.56E-05	9.23E-006 (J)	9.56E-05	1.97E-05	5.63E-05	4.42E-04	—	3.99E-04	3.14E-05	3.52E-05	7.18E-05	3.27E-05
CACV-13-24694	CDV-2E	CV-26	0–8	Sediment	7.03E-006 (J)	9.57E-05	3.48E-05	5.65E-006 (J)	4.69E-05	9.8E-006 (J)	2.53E-05	2.16E-04	—	2.21E-04	1.94e-005 (J)	1.86E-05	—	1.46E-05
CACV-13-24695	CDV-4	CV-27	0–1	Sediment	7.85E-006 (J)	7.92E-05	2.25E-05	—	4.84E-05	7E-006 (J)	2.94E-05	2.02E-04	—	2.24E-04	2.35E-05	2.05E-05	—	1.81E-05
CACV-13-24696	CDV-4	CV-28	0–2	Sediment	—	7.87E-05	2.29E-05	5.58e-006 (J)	4.41E-05	6.23E-006 (J)	3.06E-05	1.92E-04	—	2.19E-04	1.81e-005 (J)	1.80E-05	—	1.59E-05
CAWA-13-24703	WA-4	WA-15	0–2	Sediment	2.8E-006 (J)	6.23E-05	1.73E-05	5.71E-06	3.98E-05	4.49E-006 (J)	2.70E-05	1.57E-04	1.08E-005 (J)	2.01E-04	1.90E-05	1.72E-05	3.04E-006 (J)	1.47E-05
CAWA-13-24704	WA-4	WA-16	0–1	Sediment	2.16E-006 (J)	4.80E-05	1.41E-05	1.74e-006 (J)	3.03E-05	3.29E-006 (J)	1.78E-05	1.26E-04	—	1.44E-04	1.00E-05	1.04E-05	—	8.96E-06
CAWA-13-24707	WA-6	WA-19	0–5	Sediment	—	1.31E-05	1.37e-006 (J)	—	6.52E-06	—	7.59E-06	3.96E-05	—	5.64E-05	5.92E-06	5.03E-06	—	2.86E-06
CAWA-13-24708	WA-6	WA-20	0–4	Sediment	—	1.57E-05	4.00E-06	—	9.91E-06	—	7.5E-06	5.27E-05	—	6.51E-05	5.25E-06	4.19E-06	—	3.66E-06

Table 2.1-4 (continued)

Sample ID	Reach	Location ID	Depth (cm)	Media	PCB-167	PCB-17	PCB-170	PCB-171/PCB-173	PCB-172	PCB-174	PCB-176	PCB-177	PCB-178	PCB-179	PCB-18/PCB-30	PCB-180/PCB-193	PCB-183/PCB-185	PCB-187
Recreational SSL[a]					**4.88**	**na**	**1.46**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**
Residential SSSL[c]					**1.14**	**na**	**0.341**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**
CACV-13-24693	CDV-2E	CV-25	0–4	Sediment	9.98E-06	8.21E-05	1.03E-04	3.03E-05	1.69E-05	1.36E-04	1.30E-05	6.86E-05	2.29E-05	5.36E-05	1.71E-04	2.76E-04	7.88E-05	1.60E-04
CACV-13-24694	CDV-2E	CV-26	0–8	Sediment	5.98E-006 (J)	—	6.69E-05	1.99E-05	1.06E-05	9.87E-05	1.01E-05	4.80E-05	1.69E-05	4.58E-05	1.35E-005 (J)	2.02E-04	6.36E-05	1.28E-04
CACV-13-24695	CDV-4	CV-27	0–1	Sediment	8.15E-006 (J)	—	7.76E-05	2.00E-05	1.08E-05	8.92E-05	7E-006 (J)	4.81E-05	1.42E-05	3.25E-05	1.05E-005 (J)	1.93E-04	5.17E-05	1.08E-04
CACV-13-24696	CDV-4	CV-28	0–2	Sediment	6.78E-006 (J)	7.48E-006 (J)	6.65E-05	1.81E-005 (J)	1.02E-05	8.31E-05	6.53E-006 (J)	4.32E-05	1.46E-05	3.08E-05	1.76E-005 (J)	1.73E-04	4.69E-05	1.06E-04
CAWA-13-24703	WA-4	WA-15	0–2	Sediment	7.05E-06	3.27E-006 (J)	7.71E-05	1.82E-05	1.16E-05	8.44E-05	5.46E-06	4.67E-05	1.40E-05	2.93E-05	1.05E-05	—	4.63E-05	1.07E-04
CAWA-13-24704	WA-4	WA-16	0–1	Sediment	3.10E-06	—	5.92E-05	1.51E-05	9.67E-06	7.63E-05	5.22E-06	3.91E-05	1.15E-05	2.82E-05	6.48E-06	—	4.18E-05	9.41E-05
CAWA-13-24707	WA-6	WA-19	0–5	Sediment	1.08E-006 (J)	—	2.27E-05	3.7E-006 (J)	1.01E-006 (J)	1.90E-05	—	1.14E-05	1.8E-006 (J)	5.47E-06	—	5.35E-05	1.04E-05	2.61E-05
CAWA-13-24708	WA-6	WA-20	0–4	Sediment	1.05E-006 (J)	—	3.92E-05	6.44E-06	3.53E-06	3.30E-05	7.77E-007 (J)	1.96E-05	4.13E-06	1.04E-05	—	8.64E-05	1.70E-05	4.06E-05

Table 2.1-4 (continued)

Sample ID	Reach	Location ID	Depth (cm)	Media	PCB-19	PCB-190	PCB-191	PCB-194	PCB-195	PCB-196	PCB-197/PCB-200	PCB-198/PCB-199	PCB-2	PCB-20/PCB-28	PCB-201	PCB-202	PCB-203	PCB-206
Recreational SSL[a]					**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**
Residential SSSL[c]					**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**
CACV-13-24693	CDV-2E	CV-25	0–4	Sediment	1.72E-05	1.96E-05	—	5.44E-05	2.11E-05	2.62E-05	—	6.89E-05	5.72E-006 (J)	2.44E-04	5.96E-006 (J)	1.21E-05	4.13E-05	2.01E-05
CACV-13-24694	CDV-2E	CV-26	0–8	Sediment	—	1.30E-05	—	4.07E-05	1.62E-05	2.21E-05	—	5.84E-05	—	4.99E-005 (J)	5.95E-006 (J)	1.16E-05	3.36E-05	1.42E-05
CACV-13-24695	CDV-4	CV-27	0–1	Sediment	—	1.49E-05	—	4.66E-05	1.62E-05	1.99E-05	—	5.29E-05	—	4.13E-005 (J)	3.69E-006 (J)	8.21E-006 (J)	3.16E-05	1.72E-05
CACV-13-24696	CDV-4	CV-28	0–2	Sediment	—	1.26E-05	—	3.58E-05	1.30E-05	1.74E-05	—	4.95E-05	1.85E-05	6.09E-005 (J)	3.79E-006 (J)	8.5E-006 (J)	2.90E-05	1.92E-05
CAWA-13-24703	WA-4	WA-15	0–2	Sediment	—	1.41E-05	7.96E-007 (J)	4.27E-05	1.56E-05	1.83E-05	5.67E-06	5.20E-05	3.86E-06	3.20E-05	3.27E-06	7.46E-06	2.97E-05	1.48E-05
CAWA-13-24704	WA-4	WA-16	0–1	Sediment	—	1.10E-05	—	3.88E-05	1.37E-05	1.73E-05	5.73E-06	—	—	1.69E-005 (J)	3.38E-06	7.09E-06	2.65E-05	1.22E-05
CAWA-13-24707	WA-6	WA-19	0–5	Sediment	—	3.49E-06	—	9.59E-06	2.49E-006 (J)	3.32E-06	—	1.33E-05	—	—	—	1.34E-006 (J)	6.42E-06	1.33E-05
CAWA-13-24708	WA-6	WA-20	0–4	Sediment	—	6.42E-06	—	1.98E-05	5.63E-06	6.40E-06	—	1.98E-05	—	—	—	2.13E-06	1.07E-05	5.65E-06

Table 2.1-4 (continued)

Sample ID	Reach	Location ID	Depth (cm)	Media	PCB-208	PCB-209	PCB-21/PCB-33	PCB-22	PCB-25	PCB-26/PCB-29	PCB-27	PCB-3	PCB-31	PCB-32	PCB-35	PCB-37	PCB-38
Recreational SSSL[a]					**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**
Residential SSL[c]					**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**
CACV-13-24693	CDV-2E	CV-25	0–4	Sediment	3.87E-006 (J)	1.32E-05	9.42E-05	7.49E-05	9.52E-006 (J)	2.27E-05	1.15E-05	1.19E-05	2.02E-04	6.01E-05	—	7.47E-005 (J)	1.31E-04
CACV-13-24694	CDV-2E	CV-26	0–8	Sediment	—	8.31E-006 (J)	1.82E-005 (J)	1.78E-005 (J)	—	—	—	—	4.76E-005 (J)	4.7E-006 (J)	—	—	—
CACV-13-24695	CDV-4	CV-27	0–1	Sediment	3.28E-006 (J)	1.36E-05	1.41E-005 (J)	1.23E-005 (J)	—	—	—	—	3.83E-005 (J)	—	—	—	1.42E-05
CACV-13-24696	CDV-4	CV-28	0–2	Sediment	5.54E-006 (J)	1.99E-05	2.39E-005 (J)	1.92E-005 (J)	—	—	—	2.92E-05	5.22E-05	5.21E-006 (J)	—	—	4.36E-04
CAWA-13-24703	WA-4	WA-15	0–2	Sediment	2.69E-06	9.96E-06	1.51E-05	1.23E-05	2.17E-06	6.21E-06	-	6.00E-06	2.97E-05	2.27E-06	1.22E-05	3.34E-05	4.47E-05
CAWA-13-24704	WA-4	WA-16	0–1	Sediment	1.69E-006 (J)	4.87E-06	—	4.73E-06	—	—	—	—	1.53E-05	—	—	7.55E-006 (J)	2.51E-05
CAWA-13-24707	WA-6	WA-19	0–5	Sediment	4.57E-06	1.68E-05	—	—	—	—	—	—	—	—	—	—	—
CAWA-13-24708	WA-6	WA-20	0–4	Sediment	—	3.85E-06	—	—	—	—	—	—	5.03E-006 (J)	—	—	—	8.52E-06

Table 2.1-4 (continued)

Sample ID	Reach	Location ID	Depth (cm)	Media	PCB-4	PCB-40/PCB-71	PCB-41	PCB-42	PCB-43	PCB-44/PCB-47/PCB-65	PCB-45/PCB-51	PCB-46	PCB-48	PCB-49/PCB-69	PCB-50/PCB-53	PCB-52	PCB-55	PCB-56
Recreational SSSL[a]					**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**
Residential SSSL[c]					**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**
CACV-13-24693	CDV-2E	CV-25	0–4	Sediment	2.59E-05	2.46E-04	3.41E-05	1.37E-04	2.01E-05	—	—	2.69E-05	9.35E-05	3.11E-04	6.59E-05	5.48E-04	—	2.48E-04
CACV-13-24694	CDV-2E	CV-26	0–8	Sediment	—	4.65E-05	5.63E-006 (J)	3.20E-05	—	1.38E-04	—	—	1.74E-05	8.35E-05	9.64E-006 (J)	1.41E-04	—	8.48E-05
CACV-13-24695	CDV-4	CV-27	0–1	Sediment	—	3.00E-05	—	1.92E-05	—	—	—	—	9.96E-06	5.51E-05	—	9.34E-05	—	6.78E-05
CACV-13-24696	CDV-4	CV-28	0–2	Sediment	—	3.82E-05	—	2.40E-05	—	—	—	—	1.37E-05	6.41E-05	7.04E-006 (J)	1.04E-04	—	6.94E-05
CAWA-13-24703	WA-4	WA-15	0–2	Sediment	—	2.32E-05	2.13E-006 (J)	1.38E-05	—	—	4.21E-06	—	7.99E-06	3.71E-05	2.78E-006 (J)	6.43E-05	9.38E-007 (J)	4.74E-05
CAWA-13-24704	WA-4	WA-16	0–1	Sediment	—	9.52E-06	—	5.03E-06	—	—	—	—	3.03E-06	1.61E-05	—	3.00E-05	—	1.80E-05
CAWA-13-24707	WA-6	WA-19	0–5	Sediment	—	—	—	—	—	—	—	—	—	—	—	—	—	—
CAWA-13-24708	WA-6	WA-20	0–4	Sediment	—	2.26E-006 (J)	—	—	—	1.14E-05	—	—	—	6.52E-06	—	1.23E-05	—	8.29E-06

Table 2.1-4 (continued)

Sample ID	Reach	Location ID	Depth (cm)	Media	PCB-59/PCB-62/PCB-75	PCB-6	PCB-60	PCB-61/PCB-70/PCB-74/ PCB-76	PCB-63	PCB-64	PCB-66	PCB-73	PCB-77	PCB-8	PCB-82	PCB-83	PCB-84
Recreational SSL[a]					**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**1.46**	**na**	**na**	**na**	**na**
Residential SSL[c]					**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**0.341**	**na**	**na**	**na**	**na**
CACV-13-24693	CDV-2E	CV-25	0–4	Sediment	2.71E-005 (J)	6.14E-006 (J)	9.76E-05	7.05E-04	8.44E-006 (J)	2.24E-04	4.37E-04	8.92E-006 (J)	4.61E-05	6.55E-005 (J)	6.30E-05	1.98E-05	1.16E-04
CACV-13-24694	CDV-2E	CV-26	0–8	Sediment	—	—	3.31E-05	2.74E-04	—	4.97E-05	1.63E-04	—	2.18E-05	—	2.73E-05	8.12E-006 (J)	4.41E-05
CACV-13-24695	CDV-4	CV-27	0–1	Sediment	—	—	2.72E-05	2.14E-04	—	3.21E-05	1.27E-04	—	2.50E-05	—	2.03E-005 (J)	5.08E-006 (J)	3.03E-05
CACV-13-24696	CDV-4	CV-28	0–2	Sediment	—	—	2.89E-05	2.19E-04	—	3.80E-05	1.30E-04	—	1.87E-05	—	1.83E-005 (J)	5.9E-006 (J)	3.18E-05
CAWA-13-24703	WA-4	WA-15	0–2	Sediment	3.02E-006 (J)	—	2.22E-05	1.32E-04	9.24E-007 (J)	2.40E-05	8.26E-05	—	2.03E-05	—	1.34E-05	2.72E-006 (J)	2.18E-05
CAWA-13-24704	WA-4	WA-16	0–1	Sediment	—	—	8.02E-06	6.15E-05	—	1.04E-05	3.54E-05	—	5.00E-06	—	5.22E-06	1.22E-006 (J)	9.14E-06
CAWA-13-24707	WA-6	WA-19	0–5	Sediment	—	—	—	3.37E-006 (J)	—	—	—	—	—	—	—	—	—
CAWA-13-24708	WA-6	WA-20	0–4	Sediment	—	—	2.39E-006 (J)	3.05E-05	—	3.32E-06	2.01E-05	—	1.98E-006 (J)	—	1.58E-006 (J)	—	3.21E-06

Table 2.1-4 (continued)

Sample ID	Reach	Location ID	Depth (cm)	Media	PCB-85/PCB-116/PCB-117	PCB-86/87/97/109/119/125	PCB-88/PCB-91	PCB-89	PCB-90/PCB-101/PCB-113	PCB-92	PCB-95	PCB-98/PCB-102	PCB-99	TATB	Total PCB	Total DecaCB	Total DiCB	Total HeptaCB
Recreational SSL[a]					**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**16000**[e]	**na**	**na**	**na**	**na**
Residential SSL[c]					**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**2200**[e,f]	**na**	**na**	**na**	**na**
CACV-13-24693	CDV-2E	CV-25	0–4	Sediment	9.36E-05	3.11E-04	6.56E-05	6.42E-006 (J)	4.42E-04	7.38E-05	3.44E-04	1.22E-005 (J)	1.96E-04	—	1.08E-02	1.32E-05	1.25E-04	9.78E-04
CACV-13-24694	CDV-2E	CV-26	0–8	Sediment	4.33E-05	1.43E-04	2.55E-05	—	2.06E-04	3.01E-05	1.59E-04	—	9.07E-05	—	4.54E-03	8.31E-06	—	7.24E-04
CACV-13-24695	CDV-4	CV-27	0–1	Sediment	3.56E-05	1.13E-04	1.9E-005 (J)	—	1.51E-04	2.31E-05	1.00E-04	—	7.42E-05	4.43E-01 (J)	3.84E-03	1.36E-05	—	6.67E-04
CACV-13-24696	CDV-4	CV-28	0–2	Sediment	3.56E-05	1.12E-04	1.97E-005 (J)	—	1.48E-04	2.37E-05	1.06E-04	—	7.37E-05	—	4.35E-03	1.99E-05	1.01E-04	6.12E-04
CAWA-13-24703	WA-4	WA-15	0–2	Sediment	2.39E-05	8.04E-05	1.19E-05	—	1.10E-04	1.54E-05	5.86E-05	—	5.56E-05	—	3.02E-03	9.96E-06	3.29E-05	4.55E-04
CAWA-13-24704	WA-4	WA-16	0–1	Sediment	1.05E-05	3.76E-05	4.97E-06	—	6.11E-05	7.44E-06	3.41E-05	—	2.61E-05	3.36E-01 (J)	1.79E-03	4.87E-06	—	3.91E-04
CAWA-13-24707	WA-6	WA-19	0–5	Sediment	8.32E-06	8.32E-006 (J)	—	—	1.29E-05	1.34E-006 (J)	4.14E-06	—	9.80E-06	—	5.81E-04	1.68E-05	—	1.59E-04
CAWA-13-24708	WA-6	WA-20	0–4	Sediment	5.55E-006 (J)	2.10E-05	1.63E-006 (J)	—	3.08E-05	3.14E-06	1.69E-05	—	1.32E-05	—	9.23E-04	3.85E-06	—	2.68E-04

Table 2.1-4 (continued)

Sample ID	Reach	Location ID	Depth (cm)	Media	Total HexaCB	Total MonoCB	Total NonaCB	Total OctaCB	Total PentaCB	Total TetraCB	Total TriCB
Recreational SSL[a]					**na**	**na**	**na**	**na**	**na**	**na**	**na**
Residential SSL[c]					**na**	**na**	**na**	**na**	**na**	**na**	**na**
CACV-13-24693	CDV-2E	CV-25	0–4	Sediment	2.10E-03	2.14E-05	2.40E-05	2.30E-04	2.74E-03	3.28E-03	1.27E-03
CACV-13-24694	CDV-2E	CV-26	0–8	Sediment	1.07E-03	—	1.42E-05	1.89E-04	1.28E-03	1.10E-03	1.52E-04
CACV-13-24695	CDV-4	CV-27	0–1	Sediment	1.10E-03	—	2.05E-05	1.79E-04	1.02E-03	7.00E-04	1.31E-04
CACV-13-24696	CDV-4	CV-28	0–2	Sediment	1.03E-03	5.16E-05	2.47E-05	1.57E-04	9.75E-04	7.56E-04	6.23E-04
CAWA-13-24703	WA-4	WA-15	0–2	Sediment	9.15E-04	1.08E-05	1.75E-05	1.75E-04	7.06E-04	4.89E-04	2.07E-04
CAWA-13-24704	WA-4	WA-16	0–1	Sediment	6.39E-04	—	1.39E-05	1.13E-04	3.51E-04	2.02E-04	7.61E-05
CAWA-13-24707	WA-6	WA-19	0–5	Sediment	2.45E-04	—	1.79E-05	3.65E-05	1.02E-04	3.37E-06	—
CAWA-13-24708	WA-6	WA-20	0–4	Sediment	2.82E-04	—	5.65E-06	6.44E-05	1.88E-04	9.90E-05	1.35E-05

Notes: Units are mg/kg. J = The analyte was positively identified, and the associated numerical value is estimated to be more uncertain than would normally be expected for that analysis.

[a] SSLs from LANL (2012, 228733).

[b] na = Not available.

[c] SSLs from NMED (2012, 219971).

[d] — = Not detected or not analyzed.

[e] SSL for 1,3,5-trinitrobenzene used as a surrogate based on structural similarity.

[f] SSL from EPA regional tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

Table 3.1-1
Estimated Flows at Surface Gaging Stations
during 2011 and 2012 Floods in the Water Canyon and Cañon de Valle Watershed

Date	E252	E253	E256	E262	E252.8	E265
8/3/2011	93	63	58	No data	5	20
8/21/2011	1577	1450	1024	1866	3021	2429
9/4/2011	760	70	No data	No data	No data	No data
7/11/2012	118	135	No data	No data	No data	250
7/23/2012	133	0	No data	No data	No data	0
7/24/2012	88	26	No data	No data	No data	0
8/6/2012	7.5	0	No data	No data	No data	0
8/16/2012	73	56	No data	No data	No data	0
10/12/2012	8.3	19	No data	No data	No data	0

Note: All values in cfs. Values either directly measured or estimated from high-water marks at individual stations. No data were available for E256, E262, and E252.8 for the flow events from 9/4/2011 to the present because these gaging stations were rendered inoperable following the 8/21/2011 flooding event.

Appendix A

Analytical Data from 2012 Sediment Samples
from the Water Canyon and Cañon de Valle Watersheds
(on CD included with this document)