ESHID-603023-01

Los Alamos
NATIONAL LABORATORY
EST 1943

Associate Directorate for Environmental Management
P.O. Box 1663, MS M992
Los Alamos, New Mexico 87545
(505) 606-2337

EM-LA

Environmental Management
P. O. Box 1663, MS M984
Los Alamos, New Mexico 87545
(505) 665-5658/FAX (505) 606-2132

RECEIVED
APR 25 2018
NMED
Hazardous Waste Bureau

Date: APR 2 5 2018
Refer To: ADEM-18-0014
LAUR: 18-23237

John Kieling, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Subject: 2017 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project

Dear Mr. Kieling:

Enclosed please find two hard copies with electronic files of the 2017 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project. This annual monitoring report assesses overall performance of the mitigation efforts installed in the Los Alamos and Pueblo watershed since 2007. The evaluation of precipitation, storm water discharge, and constituent concentrations obtained in 2017 were used to determine the effects of mitigations installed over the years. The report was modified to consider comments in the New Mexico Environment Department's Approval [with comments for the] 2016 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project, dated July 11, 2017, and from a pre-report submittal meeting on January 22, 2018. This document satisfies Appendix B, Milestones and Targets, Milestone 4, of the 2016 Compliance Order on Consent.

If you have any questions, please contact Steve Veenis at (505) 667-0013 (veenis@lanl.gov) or Cheryl Rodriguez at (505) 665-5330 (cheryl.rodriguez@em.doe.gov).

Sincerely,

Enrique Torres, Program Director
Environmental Remediation Program
Los Alamos National Laboratory

Sincerely,

David S. Rhodes, Director
Office of Quality and Regulatory Compliance
Environmental Management
Los Alamos Field Office

ET/DR/SV

Enclosures: Two hard copies with electronic files – 2017 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project (EP2018-0014)

Cy: (w/enc.)
Cheryl Rodriguez, DOE-EM-LA
Steve Veenis, ADEM ER Program

Cy: (w/electronic enc.)
Laurie King, EPA Region 6, Dallas, TX
Raymond Martinez, San Ildefonso Pueblo
Dino Chavarria, Santa Clara Pueblo
Charles Vokes, Buckman Direct Diversion, Santa Fe, NM
Steve Yanicak, NMED-DOE-OB, MS M894
emla.docs@em.doe.gov
Public Reading Room (EPRR)
ADESH Records
PRS Database

Cy: (w/o enc./date-stamped letter emailed)
lasomailbox@nnsa.doe.gov
Peter Maggiore, DOE-NA-LA
David Rhodes, DOE-EM-LA
Enrique Torres, ADEM ER Program
Randy Erickson, ADEM
Amanda White, ADEM ER Program
Jocelyn Buckley, ADESH-EPC-CP
Benjamin Roberts, ADESH-EPC-DO
William Mairson, ADESH/PADOPS
Craig Leasure, PADOPS

LA-UR-18-23237
April 2018
EP2018-0014

2017 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project

Los Alamos
NATIONAL LABORATORY
EST. 1943

Prepared by the Associate Directorate for Environmental Management

EP2018-0014

2017 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project

April 2018

Responsible project manager:

Steve Veenis	Steve Veenis	Project Manager	Environmental Remediation Program	4.19.18
Printed Name	Signature	Title	Organization	Date

Responsible LANS representative:

for Randall Erickson	[signature]	Associate Director	Associate Directorate for Environmental Management	4/20/18
Printed Name	Signature	Title	Organization	Date

Responsible DOE EM-LA representative:

David S. Rhodes	[signature]	Office Director	Quality and Regulatory Compliance	4-25-2018
Printed Name	Signature	Title	Organization	Date

EXECUTIVE SUMMARY

This eighth annual monitoring report provides a summary of analytical data, discharge measurements, geomorphic changes, and precipitation data associated with storm water samples collected from the Los Alamos/Pueblo (LA/P) watershed from June to November 2017. Monitoring objectives include collecting data to evaluate the effect of watershed mitigations installed in the LA/P watershed on stream flow and sediment and contaminant transport. Watershed mitigations evaluated include the DP Canyon grade-control structure (GCS) and associated floodplains; the Pueblo Canyon drop structure, willow planting, wetland, and GCS; the Los Alamos Canyon low-head weir and associated sediment detention basins; and the storm water detention basins and vegetative buffer below the Solid Waste Management Unit 01-001(f) drainage in Los Alamos Canyon. Pursuant to Section VII of the 2005 Compliance Order on Consent, Los Alamos National Laboratory (the Laboratory) had implemented interim measures to reduce the migration of contaminants within the LA/P watershed. These mitigations have been implemented with the overall goals of minimizing the potentially erosive nature of storm water runoff, enhancing deposition of sediment, and reducing access of contaminated sediments to storm water.

Gaging station and sampling locations within the LA/P watershed monitor the hydrology and sediment transport, including stations that bound the mitigation sites. Stage height/discharge is monitored at 5-min intervals at a series of gaging stations. Precipitation data are collected across the Laboratory by means of 5 meteorological towers and an extended network of 14 precipitation gages. Sampling for analytical suites specific to each reach of the watershed is conducted using portable automated samplers. Sampling equipment and the extended rain gage network are deactivated during the winter months (December to April) and reactivated in the spring.

Attenuation of flow and associated sediment transport are primary goals of the sediment transport mitigation activities. Decreasing flow velocity allows for increased infiltration, thus reducing peak discharge, reducing the distance the flood bore travels downstream, and reducing the distance sediment and associated contaminants entrained in the storm water travel downstream. In DP Canyon, the GCS and associated floodplains between gaging stations E038 and E039.1 facilitated a significant reduction in the suspended sediment being transported downstream. In Pueblo Canyon, the wetland, willows, drop structure, and GCS between gaging stations E059.5 and E060.1 facilitated such a reduction in peak discharge that storm water runoff at E060.1 was not large enough to sample. In Los Alamos Canyon, the low-head weir and associated sediment detention basins between gaging stations E042.1 and E050.1 facilitated a reduction in the peak discharge during all of the early-season runoff events and a significant reduction in the volume of suspended sediment being transported downstream. The 2017 monitoring data in the LA/P watershed indicate that, in general, the mitigations are performing as designed.

Geomorphic changes are monitored at one background area, five sediment transport mitigation sites, and two sediment retention basin areas that have been established in the LA/P watershed. The bank and thalweg surveys and repeat photographs support the conclusion of overall stability of the banks and channels in Pueblo, DP, and Los Alamos Canyons and establish the geomorphic change between 2016 and 2017 as minor, indicating that the watershed mitigations are performing as designed.

Based on the correlations between concentrations of metals, radioisotopes, and polychlorinated biphenyls (PCBs) in unfiltered storm water and suspended sediment concentration presented in the "2015 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project", the Laboratory discontinued monitoring certain constituents from storm water monitoring at Los Alamos and Pueblo watershed gaging stations E026, E030, E038, E039.1, E040, E042.1, E055, E055.5, E056, E059.5, and E059.8. The Laboratory continued to monitor unfiltered target analyte list metals and isotopic uranium at E050.1 and E060.1 per the 2015 memorandum of understanding between the U.S. Department of Energy and the Buckman Direct Diversion Board. The Laboratory continued

monitoring dissolved metals and unfiltered total recoverable selenium, unfiltered mercury, and total recoverable aluminum after filtration using a 10-µm pore size filter because these dissolved and total metals have numeric criteria applicable to achieving designated and attainable uses given in New Mexico Administrative Code 20.6.4. The Laboratory continued monitoring silver in unfiltered storm water in Acid and Pueblo Canyons and continued monitoring total PCBs and certain isotopic radionuclides in unfiltered storm water.

Continued monitoring in 2018 is expected to confirm the sediment transport mitigations in the LA/P watershed are performing as designed and to document more thoroughly the performance of the drop structure in Pueblo Canyon.

CONTENTS

1.0 INTRODUCTION 1
1.1 Project Goals and Methods 2

2.0 MONITORING IN THE LA/P WATERSHED 3
2.1 Discharge and Precipitation Measurements and Sampling Activities 3
2.2 Sampling at the Detention Basins below the SWMU 01-001(f) Drainage 4
2.3 Sampling at the Gaging Stations in the LA/P Watershed 4
2.4 Samples Collected in the LA/P Watershed 4
2.5 Deviations from Monitoring Plan 5

3.0 WATERSHED HYDROLOGY 6
3.1 Drainage Areas and Impervious Surfaces 6
3.2 Water and Sediment Transmission 7
3.3 Geomorphic Changes and Willow Plantings Health 9
3.4 Impact and Efficiency of Watershed Mitigations 9

4.0 ANALYTICAL RESULTS 11
4.1 Data Exceptions 11
4.2 Analytes Exceeding Comparison Values 11
4.3 Relationships between Discharge and SSC 14
4.4 Relationship between SSC and Concentrations of Constituents 14
4.5 Storm Water Sampling below SWMU 01-001(f) 15

5.0 CHANGES FROM 2016 REPORT 15

6.0 CONCLUSIONS 15

7.0 REFERENCES AND MAP DATA SOURCES 16
7.1 References 16
7.2 Map Data Sources 19

Figures

Figure 1.1-1 Los Alamos and Pueblo Canyons showing monitoring locations and sediment transport mitigation sites 21
Figure 2.1-1 Total precipitation for each month between 2011 and 2017 based on meteorological tower data averaged across the Laboratory (mean and percentiles are based on data from 1992 to 2010) 22
Figure 2.1-2 Los Alamos and Pueblo Canyons watershed showing drainage areas for each stream gaging station and associated rain gages and Thiessen polygons 23
Figure 2.2-1 Sediment detention basins and sampling locations below the SWMU 01-001(f) drainage 24
Figure 3.2-1 Flow diagram of gaging stations and sediment transport mitigation sites in the LA/P watershed 25
Figure 3.2-2 Box-and-whisker plots of SSC for all gaging stations in the LA/P watershed over the past 6 yr of monitoring 26
Figure 3.2-3 Hydrographs during each sample-triggering runoff event for each canyon from up- to downstream reaches 29

Figure 3.2-4 Discharge and SSC for events sampled at E038, E039.1, E042.1, E050.1, E059.5, and E059.8 ... 41
Figure 3.2-5 Relationship between SSC-based sediment yield and runoff volume over the past 6 yr of monitoring ... 47
Figure 3.2-6 Relationship between SSC-based sediment yield and peak discharge over the past 6 yr of monitoring ... 48
Figure 3.4-1 Box-and-whisker plots of SSC (left) and peak discharge (right) upstream and downstream of the watershed mitigations in DP (top), Pueblo (middle), and Los Alamos (bottom) Canyons over the past 6 yr of monitoring ... 49
Figure 3.4-2 Discharge and SSC at E038 and E039.1 in upper Los Alamos Canyon on days when sampling of the same runoff event occurred ... 50
Figure 3.4-3 Discharge and SSC at E042.1 and E050.1 in upper Los Alamos Canyon on days when sampling of the same runoff event occurred ... 52

Tables

Table 2.1-1 Equipment Configuration at LA/P Gaging Stations ... 55
Table 2.3-1 Maximum Daily Discharge and Storm Water Sampling in the LA/P Watershed during 2017 ... 56
Table 2.3-2 Sampling Operational Issues during the 2017 Monitoring Year ... 57
Table 2.4-1 Locations and Analytical Suites for Storm Water Samples ... 58
Table 2.4-2 Analytical Requirements for Storm Water Samples ... 59
Table 2.4-3 Factors Contributing to Analytical Suite Prioritization ... 60
Table 2.4-4 Actual Sampling Events ... 62
Table 2.5-1 Sample Collection and Sample Retrieval Working-Day Interval ... 69
Table 2.5-2 Gaging Station Operational Issues during the 2017 Monitoring Year ... 71
Table 2.5-3 Gaging Station and Sampler Inspection Interval ... 72
Table 3.1-1 Drainage Area and Impervious Surface Percentage in the Los Alamos Canyon Watersheds ... 79
Table 3.2-1 Travel Time of Flood Bore, Peak Discharge, Increase or Decrease in Peak Discharge, and Percent Change in Peak Discharge from Up- to Downstream Gaging Stations for 2017 Runoff Events Exceeding Sampling Triggers across the Watershed Mitigations ... 80
Table 3.2-2 Pearson's Correlation Coefficients Between Post-Flood Bore Discharge (Q) and SSC for Each Gaging Station Sampled during 2017 ... 81
Table 3.2-3 SSC-Based Sediment Yield and Runoff Volume for Sampled 2012 to 2017 Runoff Events ... 82
Table 4.2-1 Comparison of Detected Analytical Results from 2017 with the Water Quality Criteria ... 86
Table 4.3-1 Calculated SSC and Instantaneous Discharge Determined for Each Sample Collected during 2017 in the LA/P Watershed ... 92
Table 4.4-1 Calculated Total Metal and Isotopic Uranium Concentrations Determined for Each Sample Analyzed for SSC during 2017 in the LA/P Watershed ... 113
Table 4.4-2 Relative Percent Difference between Measured and Estimated Metals Concentrations at E050.1 ... 125

Appendixes

Appendix A	2017 Geomorphic Changes at Sediment Transport Mitigation Sites in the Los Alamos and Pueblo Canyons Watershed
Appendix B	Pueblo Canyon Wetland Piezometer Levels
Appendix C	2017 Watershed Mitigation Inspections
Appendix D	Analytical Results and Instantaneous (5-Minute) Gaging Station Stage and Discharge Data for the Los Alamos/Pueblo Watershed (on CD included with this document)

Acronyms and Abbreviations

AAL	acute aquatic life
amsl	above mean sea level
ASTM	American Society for Testing and Materials
BDD	Buckman Direct Diversion
BDDB	Buckman Direct Diversion Board
bgs	below ground surface
CAL	chronic aquatic life
cfs	cubic feet per second
Consent Order	Compliance Order on Consent
DEM	digital elevation model
DoD	DEM of difference
DOE	Department of Energy (U.S.)
EPA	Environmental Protection Agency (U.S.)
ESH	Environment, Safety, and Health
F	filtered
FIS	fuzzy inference system
GCD	geomorphic change detection
GCS	grade-control structure
GIS	geographical information system
GPS	global positioning system
HH-OO	human health–organism only
ICP	inductively coupled plasma
IMWP	interim measure work plan
Individual Permit	National Pollutant Discharge Elimination System Permit No. NM0030759
Laboratory	Los Alamos National Laboratory
LANL	Los Alamos National Laboratory

LA/P	Los Alamos and Pueblo (watershed)
LiDAR	light detecting and ranging
LoD	level of detection
LW	livestock watering
MDL	method detection limit
MF	membership function
ND	not detected
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
PCB	polychlorinated biphenyl
PQL	practical quantitation limit
RPD	relative percent difference
RMSE	root-mean-squared error
SIMWP	supplemental interim measures work plan
SMA	Site Monitoring Area
SSC	suspended sediment concentration
SWMU	solid waste management unit
TA	Technical Area
TAL	target analyte list (EPA)
TCDD[2,3,7,8]	2,3,7,8 tetrachlorodibenzo-p-dioxin
TRM	turf-reinforcement mat
TSS	total suspended solids
UF	unfiltered
WH	wildlife habitat
WWTF	wastewater treatment facility
WWTP	wastewater treatment plant

1.0 INTRODUCTION

Los Alamos National Laboratory (LANL or the Laboratory) is a multidisciplinary research facility owned by the U.S. Department of Energy (DOE) that is managed by Los Alamos National Security, LLC. The Laboratory is located in north-central New Mexico approximately 60 mi northeast of Albuquerque and 20 mi northwest of Santa Fe. The Laboratory site comprises an area of approximately 39 mi^2, mostly on the Pajarito Plateau, which consists of a series of mesas separated by eastward-draining canyons. It also includes part of White Rock Canyon along the Rio Grande to the east.

This eighth annual monitoring report provides a summary of analytical data, discharge measurements, and precipitation data associated with storm water collected from the Los Alamos and Pueblo (LA/P) watershed from June to November 2017. In addition, the geomorphic changes at the sediment transport mitigation sites in the LA/P watershed are included in this report as Appendix A. This monitoring was initially stipulated by the New Mexico Environment Department (NMED) approval with direction for the "Los Alamos and Pueblo Canyons Supplemental Investigation Report," which states that "The Permittees must install surface water monitoring stations below each newly-installed weir and develop a monitoring plan to evaluate each weir's effectiveness" (NMED 2007, 098284). Subsequent proposed mitigation and monitoring efforts were identified and implemented per the approved "Interim Measure Work Plan to Mitigate Contaminated Sediment Transport in Los Alamos and Pueblo Canyons" (hereafter, the IMWP) (LANL 2008, 101714; NMED 2008, 103007) and the approved "Supplemental Interim Measures Work Plan to Mitigate Contaminated Sediment Transport in Los Alamos and Pueblo Canyons" (hereafter, the SIMWP) (LANL 2008, 105716; NMED 2009, 105014). Monitoring in 2017 was performed in accordance with the "2017 Monitoring Plan for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project" (LANL 2017, 602342).

Monitoring objectives include collecting data to evaluate the effect of watershed mitigations installed in the LA/P watershed on stream flow and sediment and on contaminant transport. The discussion of flow and analytical results for suspended sediment and constituent concentrations focuses on an evaluation of the overall performance of the watershed, with specific emphasis on the effects of the mitigations implemented per the IMWP and SIMWP. The discussion in Appendix A of geomorphic stability focuses on sediment stability and mobility in the watershed as a measure of the overall stability of the watershed and the performance of the sediment-mitigation structures.

The NMED approval with modifications for the 2013 monitoring plan for sediment transport mitigation (LANL 2013, 243432; NMED 2013, 523106) also directed the Laboratory to monitor storm water above and below the detention basins below the Solid Waste Management Unit (SWMU) 01-001(f) drainage in upper Los Alamos Canyon. Watershed mitigations evaluated in this report include the DP Canyon grade-control structure (GCS) and associated floodplains; the Pueblo Canyon drop structure, willow plantings, wetland, and GCS; the Los Alamos Canyon low-head weir and associated sediment detention basins; and the storm water detention basins and associated vegetative buffer below the SWMU 01-001(f) drainage in Los Alamos Canyon.

Work began in 2014 to rehabilitate and mitigate damage to the Pueblo Canyon wetlands, GCS, and gaging station E060.1 from the September 2013 flooding. Work accomplished in 2014 included planting willows below the wetlands; planting canary reed grass; installing piezometer transects to record water levels and willow performance (Appendix B); stabilizing the local banks; and undertaking Phase I post-flooding mitigation activities at gaging station E060.1, including armoring of the north bank directly downstream of the flume and stabilizing select banks. Work accomplished in 2015 included installing a drop structure at the Pueblo Canyon wetland headcut; installing gaging station E059.8 equipped with a v-notch flume; undertaking Phase II of gaging station E060.1 post-flooding mitigations, including redirecting the channel; installing spurs for bank protection; contouring the area around the gaging station; installing erosion protection measures at the downstream side of both the existing Pueblo Canyon GCS and gaging station E060.1; and constructing an access road.

Key constituents of concern in the watershed addressed in this monitoring report include radionuclides. Corrective actions at the Laboratory are subject to the 2005 Compliance Order on Consent (Consent Order). Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to NMED in accordance with DOE policy.

1.1 Project Goals and Methods

The mitigations specified in the IMWP and SIMWP have been implemented with the overall goal of minimizing the potentially erosive nature of storm water runoff to enhance deposition of sediment and to reduce or eliminate the susceptibility of contaminated sediments to flood erosion. Figure 1.1-1 shows the locations of the mitigation and monitoring stations, including stream gaging stations, in the LA/P watershed. Mitigation/rehabilitation measures performed in 2014 and 2015 in response to the September 2013 floods are discussed in this report because these measures have become integral to the LA/P watershed monitoring. In the Pueblo Canyon watershed, the central focus of the mitigations is to maintain a physically, hydrologically, and biologically functioning wetland that can reduce peak flows and trap suspended sediment because of the presence of thick wetland vegetation. Stabilization and enhancement of the wetland were partially addressed with the installation of a GCS designed to inhibit headcutting below the terminus of the wetland and to promote the establishment of additional riparian or wetland vegetation beyond the current terminus of the wetland. Mitigations in upper portions of Pueblo Canyon above the wetland are designed primarily to reduce the flood peaks and to enhance channel/floodplain interaction before floods reach the wetland. Gaging stations are situated within the watershed to monitor the overall hydrology and sediment transport along the length of the watershed, including stations that bound the wetland.

In DP and Los Alamos Canyons, mitigations included stabilizing and partially burying the channel and adjacent floodplains in upper DP Canyon, which is a source of contaminants entrained in frequent floods that originate from a portion of the Los Alamos townsite. A GCS was installed with a height that encourages channel aggradation, thus reducing the potential for erosion of contaminated sediment deposits in adjacent banks during floods. Channel aggradation should also encourage the spreading of floodwaters, thereby reducing peak discharge because of transmission loss within the reach and thus enhancing sediment deposition. Lower flood peaks should also reduce the erosion of contaminated sediment deposits downcanyon of the DP GCS. Mitigations in Los Alamos Canyon several kilometers below the DP Canyon confluence involve removing accumulated sediment behind the Los Alamos Canyon low-head weir to increase the residence time of floodwaters and to enhance settling of suspended sediment and associated contaminants. (This was performed in April 2014 but not in 2015, 2016, or 2017 because not enough sediment had accumulated to warrant its removal.)

Additional mitigations were implemented in Los Alamos Canyon under a separate administrative requirement (LANL 2008, 104020; NMED 2009, 105858) to address polychlorinated biphenyl (PCB) contamination associated with SWMU 01-001(f). The mitigation actions at that location involved removing contaminated sediment from the hillslope and constructing detention basins and a willow-planted vegetation buffer at the bottom of the associated hillside drainage to promote the settling of PCB-contaminated sediments in runoff from the upgradient PCB-contaminated hillslope drainage. In addition, a pipeline was installed in 2015 under the National Pollutant Discharge Elimination System (NPDES) Permit NM0030759 (the Individual Permit) to divert townsite runoff around SWMU 01-001(f).

Inspections of all watershed mitigations are performed on a routine basis (quarterly) and after significant flow events (greater than 50 cubic feet per second [cfs] at locations with gaging stations or greater than 0.5 in. in 30 min at locations without gaging stations). These inspections are completed to ensure the watershed mitigations are functioning properly and to identify if maintenance may be required. Appendix C contains photographs and descriptions of each inspection and associated information.

2.0 MONITORING IN THE LA/P WATERSHED

2.1 Discharge and Precipitation Measurements and Sampling Activities

Discharge was measured and surface water sampling was attempted at 13 gaging stations in the LA/P watershed in 2017. Gaging stations with concrete, trapezoidal, supercritical-flow flumes are designated Los Alamos below Low Head Weir (E050.1), Pueblo below Grade Control Structure (E060.1), DP below Grade Control Structure (E039.1), and Los Alamos above Low Head Weir (E042.1). Nine other gaging stations that complete the monitoring network in the LA/P watershed are designated as Pueblo above Acid (E055), South Fork Acid Canyon (E055.5), Acid above Pueblo (E056), Los Alamos below Ice Rink (E026), Los Alamos above DP Canyon (E030), DP above TA-21 (E038), E059.5 Pueblo below LAC WWTF (E059.5), E059.8 Pueblo below Wetlands (E059.8), and DP above Los Alamos Canyon (E040). Figure 1.1-1 shows the locations of stream gaging stations and watershed mitigations within the Laboratory’s property boundary and on adjacent land owned by the County of Los Alamos.

Stage height was monitored at each LA/P gaging station at 5-min intervals in the LA/P watershed. Sutron 9210 data loggers stored each recorded stage-height measurement as it was made. Discharge was computed for each 5-min stage measurement using rating curves for each individual gaging station. Shaft-encoder float sensors installed in stilling wells were used to measure water levels at E030, E039.1, E042.1, E050.1, and E060.1. Self-contained bubbler pressure sensors (Sutron Accubar) were used to measure water levels at E038, E055, E055.5, E056, E059.5, and E059.8 and to provide backup sensing at E039.1, E042.1, E050.1, and E060.1. An ultrasonic probe sensor (Siemens Milltronics “The Probe”) was used to measure water levels at E026 and E040 and to provide backup sensing at E050.1 and E060.1. Radar probe was installed and used at E055.5 after May 16, 2017.

A complete record of 5-min stage-height measurements for the monitoring period from June 1, 2017, to October 31, 2017, exists at E026, E030, E038, E039.1, E040, E042.1, E050.1, E055, E056, E059.5, E059.8, and E060.1. Five-minute stage measurements are incomplete at E055.5. A rating curve could not be established at E055.5 because log check dams installed downstream of E055.5 caused the channel bed to fluctuate significantly throughout 2017. The location of the stage sensor was moved upstream to a more stable location in March 2018. Appendix D contains the 5-min gaging station stage and discharge data for the LA/P watershed.

Storm water programs at the Laboratory use precipitation data collected at the Laboratory’s meteorological towers. Figure 2.1-1 shows total precipitation for each month from 2011 to 2017 averaged over the Laboratory; annual heterogeneity and increase in precipitation occurs during the summer monsoon. In addition, a seasonal, extended rain gage network is deployed during the months from April to November to coincide with storm water monitoring periods. Using a geographical information system (GIS), storm water monitoring stations are assigned to an individual rain gage using the method of Thiessen polygons. Rain gages, meteorological towers, Thiessen polygons, and the drainage area for each stream gaging station associated with the LA/P watershed are presented in Figure 2.1-2.

Sampling was conducted using ISCO 3700 portable automated samplers. Two ISCO samplers were installed at each of the following locations: E038, E039.1, E042.1, E050.1, E059.5, E059.8, and E060.1. At locations where two samplers were installed, one sampler was configured with a 24-bottle carousel to monitor primarily suspended sediment, and the second sampler was configured with a 12-bottle carousel to monitor inorganic and organic chemicals and radionuclides. At locations where a single sampler was installed, the sampler was configured with a 12-bottle carousel to monitor suspended sediment, inorganic and organic chemicals, and radionuclides. Sampler intake lines were set above the bottom of the channel or flume and were placed perpendicularly to the direction of flow. Trip levels (in discharge) and the dates during with the trip levels were active are presented in Table 2.1-1.

Sampling equipment at gaging stations in the LA/P watershed was shut down during the winter months and reactivated in the spring. Automated samplers and equipment at gaging stations were inspected weekly from June 1 to October 31 and at least monthly from November 1 to May 31. Gaging station equipment at E050.1 and E060.1 was inspected weekly throughout the year. Equipment found to be damaged or malfunctioning was repaired within 5 business days after the problem was discovered. Equipment at the 13 LA/P gaging stations was connected via telemetry to a base station, allowing real-time access to discharge measurements and battery state of charge. Inspectors reviewed telemetry daily to ensure gaging stations were functioning correctly, and gaging stations and samplers were inspected in the field when telemetry readings indicated discharge had occurred or equipment problems existed. Additionally, flumes at E039.1, E042.1, E050.1, and E060.1 were inspected for sedimentation after each discharge event and cleaned on the first workday after sedimentation occurred.

2.2 Sampling at the Detention Basins below the SWMU 01-001(f) Drainage

In 2017, samples were collected during one storm water sampling event with an automated sampler above two constructed detention basins below the SWMU 01-001(f) drainage at location CO111041. No samples were collected downgradient of the detention basins at the culvert at the terminus of the vegetative buffer below the lower basin (CO101038), because the detention basins would have to be near capacity to collect a sample but were empty throughout 2017. No paired samples were collected. Sampling locations and storm water control features at the detention basins below the SWMU 01-001(f) drainage are identified in Figure 2.2-1. No physical evidence of storm water flow across the lower basin spillway was observed during post-storm inspections in 2017.

2.3 Sampling at the Gaging Stations in the LA/P Watershed

During the monitoring period in 2017 (June 1 to approximately October 31), the sample-triggering discharge (5 cfs at E050.1/E060.1; 40 cfs at E038; and 10 cfs at the other gaging stations) was exceeded during 11 storm events occurring on 11 d as presented in Table 2.3-1. No precipitation events exceeding a sample-triggering discharge occurred before June 1 or after October 31. A total of 34 sampling events occurred during the monitoring period. A sampling event is defined as the collection of 1 or more samples from a specific gaging station during a specific runoff event. Maximum daily discharge at all gaging stations on days when the sample-triggering discharge is exceeded is presented in Table 2.3-1. Table 2.3-1 also summarizes the runoff events sampled at each gaging station. The reason storm water was not collected during each storm event is categorized and presented in Table 2.3-2. Deviations from the monitoring plan are explained more fully in section 2.5.

2.4 Samples Collected in the LA/P Watershed

Sample suites presented in the monitoring plan vary according to the monitoring location and are based on key indicator constituents, as well as requirements stipulated by NMED and the 2015 memorandum of understanding between DOE and the Buckman Direct Diversion Board (BDDB) (DOE and BDD Board 2015, 603016), for a given portion of the watershed. Analyses were obtained from storm water collected at sampling locations, as presented in Table 2.4-1. In cases where insufficient water was collected to perform all planned analyses, analyses were prioritized in the order presented in Table 2.4-1. Up to 24 samples per event were collected for suspended sediment analysis from a single ISCO sampler containing a 24-bottle carousel at the lower gaging stations (E042.1, E050.1, E059.5, and E060.1) and upper DP Canyon gaging stations (E038 and E039.1) (Figures 1.1-1 and 2.1-2). Suspended sediment analyses at all other locations were obtained from the first and last sample in an ISCO sampler containing a 12-bottle carousel. Suspended sediment analyses were conducted using American Society for Testing and Materials (ASTM) method D3977-97, from an entire sample, and reported using the designation "Suspended Sediment Concentration" (SSC).

The U.S. Environmental Protection Agency (EPA) target analyte list (TAL) dissolved metals were analyzed in filtered samples at all locations. TAL total metals were analyzed in unfiltered samples collected at E050.1 and E060.1. Total mercury, selenium, and uranium were analyzed in unfiltered samples at all locations. Other required analyses were conducted from unfiltered samples. Sample collection times were recorded for each individual sample bottle filled, which allowed more precise estimation of discharge and SSCs at the time samples were collected.

Analyses were conducted using the analytical methods presented in Table 2.4-2. Detection limits are provided for comparison purposes but are affected by sample-specific factors that are not fully known until after the sample is analyzed. Such sample-specific factors may include available sample volume, matrix interferences, and sample dilution.

Table 2.4-3 presents the prioritization matrix that was used to guide the submission of analyses during 2017. Summaries of analyses planned, samples collected, and analyses requested at each gaging station are presented in Table 2.4-4. Except at E050.1 and E060.1, where all events are monitored for all parameters, if four runoff events have been sampled at a gaging station during the monitoring year, subsequent events with discharge less than the largest discharge of the sampled storm events will not be analyzed.

Analyses planned and analyses performed differ during the year for several reasons including the following:

1. Incomplete sample volumes were collected.
    a. Minimum volumes are required to obtain specified detection limits. If the volumes were insufficient, select analyses were not performed.
    b. Lowest-priority analyses are omitted when incomplete volumes are collected.
2. Samples are collected in glass or polyethylene bottles.
    a. Organic chemical analyses are conducted on samples collected in glass bottles and if glass bottles did not fill, analyses were not performed.
    b. Boron was analyzed as an addition to the TAL metal suite, and samples were collected in polyethylene bottles. If sufficient volume was not collected in polyethylene bottles, then boron analyses were not ordered.

2.5 Deviations from Monitoring Plan

The 2017 monitoring plan (LANL 2017, 602342) calls for samples to be retrieved from the field within 1 business day of sample collection. The interval between sample collection and sample retrieval is documented in Table 2.5-1. Where samples are not retrieved on the first business day after sample collection, the following priority order is used to collect samples:

- BDDB-related gaging stations E050.1 and E060.1: Three of three sampling events were collected within 1 business day;
- Gaging stations bounding watershed mitigations at E038, E039.1, E042.1, E059.5, and E059.8: Fifteen of fifteen sampling events were collected within 1 business day; and

- Other gaging stations at E026, E030, E040, E055, E055.5, E056, CO101038, and CO111041: Sixteen of sixteen sampling events were collected within 1 business day.

In 2017, 34 sample sets were collected, retrieved, and analyzed from gaging stations and from the sampler at CO111041. Samples were collected 33 times within the first business day.

If the stage or discharge could not be correctly measured because of damage or silting that occurred, these instances are documented in Table 2.5-2. In 2017, a rating curve was not able to be established at E055.5 gaging station. Three samples were collected throughout the monitoring year; however, discharge could have exceeded sample-triggering thresholds at E055.5 because of the shifting channel bed, as noted in Table 2.5-2.

Battery voltage, stage height, and sensor function at each active gaging station were remotely monitored daily. An on-site inspection was performed if any malfunction or sample collection event was observed. Samplers and monitoring equipment were physically inspected initially in May and weekly between June 1, 2017, and November 2017. The dates of each physical inspection at each gaging station are documented in Table 2.5-3.

In 2017, the Laboratory planned to analyze samples collected from gaging stations E050.1 and E060.1 for TAL metals in the sample-sediment fraction on a dry-weight basis. None of the three sampling events collected at E050.1 in 2017 contained sufficient sediment content to analyze TAL metals in the sediment fraction on a dry-weight basis. Sediment content of the three samples ranged from 0.9 g/L to 1.7 g/L. Because 0.6 L of sample was available for sample-sediment fraction analysis, 0.54 g to 1.0 g of sediment would be entrained on the filter for collection and sediment fraction analysis. Adequate sediment content of samples will be upwards of 5.0 g/L to produce 3 g of sediment necessary to collect sample from the filter, analyze a fraction for TAL metals, and analyze a fraction for the dry-weight calculation.

3.0 WATERSHED HYDROLOGY

The topography, geology, geomorphology, and meteorology of the LA/P watershed are quite complex and include mesas, canyons, and large-elevation gradients; alluvium, volcanic tuff, pumice, and basalt; ephemeral streams, evolving stream networks (both laterally and vertically), and sediment-laden stream discharge; winter snowfall that can create spring snowmelt, intense summer monsoonal rainfall, and occasional late summer to fall tropical storm activity; and severe spatial variability of rainfall. Consequently, monitoring of the LA/P watershed runoff is also complex and challenging.

3.1 Drainage Areas and Impervious Surfaces

The drainage area specific to each gaging station (i.e., not nested) was developed using the ArcHydro Data Model in ArcGIS, and these drainage areas are presented in Figure 2.1-2. Model inputs were developed using an elevation grid created from 1-ft light detecting and ranging (LiDAR) images (a digital elevation model from 2014) and manual site-specific controls based on field assessments. Each drainage area defines the area that drains to the particular gaging station from either the next upstream gaging station or the headwaters of the watershed.

The impervious surface area was derived from the Los Alamos County’s roads and structures GIS layers. Roads, parking lots, and structures were considered impervious, and the total impervious area was computed for each watershed. The total impervious area was then divided by the total area of each watershed to compute the percent impervious surface area. The following assumptions were made in determining the percent impervious surface area: (1) the roads/parking lots and structures GIS layers were developed in 2009, and thus newer impervious surfaces will not be captured; (2) other impervious surfaces such as sidewalks and rock outcroppings may not have been included in the calculations. A significant factor in the frequency of discharge at each gaging station is the ratio of pervious to impervious surface area discharging to the gaging station or within the canyon drainage (Table 3.1-1).

3.2 Water and Sediment Transmission

Figure 3.2-1 is a flow diagram of the LA/P watershed showing each gaging station and the location of sediment transport mitigation sites. Figure 3.2-2 shows box-and-whisker plots of SSC for DP, Los Alamos, and Pueblo/Acid Canyons from up- to downstream over the past 6 yr of monitoring. As expected, Los Alamos Canyon had high concentrations of suspended sediment in 2012 and 2013 as a result of the Las Conchas fire in 2011 and because there is less impervious area contributing to Los Alamos Canyon, thus making more sediment available for erosion. Large post-fire runoff events have tapered off since the fire and SSC magnitudes have returned to pre-fire levels. In contrast, SSC in DP and Pueblo/Acid Canyons is significantly less than in Los Alamos Canyon. Historical observations show that SSC in Los Alamos Canyon generally decreases from E026 to E050.1, particularly after flowing through the lower Los Alamos Canyon sediment detention basins and low-head weir (between E042.1 and E050.1). SSC then increases greatly after the Guaje Canyon confluence (E099), and decreases slightly at E109.9. Gaging station E109.9 was decommissioned after the September 2013 flood, and sampling has not been performed at E099 since 2014 because Guaje Canyon watershed is not impacted by the Laboratory; thus, sampling is not required as part of the LA/P monitoring efforts. In DP Canyon, SSC generally decreases from E038 to E039.1, then increases again from E039.1 to E040. This is most likely because of the large percentage of impervious area in the E038 watershed, causing high-velocity, high-erodibility flows that scour the channel between the townsite and E038; then the DP Canyon floodplains area and GCS decrease the flow velocity before it reaches E039.1, removing sediment; and then the amount of available sediment between E039.1 and E040 is large and SSC increases at E040. DP Canyon joins Los Alamos Canyon to increase the flow velocity and SSC measured at E042.1, and the lower Los Alamos sediment detention basins and low-head weir remove sediment, reducing the SSC at E050.1.

In Acid Canyon, SSC decreases slightly from E055.5 to E056, most likely because of the largely impervious area associated with E055.5 and the largely pervious area associated with E056. Acid Canyon joins Pueblo Canyon, in addition to many tributaries between this confluence and lower Pueblo Canyon, to increase the flow velocity and SSC measured at E059.5. Through the Pueblo Canyon wetlands and drop structure, or from E059.5 to E059.8, there is a large reduction in SSC. From E059.8 to below the GCS at E060.1, SSC increases significantly; however, there was no flow large enough to sample at E060.1 in 2012, 2013, 2014, 2016, or 2017.

For runoff events exceeding sampling triggers in 2017, Figure 3.2-3 shows hydrographs for Los Alamos, DP, and Acid/Pueblo Canyons from up- to downstream. Table 3.2-1 summarizes the flood bore transmission downstream across the major sediment transport mitigations, including travel time of flood bore from the upstream to the downstream gaging station, peak discharges of the flood bore at the gaging station, and the percent reduction in peak discharge between the stations for every sampled runoff event in 2017. The flood bore is defined as the leading edge of the storm hydrograph as it transmits downcanyon, and peak discharge is the maximum 5-min instantaneous flow rate measured during a flood. The focus was on peak discharge because it is related to stream power, and in ephemeral streams in semiarid climates, the greater the stream power, the greater the erosive force, and hence the greater the sediment transport (Bagnold 1977, 111753; Graf 1983, 111754; Lane et al. 1994, 111757). As flood bores move from up- to downstream, peak discharge can either increase by means of alluvial groundwater and/or tributary contributions or decrease because of transmission losses (infiltration). In some events, downstream stations experienced discharge before upstream stations because of inputs from intermediate tributary drainages or localized storms centered closer to the downstream gaging station.

Figure 3.2-4 shows the hydrograph and sedigraph for gaging stations E038, E039.1, E042.1, E050.1, E059.5, and E059.8 that sampled through all or most of the duration of a runoff event plotted as time after the peak. Typically SSC decreases through the hydrograph as energy dissipates and is highly correlated with discharge. Table 3.2-2 shows the Pearson's correlation coefficients between discharge and SSC for these stations and runoff events. Concurrent times as well as various time lags are displayed. Pearson's correlation coefficients are computed as follows:

$$corr_{Q_t,TSS_t} = \frac{\sum_{t=0}^{n}(Q_t-\bar{Q})(SSC_t-\overline{SSC})}{\sqrt{\sum_{t=0}^{n}(Q_t-\bar{Q})^2 \sum_{t=0}^{n}(SSC_t-\overline{SSC})^2}}$$ **Equation 1**

where Q_t is the discharge at time t, SSC_t is the SSC at time t, n is the number of measurements to be correlated $(t = 1, 2, \ldots, n)$, and

$$\bar{Q} = \frac{\sum_{t=0}^{n} Q_t}{n}$$ **Equation 2**

$$\overline{SSC} = \frac{\sum_{t=0}^{n} SSC_t}{n}$$ **Equation 3**

The peak SSC can occur after the peak discharge; thus, lags between 0 and 30 min are presented with the discharge lagging behind the SSC to align the peaks (after 30 min, the correlations were reduced for all stations and all runoff events). For example, when the Pearson's correlation coefficient between Q_t and SSC_{t+5} is computed, the SSC time series begins 5 min after the discharge time series.

For stations E038, E039.1, E042.1, E050.1, and E059.5, discharge is reasonably positively correlated to SSC with little to no lag. The exceptions are when the sampler intake clogged and a few end-of-the-year storm events in October when there were negative correlations. Figure 3.2-5 shows the linear relationship between sediment yield and runoff volume for the stations where SSC was measured throughout the runoff event over the past 6 yr of monitoring; Table 3.2-3 presents the 2012 through 2017 values shown in Figure 3.2-5. Although SSC and instantaneous discharge are not always highly correlated as a result of localized precipitation, sediment availability, or antecedent conditions, the linear relationship between sediment yield and runoff volume is well established (Onodera et al. 1993, 111759; Nichols 2006, 111758; Mingguo et al. 2007, 111756).

The runoff volume for each event was computed as follows:

$$V = \sum_{i=0}^{n} Q(t_i)(t_{i+1} - t_i) \quad ,$$ **Equation 4**

where n = the number of instantaneous discharge measurements taken throughout the runoff event,

t_i = the time at which an instantaneous discharge measurement is taken, and

$Q(t_i)$ = the discharge (ft^3/s) at time t_i (multiplied by 60 to convert from ft^3/s to ft^3/min).

The mass of sediment for each runoff event was computed by

$$M = \sum_{j=0}^{m} Q(t_j)(t_{j+1} - t_j)\, SSC(t_j) \quad ,$$ **Equation 5**

where m = the number of SSC samples taken throughout the storm event,

t_j = the time, j, at which an SSC sample is taken,

$Q(t_j)$ = the discharge (ft^3/s) at time t_j interpolated from the instantaneous discharge measurements taken at time t_j (multiplied by 60 to convert from ft^3/s to ft^3/min), and

$SSC(t_j)$ = SSC (mg/L) at time t_j (multiplied by 28.3 × 10^{-6} to convert from mg/L to kg/ft^3).

Figure 3.2-6 shows the linear relationship between sediment yield and peak discharge, which is not as robust as the relationship between sediment yield and runoff volume during the past 6 yr, shown in Figure 3.2-5.

3.3 Geomorphic Changes and Willow Plantings Health

Geomorphic changes that occurred from October 2016 to November 2017 at sediment transport mitigation sites in the LA/P watershed were evaluated and are discussed in Appendix A. The evaluation was performed via a comparison of bank and thalweg surveys encompassing accumulated change over the 2017 monsoon season and repeat photographs of the sediment transport mitigation sites. In addition, photographs of examples of erosion and deposition at surveyed cross-sections were taken. Following NMED's approval of the Laboratory's recommendation to reduce LiDAR monitoring from annual to a period of every 3 yr (or following significant storm events), the baseline results are presented (i.e., geomorphic change detection [GCD] digital elevation model [DEM] comparison) for a 3-yr window in which rainfall amounts were average to below average (spring 2014 to fall 2016).

The LA/P watershed underwent minor geomorphologic changes during the 2017 monsoon season. Repeat global positioning system (GPS) surveys data support the conclusion that features within the watershed have remained stable since they were last surveyed before the 2017 monsoon season. The monsoon season of 2017, being generally average to below average in its intensity of rainfalls, has resulted in minor annual changes to morphology of monitored features and caused no significant geomorphic changes within the watershed.

Willows were planted in Pueblo Canyon to aid in surface stabilization, reduce flow velocity, and promote sediment accumulation (Appendix A and Figure A-1.0-1). Willows were initially planted in 2010 in the upper Pueblo Canyon willow-planting area. Although many of the willows planted in this area were laid down during the September 2013 flood, many have since resprouted. As long as the willows continue to survive and propagate, they will attenuate flood energy and promote local channel stability/aggradation. In 2014, an additional 9000 willows were planted in lower Pueblo Canyon below the new drop structure to assist with channel stabilization efforts after the September 2013 flood. Piezometers were installed to monitor the health of the willows via alluvial groundwater levels, and Appendix B presents a summary of this monitoring from 2015 to 2017. The piezometers monitoring alluvial groundwater levels were removed in January 2018 because it is apparent that the health of the willows is highly correlated with the presence of water, which is highly correlated with the Los Alamos County wastewater treatment facility's outfall discharge, and because the willow populations have stabilized over the past 3 yr, as discussed below and in Appendix A.

Baseline coyote willow (Salix exigua) qualitative monitoring in Pueblo Canyon was first conducted in November of 2016. A second qualitative monitoring campaign was conducted in September of 2017. Monitoring activities have continued to be completed annually and will be compared with previous years' monitoring results. To monitor willow communities in Pueblo Canyon, average range of plant growth (height) and spatial distribution of willow populations, as well as repeat photographs, were used to characterize and define discrete willow populations. There were no observed changes in Pueblo Canyon willow communities between 2016 and 2017.

3.4 Impact and Efficiency of Watershed Mitigations

Below is a discussion of each watershed mitigation and the impact and efficiency of that system.

DP Canyon: Sampling was performed in DP Canyon on July 8, 26, 29, and August 7, 2017, above (E038) and below (E039.1) the GCS and upstream wetland (Table 2.3-1). SSC analyses performed from samples collected during these runoff events allow direct evaluation of the effect of the GCS and upstream wetland on flow and sediment transport (Figures 3.4-1 and 3.4-2). Sample collection began within 5 min of initial discharge (triggered above 40 cfs for E038 and 10 cfs for E039.1). For E038 and E039.1, respectively, the calculated sediment yield is 4.6 yd^3 and 2.1 yd^3 on July 8; 12.3 yd^3 and 3.9 yd^3 on July 26; 1.5 yd^3 and 0.6 yd^3 on July 29; and 2.0 yd^3 and 0.2 yd^3 on August 7 (Table 3.2-3). Between these two stations, or from above to below the GCS/wetland, there is a 75%, 104%, 86%, and 164% relative percent difference (RPD) decrease in sediment yield for these events, respectively. The runoff volume between E038 and E039.1 increased slightly during the July 8 event with a 5% RPD increase (2.0 acre-ft for E038 and 2.1 acre-ft for E039.1) but decreased during the July 26, July 29, and August 7 events with a 28% (4.5 acre-ft to 3.4 acre-ft), 6% (1.8 acre-ft to 1.7 acre-ft), and 81% (1.9 acre-ft to 0.8 acre-ft) RPD decrease, respectively.

Overall statistics over the past 6 yr of monitoring are also useful in assessing performance. Figure 3.4-1 shows box-and-whisker plots for E038 and E039.1 for SSC and peak discharge. These plots show major reductions in SSC and slight reduction (depending on the year) in mean peak discharge (i.e., erosive force) over the 6 yr, which is consistent with the goals of the sediment transport mitigation activities.

Decreasing storm water velocity allows for increased infiltration, thus reducing peak discharge, reducing the distance the flood bore travels downstream, and reducing the distance that sediment and associated contaminants entrained in the storm water travel downstream. Increasing infiltration reduces peak discharge but can also decrease the total volume of storm water. In 2017, the peak discharge decreased in 10 of 11 measureable runoff events between E038 and E039.1, with a decrease of 54% RPD, and no increase or decrease in peak discharge in 1 of 11 events (Table 3.2-1).

Pueblo Canyon: In 2017, no SSC analyses were performed in Pueblo Canyon above the drop structure (E059.5), below the drop structure (E059.8), and below the wetland and GCS (E060.1) (Table 2.3-1). Therefore, overall statistics over the past 6 yr of monitoring must be used to assess performance. Figure 3.4-1 shows box-and-whisker plots for E059.5, E059.8, and E060.1 for SSC and peak discharge. As these plots indicate, mean peak discharge was effectively attenuated through the Pueblo Canyon wetland, resulting in little to no transport from the upper Pueblo watershed into lower Los Alamos Canyon. This is consistent with the goals of the sediment transport mitigation activities. Also note that of the 10 measurable storm events in 2017, the peak discharge at E059.8 was less than peak discharge at E059.5, with an average decrease of 98% RPD (Table 3.2-1). The peak discharge between E059.8 and E060.1 decreased in 2 of 6 runoff events, with a decrease of 100% RPD, and increased in 3 of 6 runoff events, with an increase of 100% RPD, and during one runoff event, the downstream peak occurred before the upstream peak, indicating subtributaries and hillslopes accounted for most of the flow to E060.1 (Table 3.2-1).

The discharge magnitude is being reduced through this area, which is a primary goal of the mitigation actions. Indeed, discharge is being reduced so much that at E060.1, no samples were collected in 2012, 2013, 2016, or 2017; SSC was not analyzed for the one sample collected in 2014; and only two samples were collected in 2015. In addition, SSC magnitude was reduced through the mitigation structures in 2015.

Los Alamos Canyon: Sampling was performed in Los Alamos Canyon on September 27, September 29, and October 4, 2017, above (E042.1) and below (E050.1) the lower Los Alamos sediment detention basins and low-head weir (Table 2.3-1). SSC analyses performed from samples collected during these runoff events allow direct evaluation of the effect of the weir and associated basins on flow and sediment transport (Figure 3.4-3). Sample collection began within 5 min of initial discharge (triggered above 10 cfs for E042.1 and 5 cfs for E050.1). For E042.1 and E050.1, respectively, the calculated sediment yield is 3.7 yd^3 and 1.9 yd^3 on September 27; 22.0 yd^3 and 7.8 yd^3 on September 29; and 19.6 yd^3 and 5.8 yd^3 on October 4 (Table 3.2-3). Between these two stations, or from above to below the basins/weir, there is a 64%, 95%, and 109% RPD decrease in sediment yield for these events, respectively. The runoff volume between E042.1 and E050.1 increased during the September 27, September 29, and October 4 events with a 34% (6.9 acre-ft for E042.1 and 9.7 acre-ft for E050.1), 46% (10.8 acre-ft and 17.3 acre-ft), and 94% (5.9 acre-ft and 16.3 acre-ft) RPD increase, respectively. In addition, in 2017, peak discharge decreased in four of seven measureable runoff events between E042.1 and E050.1, with an average decrease of 78% RPD, and peak discharge increased in three of seven storm events, with an average increase of 44% RPD (Table 3.2-1). Sediment trapping efficiency is expected to be higher in smaller events and events early in the season before the detention basins have filled with water. Flow is reduced through the weir and the upstream sediment detention basins, allowing sediment to settle out of suspension; thus, this mitigation feature is performing as designed.

In addition to examining coinciding sampling events, performance of the weir and upstream sediment detention basins can be assessed by examining overall statistics over the past 6 yr of monitoring. Figure 3.4-1 shows box-and-whisker plots for E042.1 and E050.1 for SSC and peak discharge. These plots show major reductions in SSC, particularly in the post–Las Conchas fire years of 2012 and 2013; thus, the weir is performing as designed. Minor reductions in peak discharge occurred from 2011 to 2013 and 2016; minor increases in peak discharge occurred in 2010, 2014, 2015, and 2017.

4.0 ANALYTICAL RESULTS

Appendix D contains the analytical results for the LA/P watershed.

4.1 Data Exceptions

Low bias of analytical results in high-sediment-content storm water has been observed in analyses performed by gamma spectroscopy, alpha spectroscopy, inductively coupled plasma (ICP) mass spectroscopy and ICP optical emission spectroscopy. This low bias can be avoided when the solid phase and liquid phase of each biphasic sample are analyzed separately and the results mathematically recombined. No biphasic samples were analyzed in 2017.

4.2 Analytes Exceeding Comparison Values

As explained in the IMWP, several actions were taken as part of an interim measure under Section VII.B of the 2005 Consent Order to mitigate transport of contaminated sediments in the LA/P watershed (LANL 2008, 101714). The analytical results from monitoring are presented and evaluated within this context. The mitigation actions were not undertaken with the objective of reducing concentrations of water-borne contaminants to specific levels, and the analytical results are therefore not compared with water-quality standards or other criteria for that purpose or for the purpose of evaluating compliance with regulatory requirements. For this report, monitoring results are compared with water-quality standards at the request of NMED.

The New Mexico Water Quality Control Commission Standards for Interstate and Intrastate Surface Waters (New Mexico Administrative Code [NMAC] 20.6.4) establish surface water criteria. Surface waters within DP Canyon at E038, Pueblo, and Acid Canyons are unclassified, non-perennial waters of the state under NMAC 20.6.4.98, with segment-specific designated uses of livestock watering, wildlife habitat, marginal warm-water aquatic life, and primary contact. The criteria applicable to the marginal warm-water aquatic life designation include both acute and chronic aquatic life criteria and the human health–organism only (HH-OO) criteria. Surface waters within Los Alamos Canyon and DP Canyon at E039.1 are classified as ephemeral and intermittent waters of the state under NMAC 20.6.4.128, with segment-specific designated uses of livestock watering, wildlife habitat, limited aquatic life, and secondary contact.

The criteria applicable to the limited aquatic life designation include the acute aquatic life criteria and the HH-OO only criteria but do not include the chronic aquatic life criteria.

Water quality criteria for total and total recoverable pollutants are compared with unfiltered surface water sample concentrations. The water quality criterion for total recoverable aluminum is for filtered storm water samples using a 10-µm pore size; however, NMED's Surface Water Quality Bureau suggested that a 10-µm filter size is too large (NMED 2016, 602301); thus this report presents exceedances of the 0.45-µm pore size. Other water quality criteria are for dissolved concentrations of pollutants, which are compared with filtered storm water samples using a 0.45-µm pore size. Acute and chronic aquatic life criteria for dissolved cadmium, chromium, copper, lead, manganese, nickel, and zinc, and acute aquatic life criteria for dissolved silver, are calculated based on the hardness of each sample. Concurrent hardness values in the LA/P watershed range between 10.3 mg/L and 74.5 mg/L (average value is 27.4 mg/L) calcium carbonate ($CaCO_3$) calculated from calcium and magnesium values from storm water collected in 2017. Hardness-dependent metals criteria are strongly influenced by the hardness value used in the calculation, i.e., a low hardness value results in a low metals criterion and a high hardness value results in a high metals criterion. The water quality criteria for dioxins are the sum of the dioxin toxicity equivalents expressed as 2,3,7,8 tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). Table 4.2-1 presents the comparison of detected analytical results from 2017 with the water quality criteria.

The Los Alamos County townsite routes most of its storm water and entrained pollutants into Los Alamos and Pueblo Canyons. Storm water pollutant loading to receiving waters is derived from the decay of buildings, parking lots, roads, and automobile traffic emissions that occurs in a developed urban landscape and is common to urban developed landscapes throughout the developed world (Tsihrintzis and Hamid 1997, 602314; Göbel et al. 2007, 252959). Many of the structures and impervious surfaces within the Los Alamos County townsite are older and have weathered over the years and continue to shed metals and organic compounds to Los Alamos and Pueblo Canyons adjacent to the townsite. In addition, pollutants have accumulated in sediments in canyon bottoms over time and are mobilized during storm flow events in canyon bottoms and are commonly detected throughout the gage network adjacent to and downstream of the Los Alamos townsite.

A large portion of townsite runoff is routed to DP canyon, the south fork of Acid Canyon, and upper Pueblo Canyon. Most of the exceedances observed in 2017 are metals and PCBs detected at gage stations located directly downstream from these routing pathways. In 2017, 34 hardness-dependent metals (including aluminum, copper, and lead) with chronic and acute aquatic life criteria exceedances were observed at gaging stations adjacent to and directly downstream from the Los Alamos townsite.

In 2017, there were 25 aluminum exceedances in storm water ranging from 250 to 1350 µg/L; the average exceedance value is 774 µg/L. Hardness-dependent water quality criteria range from 60.9 to 1700 µg/L. The national acute aquatic life criteria is 750 µg/L. The 750 µg/L acute aquatic life criteria was changed to total recoverable aluminum, a hardness-based criteria, in 2010 and is now dependent upon the concurrent hardness value. Because hardness in storm water runoff is typically very low, the corresponding calculated aluminum water quality criteria is low, resulting in a greater number of exceedances. Aluminum in storm water is representative of the natural background composition of the Bandelier tuff (LANL 2013, 239557). On the Pajarito Plateau, much of the sediment-bound aluminum is associated with poorly crystalline silica-rich glass of Bandelier tuff. As the tuff weathers, the glass particles and associated aluminum form sediment that accumulates, is entrained, and is then transported by storm water runoff. In addition, aluminum is generally not an issue or problematic in runoff from developed urban landscapes on a national scale and is not associated with current or historical industrial processes within the Los Alamos County townsite.

Copper exceedances in 2017 range from 2.29 to 9.42 µg/L; the average exceedance value is 3.77 µg/L. The corresponding acute and chronic aquatic life screening criteria range between 1.28 µg/L and

8.31 µg/L. To put this into perspective, the copper acute aquatic life criteria threshold in the NPDES Individual Permit (NM0030759) is 4.3 µg/L calculated with a hardness of 30 mg/L $CaCO_3$. Copper is a component of brake pads and roofing materials and is a common constituent in storm water emanating from urban environments in both dissolved and colloidal form (TCD Environmental 2004, 602305). With this in mind, copper exceedances are most likely due to runoff from the impervious developed landscape within the Los Alamos townsite.

Ten lead results were observed above the acute and chronic screening criteria in 2017. Exceedance concentrations range between 0.783 µg/L and 3.68 µg/L; the average 2017 exceedance was 1.57 µg/L. The hardness-dependent aquatic life screening criteria range between 0.198 µg/L and 36.9 µg/L. Lead is a common component of house paint, building siding, and automobiles and is commonly found in storm water runoff from urban landscapes on a national scale (Davis and Burns 1999, 602303; Göbel et al. 2007, 252959), such as the Los Alamos County townsite. Because of the low solubility in the neutral pH range, lead is usually present in particulate form entrained in urban storm water.

Twenty nine gross alpha radioactivity concentrations were observed above the 15 pCi/L screening level threshold in 2017. The exceedances range from a minimum of 15.9 pCi/L to a maximum radioactivity concentration of 360 pCi/L; average exceedance value is 82.0 pCi/L. Gross alpha is strongly correlated with SSC and is associated with the decay of naturally occurring uranium and thorium in the Bandelier tuff (LANL 2013, 239557). Although there have been discharges of legacy radionuclide pollutants in the past at select locations within the Laboratory, the alpha activity of those constituents when measured by alpha spectroscopy contributes an insignificant amount of activity to the gross alpha activity values (McNaughton et al. 2012, 254666).

Two mercury and two selenium results were observed above the New Mexico Wildlife Habitat screening criteria in 2017 from samples collected at E042.1 on July 26 and October 4, 2017. Mercury concentrations of 1.41 µg/L and 0.793 µg/L and selenium concentrations of 6.92 µg/L and 38 µg/L were observed. Seven of thirty-two mercury results collected at E042.1 since July 2010 have exceeded the New Mexico Wildlife Habitat screening criteria of 0.77 µg/L. Eleven of thirty-two selenium results collected at E042.1 since July 2010 have exceeded the New Mexico Wildlife Habitat screening criteria of 5.0 µg/L.

Two zinc results were observed above the acute screening criteria in 2017. The concentration of zinc measured at E055.5 from the sample collected on July 27 was 33.9 µg/L, which was greater than the acute screening criteria of 33.4 µg/L based on the measured hardness of 24.2 mg/L in the sample. The concentration of zinc measured at E056 from the sample collected on July 8 was 27.6 µg/L, which was greater than the acute screening criteria of 19.6 µg/L based on the measured hardness of 27.5 mg/L in the sample.

PCBs are by far the most common compound that exceeded water quality criteria in 2017. Total PCB concentrations range from 0.00112 µg/L to 9.57 µg/L and most often exceed the most sensitive screening level (HH-OO threshold of 0.000064 µg/L). The average overall exceedance concentration observed in 2017 is 0.307 µg/L and is heavily weighted by PCB concentrations observed at CO111041 (upper Los Alamos detention basins). Without the upper Los Alamos detention basin results (see section 4.5), the average PCB concentration is 0.086 µg/L, which is greater than the urban runoff PCB median value of 0.012 µg/L reported in the 2012 PCB report presenting PCB concentrations in Los Alamos County storm water runoff (LANL 2012, 219767). In addition to electrical transformer cooling fluids, PCBs were commonly used as a stabilizing agent for paints, caulking, oils, hydraulic fluid, road paint, pigments, plastics, and a host of other industrial materials. The ubiquitous distribution of PCBs in an urban setting in addition to atmospheric deposition and very low screening levels accounts for the relatively high number of detections and exceedances in surface and storm water emanating from developed urban landscapes in Los Alamos County (LANL 2012, 219767). In addition, PCBs have been archived in sediment and organic material that is occasionally released from the terrestrial inventory and transported in storm water flow events to canyon bottoms.

The method detection limits (MDLs) reported for analyses of nondetected 2,3,7,8 TCDD, cadmium, silver, and thallium exceeded the screening levels for those compounds. Cadmium MDLs were 0.28 to 1.1 times the hardness-dependent acute screening levels and 1.0 to 3.4 times the hardness-dependent chronic screening levels. Silver MDLs are 0.22 to 3.2 times the hardness-dependent acute screening levels. The thallium MDL of 0.6 µg/L is 1.3 times the human health screening level of 0.47 µg/L. MDLs for 2,3,7,8-TCDD range from 10.4 pg/L to 11.4 pg/L, which are approximately 200 times the human health screening level of 0.051 pg/L. More sensitive analytical methods are not available for these compounds.

In summary, exceedances in storm water are associated with pollutant loadings emanating from Los Alamos County and are mainly associated with the developed urban landscape and day-to-day activities associated with the weathering of roads, parking lots, and structures that are in various stages of decay and with vehicle traffic. The chemical signature of storm water runoff is representative of many urban landscapes on a national scale.

4.3 Relationships between Discharge and SSC

Discharge was calculated from stage height using a rating curve, which is the relationship between discharge in cubic feet per second and height of the water in feet, developed for each individual gaging station. Stage height was measured at 5-min intervals and logged continuously during each sampled storm event. SSC and particle size were measured during each storm in conjunction with inorganic and organic chemicals and radionuclides.

SSC and instantaneous discharge estimates were calculated for each sample using a linear relationship between the two corresponding analytically determined SSCs or the two corresponding physically measured discharges, as follows:

$$y = mx + b$$ **Equation 6**

where y = the calculated SSC or discharge at the time of sample collection,

m = the slope of the line,

x = the time differential in minutes between SSC sample collection or discharge measurements, and

b = the concentration of analytically determined SSC before sample analyses or corresponding physically determined discharge.

The slope is determined by dividing the difference in SSC or discharge by the difference in time, in minutes, between SSC sample collection or discharge measurements before and after analytical sample collection. This equation was used to calculate SSC and instantaneous discharge for samples collected. Where analytical results are not bounded by sediment results, the concentration of the nearest sediment result is used as an estimate of the sediment concentration at the time the sample was collected. If SSC was not measured during a storm, an estimate was not produced. The calculated SSCs and instantaneous discharges are presented in Table 4.3-1.

4.4 Relationship between SSC and Concentrations of Constituents

The projected total metal values for each sample with measured SSC analyses are calculated using equations presented in Appendix D of the “2015 Monitoring Report for Los Alamos/Pueblo Watershed”

(LANL 2016, 601433). Estimated concentrations for each metal and isotopic uranium are presented in Table 4.4-1.

The measured concentrations of total metals at E050.1 and the estimated concentrations of total metals for all SSC analyses are presented in Table 4.4-2. The RPD of the measured and calculated total metals was less than 50% for detected selenium, aluminum, and iron. Silver and thallium were not detected in unfiltered samples measured at E050.1. The RPD of the detected measured and calculated arsenic, beryllium, cadmium, chromium, nickel, and vanadium was greater than 50% and less than 100%. The RPD of the detected measured and calculated barium, cobalt, copper, manganese, lead, and zinc was greater than 100%.

4.5 Storm Water Sampling below SWMU 01-001(f)

The 2017 result for the storm water sample analyzed for total PCBs collected at the inlet to the upper detention basin below the SWMU 01-001(f) drainage is 9.57 µg/L. This total PCB result is within the range of results for samples collected from 2011 to 2016. The results continue to indicate the hillslope is a source of PCBs, even after sediment and rock were removed during corrective action at SWMU 01-001(f) in 2010.

5.0 CHANGES FROM 2016 REPORT

Based on changes that occurred in 2017, this report has been updated from the 2016 report. The changes are summarized below:

- The difference between measured and estimated total metals concentrations is analyzed at E050.1, the only gaging station where total metals were analyzed in 2017 (no runoff event larger than 5 cfs, the sampler trip level, was measured at E060.1). Unfortunately, the sediment content of the two samples collected at E050.1 was not enough to analyze TAL metals in the sample-sediment fraction on a dry-weight basis.

6.0 CONCLUSIONS

Attenuation of flow and associated sediment transport are primary goals of the sediment transport mitigation activities. Decreasing flow velocity allows for increased infiltration, thus reducing peak discharge, reducing the distance the flood bore travels downstream, and reducing the distance sediment and associated contaminants entrained in the storm water travel downstream. In DP Canyon, the GCS and associated floodplains between gaging stations E038 and E039.1 facilitated a significant reduction in the suspended sediment being transported downstream. In Pueblo Canyon, the wetland, willows, drop structure, and GCS between gaging stations E059.5 and E060.1 facilitated such a reduction in peak discharge that storm water runoff at E060.1 was not large enough to sample. In Los Alamos Canyon, the low-head weir and associated sediment detention basins between gaging stations E042.1 and E050.1 facilitated a reduction in the peak discharge during all of the early-season runoff events and a significant reduction in the volume of suspended sediment being transported downstream. The 2017 monitoring data in the LA/P watershed indicate that, in general, the mitigations are performing as designed.

Geomorphic changes are monitored at one background area, five sediment transport mitigation sites, and two sediment retention basin areas that have been established in the LA/P watershed. The bank and thalweg surveys and repeat photographs support the conclusion of overall stability of the banks and channels in Pueblo, DP, and Los Alamos Canyons and establish the geomorphic change between 2016 and 2017 as minor, indicating that the watershed mitigations are performing as designed.

Based on the correlations between concentrations of metals, radioisotopes, and PCBs in unfiltered storm water and SSC presented in the “2015 Monitoring Report for Los Alamos/Pueblo Watershed” (LANL 2016, 601433), the Laboratory discontinued monitoring certain constituents in storm water at Los Alamos and Pueblo watershed gaging stations E026, E030, E038, E039.1, E040, E042.1, E055, E055.5, E056, E059.5, and E059.8. The Laboratory continued to monitor unfiltered TAL metals and isotopic uranium at E050.1 and E060.1 per the memorandum of understanding between DOE and BDDB (DOE and BDD Board 2015, 603016). The Laboratory continued monitoring dissolved metals and unfiltered total recoverable selenium, unfiltered mercury, and total recoverable aluminum after filtration using a 10-µm pore size filter because these dissolved and total metals have numeric criteria applicable to achieving designated and attainable uses given in NMAC 20.6.4. The Laboratory continued monitoring silver in unfiltered storm water in Acid and Pueblo Canyons and continued monitoring total PCBs and certain isotopic radionuclides in unfiltered storm water.

Continued monitoring in 2018 is expected to confirm the sediment transport mitigations in the LA/P watershed are performing as designed and to document more thoroughly the performance of the drop structure in Pueblo Canyon.

7.0 REFERENCES AND MAP DATA SOURCES

7.1 References

The following reference list includes documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ERID or ESHID. This information is also included in text citations. ERIDs were assigned by the Associate Directorate for Environmental Management’s (ADEM’s) Records Processing Facility (IDs through 599999), and ESHIDs are assigned by the Environment, Safety, and Health Directorate (IDs 600000 and above). IDs are used to locate documents in the Laboratory’s Electronic Document Management System and in the Master Reference Set. The NMED Hazardous Waste Bureau and ADEM maintain copies of the Master Reference Set. The set ensures that NMED has the references to review documents. The set is updated when new references are cited in documents.

Bagnold, R.A., April 1977. “Bed Load Transport by Natural Rivers,” *Water Resources Research,* Vol. 13, No. 2, pp. 303–312. (Bagnold 1977, 111753)

Davis, A.P., and M. Burns, 1999. “Evaluation of Lead Concentration in Runoff from Painted Structures,” *Water Resources,* Vol. 33, No. 13, pp. 2949-2958. (Davis and Burns 1999, 602303)

DOE and BDD Board (U.S. Department of Energy and Buckman Direct Diversion Board), January 2015. “Memorandum of Understanding between the U.S. Department of Energy and the Buckman Direct Diversion Board Regarding Water Quality Monitoring,” Santa Fe, New Mexico. (DOE and BDD Board 2015, 603016)

Göbel, P., C. Dierkes, and W.G. Coldewey, April 2007. “Storm Water Runoff Concentration Matrix for Urban Areas,” *Journal of Contaminant Hydrology,* Vol. 91, No. 1–2, pp. 26–42. (Göbel et al. 2007, 252959)

Graf, W.L., September 1983. “Downstream Changes in Stream Power in the Henry Mountains, Utah,” *Annals of the Association of American Geographers,* Vol. 73, No. 3, pp. 373–387. (Graf 1983, 111754)

Lane, L.J., M.H. Nichols, M. Hernandez, C. Manetsch, and W.R. Osterkamp, December 12–16, 1994. “Variability in Discharge, Stream Power, and Particle-Size Distributions in Ephemeral-Stream Channel Systems,” in *Variability in Stream Erosion and Sediment Transport*, Proceedings of the Canberra Symposium, December 12–16, 1994, International Association of Hydrological Sciences publication no. 224, pp. 335–342. (Lane et al. 1994, 111757)

LANL (Los Alamos National Laboratory), February 2008. “Interim Measure Work Plan to Mitigate Contaminated Sediment Transport in Los Alamos and Pueblo Canyons,” Los Alamos National Laboratory document LA-UR-08-1071, Los Alamos, New Mexico. (LANL 2008, 101714)

LANL (Los Alamos National Laboratory), October 2008. “Supplemental Interim Measures Work Plan to Mitigate Contaminated Sediment Transport in Los Alamos and Pueblo Canyons,” Los Alamos National Laboratory document LA-UR-08-6588, Los Alamos, New Mexico. (LANL 2008, 105716)

LANL (Los Alamos National Laboratory), November 2008. “Los Alamos Site Monitoring Area 2 Interim Measure and Monitoring Plan,” Los Alamos National Laboratory document LA-UR-08-6891, Los Alamos, New Mexico. (LANL 2008, 104020)

LANL (Los Alamos National Laboratory), May 2012. “Polychlorinated Biphenyls in Precipitation and Stormwater within the Upper Rio Grande Watershed,” Los Alamos National Laboratory document LA-UR-12-1081, Los Alamos, New Mexico. (LANL 2012, 219767)

LANL (Los Alamos National Laboratory), April 2013. “Background Metals Concentrations and Radioactivity in Storm Water on the Pajarito Plateau, Northern New Mexico,” Los Alamos National Laboratory document LA-UR-13-22841, Los Alamos, New Mexico. (LANL 2013, 239557)

LANL (Los Alamos National Laboratory), June 2013. “2013 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project, Revision 1,” Los Alamos National Laboratory document LA-UR-13-24419, Los Alamos, New Mexico. (LANL 2013, 243432)

LANL (Los Alamos National Laboratory), April 2016. “2015 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project,” Los Alamos National Laboratory document LA-UR-16-22705, Los Alamos, New Mexico. (LANL 2016, 601433)

LANL (Los Alamos National Laboratory), April 2017. “2017 Monitoring Plan for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project,” Los Alamos National Laboratory document LA-UR-17-23270, Los Alamos, New Mexico. (LANL 2017, 602342)

McNaughton, M., W. Eisele, D. Englert, R. Ford-Schmid, and J. Whicker, 2012. “Natural Radioactivity in Northern New Mexico Water,” Los Alamos National Laboratory document LA-UR-12-26061, Los Alamos, New Mexico. (McNaughton et al. 2012, 254666)

Mingguo, Z., C. Qiangguo, and C. Hao, September 2007. “Effect of Vegetation on Runoff-Sediment Yield Relationship at Different Spatial Scales in Hilly Areas of the Loess Plateau, North China,” *Acta Ecologica Sinica,* Vol. 27, No. 9, pp. 3572–3581. (Mingguo et al. 2007, 111756)

Nichols, M.H., January 2006. “Measured Sediment Yield Rates from Semiarid Rangeland Watersheds,” *Rangeland Ecology and Management,* Vol. 59, No. 1, pp. 55–62. (Nichols 2006, 111758)

NMED (New Mexico Environment Department), August 30, 2007. "Approval with Direction, Los Alamos and Pueblo Canyons Supplemental Investigation Report," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2007, 098284)

NMED (New Mexico Environment Department), July 18, 2008. "Approval with Modifications, Interim Measure Work Plan to Mitigate Contaminated Sediment Transport in Los Alamos and Pueblo Canyons," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2008, 103007)

NMED (New Mexico Environment Department), February 20, 2009. "Approval with Modifications, Supplemental Interim Measure Work Plan (SIWP) to Mitigate Contaminated Sediment Transport in Los Alamos and Pueblo Canyons," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2009, 105014)

NMED (New Mexico Environment Department), May 5, 2009. "Approval with Modifications, Los Alamos Site Monitoring Area 2 (LA-SMA-2) Interim Measure and Monitoring Plan to Mitigate Contaminated Sediment Transport in Los Alamos Canyon," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2009, 105858)

NMED (New Mexico Environment Department), July 19, 2013. "Approval, 2013 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project, Revision 1," 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 2013, 523106)

NMED (New Mexico Environment Department), November 29, 2016. "Preliminary Evaluations of LANS Aluminum Filter Study Data, Aluminum Bioavailability: Implications for Ambient Water Quality Criteria and Sampling," New Mexico Environment Department, Surface Water Quality Bureau. (NMED 2016, 602301)

Onodera, S., J. Wakui, H. Morishita, and E. Matsumoto, July 1993. "Seasonal Variation of Sediment Yield on a Gentle Slope in Semi-Arid Region, Tanzania," in *Sediment Problems: Strategies for Monitoring, Prediction and Control*, Proceedings of the Yokohama Symposium, July 1993, International Association of Hydrological Sciences publication no. 217, pp. 29–37. (Onodera et al. 1993, 111759)

TCD Environmental (TCD Environmental, LLC), November 2004. "Copper Sources in Urban Runoff and Shoreline Activities, Information Update." (TCD Environmental 2004, 602305)

Tsihrintzis, V.A., and R. Hamid, 1997. "Modeling and Management of Urban Stormwater Runoff Quality: A Review," *Water Resources Management,* Vol. 11, pp. 137-164. (Tsihrintzis and Hamid 1997, 602314)

7.2 Map Data Sources

GageStation; Los Alamos National Laboratory, ER-ES, As published, project folder 15-0013; \\slip\gis\GIS\Projects\15-Projects\15-0013\zip\2015_E059.8_GageStation.shp; 2015

Facility location; Los Alamos National Laboratory, ER-ES, As published, project folder 15-0013;\\slip\gis\GIS\Projects\15-Projects\15-0013\project_data.gdb;merge_sandia_features_AGAIN;2015

Erosion control structure; Los Alamos National Laboratory, ER-ES, As published, project folder 15-0013;\\slip\gis\GIS\Projects\15-Projects\15-0013\project_data.gdb;merge_sandia_features_AGAIN;2015

Sediment control structure; Los Alamos National Laboratory, ER-ES, As published, project folder 15-0013;\\slip\gis\GIS\Projects\15-Projects\15-0013\project_data.gdb;merge_sandia_features_AGAIN;2015

Willow planting area; Los Alamos National Laboratory, ER-ES, As published, project folder 14-0015; \\slip\gis\GIS\Projects\14-Projects\14-0015\shp\as_built_willow_banks.shp; 2015

Structures; County of Los Alamos, Information Services; as published 29 October 2007.

Drainage; County of Los Alamos, Information Services; as published 16 May 2006.

Los Alamos County Boundary; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; Unknown publication date.

Road Centerlines for the County of Los Alamos; County of Los Alamos, Information Services; as published 04 March 2009.

Watersheds; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; EP2006-0942; 1:2,500 Scale Data; 27 October 2006.

Contour, 4-ft interval; Los Alamos National Laboratory, ER-ES, As published, project folder 15-0013;\\slip\gis\Data\HYP\LiDAR\2014\Bare_Earth\BareEarth_DEM_Mosaic.gdb; 2015

Technical Area Boundaries; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Office; September 2007; as published 13 August 2010.

Sediment Geomorphology; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program, ER2002-0589; 1:1,200 Scale Data; 01 January 2002.

Monitoring area; Los Alamos National Laboratory, ER-ES, As published, project folder 15-0013; \\slip\gis\GIS\Projects\15-Projects\15-0013\zip\ZoomAreas.shp; 2015

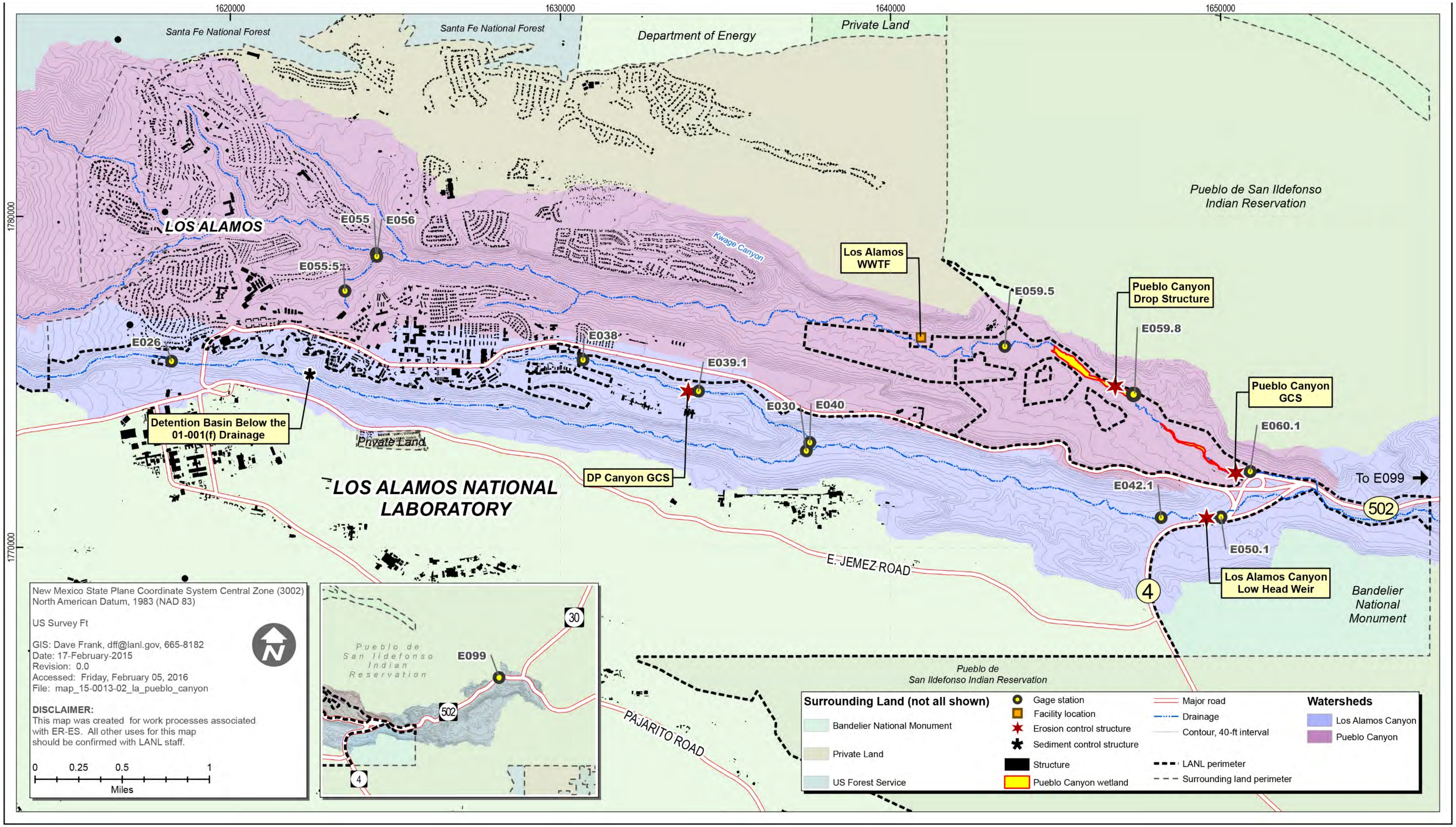


Figure 1.1-1 Los Alamos and Pueblo Canyons showing monitoring locations and sediment transport mitigation sites

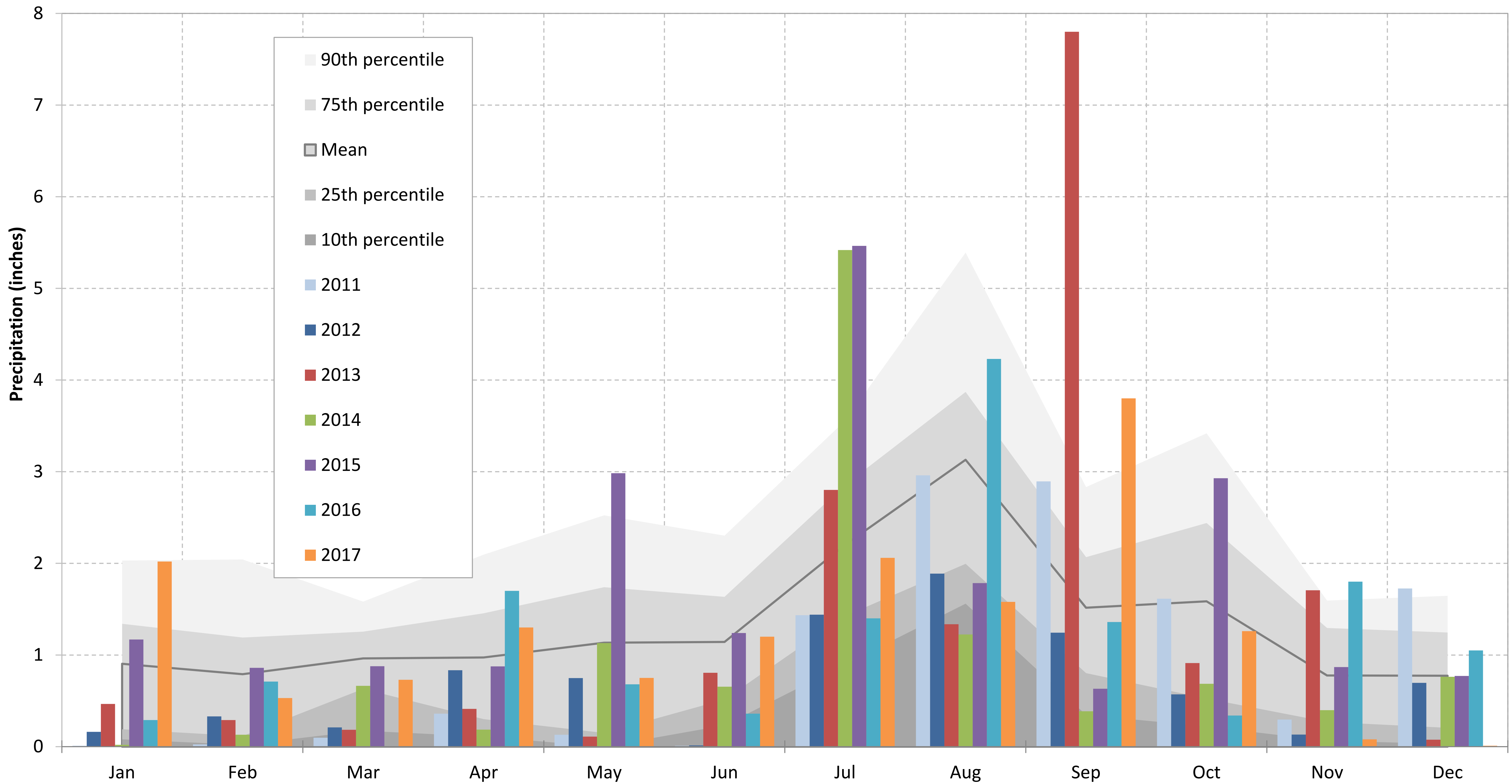


Figure 2.1-1 Total precipitation for each month between 2011 and 2017 based on meteorological tower data averaged across the Laboratory (mean and percentiles are based on data from 1992 to 2010)

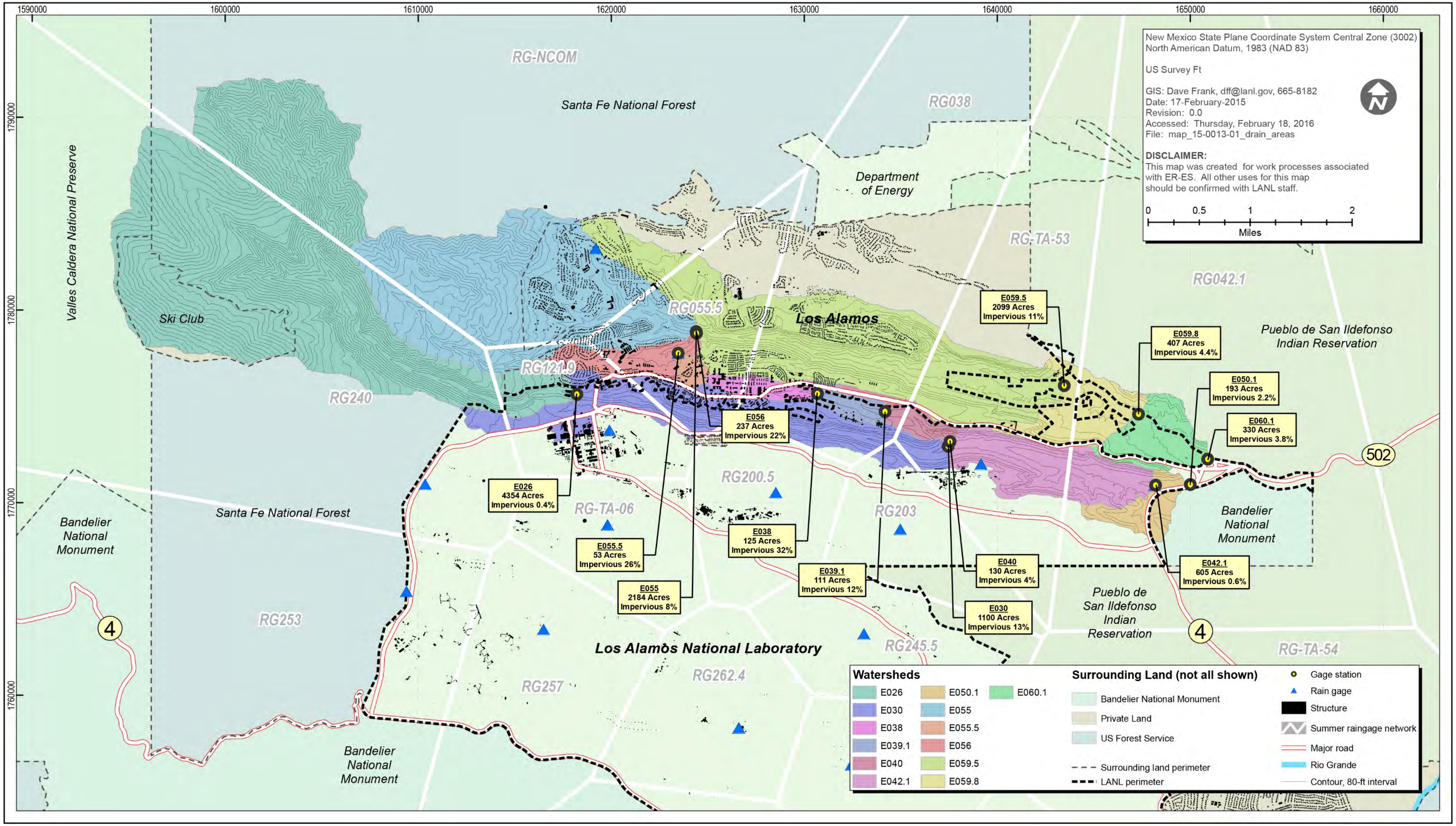


Figure 2.1-2 Los Alamos and Pueblo Canyons watershed showing drainage areas for each stream gaging station and associated rain gages and Thiessen polygons

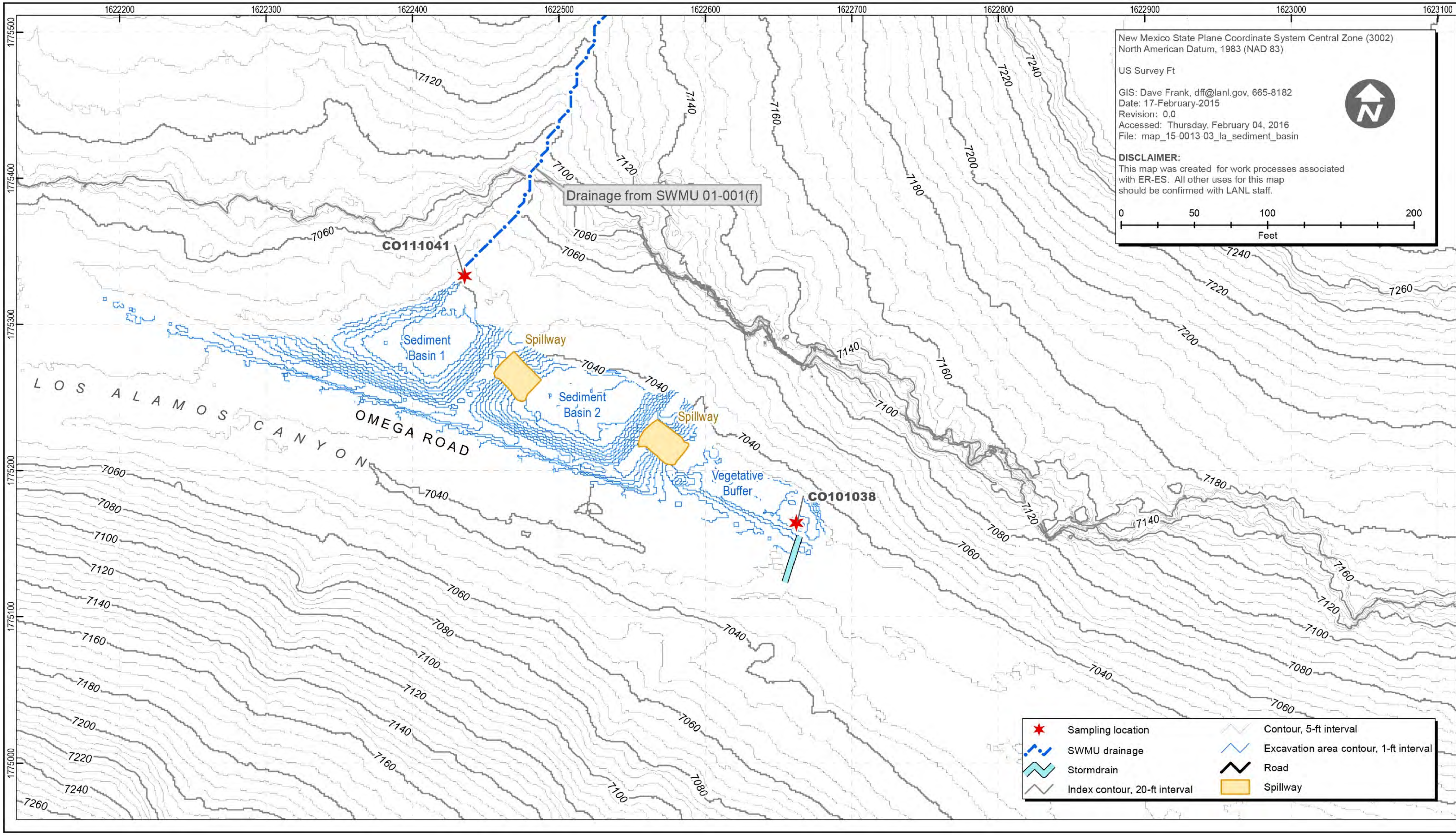


Figure 2.2-1 Sediment detention basins and sampling locations below the SWMU 01-001(f) drainage

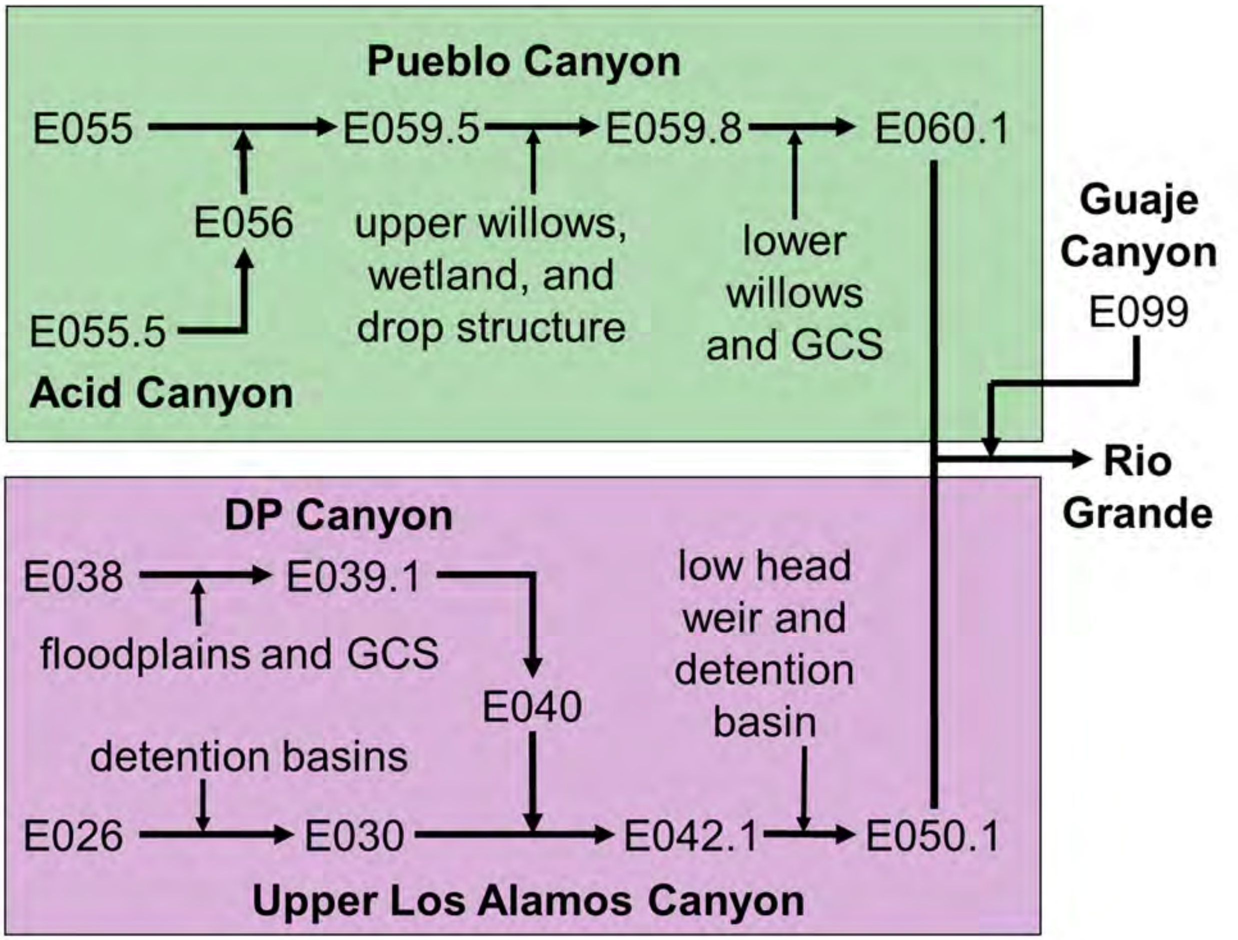


Figure 3.2-1 Flow diagram of gaging stations and sediment transport mitigation sites in the LA/P watershed

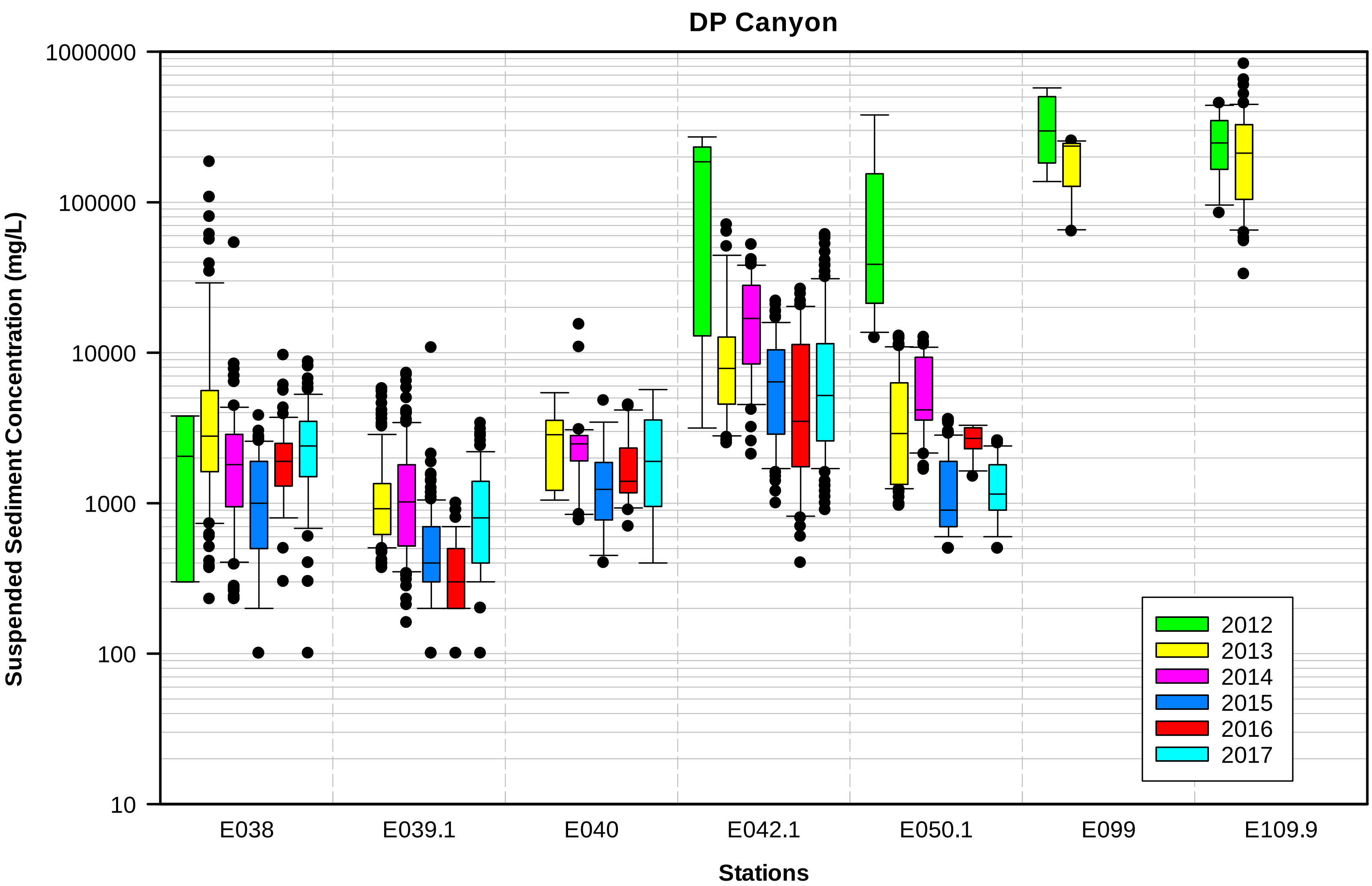


Figure 3.2-2 Box-and-whisker plots of SSC for all gaging stations in the LA/P watershed over the past 6 yr of monitoring

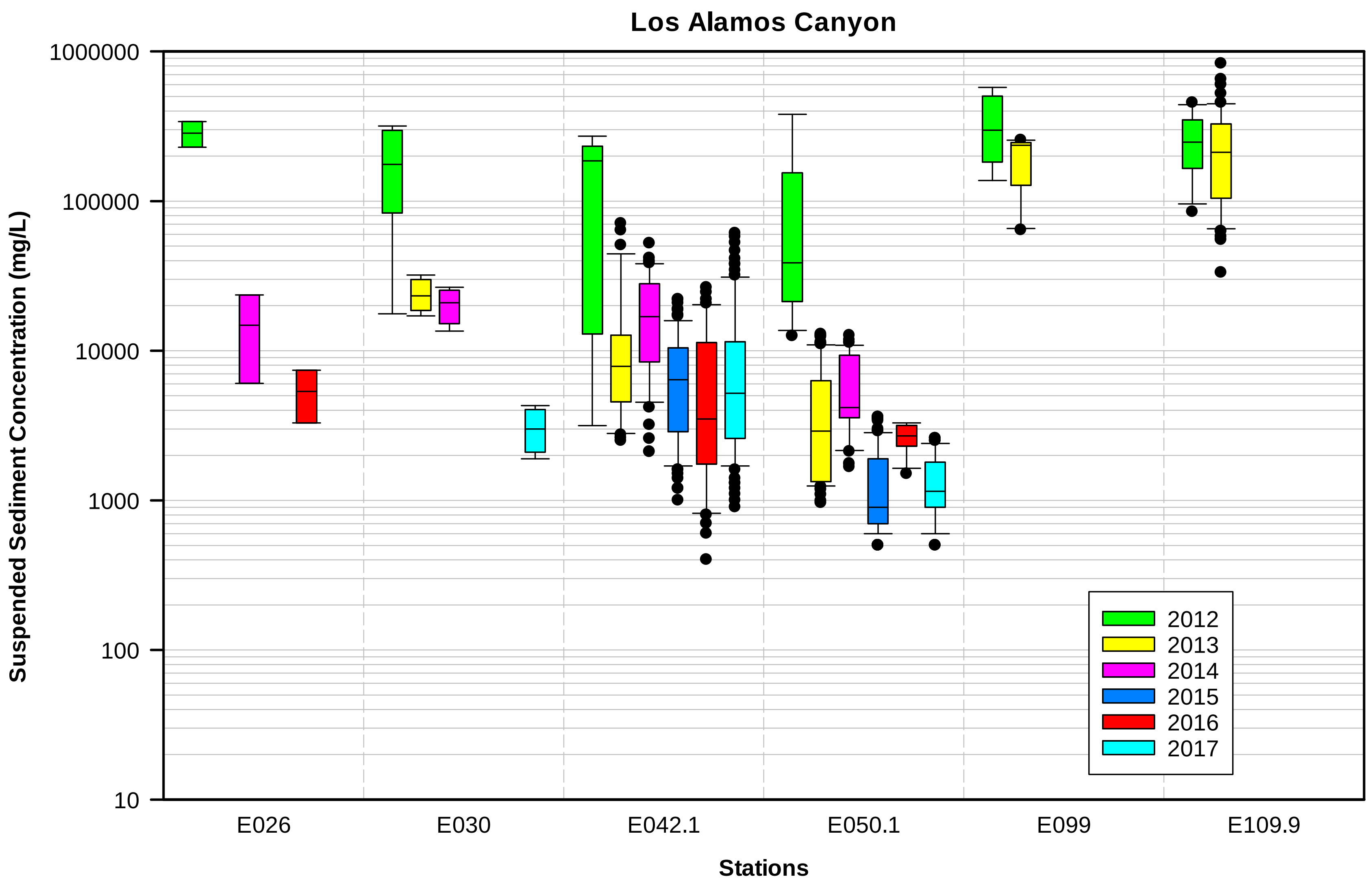


Figure 3.2-2 (continued) **Box-and-whisker plots of SSC for all gaging stations in the LA/P watershed over the past 6 yr of monitoring**

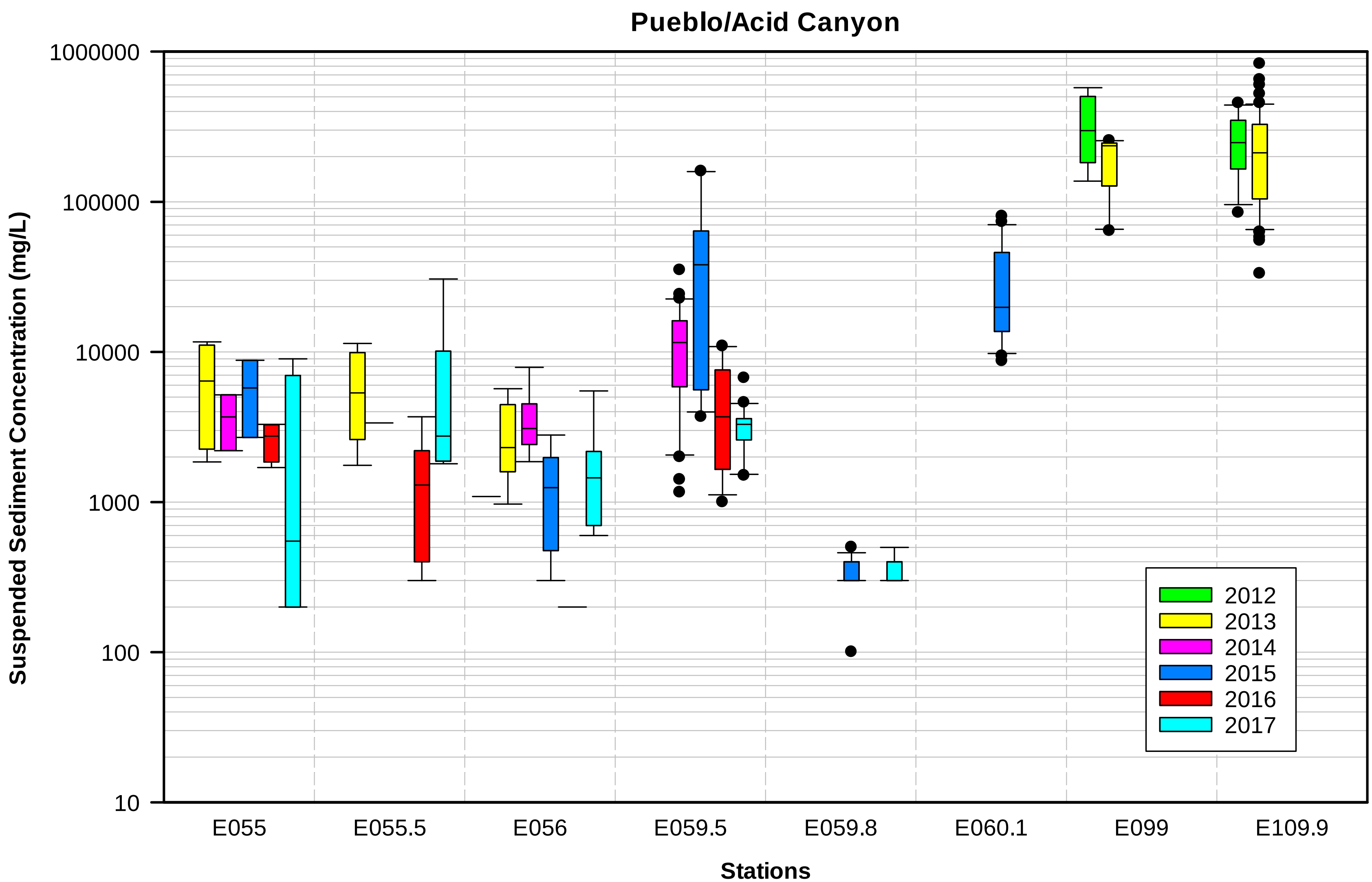


Figure 3.2-2 (continued) Box-and-whisker plots of SSC for all gaging stations in the LA/P watershed over the past 6 yr of monitoring

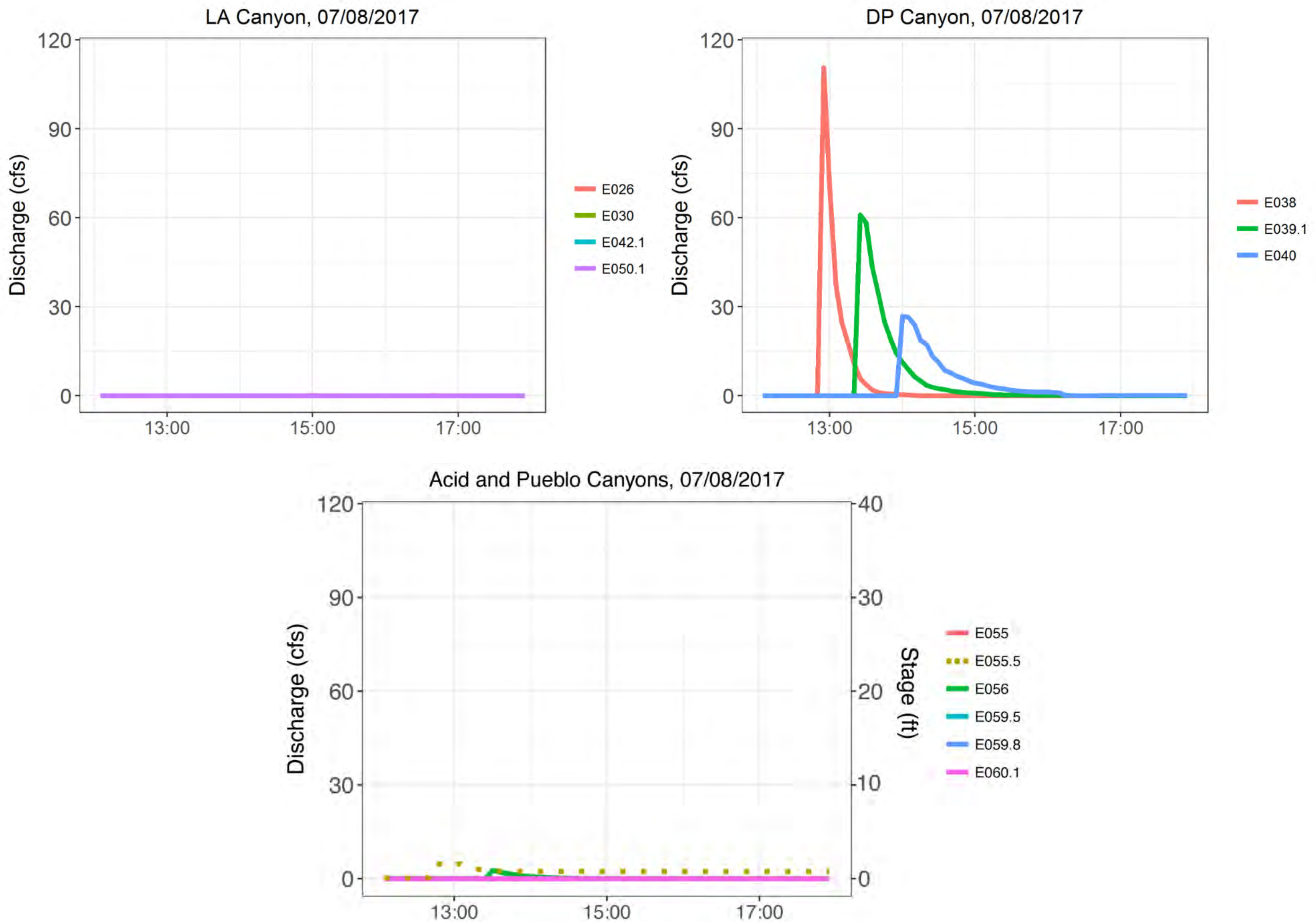


Figure 3.2-3 Hydrographs during each sample-triggering runoff event for each canyon from up- to downstream reaches

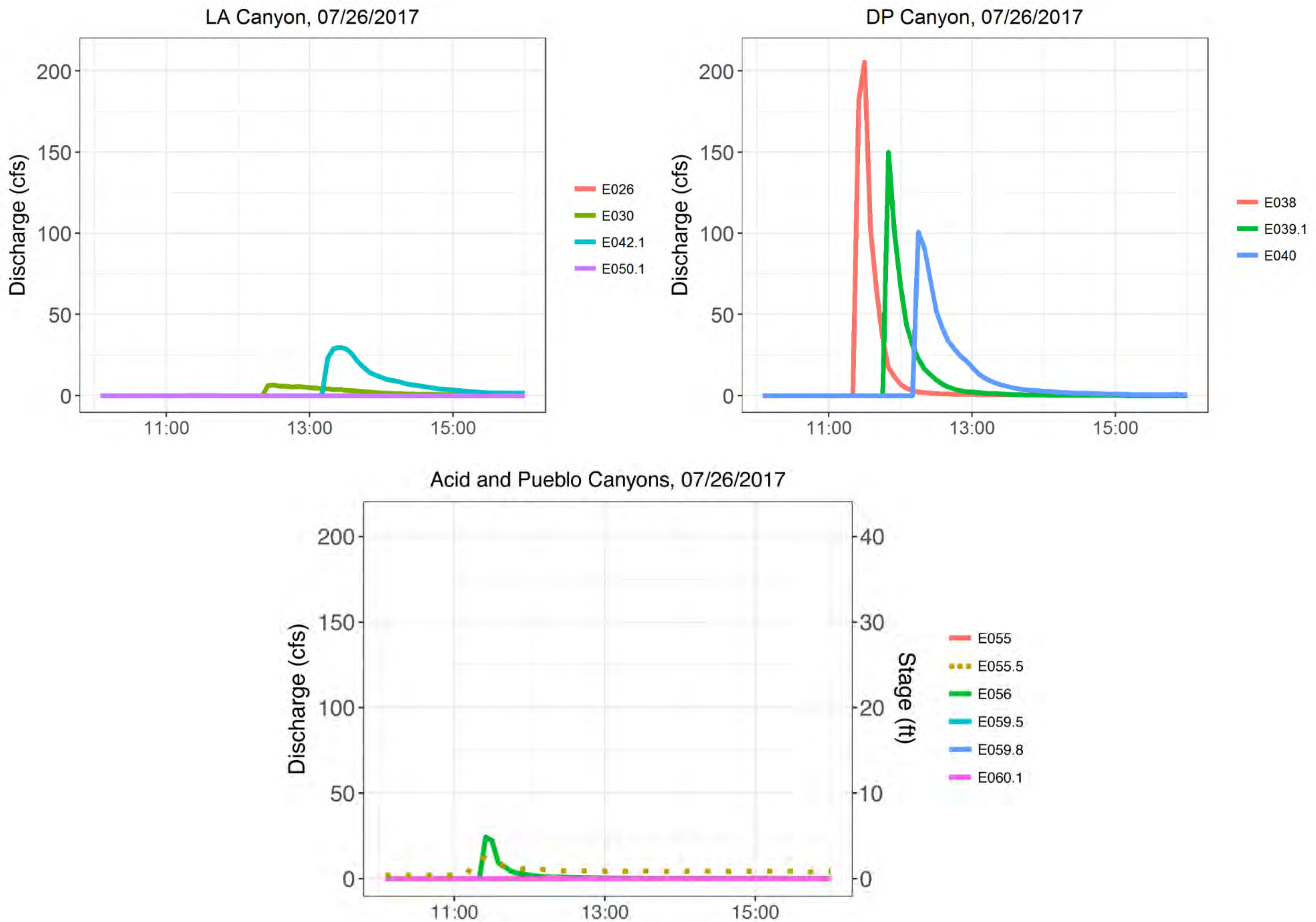


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from up- to downstream reaches**

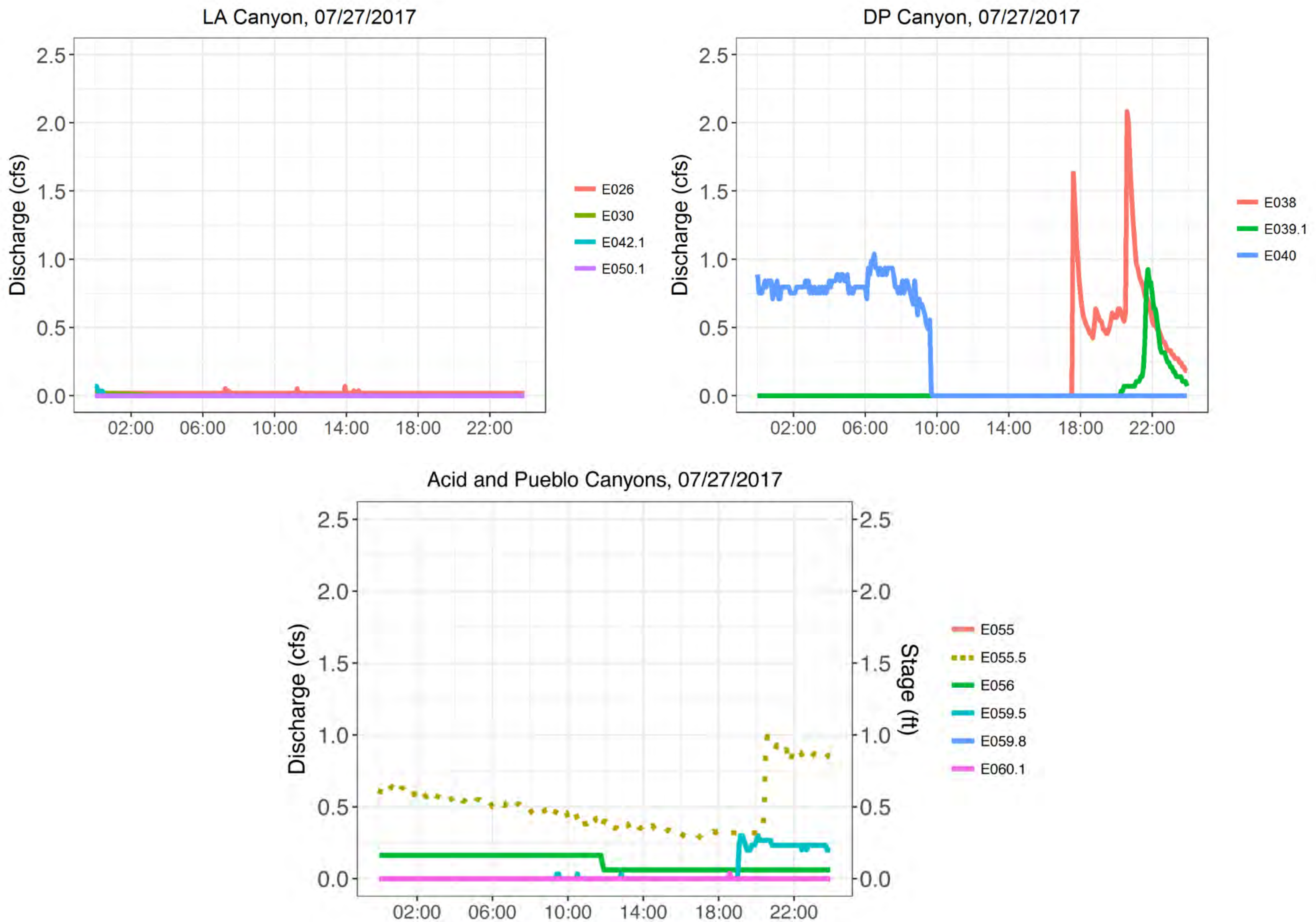


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from up- to downstream reaches**

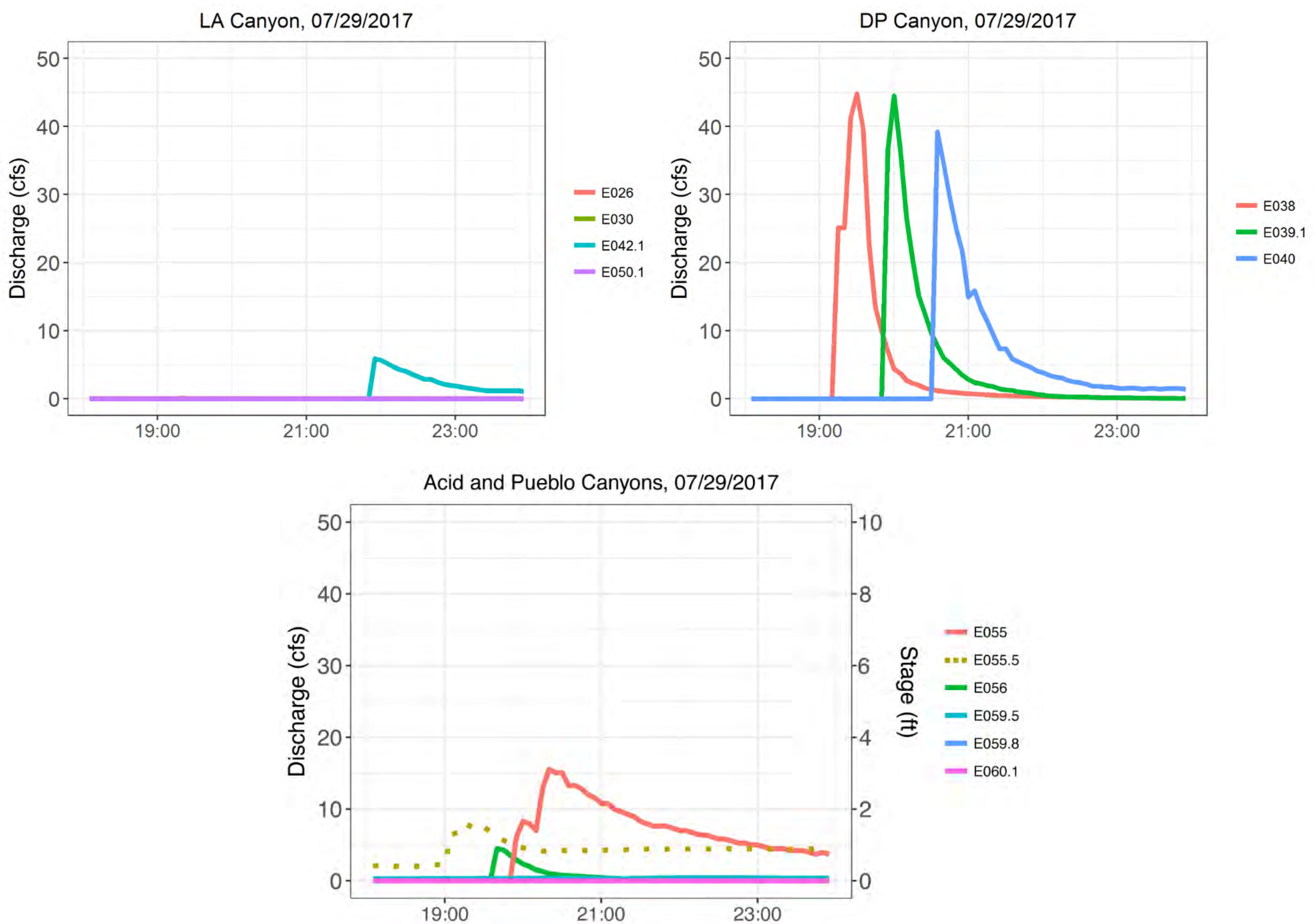


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from up- to downstream reaches**

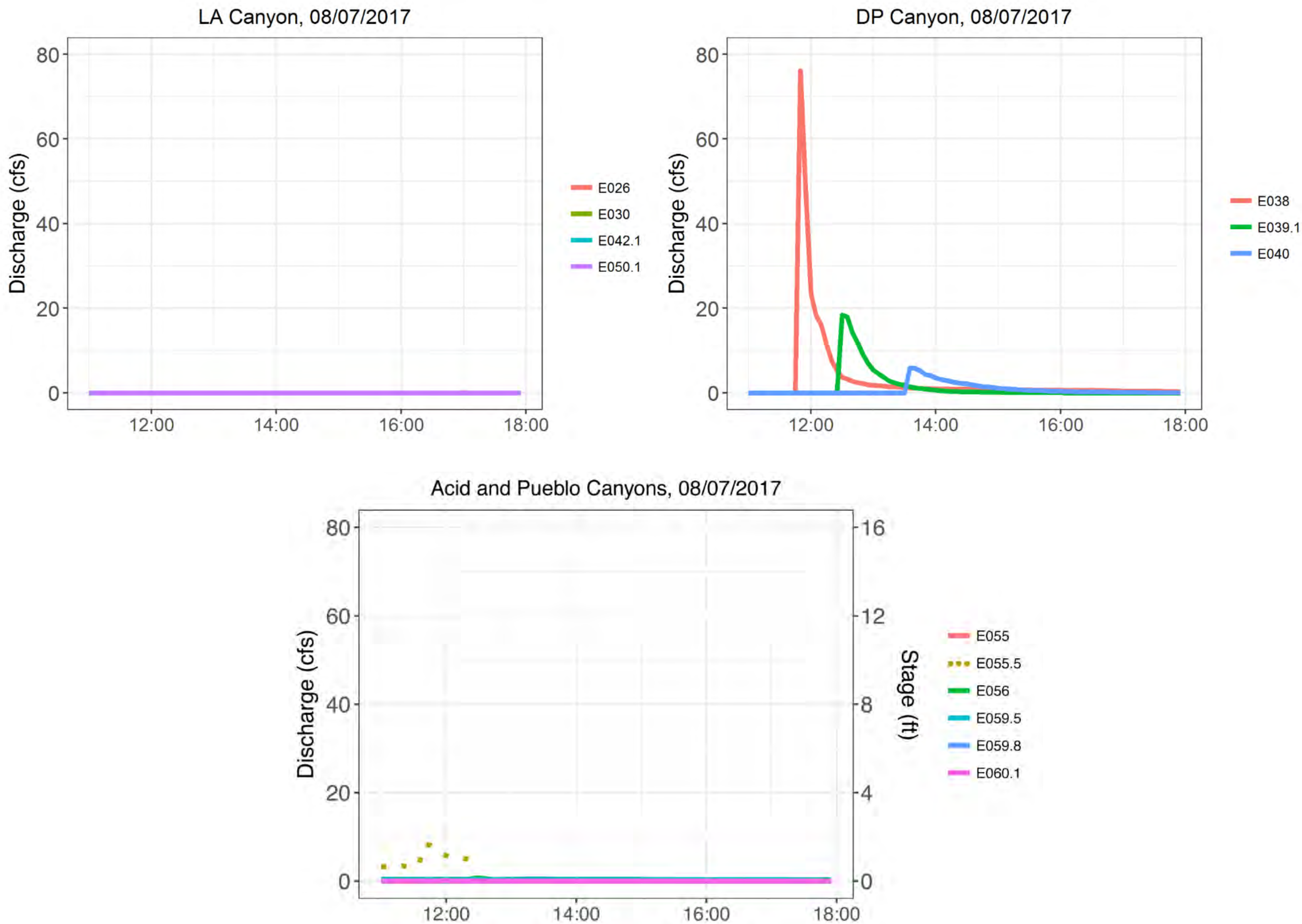


Figure 3.2-3 (continued) Hydrographs during each sample-triggering runoff event for each canyon from up- to downstream reaches

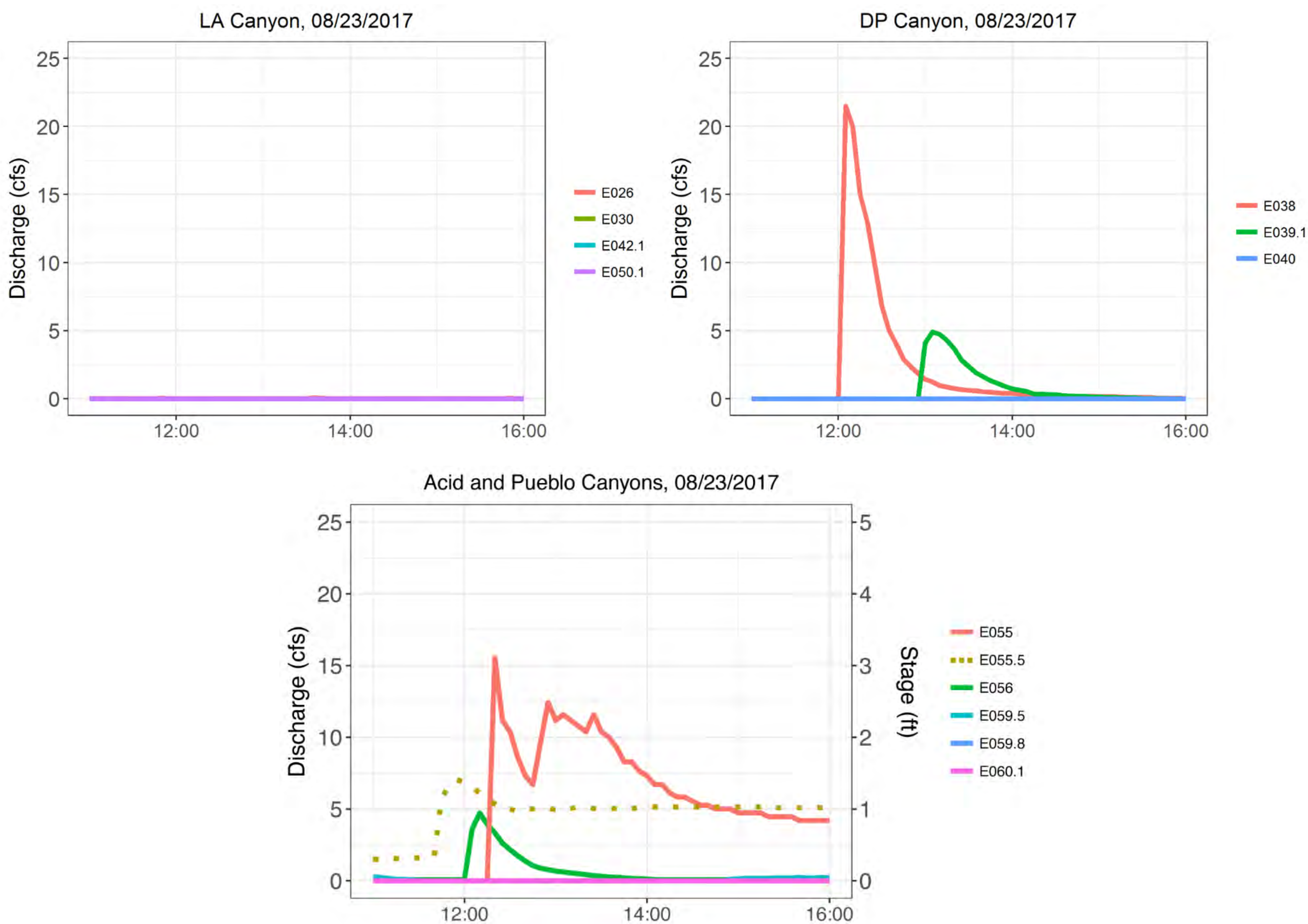


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from up- to downstream reaches**

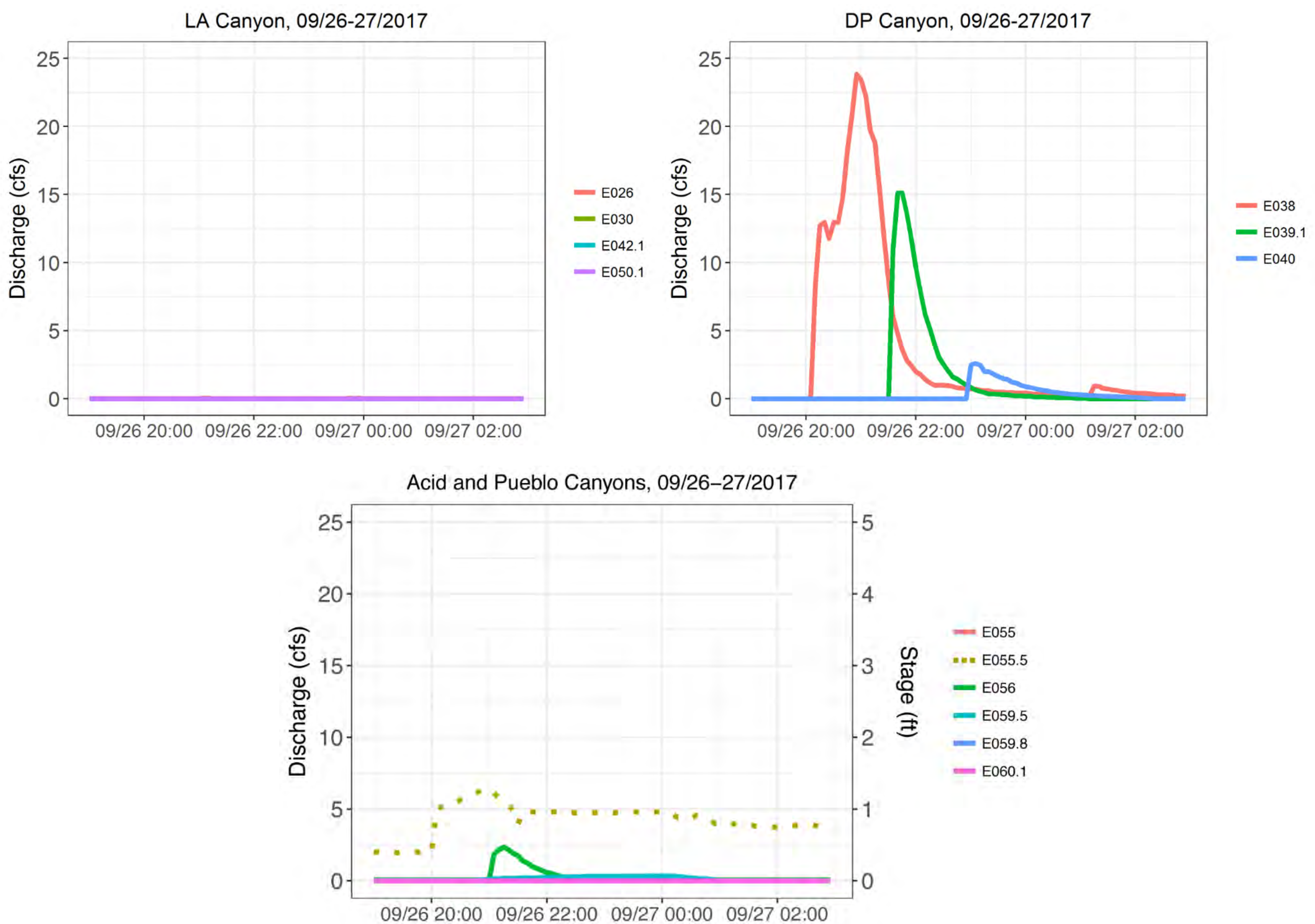


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from up- to downstream reaches**

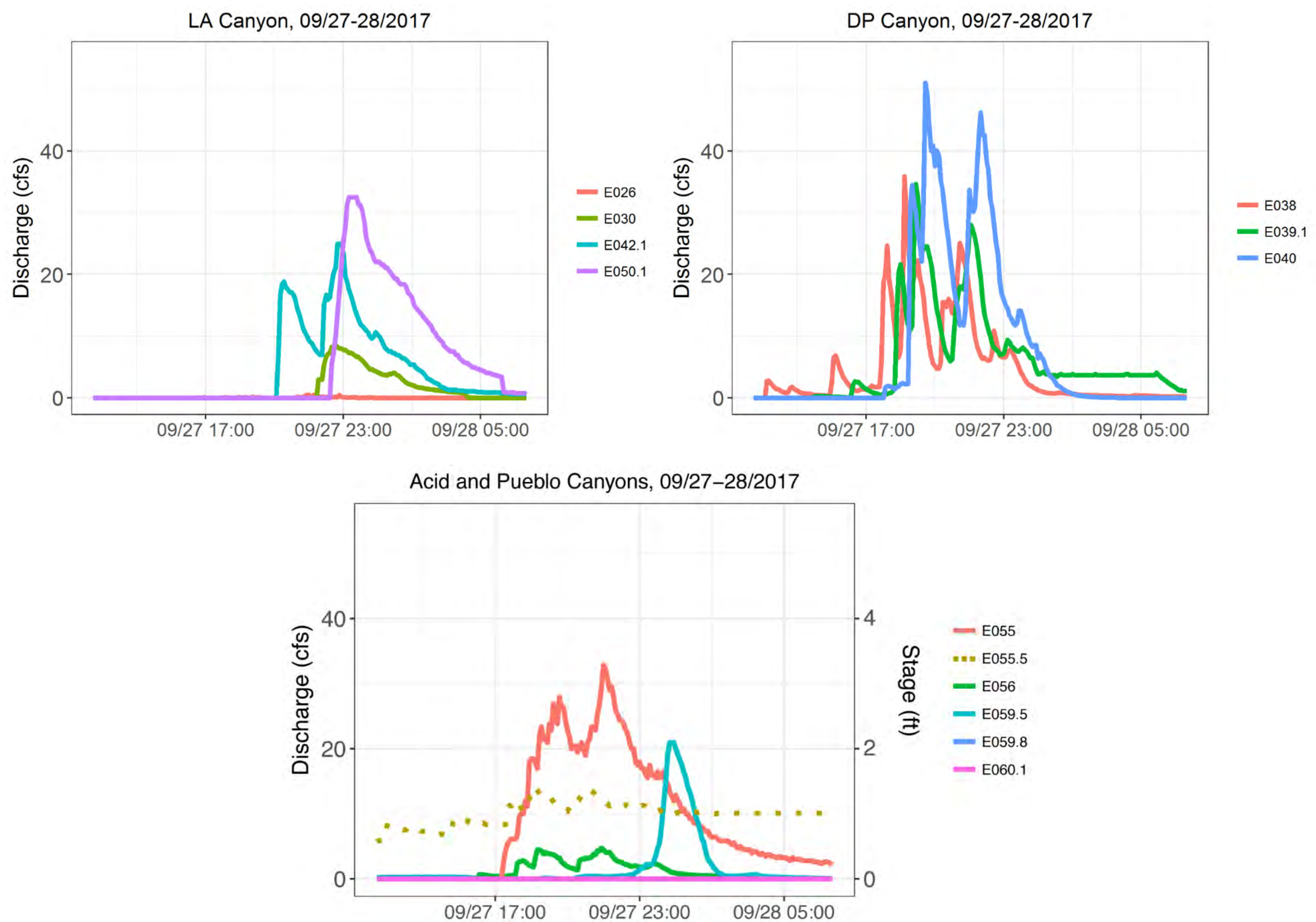


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from up- to downstream reaches**

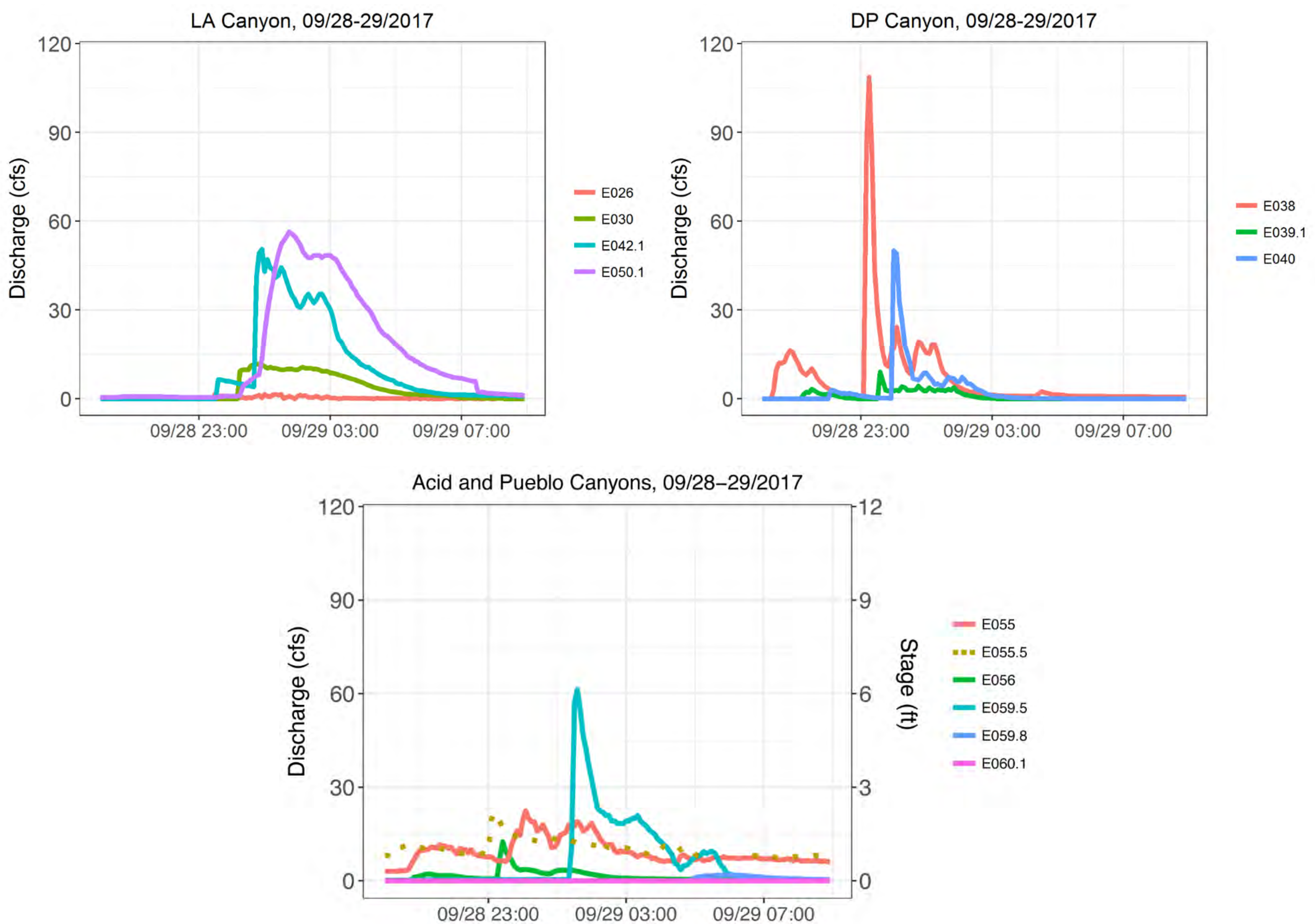


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from up- to downstream reaches**

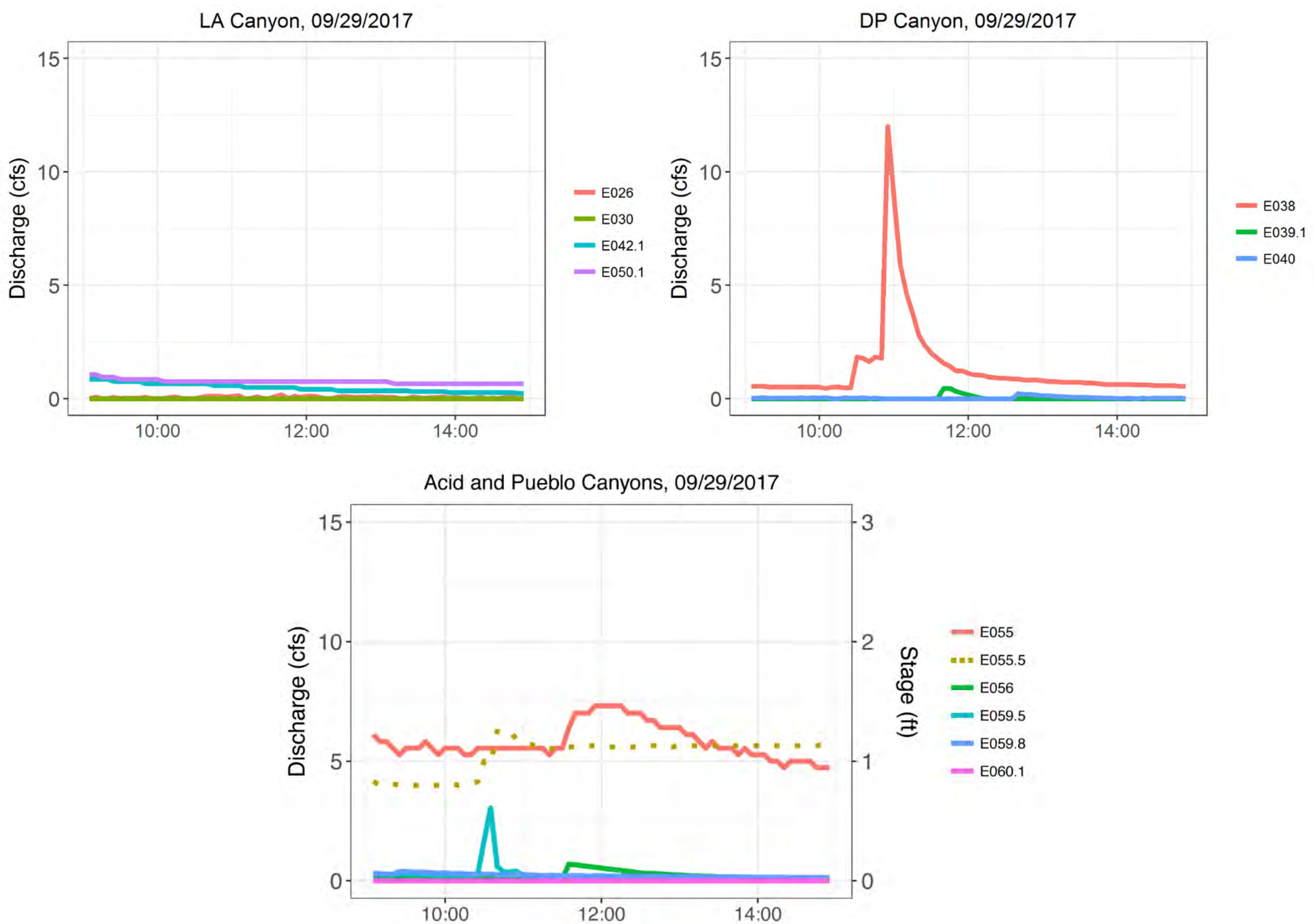


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from up- to downstream reaches**

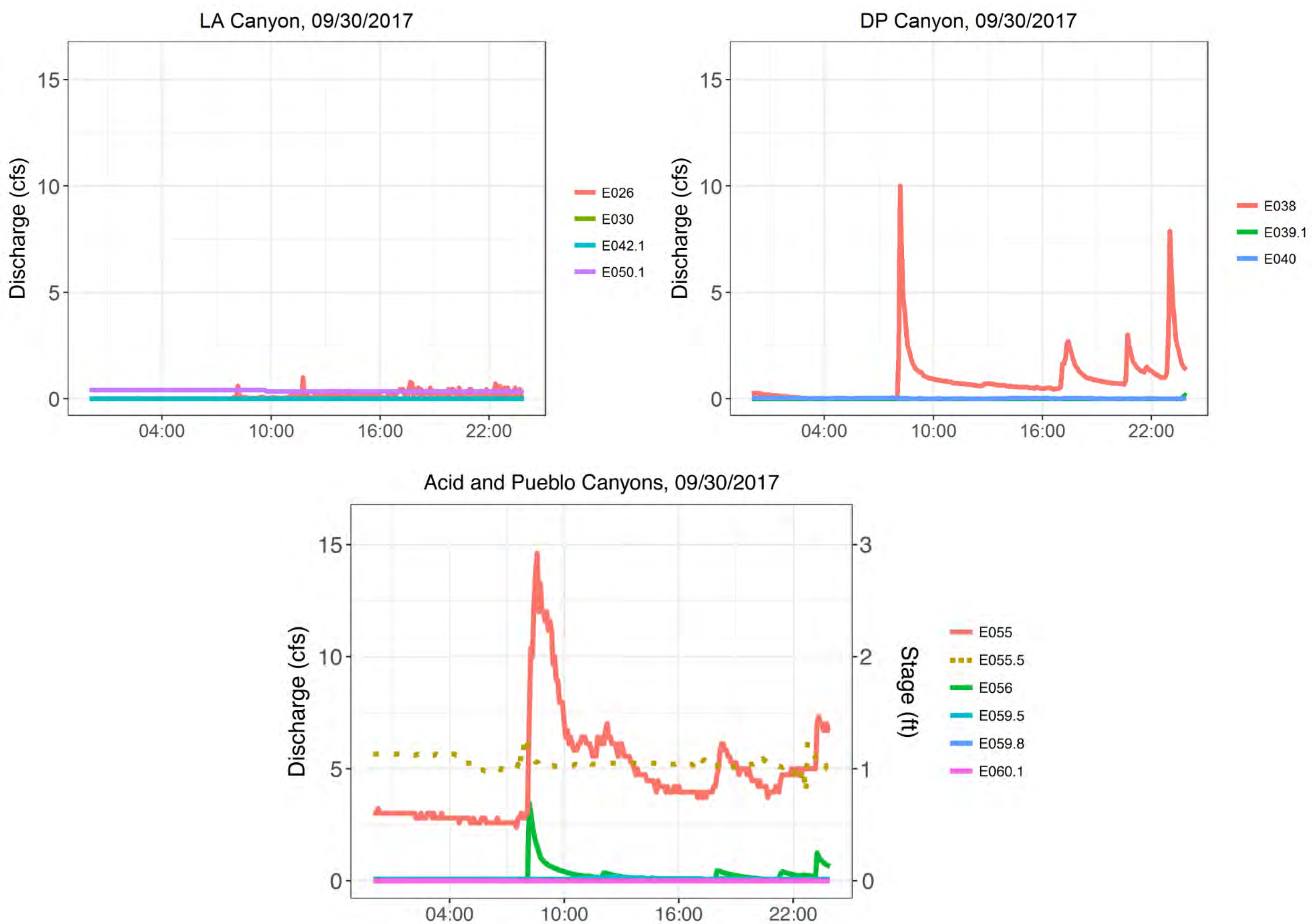


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from up- to downstream reaches**

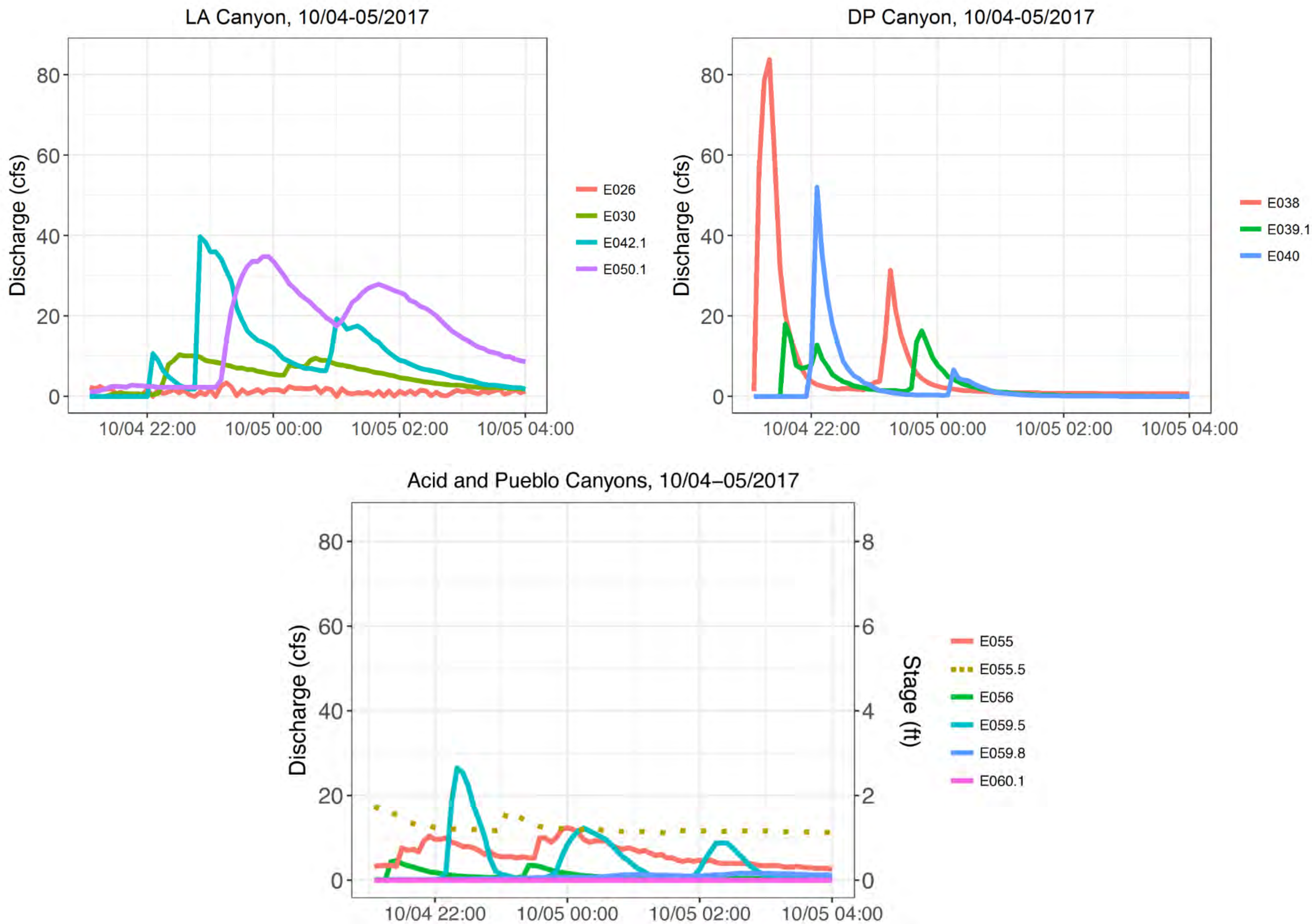


Figure 3.2-3 (continued) Hydrographs during each sample-triggering runoff event for each canyon from up- to downstream reaches

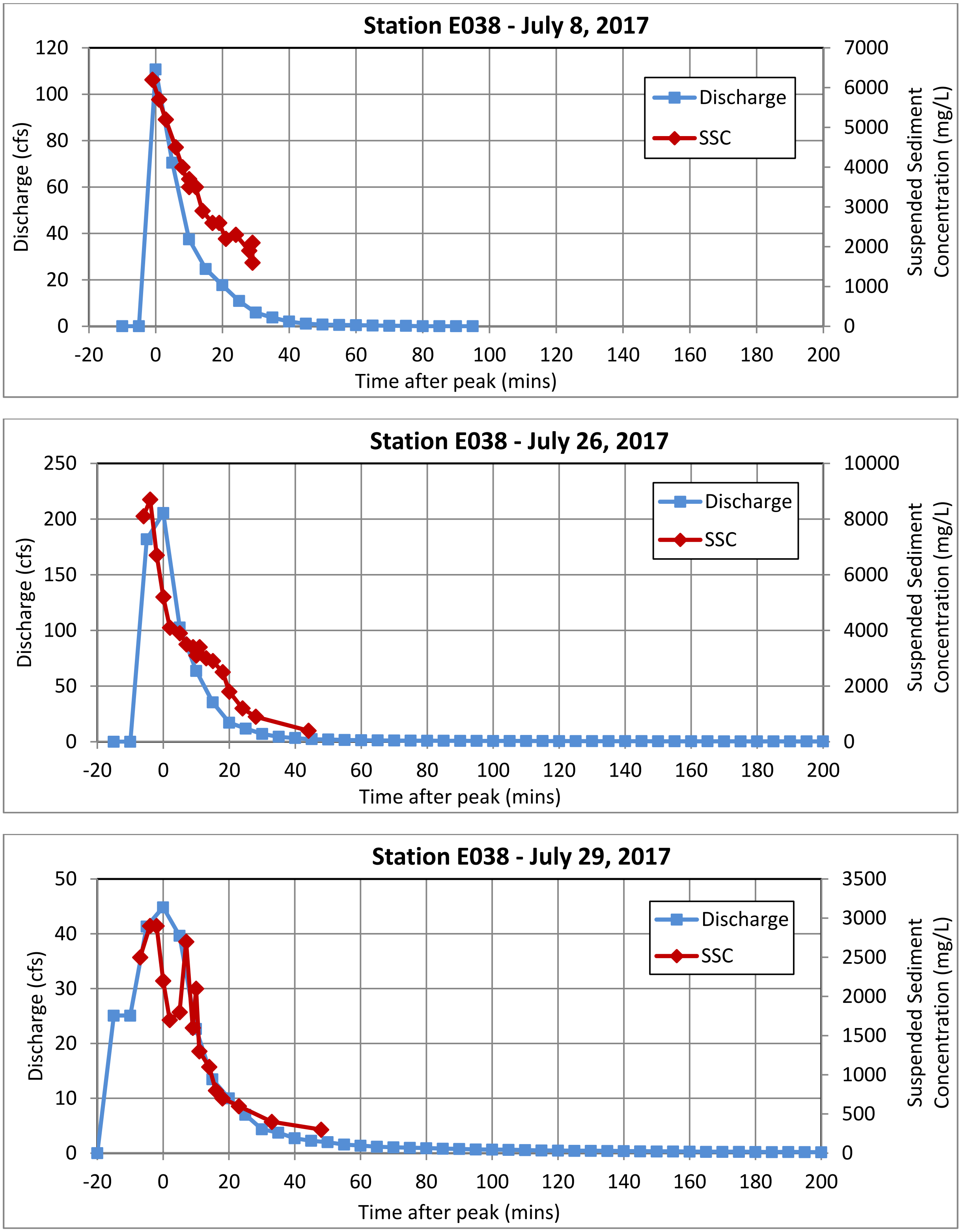
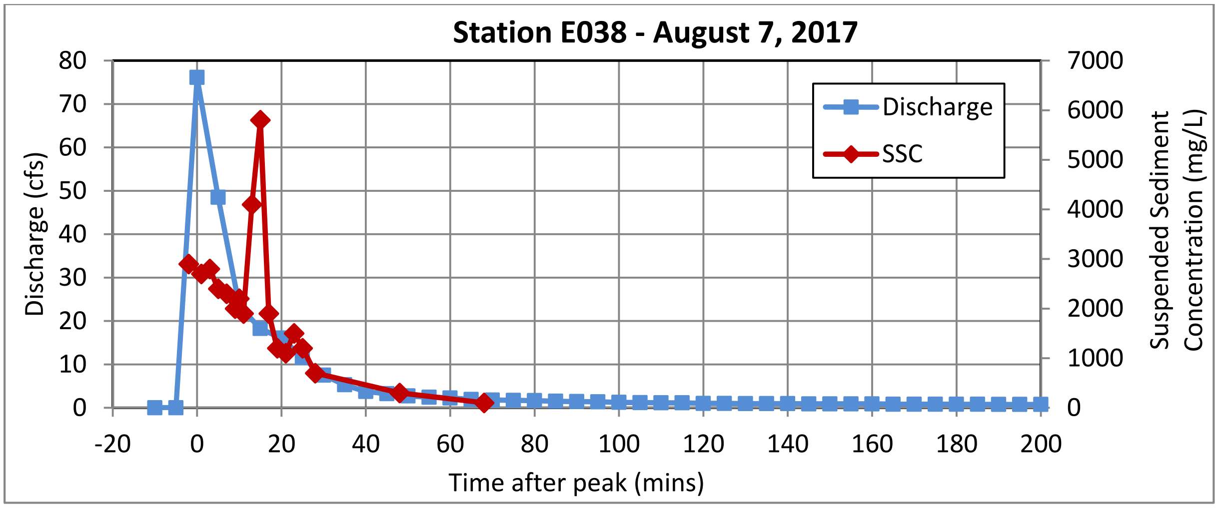
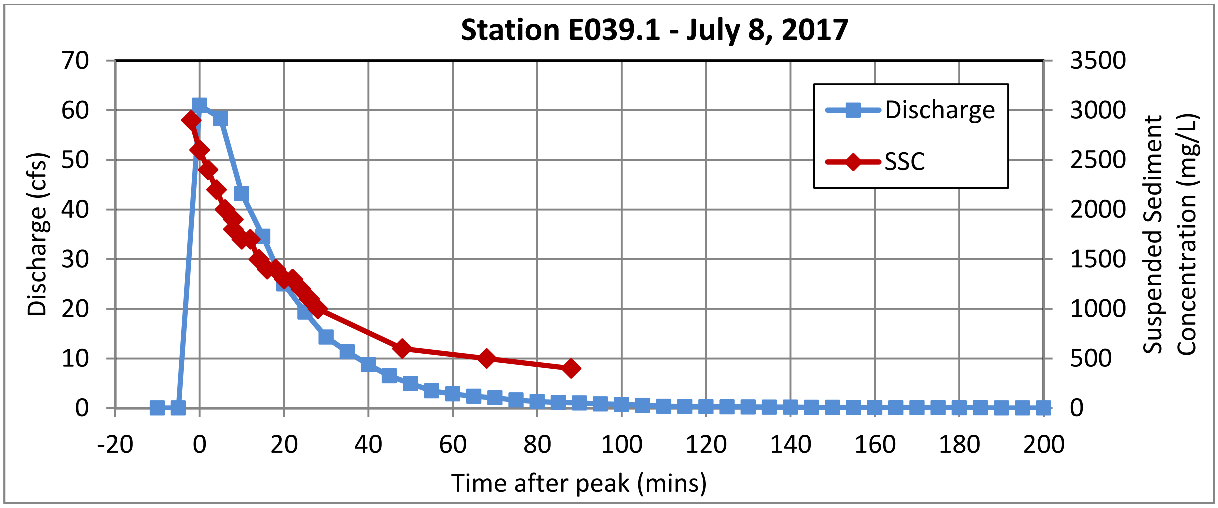


Figure 3.2-4 Discharge and SSC for events sampled at E038, E039.1, E042.1, E050.1, E059.5, and E059.8





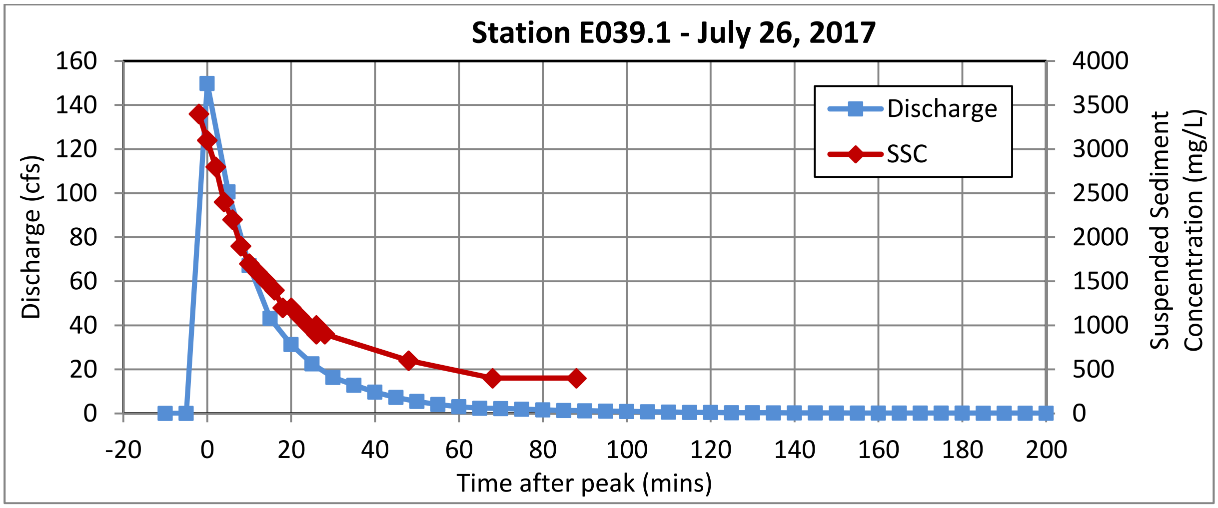
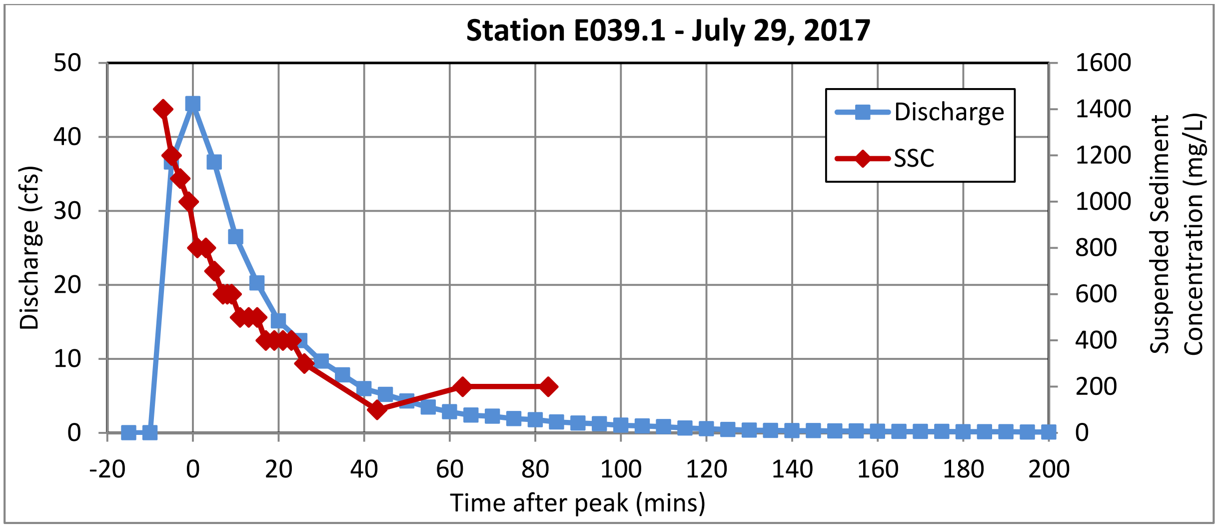
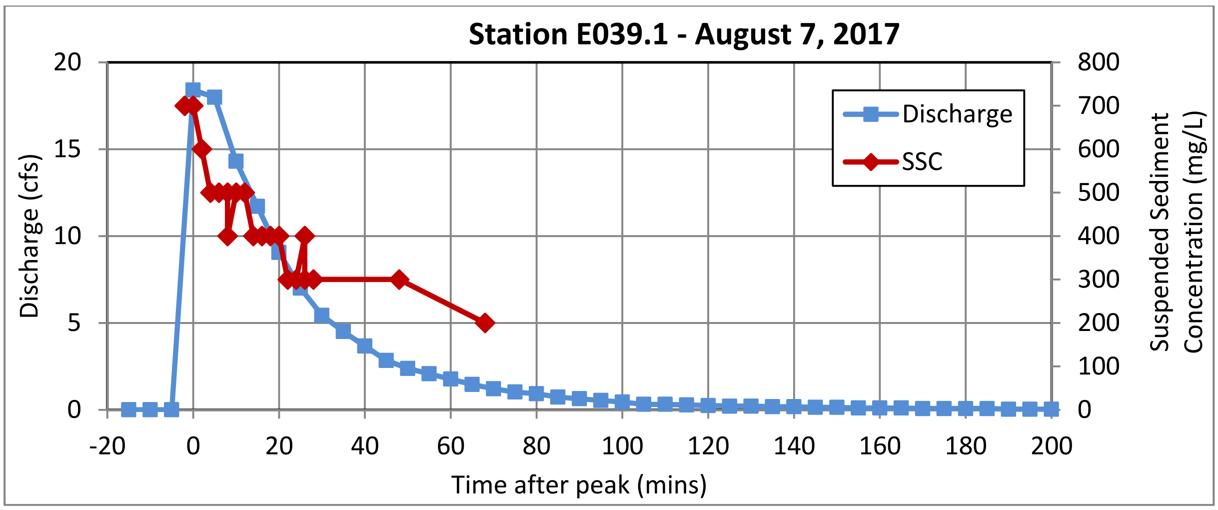


Figure 3.2-4 (continued) **Discharge and SSC for events sampled at E038, E039.1, E042.1, E050.1, E059.5, and E059.8**





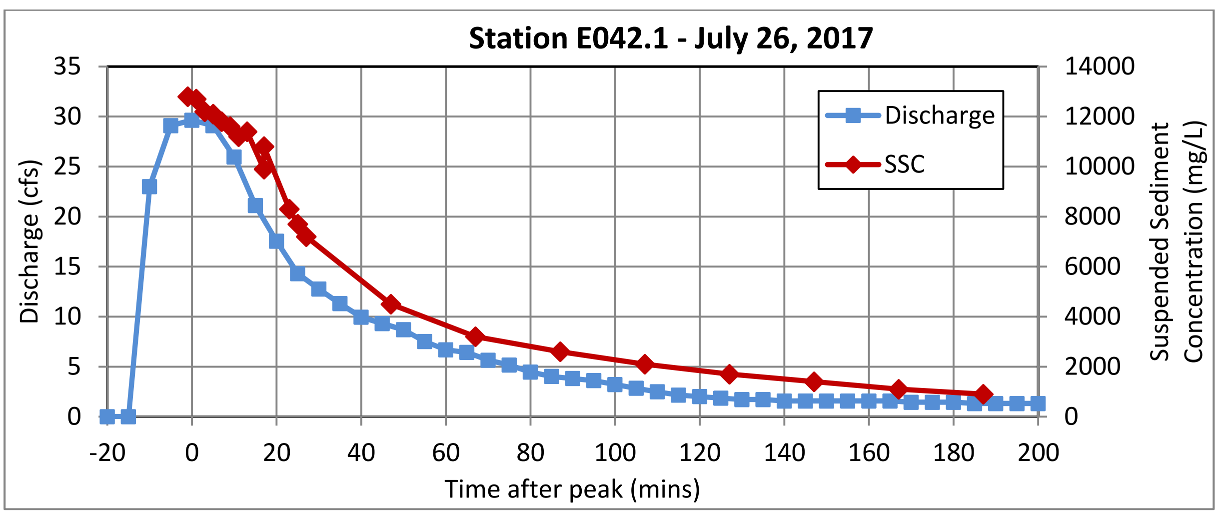
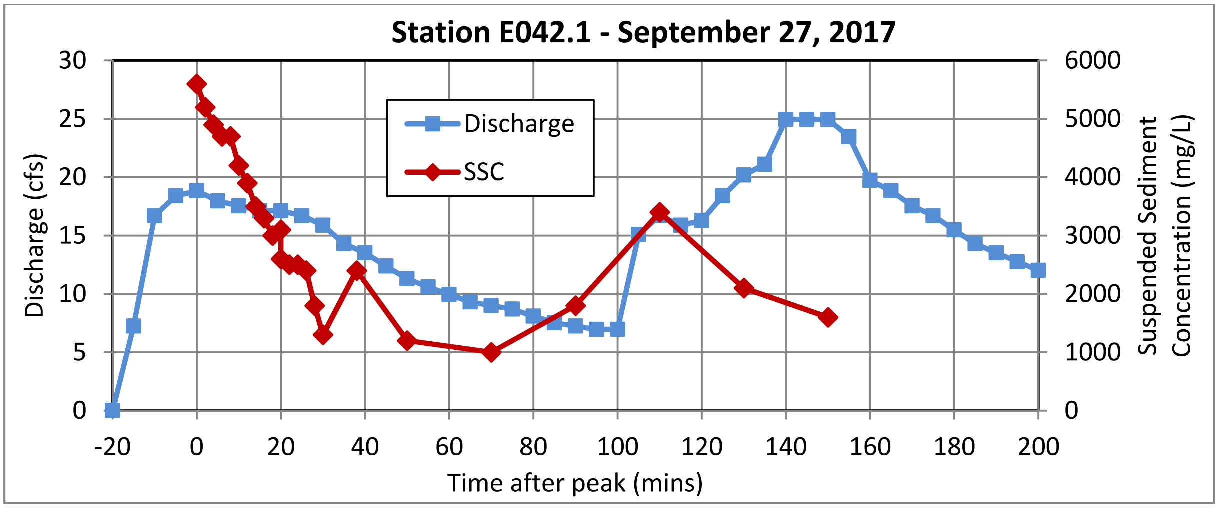
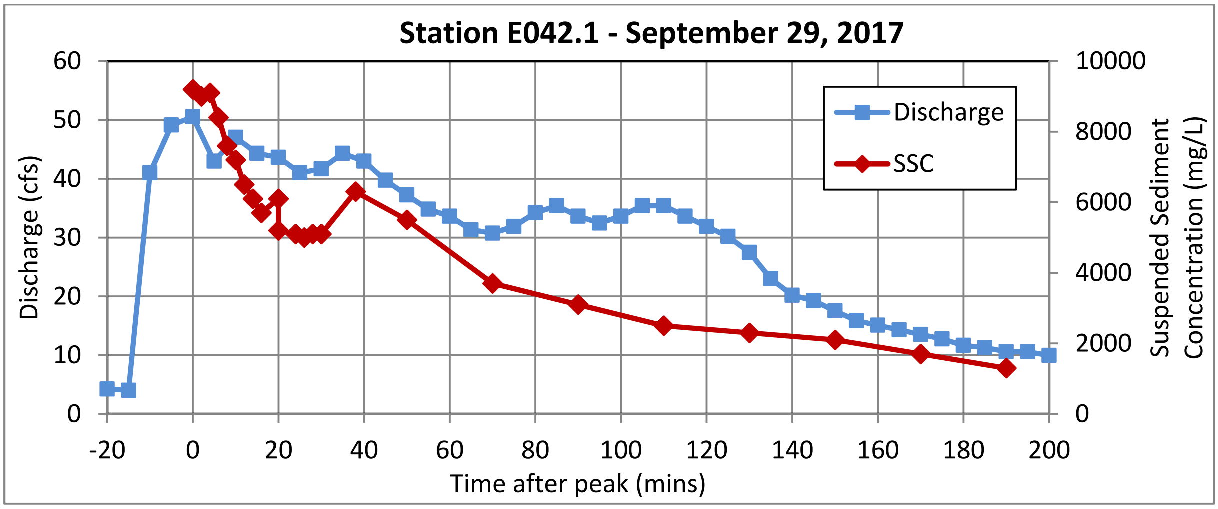


Figure 3.2-4 (continued) Discharge and SSC for events sampled at E038, E039.1, E042.1, E050.1, E059.5, and E059.8





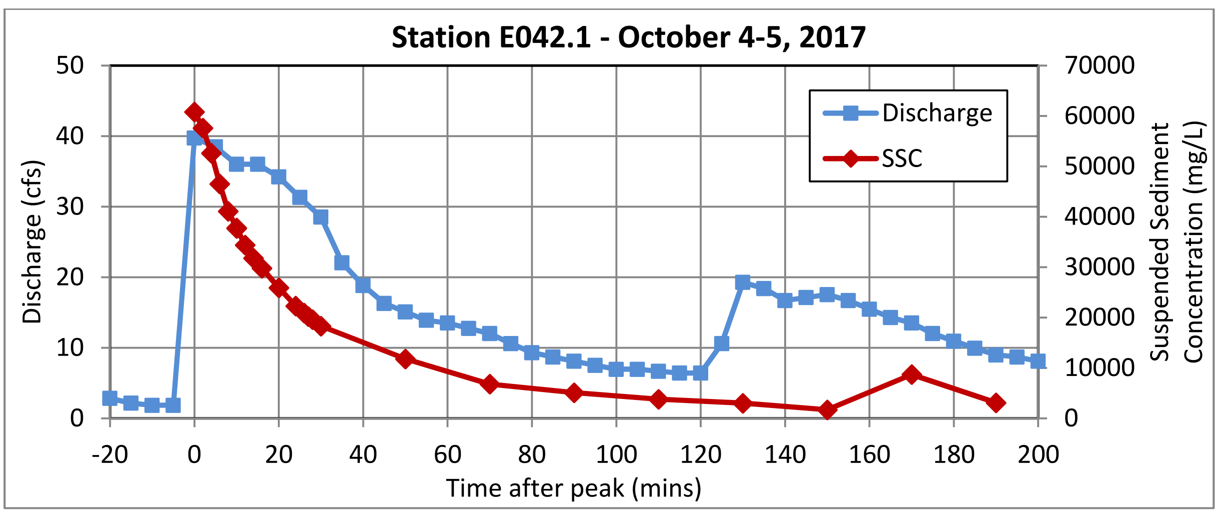
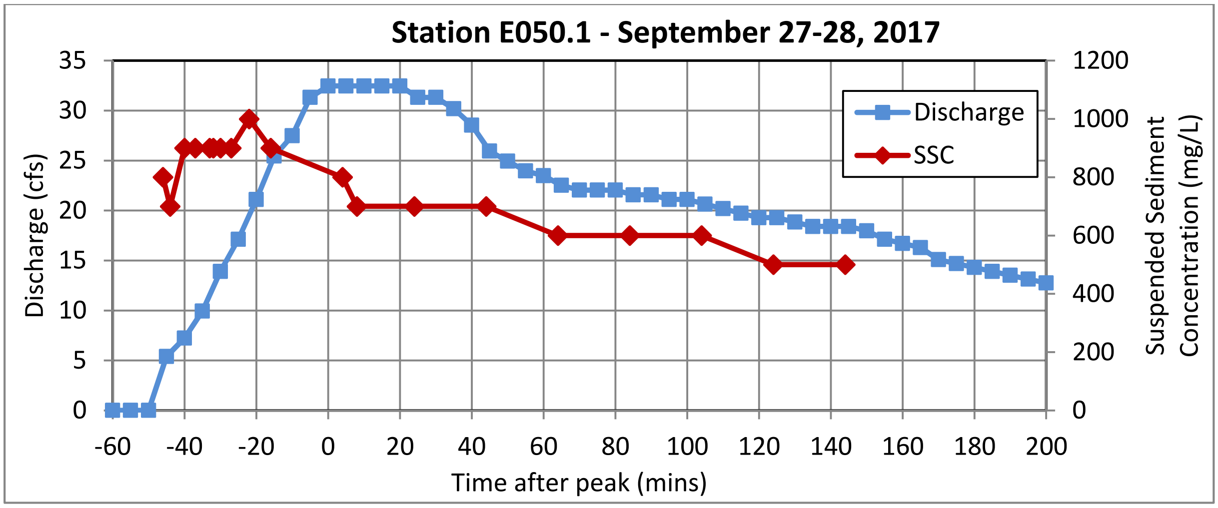
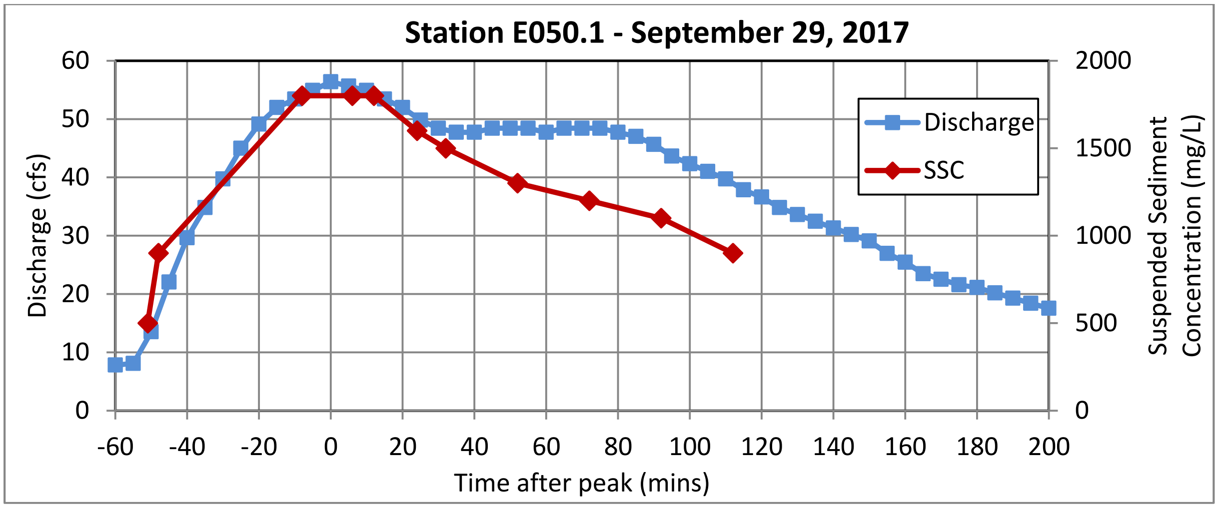


Figure 3.2-4 (continued) **Discharge and SSC for events sampled at E038, E039.1, E042.1, E050.1, E059.5, and E059.8**





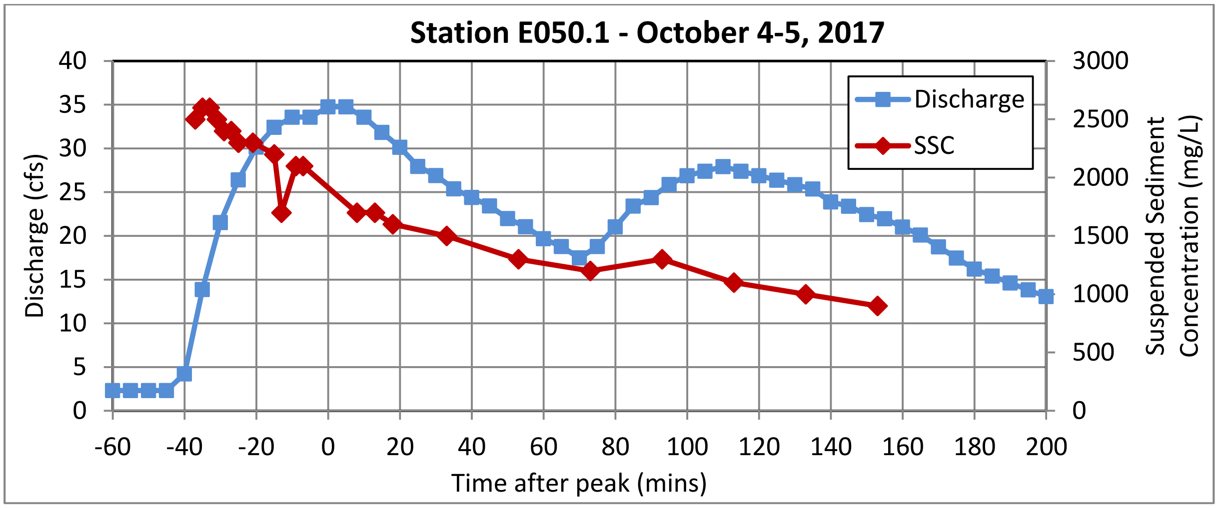
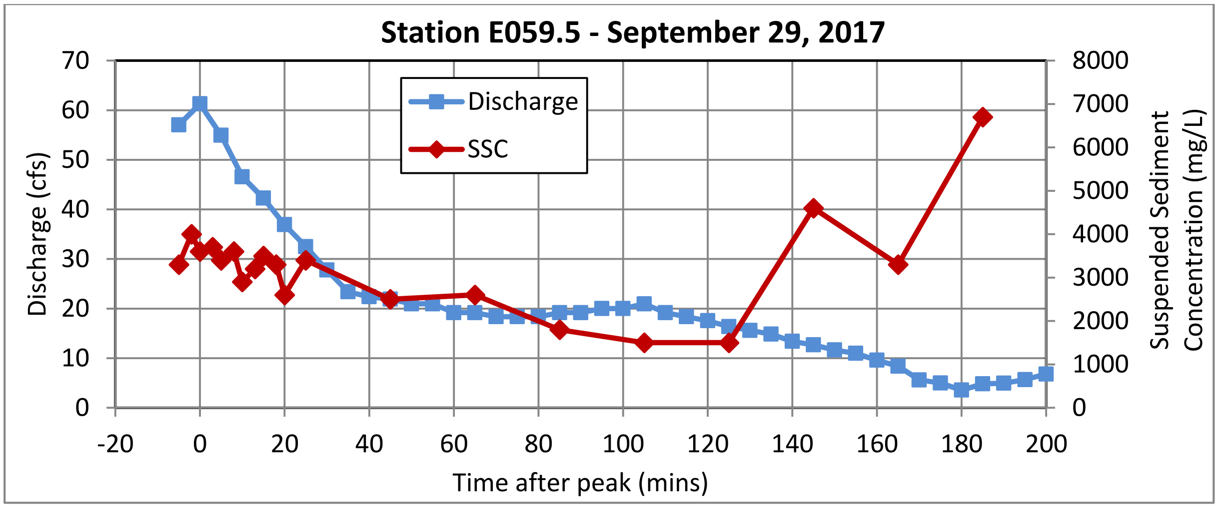


Figure 3.2-4 (continued) Discharge and SSC for events sampled at E038, E039.1, E042.1, E050.1, E059.5, and E059.8



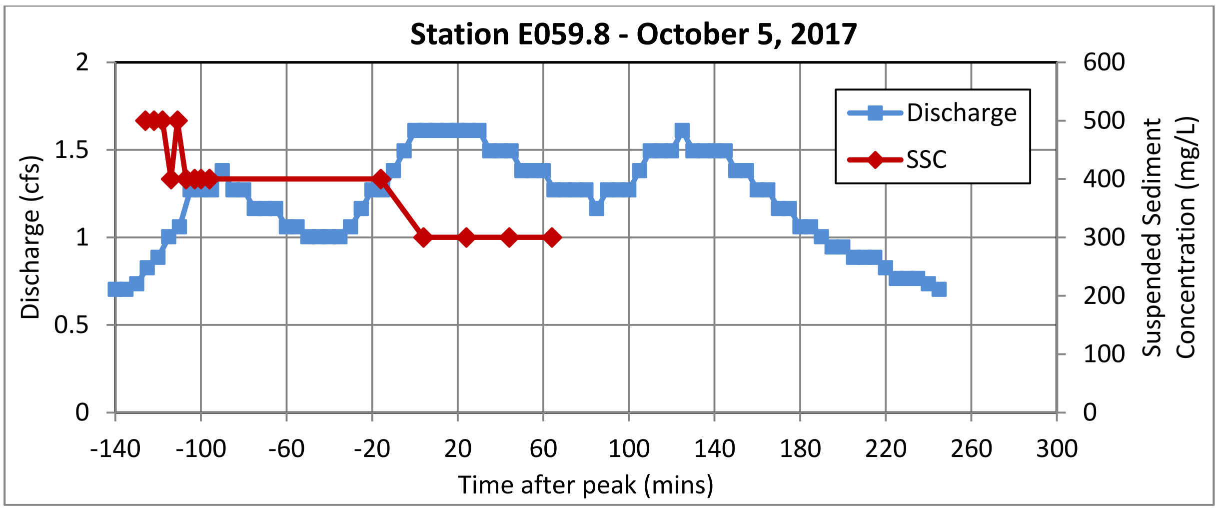


Figure 3.2-4 (continued) **Discharge and SSC for events sampled at E038, E039.1, E042.1, E050.1, E059.5, and E059.8**

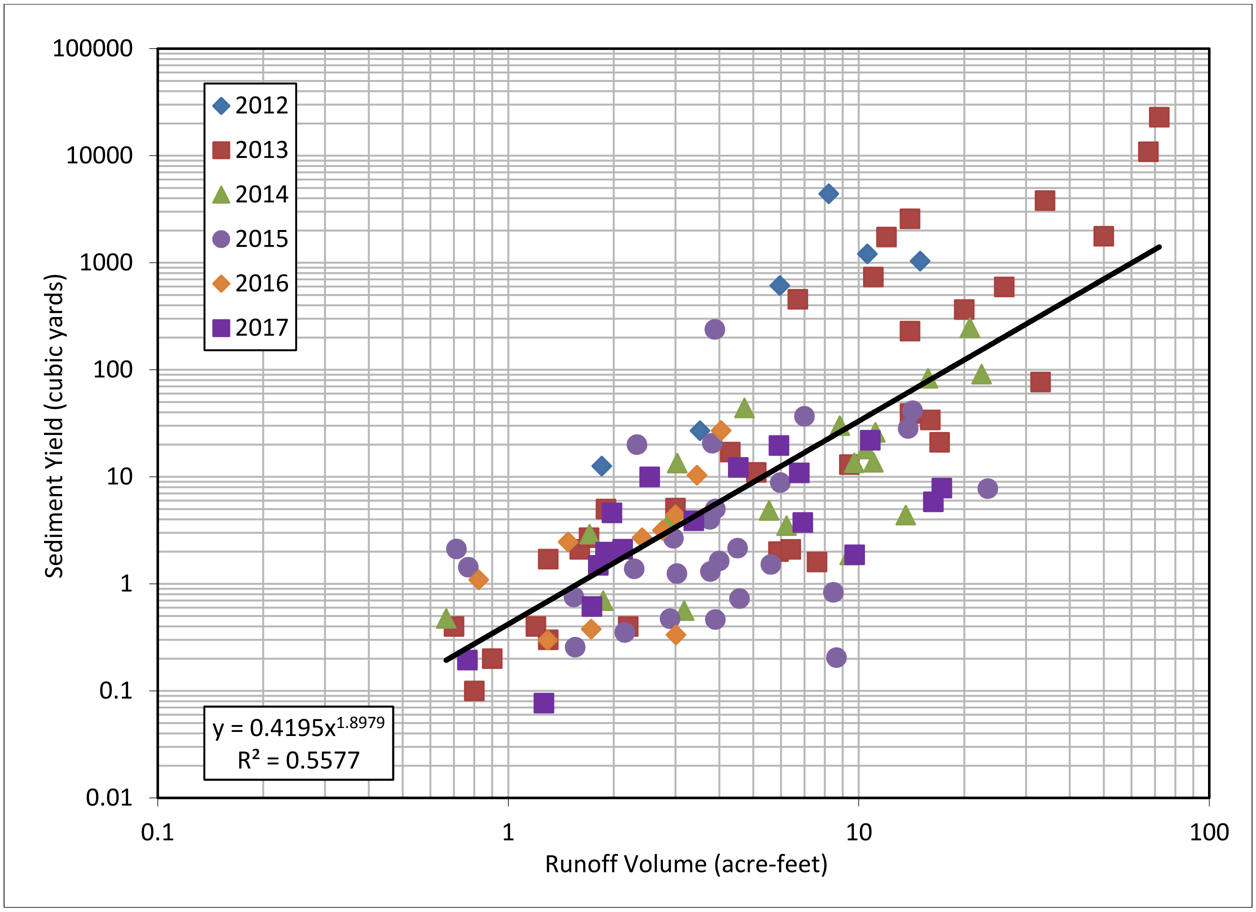


Figure 3.2-5 Relationship between SSC-based sediment yield and runoff volume over the past 6 yr of monitoring

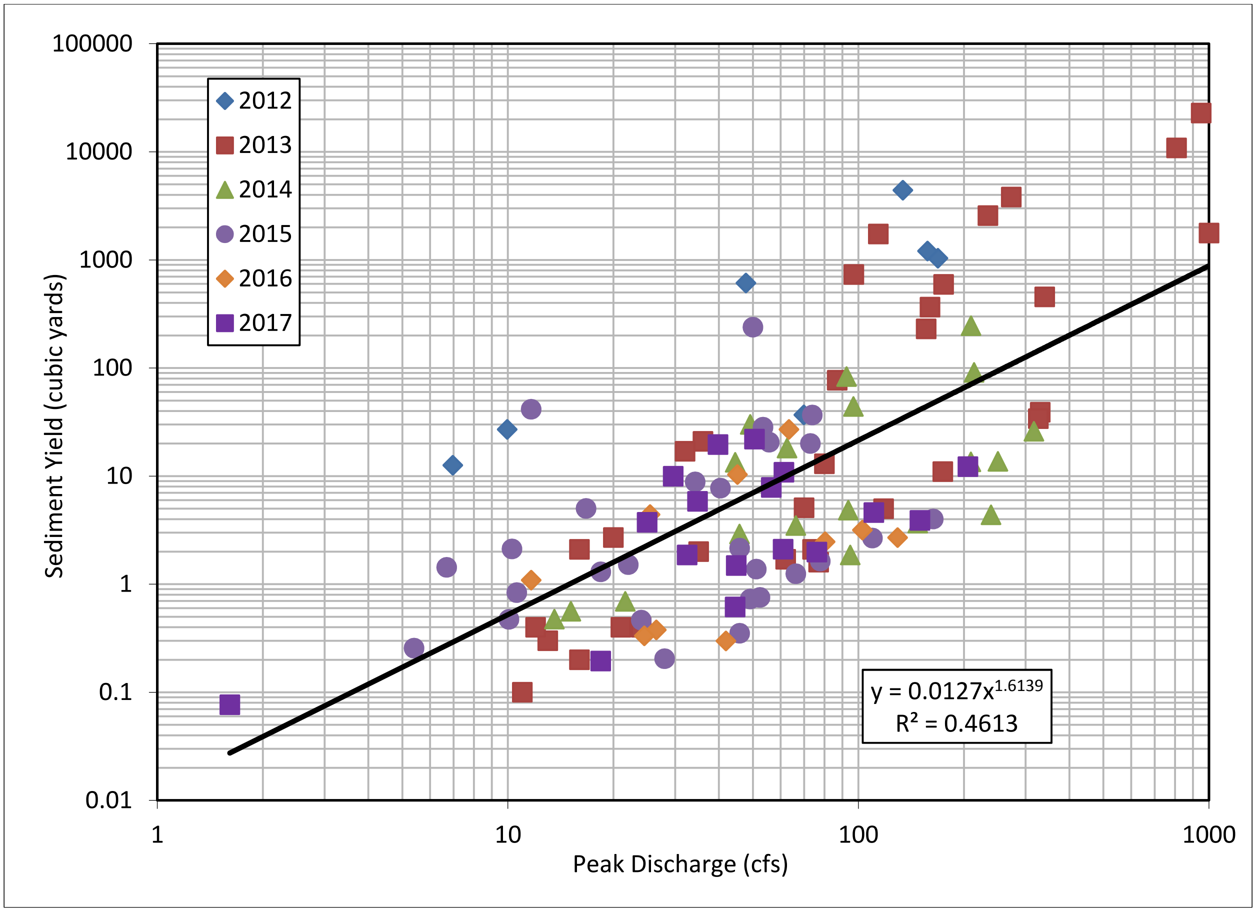


Figure 3.2-6 Relationship between SSC-based sediment yield and peak discharge over the past 6 yr of monitoring

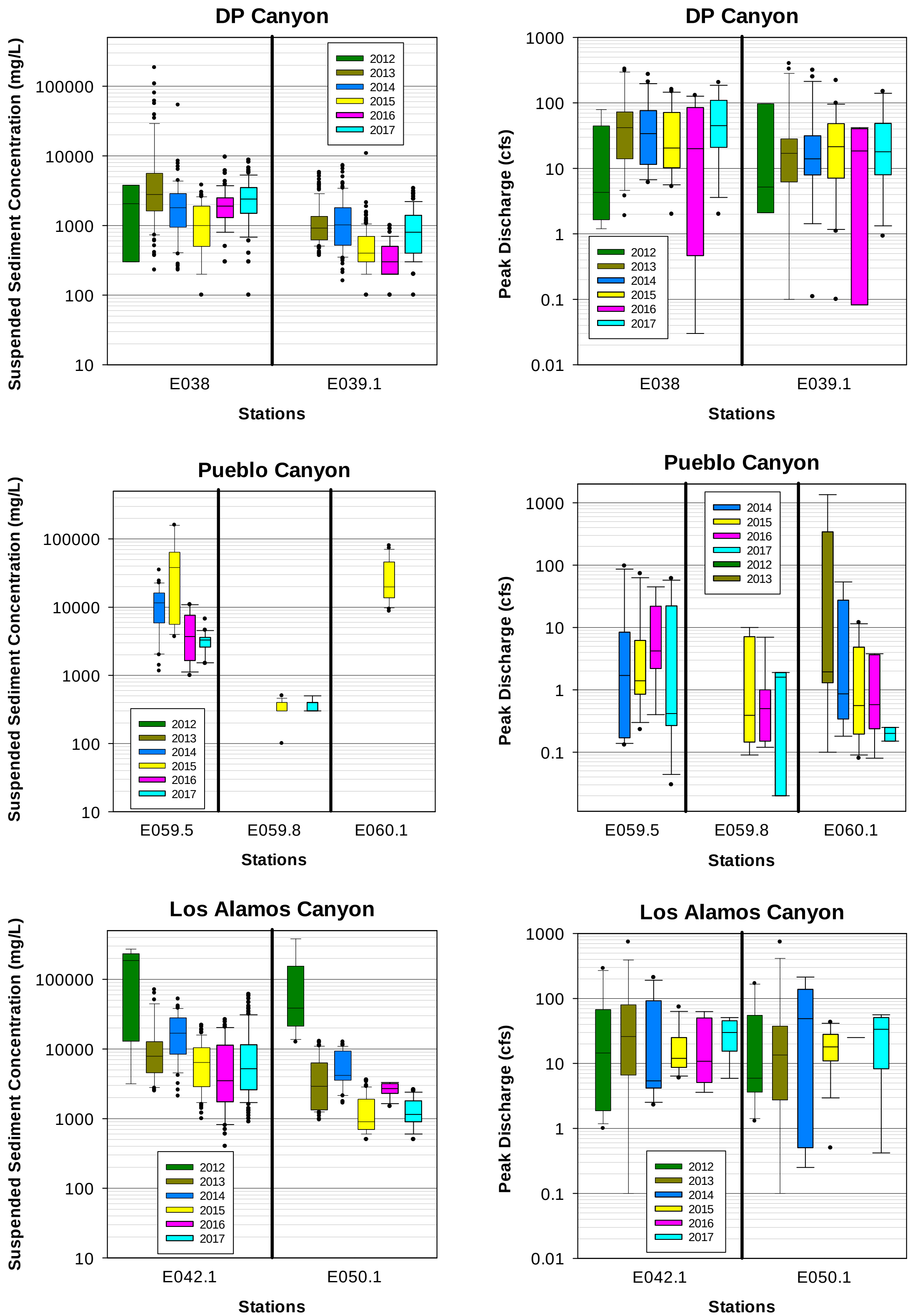
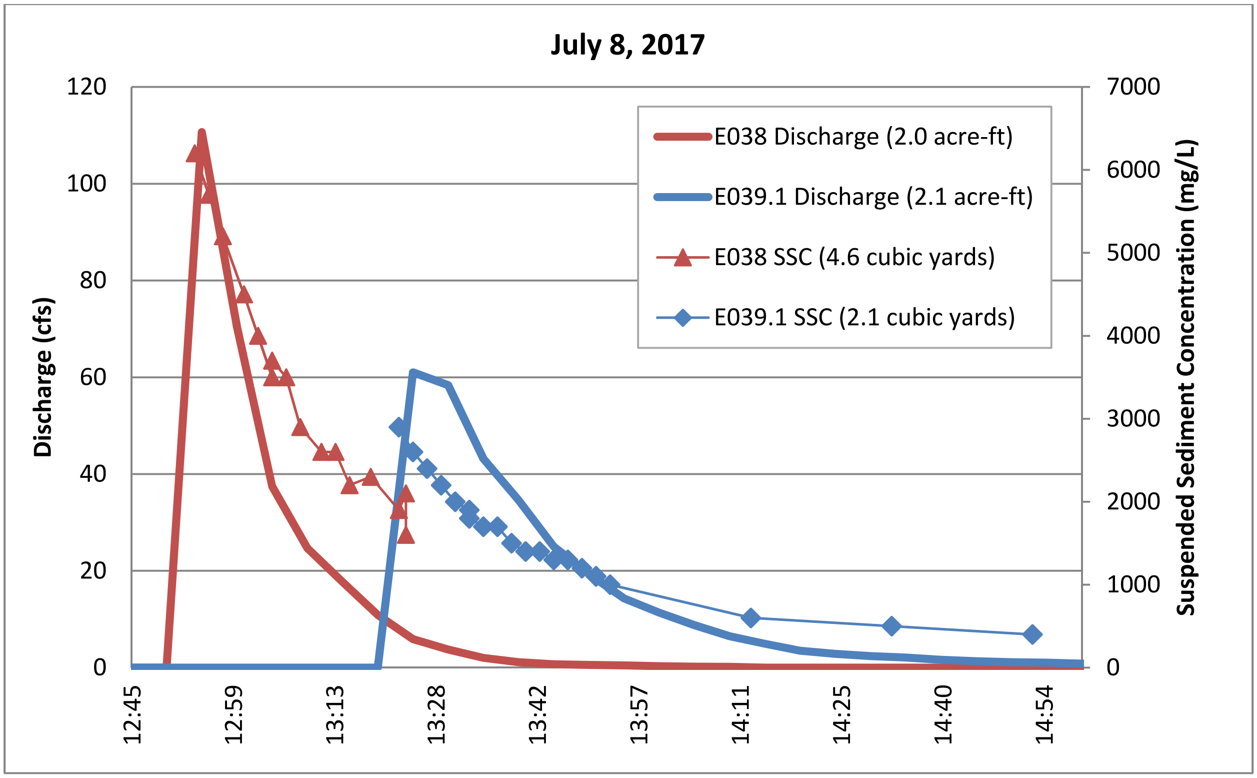


Figure 3.4-1 Box-and-whisker plots of SSC (left) and peak discharge (right) upstream and downstream of the watershed mitigations in DP (top), Pueblo (middle), and Los Alamos (bottom) Canyons over the past 6 yr of monitoring



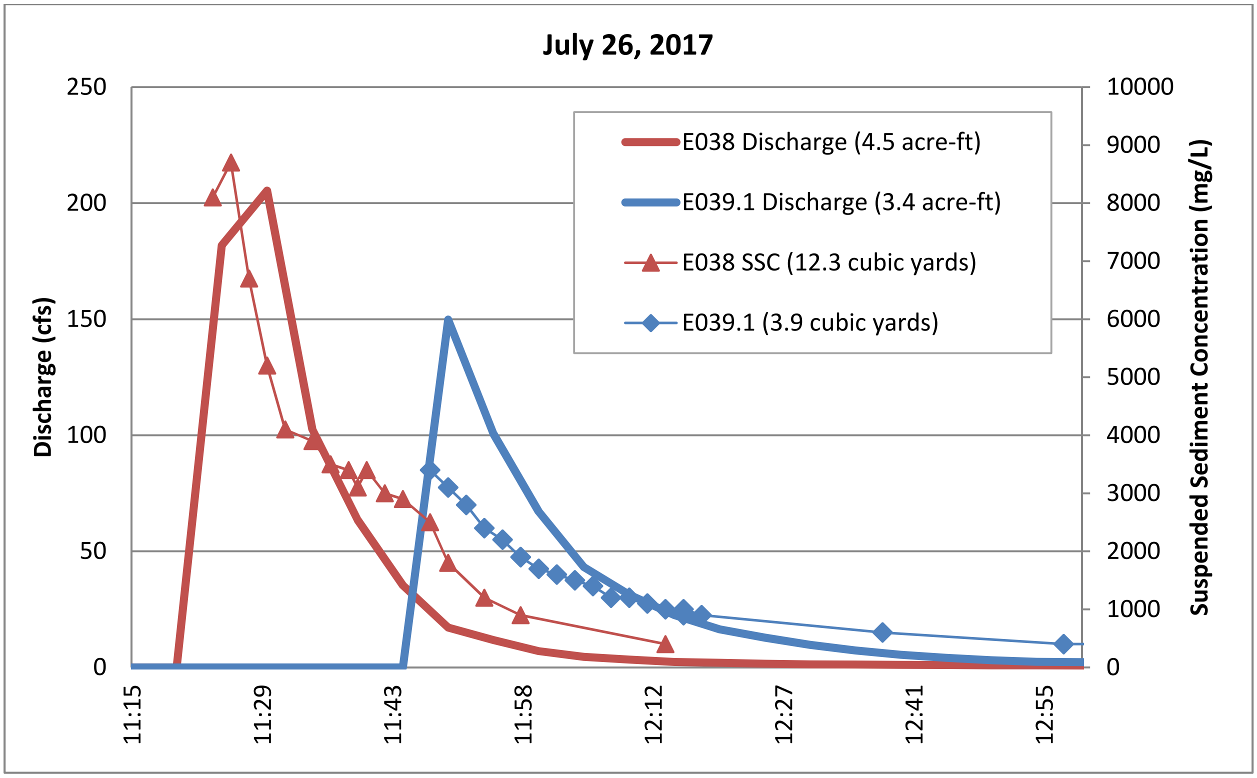
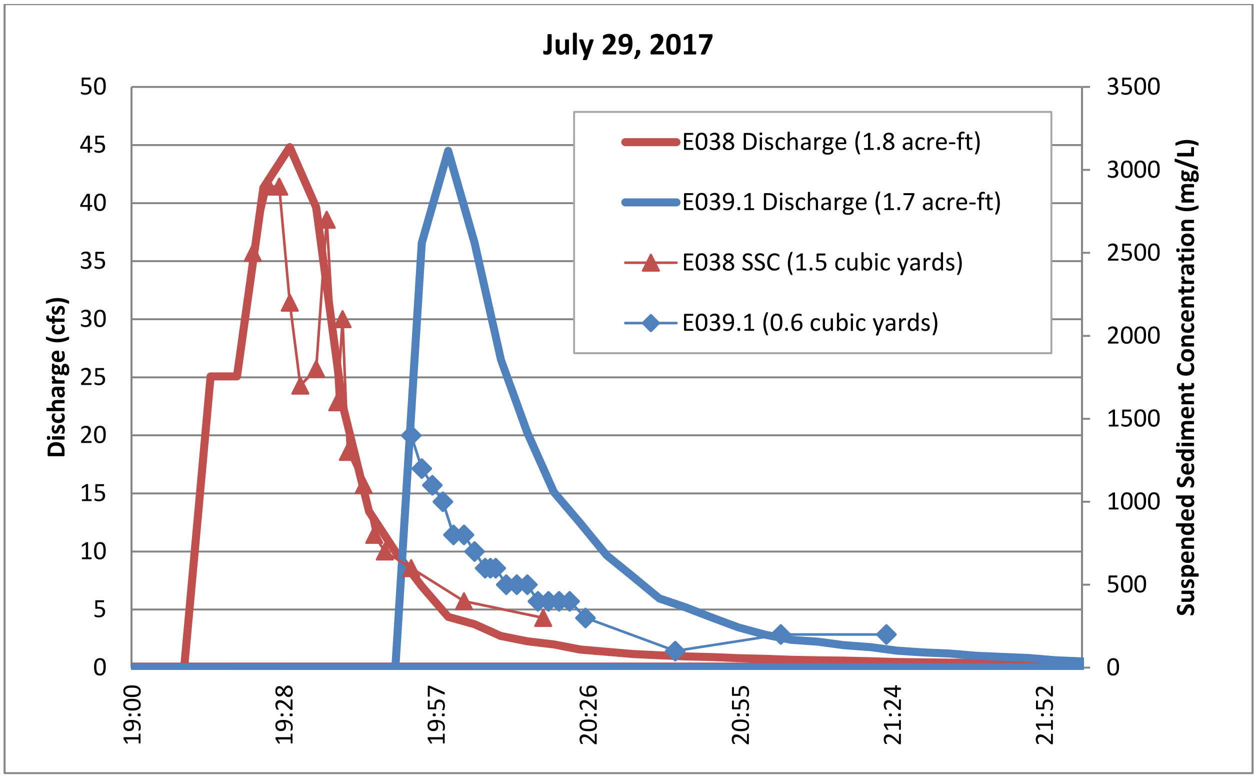


Figure 3.4-2 Discharge and SSC at E038 and E039.1 in upper Los Alamos Canyon on days when sampling of the same runoff event occurred



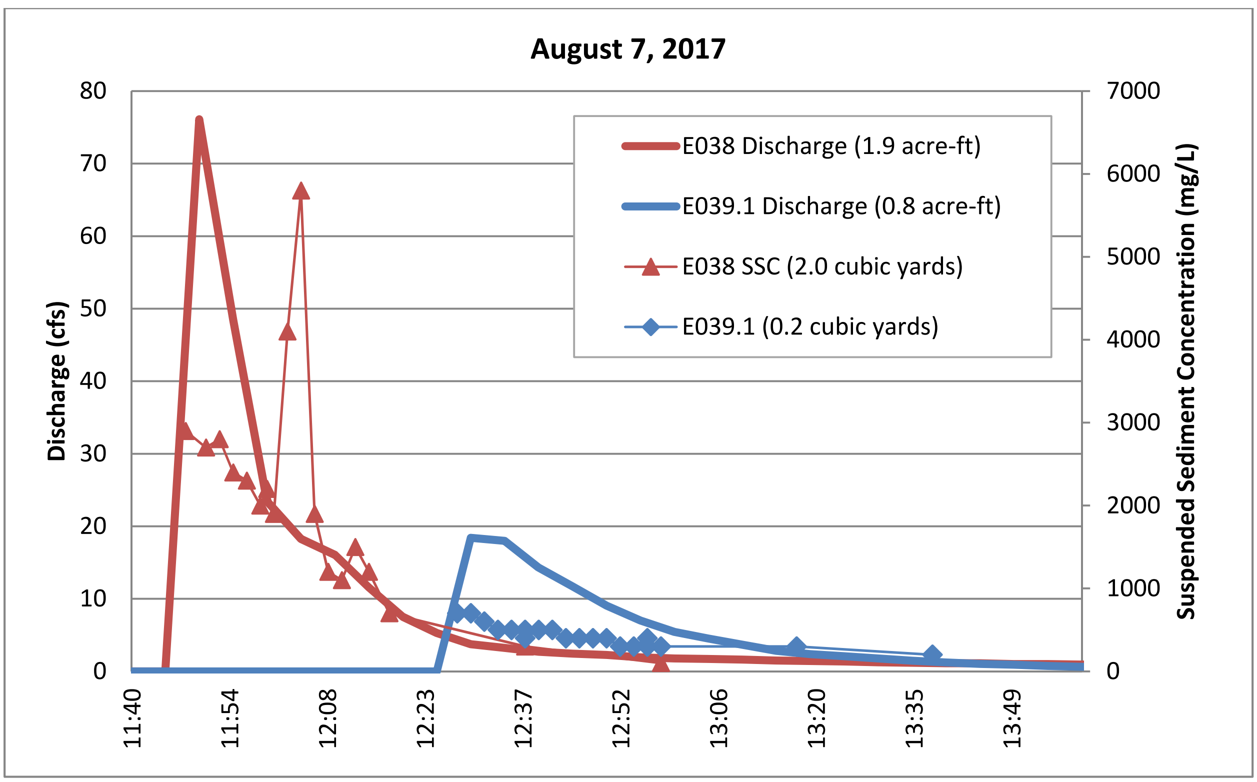
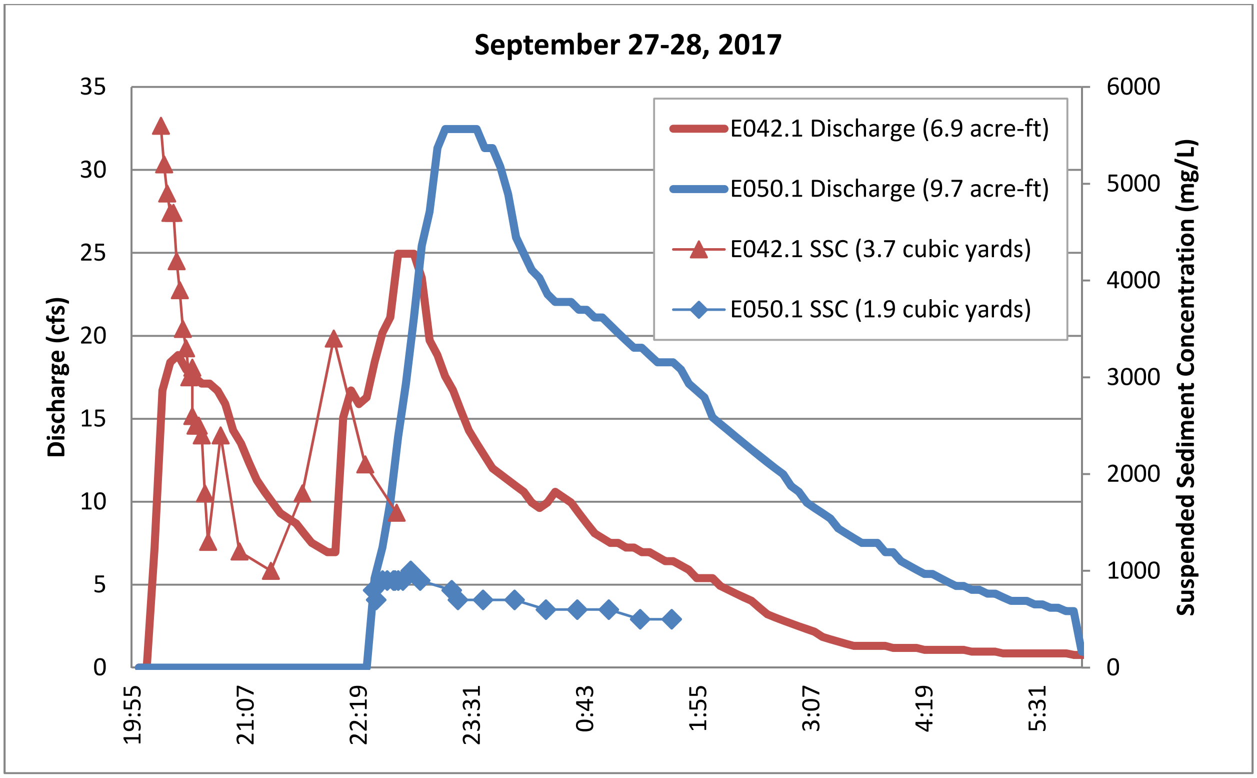


Figure 3.4-2 (continued) **Discharge and SSC at E038 and E039.1 in upper Los Alamos Canyon on days when sampling of the same runoff event occurred**



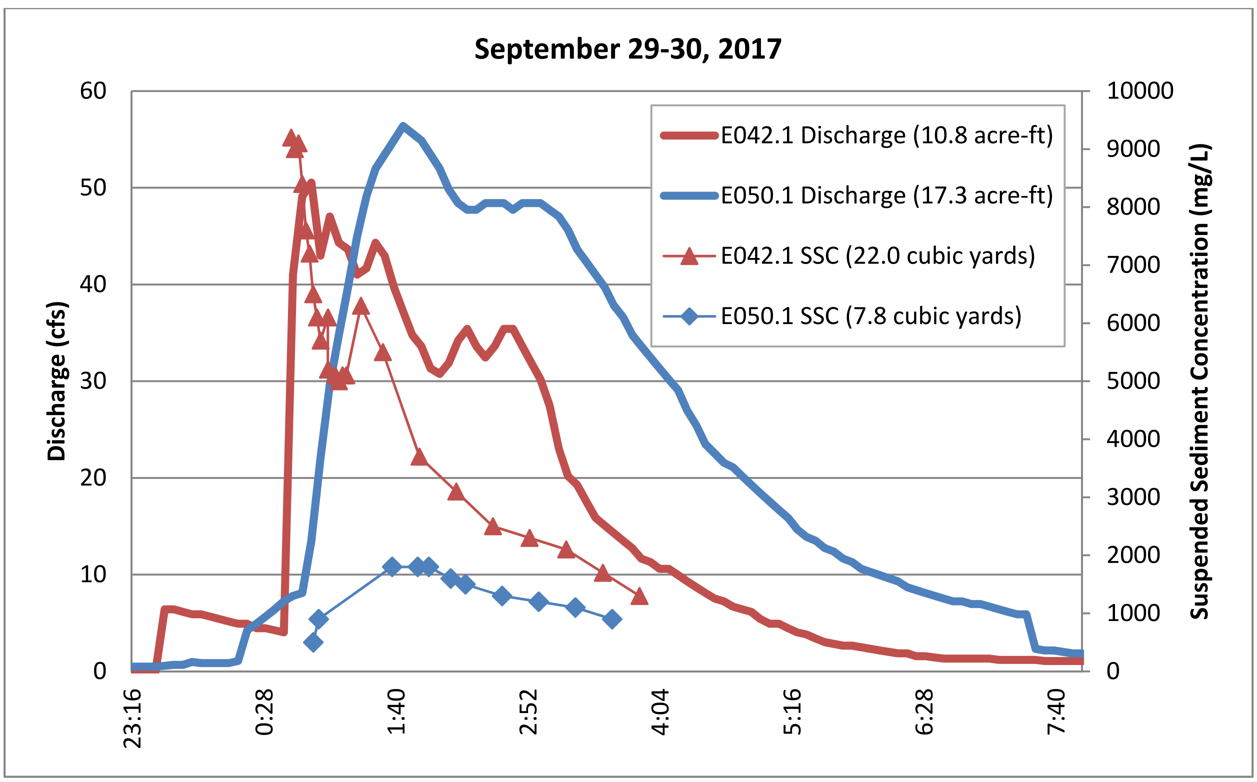


Figure 3.4-3 Discharge and SSC at E042.1 and E050.1 in upper Los Alamos Canyon on days when sampling of the same runoff event occurred

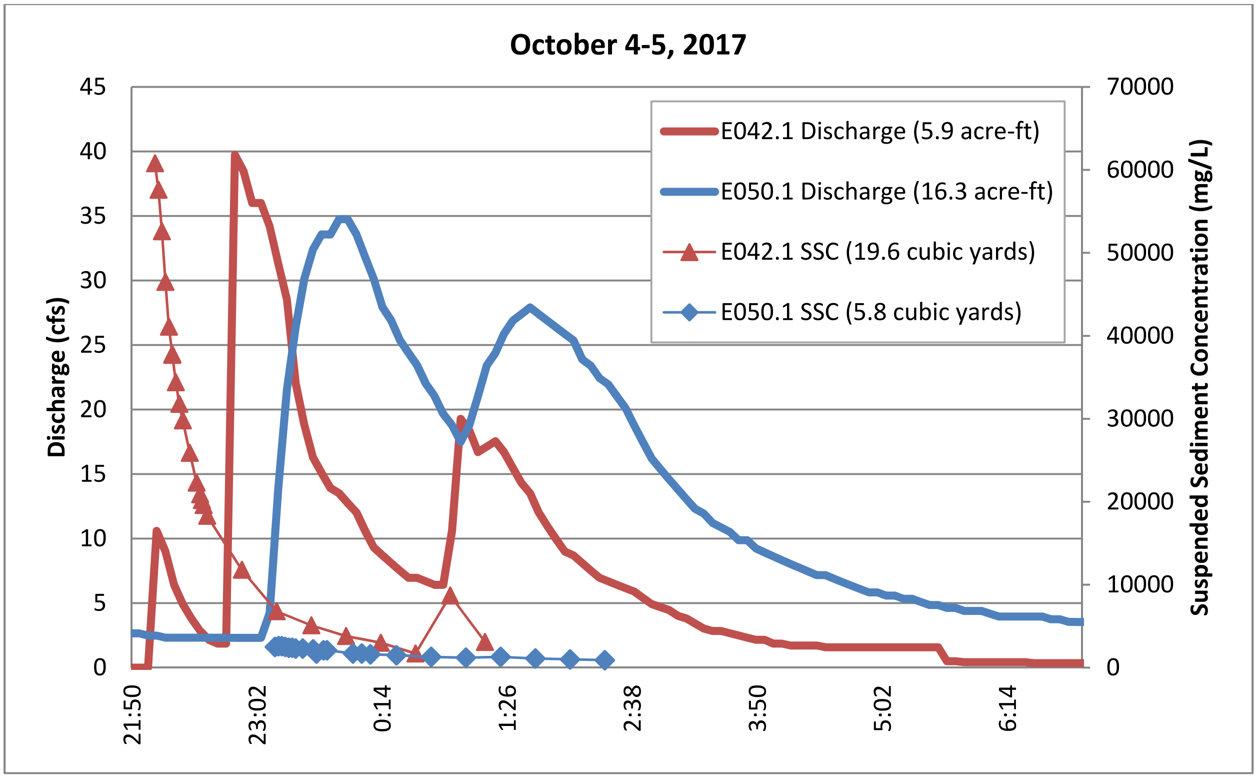


Figure 3.4-3 (continued) **Discharge and SSC at E042.1 and E050.1 in upper Los Alamos Canyon on days when sampling of the same runoff event occurred**

Table 2.1-1
Equipment Configuration at LA/P Gaging Stations

Gaging Station	Stage Measurement Sensor	Communication Method with Data Logger	Sampler Trip Level (Discharge) (cfs)	Dates Sampler Trip Level Active
E026	Probe	Radio telemetry	10	Monitoring season
E030	Encoder	Radio telemetry	10	Monitoring season
E038	Bubbler	Radio telemetry	40	5/12/2017–8/24/2017
E038	Bubbler	Radio telemetry	205	8/24/2017–11/3/2017
E039.1	Encoder, bubbler	Radio telemetry	10	5/10/2017–8/23/2017
E039.1	Encoder, bubbler	Radio telemetry	150	8/23/2017–11/2/2017
E040	Probe	Radio telemetry	10	5/5/2017–10/18/2017
E040	Probe	Radio telemetry	101	10/18/2017–11/1/2017
E042.1	Encoder, bubbler	Radio telemetry	10	Monitoring season
E050.1	Encoder, bubbler, probe	Radio telemetry	5	Monitoring season
E055	Bubbler	Radio telemetry	10	Monitoring season
E055.5	Radar sensor	Radio telemetry	Varied, as close to 10 cfs as possible*	Monitoring season
E056	Bubbler	Radio telemetry	10	5/16/2017–8/31/2017

* Log check dams installed downstream of E055.5 caused the channel bed to fluctuate significantly throughout 2017; therefore, the water depth (ft) is presented for E055.5 instead of discharge. The location of the stage sensor was moved upstream to a more stable location in March 2018.

Table 2.3-1
Maximum Daily Discharge and Storm Water Sampling in the LA/P Watershed during 2017

	Los Alamos Canyon Discharge (cfs)							Pueblo and Acid Canyon Discharge (cfs)					
	DP Canyon			Los Alamos Canyon				Acid Canyon		Pueblo Canyon			
Date	E038	E039.1	E040	E026	E030	E042.1	E050.1	E055.5[a]	E056	E055	E059.5	E059.8	E060.1
7/8/2017	110 S[b]	60 S	27 S	0.14 BT[c]	0 BT	0 BT	0 BT	1.55 NS[d]	2.6 S	0 BT	0 BT	0 BT	0 BT
7/26/2017	205 S	150 S	101 S	0.29 BT	6.5 BT	30 S	0 BT	2.31 S	24 S	0.75 BT	0.03 BT	0 BT	0.25 BT
7/27/2017	2 BT	0.93 BT	1.04 BT	0 BT	0 BT	0 BT	0 BT	0.89 S	0.16 BT	0 BT	0.3 BT	0 BT	0 BT
7/29/2017	45 S	45 S	39 NS	0.09 BT	0 BT	5.9 BT	0 BT	1.50 S	4.4 S	16 NS	0.43 BT	0 BT	0 BT
8/7/2017	76 S	18 S	5.9 BT	0.04 BT	0 BT	0 BT	0 BT	0 BT	0.67 BT	0.25 BT	0.47 BT	0 BT	0.15 BT
8/23/2017	21 BT	4.9 BT	0 BT	0.07 BT	0 BT	0 BT	0 BT	0 BT	4.7 S	16 NS	0.4 BT	0 BT	0 BT
9/26/2017	24 BT	15 BG[e]	2.6 BT	0.04 BT	0 BT	0 BT	0 BT	0 BT	2.3 BT	0 BT	0.33 BT	0 BT	0 BT
9/27/2017	36 BT	35 BG	51 S	0.44 BT	8.5 CT[f]	25 S	32 S	0 BT	4.7 BT	33 S	21 NS	0 BT	0 BT
9/28–9/29/2017	110 BG	9 BT	50 S	1.9 BT	12 S	51 S	56 S	0 BT	12 BG	22 S	61 S	1.9 S	0 BT
9/30/2017	10 BT	0 BT	0.14 BT	1 BT	0 BT	0 BT	0.42 BT	0 BT	3.5 BT	15 NS	0.17 BT	0.02 BT	0 BT
10/4–10/5/2017	84 BG	18 BG	51 BG	3.4 CT	10 S	40 S	35 S	0 BT	4.6 BT	14 NS	26 NS	1.6 S	0 BT

[a] Log check dams installed downstream of E055.5 caused the channel bed to fluctuate significantly throughout 2017; therefore, the water depth (ft) is presented for E055.5 instead of discharge. The location of the stage sensor was moved upstream to a more stable location in March 2018.

[b] S = Sample was collected. These discharge levels are highlighted in yellow to emphasize those events for which discharge exceeded the trip level and samples were collected.

[c] BT = Below gage station triggering threshold, no sample collected.

[d] NS = No sample was collected, but discharge was above gaging station trip level. These discharge levels are shaded in blue to highlight those events where discharge was above trip level, but no sample was collected.

[e] BG = Below greatest discharge; that is, if four samples have been collected, only storms with a peak discharge greater than the peak discharge of the storms already collected will be sampled.

[f] CT = Close to gage station trip level, no sample collected. Stage measurement sensors can have inaccuracies +/- 2 cfs.

Table 2.3-2
Sampling Operational Issues during the 2017 Monitoring Year

Gaging Station	Date	Peak Discharge (cfs)	Reason	Comment
E026	n/a*	n/a	n/a	No sampling operational issues during 2017
E030	n/a	n/a	n/a	No sampling operational issues during 2017
E038	n/a	n/a	n/a	No sampling operational issues during 2017
E039.1	n/a	n/a	n/a	No sampling operational issues during 2017
E040	7/29/2017	39	Intake clogged	Sampler tried to collect but intake clogged
E042.1	n/a	n/a	n/a	No sampling operational issues during 2017
E050.1	n/a	n/a	n/a	No sampling operational issues during 2017
E055	7/29/2017	16	Trip level set high	Trip level was set too high, will be addressed before 2018 monitoring year
E055	8/23/2017	16	Trip level set high	Trip level was set too high, will be addressed before 2018 monitoring year
E055	9/30/2017	15	Trip level set high	Trip level was set too high, will be addressed before 2018 monitoring year
E055	10/4/2017	14	Trip level set high	Trip level was set too high, will be addressed before 2018 monitoring year
E055.5	7/8/2017	1.55 (ft)	Intake clogged	Sampler tried to collect but intake clogged
E056	n/a	n/a	n/a	No sampling operational issues during 2017
E059.5	9/27/2017	21	Trip level set high	Trip level was set too high, will be addressed before 2018 monitoring year
E059.5	10/4/2017	26	Trip level set high	Trip level was set too high, will be addressed before 2018 monitoring year
E059.8	n/a	n/a	n/a	No sampling operational issues during 2017
E060.1	n/a	n/a	n/a	No sampling operational issues during 2017

*n/a = Not applicable.

Table 2.4-1
Locations and Analytical Suites for Storm Water Samples

Monitoring Group	Locations	Analytical Suites[a]
BDD[b] Required Monitoring	E050.1, E060.1	PCBs, alkalinity, pH, dioxins/furans, dissolved organic carbon, gamma spectroscopy, gross alpha, gross beta, isotopic plutonium, isotopic uranium, americium-241, particle size, radium-226/radium-228, sulfate, chloride, strontium-90, SSC, dissolved TAL metals[c], total organic carbon
Detention Basins and Vegetative Buffer below the SWMU 01-001(f) Drainage	CO101038, CO111041	PCBs, dissolved TAL metals, gross alpha, SSC, particle size, dissolved organic carbon, total organic carbon, alkalinity, pH, sulfate, chloride
DP Canyon Gaging Stations	E038, E039.1, E040	PCBs, gamma spectroscopy, isotopic plutonium, strontium-90, dissolved TAL metals, gross alpha, SSC, particle size, sulfate, chloride, total organic carbon, alkalinity, pH, dissolved organic carbon
Fire-affected Lower Watershed Gaging Stations	E042.1, E050.1	PCBs, gamma spectroscopy, alkalinity, pH, isotopic plutonium, isotopic uranium, americium-241, dioxins/furans, strontium-90, dissolved TAL metals, dissolved organic carbon, gross alpha, gross beta, particle size, radium-226/radium-228, sulfate, chloride, SSC, total organic carbon
Lower Pueblo Canyon Gaging Stations	E059.5, E059.8, E060.1	PCBs, gamma spectroscopy, isotopic plutonium, americium-241, isotopic uranium, strontium-90, silver, dissolved TAL metals, gross alpha, dioxins/furans, gross beta, radium-226/radium-228, SSC, particle size, alkalinity, pH, dissolved organic carbon, total organic carbon, sulfate, chloride
Upper Los Alamos Canyon Gaging Stations	E026, E030	PCBs, alkalinity, pH, dioxins/furans, dissolved organic carbon, gamma spectroscopy, gross alpha, particle size, sulfate, chloride, strontium-90, SSC, dissolved TAL metals, total organic carbon
Upper Pueblo Canyon and Acid Canyon Gaging Stations	E055, E055.5, E056	PCBs, gamma spectroscopy, gross alpha, silver, alkalinity, pH, dissolved organic carbon, particle size, sulfate, chloride, SSC, dissolved TAL metals, total organic carbon

[a] Suites are listed in order of priority to guide analysis of limited water volume. SSC is independent of prioritization because it is derived from separate sample bottles.

[b] BDD = Buckman Direct Diversion.

[c] Hardness is calculated from calcium and magnesium, components of the TAL list.

Table 2.4-2
Analytical Requirements for Storm Water Samples

Analytical Suite	Method	BDD[a]-Required Monitoring	Detention Basins and Wetland below the SWMU 01-001(f) Drainage	DP Canyon Gaging Stations	Fire-affected Lower Watershed Gaging Stations	Lower Pueblo Canyon Gaging Stations	Upper Los Alamos Canyon Gaging Stations	Upper Pueblo Canyon and Acid Canyon Gaging Stations
Alkalinity	EPA:150.1	X[b]	X	X	X	X	X	X
Americium-241	HASL-300:AM-241	X	—[c]	—	X	X	—	X
Dioxins/furans	EPA:1613B	X	—	—	X	X	X	—
Dissolved organic carbon	SW-846:9060	X	X	X	X	X	X	X
Gamma spectroscopy	EPA:901.1	X	—	X	X	X	X	X
Gross alpha	EPA:900	X	X	X	X	X	X	X
Gross beta	EPA:900	X	—	—	X	X	—	—
Hardness[d]	SM:A2340B	X	X	X	X	X	X	X
Isotopic plutonium	HASL-300:ISOPU	X	—	X	X	X	X	X
Isotopic uranium	HASL-300:ISOU	X	—	—	X	X	—	—
Mercury	EPA:245.2	—	X	X	X	X	X	X
Particle size	ASTM:C1070-01	X	X	X	X	X	X	X
PCBs	EPA:1668C	X	X	X	X	X	X	X
pH	EPA:310.1	X	X	X	X	X	X	X
Radium-226/radium-228	EPA:903.1/904	X	—	—	X	X	—	—
Selenium	EPA:200.8	—	X	X	X	X	X	X
Silver	EPA:200.8	—	—	—	—	X	—	X
SSC	ASTM:D3977-97	X	X	X	X	X	X	X
SSC	SM:2540D	X	X	X	X	X	X	X
Strontium-90	EPA:905.0	X	—	X	X	X	X	—
Sulfate	EPA:300.0	X	X	X	X	X	X	X
TAL metals, dissolved	EPA:200.7/200.8/245.2	X	X	X	X	X	X	X
Total organic carbon	SM:5310B/C	X	X	X	X	X	X	X
Uranium	EPA:200.8	—	X	X	X	X	X	X

[a] BDD = Buckman Direct Diversion gages E050.1 and E060.1.

[b] X = Monitoring planned.

[c] — = Monitoring not planned.

[d] Hardness is calculated from filtered calcium and magnesium, components of the TAL list.

Table 2.4-3
Factors Contributing to Analytical Suite Prioritization

Gage	Priority	Analytical Suite	Glass Bottle	Polyethylene Bottle	Minimum Volume Required (L)
DP Canyon Gages					
E038, E039.1, E040	1	PCBs	Yes	No	1
	2	Gamma spectroscopy, isotopic plutonium	Yes	Yes	1
	3	Strontium-90	Yes	Yes	1
	4	Dioxins and furans	Yes	No	1
	5	TAL metals+B+U (F[a])	No	Yes	0.25
	6	Mercury, selenium, uranium (UF[b])	Yes	Yes	0.25
	7	Gross alpha	Yes	Yes	1
Upper Los Alamos Canyon Gages					
E026, E030	1	PCBs	Yes	No	1
	2	Gamma spectroscopy, isotopic plutonium, Isotopic uranium	Yes	Yes	1
	3	Dioxins and furans	Yes	No	1
	4	Strontium-90	Yes	Yes	1
	5	TAL Metals+B+U (F)	No	Yes	0.25
	6	Mercury, selenium, uranium (UF)	Yes	Yes	0.25
	7	Gross alpha	Yes	Yes	1
Upper Pueblo Canyon and Acid Canyon Gages					
E055, E055.5, E056	1	PCBs	Yes	No	1
	2	Gamma spectroscopy, isotopic plutonium, americium-241	Yes	Yes	1
	3	TAL Metals+B+U (F)	No	Yes	0.25
	4	Mercury, selenium, silver, uranium (UF)	Yes	Yes	0.25
	5	Gross alpha	Yes	Yes	1
Lower Los Alamos Canyon Gages					
E042.1	1	PCBs	Yes	No	1
	2	Gamma spectroscopy, isotopic plutonium, americium-241	Yes	Yes	1
	3	Dioxins and furans	Yes	No	1
	4	Strontium-90	Yes	Yes	1
	5	TAL Metals+B+U (F)	No	Yes	0.25
	6	Mercury, selenium, uranium (UF)	Yes	Yes	0.25
	7	Gross alpha	Yes	Yes	1

Table 2.4-3 (continued)

Gage	Priority	Analytical Suite	Glass Bottle	Polyethylene Bottle	Minimum Volume Required (L)
Lower Los Alamos Canyon Gages					
E050.1	1	PCBs	Yes	No	1
	2	Gamma spectroscopy, isotopic plutonium, isotopic uranium, americium-241	Yes	Yes	1
	3	Strontium-90	Yes	Yes	1
	4	Dioxins and furans	Yes	No	1
	5	TAL Metals+B+U (F/UF)	No	Yes	0.25/0.25
	6	Radium-226 and radium-228 (UF)	Yes	Yes	2
	7	Gross alpha, gross beta	Yes	Yes	1
Lower Pueblo Canyon Gages					
E059.5, E059.8	1	PCBs	Yes	No	1
	2	Gamma spectroscopy, isotopic plutonium, americium-241	Yes	Yes	1
	3	TAL Metals+B+U (F)	No	Yes	0.25
	4	Mercury, selenium, uranium (UF)	Yes	Yes	0.25
	5	Strontium-90	Yes	Yes	1
	6	Gross alpha	Yes	Yes	1
E060.1	1	PCBs	Yes	No	1
	2	Gamma spectroscopy, isotopic plutonium, isotopic uranium, americium-241	Yes	Yes	1
	3	Strontium-90	Yes	Yes	1
	4	Dioxins and furans	Yes	No	1
	5	TAL Metals+B+U (F/UF)	No	Yes	0.25/0.25
	6	Radium-226 and radium-228 (UF)	Yes	Yes	2
	7	Gross alpha, gross beta	Yes	Yes	1
Detention Basin and Vegetative Buffer below the SWMU 01-001(f) Drainage					
CO111041, CO101038	1	PCBs	Yes	No	1
	2	TAL Metals+B+U (F)	No	Yes	0.25
	3	Mercury, selenium, uranium (UF)	Yes	Yes	0.25
	4	Gross alpha	Yes	Yes	1

[a] F = Analyses of filtered sample.

[b] UF = Analyses unfiltered sample.

Table 2.4-4
Actual Sampling Events

Sampling Station	Analytical Method Category	Analytical Method	Analytical Suite Code	Count of Field Sample IDs Collected
E030	Dioxins Furans	EPA:1613B	SW-D/F-1613B (UF[a])	2
	General Chemistry	ASTM:C1070-01	SW-Particle Size - 1L (UF)	1
	General Chemistry	ASTM:D3977-97	SW-SSC (UF)	2
	General Chemistry	EPA:150.1	SW-ALK+pH (UF)	2
	General Chemistry	EPA:300.0	SW-SO4+Cl (F[b])	2
	General Chemistry	EPA:310.1	SW-ALK+pH (UF)	2
	General Chemistry	SM:5310B	SW-DOC (F)	2
	General Chemistry	SM:5310B	SW-TOC (UF)	2
	Inorganic	EPA:200.7	SW-TAL+B+U[c] (F)	2
	Inorganic	EPA:200.8	SW-TAL+B+U (F)	2
	Inorganic	EPA:200.8	SW-IP-Hg+Se+U (UF)	2
	Inorganic	EPA:245.2	SW-TAL+B+U (F)	2
	Inorganic	EPA:245.2	SW-IP-Hg+Se+U (UF)	2
	Inorganic	SM:A2340B	SW-TAL+B+U (F)	2
	PCB Congeners	EPA:1668C	SW-PCB-1668C-MDL (UF)	2
	Rad	EPA:900	SW-Gamma Spec+GrossA (UF)	2
	Rad	EPA:901.1	SW-Gamma Spec+GrossA (UF)	2
	Rad	EPA:905.0	SW-SR90 (UF)	2
	Rad	HASL-300:ISOPU	SW-ISOPU (UF)	2
E038	General Chemistry	ASTM:C1070-01	SW-Particle Size - 1L (UF)	4
	General Chemistry	ASTM:D3977-97	SW-SSC (UF)	68
	General Chemistry	EPA:150.1	SW-ALK+pH (UF)	4
	General Chemistry	EPA:300.0	SW-SO4+Cl (F)	4
	General Chemistry	EPA:310.1	SW-ALK+pH (UF)	4
	General Chemistry	SM:5310B	SW-TOC (UF)	1
	General Chemistry	SM:5310B	SW-DOC (F)	1
	General Chemistry	SM:5310C	SW-DOC (F)	3
	General Chemistry	SM:5310D	SW-TOC (UF)	2
	Inorganic	EPA:200.7	SW-TAL+B+U (F)	4
	Inorganic	EPA:200.8	SW-IP-Hg+Se+U (UF)	4
	Inorganic	EPA:200.8	SW-TAL+B+U (F)	4
	Inorganic	EPA:245.2	SW-IP-Hg+Se+U (UF)	4
	Inorganic	EPA:245.2	SW-TAL+B+U (F)	4
	Inorganic	SM:A2340B	SW-TAL+B+U (F)	4
	PCB Congeners	EPA:1668C	SW-PCB-1668C-MDL (UF)	4

Table 2.4-4 (continued)

Sampling Station	Analytical Method Category	Analytical Method	Analytical Suite Code	Count of Field Sample IDs Collected
E038 (cont.)	Rad	EPA:900	SW-Gamma Spec+GrossA (UF)	4
	Rad	EPA:901.1	SW-Gamma Spec+GrossA (UF)	4
	Rad	EPA:905.0	SW-SR90 (UF)	4
	Rad	HASL-300:ISOPU	SW-ISOPU (UF)	4
E039.1	General Chemistry	ASTM:C1070-01	SW-Particle Size - 1L (UF)	4
	General Chemistry	ASTM:D3977-97	SW-SSC (UF)	83
	General Chemistry	EPA:150.1	SW-ALK+pH (UF)	4
	General Chemistry	EPA:300.0	SW-SO4+Cl (F)	4
	General Chemistry	EPA:310.1	SW-ALK+pH (UF)	4
	General Chemistry	SM:5310B	SW-TOC (UF)	1
	General Chemistry	SM:5310B	SW-DOC (F)	1
	General Chemistry	SM:5310C	SW-DOC (F)	3
	General Chemistry	SM:5310D	SW-TOC (UF)	2
	Inorganic	EPA:200.7	SW-TAL+B+U (F)	4
	Inorganic	EPA:200.8	SW-IP-Hg+Se+U (UF)	4
	Inorganic	EPA:200.8	SW-TAL+B+U (F)	4
	Inorganic	EPA:245.2	SW-IP-Hg+Se+U (UF)	4
	Inorganic	EPA:245.2	SW-TAL+B+U (F)	4
	Inorganic	SM:A2340B	SW-TAL+B+U (F)	4
	PCB Congeners	EPA:1668C	SW-PCB-1668C-MDL (UF)	4
	Rad	EPA:900	SW-Gamma Spec+GrossA (UF)	4
	Rad	EPA:901.1	SW-Gamma Spec+GrossA (UF)	4
	Rad	EPA:905.0	SW-SR90 (UF)	4
	Rad	HASL-300:ISOPU	SW-ISOPU/U (UF)	1
	Rad	HASL-300:ISOPU	SW-ISOPU (UF)	3
E040	General Chemistry	ASTM:C1070-01	SW-Particle Size - 1L (UF)	4
	General Chemistry	ASTM:D3977-97	SW-SSC (UF)	8
	General Chemistry	EPA:150.1	SW-ALK+pH (UF)	4
	General Chemistry	EPA:300.0	SW-SO4+Cl (F)	4
	General Chemistry	EPA:310.1	SW-ALK+pH (UF)	4
	General Chemistry	SM:5310B	SW-TOC (UF)	2
	General Chemistry	SM:5310B	SW-DOC (F)	2
	General Chemistry	SM:5310C	SW-DOC (F)	2
	General Chemistry	SM:5310D	SW-TOC (UF)	2
	Inorganic	EPA:200.7	SW-TAL+B+U (F)	4
	Inorganic	EPA:200.8	SW-TAL+B+U (F)	4
	Inorganic	EPA:200.8	SW-IP-Hg+Se+U (UF)	4

Table 2.4-4 (continued)

Sampling Station	Analytical Method Category	Analytical Method	Analytical Suite Code	Count of Field Sample IDs Collected
E040 (cont.)	Inorganic	EPA:245.2	SW-IP-Hg+Se+U (UF)	4
	Inorganic	EPA:245.2	SW-TAL+B+U (F)	4
	Inorganic	SM:A2340B	SW-TAL+B+U (F)	4
	PCB Congeners	EPA:1668C	SW-PCB-1668C-MDL (UF)	4
	Rad	EPA:900	SW-Gamma Spec+GrossA (UF)	4
	Rad	EPA:901.1	SW-Gamma Spec+GrossA (UF)	4
	Rad	EPA:905.0	SW-SR90 (UF)	4
	Rad	HASL-300:ISOPU	SW-ISOPU (UF)	4
E042.1	Dioxins Furans	EPA:1613B	SW-D/F-1613B (UF)	4
	General Chemistry	ASTM:C1070-01	SW-Particle Size - 1L (UF)	3
	General Chemistry	ASTM:D3977-97	SW-SSC (UF)	91
	General Chemistry	EPA:150.1	SW-ALK+pH (UF)	4
	General Chemistry	EPA:300.0	SW-SO4+Cl (F)	4
	General Chemistry	EPA:310.1	SW-ALK+pH (UF)	4
	General Chemistry	SM:5310B	SW-DOC (F)	3
	General Chemistry	SM:5310B	SW-TOC (UF)	3
	General Chemistry	SM:5310C	SW-DOC (F)	1
	General Chemistry	SM:5310D	SW-TOC (UF)	1
	Inorganic	EPA:200.7	SW-TAL+B+U (F)	4
	Inorganic	EPA:200.8	SW-TAL+B+U (F)	4
	Inorganic	EPA:200.8	SW-IP-Hg+Se+U (UF)	4
	Inorganic	EPA:245.2	SW-TAL+B+U (F)	4
	Inorganic	EPA:245.2	SW-IP-Hg+Se+U (UF)	4
	Inorganic	SM:A2340B	SW-TAL+B+U (F)	4
	PCB Congeners	EPA:1668C	SW-PCB-1668C-MDL (UF)	8
	Rad	EPA:900	SW-Gamma Spec+GrossA (UF)	4
	Rad	EPA:901.1	SW-Gamma Spec+GrossA (UF)	4
	Rad	EPA:905.0	SW-SR90 (UF)	4
	Rad	HASL-300:AM-241	SW-Am241+ISOPU (UF)	4
	Rad	HASL-300:ISOPU	SW-ISOPU (UF)	4
	Rad	HASL-300:ISOPU	SW-Am241+ISOPU (UF)	4
E050.1	Dioxins Furans	EPA:1613B	SW-D/F-1613B (UF)	3
	General Chemistry	ASTM:C1070-01	SW-Particle Size - 1L (UF)	2
	General Chemistry	ASTM:D3977-97	SW-SSC (UF)	30
	General Chemistry	EPA:150.1	SW-ALK+pH (UF)	3
	General Chemistry	EPA:300.0	SW-SO4+Cl (F)	3
	General Chemistry	EPA:310.1	SW-ALK+pH (UF)	3

Table 2.4-4 (continued)

Sampling Station	Analytical Method Category	Analytical Method	Analytical Suite Code	Count of Field Sample IDs Collected
E050.1 (cont.)	General Chemistry	SM:2540D	SW-SSC (UF)	1
	General Chemistry	SM:5310B	SW-TOC (UF)	3
	General Chemistry	SM:5310B	SW-DOC (F)	3
	Inorganic	EPA:200.7	SW-TAL+B+U ()	3
	Inorganic	EPA:200.7	SW-TAL+B+U (UF)	3
	Inorganic	EPA:200.7	SW-TAL+B+U (F)	6
	Inorganic	EPA:200.8	SW-TAL+B+U ()	3
	Inorganic	EPA:200.8	SW-TAL+B+U (F)	6
	Inorganic	EPA:200.8	SW-TAL+B+U (UF)	3
	Inorganic	EPA:245.2	SW-TAL+B+U ()	3
	Inorganic	EPA:245.2	SW-TAL+B+U (UF)	3
	Inorganic	EPA:245.2	SW-TAL+B+U (F)	6
	Inorganic	SM:A2340B	SW-TAL+B+U (UF)	3
	Inorganic	SM:A2340B	SW-TAL+B+U ()	3
	Inorganic	SM:A2340B	SW-TAL+B+U (F)	6
	PCB Congeners	EPA:1668C	SW-PCB-1668C-MDL (UF)	6
	Rad	EPA:900	SW-Gamma Spec+GrossA (UF)	3
	Rad	EPA:900	SW-GrossB (UF)	3
	Rad	EPA:901.1	SW-Gamma Spec+GrossA (UF)	3
	Rad	EPA:903.1	SW-Ra226/Ra228 (UF)	3
	Rad	EPA:904	SW-Ra226/Ra228 (UF)	3
	Rad	EPA:905.0	SW-SR90 (UF)	3
	Rad	Generic:Radium by Calculation	SW-Ra226/Ra228 (UF)	3
	Rad	HASL-300:AM-241	SW-ISOPU/U/Am241 (UF)	3
	Rad	HASL-300:ISOPU	SW-ISOPU/U/Am241 (UF)	3
	Rad	HASL-300:ISOPU	SW-ISOPU (UF)	3
	Rad	HASL-300:ISOPU	SW-ISOPU/U/Am241 (UF)	3
E055	General Chemistry	ASTM:C1070-01	SW-Particle Size - 1L (UF)	2
	General Chemistry	ASTM:D3977-97	SW-SSC (UF)	4
	General Chemistry	EPA:150.1	SW-ALK+pH (UF)	2
	General Chemistry	EPA:300.0	SW-SO4+Cl (F)	2
	General Chemistry	EPA:310.1	SW-ALK+pH (UF)	2
	General Chemistry	SM:5310B	SW-DOC (F)	2
	General Chemistry	SM:5310B	SW-TOC (UF)	2
	Inorganic	EPA:200.7	SW-TAL+B+U (F)	2
	Inorganic	EPA:200.8	SW-TAL+B+U (F)	2
	Inorganic	EPA:200.8	SW-Ag (UF)	2

Table 2.4-4 (continued)

Sampling Station	Analytical Method Category	Analytical Method	Analytical Suite Code	Count of Field Sample IDs Collected
E055 (cont.)	Inorganic	EPA:200.8	SW-IP-Hg+Se+U (UF)	2
	Inorganic	EPA:245.2	SW-IP-Hg+Se+U (UF)	2
	Inorganic	EPA:245.2	SW-TAL+B+U (F)	2
	Inorganic	SM:A2340B	SW-TAL+B+U (F)	2
	PCB Congeners	EPA:1668C	SW-PCB-1668C-MDL (UF)	2
	Rad	EPA:900	SW-Gamma Spec+GrossA (UF)	2
	Rad	EPA:901.1	SW-Gamma Spec+GrossA (UF)	2
	Rad	HASL-300:AM-241	SW-Am241+ISOPU (UF)	2
	Rad	HASL-300:ISOPU	SW-Am241+ISOPU (UF)	2
E055.5	General Chemistry	ASTM:C1070-01	SW-Particle Size - 1L (UF)	3
	General Chemistry	ASTM:D3977-97	SW-SSC (UF)	6
	General Chemistry	EPA:150.1	SW-ALK+pH (UF)	3
	General Chemistry	EPA:300.0	SW-SO4+Cl (F)	2
	General Chemistry	EPA:300.0	SW-SO4+Cl (UF)	1
	General Chemistry	EPA:310.1	SW-ALK+pH (UF)	3
	General Chemistry	SM:5310C	SW-DOC (F)	3
	General Chemistry	SM:5310D	SW-TOC (UF)	3
	Inorganic	EPA:200.7	SW-TAL+B+U (F)	3
	Inorganic	EPA:200.8	SW-TAL+B+U (F)	3
	Inorganic	EPA:200.8	SW-Ag (UF)	3
	Inorganic	EPA:200.8	SW-IP-Hg+Se+U (UF)	3
	Inorganic	EPA:245.2	SW-TAL+B+U (F)	3
	Inorganic	EPA:245.2	SW-IP-Hg+Se+U (UF)	3
	Inorganic	SM:A2340B	SW-TAL+B+U (F)	3
	PCB Congeners	EPA:1668C	SW-PCB-1668C-MDL (UF)	3
	Rad	EPA:900	SW-Gamma Spec+GrossA (UF)	3
	Rad	EPA:901.1	SW-Gamma Spec+GrossA (UF)	3
	Rad	HASL-300:AM-241	SW-Am241+ISOPU (UF)	3
	Rad	HASL-300:ISOPU	SW-Am241+ISOPU (UF)	3
E056	General Chemistry	ASTM:C1070-01	SW-Particle Size - 1L (UF)	4
	General Chemistry	ASTM:D3977-97	SW-SSC (UF)	8
	General Chemistry	EPA:150.1	SW-ALK+pH (UF)	4
	General Chemistry	EPA:300.0	SW-SO4+Cl (F)	4
	General Chemistry	EPA:310.1	SW-ALK+pH (UF)	4
	General Chemistry	SM:5310B	SW-TOC (UF)	1
	General Chemistry	SM:5310C	SW-DOC (F)	3
	General Chemistry	SM:5310D	SW-TOC (UF)	3

Table 2.4-4 (continued)

Sampling Station	Analytical Method Category	Analytical Method	Analytical Suite Code	Count of Field Sample IDs Collected
E056 (cont.)	General Chemistry	SW-846:9060	SW-DOC (F)	1
	Inorganic	EPA:200.7	SW-TAL+B+U (F)	4
	Inorganic	EPA:200.8	SW-Ag (UF)	4
	Inorganic	EPA:200.8	SW-IP-Hg+Se+U (UF)	4
	Inorganic	EPA:200.8	SW-TAL+B+U (F)	4
	Inorganic	EPA:245.2	SW-IP-Hg+Se+U (UF)	4
	Inorganic	EPA:245.2	SW-TAL+B+U (F)	4
	Inorganic	SM:A2340B	SW-TAL+B+U (F)	4
	PCB Congeners	EPA:1668C	SW-PCB-1668C-MDL (UF)	4
	Rad	EPA:900	SW-Gamma Spec+GrossA (UF)	4
	Rad	EPA:901.1	SW-Gamma Spec+GrossA (UF)	4
	Rad	HASL-300:AM-241	SW-Am241+ISOPU (UF)	4
	Rad	HASL-300:ISOPU	SW-Am241+ISOPU (UF)	4
E059.5	General Chemistry	ASTM:D3977-97	SW-SSC (UF)	20
	General Chemistry	EPA:150.1	SW-ALK+pH (UF)	1
	General Chemistry	EPA:300.0	SW-SO4+Cl (F)	1
	General Chemistry	EPA:310.1	SW-ALK+pH (UF)	1
	General Chemistry	SM:5310B	SW-DOC (F)	1
	General Chemistry	SM:5310B	SW-TOC (UF)	1
	Inorganic	EPA:200.7	SW-TAL+B+U (F)	1
	Inorganic	EPA:200.8	SW-IP-Hg+Se+U (UF)	1
	Inorganic	EPA:200.8	SW-TAL+B+U (F)	1
	Inorganic	EPA:200.8	SW-Ag (UF)	1
	Inorganic	EPA:245.2	SW-IP-Hg+Se+U (UF)	1
	Inorganic	EPA:245.2	SW-TAL+B+U (F)	1
	Inorganic	SM:A2340B	SW-TAL+B+U (F)	1
	PCB Congeners	EPA:1668C	SW-PCB-1668C-MDL (UF)	2
	Rad	EPA:900	SW-Gamma Spec+GrossA (UF)	1
	Rad	EPA:901.1	SW-Gamma Spec+GrossA (UF)	1
	Rad	EPA:905.0	SW-SR90 (UF)	1
	Rad	HASL-300:AM-241	SW-Am241+ISOPU (UF)	1
	Rad	HASL-300:ISOPU	SW-ISOPU (UF)	1
	Rad	HASL-300:ISOPU	SW-Am241+ISOPU (UF)	1
E059.8	General Chemistry	ASTM:C1070-01	SW-Particle Size - 1L (UF)	1
	General Chemistry	ASTM:D3977-97	SW-SSC (UF)	27
	General Chemistry	EPA:150.1	SW-ALK+pH (UF)	2
	General Chemistry	EPA:300.0	SW-SO4+Cl (F)	2

Table 2.4-4 (continued)

Sampling Station	Analytical Method Category	Analytical Method	Analytical Suite Code	Count of Field Sample IDs Collected
E059.8 (cont.)	General Chemistry	EPA:310.1	SW-ALK+pH (UF)	2
	General Chemistry	SM:5310B	SW-TOC (UF)	2
	General Chemistry	SM:5310B	SW-DOC (F)	2
	Inorganic	EPA:200.7	SW-TAL+B+U (F)	2
	Inorganic	EPA:200.8	SW-Ag (UF)	1
	Inorganic	EPA:200.8	SW-TAL+B+U (F)	2
	Inorganic	EPA:200.8	SW-IP-Hg+Se+U (UF)	2
	Inorganic	EPA:245.2	SW-TAL+B+U (F)	2
	Inorganic	EPA:245.2	SW-IP-Hg+Se+U (UF)	2
	Inorganic	SM:A2340B	SW-TAL+B+U (F)	2
	PCB Congeners	EPA:1668C	SW-PCB-1668C-MDL (UF)	4
	Rad	EPA:900	SW-Gamma Spec+GrossA (UF)	2
	Rad	EPA:901.1	SW-Gamma Spec+GrossA (UF)	2
	Rad	EPA:905.0	SW-SR90 (UF)	2
	Rad	HASL-300:AM-241	SW-Am241+ISOPU (UF)	2
	Rad	HASL-300:ISOPU	SW-Am241+ISOPU (UF)	2
	Rad	HASL-300:ISOPU	SW-ISOPU (UF)	2
CO111041	General Chemistry	ASTM:C1070-01	SW-Particle Size - 1L (UF)	1
	General Chemistry	ASTM:D3977-97	SW-SSC (UF)	2
	General Chemistry	EPA:150.1	SW-ALK+pH (UF)	1
	General Chemistry	EPA:300.0	SW-SO4+Cl (F)	1
	General Chemistry	EPA:310.1	SW-ALK+pH (UF)	1
	General Chemistry	SM:5310C	SW-DOC (F)	1
	General Chemistry	SM:5310D	SW-TOC (UF)	1
	Inorganic	EPA:200.7	SW-TAL+B+U (F)	1
	Inorganic	EPA:200.8	SW-IP-Hg+Se+U (UF)	1
	Inorganic	EPA:200.8	SW-TAL+B+U (F)	1
	Inorganic	EPA:245.2	SW-IP-Hg+Se+U (UF)	1
	Inorganic	EPA:245.2	SW-TAL+B+U (F)	1
	Inorganic	SM:A2340B	SW-TAL+B+U (F)	1
	PCB Congeners	EPA:1668C	SW-PCB-1668C-MDL (UF)	1
	Rad	EPA:900	SW-Gross Alpha (UF)	1

[a] UF = Unfiltered.

[b] F = Filtered.

[c] SW-TAL+B+U = components of the TAL list plus boron and uranium.

Table 2.5-1
Sample Collection and Sample Retrieval Working-Day Interval

Location Alias	Count of Sampled Storms	Count Retrieved on First Working Day	Count Retrieved after First Working Day	Comment
E030	2	2	0	1 working day between sample collection on 09/29/2017 at 01:12 and sample retrieval on 09/29/2017 at 15:45 1 working day between sample collection on 10/04/2017 at 23:00 and sample retrieval on 10/05/2017 at 16:40
E038	4	4	0	1 working day between sample collection on 07/08/2017 at 13:25 and sample retrieval on 07/10/2017 at 12:20 1 working day between sample collection on 07/26/2017 at 12:14 and sample retrieval on 07/26/2017 at 15:45 1 working day between sample collection on 07/29/2017 at 20:18 and sample retrieval on 07/31/2017 at 09:40 1 working day between sample collection on 08/07/2017 at 12:58 and sample retrieval on 08/08/2017 at 10:45
E039.1	4	4	0	1 working day between sample collection on 07/08/2017 at 16:33 and sample retrieval on 07/10/2017 at 14:34 1 working day between sample collection on 07/26/2017 at 13:18 and sample retrieval on 07/26/2017 at 16:45 1 working day between sample collection on 07/29/2017 at 23:03 and sample retrieval on 07/31/2017 at 10:20 1 working day between sample collection on 08/07/2017 at 14:38 and sample retrieval on 08/08/2017 at 12:04
E040	4	4	0	1 working day between sample collection on 07/08/2017 at 14:37 and sample retrieval on 07/10/2017 at 15:50 1 working day between sample collection on 07/26/2017 at 12:42 and sample retrieval on 07/27/2017 at 10:57 1 working day between sample collection on 09/27/2017 at 19:25 and sample retrieval on 09/28/2017 at 13:15 1 working day between sample collection on 09/28/2017 at 22:32 and sample retrieval on 09/29/2017 at 14:35
E042.1	4	4	0	1 working day between sample collection on 07/26/2017 at 16:24 and sample retrieval on 07/27/2017 at 09:40 1 working day between sample collection on 09/27/2017 at 23:24 and sample retrieval on 09/28/2017 at 14:02 1 working day between sample collection on 09/29/2017 at 03:54 and sample retrieval on 09/29/2017 at 15:56 1 working day between sample collection on 10/05/2017 at 01:14 and sample retrieval on 10/05/2017 at 13:55
E050.1	3	3	0	1 working day between sample collection on 09/28/2017 at 01:39 and sample retrieval on 09/28/2017 at 16:55 1 working day between sample collection on 09/29/2017 at 03:39 and sample retrieval on 09/29/2017 at 13:30 1 working day between sample collection on 10/05/2017 at 02:23 and sample retrieval on 10/05/2017 at 12:00

Table 2.5-1 (continued)

Location Alias	Count of Sampled Storms	Count Retrieved on First Working Day	Count Retrieved after First Working Day	Comment
E055	2	2	0	1 working day between sample collection on 09/27/2017 at 19:22 and sample retrieval on 09/28/2017 at 11:45 1 working day between sample collection on 09/29/2017 at 00:32 and sample retrieval on 09/29/2017 at 17:24
E055.5	3	3	0	1 working day between sample collection on 07/26/2017 at 11:55 and sample retrieval on 07/27/2017 at 13:30 1 working day between sample collection on 07/27/2017 at 21:03 and sample retrieval on 07/28/2017 at 09:40 1 working day between sample collection on 07/29/2017 at 19:46 and sample retrieval on 07/31/2017 at 12:30
E056	4	4	0	1 working day between sample collection on 07/08/2017 at 13:58 and sample retrieval on 07/10/2017 at 17:45 1 working day between sample collection on 07/26/2017 at 11:55 and sample retrieval on 07/27/2017 at 13:10 1 working day between sample collection on 07/29/2017 at 20:08 and sample retrieval on 08/01/2017 at 10:30 1 working day between sample collection on 08/23/2017 at 12:38 and sample retrieval on 08/24/2017 at 11:55
E059.5	1	1	0	1 working day between sample collection on 09/29/2017 at 04:40 and sample retrieval on 09/29/2017 at 10:45
E059.8	2	2	0	1 working day between sample collection on 09/29/2017 at 13:44 and sample retrieval on 09/29/2017 at 16:30 1 working day between sample collection on 10/05/2017 at 03:39 and sample retrieval on 10/05/2017 at 15:04
CO111041	1	1	0	1 working day between sample collection on 07/08/2017 at 13:18 and sample retrieval on 07/10/2017 at 15:00

Table 2.5-2
Gaging Station Operational Issues during the 2017 Monitoring Year

Gaging Station	Reason	Issue Date	Repair Date	Working Days from Issue to Repair	Potential Missed Discharge above Trigger	Peak Discharge (cfs)
E039.1[a]	Sensor malfunction	9/28/2017	10/11/2017	8	0	9
E040	Silting	7/8/2017	7/10/2017	0	0	0
	Silting	7/26/2017	7/27/2017	1	0	0
	Silting	7/29/2017	7/31/2017	1	0	0
	Silting	8/11/2017	8/14/2017	1	0	0
	Silting	9/28/2017	9/28/2017	0	0	0
	Silting	9/29/2017	10/4/2017	3	0	0
	Silting	10/5/2017	10/11/2017	3	0	0
E042.1	Silting	10/5/2017	10/24/2017	12	0	0
E055.5[b]	Shifting channel bed	1/1/2017	12/31/2017	n/a[c]	3	n/a

[a] Backup gage sensor was operating during this time.

[b] Log check dams installed downstream of E055.5 caused the channel bed to fluctuate significantly throughout 2017; therefore, the water depth (ft) is presented for E055.5 instead of discharge. The location of the stage sensor was moved upstream to a more stable location in March 2018.

[c] n/a = Not applicable.

Table 2.5-3
Gaging Station and Sampler Inspection Interval

Inspection Date	Days from Previous Inspection														
	CO101038	CO111041	E026	E030	E038	E039.1	E040	E042.1	E050.1	E055	E055.5	E056	E059.5	E059.8	E060.1
1/3/2017	—[a]	—	—	—	—	—	—	—	—	Initial GI[b]	—	Initial GI	Initial GI	—	Initial GI
1/5/2017	—	—	—	—	—	Initial GI	—	—	Initial GI	—	—	—	—	—	—
1/6/2017	—	—	—	—	—	—	—	—	—	—	Initial GI	—	—	—	—
1/9/2017	—	—	Initial GI	Initial GI	—	—	Initial GI	Initial GI	4 GI[c]	—	—	—	—	—	—
1/10/2017	—	—	—	—	—	5 GI	—	—	—	—	—	—	—	—	—
1/11/2017	—	—	—	—	Initial GI	—	—	—	—	—	—	—	—	—	—
1/12/2017	—	—	—	—	—	—	—	—	—	—	—	—	—	—	9 GI
1/19/2017	—	—	—	—	—	—	—	—	10 GI	—	—	—	—	Initial GI	7 GI
1/24/2017	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5 GI
1/26/2017	—	—	—	—	—	—	—	—	7 GI	—	—	—	—	—	—
2/1/2017	—	—	—	—	—	—	—	—	—	29 GI	26 GI	29 GI	—	—	8 GI
2/2/2017	—	—	—	—	—	—	—	—	7 GI	—	—	—	—	—	—
2/3/2017	—	—	—	—	—	—	—	—	—	—	—	—	31 GI	15 GI	—
2/7/2017	—	—	29 GI	29 GI	—	—	29 GI	29 GI	5 GI	—	—	—	—	—	—
2/9/2017	—	—	—	—	29 GI	30 GI	—	—	—	—	—	—	—	—	8 GI
2/16/2017	—	—	—	—	—	—	—	—	9 GI	—	—	—	—	—	7 GI
2/23/2017	—	—	—	—	—	—	—	—	7 GI	—	—	—	—	—	7 GI
2/28/2017	—	—	—	—	—	—	—	—	—	27 GI	—	27 GI	—	—	—

Table 2.5-3 (continued)

Inspection Date	Days from Previous Inspection														
	CO101038	CO111041	E026	E030	E038	E039.1	E040	E042.1	E050.1	E055	E055.5	E056	E059.5	E059.8	E060.1
3/1/2017	—	—	—	—	—	—	—	—	6 GI	—	28 GI	—	26 GI	26 GI	6 GI
3/7/2017	—	—	28 GI	28 GI	—	—	28 GI	—	6 GI	—	—	—	—	—	—
3/8/2017	—	—	—	—	—	—	—	29 GI	—	—	—	—	—	—	—
3/9/2017	—	—	—	—	28 GI	28 GI	—	—	—	—	—	—	—	—	8 GI
3/16/2017	—	—	—	—	—	—	—	—	9 GI	—	—	—	—	—	7 GI
3/23/2017	—	—	—	—	—	—	—	—	7 GI	—	—	—	—	—	7 GI
3/27/2017	—	—	—	—	—	—	—	—	4 GI	—	—	—	—	26 GI	4 GI
3/28/2017	—	—	—	—	—	—	—	—	—	28 GI	—	28 GI	27 GI	—	—
3/29/2017	—	—	—	—	—	—	—	—	—	—	28 GI	—	—	—	—
4/3/2017	—	—	27 GI	27 GI	—	—	27 GI	26 GI	7 GI	—	—	—	—	—	—
4/5/2017	—	—	—	—	27 GI	27 GI	—	—	—	—	—	—	—	—	—
4/6/2017	—	—	—	—	—	—	—	—	—	—	—	—	—	—	10 GI
4/11/2017	—	—	—	—	—	—	—	—	8 GI	—	—	—	—	—	—
4/12/2017	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6 GI
4/20/2017	—	—	—	—	—	—	—	—	9 GI	—	—	—	—	—	8 GI
4/25/2017	—	—	—	—	—	—	—	—	—	28 GI	27 GI	28 GI	28 GI	28 GI	—
4/27/2017	—	—	—	—	—	—	—	—	7 GI	—	—	—	—	—	7 GI
5/2/2017	—	—	—	—	—	—	—	—	5 SA[d]	—	—	—	—	—	5 SA
5/3/2017	—	—	30 GI	30 GI	—	—	30 GI	30 GI	—	—	—	—	—	—	—
5/4/2017	—	—	—	—	—	—	—	—	2 GI	—	—	—	—	—	2 GI
5/5/2017	—	—	2 SA	2 SA	—	—	2 SA	—	—	—	—	—	—	—	—
5/9/2017	Initial SA	Initial SA	4 GI	—	—	34 GI	4 GI	6 GI	—	—	—	—	—	—	—
5/10/2017	—	—	—	5 GI	—	1 SA	—	1 SA	6 GSI[e]	—	—	—	—	—	6 GSI
5/12/2017	—	—	—	—	37 GISA[f]	—	—	—	—	17 GI	17 GI	17 GI	17 GI	17 GI	—

Table 2.5-3 (continued)

Inspection Date	Days from Previous Inspection														
	CO101038	CO111041	E026	E030	E038	E039.1	E040	E042.1	E050.1	E055	E055.5	E056	E059.5	E059.8	E060.1
5/15/2017	6 SI[g]	6 SI	6 GSI	5 GSI	—	—	6 GSI	5 GSI	—	—	—	—	—	—	—
5/16/2017	—	—	—	—	—	—	—	—	—	4 GISA	—	4 GISA	4 GISA	—	—
5/17/2017	—	—	—	—	—	—	—	—	—	—	5 GI	—	—	5 GISA	—
5/18/2017	—	—	—	—	—	—	—	—	8 GSI	—	—	—	—	—	8 GSI
5/19/2017	—	—	—	—	—	—	—	—	—	—	2 SA	—	—	—	—
5/23/2017	8 SI	8 SI	8 GSI	8 GSI	—	13 GSI	8 GSI	8 GSI	—	7 GSI	—	7 GSI	7 GSI	6 GSI	—
5/25/2017	—	—	—	—	13 GSI	—	—	—	7 GSI	—	6 GSI	—	—	—	7 GSI
5/31/2017	—	—	8 GSI	—	—	—	—	—	6 GSI	8 GSI	6 GSI	8 GSI	8 GSI	8 GSI	6 GSI
6/1/2017	9 SI	9 SI	—	9 GSI	7 GSI	9 GSI	9 GSI	9 GSI	—	—	—	—	—	—	—
6/2/2017	—	—	—	—	—	2 GSI	—	—	—	—	—	—	—	—	—
6/5/2017	4 SI	4 SI	5 GSI	4 GSI	—	—	4 GSI	4 GSI	—	—	—	—	—	—	—
6/6/2017	—	—	—	—	—	—	—	—	6 GSI	—	—	—	6 GSI	6 GSI	6 GSI
6/7/2017	2 SI	2 SI	2 SI	—	—	—	—	—	—	—	—	—	—	—	—
6/8/2017	—	—	—	—	—	—	—	—	—	8 GSI	8 GSI	8 GSI	—	—	—
6/9/2017	—	—	—	—	8 GSI	7 GSI	—	—	—	—	—	—	—	—	—
6/12/2017	5 SI	5 SI	5 GSI	7 GSI	—	—	7 GSI	7 GSI	—	—	—	—	—	—	—
6/15/2017	—	—	—	—	6 GSI	6 GSI	—	—	9 GSI	7 GSI	7 GSI	7 GSI	9 GSI	9 GSI	9 GSI
6/20/2017	—	—	—	—	—	—	—	—	5 GSI	—	—	—	—	—	—
6/21/2017	9 SI	9 SI	9 GSI	9 GSI	6 GSI	—	9 GSI	9 GSI	—	—	—	—	6 GSI	6 GSI	6 GSI
6/22/2017	—	—	—	—	—	—	—	—	—	7 GSI	7 GSI	7 GSI	—	—	—
6/23/2017	—	—	—	—	—	8 GSI	—	—	—	—	—	—	—	—	—
6/29/2017	8 SI	8 SI	8 GSI	8 GSI	8 GSI	6 GSI	8 GSI	8 GSI	9 GSI	—	—	—	8 GSI	8 GSI	8 GSI
6/30/2017	—	—	—	—	—	—	—	—	—	8 GSI	8 GSI	8 GSI	—	—	—
7/3/2017	—	—	—	—	—	—	—	—	4 GSI	—	—	—	—	—	—
7/5/2017	6 SI	6 SI	6 GSI	6 GSI	—	—	6 GSI	6 GSI	—	—	—	—	—	—	—

Table 2.5-3 (continued)

Inspection Date	Days from Previous Inspection														
	CO101038	CO111041	E026	E030	E038	E039.1	E040	E042.1	E050.1	E055	E055.5	E056	E059.5	E059.8	E060.1
7/6/2017	—	—	—	—	—	—	—	—	—	—	—	—	7 GSI	7 GSI	7 GSI
7/7/2017	—	—	—	—	8 GSI	8 GSI	—	—	—	7 GSI	7 GSI	7 GSI	—	—	—
7/10/2017	—	5 SI	—	—	3 GSI	3 GSI	5 GSI	—	—	3 GSI	3 GSI	3 GSI	—	—	—
7/11/2017	6 SI	—	6 GSI	6 GSI	—	—	—	6 GSI	8 SI	—	—	—	5 GSI	5 GSI	5 GSI
7/13/2017	—	—	—	—	—	—	—	—	2 GI	—	—	—	—	—	—
7/17/2017	—	—	—	6 GSI	—	—	7 GSI	6 GSI	4 GSI	—	—	—	6 GSI	6 GSI	6 GSI
7/18/2017	7 SI	8 SI	7 GSI	—	8 GSI	8 GSI	—	—	—	—	8 GSI	—	—	—	—
7/20/2017	—	—	—	—	—	—	—	—	—	10 GSI	—	10 GSI	—	—	—
7/24/2017	6 SI	6 SI	6 GSI	7 GSI	—	—	7 GSI	7 GSI	—	—	—	—	7 GSI	7 GSI	—
7/25/2017	—	—	—	—	7 GSI	7 GSI	—	—	—	—	—	—	—	—	8 GSI
7/26/2017	—	—	—	—	1 SI	1 SI	—	—	9 GSI	—	—	—	—	—	—
7/27/2017	—	—	—	—	—	—	3 SI	3 SI	—	7 GSI	9 GSI	7 GSI	—	—	—
7/28/2017	—	—	—	—	—	—	—	—	—	—	1 SI	—	—	—	—
7/31/2017	—	7 SI	—	—	5 GSI	5 GSI	4 GSI	4 GSI	—	—	3 GSI	—	—	—	—
8/1/2017	8 SI	—	8 GSI	8 GSI	—	—	—	—	—	5 GSI	—	5 GSI	—	—	—
8/3/2017	—	—	—	—	—	—	—	—	8 GSI	—	—	—	—	—	9 GSI
8/4/2017	—	—	—	—	—	—	—	—	—	—	—	—	11 GSI	11 GSI	—
8/7/2017	6 SI	7 SI	6 GSI	6 GSI	—	—	7 GSI	7 GSI	—	—	—	—	—	—	—
8/8/2017	—	—	—	—	8 GSI	8 GSI	—	—	—	—	—	—	—	—	—
8/9/2017	—	—	—	—	—	—	—	—	—	—	9 GSI	—	—	—	—
8/10/2017	—	—	—	—	—	—	—	—	7 GSI	—	—	—	6 GSI	6 GSI	7 GSI
8/11/2017	—	—	—	—	—	—	—	—	—	10 GSI	—	10 GSI	—	—	—
8/14/2017	7 SI	7 SI	7 GSI	7 GSI	—	—	7 GSI	7 GSI	—	—	—	—	—	—	—
8/15/2017	—	—	—	—	—	—	—	—	5 GSI	—	—	—	—	—	—
8/16/2017	—	—	—	—	8 GSI	—	—	—	—	—	—	—	—	—	—

Table 2.5-3 (continued)

Inspection Date	Days from Previous Inspection														
	CO101038	CO111041	E026	E030	E038	E039.1	E040	E042.1	E050.1	E055	E055.5	E056	E059.5	E059.8	E060.1
8/17/2017	—	—	—	—	—	9 GSI	—	—	—	6 GSI	—	6 GSI	7 GSI	7 GSI	7 GSI
8/18/2017	—	—	—	—	—	—	—	—	—	—	9 GSI	—	—	—	—
8/21/2017	7 SI	7 SI	7 GSI	7 GSI	5 GSI	—	7 GSI	7 GSI	—	—	—	—	—	—	—
8/22/2017	—	—	—	—	—	—	—	—	7 GSI	—	4 GSI	—	—	—	—
8/23/2017	—	—	—	—	—	6 GSI	—	—	—	6 GSI	—	6 GSI	—	—	—
8/24/2017	—	—	—	—	—	—	—	—	—	—	2 SI	1 GSI	—	—	—
8/25/2017	—	—	—	—	—	—	—	—	—	—	—	—	8 GSI	8 GSI	8 GSI
8/28/2017	7 SI	7 SI	7 GSI	7 GSI	—	—	7 GSI	—	—	—	—	—	—	—	—
8/29/2017	—	—	—	—	8 GSI	6 GSI	—	8 GSI	—	—	—	—	—	—	—
8/30/2017	—	—	—	—	—	—	—	—	—	—	—	—	5 GSI	5 GSI	5 GSI
8/31/2017	—	—	—	—	—	—	—	—	9 GSI	8 GSI	7 GSI	7 GSI	—	—	—
9/5/2017	8 SI	8 SI	8 GSI	8 GSI	—	—	8 GSI	—	—	—	—	—	—	—	—
9/7/2017	—	—	—	—	—	—	—	9 GSI	7 GSI	—	—	—	8 GSI	8 GSI	8 GSI
9/8/2017	—	—	—	—	10 GSI	10 GSI	—	—	—	8 GSI	8 GSI	8 GSI	—	—	—
9/11/2017	6 SI	6 SI	—	6 GSI	—	—	6 GSI	4 GSI	—	—	—	—	—	—	—
9/12/2017	—	—	7 GSI	—	4 GSI	4 GSI	—	—	—	—	4 GSI	—	—	—	—
9/13/2017	—	—	—	—	—	—	—	—	6 GSI	—	—	—	6 GSI	6 GSI	6 GSI
9/14/2017	—	—	—	—	—	—	—	—	—	6 GSI	—	6 GSI	—	—	—
9/18/2017	7 SI	7 SI	6 GSI	7 GSI	—	—	7 GSI	—	—	—	6 GSI	—	—	—	—
9/19/2017	—	—	—	—	7 GSI	7 GSI	—	8 GSI	—	—	—	—	—	—	—
9/20/2017	—	—	—	—	—	—	—	—	7 GSI	—	—	—	—	—	—
9/21/2017	—	—	—	—	—	—	—	—	—	—	—	—	8 GSI	8 GSI	8 GSI
9/22/2017	—	—	—	—	—	—	—	—	—	8 GSI	—	8 GSI	—	—	—
9/25/2017	—	—	—	—	6 GSI	6 GSI	—	—	—	—	7 GSI	—	—	—	—
9/26/2017	8 SI	8 SI	8 GSI	8 GSI	—	—	8 GSI	7 GSI	6 GSI	—	—	—	—	—	—

Table 2.5-3 (continued)

Inspection Date	Days from Previous Inspection														
	CO101038	CO111041	E026	E030	E038	E039.1	E040	E042.1	E050.1	E055	E055.5	E056	E059.5	E059.8	E060.1
9/27/2017	—	—	—	—	—	—	—	—	—	—	2 GSI	—	—	—	—
9/28/2017	—	—	—	—	—	—	2 GSI	2 GSI	2 GSI	6 GSI	1 GSI	6 GSI	—	—	—
9/29/2017	—	—	—	3 GSI	—	—	1 GSI	1 GSI	1 GSI	1 GSI	—	—	8 GSI	8 GSI	8 GSI
10/2/2017	—	—	—	—	—	—	—	—	3 GSI	—	—	—	—	3 GSI	3 GSI
10/3/2017	—	7 SI	7 GSI	—	—	—	—	—	—	—	—	—	—	—	—
10/4/2017	8 SI	—	—	5 GSI	—	—	5 GSI	5 GSI	—	—	—	—	—	—	—
10/5/2017	—	—	—	1 GSI	—	—	1 GSI	1 GSI	3 GSI	—	—	—	—	3 GSI	—
10/6/2017	—	—	—	—	11 GSI	11 GSI	—	—	1 SI	7 GSI	8 GSI	8 GSI	7 GSI	—	—
10/10/2017	—	—	7 GSI	—	4 GSI	4 GSI	—	—	4 GSI	—	—	—	4 GSI	—	—
10/11/2017	7 SI	8 SI	—	6 GSI	—	—	6 GSI	6 GSI	—	—	—	—	—	6 GSI	—
10/13/2017	—	—	—	—	—	—	—	—	—	7 GSI	7 GSI	7 GSI	—	—	11 GSI
10/18/2017	7 SI	7 SI	8 GSI	7 GSI	—	—	7 GSI	7 GSI	8 GSI	—	—	—	8 GSI	7 GSI	5 GSI
10/19/2017	—	—	—	—	9 GSI	9 GSI	—	—	—	6 GSI	6 GSI	6 GSI	—	—	—
10/24/2017	6 SI	6 SI	5 GSI	6 GSI	—	—	6 GSI	6 GSI	—	—	—	—	—	—	—
10/25/2017	—	—	—	—	—	—	—	—	—	—	—	—	7 GSI	7 GSI	7 GSI
10/26/2017	—	—	—	—	—	—	—	—	8 GSI	7 GSI	7 GSI	7 GSI	—	—	—
10/27/2017	—	—	—	—	8 GSI	8 GSI	—	—	—	—	—	—	—	—	—
10/31/2017	—	—	—	—	—	—	—	—	—	—	—	—	6 GSI	6 GSI	6 GSI
11/1/2017	8 SSD[h]	8 SSD	8 SSD	8 SSD	—	—	8 SSD	—	—	—	—	—	—	—	—
11/2/2017	—	—	—	—	—	6 SSD	—	9 SSD	7 GSI	—	—	—	—	—	—
11/3/2017	—	—	—	—	7 SSD	—	—	—	—	8 SSD	8 SSD	8 SSD	—	—	—
11/7/2017	—	—	6 GI	6 GI	—	—	6 GI	5 GI	—	—	—	—	—	—	—
11/8/2017	—	—	—	—	5 GI	6 GI	—	—	—	—	—	—	8 SSD	8 SSD	—
11/9/2017	—	—	—	—	—	—	—	—	7 GI	6 GI	6 GI	6 GI	—	—	9 GSI
11/14/2017	—	—	7 GI	7 GI	—	—	7 GI	7 GI	—	—	—	—	—	—	—

Table 2.5-3 (continued)

Inspection Date	Days from Previous Inspection														
	CO101038	CO111041	E026	E030	E038	E039.1	E040	E042.1	E050.1	E055	E055.5	E056	E059.5	E059.8	E060.1
11/15/2017	—	—	—	—	—	—	—	—	—	—	6 GI	—	7 GI	7 GI	—
11/16/2017	—	—	—	—	—	—	—	—	7 GSI	—	—	—	—	—	7 GSI
11/17/2017	—	—	—	—	9 GI	9 GI	—	—	—	8 GI	—	8 GI	—	—	—
11/20/2017	—	—	—	—	—	—	—	—	4 SSD	—	—	—	—	—	4 SSD
11/27/2017	—	—	—	—	—	—	—	13 GI	—	—	—	—	—	—	—
11/30/2017	—	—	—	—	13 GI	—	—	—	10 GI	—	—	—	—	—	10 GI
12/6/2017	—	—	22 GI	—	—	—	—	—	—	—	—	—	—	—	—
12/7/2017	—	—	—	—	—	—	—	—	7 GI	—	—	—	—	—	7 GI
12/8/2017	—	—	—	—	8 GI	—	—	—	—	—	—	—	—	—	—
12/13/2017	—	—	—	—	—	26 GI	—	—	—	—	—	—	28 GI	28 GI	—
12/14/2017	—	—	—	—	—	—	—	—	—	28 GI	—	—	—	—	—
12/15/2017	—	—	—	—	—	—	—	—	8 GI	—	—	28 GI	—	—	8 GI
12/18/2017	—	—	—	34 GI	—	—	34 GI	—	—	—	—	—	—	—	—
12/19/2017	—	—	—	—	—	6 GI	—	22 GI	—	—	34 GI	—	—	—	—
12/20/2017	—	—	—	—	—	—	—	—	5 GI	—	—	—	—	—	5 GI

Note: Gray shading denotes days in which gaging stations/samplers were not active.

[a] — = No inspection performed.

[b] Initial GI = Initial gage inspection for the year.

[c] GI = Gage inspection.

[d] SA = Sampler activation.

[e] GSI = Gage and sampler inspection.

[f] GISA = Gage inspection and sampler activation.

[g] SI = Sampler inspection.

[h] SSD = Sampler shutdown.

Table 3.1-1
Drainage Area and Impervious Surface Percentage in the Los Alamos Canyon Watersheds

Canyon	Gaging Station	Drainage Area (acres)	Impervious Surface (%)
Acid	E055.5	53	26
Acid*	E056	237	22
Acid	Acid Canyon above E056	290	23
Pueblo	E055	2184	8.0
Pueblo	E059.5	2099	11
Pueblo	E059.8	407	4.4
Pueblo*	E060.1	330	3.8
Pueblo	Pueblo Canyon above E060.1	5310	9.5
DP	E038	125	32
DP*	E039.1	111	12
DP*	E040	130	4.0
DP	DP Canyon above E039.1	236	23
DP	DP Canyon above E040	366	16
LA	E026	4354	0.4
LA*	E030	1100	13
LA*	E042.1	605	0.6
LA*	E050.1	193	2.2
LA*	E109.9 (including Guaje Canyon)	27,000	1.2
LA	Los Alamos Canyon above E050.1	6250	2.7
LA	Los Alamos, Pueblo, and Guaje Canyons above E109.9	37,760	2.6
LA*	Los Alamos Canyon between E050.1, E060.1, and E109.9	5240	2.4
Guaje	E099	21,000	0.9

Notes: Drainage areas marked by an asterisk do not extend to head of watershed above gaging station. The drainage areas without an asterisk extend from the gaging station to the head of the watershed.

Table 3.2-1
Travel Time of Flood Bore, Peak Discharge, Increase or Decrease in Peak Discharge, and Percent Change in Peak Discharge from Up- to Downstream Gaging Stations for 2017 Runoff Events Exceeding Sampling Triggers across the Watershed Mitigations

Date	Travel Time from E038 to E039.1 (min)	Peak Discharge (cfs)		+/−[a]	%[a]	Travel Time from E042.1 to E050.1 (min)	Peak Discharge (cfs)		+/−[a]	%[a]
		E038	E039.1				E042.1	E050.1		
7/8	30	110	60	−	45	—[b]	0	0	—	—
7/26	20	205	150	−	27	—	30	0	−	100
7/27	70	2	0.9	−	56	—	0.01	0	−	100
7/29	30	45	45	—	0	—	5.9	0	−	100
8/7	40	76	18	−	76	—	0	0	—	—
8/23	60	21	4.9	−	77	—	0	0	—	—
9/26	45	24	15	−	38	—	0	0	—	—
9/27	30	36	35	−	3	35	25	32	+	22
9/28–9/29	20	110	9	−	92	50	51	56	+	9
9/30	—	10	0	−	100	—	0	0.3	+	100
10/4–10/5	15	84	18	−	79	65	40	35	−	13
Min	15	2	0	—	0	35	0	0	—	9
Mean	36	66	32	—	54	50	14	11	—	63
Max	70	205	150	—	100	65	51	56	—	100

Date	Travel Time from E059.5 to E059.8 (min)	Peak Discharge (cfs)		+/−[a]	%[a]	Travel Time from E059.8 to E060.1 (min)	Peak Discharge (cfs)		+/−[a]	%[a]
		E059.5	E059.8				E059.8	E060.1		
7/8	—	0	0	—	—	—	0	0	—	—
7/26	—	0.03	0	−	100	—	0	0.25	+	100
7/27	—	0.30	0	−	100	—	0	0.04	+	100
7/29	—	0.43	0	−	100	—	0	0	—	—
8/7	—	0.47	0	−	100	—	0	0.2	+	100
8/23	—	0.4	0	−	100	—	0	0	—	—
9/26	—	0.3	0	−	100	—	0	0	—	—
9/27	—	12	0	−	100	—	0	0	—	—
9/28–9/29	250	61	1.9	−	97	G[c]	1.9	0.07	G	G
9/30	250	0.17	0.02	−	88	—	0.02	0	−	100
10/4–10/5	85	26	0.67	−	97	—	0.67	0	−	100
Min	85	0	0	—	88	—	0	0	—	100
Mean	195	9	0.2	—	98	—	0.2	0.1	—	100
Max	250	61	1.9	—	100	—	1.9	0.3	—	100

[a] + = Increase; − = decrease; % = percent change in peak discharge.

[b] — = Result not applicable.

[c] G = Negative travel time (i.e., peak of downstream gaging station occurred before peak of upstream gaging station).

Table 3.2-2
Pearson's Correlation Coefficients Between Post-Flood Bore Discharge (Q) and SSC for Each Gaging Station Sampled during 2017

	E038				E039.1				E042.1				E050.1			E059.5	E059.8
Time Lag	7/8	7/26	7/29	8/7	7/8	7/26	7/29	8/7	7/26	9/27	9/29	10/4	9/27	9/29	10/4	9/29	10/5
Q_t, TSS_t	0.98	0.87	0.89	0.43	0.89	0.94	0.75	0.78	0.98	0.20	0.73	−0.31	0.69	0.89	0.01	0.02	−0.90
Q_t, TSS_{t-5}	0.98	0.95	0.88	0.39	0.97	0.99	0.89	0.88	0.98	0.49	0.82	−0.24	0.69	0.74	0.14	0.43	−0.76
Q_t, TSS_{t-10}	0.97	0.98	0.87	0.35	0.97	0.99	0.93	0.89	0.97	0.64	0.83	−0.25	0.74	−0.21	0.28	0.49	−0.62
Q_t, TSS_{t-15}	0.98	0.96	0.86	0.32	0.97	0.99	0.94	0.86	0.95	0.49	0.85	−0.28	0.72	−0.45	0.27	0.83	−0.52
Q_t, TSS_{t-20}	0.98	0.91	0.81	0.29	0.97	0.99	0.95	0.86	0.90	0.37	0.83	−0.33	0.56	−0.49	0.39	0.78	−0.61
Q_t, TSS_{t-25}	0.98	0.92	0.73	0.26	0.96	0.99	0.95	0.92	0.86	0.44	0.77	−0.39	0.25	−0.38	0.65	0.74	−0.58
Q_t, TSS_{t-30}	0.98	0.92	0.68	0.07	0.97	0.99	0.95	0.90	0.82	0.46	0.65	−0.41	−0.16	−0.54	0.47	0.75	−0.64

Note: First maximum correlations are shaded in gray.

Table 3.2-3
SSC-Based Sediment Yield and Runoff Volume for Sampled 2012 to 2017 Runoff Events

Gaging Station	Date	Sediment Yield (tons)	Sediment Yield (yd^3)[a]	Runoff Volume (acre-feet)	Peak Discharge (cfs)
2012 Runoff Events					
E042.1	10/12/2012	82	37	14	70
E050.1	7/11/2012	9883	4425	8.2	130
E050.1	7/24/2012	60	27	3.5	9.9
E050.1	8/3/2012	2320	1039	15	170
E050.1	9/28/2012	28	13	1.8	7.0
E109.9	7/5/2012	1369	613	5.9	48
E109.9	8/24/2012	2706	1211	11	160
2013 Runoff Events					
E038	6/14/2013	11	5.1	3.0	70
E038	6/30/2013	11	5.0	1.9	120
E038	7/12/2013	87	39	14	330
E038	7/28/2013	4.7	2.1	1.6	74
E038	8/5/2013	25	11	5.1	170
E038	8/9/2013	3.8	1.7	1.3	62
E039.1	6/14/2013	0.6	0.3	1.3	13
E039.1	6/30/2013	0.3	0.1	0.8	11
E039.1	7/12/2013	75	34	16	330
E039.1	7/28/2013	0.8	0.4	1.2	24
E039.1	8/4/2013	0.8	0.4	0.7	12
E039.1	8/9/2013	0.5	0.2	0.9	16
E039.1	9/10/2013	4.4	2.0	5.9	35
E039.1	9/12/2013	3.6	1.6	7.6	77
E039.1	11/5/2013	0.9	0.4	2.2	21
E042.1	7/12/2013	817	366	20	160
E042.1	8/5/2013	29	13	9.4	80
E042.1	9/10/2013	48	21	17	36
E050.1	7/12/2013	39	17	4.3	32
E050.1	8/5/2013	6.1	2.7	1.7	20
E050.1	9/10/2013	4.6	2.1	6.4	11
E050.1	9/12/2013	171	77	33	87
E099	7/12/2013	5748	2574	14	230
E099	8/5/2013	1015	455	6.7	340
E109.9	7/8/2013	3880	1737	12	110
E109.9	7/12/2013[b]	1326	594	26	180
E109.9	7/20/2013[b]	24,305	10,883	67	810
E109.9	7/25/2013	1639	734	11	100

Table 3.2-3 (continued)

Gaging Station	Date	Sediment Yield (tons)	Sediment Yield (yd^3)[a]	Runoff Volume (acre-feet)	Peak Discharge (cfs)
2013 Runoff Events (continued)					
E109.9	7/26/2013[b]	515	230	14	160
E109.9	8/3/2013	51,060	22,862	72	950
E109.9	8/5/2013[b]	3955	1771	50	1000
E109.9	8/9/2013	8524	3816	34	270
2014 Runoff Events					
E038	7/8/2014	6.5	2.9	1.7	46
E038	7/27/2014	7.9	3.5	2.9	148
E038	7/29/2014	11	4.8	5.5	94
E038	7/31/2014	30	14	9.7	209
E039.1	7/8/2014	1.1	0.5	0.7	14
E039.1	7/15/2014	1.3	0.6	3.2	15
E039.1	7/15/2014	58	26	11	317
E039.1	7/27/2014	1.6	0.7	1.9	22
E039.1	7/29/2014	7.8	3.5	6.2	66
E039.1	7/31/2014	31	14	11	250
E040	7/29/2014	4.2	1.9	9.4	95
E040	7/31/2014	9.8	4.4	14	239
E042.1	7/29/2014	186	83	16	92
E042.1	7/31/2014	551	247	21	210
E050.1	7/15/2014	67	30	8.8	49
E050.1	7/29/2014	41	18	11	63
E050.1	7/31/2014	204	91	22	214
E059.5	7/29/2014	30	13	3.0	44
E059.5	7/31/2014	98	44	4.7	97
2015 Runoff Events					
E038	06/26/2015	9.0	4.0	3.8	163
E038	07/20/2015	3.7	1.6	4.0	78
E038	07/31/2015	6.0	2.7	3.0	110
E038	08/08/2015	1.7	0.8	1.5	52
E039.1	05/21/2015	1.0	0.5	3.9	24
E039.1	06/26/2015[b]	2.8	1.3	3.0	66
E039.1	07/03/2015	3.1	1.4	2.3	51
E039.1	07/07/2015	4.8	2.2	4.5	46
E039.1	07/29/2015	1.6	0.7	4.6	49
E039.1	08/08/2015	0.8	0.4	2.1	46
E039.1	10/21/2015	0.5	0.2	8.6	28
E042.1	07/03/2015	4.7	2.1	0.7	10

Table 3.2-3 (continued)

Gaging Station	Date	Sediment Yield (tons)	Sediment Yield (yd^3)[a]	Runoff Volume (acre-feet)	Peak Discharge (cfs)
2015 Runoff Events (continued)					
E042.1	07/07/2015	63	28	14	53
E042.1	07/20/2015	46	21	3.8	56
E042.1	07/31/2015	82	37	7.0	74
E042.1	10/21/2015	11	5.0	3.9	17
E050.1	07/07/2015	17	7.8	23	40
E050.1	07/20/2015	20	8.9	6.0	34
E050.1	07/29/2015	3.4	1.5	5.6	22
E050.1	08/08/2015	1.9	0.8	8.5	11
E050.1	10/21/2015	2.9	1.3	3.8	18
E050.1	10/23/2015[b]	0.6	0.3	1.6	5.4
E059.5	07/03/2015	533	239	3.9	50
E059.5	07/31/2015	44.8	20	2.3	73
E059.8	10/21/2015	1.1	0.5	2.9	10
E060.1	07/02/2015[b]	93	42	14	12
E060.1	07/20/2015	3.2	1.4	0.8	6.7
2016 Runoff Events					
E038	8/19/2016	5.5	2.5	1.5	80
E038	8/24/2016	6.0	2.7	2.4	129
E038	8/27/2016	7.1	3.2	2.8	103
E039.1	8/3/2016	0.8	0.4	1.7	27
E039.1	9/6/2016	0.7	0.3	1.3	42
E039.1	11/5/2016	0.7	0.3	3.0	25
E042.1	8/27/2016	60	27	4.0	63
E042.1	11/6/2016	2.4	1.1	0.8	12
E050.1	8/27/2016	9.9	4.4	3.0	25
E059.5	8/27/2016	23	10	3.5	45
2017 Runoff Events					
E038	7/8/2017	9327	4.6	2.0	110
E038	7/26/2017	24,828	12.3	4.5	205
E038	7/29/2017	3016	1.5	1.8	45
E038	8/7/2017	4013	2.0	1.9	76
E039.1	7/8/2017	4273	2.1	2.1	60
E039.1	7/26/2017	7881	3.9	3.4	150
E039.1	7/29/2017	1247	0.6	1.7	45
E039.1	8/7/2017	394	0.2	0.8	18
E042.1	7/26/2017	20,223	10.0	2.5	30
E042.1	9/27/2017	7583	3.7	6.9	25

Table 3.2-3 (continued)

Gaging Station	Date	Sediment Yield (tons)	Sediment Yield (yd^3)[a]	Runoff Volume (acre-feet)	Peak Discharge (cfs)
2017 Runoff Events (continued)					
E042.1	9/29/2017	44,574	22.0	10.8	51
E042.1	10/4/2017	39,745	19.6	5.9	40
E050.1	9/27/2017	3781	1.9	9.7	32
E050.1	9/29/2017	15,899	7.8	17.3	56
E050.1	10/4/2017	11,842	5.8	16.3	35
E059.5	9/29/2017	22,036	10.9	6.8	61
E059.8	10/5/2017[b]	156	0.1	1.3	1.6

Notes: Sediment yield and runoff volume were calculated only from sampled events with reliable hydrographs and sedigraphs. Thus, the September 12, 2013, sampling at E026 and E109.9 was excluded.

[a] Volumetric sediment yield was computed using a soil bulk density of 2650 kg/m^3 and volume = mass/density.

[b] Samples were not collected throughout the entire hydrograph (see Figures 3.2-3 and 3.2-4); thus, sediment yields may be underestimated.

Table 4.2-1
Comparison of Detected Analytical Results from 2017 with the Water Quality Criteria

Location ID	Location Alias	Sample Date	Analyte	Field Prep Code	Result	MDL	PQL[a]	Unit[b]	Screening Level	Screening Level Type[c]	Hardness Used[d]
CO111041	CO111041	7/8/2017	Copper	F[e]	4.32	0.3	1	µg/L	2.43	AAL	16.3
CO111041	CO111041	7/8/2017	Gross alpha	UF[f]	24.9	2.21	1.41	pCi/L	15	LW	—
CO111041	CO111041	7/8/2017	Total PCB	UF	9.57	—[g]	—	µg/L	0.00064	HH-OO	—
Los Alamos above DP Canyon	E030	9/29/2017	Aluminum	F	1100	19.3	50	µg/L	238	AAL	14.3
Los Alamos above DP Canyon	E030	9/29/2017	Copper	F	2.29	0.3	1	µg/L	2.15	AAL	14.3
Los Alamos above DP Canyon	E030	9/29/2017	Gross alpha	UF	100	4.2	4.27	pCi/L	15	LW	—
Los Alamos above DP Canyon	E030	9/29/2017	Total PCB	UF	0.277	—	—	µg/L	0.00064	HH-OO	—
Los Alamos above DP Canyon	E030	10/4/2017	Gross alpha	UF	45.2	4.35	2.64	pCi/L	15	LW	—
Los Alamos above DP Canyon	E030	10/4/2017	Total PCB	UF	0.438	—	—	µg/L	0.00064	HH-OO	—
DP above TA-21	E038	7/8/2017	Gross alpha	UF	80.2	3.97	3.13	pCi/L	15	LW	—
DP above TA-21	E038	7/8/2017	Total PCB	UF	0.098	—	—	µg/L	0.00064	HH-OO	—
DP above TA-21	E038	7/26/2017	Aluminum	F	250	19.3	50	µg/L	203	AAL	12.7
DP above TA-21	E038	7/26/2017	Copper	F	3.35	0.3	1	µg/L	1.92	AAL	12.7
DP above TA-21	E038	7/26/2017	Gross alpha	UF	25.6	3.66	1.82	pCi/L	15	LW	—
DP above TA-21	E038	7/26/2017	Total PCB	UF	0.0447	—	—	µg/L	0.00064	HH-OO	—
DP above TA-21	E038	7/29/2017	Aluminum	F	393	19.3	50	µg/L	207	AAL	12.9
DP above TA-21	E038	7/29/2017	Gross alpha	UF	29.4	4.6	2.23	pCi/L	15	LW	—
DP above TA-21	E038	7/29/2017	Total PCB	UF	0.0907	—	—	µg/L	0.00064	HH-OO	—
DP above TA-21	E038	8/7/2017	Aluminum	F	301	19.3	50	µg/L	295	AAL	16.7
DP above TA-21	E038	8/7/2017	Copper	F	2.98	0.3	1	µg/L	2.49	AAL	16.7
DP above TA-21	E038	8/7/2017	Gross alpha	UF	15.9	3.25	1.49	pCi/L	15	LW	—
DP above TA-21	E038	8/7/2017	Total PCB	UF	0.0429	—	—	µg/L	0.00064	HH-OO	—
DP below Grade Control Structure	E039.1	7/8/2017	Gross alpha	UF	16.8	2.71	1.33	pCi/L	15	LW	—
DP below Grade Control Structure	E039.1	7/8/2017	Total PCB	UF	0.0513	—	—	µg/L	0.00064	HH-OO	—

Table 4.2-1 (continued)

Location ID	Location Alias	Sample Date	Analyte	Field Prep Code	Result	MDL	PQL[a]	Unit[b]	Screening Level	Screening Level Type[c]	Hardness Used[d]
DP below Grade Control Structure	E039.1	7/26/2017	Copper	F	3.33	0.3	1	µg/L	2.66	AAL	17.9
DP below Grade Control Structure	E039.1	7/26/2017	Gross alpha	UF	113	11	5.9	pCi/L	15	LW	—
DP below Grade Control Structure	E039.1	7/26/2017	Total PCB	UF	0.0606	—	—	µg/L	0.00064	HH-OO	—
DP below Grade Control Structure	E039.1	7/29/2017	Aluminum	F	460	19.3	50	µg/L	396	AAL	20.7
DP below Grade Control Structure	E039.1	7/29/2017	Gross alpha	UF	39.3	4.2	2.47	pCi/L	15	LW	—
DP below Grade Control Structure	E039.1	7/29/2017	Total PCB	UF	0.0169	—	—	µg/L	0.00064	HH-OO	—
DP below Grade Control Structure	E039.1	8/7/2017	Aluminum	F	546	19.3	50	µg/L	419	AAL	21.6
DP below Grade Control Structure	E039.1	8/7/2017	Copper	F	3.66	0.3	1	µg/L	3.17	AAL	21.6
DP below Grade Control Structure	E039.1	8/7/2017	Total PCB	UF	0.0167	—	—	µg/L	0.00064	HH-OO	—
DP above Los Alamos Canyon	E040	7/8/2017	Gross alpha	UF	207	6.75	6.52	pCi/L	15	LW	—
DP above Los Alamos Canyon	E040	7/8/2017	Total PCB	UF	0.0373	—	—	µg/L	0.00064	HH-OO	—
DP above Los Alamos Canyon	E040	7/26/2017	Gross alpha	UF	241	18.8	11.5	pCi/L	15	LW	—
DP above Los Alamos Canyon	E040	7/26/2017	Total PCB	UF	0.076	—	—	µg/L	0.00064	HH-OO	—
DP above Los Alamos Canyon	E040	9/27/2017	Aluminum	F	663	19.3	50	µg/L	357	AAL	19.2
DP above Los Alamos Canyon	E040	9/27/2017	Copper	F	2.94	0.3	1	µg/L	2.84	AAL	19.2
DP above Los Alamos Canyon	E040	9/27/2017	Gross alpha	UF	19.1	3.95	1.79	pCi/L	15	LW	—
DP above Los Alamos Canyon	E040	9/27/2017	Total PCB	UF	0.0151	—	—	µg/L	0.00064	HH-OO	—
DP above Los Alamos Canyon	E040	9/28/2017	Aluminum	F	810	19.3	50	µg/L	649	AAL	29.7
DP above Los Alamos Canyon	E040	9/28/2017	Total PCB	UF	0.0147	—	—	µg/L	0.00064	HH-OO	—
Los Alamos above low-head weir	E042.1	7/26/2017	Gross alpha	UF	113	5.49	4.28	pCi/L	15	LW	—
Los Alamos above Low Head Weir	E042.1	7/26/2017	Mercury	UF	1.41	0.067	0.2	µg/L	0.77	WH	—
Los Alamos above Low Head Weir	E042.1	7/26/2017	Selenium	UF	6.92	2	5	µg/L	5	WH	—
Los Alamos above Low Head Weir	E042.1	7/26/2017	Total PCB	UF	0.151	—	—	µg/L	0.00064	HH-OO	—
Los Alamos above Low Head Weir	E042.1	7/26/2017	Total PCB	UF	0.292	—	—	µg/L	0.00064	HH-OO	—
Los Alamos above Low Head Weir	E042.1	9/27/2017	Aluminum	F	662	19.3	50	µg/L	307	AAL	17.2
Los Alamos above Low Head Weir	E042.1	9/27/2017	Copper	F	2.63	0.3	1	µg/L	2.56	AAL	17.2

Table 4.2-1 (continued)

Location ID	Location Alias	Sample Date	Analyte	Field Prep Code	Result	MDL	PQL[a]	Unit[b]	Screening Level	Screening Level Type[c]	Hardness Used[d]
Los Alamos above Low Head Weir	E042.1	9/27/2017	Gross alpha	UF	70.2	3.77	3.15	pCi/L	15	LW	—
Los Alamos above Low Head Weir	E042.1	9/27/2017	Total PCB	UF	0.0725	—	—	µg/L	0.00064	HH-OO	—
Los Alamos above Low Head Weir	E042.1	9/27/2017	Total PCB	UF	0.276	—	—	µg/L	0.00064	HH-OO	—
Los Alamos above Low Head Weir	E042.1	9/29/2017	Aluminum	F	813	19.3	50	µg/L	322	AAL	17.8
Los Alamos above Low Head Weir	E042.1	9/29/2017	Gross alpha	UF	149	4.8	5.15	pCi/L	15	LW	—
Los Alamos above Low Head Weir	E042.1	9/29/2017	Total PCB	UF	0.111	—	—	µg/L	0.00064	HH-OO	—
Los Alamos above Low Head Weir	E042.1	9/29/2017	Total PCB	UF	0.0999	—	—	µg/L	0.00064	HH-OO	—
Los Alamos above Low Head Weir	E042.1	10/4/2017	Gross alpha	UF	360	18.3	15.1	pCi/L	15	LW	—
Los Alamos above Low Head Weir	E042.1	10/4/2017	Mercury	UF	0.793	0.067	0.2	µg/L	0.77	WH	—
Los Alamos above Low Head Weir	E042.1	10/4/2017	Selenium	UF	38	2	5	µg/L	5	WH	—
Los Alamos above Low Head Weir	E042.1	10/4/2017	Total PCB	UF	0.13	—	—	µg/L	0.00064	HH-OO	—
Los Alamos above Low Head Weir	E042.1	10/4/2017	Total PCB	UF	0.0792	—	—	µg/L	0.00064	HH-OO	—
Los Alamos below Low Head Weir	E050.1	9/27/2017	Aluminum	F	1110	19.3	50	µg/L	359	AAL	19.3
Los Alamos below Low Head Weir	E050.1	9/27/2017	Gross alpha	UF	23.9	1.76	1.44	pCi/L	15	LW	—
Los Alamos below Low Head Weir	E050.1	9/27/2017	Total PCB	UF	0.0367	—	—	µg/L	0.00064	HH-OO	—
Los Alamos below Low Head Weir	E050.1	9/27/2017	Total PCB	UF	0.0186	—	—	µg/L	0.00064	HH-OO	—
Los Alamos below Low Head Weir	E050.1	9/29/2017	Aluminum	F	876	19.3	50	µg/L	322	AAL	17.8
Los Alamos below Low Head Weir	E050.1	9/29/2017	Aluminum	F	1030	19.3	50	µg/L	452	AAL	22.8
Los Alamos below Low Head Weir	E050.1	9/29/2017	Gross alpha	UF	89.5	4.23	3.82	pCi/L	15	LW	—
Los Alamos below Low Head Weir	E050.1	9/29/2017	Total PCB	UF	0.183	—	—	µg/L	0.00064	HH-OO	—
Los Alamos below Low Head Weir	E050.1	9/29/2017	Total PCB	UF	0.0863	—	—	µg/L	0.00064	HH-OO	—
Los Alamos below Low Head Weir	E050.1	10/4/2017	Aluminum	F	963	19.3	50	µg/L	558	AAL	26.6
Los Alamos below Low Head Weir	E050.1	10/5/2017	Gross alpha	UF	71	2.64	3.02	pCi/L	15	LW	—
Los Alamos below Low Head Weir	E050.1	10/5/2017	Total PCB	UF	0.106	—	—	µg/L	0.00064	HH-OO	—
Los Alamos below Low Head Weir	E050.1	10/5/2017	Total PCB	UF	0.0958	—	—	µg/L	0.00064	HH-OO	—
Pueblo above Acid	E055	9/27/2017	Aluminum	F	1350	19.3	50	µg/L	111	CAL	16

Table 4.2-1 (continued)

Location ID	Location Alias	Sample Date	Analyte	Field Prep Code	Result	MDL	PQL[a]	Unit[b]	Screening Level	Screening Level Type[c]	Hardness Used[d]
Pueblo above Acid	E055	9/27/2017	Copper	F	3.18	0.3	1	µg/L	1.87	CAL	16
Pueblo above Acid	E055	9/27/2017	Gross alpha	UF	16.8	2.7	1.41	pCi/L	15	LW	—
Pueblo above Acid	E055	9/27/2017	Lead	F	1.56	0.5	2	µg/L	0.327	CAL	16
Pueblo above Acid	E055	9/27/2017	Total PCB	UF	0.045	—	—	µg/L	0.00064	HH-OO	—
Pueblo above Acid	E055	9/29/2017	Aluminum	F	1220	19.3	50	µg/L	148	CAL	19.7
Pueblo above Acid	E055	9/29/2017	Copper	F	3.18	0.3	1	µg/L	2.23	CAL	19.7
Pueblo above Acid	E055	9/29/2017	Lead	F	1.76	0.5	2	µg/L	0.413	CAL	19.7
Pueblo above Acid	E055	9/29/2017	Total PCB	UF	0.00756	—	—	µg/L	0.00064	HH-OO	—
South Fork Acid Canyon	E055.5	7/26/2017	Aluminum	F	797	19.3	50	µg/L	109	CAL	15.7
South Fork Acid Canyon	E055.5	7/26/2017	Copper	F	4.28	0.3	1	µg/L	1.84	CAL	15.7
South Fork Acid Canyon	E055.5	7/26/2017	Gross alpha	UF	73.9	3.43	2.62	pCi/L	15	LW	—
South Fork Acid Canyon	E055.5	7/26/2017	Lead	F	1.6	0.5	2	µg/L	0.32	CAL	15.7
South Fork Acid Canyon	E055.5	7/26/2017	Total PCB	UF	0.0851	—	—	µg/L	0.00064	HH-OO	—
South Fork Acid Canyon	E055.5	7/27/2017	Aluminum	F	1030	19.3	50	µg/L	196	CAL	24.2
South Fork Acid Canyon	E055.5	7/27/2017	Copper	F	9.42	0.3	1	µg/L	2.66	CAL	24.2
South Fork Acid Canyon	E055.5	7/27/2017	Gross alpha	UF	55.5	3.24	2.3	pCi/L	15	LW	—
South Fork Acid Canyon	E055.5	7/27/2017	Lead	F	3.68	0.5	2	µg/L	0.522	CAL	24.2
South Fork Acid Canyon	E055.5	7/27/2017	Total PCB	UF	0.0327	—	—	µg/L	0.00064	HH-OO	—
South Fork Acid Canyon	E055.5	7/27/2017	Zinc	F	33.9	3.3	10	µg/L	33.4	CAL	24.2
South Fork Acid Canyon	E055.5	7/29/2017	Aluminum	F	773	19.3	50	µg/L	91	CAL	13.8
South Fork Acid Canyon	E055.5	7/29/2017	Copper	F	3.25	0.3	1	µg/L	1.65	CAL	13.8
South Fork Acid Canyon	E055.5	7/29/2017	Gross alpha	UF	65.9	3.86	2.79	pCi/L	15	LW	—
South Fork Acid Canyon	E055.5	7/29/2017	Lead	F	1.64	0.5	2	µg/L	0.276	CAL	13.8
South Fork Acid Canyon	E055.5	7/29/2017	Total PCB	UF	0.181	—	—	µg/L	0.00064	HH-OO	—
Acid above Pueblo	E056	7/8/2017	Aluminum	F	592	19.3	50	µg/L	147	CAL	19.6
Acid above Pueblo	E056	7/8/2017	Copper	F	5.04	0.3	1	µg/L	2.23	CAL	19.6

Table 4.2-1 (continued)

Location ID	Location Alias	Sample Date	Analyte	Field Prep Code	Result	MDL	PQL[a]	Unit[b]	Screening Level	Screening Level Type[c]	Hardness Used[d]
Acid above Pueblo	E056	7/8/2017	Gross alpha	UF	95.5	4.28	3.33	pCi/L	15	LW	—
Acid above Pueblo	E056	7/8/2017	Lead	F	1.17	0.5	2	µg/L	0.411	CAL	19.6
Acid above Pueblo	E056	7/8/2017	Total PCB	UF	0.0455	—	—	µg/L	0.00064	HH-OO	—
Acid above Pueblo	E056	7/8/2017	Zinc	F	27.6	3.3	10	µg/L	27.5	CAL	19.6
Acid above Pueblo	E056	7/26/2017	Aluminum	F	529	19.3	50	µg/L	105	CAL	15.3
Acid above Pueblo	E056	7/26/2017	Copper	F	3.34	0.3	1	µg/L	1.8	CAL	15.3
Acid above Pueblo	E056	7/26/2017	Gross alpha	UF	83.4	5.01	3.31	pCi/L	15	LW	—
Acid above Pueblo	E056	7/26/2017	Lead	F	1.08	0.5	2	µg/L	0.31	CAL	15.3
Acid above Pueblo	E056	7/26/2017	Total PCB	UF	0.0771	—	—	µg/L	0.00064	HH-OO	—
Acid above Pueblo	E056	7/29/2017	Aluminum	F	591	19.3	50	µg/L	60.9	CAL	10.3
Acid above Pueblo	E056	7/29/2017	Copper	F	2.87	0.3	1	µg/L	1.28	CAL	10.3
Acid above Pueblo	E056	7/29/2017	Gross alpha	UF	29.8	3.2	1.79	pCi/L	15	LW	—
Acid above Pueblo	E056	7/29/2017	Lead	F	0.898	0.5	2	µg/L	0.198	CAL	10.3
Acid above Pueblo	E056	7/29/2017	Total PCB	UF	0.0381	—	—	µg/L	0.00064	HH-OO	—
Acid above Pueblo	E056	8/23/2017	Aluminum	F	475	19.3	50	µg/L	65	CAL	10.8
Acid above Pueblo	E056	8/23/2017	Copper	F	2.44	0.3	1	µg/L	1.34	CAL	10.8
Acid above Pueblo	E056	8/23/2017	Gross alpha	UF	31	3.54	2.05	pCi/L	15	LW	—
Acid above Pueblo	E056	8/23/2017	Lead	F	0.783	0.5	2	µg/L	0.209	CAL	10.8
Acid above Pueblo	E056	8/23/2017	Total PCB	UF	0.0522	—	—	µg/L	0.00064	HH-OO	—
E059.5 Pueblo below LAC WWTF	E059.5	9/29/2017	Aluminum	F	1120	19.3	50	µg/L	131	CAL	18
E059.5 Pueblo below LAC WWTF	E059.5	9/29/2017	Copper	F	3.24	0.3	1	µg/L	2.07	CAL	18
E059.5 Pueblo below LAC WWTF	E059.5	9/29/2017	Gross alpha	UF	91.6	3.27	3.43	pCi/L	15	LW	—
E059.5 Pueblo below LAC WWTF	E059.5	9/29/2017	Lead	F	1.56	0.5	2	µg/L	0.373	CAL	18
E059.5 Pueblo below LAC WWTF	E059.5	9/29/2017	Total PCB	UF	0.0232	—	—	µg/L	0.00064	HH-OO	—
E059.8 Pueblo below Wetlands	E059.8	9/29/2017	Aluminum	F	896	19.3	50	µg/L	622	CAL	56.2
E059.8 Pueblo below Wetlands	E059.8	9/29/2017	Copper	F	5.83	0.3	1	µg/L	5.47	CAL	56.2

Table 4.2-1 (continued)

Location ID	Location Alias	Sample Date	Analyte	Field Prep Code	Result	MDL	PQL[a]	Unit[b]	Screening Level	Screening Level Type[c]	Hardness Used[d]
E059.8 Pueblo below Wetlands	E059.8	9/29/2017	Total PCB	UF	0.00192	—	—	µg/L	0.00064	HH-OO	—
E059.8 Pueblo below Wetlands	E059.8	9/29/2017	Total PCB	UF	0.00303	—	—	µg/L	0.00064	HH-OO	—
E059.8 Pueblo below Wetlands	E059.8	10/5/2017	Total PCB	UF	0.00257	—	—	µg/L	0.00064	HH-OO	—
E059.8 Pueblo below Wetlands	E059.8	10/5/2017	Total PCB	UF	0.00112	—	—	µg/L	0.00064	HH-OO	—

[a] PQL = Practical quantitation limit.

[b] Unit applies to result, MDL, PQL, and screening level.

[c] AAL = acute aquatic life, CAL = chronic aquatic life, HH-OO = human health-organism only, LW = livestock watering, WH = wildlife habitat.

[d] The hardness measured during the storm event was used to calculate hardness-based screening levels.

[e] F = Filtered.

[f] UF = Unfiltered.

[g] — = Not provided by the laboratory or not applicable.

Table 4.3-1
Calculated SSC and Instantaneous Discharge Determined for Each Sample Collected during 2017 in the LA/P Watershed

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
CO111041	7/8/2017 13:09	UF[b]	WT_LAP-17-133399	SSC	2400	n/a[c]
CO111041	7/8/2017 13:10	UF	WT_LAP-17-133461	Estimated	2200	n/a
CO111041	7/8/2017 13:11	UF	WT_LAP-17-133881	Estimated	2000	n/a
CO111041	7/8/2017 13:11	UF	WT_LAP-17-133581	Estimated	2000	n/a
CO111041	7/8/2017 13:11	UF	WT_LAP-17-133671	Estimated	2000	n/a
CO111041	7/8/2017 13:11	F[d]	WT_LAP-17-133761	Estimated	2000	n/a
CO111041	7/8/2017 13:11	F	WT_LAP-17-133821	Estimated	2000	n/a
CO111041	7/8/2017 13:14	F	WT_LAP-17-133521	Estimated	1300	n/a
CO111041	7/8/2017 13:15	UF	WT_LAP-17-134210	Estimated	1100	n/a
CO111041	7/8/2017 13:17	UF	WT_LAP-17-134289	Estimated	710	n/a
CO111041	7/8/2017 13:18	UF	WT_LAP-17-133641	SSC	500	n/a
E030	9/29/2017 0:54	UF	WT_LAP-17-133404	SSC	4300	11
E030	9/29/2017 0:56	UF	WT_LAP-17-133467	Estimated	4100	11
E030	9/29/2017 0:58	UF	WT_LAP-17-133587	Estimated	3900	11
E030	9/29/2017 0:58	UF	WT_LAP-17-133887	Estimated	3900	11
E030	9/29/2017 0:58	F	WT_LAP-17-133827	Estimated	3900	11
E030	9/29/2017 0:58	F	WT_LAP-17-133767	Estimated	3900	11
E030	9/29/2017 1:02	F	WT_LAP-17-133527	Estimated	3600	11
E030	9/29/2017 1:04	UF	WT_LAP-17-134216	Estimated	3400	10
E030	9/29/2017 1:06	UF	WT_LAP-17-133959	Estimated	3200	10
E030	9/29/2017 1:10	UF	WT_LAP-17-134115	Estimated	2900	11
E030	9/29/2017 1:12	UF	WT_LAP-17-133647	SSC	2700	10
E030	9/29/2017 1:14	UF	WT_LAP-17-133987	Estimated	2700	10
E030	9/29/2017 1:16	UF	WT_LAP-17-134047	Estimated	2700	10
E030	10/4/2017 22:38	UF	WT_LAP-17-133419	SSC	3300	10
E030	10/4/2017 22:40	UF	WT_LAP-17-133482	Estimated	3200	10
E030	10/4/2017 22:42	F	WT_LAP-17-133842	Estimated	3000	10
E030	10/4/2017 22:42	UF	WT_LAP-17-133902	Estimated	3000	10
E030	10/4/2017 22:46	F	WT_LAP-17-133542	Estimated	2800	10
E030	10/4/2017 22:48	UF	WT_LAP-17-134231	Estimated	2700	9.9
E030	10/4/2017 22:50	UF	WT_LAP-17-133964	Estimated	2500	9.8
E030	10/4/2017 22:50	UF	WT_LAP-17-133602	Estimated	2500	9.8
E030	10/4/2017 22:50	F	WT_LAP-17-133782	Estimated	2500	9.8
E030	10/4/2017 22:54	UF	WT_LAP-17-134130	Estimated	2300	9.1

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
E030	10/4/2017 22:56	UF	WT_LAP-17-134002	Estimated	2200	8.9
E030	10/4/2017 22:58	UF	WT_LAP-17-134062	Estimated	2000	8.8
E030	10/4/2017 23:00	UF	WT_LAP-17-133662	SSC	1900	8.7
E038	7/8/2017 12:54	UF	WT_LAP-17-133643	SSC	6200	89
E038	7/8/2017 12:56	UF	WT_LAP-17-134316	SSC	5700	100
E038	7/8/2017 12:58	UF	WT_LAP-17-134317	SSC	5200	87
E038	7/8/2017 13:01	UF	WT_LAP-17-134318	SSC	4500	64
E038	7/8/2017 13:03	UF	WT_LAP-17-134319	SSC	4000	51
E038	7/8/2017 13:05	UF	WT_LAP-17-134320	SSC	3500	37
E038	7/8/2017 13:05	UF	WT_LAP-17-133400	SSC	3700	37
E038	7/8/2017 13:07	UF	WT_LAP-17-134321	SSC	3500	32
E038	7/8/2017 13:07	UF	WT_LAP-17-133463	Estimated	3500	32
E038	7/8/2017 13:09	UF	WT_LAP-17-134322	SSC	2900	27
E038	7/8/2017 13:09	UF	WT_LAP-17-133883	Estimated	2900	27
E038	7/8/2017 13:09	UF	WT_LAP-17-133583	Estimated	2900	27
E038	7/8/2017 13:12	UF	WT_LAP-17-134323	SSC	2600	22
E038	7/8/2017 13:13	F	WT_LAP-17-133523	Estimated	2600	20
E038	7/8/2017 13:14	UF	WT_LAP-17-134324	SSC	2600	19
E038	7/8/2017 13:15	UF	WT_LAP-17-134212	Estimated	2400	18
E038	7/8/2017 13:16	UF	WT_LAP-17-134325	SSC	2200	16
E038	7/8/2017 13:17	UF	WT_LAP-17-134111	Estimated	2200	15
E038	7/8/2017 13:19	UF	WT_LAP-17-134326	SSC	2300	12
E038	7/8/2017 13:19	UF	WT_LAP-17-133983	Estimated	2300	12
E038	7/8/2017 13:21	UF	WT_LAP-17-134043	Estimated	2100	9.9
E038	7/8/2017 13:23	UF	WT_LAP-17-134339	SSC	1900	7.9
E038	7/8/2017 13:24	UF	WT_LAP-17-134327	SSC	2100	6.9
E038	7/8/2017 13:24	UF	WT_LAP-17-134330	SSC	1600	6.9
E038	7/8/2017 13:25	F	WT_LAP-17-133763	Estimated	1600	5.9
E038	7/8/2017 13:25	F	WT_LAP-17-133823	Estimated	1600	5.9
E038	7/26/2017 11:24	UF	WT_LAP-17-133658	SSC	8100	150
E038	7/26/2017 11:26	UF	WT_LAP-17-134484	SSC	8700	190
E038	7/26/2017 11:28	UF	WT_LAP-17-134485	SSC	6700	200
E038	7/26/2017 11:30	UF	WT_LAP-17-134486	SSC	5200	210
E038	7/26/2017 11:32	UF	WT_LAP-17-134487	SSC	4100	160
E038	7/26/2017 11:35	UF	WT_LAP-17-134488	SSC	3900	100
E038	7/26/2017 11:37	UF	WT_LAP-17-134489	SSC	3500	87
E038	7/26/2017 11:39	UF	WT_LAP-17-134490	SSC	3400	71
E038	7/26/2017 11:40	UF	WT_LAP-17-133415	SSC	3100	64

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
E038	7/26/2017 11:41	UF	WT_LAP-17-134491	SSC	3400	58
E038	7/26/2017 11:42	UF	WT_LAP-17-133478	Estimated	3200	52
E038	7/26/2017 11:43	UF	WT_LAP-17-134492	SSC	3000	47
E038	7/26/2017 11:44	F	WT_LAP-17-133778	Estimated	3000	41
E038	7/26/2017 11:44	F	WT_LAP-17-133838	Estimated	3000	41
E038	7/26/2017 11:44	UF	WT_LAP-17-133898	Estimated	3000	41
E038	7/26/2017 11:44	UF	WT_LAP-17-133598	Estimated	3000	41
E038	7/26/2017 11:45	UF	WT_LAP-17-134493	SSC	2900	35
E038	7/26/2017 11:48	UF	WT_LAP-17-134494	SSC	2500	24
E038	7/26/2017 11:48	F	WT_LAP-17-133538	Estimated	2500	24
E038	7/26/2017 11:50	UF	WT_LAP-17-134495	SSC	1800	17
E038	7/26/2017 11:51	UF	WT_LAP-17-134227	Estimated	1600	16
E038	7/26/2017 11:54	UF	WT_LAP-17-134498	SSC	1200	13
E038	7/26/2017 11:55	UF	WT_LAP-17-133998	Estimated	1100	12
E038	7/26/2017 11:57	UF	WT_LAP-17-134126	Estimated	980	9.9
E038	7/26/2017 11:57	UF	WT_LAP-17-134058	Estimated	980	9.9
E038	7/26/2017 11:58	UF	WT_LAP-17-134507	SSC	900	8.9
E038	7/26/2017 12:14	UF	WT_LAP-17-134499	SSC	400	2.5
E038	7/29/2017 19:23	UF	WT_LAP-17-133673	SSC	2500	35
E038	7/29/2017 19:26	UF	WT_LAP-17-134652	SSC	2900	42
E038	7/29/2017 19:28	UF	WT_LAP-17-134653	SSC	2900	43
E038	7/29/2017 19:30	UF	WT_LAP-17-134654	SSC	2200	45
E038	7/29/2017 19:32	UF	WT_LAP-17-134655	SSC	1700	43
E038	7/29/2017 19:35	UF	WT_LAP-17-134656	SSC	1800	40
E038	7/29/2017 19:37	UF	WT_LAP-17-134657	SSC	2700	33
E038	7/29/2017 19:39	UF	WT_LAP-17-134658	SSC	1600	26
E038	7/29/2017 19:40	UF	WT_LAP-17-133430	SSC	2100	23
E038	7/29/2017 19:41	UF	WT_LAP-17-134659	SSC	1300	21
E038	7/29/2017 19:42	UF	WT_LAP-17-133493	Estimated	1200	19
E038	7/29/2017 19:44	UF	WT_LAP-17-134660	SSC	1100	15
E038	7/29/2017 19:44	UF	WT_LAP-17-133613	Estimated	1100	15
E038	7/29/2017 19:44	F	WT_LAP-17-133793	Estimated	1100	15
E038	7/29/2017 19:44	F	WT_LAP-17-133853	Estimated	1100	15
E038	7/29/2017 19:44	UF	WT_LAP-17-133913	Estimated	1100	15
E038	7/29/2017 19:46	UF	WT_LAP-17-134661	SSC	800	13
E038	7/29/2017 19:48	UF	WT_LAP-17-134662	SSC	700	11
E038	7/29/2017 19:48	F	WT_LAP-17-133553	Estimated	700	11
E038	7/29/2017 19:51	UF	WT_LAP-17-134242	Estimated	640	9.4

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
E038	7/29/2017 19:53	UF	WT_LAP-17-134666	SSC	600	8.2
E038	7/29/2017 19:53	UF	WT_LAP-17-134141	Estimated	600	8.2
E038	7/29/2017 19:57	UF	WT_LAP-17-134073	Estimated	520	5.9
E038	7/29/2017 19:57	UF	WT_LAP-17-134013	Estimated	520	5.9
E038	7/29/2017 20:03	UF	WT_LAP-17-134675	SSC	400	4
E038	7/29/2017 20:18	UF	WT_LAP-17-134667	SSC	300	2.1
E038	8/7/2017 11:48	UF	WT_LAP-17-133688	SSC	2900	46
E038	8/7/2017 11:51	UF	WT_LAP-17-134820	SSC	2700	71
E038	8/7/2017 11:53	UF	WT_LAP-17-134821	SSC	2800	60
E038	8/7/2017 11:55	UF	WT_LAP-17-134822	SSC	2400	49
E038	8/7/2017 11:57	UF	WT_LAP-17-134823	SSC	2300	38
E038	8/7/2017 11:59	UF	WT_LAP-17-134824	SSC	2000	28
E038	8/7/2017 12:00	UF	WT_LAP-17-133445	SSC	2200	23
E038	8/7/2017 12:01	UF	WT_LAP-17-134825	SSC	1900	22
E038	8/7/2017 12:02	UF	WT_LAP-17-133508	Estimated	3000	21
E038	8/7/2017 12:03	UF	WT_LAP-17-134826	SSC	4100	20
E038	8/7/2017 12:04	UF	WT_LAP-17-133928	Estimated	5000	19
E038	8/7/2017 12:04	F	WT_LAP-17-133868	Estimated	5000	19
E038	8/7/2017 12:04	F	WT_LAP-17-133808	Estimated	5000	19
E038	8/7/2017 12:04	UF	WT_LAP-17-133628	Estimated	5000	19
E038	8/7/2017 12:05	UF	WT_LAP-17-134827	SSC	5800	18
E038	8/7/2017 12:07	UF	WT_LAP-17-134828	SSC	1900	17
E038	8/7/2017 12:08	F	WT_LAP-17-133568	Estimated	1600	17
E038	8/7/2017 12:09	UF	WT_LAP-17-134829	SSC	1200	16
E038	8/7/2017 12:10	UF	WT_LAP-17-134257	Estimated	1200	16
E038	8/7/2017 12:11	UF	WT_LAP-17-134830	SSC	1100	15
E038	8/7/2017 12:12	UF	WT_LAP-17-134156	Estimated	1300	14
E038	8/7/2017 12:13	UF	WT_LAP-17-134831	SSC	1500	13
E038	8/7/2017 12:14	UF	WT_LAP-17-134028	Estimated	1400	12
E038	8/7/2017 12:15	UF	WT_LAP-17-134832	SSC	1200	12
E038	8/7/2017 12:16	UF	WT_LAP-17-134088	Estimated	700	11
E038	8/7/2017 12:18	UF	WT_LAP-17-134843	SSC	700	9.1
E038	8/7/2017 12:18	UF	WT_LAP-17-134834	SSC	700	9.1
E038	8/7/2017 12:38	UF	WT_LAP-17-134835	SSC	300	2.9
E038	8/7/2017 12:58	UF	WT_LAP-17-134836	SSC	100	1.8
E039.1	7/8/2017 13:23	UF	WT_LAP-17-133644	SSC	2900	37
E039.1	7/8/2017 13:25	UF	WT_LAP-17-134340	SSC	2600	61
E039.1	7/8/2017 13:27	UF	WT_LAP-17-134341	SSC	2400	60

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
E039.1	7/8/2017 13:29	UF	WT_LAP-17-134342	SSC	2200	59
E039.1	7/8/2017 13:31	UF	WT_LAP-17-134343	SSC	2000	55
E039.1	7/8/2017 13:33	UF	WT_LAP-17-133401	SSC	1800	49
E039.1	7/8/2017 13:33	UF	WT_LAP-17-134344	SSC	1900	49
E039.1	7/8/2017 13:35	UF	WT_LAP-17-134345	SSC	1700	43
E039.1	7/8/2017 13:35	UF	WT_LAP-17-133464	Estimated	1700	43
E039.1	7/8/2017 13:37	UF	WT_LAP-17-134346	SSC	1700	40
E039.1	7/8/2017 13:37	F	WT_LAP-17-133764	Estimated	1700	40
E039.1	7/8/2017 13:37	F	WT_LAP-17-133824	Estimated	1700	40
E039.1	7/8/2017 13:37	UF	WT_LAP-17-133884	Estimated	1700	40
E039.1	7/8/2017 13:37	UF	WT_LAP-17-133584	Estimated	1700	40
E039.1	7/8/2017 13:39	UF	WT_LAP-17-134347	SSC	1500	36
E039.1	7/8/2017 13:41	UF	WT_LAP-17-134348	SSC	1400	33
E039.1	7/8/2017 13:41	F	WT_LAP-17-133524	Estimated	1400	33
E039.1	7/8/2017 13:43	UF	WT_LAP-17-134349	SSC	1400	29
E039.1	7/8/2017 13:43	UF	WT_LAP-17-134213	Estimated	1400	29
E039.1	7/8/2017 13:45	UF	WT_LAP-17-134350	SSC	1300	25
E039.1	7/8/2017 13:45	UF	WT_LAP-17-134112	Estimated	1300	25
E039.1	7/8/2017 13:47	UF	WT_LAP-17-134351	SSC	1300	23
E039.1	7/8/2017 13:47	UF	WT_LAP-17-133984	Estimated	1300	23
E039.1	7/8/2017 13:49	UF	WT_LAP-17-134352	SSC	1200	20
E039.1	7/8/2017 13:49	UF	WT_LAP-17-134044	Estimated	1200	20
E039.1	7/8/2017 13:51	UF	WT_LAP-17-134353	SSC	1100	18
E039.1	7/8/2017 13:51	UF	WT_LAP-17-134363	SSC	1100	18
E039.1	7/8/2017 13:53	UF	WT_LAP-17-134354	SSC	1000	16
E039.1	7/8/2017 14:13	UF	WT_LAP-17-134355	SSC	600	5.5
E039.1	7/8/2017 14:33	UF	WT_LAP-17-134356	SSC	500	2.2
E039.1	7/8/2017 14:53	UF	WT_LAP-17-134357	SSC	400	1.1
E039.1	7/26/2017 11:48	UF	WT_LAP-17-133659	SSC	3400	90
E039.1	7/26/2017 11:50	UF	WT_LAP-17-134509	SSC	3100	150
E039.1	7/26/2017 11:52	UF	WT_LAP-17-134510	SSC	2800	130
E039.1	7/26/2017 11:54	UF	WT_LAP-17-134511	SSC	2400	110
E039.1	7/26/2017 11:56	UF	WT_LAP-17-134512	SSC	2200	94
E039.1	7/26/2017 11:58	UF	WT_LAP-17-133416	SSC	1900	81
E039.1	7/26/2017 11:58	UF	WT_LAP-17-134513	SSC	1900	81
E039.1	7/26/2017 12:00	UF	WT_LAP-17-134514	SSC	1700	67
E039.1	7/26/2017 12:00	UF	WT_LAP-17-133479	Estimated	1700	67
E039.1	7/26/2017 12:02	UF	WT_LAP-17-134515	SSC	1600	58

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
E039.1	7/26/2017 12:02	UF	WT_LAP-17-133599	Estimated	1600	58
E039.1	7/26/2017 12:02	UF	WT_LAP-17-133899	Estimated	1600	58
E039.1	7/26/2017 12:02	F	WT_LAP-17-133839	Estimated	1600	58
E039.1	7/26/2017 12:02	F	WT_LAP-17-133779	Estimated	1600	58
E039.1	7/26/2017 12:04	UF	WT_LAP-17-134516	SSC	1500	48
E039.1	7/26/2017 12:06	UF	WT_LAP-17-134517	SSC	1400	41
E039.1	7/26/2017 12:06	F	WT_LAP-17-133539	Estimated	1400	41
E039.1	7/26/2017 12:06	UF	WT_LAP-17-134127	Estimated	1400	41
E039.1	7/26/2017 12:08	UF	WT_LAP-17-134518	SSC	1200	36
E039.1	7/26/2017 12:08	UF	WT_LAP-17-134228	Estimated	1200	36
E039.1	7/26/2017 12:10	UF	WT_LAP-17-134519	SSC	1200	31
E039.1	7/26/2017 12:12	UF	WT_LAP-17-134520	SSC	1100	28
E039.1	7/26/2017 12:12	UF	WT_LAP-17-133999	Estimated	1100	28
E039.1	7/26/2017 12:14	UF	WT_LAP-17-134521	SSC	1000	24
E039.1	7/26/2017 12:14	UF	WT_LAP-17-134059	Estimated	1000	24
E039.1	7/26/2017 12:16	UF	WT_LAP-17-134522	SSC	900	21
E039.1	7/26/2017 12:16	UF	WT_LAP-17-134531	SSC	1000	21
E039.1	7/26/2017 12:18	UF	WT_LAP-17-134523	SSC	900	19
E039.1	7/26/2017 12:38	UF	WT_LAP-17-134524	SSC	600	6.2
E039.1	7/26/2017 12:58	UF	WT_LAP-17-134525	SSC	400	2.3
E039.1	7/26/2017 13:18	UF	WT_LAP-17-134526	SSC	400	1.3
E039.1	7/29/2017 19:53	UF	WT_LAP-17-133674	SSC	1400	22
E039.1	7/29/2017 19:55	UF	WT_LAP-17-134676	SSC	1200	37
E039.1	7/29/2017 19:57	UF	WT_LAP-17-134677	SSC	1100	40
E039.1	7/29/2017 19:59	UF	WT_LAP-17-134678	SSC	1000	43
E039.1	7/29/2017 20:01	UF	WT_LAP-17-134679	SSC	800	43
E039.1	7/29/2017 20:03	UF	WT_LAP-17-134680	SSC	800	40
E039.1	7/29/2017 20:05	UF	WT_LAP-17-134681	SSC	700	37
E039.1	7/29/2017 20:07	UF	WT_LAP-17-134682	SSC	600	33
E039.1	7/29/2017 20:08	UF	WT_LAP-17-133431	SSC	600	31
E039.1	7/29/2017 20:09	UF	WT_LAP-17-134683	SSC	600	29
E039.1	7/29/2017 20:10	UF	WT_LAP-17-133494	Estimated	550	26
E039.1	7/29/2017 20:11	UF	WT_LAP-17-134684	SSC	500	25
E039.1	7/29/2017 20:12	UF	WT_LAP-17-133914	Estimated	500	24
E039.1	7/29/2017 20:12	F	WT_LAP-17-133854	Estimated	500	24
E039.1	7/29/2017 20:12	F	WT_LAP-17-133794	Estimated	500	24
E039.1	7/29/2017 20:12	UF	WT_LAP-17-133614	Estimated	500	24
E039.1	7/29/2017 20:13	UF	WT_LAP-17-134685	SSC	500	23

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
E039.1	7/29/2017 20:15	UF	WT_LAP-17-134686	SSC	500	20
E039.1	7/29/2017 20:16	F	WT_LAP-17-133554	Estimated	450	19
E039.1	7/29/2017 20:17	UF	WT_LAP-17-134687	SSC	400	18
E039.1	7/29/2017 20:18	UF	WT_LAP-17-134243	Estimated	400	17
E039.1	7/29/2017 20:19	UF	WT_LAP-17-134688	SSC	400	16
E039.1	7/29/2017 20:20	UF	WT_LAP-17-134142	Estimated	400	15
E039.1	7/29/2017 20:21	UF	WT_LAP-17-134689	SSC	400	15
E039.1	7/29/2017 20:22	UF	WT_LAP-17-134074	Estimated	400	14
E039.1	7/29/2017 20:22	UF	WT_LAP-17-134014	Estimated	400	14
E039.1	7/29/2017 20:23	UF	WT_LAP-17-134690	SSC	400	14
E039.1	7/29/2017 20:26	UF	WT_LAP-17-134699	SSC	300	12
E039.1	7/29/2017 20:43	UF	WT_LAP-17-134691	SSC	100	5.5
E039.1	7/29/2017 21:03	UF	WT_LAP-17-134692	SSC	200	2.6
E039.1	7/29/2017 21:23	UF	WT_LAP-17-134693	SSC	200	1.6
E039.1	8/7/2017 12:28	UF	WT_LAP-17-133689	SSC	700	11
E039.1	8/7/2017 12:30	UF	WT_LAP-17-134844	SSC	700	18
E039.1	8/7/2017 12:32	UF	WT_LAP-17-134845	SSC	600	18
E039.1	8/7/2017 12:34	UF	WT_LAP-17-134846	SSC	500	18
E039.1	8/7/2017 12:36	UF	WT_LAP-17-134847	SSC	500	17
E039.1	8/7/2017 12:38	UF	WT_LAP-17-133446	SSC	400	16
E039.1	8/7/2017 12:38	UF	WT_LAP-17-134848	SSC	500	16
E039.1	8/7/2017 12:40	UF	WT_LAP-17-134849	SSC	500	14
E039.1	8/7/2017 12:40	UF	WT_LAP-17-133509	Estimated	500	14
E039.1	8/7/2017 12:42	UF	WT_LAP-17-134850	SSC	500	13
E039.1	8/7/2017 12:42	UF	WT_LAP-17-133929	Estimated	500	13
E039.1	8/7/2017 12:42	F	WT_LAP-17-133869	Estimated	500	13
E039.1	8/7/2017 12:42	F	WT_LAP-17-133809	Estimated	500	13
E039.1	8/7/2017 12:42	UF	WT_LAP-17-133629	Estimated	500	13
E039.1	8/7/2017 12:44	UF	WT_LAP-17-134851	SSC	400	12
E039.1	8/7/2017 12:46	UF	WT_LAP-17-134852	SSC	400	11
E039.1	8/7/2017 12:46	F	WT_LAP-17-133569	Estimated	400	11
E039.1	8/7/2017 12:48	UF	WT_LAP-17-134853	SSC	400	10
E039.1	8/7/2017 12:48	UF	WT_LAP-17-134258	Estimated	400	10
E039.1	8/7/2017 12:50	UF	WT_LAP-17-134854	SSC	400	9.1
E039.1	8/7/2017 12:50	UF	WT_LAP-17-134157	Estimated	400	9.1
E039.1	8/7/2017 12:52	UF	WT_LAP-17-134855	SSC	300	8.2
E039.1	8/7/2017 12:52	UF	WT_LAP-17-134029	Estimated	300	8.2
E039.1	8/7/2017 12:54	UF	WT_LAP-17-134856	SSC	300	7.4

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
E039.1	8/7/2017 12:54	UF	WT_LAP-17-134089	Estimated	300	7.4
E039.1	8/7/2017 12:56	UF	WT_LAP-17-134857	SSC	400	6.7
E039.1	8/7/2017 12:56	UF	WT_LAP-17-134867	SSC	300	6.7
E039.1	8/7/2017 12:58	UF	WT_LAP-17-134858	SSC	300	6.1
E039.1	8/7/2017 13:18	UF	WT_LAP-17-134859	SSC	300	2.6
E039.1	8/7/2017 13:38	UF	WT_LAP-17-134860	SSC	200	1.3
E040	7/8/2017 14:19	UF	WT_LAP-17-135616	SSC	3600	18
E040	7/8/2017 14:21	UF	WT_LAP-17-133462	Estimated	2400	16
E040	7/8/2017 14:23	UF	WT_LAP-17-133672	SSC	1100	15
E040	7/8/2017 14:23	UF	WT_LAP-17-133882	Estimated	1100	15
E040	7/8/2017 14:23	UF	WT_LAP-17-133582	Estimated	1100	15
E040	7/8/2017 14:23	F	WT_LAP-17-133822	Estimated	1100	15
E040	7/8/2017 14:23	F	WT_LAP-17-133762	Estimated	1100	15
E040	7/8/2017 14:27	F	WT_LAP-17-133522	Estimated	1400	12
E040	7/8/2017 14:29	UF	WT_LAP-17-134211	Estimated	1600	11
E040	7/8/2017 14:31	UF	WT_LAP-17-134110	Estimated	1800	11
E040	7/8/2017 14:33	UF	WT_LAP-17-133982	Estimated	2000	9.6
E040	7/8/2017 14:35	UF	WT_LAP-17-134042	Estimated	2100	8.6
E040	7/8/2017 14:37	UF	WT_LAP-17-133642	SSC	2300	8.2
E040	7/26/2017 12:24	UF	WT_LAP-17-133414	SSC	5700	75
E040	7/26/2017 12:26	UF	WT_LAP-17-133477	Estimated	5500	67
E040	7/26/2017 12:28	UF	WT_LAP-17-133897	Estimated	5200	60
E040	7/26/2017 12:28	F	WT_LAP-17-133837	Estimated	5200	60
E040	7/26/2017 12:28	F	WT_LAP-17-133777	Estimated	5200	60
E040	7/26/2017 12:28	UF	WT_LAP-17-133597	Estimated	5200	60
E040	7/26/2017 12:32	F	WT_LAP-17-133537	Estimated	4700	48
E040	7/26/2017 12:34	UF	WT_LAP-17-134226	Estimated	4500	44
E040	7/26/2017 12:36	UF	WT_LAP-17-134125	Estimated	4200	40
E040	7/26/2017 12:38	UF	WT_LAP-17-133997	Estimated	4000	37
E040	7/26/2017 12:40	UF	WT_LAP-17-134057	Estimated	3700	34
E040	7/26/2017 12:42	UF	WT_LAP-17-133657	SSC	3500	32
E040	9/27/2017 19:09	UF	WT_LAP-17-133429	SSC	1500	30
E040	9/27/2017 19:11	UF	WT_LAP-17-133492	Estimated	1500	29
E040	9/27/2017 19:13	F	WT_LAP-17-133852	Estimated	1500	28
E040	9/27/2017 19:13	F	WT_LAP-17-133792	Estimated	1500	28
E040	9/27/2017 19:13	UF	WT_LAP-17-133912	Estimated	1500	28
E040	9/27/2017 19:13	UF	WT_LAP-17-133612	Estimated	1500	28
E040	9/27/2017 19:17	F	WT_LAP-17-133552	Estimated	1500	26

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
E040	9/27/2017 19:19	UF	WT_LAP-17-134241	Estimated	1500	25
E040	9/27/2017 19:21	UF	WT_LAP-17-134140	Estimated	1500	24
E040	9/27/2017 19:23	UF	WT_LAP-17-134012	Estimated	1500	23
E040	9/27/2017 19:25	UF	WT_LAP-17-134072	Estimated	1500	22
E040	9/28/2017 22:14	UF	WT_LAP-17-133444	SSC	900	2.5
E040	9/28/2017 22:16	UF	WT_LAP-17-133507	Estimated	840	2.3
E040	9/28/2017 22:18	UF	WT_LAP-17-133927	Estimated	790	2.2
E040	9/28/2017 22:18	F	WT_LAP-17-133807	Estimated	790	2.2
E040	9/28/2017 22:18	F	WT_LAP-17-133867	Estimated	790	2.2
E040	9/28/2017 22:18	UF	WT_LAP-17-133627	Estimated	790	2.2
E040	9/28/2017 22:22	F	WT_LAP-17-133567	Estimated	680	1.9
E040	9/28/2017 22:24	UF	WT_LAP-17-134256	Estimated	620	1.8
E040	9/28/2017 22:26	UF	WT_LAP-17-134155	Estimated	570	1.8
E040	9/28/2017 22:28	UF	WT_LAP-17-134027	Estimated	510	1.8
E040	9/28/2017 22:30	UF	WT_LAP-17-134087	Estimated	460	1.9
E040	9/28/2017 22:32	UF	WT_LAP-17-133687	SSC	400	1.8
E042.1	7/26/2017 13:16	UF	WT_LAP-17-134414	SSC	13,000	24
E042.1	7/26/2017 13:18	UF	WT_LAP-17-134415	SSC	13,000	27
E042.1	7/26/2017 13:20	UF	WT_LAP-17-134416	SSC	12,000	29
E042.1	7/26/2017 13:22	UF	WT_LAP-17-134417	SSC	12,000	29
E042.1	7/26/2017 13:24	UF	WT_LAP-17-134418	SSC	12,000	30
E042.1	7/26/2017 13:26	UF	WT_LAP-17-134419	SSC	12,000	30
E042.1	7/26/2017 13:28	UF	WT_LAP-17-134420	SSC	11,000	29
E042.1	7/26/2017 13:30	UF	WT_LAP-17-134421	SSC	11,000	29
E042.1	7/26/2017 13:32	UF	WT_LAP-17-134989	Estimated	10,400	28
E042.1	7/26/2017 13:34	UF	WT_LAP-17-134422	SSC	9900	27
E042.1	7/26/2017 13:34	UF	WT_LAP-17-133405	SSC	11,000	27
E042.1	7/26/2017 13:34	UF	WT_LAP-17-133960	Estimated	n/a	27
E042.1	7/26/2017 13:36	UF	WT_LAP-17-133468	Estimated	10,000	25
E042.1	7/26/2017 13:36	UF	WT_LAP-17-135017	Estimated	10,000	25
E042.1	7/26/2017 13:38	UF	WT_LAP-17-133888	Estimated	9100	23
E042.1	7/26/2017 13:38	UF	WT_LAP-17-133588	Estimated	9100	23
E042.1	7/26/2017 13:38	F	WT_LAP-17-133768	Estimated	9100	23
E042.1	7/26/2017 13:38	F	WT_LAP-17-133828	Estimated	9100	23
E042.1	7/26/2017 13:40	UF	WT_LAP-17-134424	SSC	8300	21
E042.1	7/26/2017 13:42	UF	WT_LAP-17-134425	SSC	7700	20
E042.1	7/26/2017 13:42	F	WT_LAP-17-133528	Estimated	7700	20
E042.1	7/26/2017 13:44	UF	WT_LAP-17-134426	SSC	7200	18

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
E042.1	7/26/2017 13:46	UF	WT_LAP-17-134116	Estimated	6900	17
E042.1	7/26/2017 13:48	UF	WT_LAP-17-133988	Estimated	6700	16
E042.1	7/26/2017 14:04	UF	WT_LAP-17-134427	SSC	4500	10
E042.1	7/26/2017 14:24	UF	WT_LAP-17-134428	SSC	3200	6.9
E042.1	7/26/2017 14:24	UF	WT_LAP-17-133941	Estimated	3200	6.9
E042.1	7/26/2017 14:26	UF	WT_LAP-17-134048	Estimated	3100	6.6
E042.1	7/26/2017 14:44	UF	WT_LAP-17-134429	SSC	2600	4.6
E042.1	7/26/2017 15:04	UF	WT_LAP-17-134430	SSC	2100	3.3
E042.1	7/26/2017 15:24	UF	WT_LAP-17-134431	SSC	1700	2
E042.1	7/26/2017 15:44	UF	WT_LAP-17-134432	SSC	1400	1.6
E042.1	7/26/2017 16:04	UF	WT_LAP-17-134433	SSC	1100	1.6
E042.1	7/26/2017 16:24	UF	WT_LAP-17-134434	SSC	900	1.4
E042.1	9/27/2017 20:14	UF	WT_LAP-17-134581	SSC	5600	15
E042.1	9/27/2017 20:16	UF	WT_LAP-17-134582	SSC	5200	17
E042.1	9/27/2017 20:18	UF	WT_LAP-17-134583	SSC	4900	18
E042.1	9/27/2017 20:20	UF	WT_LAP-17-134584	SSC	4700	18
E042.1	9/27/2017 20:22	UF	WT_LAP-17-134585	SSC	4700	19
E042.1	9/27/2017 20:24	UF	WT_LAP-17-134586	SSC	4200	19
E042.1	9/27/2017 20:26	UF	WT_LAP-17-134587	SSC	3900	19
E042.1	9/27/2017 20:28	UF	WT_LAP-17-134588	SSC	3500	18
E042.1	9/27/2017 20:30	UF	WT_LAP-17-134589	SSC	3300	18
E042.1	9/27/2017 20:32	UF	WT_LAP-17-134590	SSC	3000	18
E042.1	9/27/2017 20:34	UF	WT_LAP-17-134591	SSC	2600	18
E042.1	9/27/2017 20:34	UF	WT_LAP-17-133420	SSC	3100	18
E042.1	9/27/2017 20:36	UF	WT_LAP-17-134592	SSC	2500	17
E042.1	9/27/2017 20:36	UF	WT_LAP-17-133483	Estimated	2500	17
E042.1	9/27/2017 20:38	UF	WT_LAP-17-134593	SSC	2500	17
E042.1	9/27/2017 20:38	UF	WT_LAP-17-133903	Estimated	2500	17
E042.1	9/27/2017 20:38	F	WT_LAP-17-133843	Estimated	2500	17
E042.1	9/27/2017 20:38	F	WT_LAP-17-133783	Estimated	2500	17
E042.1	9/27/2017 20:38	UF	WT_LAP-17-133603	Estimated	2500	17
E042.1	9/27/2017 20:40	UF	WT_LAP-17-134594	SSC	2400	17
E042.1	9/27/2017 20:42	UF	WT_LAP-17-134595	SSC	1800	17
E042.1	9/27/2017 20:42	F	WT_LAP-17-133543	Estimated	1800	17
E042.1	9/27/2017 20:44	UF	WT_LAP-17-134596	SSC	1300	17
E042.1	9/27/2017 20:44	UF	WT_LAP-17-133965	Estimated	1300	17
E042.1	9/27/2017 20:46	UF	WT_LAP-17-134131	Estimated	1600	17
E042.1	9/27/2017 20:48	UF	WT_LAP-17-134003	Estimated	1800	17

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
E042.1	9/27/2017 20:52	UF	WT_LAP-17-134603	SSC	2400	16
E042.1	9/27/2017 21:04	UF	WT_LAP-17-134597	SSC	1200	14
E042.1	9/27/2017 21:24	UF	WT_LAP-17-134598	SSC	1000	10
E042.1	9/27/2017 21:24	UF	WT_LAP-17-133946	Estimated	1000	10
E042.1	9/27/2017 21:26	UF	WT_LAP-17-134063	Estimated	1100	9.8
E042.1	9/27/2017 21:44	UF	WT_LAP-17-134599	SSC	1800	8.2
E042.1	9/27/2017 22:04	UF	WT_LAP-17-134600	SSC	3400	7
E042.1	9/27/2017 22:24	UF	WT_LAP-17-134601	SSC	2100	16
E042.1	9/27/2017 22:44	UF	WT_LAP-17-134602	SSC	1600	24
E042.1	9/27/2017 23:04	UF	WT_LAP-17-134990	Estimated	1600	20
E042.1	9/27/2017 23:24	UF	WT_LAP-17-135018	Estimated	1600	16
E042.1	9/29/2017 0:44	UF	WT_LAP-17-134749	SSC	9200	34
E042.1	9/29/2017 0:46	UF	WT_LAP-17-134750	SSC	9000	43
E042.1	9/29/2017 0:48	UF	WT_LAP-17-134751	SSC	9100	46
E042.1	9/29/2017 0:50	UF	WT_LAP-17-134752	SSC	8400	49
E042.1	9/29/2017 0:52	UF	WT_LAP-17-134753	SSC	7600	50
E042.1	9/29/2017 0:54	UF	WT_LAP-17-134754	SSC	7200	50
E042.1	9/29/2017 0:56	UF	WT_LAP-17-134755	SSC	6500	49
E042.1	9/29/2017 0:58	UF	WT_LAP-17-134756	SSC	6100	46
E042.1	9/29/2017 1:00	UF	WT_LAP-17-134757	SSC	5700	43
E042.1	9/29/2017 1:02	UF	WT_LAP-17-134991	Estimated	5400	45
E042.1	9/29/2017 1:04	UF	WT_LAP-17-134758	SSC	5200	46
E042.1	9/29/2017 1:04	UF	WT_LAP-17-133435	SSC	6100	46
E042.1	9/29/2017 1:06	UF	WT_LAP-17-133498	Estimated	5600	46
E042.1	9/29/2017 1:06	UF	WT_LAP-17-135019	Estimated	5600	46
E042.1	9/29/2017 1:08	UF	WT_LAP-17-134759	SSC	5100	45
E042.1	9/29/2017 1:08	UF	WT_LAP-17-133918	Estimated	5100	45
E042.1	9/29/2017 1:08	F	WT_LAP-17-133858	Estimated	5100	45
E042.1	9/29/2017 1:08	F	WT_LAP-17-133798	Estimated	5100	45
E042.1	9/29/2017 1:08	UF	WT_LAP-17-133618	Estimated	5100	45
E042.1	9/29/2017 1:10	UF	WT_LAP-17-134760	SSC	5000	44
E042.1	9/29/2017 1:12	UF	WT_LAP-17-134761	SSC	5100	44
E042.1	9/29/2017 1:12	F	WT_LAP-17-133558	Estimated	5100	44
E042.1	9/29/2017 1:14	UF	WT_LAP-17-134762	SSC	5100	44
E042.1	9/29/2017 1:14	UF	WT_LAP-17-133970	Estimated	5100	44
E042.1	9/29/2017 1:16	UF	WT_LAP-17-134146	Estimated	5400	43
E042.1	9/29/2017 1:18	UF	WT_LAP-17-134018	Estimated	5700	42
E042.1	9/29/2017 1:22	UF	WT_LAP-17-134771	SSC	6300	41

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
E042.1	9/29/2017 1:34	UF	WT_LAP-17-134763	SSC	5500	43
E042.1	9/29/2017 1:54	UF	WT_LAP-17-134764	SSC	3700	34
E042.1	9/29/2017 1:54	UF	WT_LAP-17-133951	Estimated	3700	34
E042.1	9/29/2017 1:56	UF	WT_LAP-17-134078	Estimated	3600	33
E042.1	9/29/2017 2:14	UF	WT_LAP-17-134765	SSC	3100	34
E042.1	9/29/2017 2:34	UF	WT_LAP-17-134766	SSC	2500	33
E042.1	9/29/2017 2:54	UF	WT_LAP-17-134767	SSC	2300	32
E042.1	9/29/2017 3:14	UF	WT_LAP-17-134768	SSC	2100	21
E042.1	9/29/2017 3:34	UF	WT_LAP-17-134769	SSC	1700	15
E042.1	9/29/2017 3:54	UF	WT_LAP-17-134770	SSC	1300	12
E042.1	10/4/2017 22:04	UF	WT_LAP-17-134917	SSC	61,000	8.5
E042.1	10/4/2017 22:06	UF	WT_LAP-17-134918	SSC	58,000	10
E042.1	10/4/2017 22:08	UF	WT_LAP-17-134919	SSC	53,000	9.6
E042.1	10/4/2017 22:10	UF	WT_LAP-17-134920	SSC	46,000	9
E042.1	10/4/2017 22:12	UF	WT_LAP-17-134921	SSC	41,000	8
E042.1	10/4/2017 22:14	UF	WT_LAP-17-134922	SSC	38,000	6.9
E042.1	10/4/2017 22:14	UF	WT_LAP-17-133450	SSC	38,000	6.9
E042.1	10/4/2017 22:16	UF	WT_LAP-17-134923	SSC	34,000	6.1
E042.1	10/4/2017 22:16	UF	WT_LAP-17-133513	Estimated	34,000	6.1
E042.1	10/4/2017 22:18	UF	WT_LAP-17-134924	SSC	32,000	5.5
E042.1	10/4/2017 22:18	UF	WT_LAP-17-133933	Estimated	32,000	5.5
E042.1	10/4/2017 22:18	UF	WT_LAP-17-133633	Estimated	32,000	5.5
E042.1	10/4/2017 22:18	F	WT_LAP-17-133813	Estimated	32,000	5.5
E042.1	10/4/2017 22:18	F	WT_LAP-17-133873	Estimated	32,000	5.5
E042.1	10/4/2017 22:20	UF	WT_LAP-17-134925	SSC	30,000	4.9
E042.1	10/4/2017 22:22	UF	WT_LAP-17-134992	Estimated	28,000	4.5
E042.1	10/4/2017 22:23	F	WT_LAP-17-133573	Estimated	27,000	4.3
E042.1	10/4/2017 22:24	UF	WT_LAP-17-134926	SSC	26,000	4
E042.1	10/4/2017 22:25	UF	WT_LAP-17-133975	Estimated	25,000	3.8
E042.1	10/4/2017 22:26	UF	WT_LAP-17-135020	Estimated	24,000	3.6
E042.1	10/4/2017 22:28	UF	WT_LAP-17-134927	SSC	22,000	3.2
E042.1	10/4/2017 22:28	UF	WT_LAP-17-134161	Estimated	22,000	3.2
E042.1	10/4/2017 22:30	UF	WT_LAP-17-134928	SSC	21,000	2.8
E042.1	10/4/2017 22:30	UF	WT_LAP-17-134033	Estimated	21,000	2.8
E042.1	10/4/2017 22:31	UF	WT_LAP-17-134939	SSC	20,000	2.7
E042.1	10/4/2017 22:32	UF	WT_LAP-17-134929	SSC	20,000	2.6
E042.1	10/4/2017 22:34	UF	WT_LAP-17-134930	SSC	18,000	2.3
E042.1	10/4/2017 22:54	UF	WT_LAP-17-134931	SSC	12,000	39

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
E042.1	10/4/2017 23:04	UF	WT_LAP-17-133956	Estimated	9300	36
E042.1	10/4/2017 23:06	UF	WT_LAP-17-134093	Estimated	8800	36
E042.1	10/4/2017 23:14	UF	WT_LAP-17-134932	SSC	6800	32
E042.1	10/4/2017 23:34	UF	WT_LAP-17-134933	SSC	5100	17
E042.1	10/4/2017 23:54	UF	WT_LAP-17-134934	SSC	3800	13
E042.1	10/5/2017 0:14	UF	WT_LAP-17-134935	SSC	3000	8.8
E042.1	10/5/2017 0:34	UF	WT_LAP-17-134936	SSC	1700	7
E042.1	10/5/2017 0:54	UF	WT_LAP-17-134937	SSC	8700	9.8
E042.1	10/5/2017 1:14	UF	WT_LAP-17-134938	SSC	3100	17
E050.1	9/27/2017 22:29	UF	WT_LAP-17-134438	SSC	800	4.3
E050.1	9/27/2017 22:31	UF	WT_LAP-17-134439	SSC	700	5.8
E050.1	9/27/2017 22:35	UF	WT_LAP-17-134440	SSC	900	7.2
E050.1	9/27/2017 22:38	UF	WT_LAP-17-134441	SSC	900	8.9
E050.1	9/27/2017 22:42	UF	WT_LAP-17-134442	SSC	900	12
E050.1	9/27/2017 22:43	UF	WT_LAP-17-134443	SSC	900	12
E050.1	9/27/2017 22:45	UF	WT_LAP-17-134444	SSC	900	14
E050.1	9/27/2017 22:46	UF	WT_LAP-17-135029	Estimated	900	15
E050.1	9/27/2017 22:48	UF	WT_LAP-17-134445	SSC	900	16
E050.1	9/27/2017 22:50	UF	WT_LAP-17-135021	Estimated	940	17
E050.1	9/27/2017 22:53	UF	WT_LAP-17-134446	SSC	1000	20
E050.1	9/27/2017 22:55	UF	WT_LAP-17-134447	Estimated	970	21
E050.1	9/27/2017 22:55	UF	WT_LAP-17-134993	Estimated	970	21
E050.1	9/27/2017 22:55	NA	WT_LAP-17-134994	Estimated	970	21
E050.1	9/27/2017 22:55	F	WT_LAP-17-133530	Estimated	970	21
E050.1	9/27/2017 22:59	UF	WT_LAP-17-134450	SSC	900	25
E050.1	9/27/2017 23:19	UF	WT_LAP-17-134451	SSC	800	32
E050.1	9/27/2017 23:23	UF	WT_LAP-17-133407	SSC	700	32
E050.1	9/27/2017 23:25	UF	WT_LAP-17-133470	Estimated	700	32
E050.1	9/27/2017 23:27	UF	WT_LAP-17-133590	Estimated	700	32
E050.1	9/27/2017 23:27	F	WT_LAP-17-133770	Estimated	700	32
E050.1	9/27/2017 23:27	UF	WT_LAP-17-133890	Estimated	700	32
E050.1	9/27/2017 23:27	F	WT_LAP-17-133830	Estimated	700	32
E050.1	9/27/2017 23:29	F	WT_LAP-17-134995	Estimated	700	32
E050.1	9/27/2017 23:31	UF	WT_LAP-17-133962	Estimated	700	32
E050.1	9/27/2017 23:33	UF	WT_LAP-17-134118	Estimated	700	32
E050.1	9/27/2017 23:35	UF	WT_LAP-17-134099	Estimated	700	32
E050.1	9/27/2017 23:37	UF	WT_LAP-17-133990	Estimated	700	32
E050.1	9/27/2017 23:39	UF	WT_LAP-17-134452	SSC	700	32

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
E050.1	9/27/2017 23:59	UF	WT_LAP-17-134453	SSC	700	26
E050.1	9/28/2017 0:13	UF	WT_LAP-17-133942	Estimated	630	24
E050.1	9/28/2017 0:15	UF	WT_LAP-17-134050	Estimated	620	23
E050.1	9/28/2017 0:19	UF	WT_LAP-17-134454	SSC	600	23
E050.1	9/28/2017 0:39	UF	WT_LAP-17-134455	SSC	600	22
E050.1	9/28/2017 0:59	UF	WT_LAP-17-134456	SSC	600	21
E050.1	9/28/2017 1:19	UF	WT_LAP-17-134457	SSC	500	19
E050.1	9/28/2017 1:39	UF	WT_LAP-17-134458	SSC	500	18
E050.1	9/29/2017 0:51	UF	WT_LAP-17-135023	Estimated	500	9.2
E050.1	9/29/2017 0:55	UF	WT_LAP-17-135031	Estimated	500	14
E050.1	9/29/2017 0:56	UF	WT_LAP-17-134614	SSC	500	15
E050.1	9/29/2017 0:59	UF	WT_LAP-17-134615	SSC	900	20
E050.1	9/29/2017 0:59	F	WT_LAP-17-135001	Estimated	900	20
E050.1	9/29/2017 0:59	UF	WT_LAP-17-134999	Estimated	900	20
E050.1	9/29/2017 0:59	NA	WT_LAP-17-135000	Estimated	900	20
E050.1	9/29/2017 1:39	UF	WT_LAP-17-134620	SSC	1800	55
E050.1	9/29/2017 1:53	UF	WT_LAP-17-133422	SSC	1800	55
E050.1	9/29/2017 1:55	UF	WT_LAP-17-133485	Estimated	1800	55
E050.1	9/29/2017 1:57	UF	WT_LAP-17-133905	Estimated	1800	54
E050.1	9/29/2017 1:57	F	WT_LAP-17-133845	Estimated	1800	54
E050.1	9/29/2017 1:57	F	WT_LAP-17-133785	Estimated	1800	54
E050.1	9/29/2017 1:57	UF	WT_LAP-17-133605	Estimated	1800	54
E050.1	9/29/2017 1:59	UF	WT_LAP-17-134621	SSC	1800	54
E050.1	9/29/2017 2:01	UF	WT_LAP-17-133967	Estimated	1800	53
E050.1	9/29/2017 2:01	F	WT_LAP-17-133545	Estimated	1800	53
E050.1	9/29/2017 2:03	UF	WT_LAP-17-134133	Estimated	1700	53
E050.1	9/29/2017 2:05	UF	WT_LAP-17-134101	Estimated	1700	52
E050.1	9/29/2017 2:09	UF	WT_LAP-17-134005	Estimated	1600	50
E050.1	9/29/2017 2:11	UF	WT_LAP-17-134627	SSC	1600	50
E050.1	9/29/2017 2:19	UF	WT_LAP-17-134622	SSC	1500	48
E050.1	9/29/2017 2:39	UF	WT_LAP-17-134623	SSC	1300	48
E050.1	9/29/2017 2:43	UF	WT_LAP-17-133947	Estimated	1300	48
E050.1	9/29/2017 2:45	UF	WT_LAP-17-134065	Estimated	1300	48
E050.1	9/29/2017 2:59	UF	WT_LAP-17-134624	SSC	1200	48
E050.1	9/29/2017 3:19	UF	WT_LAP-17-134625	SSC	1100	44
E050.1	9/29/2017 3:39	UF	WT_LAP-17-134626	SSC	900	38
E050.1	10/4/2017 23:13	UF	WT_LAP-17-134774	SSC	2500	10
E050.1	10/4/2017 23:15	UF	WT_LAP-17-134775	SSC	2600	14

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
E050.1	10/4/2017 23:17	UF	WT_LAP-17-134776	SSC	2600	17
E050.1	10/4/2017 23:19	UF	WT_LAP-17-134777	SSC	2500	20
E050.1	10/4/2017 23:21	UF	WT_LAP-17-134778	SSC	2400	23
E050.1	10/4/2017 23:23	UF	WT_LAP-17-134779	SSC	2400	24
E050.1	10/4/2017 23:25	UF	WT_LAP-17-134780	SSC	2300	26
E050.1	10/4/2017 23:27	UF	WT_LAP-17-135033	Estimated	2300	28
E050.1	10/4/2017 23:29	UF	WT_LAP-17-134781	SSC	2300	29
E050.1	10/4/2017 23:33	UF	WT_LAP-17-135025	Estimated	2200	32
E050.1	10/4/2017 23:35	UF	WT_LAP-17-134782	SSC	2200	32
E050.1	10/4/2017 23:37	UF	WT_LAP-17-134783	SSC	1700	33
E050.1	10/4/2017 23:37	F	WT_LAP-17-135007	Estimated	1700	33
E050.1	10/4/2017 23:37	NA	WT_LAP-17-135006	Estimated	1700	33
E050.1	10/4/2017 23:37	UF	WT_LAP-17-135005	Estimated	1700	33
E050.1	10/4/2017 23:41	UF	WT_LAP-17-134785	SSC	2100	34
E050.1	10/4/2017 23:43	UF	WT_LAP-17-134786	SSC	2100	34
E050.1	10/4/2017 23:58	UF	WT_LAP-17-133437	SSC	1700	34
E050.1	10/5/2017 0:00	UF	WT_LAP-17-134148	Estimated	1700	34
E050.1	10/5/2017 0:00	UF	WT_LAP-17-133500	Estimated	1700	34
E050.1	10/5/2017 0:02	F	WT_LAP-17-133800	Estimated	1700	33
E050.1	10/5/2017 0:02	UF	WT_LAP-17-133620	Estimated	1700	33
E050.1	10/5/2017 0:02	F	WT_LAP-17-133860	Estimated	1700	33
E050.1	10/5/2017 0:02	UF	WT_LAP-17-133920	Estimated	1700	33
E050.1	10/5/2017 0:03	UF	WT_LAP-17-134787	SSC	1700	33
E050.1	10/5/2017 0:04	F	WT_LAP-17-133560	Estimated	1700	32
E050.1	10/5/2017 0:05	UF	WT_LAP-17-134080	Estimated	1700	32
E050.1	10/5/2017 0:06	UF	WT_LAP-17-133972	Estimated	1600	31
E050.1	10/5/2017 0:08	UF	WT_LAP-17-134795	SSC	1600	31
E050.1	10/5/2017 0:10	UF	WT_LAP-17-134103	Estimated	1600	30
E050.1	10/5/2017 0:14	UF	WT_LAP-17-134020	Estimated	1600	28
E050.1	10/5/2017 0:23	UF	WT_LAP-17-134788	SSC	1500	26
E050.1	10/5/2017 0:43	UF	WT_LAP-17-134789	SSC	1300	21
E050.1	10/5/2017 0:48	UF	WT_LAP-17-133952	Estimated	1300	20
E050.1	10/5/2017 1:03	UF	WT_LAP-17-134790	SSC	1200	18
E050.1	10/5/2017 1:23	UF	WT_LAP-17-134791	SSC	1300	25
E050.1	10/5/2017 1:43	UF	WT_LAP-17-134792	SSC	1100	28
E050.1	10/5/2017 2:03	UF	WT_LAP-17-134793	SSC	1000	26
E050.1	10/5/2017 2:23	UF	WT_LAP-17-134794	SSC	900	22
E055	9/27/2017 19:04	UF	WT_LAP-17-133408	SSC	9000	22

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
E055	9/27/2017 19:06	UF	WT_LAP-17-133471	Estimated	8100	22
E055	9/27/2017 19:08	F	WT_LAP-17-133831	Estimated	7200	21
E055	9/27/2017 19:08	F	WT_LAP-17-133771	Estimated	7200	21
E055	9/27/2017 19:08	UF	WT_LAP-17-133591	Estimated	7200	21
E055	9/27/2017 19:12	F	WT_LAP-17-133531	Estimated	5400	22
E055	9/27/2017 19:14	UF	WT_LAP-17-133991	Estimated	4500	23
E055	9/27/2017 19:14	UF	WT_LAP-17-134299	Estimated	4500	23
E055	9/27/2017 19:14	UF	WT_LAP-17-134220	Estimated	4500	23
E055	9/27/2017 19:16	UF	WT_LAP-17-134271	Estimated	3600	24
E055	9/27/2017 19:20	UF	WT_LAP-17-133891	Estimated	1800	23
E055	9/27/2017 19:22	UF	WT_LAP-17-133651	SSC	900	24
E055	9/29/2017 0:14	UF	WT_LAP-17-133423	SSC	200	19
E055	9/29/2017 0:16	UF	WT_LAP-17-133486	Estimated	200	19
E055	9/29/2017 0:18	F	WT_LAP-17-133786	Estimated	200	19
E055	9/29/2017 0:18	UF	WT_LAP-17-133906	Estimated	200	19
E055	9/29/2017 0:18	F	WT_LAP-17-133846	Estimated	200	19
E055	9/29/2017 0:18	UF	WT_LAP-17-133606	Estimated	200	19
E055	9/29/2017 0:22	F	WT_LAP-17-133546	Estimated	200	18
E055	9/29/2017 0:24	UF	WT_LAP-17-134235	Estimated	200	17
E055	9/29/2017 0:26	UF	WT_LAP-17-134276	Estimated	200	16
E055	9/29/2017 0:28	UF	WT_LAP-17-134304	Estimated	200	16
E055	9/29/2017 0:30	UF	WT_LAP-17-134006	Estimated	200	16
E055	9/29/2017 0:32	UF	WT_LAP-17-133666	SSC	200	17
E055.5	7/26/2017 11:36	F	WT_LAP-17-133773	Estimated	2600	33
E055.5	7/26/2017 11:36	UF	WT_LAP-17-133593	Estimated	2600	33
E055.5	7/26/2017 11:38	UF	WT_LAP-17-133473	Estimated	2600	31
E055.5	7/26/2017 11:40	F	WT_LAP-17-133533	Estimated	2600	28
E055.5	7/26/2017 11:43	UF	WT_LAP-17-134300	Estimated	2600	26
E055.5	7/26/2017 11:43	UF	WT_LAP-17-134222	Estimated	2600	26
E055.5	7/26/2017 11:45	UF	WT_LAP-17-134272	Estimated	2600	24
E055.5	7/26/2017 11:47	UF	WT_LAP-17-133993	Estimated	2600	22
E055.5	7/26/2017 11:51	UF	WT_LAP-17-133653	SSC	2600	20
E055.5	7/26/2017 11:53	UF	WT_LAP-17-133893	Estimated	2200	19
E055.5	7/26/2017 11:53	F	WT_LAP-17-133833	Estimated	2200	19
E055.5	7/26/2017 11:55	UF	WT_LAP-17-133410	SSC	1800	19
E055.5	7/27/2017 20:44	UF	WT_LAP-17-133425	SSC	3300	16
E055.5	7/27/2017 20:46	UF	WT_LAP-17-133488	Estimated	3200	16
E055.5	7/27/2017 20:48	UF	WT_LAP-17-133908	Estimated	3000	16

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
E055.5	7/27/2017 20:48	UF	WT_LAP-17-133608	Estimated	3000	16
E055.5	7/27/2017 20:48	F	WT_LAP-17-133788	Estimated	3000	16
E055.5	7/27/2017 20:48	F	WT_LAP-17-133848	Estimated	3000	16
E055.5	7/27/2017 20:53	F	WT_LAP-17-133548	Estimated	2600	15
E055.5	7/27/2017 20:55	UF	WT_LAP-17-134237	Estimated	2500	15
E055.5	7/27/2017 20:55	UF	WT_LAP-17-134305	Estimated	2500	15
E055.5	7/27/2017 20:57	UF	WT_LAP-17-134277	Estimated	2300	15
E055.5	7/27/2017 20:59	UF	WT_LAP-17-134008	Estimated	2200	15
E055.5	7/27/2017 21:03	UF	WT_LAP-17-133668	SSC	1900	15
E055.5	7/29/2017 19:29	UF	WT_LAP-17-133440	SSC	31,000	30
E055.5	7/29/2017 19:31	UF	WT_LAP-17-133503	Estimated	28,000	28
E055.5	7/29/2017 19:33	UF	WT_LAP-17-133923	Estimated	26,000	26
E055.5	7/29/2017 19:33	F	WT_LAP-17-133803	Estimated	26,000	26
E055.5	7/29/2017 19:33	UF	WT_LAP-17-133623	Estimated	26,000	26
E055.5	7/29/2017 19:33	UF	WT_LAP-17-133863	Estimated	26,000	26
E055.5	7/29/2017 19:38	F	WT_LAP-17-133563	Estimated	20,000	21
E055.5	7/29/2017 19:40	UF	WT_LAP-17-134252	Estimated	17,000	20
E055.5	7/29/2017 19:40	UF	WT_LAP-17-134310	Estimated	17,000	20
E055.5	7/29/2017 19:42	UF	WT_LAP-17-134282	Estimated	15,000	19
E055.5	7/29/2017 19:46	UF	WT_LAP-17-134023	Estimated	10,000	18
E055.5	7/29/2017 19:52	UF	WT_LAP-17-133683	SSC	2900	16
E056	7/8/2017 13:40	UF	WT_LAP-17-133397	SSC	1500	1.7
E056	7/8/2017 13:42	UF	WT_LAP-17-133459	Estimated	1400	1.6
E056	7/8/2017 13:44	F	WT_LAP-17-133759	Estimated	1300	1.5
E056	7/8/2017 13:44	UF	WT_LAP-17-133579	Estimated	1300	1.5
E056	7/8/2017 13:44	F	WT_LAP-17-133819	Estimated	1300	1.5
E056	7/8/2017 13:44	UF	WT_LAP-17-133879	Estimated	1300	1.5
E056	7/8/2017 13:48	F	WT_LAP-17-133519	Estimated	1100	1.2
E056	7/8/2017 13:50	UF	WT_LAP-17-134296	Estimated	1100	1.1
E056	7/8/2017 13:50	UF	WT_LAP-17-134208	Estimated	1100	1.1
E056	7/8/2017 13:52	UF	WT_LAP-17-134268	Estimated	970	0.97
E056	7/8/2017 13:54	UF	WT_LAP-17-133979	Estimated	880	0.88
E056	7/8/2017 13:58	UF	WT_LAP-17-133639	SSC	700	0.74
E056	7/26/2017 11:35	UF	WT_LAP-17-133411	SSC	5500	9.4
E056	7/26/2017 11:37	UF	WT_LAP-17-133474	Estimated	5100	8.5
E056	7/26/2017 11:39	F	WT_LAP-17-133774	Estimated	4800	7.5
E056	7/26/2017 11:39	UF	WT_LAP-17-133594	Estimated	4800	7.5
E056	7/26/2017 11:43	F	WT_LAP-17-133534	Estimated	4000	5.5

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
E056	7/26/2017 11:45	UF	WT_LAP-17-134301	Estimated	3700	4.4
E056	7/26/2017 11:45	UF	WT_LAP-17-134223	Estimated	3700	4.4
E056	7/26/2017 11:47	UF	WT_LAP-17-134273	Estimated	3300	4
E056	7/26/2017 11:49	UF	WT_LAP-17-133994	Estimated	2900	3.5
E056	7/26/2017 11:53	UF	WT_LAP-17-133654	SSC	2200	2.9
E056	7/26/2017 11:55	UF	WT_LAP-17-133894	Estimated	2200	2.6
E056	7/26/2017 11:55	F	WT_LAP-17-133834	Estimated	2200	2.6
E056	7/29/2017 19:50	UF	WT_LAP-17-133426	SSC	2100	3.6
E056	7/29/2017 19:52	UF	WT_LAP-17-133489	Estimated	1900	3.3
E056	7/29/2017 19:54	UF	WT_LAP-17-133609	Estimated	1800	3.1
E056	7/29/2017 19:54	UF	WT_LAP-17-133909	Estimated	1800	3.1
E056	7/29/2017 19:54	F	WT_LAP-17-133849	Estimated	1800	3.1
E056	7/29/2017 19:54	F	WT_LAP-17-133789	Estimated	1800	3.1
E056	7/29/2017 19:58	F	WT_LAP-17-133549	Estimated	1400	2.6
E056	7/29/2017 20:00	UF	WT_LAP-17-134238	Estimated	1300	2.3
E056	7/29/2017 20:00	UF	WT_LAP-17-134306	Estimated	1300	2.3
E056	7/29/2017 20:02	UF	WT_LAP-17-134278	Estimated	1100	2.2
E056	7/29/2017 20:04	UF	WT_LAP-17-134009	Estimated	930	2.1
E056	7/29/2017 20:08	UF	WT_LAP-17-133669	SSC	600	1.7
E056	8/23/2017 12:20	UF	WT_LAP-17-133441	SSC	1400	3.3
E056	8/23/2017 12:22	UF	WT_LAP-17-133504	Estimated	1300	3.1
E056	8/23/2017 12:24	F	WT_LAP-17-133864	Estimated	1200	2.8
E056	8/23/2017 12:24	UF	WT_LAP-17-133924	Estimated	1200	2.8
E056	8/23/2017 12:24	UF	WT_LAP-17-133624	Estimated	1200	2.8
E056	8/23/2017 12:24	F	WT_LAP-17-133804	Estimated	1200	2.8
E056	8/23/2017 12:28	F	WT_LAP-17-133564	Estimated	1100	2.3
E056	8/23/2017 12:30	UF	WT_LAP-17-134311	Estimated	1000	2.2
E056	8/23/2017 12:30	UF	WT_LAP-17-134253	Estimated	1000	2.2
E056	8/23/2017 12:32	UF	WT_LAP-17-134283	Estimated	930	2
E056	8/23/2017 12:34	UF	WT_LAP-17-134024	Estimated	860	1.8
E056	8/23/2017 12:38	UF	WT_LAP-17-133684	SSC	700	1.5
E059.5	9/29/2017 1:30	UF	WT_LAP-17-133645	SSC	3300	57
E059.5	9/29/2017 1:33	UF	WT_LAP-17-134364	SSC	4000	60
E059.5	9/29/2017 1:35	UF	WT_LAP-17-134365	SSC	3600	61
E059.5	9/29/2017 1:38	UF	WT_LAP-17-134366	SSC	3700	57
E059.5	9/29/2017 1:40	UF	WT_LAP-17-134367	SSC	3400	55
E059.5	9/29/2017 1:43	UF	WT_LAP-17-134368	SSC	3600	50
E059.5	9/29/2017 1:45	UF	WT_LAP-17-134369	SSC	2900	47

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
E059.5	9/29/2017 1:48	UF	WT_LAP-17-134370	SSC	3200	44
E059.5	9/29/2017 1:50	UF	WT_LAP-17-134371	SSC	3500	42
E059.5	9/29/2017 1:53	UF	WT_LAP-17-134372	SSC	3300	39
E059.5	9/29/2017 1:54	UF	WT_LAP-17-133465	Estimated	3000	38
E059.5	9/29/2017 1:55	UF	WT_LAP-17-134373	SSC	2600	37
E059.5	9/29/2017 1:57	UF	WT_LAP-17-133885	Estimated	2900	35
E059.5	9/29/2017 1:57	F	WT_LAP-17-133825	Estimated	2900	35
E059.5	9/29/2017 1:57	F	WT_LAP-17-133765	Estimated	2900	35
E059.5	9/29/2017 1:57	UF	WT_LAP-17-133585	Estimated	2900	35
E059.5	9/29/2017 2:00	UF	WT_LAP-17-134378	SSC	3400	32
E059.5	9/29/2017 2:02	F	WT_LAP-17-133525	Estimated	3300	31
E059.5	9/29/2017 2:04	UF	WT_LAP-17-134297	Estimated	3200	29
E059.5	9/29/2017 2:04	UF	WT_LAP-17-134214	Estimated	3200	29
E059.5	9/29/2017 2:06	UF	WT_LAP-17-133985	Estimated	3100	27
E059.5	9/29/2017 2:06	UF	WT_LAP-17-134113	Estimated	3100	27
E059.5	9/29/2017 2:20	UF	WT_LAP-17-134379	SSC	2500	22
E059.5	9/29/2017 2:39	UF	WT_LAP-17-133939	Estimated	2600	19
E059.5	9/29/2017 2:40	UF	WT_LAP-17-134380	SSC	2600	19
E059.5	9/29/2017 2:41	UF	WT_LAP-17-134269	Estimated	2600	19
E059.5	9/29/2017 2:41	UF	WT_LAP-17-134045	Estimated	2600	19
E059.5	9/29/2017 3:00	UF	WT_LAP-17-134381	SSC	1800	19
E059.5	9/29/2017 3:20	UF	WT_LAP-17-134382	SSC	1500	21
E059.5	9/29/2017 3:40	UF	WT_LAP-17-134383	SSC	1500	16
E059.5	9/29/2017 4:00	UF	WT_LAP-17-134384	SSC	4600	13
E059.5	9/29/2017 4:20	UF	WT_LAP-17-134385	SSC	3300	8.4
E059.5	9/29/2017 4:40	UF	WT_LAP-17-134386	SSC	6700	4.8
E059.8	9/29/2017 11:14	UF	WT_LAP-17-133986	Estimated	380	0.22
E059.8	9/29/2017 11:14	UF	WT_LAP-17-134046	Estimated	380	0.22
E059.8	9/29/2017 11:18	UF	WT_LAP-17-134114	Estimated	320	0.22
E059.8	9/29/2017 11:18	UF	WT_LAP-17-134270	Estimated	320	0.22
E059.8	9/29/2017 11:19	UF	WT_LAP-17-133403	SSC	300	0.23
E059.8	9/29/2017 11:19	UF	WT_LAP-17-133940	Estimated	300	0.23
E059.8	9/29/2017 11:22	UF	WT_LAP-17-134298	Estimated	300	0.23
E059.8	9/29/2017 11:24	UF	WT_LAP-17-133466	Estimated	300	0.23
E059.8	9/29/2017 11:26	UF	WT_LAP-17-134390	SSC	300	0.23
E059.8	9/29/2017 11:28	UF	WT_LAP-17-133886	Estimated	370	0.22
E059.8	9/29/2017 11:28	F	WT_LAP-17-133826	Estimated	370	0.22
E059.8	9/29/2017 11:28	F	WT_LAP-17-133766	Estimated	370	0.22

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
E059.8	9/29/2017 11:28	UF	WT_LAP-17-133586	Estimated	370	0.22
E059.8	9/29/2017 11:29	UF	WT_LAP-17-134391	SSC	400	0.22
E059.8	9/29/2017 11:35	UF	WT_LAP-17-134392	SSC	300	0.21
E059.8	9/29/2017 11:35	UF	WT_LAP-17-134215	Estimated	300	0.21
E059.8	9/29/2017 11:35	F	WT_LAP-17-133526	Estimated	300	0.21
E059.8	9/29/2017 11:37	UF	WT_LAP-17-134393	SSC	400	0.21
E059.8	9/29/2017 11:41	UF	WT_LAP-17-134394	SSC	300	0.21
E059.8	9/29/2017 11:44	UF	WT_LAP-17-134402	SSC	300	0.21
E059.8	9/29/2017 12:04	UF	WT_LAP-17-134403	SSC	300	0.2
E059.8	9/29/2017 12:24	UF	WT_LAP-17-134404	SSC	300	0.2
E059.8	9/29/2017 12:44	UF	WT_LAP-17-134405	SSC	300	0.18
E059.8	9/29/2017 13:04	UF	WT_LAP-17-134406	SSC	300	0.18
E059.8	9/29/2017 13:24	UF	WT_LAP-17-134407	SSC	400	0.17
E059.8	9/29/2017 13:44	UF	WT_LAP-17-134408	SSC	400	0.17
E059.8	10/5/2017 0:29	UF	WT_LAP-17-133661	SSC	500	0.81
E059.8	10/5/2017 0:33	UF	WT_LAP-17-134556	SSC	500	0.86
E059.8	10/5/2017 0:37	UF	WT_LAP-17-134557	SSC	500	0.93
E059.8	10/5/2017 0:41	UF	WT_LAP-17-134558	SSC	400	1
E059.8	10/5/2017 0:44	UF	WT_LAP-17-134559	SSC	500	1
E059.8	10/5/2017 0:48	UF	WT_LAP-17-134560	SSC	400	1.2
E059.8	10/5/2017 0:52	UF	WT_LAP-17-134561	SSC	400	1.3
E059.8	10/5/2017 0:55	UF	WT_LAP-17-134562	SSC	400	1.3
E059.8	10/5/2017 0:59	UF	WT_LAP-17-134570	SSC	400	1.3
E059.8	10/5/2017 0:59	UF	WT_LAP-17-133418	SSC	400	1.3
E059.8	10/5/2017 1:04	UF	WT_LAP-17-133481	Estimated	400	1.4
E059.8	10/5/2017 1:08	F	WT_LAP-17-133841	Estimated	400	1.3
E059.8	10/5/2017 1:08	F	WT_LAP-17-133781	Estimated	400	1.3
E059.8	10/5/2017 1:08	UF	WT_LAP-17-133901	Estimated	400	1.3
E059.8	10/5/2017 1:08	UF	WT_LAP-17-133601	Estimated	400	1.3
E059.8	10/5/2017 1:15	F	WT_LAP-17-133541	Estimated	400	1.3
E059.8	10/5/2017 1:15	UF	WT_LAP-17-134230	Estimated	400	1.3
E059.8	10/5/2017 1:19	UF	WT_LAP-17-134129	Estimated	400	1.2
E059.8	10/5/2017 1:39	UF	WT_LAP-17-134275	Estimated	400	1.1
E059.8	10/5/2017 1:49	UF	WT_LAP-17-133945	Estimated	400	1
E059.8	10/5/2017 1:53	UF	WT_LAP-17-134061	Estimated	400	1
E059.8	10/5/2017 1:59	UF	WT_LAP-17-134001	Estimated	400	1
E059.8	10/5/2017 2:19	UF	WT_LAP-17-134574	SSC	400	1.3
E059.8	10/5/2017 2:39	UF	WT_LAP-17-134575	SSC	300	1.6

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (cfs)
E059.8	10/5/2017 2:59	UF	WT_LAP-17-134576	SSC	300	1.6
E059.8	10/5/2017 3:19	UF	WT_LAP-17-134577	SSC	300	1.5
E059.8	10/5/2017 3:39	UF	WT_LAP-17-134578	SSC	300	1.3

[a] SSC = Measured using ASTM method D3977-97.

[b] UF = Unfiltered.

[c] n/a = Not applicable.

[d] F = Filtered.

Table 4.4-1
Calculated Total Metal and Isotopic Uranium Concentrations Determined for Each Sample Analyzed for SSC during 2017 in the LA/P Watershed

Station	Sample Collection Date and Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																			
				Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) −117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) −12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) −0.856 + 0.00078[c] * SSC	U-235/236 (pCi/L) −0.131 + 0.0000474 * SSC	U-238 (pCi/L) −1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) −53.3 + 0.0788 * SSC
Sediment Background Value (mg/kg)				**1**	**15,400**	**3.98**	**127**	**1.31**	**0.4**	**10.5**	**11.2**	**13,800**	**0.1**	**543**	**9.38**	**19.7**	**0.3**	**0.73**	**2.59**	**0.2**	**2.29**	**19.7**	**60.2**
CO111041	7/8/2017 13:09	WT_LAP-17-133399	2400	0.556	28,500	8.38	267	4.19	1.36	30.1	55	17,900	0.359	-6940	27.6	128	4.99	0.899	1.02	-0.0172	0.595	43.1	136
CO111041	7/8/2017 13:18	WT_LAP-17-133641	500	0.511	21,700	7.12	-37	2.91	0.878	25.3	48.9	6480	0.318	-11,700	21	111	4.73	0.679	-0.466	-0.107	-0.929	29.1	-13.9
E030	9/29/2017 0:54	WT_LAP-17-133404	4300	0.601	35,300	9.64	571	5.46	1.84	35	61.1	29,200	0.401	-2170	34.1	144	5.24	1.12	2.5	0.0728	2.12	57.2	286
E030	9/29/2017 1:12	WT_LAP-17-133647	2700	0.563	29,600	8.58	315	4.39	1.44	30.9	56	19,700	0.366	-6190	28.6	130	5.03	0.934	1.25	-0.00302	0.835	45.4	159
E030	10/4/2017 22:38	WT_LAP-17-133419	3300	0.577	31,700	8.98	411	4.79	1.59	32.4	57.9	23,300	0.379	-4680	30.7	136	5.11	1	1.72	0.0254	1.32	49.8	207
E030	10/4/2017 23:00	WT_LAP-17-133662	1900	0.544	26,700	8.05	187	3.85	1.23	28.8	53.4	14,900	0.348	-8190	25.8	123	4.92	0.841	0.626	-0.0409	0.194	39.4	96.4
E038	7/8/2017 12:54	WT_LAP-17-133643	6200	0.646	42,200	10.9	875	6.74	2.33	39.8	67.3	40,600	0.442	2600	40.6	161	5.5	1.34	3.98	0.163	3.64	71.2	435
E038	7/8/2017 12:56	WT_LAP-17-134316	5700	0.634	40,400	10.6	795	6.41	2.2	38.5	65.7	37,600	0.431	1340	38.9	156	5.44	1.28	3.59	0.139	3.24	67.5	396
E038	7/8/2017 12:58	WT_LAP-17-134317	5200	0.622	38,600	10.2	715	6.07	2.07	37.3	64	34,600	0.42	90	37.2	152	5.37	1.22	3.2	0.115	2.84	63.8	356
E038	7/8/2017 13:01	WT_LAP-17-134318	4500	0.606	36,000	9.77	603	5.6	1.89	35.5	61.8	30,400	0.405	-1670	34.8	146	5.27	1.14	2.65	0.0823	2.28	58.7	301
E038	7/8/2017 13:03	WT_LAP-17-134319	4000	0.594	34,300	9.44	523	5.26	1.77	34.2	60.2	27,400	0.394	-2920	33.1	142	5.2	1.08	2.26	0.0586	1.88	55	262
E038	7/8/2017 13:05	WT_LAP-17-133400	3700	0.587	33,200	9.24	475	5.06	1.69	33.4	59.2	25,700	0.388	-3680	32	139	5.16	1.05	2.03	0.0444	1.64	52.7	238
E038	7/8/2017 13:05	WT_LAP-17-134320	3500	0.582	32,500	9.11	443	4.93	1.64	32.9	58.6	24,500	0.383	-4180	31.3	137	5.14	1.03	1.87	0.0349	1.48	51.3	222
E038	7/8/2017 13:07	WT_LAP-17-134321	3500	0.582	32,500	9.11	443	4.93	1.64	32.9	58.6	24,500	0.383	-4180	31.3	137	5.14	1.03	1.87	0.0349	1.48	51.3	222
E038	7/8/2017 13:09	WT_LAP-17-134322	2900	0.568	30,300	8.71	347	4.52	1.49	31.4	56.6	20,900	0.37	-5680	29.3	132	5.05	0.957	1.41	0.00646	0.996	46.8	175
E038	7/8/2017 13:12	WT_LAP-17-134323	2600	0.561	29,200	8.51	299	4.32	1.41	30.6	55.7	19,100	0.364	-6440	28.2	129	5.01	0.923	1.17	-0.00776	0.755	44.6	152
E038	7/8/2017 13:14	WT_LAP-17-134324	2600	0.561	29,200	8.51	299	4.32	1.41	30.6	55.7	19,100	0.364	-6440	28.2	129	5.01	0.923	1.17	-0.00776	0.755	44.6	152
E038	7/8/2017 13:16	WT_LAP-17-134325	2200	0.551	27,800	8.25	235	4.05	1.31	29.6	54.4	16,700	0.355	-7440	26.9	126	4.96	0.876	0.86	-0.0267	0.434	41.7	120
E038	7/8/2017 13:19	WT_LAP-17-134326	2300	0.554	28,200	8.31	251	4.12	1.34	29.9	54.7	17,300	0.357	-7190	27.2	127	4.97	0.888	0.938	-0.022	0.515	42.4	128
E038	7/8/2017 13:23	WT_LAP-17-134339	1900	0.544	26,700	8.05	187	3.85	1.23	28.8	53.4	14,900	0.348	-8190	25.8	123	4.92	0.841	0.626	-0.0409	0.194	39.4	96.4
E038	7/8/2017 13:24	WT_LAP-17-134327	2100	0.549	27,400	8.18	219	3.98	1.28	29.4	54.1	16,100	0.353	-7690	26.5	125	4.95	0.865	0.782	-0.0315	0.354	40.9	112
E038	7/8/2017 13:24	WT_LAP-17-134330	1600	0.537	25,600	7.85	139	3.65	1.16	28.1	52.5	13,100	0.342	-8950	24.8	121	4.88	0.807	0.392	-0.0552	-0.0468	37.2	72.8
E038	7/26/2017 11:24	WT_LAP-17-133658	8100	0.691	49,000	12.2	1180	8.02	2.81	44.7	73.4	52,000	0.484	7370	47.2	177	5.76	1.56	5.46	0.253	5.17	85.3	585
E038	7/26/2017 11:26	WT_LAP-17-134484	8700	0.705	51,100	12.6	1280	8.43	2.96	46.2	75.3	55,600	0.497	8870	49.2	182	5.84	1.63	5.93	0.281	5.65	89.7	632
E038	7/26/2017 11:28	WT_LAP-17-134485	6700	0.658	43,900	11.2	955	7.08	2.45	41.1	68.9	43,600	0.453	3860	42.3	165	5.57	1.4	4.37	0.187	4.04	74.9	475
E038	7/26/2017 11:30	WT_LAP-17-134486	5200	0.622	38,600	10.2	715	6.07	2.07	37.3	64	34,600	0.42	90	37.2	152	5.37	1.22	3.2	0.115	2.84	63.8	356
E038	7/26/2017 11:32	WT_LAP-17-134487	4100	0.596	34,600	9.51	539	5.33	1.79	34.5	60.5	28,000	0.396	-2670	33.4	142	5.22	1.1	2.34	0.0633	1.96	55.7	270
E038	7/26/2017 11:35	WT_LAP-17-134488	3900	0.591	33,900	9.38	507	5.19	1.74	33.9	59.9	26,800	0.392	-3170	32.7	141	5.19	1.07	2.19	0.0539	1.8	54.2	254
E038	7/26/2017 11:37	WT_LAP-17-134489	3500	0.582	32,500	9.11	443	4.93	1.64	32.9	58.6	24,500	0.383	-4180	31.3	137	5.14	1.03	1.87	0.0349	1.48	51.3	222

Table 4.4-1 (continued)

Station	Sample Collection Date and Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																			
				Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) −117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) −12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) −0.856 + 0.00078[c] * SSC	U-235/236 (pCi/L) −0.131 + 0.0000474 * SSC	U-238 (pCi/L) −1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) −53.3 + 0.0788 * SSC
Sediment Background Value (mg/kg)				**1**	**15,400**	**3.98**	**127**	**1.31**	**0.4**	**10.5**	**11.2**	**13,800**	**0.1**	**543**	**9.38**	**19.7**	**0.3**	**0.73**	**2.59**	**0.2**	**2.29**	**19.7**	**60.2**
E038	7/26/2017 11:39	WT_LAP-17-134490	3400	0.58	32,100	9.04	427	4.86	1.61	32.7	58.2	23,900	0.381	-4430	31	136	5.12	1.02	1.8	0.0302	1.4	50.5	215
E038	7/26/2017 11:40	WT_LAP-17-133415	3100	0.572	31,000	8.85	379	4.66	1.54	31.9	57.3	22,100	0.375	-5180	30	134	5.08	0.981	1.56	0.0159	1.16	48.3	191
E038	7/26/2017 11:41	WT_LAP-17-134491	3400	0.58	32,100	9.04	427	4.86	1.61	32.7	58.2	23,900	0.381	-4430	31	136	5.12	1.02	1.8	0.0302	1.4	50.5	215
E038	7/26/2017 11:43	WT_LAP-17-134492	3000	0.57	30,700	8.78	363	4.59	1.51	31.6	57	21,500	0.372	-5430	29.6	133	5.07	0.969	1.48	0.0112	1.08	47.6	183
E038	7/26/2017 11:45	WT_LAP-17-134493	2900	0.568	30,300	8.71	347	4.52	1.49	31.4	56.6	20,900	0.37	-5680	29.3	132	5.05	0.957	1.41	0.00646	0.996	46.8	175
E038	7/26/2017 11:48	WT_LAP-17-134494	2500	0.558	28,900	8.45	283	4.25	1.39	30.4	55.4	18,500	0.362	-6690	27.9	129	5	0.911	1.09	-0.0125	0.675	43.9	144
E038	7/26/2017 11:50	WT_LAP-17-134495	1800	0.542	26,400	7.98	171	3.78	1.21	28.6	53.1	14,300	0.346	-8440	25.5	123	4.9	0.83	0.548	-0.0457	0.114	38.7	88.5
E038	7/26/2017 11:54	WT_LAP-17-134498	1200	0.527	24,200	7.59	75	3.38	1.06	27.1	51.2	10,700	0.333	-9950	23.4	117	4.82	0.76	0.08	-0.0741	-0.368	34.3	41.3
E038	7/26/2017 11:58	WT_LAP-17-134507	900	0.52	23,100	7.39	27	3.18	0.98	26.3	50.2	8880	0.327	-10,700	22.4	115	4.78	0.725	-0.154	-0.0883	-0.608	32.1	17.6
E038	7/26/2017 12:14	WT_LAP-17-134499	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E038	7/29/2017 19:23	WT_LAP-17-133673	2500	0.558	28,900	8.45	283	4.25	1.39	30.4	55.4	18,500	0.362	-6690	27.9	129	5	0.911	1.09	-0.0125	0.675	43.9	144
E038	7/29/2017 19:26	WT_LAP-17-134652	2900	0.568	30,300	8.71	347	4.52	1.49	31.4	56.6	20,900	0.37	-5680	29.3	132	5.05	0.957	1.41	0.00646	0.996	46.8	175
E038	7/29/2017 19:28	WT_LAP-17-134653	2900	0.568	30,300	8.71	347	4.52	1.49	31.4	56.6	20,900	0.37	-5680	29.3	132	5.05	0.957	1.41	0.00646	0.996	46.8	175
E038	7/29/2017 19:30	WT_LAP-17-134654	2200	0.551	27,800	8.25	235	4.05	1.31	29.6	54.4	16,700	0.355	-7440	26.9	126	4.96	0.876	0.86	-0.0267	0.434	41.7	120
E038	7/29/2017 19:32	WT_LAP-17-134655	1700	0.539	26,000	7.92	155	3.71	1.18	28.3	52.8	13,700	0.344	-8700	25.1	122	4.89	0.818	0.47	-0.0504	0.0334	38	80.7
E038	7/29/2017 19:35	WT_LAP-17-134656	1800	0.542	26,400	7.98	171	3.78	1.21	28.6	53.1	14,300	0.346	-8440	25.5	123	4.9	0.83	0.548	-0.0457	0.114	38.7	88.5
E038	7/29/2017 19:37	WT_LAP-17-134657	2700	0.563	29,600	8.58	315	4.39	1.44	30.9	56	19,700	0.366	-6190	28.6	130	5.03	0.934	1.25	-0.00302	0.835	45.4	159
E038	7/29/2017 19:39	WT_LAP-17-134658	1600	0.537	25,600	7.85	139	3.65	1.16	28.1	52.5	13,100	0.342	-8950	24.8	121	4.88	0.807	0.392	-0.0552	-0.0468	37.2	72.8
E038	7/29/2017 19:40	WT_LAP-17-133430	2100	0.549	27,400	8.18	219	3.98	1.28	29.4	54.1	16,100	0.353	-7690	26.5	125	4.95	0.865	0.782	-0.0315	0.354	40.9	112
E038	7/29/2017 19:41	WT_LAP-17-134659	1300	0.53	24,600	7.65	91	3.44	1.08	27.3	51.5	11,300	0.335	-9700	23.8	118	4.84	0.772	0.158	-0.0694	-0.287	35	49.1
E038	7/29/2017 19:44	WT_LAP-17-134660	1100	0.525	23,800	7.52	59	3.31	1.03	26.8	50.8	10,100	0.331	-10,200	23.1	117	4.81	0.749	0.002	-0.0789	-0.448	33.5	33.4
E038	7/29/2017 19:46	WT_LAP-17-134661	800	0.518	22,800	7.32	11	3.11	0.954	26	49.9	8280	0.324	-11,000	22.1	114	4.77	0.714	-0.232	-0.0931	-0.688	31.3	9.74
E038	7/29/2017 19:48	WT_LAP-17-134662	700	0.516	22,400	7.25	-5	3.04	0.929	25.8	49.6	7680	0.322	-11,200	21.7	113	4.76	0.702	-0.31	-0.0978	-0.769	30.6	1.86
E038	7/29/2017 19:53	WT_LAP-17-134666	600	0.513	22,000	7.19	-21	2.97	0.903	25.5	49.2	7080	0.32	-11,500	21.4	112	4.74	0.691	-0.388	-0.103	-0.849	29.8	-6.02
E038	7/29/2017 20:03	WT_LAP-17-134675	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E038	7/29/2017 20:18	WT_LAP-17-134667	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E038	8/7/2017 11:48	WT_LAP-17-133688	2900	0.568	30,300	8.71	347	4.52	1.49	31.4	56.6	20,900	0.37	-5680	29.3	132	5.05	0.957	1.41	0.00646	0.996	46.8	175
E038	8/7/2017 11:51	WT_LAP-17-134820	2700	0.563	29,600	8.58	315	4.39	1.44	30.9	56	19,700	0.366	-6190	28.6	130	5.03	0.934	1.25	-0.00302	0.835	45.4	159
E038	8/7/2017 11:53	WT_LAP-17-134821	2800	0.565	29,900	8.65	331	4.45	1.46	31.1	56.3	20,300	0.368	-5930	28.9	131	5.04	0.946	1.33	0.00172	0.916	46.1	167
E038	8/7/2017 11:55	WT_LAP-17-134822	2400	0.556	28,500	8.38	267	4.19	1.36	30.1	55	17,900	0.359	-6940	27.6	128	4.99	0.899	1.02	-0.0172	0.595	43.1	136
E038	8/7/2017 11:57	WT_LAP-17-134823	2300	0.554	28,200	8.31	251	4.12	1.34	29.9	54.7	17,300	0.357	-7190	27.2	127	4.97	0.888	0.938	-0.022	0.515	42.4	128

Table 4.4-1 (continued)

Station	Sample Collection Date and Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																					
				Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) −117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) −12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) −0.856 + 0.00078[c] * SSC	U-235/236 (pCi/L) −0.131 + 0.0000474 * SSC	U-238 (pCi/L) −1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) −53.3 + 0.0788 * SSC
E038	8/7/2017 11:59	WT_LAP-17-134824	2000	0.546	27,100	8.12	203	3.92	1.26	29.1	53.7	15,500	0.351	-7940	26.2	124	4.93	0.853	0.704	-0.0362	0.274	40.2	104
E038	8/7/2017 12:00	WT_LAP-17-133445	2200	0.551	27,800	8.25	235	4.05	1.31	29.6	54.4	16,700	0.355	-7440	26.9	126	4.96	0.876	0.86	-0.0267	0.434	41.7	120
E038	8/7/2017 12:01	WT_LAP-17-134825	1900	0.544	26,700	8.05	187	3.85	1.23	28.8	53.4	14,900	0.348	-8190	25.8	123	4.92	0.841	0.626	-0.0409	0.194	39.4	96.4
E038	8/7/2017 12:03	WT_LAP-17-134826	4100	0.596	34,600	9.51	539	5.33	1.79	34.5	60.5	28,000	0.396	-2670	33.4	142	5.22	1.1	2.34	0.0633	1.96	55.7	270
E038	8/7/2017 12:05	WT_LAP-17-134827	5800	0.636	40,700	10.6	811	6.47	2.22	38.8	66	38,200	0.433	1600	39.3	157	5.45	1.29	3.67	0.144	3.32	68.3	404
E038	8/7/2017 12:07	WT_LAP-17-134828	1900	0.544	26,700	8.05	187	3.85	1.23	28.8	53.4	14,900	0.348	-8190	25.8	123	4.92	0.841	0.626	-0.0409	0.194	39.4	96.4
E038	8/7/2017 12:09	WT_LAP-17-134829	1200	0.527	24,200	7.59	75	3.38	1.06	27.1	51.2	10,700	0.333	-9950	23.4	117	4.82	0.76	0.08	-0.0741	-0.368	34.3	41.3
E038	8/7/2017 12:11	WT_LAP-17-134830	1100	0.525	23,800	7.52	59	3.31	1.03	26.8	50.8	10,100	0.331	-10200	23.1	117	4.81	0.749	0.002	-0.0789	-0.448	33.5	33.4
E038	8/7/2017 12:13	WT_LAP-17-134831	1500	0.535	25,300	7.78	123	3.58	1.13	27.8	52.1	12,500	0.34	-9200	24.5	120	4.86	0.795	0.314	-0.0599	-0.127	36.5	64.9
E038	8/7/2017 12:15	WT_LAP-17-134832	1200	0.527	24,200	7.59	75	3.38	1.06	27.1	51.2	10,700	0.333	-9950	23.4	117	4.82	0.76	0.08	-0.0741	-0.368	34.3	41.3
E038	8/7/2017 12:18	WT_LAP-17-134834	700	0.516	22,400	7.25	-5	3.04	0.929	25.8	49.6	7680	0.322	-11.200	21.7	113	4.76	0.702	-0.31	-0.0978	-0.769	30.6	1.86
E038	8/7/2017 12:18	WT_LAP-17-134843	700	0.516	22,400	7.25	-5	3.04	0.929	25.8	49.6	7680	0.322	-11,200	21.7	113	4.76	0.702	-0.31	-0.0978	-0.769	30.6	1.86
E038	8/7/2017 12:38	WT_LAP-17-134835	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E038	8/7/2017 12:58	WT_LAP-17-134836	100	0.501	20,300	6.86	-101	2.64	0.776	24.3	47.6	4090	0.309	-12,700	19.6	108	4.67	0.633	-0.778	-0.126	-1.25	26.1	-45.4
E039.1	7/8/2017 13:23	WT_LAP-17-133644	2900	0.568	30,300	8.71	347	4.52	1.49	31.4	56.6	20,900	0.37	-5680	29.3	132	5.05	0.957	1.41	0.00646	0.996	46.8	175
E039.1	7/8/2017 13:25	WT_LAP-17-134340	2600	0.561	29,200	8.51	299	4.32	1.41	30.6	55.7	19,100	0.364	-6440	28.2	129	5.01	0.923	1.17	-0.00776	0.755	44.6	152
E039.1	7/8/2017 13:27	WT_LAP-17-134341	2400	0.556	28,500	8.38	267	4.19	1.36	30.1	55	17,900	0.359	-6940	27.6	128	4.99	0.899	1.02	-0.0172	0.595	43.1	136
E039.1	7/8/2017 13:29	WT_LAP-17-134342	2200	0.551	27,800	8.25	235	4.05	1.31	29.6	54.4	16,700	0.355	-7440	26.9	126	4.96	0.876	0.86	-0.0267	0.434	41.7	120
E039.1	7/8/2017 13:31	WT_LAP-17-134343	2000	0.546	27,100	8.12	203	3.92	1.26	29.1	53.7	15,500	0.351	-7940	26.2	124	4.93	0.853	0.704	-0.0362	0.274	40.2	104
E039.1	7/8/2017 13:33	WT_LAP-17-133401	1800	0.542	26,400	7.98	171	3.78	1.21	28.6	53.1	14,300	0.346	-8440	25.5	123	4.9	0.83	0.548	-0.0457	0.114	38.7	88.5
E039.1	7/8/2017 13:33	WT_LAP-17-134344	1900	0.544	26,700	8.05	187	3.85	1.23	28.8	53.4	14,900	0.348	-8190	25.8	123	4.92	0.841	0.626	-0.0409	0.194	39.4	96.4
E039.1	7/8/2017 13:35	WT_LAP-17-134345	1700	0.539	26,000	7.92	155	3.71	1.18	28.3	52.8	13,700	0.344	-8700	25.1	122	4.89	0.818	0.47	-0.0504	0.0334	38	80.7
E039.1	7/8/2017 13:37	WT_LAP-17-134346	1700	0.539	26,000	7.92	155	3.71	1.18	28.3	52.8	13,700	0.344	-8700	25.1	122	4.89	0.818	0.47	-0.0504	0.0334	38	80.7
E039.1	7/8/2017 13:39	WT_LAP-17-134347	1500	0.535	25,300	7.78	123	3.58	1.13	27.8	52.1	12,500	0.34	-9200	24.5	120	4.86	0.795	0.314	-0.0599	-0.127	36.5	64.9
E039.1	7/8/2017 13:41	WT_LAP-17-134348	1400	0.532	24,900	7.72	107	3.51	1.11	27.6	51.8	11,900	0.338	-9450	24.1	119	4.85	0.783	0.236	-0.0646	-0.207	35.7	57
E039.1	7/8/2017 13:43	WT_LAP-17-134349	1400	0.532	24,900	7.72	107	3.51	1.11	27.6	51.8	11,900	0.338	-9450	24.1	119	4.85	0.783	0.236	-0.0646	-0.207	35.7	57
E039.1	7/8/2017 13:45	WT_LAP-17-134350	1300	0.53	24,600	7.65	91	3.44	1.08	27.3	51.5	11,300	0.335	-9700	23.8	118	4.84	0.772	0.158	-0.0694	-0.287	35	49.1
E039.1	7/8/2017 13:47	WT_LAP-17-134351	1300	0.53	24,600	7.65	91	3.44	1.08	27.3	51.5	11,300	0.335	-9700	23.8	118	4.84	0.772	0.158	-0.0694	-0.287	35	49.1
E039.1	7/8/2017 13:49	WT_LAP-17-134352	1200	0.527	24,200	7.59	75	3.38	1.06	27.1	51.2	10,700	0.333	-9950	23.4	117	4.82	0.76	0.08	-0.0741	-0.368	34.3	41.3
E039.1	7/8/2017 13:51	WT_LAP-17-134353	1100	0.525	23,800	7.52	59	3.31	1.03	26.8	50.8	10,100	0.331	-10,200	23.1	117	4.81	0.749	0.002	-0.0789	-0.448	33.5	33.4
E039.1	7/8/2017 13:51	WT_LAP-17-134363	1100	0.525	23,800	7.52	59	3.31	1.03	26.8	50.8	10,100	0.331	-10,200	23.1	117	4.81	0.749	0.002	-0.0789	-0.448	33.5	33.4
E039.1	7/8/2017 13:53	WT_LAP-17-134354	1000	0.523	23,500	7.45	43	3.24	1	26.6	50.5	9480	0.329	-10,500	22.7	116	4.8	0.737	-0.076	-0.0836	-0.528	32.8	25.5

Table 4.4-1 (continued)

Station	Sample Collection Date and Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																			
				Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) –117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) –12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) –0.856 + 0.00078[c] * SSC	U-235/236 (pCi/L) –0.131 + 0.0000474 * SSC	U-238 (pCi/L) –1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) –53.3 + 0.0788 * SSC
E039.1	7/8/2017 14:13	WT_LAP-17-134355	600	0.513	22,000	7.19	-21	2.97	0.903	25.5	49.2	7080	0.32	-11,500	21.4	112	4.74	0.691	-0.388	-0.103	-0.849	29.8	-6.02
E039.1	7/8/2017 14:33	WT_LAP-17-134356	500	0.511	21,700	7.12	-37	2.91	0.878	25.3	48.9	6480	0.318	-11,700	21	111	4.73	0.679	-0.466	-0.107	-0.929	29.1	-13.9
E039.1	7/8/2017 14:53	WT_LAP-17-134357	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	7/26/2017 11:48	WT_LAP-17-133659	3400	0.58	32,100	9.04	427	4.86	1.61	32.7	58.2	23,900	0.381	-4430	31	136	5.12	1.02	1.8	0.0302	1.4	50.5	215
E039.1	7/26/2017 11:50	WT_LAP-17-134509	3100	0.572	31,000	8.85	379	4.66	1.54	31.9	57.3	22,100	0.375	-5180	30	134	5.08	0.981	1.56	0.0159	1.16	48.3	191
E039.1	7/26/2017 11:52	WT_LAP-17-134510	2800	0.565	29,900	8.65	331	4.45	1.46	31.1	56.3	20,300	0.368	-5930	28.9	131	5.04	0.946	1.33	0.00172	0.916	46.1	167
E039.1	7/26/2017 11:54	WT_LAP-17-134511	2400	0.556	28,500	8.38	267	4.19	1.36	30.1	55	17,900	0.359	-6940	27.6	128	4.99	0.899	1.02	-0.0172	0.595	43.1	136
E039.1	7/26/2017 11:56	WT_LAP-17-134512	2200	0.551	27,800	8.25	235	4.05	1.31	29.6	54.4	16,700	0.355	-7440	26.9	126	4.96	0.876	0.86	-0.0267	0.434	41.7	120
E039.1	7/26/2017 11:58	WT_LAP-17-133416	1900	0.544	26,700	8.05	187	3.85	1.23	28.8	53.4	14,900	0.348	-8190	25.8	123	4.92	0.841	0.626	-0.0409	0.194	39.4	96.4
E039.1	7/26/2017 11:58	WT_LAP-17-134513	1900	0.544	26,700	8.05	187	3.85	1.23	28.8	53.4	14,900	0.348	-8190	25.8	123	4.92	0.841	0.626	-0.0409	0.194	39.4	96.4
E039.1	7/26/2017 12:00	WT_LAP-17-134514	1700	0.539	26,000	7.92	155	3.71	1.18	28.3	52.8	13,700	0.344	-8700	25.1	122	4.89	0.818	0.47	-0.0504	0.0334	38	80.7
E039.1	7/26/2017 12:02	WT_LAP-17-134515	1600	0.537	25,600	7.85	139	3.65	1.16	28.1	52.5	13,100	0.342	-8950	24.8	121	4.88	0.807	0.392	-0.0552	-0.0468	37.2	72.8
E039.1	7/26/2017 12:04	WT_LAP-17-134516	1500	0.535	25,300	7.78	123	3.58	1.13	27.8	52.1	12,500	0.34	-9200	24.5	120	4.86	0.795	0.314	-0.0599	-0.127	36.5	64.9
E039.1	7/26/2017 12:06	WT_LAP-17-134517	1400	0.532	24,900	7.72	107	3.51	1.11	27.6	51.8	11,900	0.338	-9450	24.1	119	4.85	0.783	0.236	-0.0646	-0.207	35.7	57
E039.1	7/26/2017 12:08	WT_LAP-17-134518	1200	0.527	24,200	7.59	75	3.38	1.06	27.1	51.2	10,700	0.333	-9950	23.4	117	4.82	0.76	0.08	-0.0741	-0.368	34.3	41.3
E039.1	7/26/2017 12:10	WT_LAP-17-134519	1200	0.527	24,200	7.59	75	3.38	1.06	27.1	51.2	10,700	0.333	-9950	23.4	117	4.82	0.76	0.08	-0.0741	-0.368	34.3	41.3
E039.1	7/26/2017 12:12	WT_LAP-17-134520	1100	0.525	23,800	7.52	59	3.31	1.03	26.8	50.8	10,100	0.331	-10,200	23.1	117	4.81	0.749	0.002	-0.0789	-0.448	33.5	33.4
E039.1	7/26/2017 12:14	WT_LAP-17-134521	1000	0.523	23,500	7.45	43	3.24	1	26.6	50.5	9480	0.329	-10,500	22.7	116	4.8	0.737	-0.076	-0.0836	-0.528	32.8	25.5
E039.1	7/26/2017 12:16	WT_LAP-17-134522	900	0.52	23,100	7.39	27	3.18	0.98	26.3	50.2	8880	0.327	-10,700	22.4	115	4.78	0.725	-0.154	-0.0883	-0.608	32.1	17.6
E039.1	7/26/2017 12:16	WT_LAP-17-134531	1000	0.523	23,500	7.45	43	3.24	1	26.6	50.5	9480	0.329	-10,500	22.7	116	4.8	0.737	-0.076	-0.0836	-0.528	32.8	25.5
E039.1	7/26/2017 12:18	WT_LAP-17-134523	900	0.52	23,100	7.39	27	3.18	0.98	26.3	50.2	8880	0.327	-10,700	22.4	115	4.78	0.725	-0.154	-0.0883	-0.608	32.1	17.6
E039.1	7/26/2017 12:38	WT_LAP-17-134524	600	0.513	22,000	7.19	-21	2.97	0.903	25.5	49.2	7080	0.32	-11,500	21.4	112	4.74	0.691	-0.388	-0.103	-0.849	29.8	-6.02
E039.1	7/26/2017 12:58	WT_LAP-17-134525	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	7/26/2017 13:18	WT_LAP-17-134526	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	7/29/2017 19:53	WT_LAP-17-133674	1400	0.532	24,900	7.72	107	3.51	1.11	27.6	51.8	11,900	0.338	-9450	24.1	119	4.85	0.783	0.236	-0.0646	-0.207	35.7	57
E039.1	7/29/2017 19:55	WT_LAP-17-134676	1200	0.527	24,200	7.59	75	3.38	1.06	27.1	51.2	10,700	0.333	-9950	23.4	117	4.82	0.76	0.08	-0.0741	-0.368	34.3	41.3
E039.1	7/29/2017 19:57	WT_LAP-17-134677	1100	0.525	23,800	7.52	59	3.31	1.03	26.8	50.8	10,100	0.331	-10,200	23.1	117	4.81	0.749	0.002	-0.0789	-0.448	33.5	33.4
E039.1	7/29/2017 19:59	WT_LAP-17-134678	1000	0.523	23,500	7.45	43	3.24	1	26.6	50.5	9480	0.329	-10,500	22.7	116	4.8	0.737	-0.076	-0.0836	-0.528	32.8	25.5
E039.1	7/29/2017 20:01	WT_LAP-17-134679	800	0.518	22,800	7.32	11	3.11	0.954	26	49.9	8280	0.324	-11,000	22.1	114	4.77	0.714	-0.232	-0.0931	-0.688	31.3	9.74
E039.1	7/29/2017 20:03	WT_LAP-17-134680	800	0.518	22,800	7.32	11	3.11	0.954	26	49.9	8280	0.324	-11,000	22.1	114	4.77	0.714	-0.232	-0.0931	-0.688	31.3	9.74
E039.1	7/29/2017 20:05	WT_LAP-17-134681	700	0.516	22,400	7.25	-5	3.04	0.929	25.8	49.6	7680	0.322	-11,200	21.7	113	4.76	0.702	-0.31	-0.0978	-0.769	30.6	1.86
E039.1	7/29/2017 20:07	WT_LAP-17-134682	600	0.513	22,000	7.19	-21	2.97	0.903	25.5	49.2	7080	0.32	-11,500	21.4	112	4.74	0.691	-0.388	-0.103	-0.849	29.8	-6.02

Table 4.4-1 (continued)

Station	Sample Collection Date and Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																			
				Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) –117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) –12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) –0.856 + 0.00078[c] * SSC	U-235/236 (pCi/L) –0.131 + 0.0000474 * SSC	U-238 (pCi/L) –1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) –53.3 + 0.0788 * SSC
E039.1	7/29/2017 20:08	WT_LAP-17-133431	600	0.513	22,000	7.19	-21	2.97	0.903	25.5	49.2	7080	0.32	-11,500	21.4	112	4.74	0.691	-0.388	-0.103	-0.849	29.8	-6.02
E039.1	7/29/2017 20:09	WT_LAP-17-134683	600	0.513	22,000	7.19	-21	2.97	0.903	25.5	49.2	7080	0.32	-11,500	21.4	112	4.74	0.691	-0.388	-0.103	-0.849	29.8	-6.02
E039.1	7/29/2017 20:11	WT_LAP-17-134684	500	0.511	21,700	7.12	-37	2.91	0.878	25.3	48.9	6480	0.318	-11,700	21	111	4.73	0.679	-0.466	-0.107	-0.929	29.1	-13.9
E039.1	7/29/2017 20:13	WT_LAP-17-134685	500	0.511	21,700	7.12	-37	2.91	0.878	25.3	48.9	6480	0.318	-11,700	21	111	4.73	0.679	-0.466	-0.107	-0.929	29.1	-13.9
E039.1	7/29/2017 20:15	WT_LAP-17-134686	500	0.511	21,700	7.12	-37	2.91	0.878	25.3	48.9	6480	0.318	-11,700	21	111	4.73	0.679	-0.466	-0.107	-0.929	29.1	-13.9
E039.1	7/29/2017 20:17	WT_LAP-17-134687	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	7/29/2017 20:19	WT_LAP-17-134688	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	7/29/2017 20:21	WT_LAP-17-134689	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	7/29/2017 20:23	WT_LAP-17-134690	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	7/29/2017 20:26	WT_LAP-17-134699	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E039.1	7/29/2017 20:43	WT_LAP-17-134691	100	0.501	20,300	6.86	-101	2.64	0.776	24.3	47.6	4090	0.309	-12,700	19.6	108	4.67	0.633	-0.778	-0.126	-1.25	26.1	-45.4
E039.1	7/29/2017 21:03	WT_LAP-17-134692	200	0.504	20,600	6.92	-85	2.7	0.802	24.5	47.9	4690	0.311	-12,500	20	109	4.69	0.644	-0.7	-0.122	-1.17	26.9	-37.5
E039.1	7/29/2017 21:23	WT_LAP-17-134693	200	0.504	20,600	6.92	-85	2.7	0.802	24.5	47.9	4690	0.311	-12,500	20	109	4.69	0.644	-0.7	-0.122	-1.17	26.9	-37.5
E039.1	8/7/2017 12:28	WT_LAP-17-133689	700	0.516	22,400	7.25	-5	3.04	0.929	25.8	49.6	7680	0.322	-11,200	21.7	113	4.76	0.702	-0.31	-0.0978	-0.769	30.6	1.86
E039.1	8/7/2017 12:30	WT_LAP-17-134844	700	0.516	22,400	7.25	-5	3.04	0.929	25.8	49.6	7680	0.322	-11,200	21.7	113	4.76	0.702	-0.31	-0.0978	-0.769	30.6	1.86
E039.1	8/7/2017 12:32	WT_LAP-17-134845	600	0.513	22,000	7.19	-21	2.97	0.903	25.5	49.2	7080	0.32	-11,500	21.4	112	4.74	0.691	-0.388	-0.103	-0.849	29.8	-6.02
E039.1	8/7/2017 12:34	WT_LAP-17-134846	500	0.511	21,700	7.12	-37	2.91	0.878	25.3	48.9	6480	0.318	-11,700	21	111	4.73	0.679	-0.466	-0.107	-0.929	29.1	-13.9
E039.1	8/7/2017 12:36	WT_LAP-17-134847	500	0.511	21,700	7.12	-37	2.91	0.878	25.3	48.9	6480	0.318	-11,700	21	111	4.73	0.679	-0.466	-0.107	-0.929	29.1	-13.9
E039.1	8/7/2017 12:38	WT_LAP-17-133446	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	8/7/2017 12:38	WT_LAP-17-134848	500	0.511	21,700	7.12	-37	2.91	0.878	25.3	48.9	6480	0.318	-11,700	21	111	4.73	0.679	-0.466	-0.107	-0.929	29.1	-13.9
E039.1	8/7/2017 12:40	WT_LAP-17-134849	500	0.511	21,700	7.12	-37	2.91	0.878	25.3	48.9	6480	0.318	-11,700	21	111	4.73	0.679	-0.466	-0.107	-0.929	29.1	-13.9
E039.1	8/7/2017 12:42	WT_LAP-17-134850	500	0.511	21,700	7.12	-37	2.91	0.878	25.3	48.9	6480	0.318	-11,700	21	111	4.73	0.679	-0.466	-0.107	-0.929	29.1	-13.9
E039.1	8/7/2017 12:44	WT_LAP-17-134851	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	8/7/2017 12:46	WT_LAP-17-134852	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	8/7/2017 12:48	WT_LAP-17-134853	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	8/7/2017 12:50	WT_LAP-17-134854	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	8/7/2017 12:52	WT_LAP-17-134855	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E039.1	8/7/2017 12:54	WT_LAP-17-134856	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E039.1	8/7/2017 12:56	WT_LAP-17-134857	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	8/7/2017 12:56	WT_LAP-17-134867	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E039.1	8/7/2017 12:58	WT_LAP-17-134858	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E039.1	8/7/2017 13:18	WT_LAP-17-134859	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7

Table 4.4-1 (continued)

Station	Sample Collection Date and Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																			
				Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) −117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) −12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) −0.856 + 0.00078[c] * SSC	U-235/236 (pCi/L) −0.131 + 0.0000474 * SSC	U-238 (pCi/L) −1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) −53.3 + 0.0788 * SSC
E039.1	8/7/2017 13:38	WT_LAP-17-134860	200	0.504	20,600	6.92	-85	2.7	0.802	24.5	47.9	4690	0.311	-12,500	20	109	4.69	0.644	-0.7	-0.122	-1.17	26.9	-37.5
E040	7/8/2017 14:19	WT_LAP-17-135616	3600	0.584	32,800	9.18	459	4.99	1.67	33.2	58.9	25,100	0.385	-3930	31.7	138	5.15	1.04	1.95	0.0396	1.56	52	230
E040	7/8/2017 14:23	WT_LAP-17-133672	1100	0.525	23,800	7.52	59	3.31	1.03	26.8	50.8	10,100	0.331	-10,200	23.1	117	4.81	0.749	0.002	-0.0789	-0.448	33.5	33.4
E040	7/8/2017 14:37	WT_LAP-17-133642	2300	0.554	28,200	8.31	251	4.12	1.34	29.9	54.7	17,300	0.357	-7190	27.2	127	4.97	0.888	0.938	-0.022	0.515	42.4	128
E040	7/26/2017 12:24	WT_LAP-17-133414	5700	0.634	40,400	10.6	795	6.41	2.2	38.5	65.7	37,600	0.431	1340	38.9	156	5.44	1.28	3.59	0.139	3.24	67.5	396
E040	7/26/2017 12:42	WT_LAP-17-133657	3500	0.582	32,500	9.11	443	4.93	1.64	32.9	58.6	24,500	0.383	-4180	31.3	137	5.14	1.03	1.87	0.0349	1.48	51.3	222
E040	9/27/2017 19:09	WT_LAP-17-133429	1500	0.535	25,300	7.78	123	3.58	1.13	27.8	52.1	12,500	0.34	-9200	24.5	120	4.86	0.795	0.314	-0.0599	-0.127	36.5	64.9
E040	9/28/2017 22:14	WT_LAP-17-133444	900	0.52	23,100	7.39	27	3.18	0.98	26.3	50.2	8880	0.327	-10,700	22.4	115	4.78	0.725	-0.154	-0.0883	-0.608	32.1	17.6
E040	9/28/2017 22:32	WT_LAP-17-133687	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E042.1	7/26/2017 13:16	WT_LAP-17-134414	12,800	0.802	65,800	15.3	1930	11.2	4	56.6	88.5	80,200	0.586	19,200	63.3	218	6.4	2.11	9.13	0.476	8.94	120	955
E042.1	7/26/2017 13:18	WT_LAP-17-134415	12,700	0.8	65,500	15.2	1920	11.1	3.98	56.4	88.2	79,600	0.584	18,900	63	217	6.39	2.09	9.05	0.471	8.86	119	947
E042.1	7/26/2017 13:20	WT_LAP-17-134416	12,200	0.788	63,700	14.9	1840	10.8	3.85	55.1	86.6	76,600	0.573	17,700	61.3	212	6.32	2.04	8.66	0.447	8.45	116	908
E042.1	7/26/2017 13:22	WT_LAP-17-134417	12,100	0.786	63,300	14.8	1820	10.7	3.82	54.9	86.3	76,600	0.571	17,400	60.9	212	6.31	2.02	8.58	0.443	8.37	115	900
E042.1	7/26/2017 13:24	WT_LAP-17-134418	11,800	0.779	62,300	14.6	1770	10.5	3.75	54.1	85.3	74,200	0.564	16,700	59.9	209	6.26	1.99	8.35	0.428	8.13	113	877
E042.1	7/26/2017 13:26	WT_LAP-17-134419	11,600	0.774	61,500	14.5	1740	10.4	3.7	53.6	84.7	73,000	0.56	16,200	59.2	207	6.24	1.97	8.19	0.419	7.97	111	861
E042.1	7/26/2017 13:28	WT_LAP-17-134420	11,200	0.764	60,100	14.2	1680	10.1	3.6	52.6	83.4	70,600	0.551	15,100	57.8	204	6.18	1.92	7.88	0.4	7.65	108	829
E042.1	7/26/2017 13:30	WT_LAP-17-134421	11,400	0.769	60,800	14.3	1710	10.2	3.65	53.1	84	71,800	0.556	15,700	58.5	205	6.21	1.94	8.04	0.409	7.81	110	845
E042.1	7/26/2017 13:34	WT_LAP-17-133405	10,800	0.755	58,700	14	1610	9.84	3.49	51.5	82.1	68,200	0.542	14,100	56.5	200	6.13	1.87	7.57	0.381	7.33	105	798
E042.1	7/26/2017 13:34	WT_LAP-17-134422	9900	0.734	55,400	13.4	1470	9.23	3.27	49.2	79.2	62,800	0.523	11,900	53.4	193	6.01	1.77	6.87	0.338	6.61	98.6	727
E042.1	7/26/2017 13:40	WT_LAP-17-134424	8300	0.696	49,700	12.3	1210	8.16	2.86	45.2	74	53,200	0.488	7870	47.9	179	5.79	1.58	5.62	0.262	5.33	86.7	601
E042.1	7/26/2017 13:42	WT_LAP-17-134425	7700	0.681	47,500	11.9	1120	7.75	2.71	43.6	72.1	49,600	0.475	6360	45.8	174	5.71	1.51	5.15	0.234	4.85	82.3	553
E042.1	7/26/2017 13:44	WT_LAP-17-134426	7200	0.67	45,700	11.6	1040	7.42	2.58	42.4	70.5	46,600	0.464	5110	44.1	169	5.64	1.46	4.76	0.21	4.44	78.6	514
E042.1	7/26/2017 14:04	WT_LAP-17-134427	4500	0.606	36,000	9.77	603	5.6	1.89	35.5	61.8	30,400	0.405	-1670	34.8	146	5.27	1.14	2.65	0.0823	2.28	58.7	301
E042.1	7/26/2017 14:24	WT_LAP-17-134428	3200	0.575	31,400	8.91	395	4.72	1.56	32.2	57.6	22,700	0.377	-4930	30.3	135	5.1	0.992	1.64	0.0207	1.24	49	199
E042.1	7/26/2017 14:44	WT_LAP-17-134429	2600	0.561	29,200	8.51	299	4.32	1.41	30.6	55.7	19,100	0.364	-6440	28.2	129	5.01	0.923	1.17	-0.00776	0.755	44.6	152
E042.1	7/26/2017 15:04	WT_LAP-17-134430	2100	0.549	27,400	8.18	219	3.98	1.28	29.4	54.1	16,100	0.353	-7690	26.5	125	4.95	0.865	0.782	-0.0315	0.354	40.9	112
E042.1	7/26/2017 15:24	WT_LAP-17-134431	1700	0.539	26,000	7.92	155	3.71	1.18	28.3	52.8	13,700	0.344	-8700	25.1	122	4.89	0.818	0.47	-0.0504	0.0334	38	80.7
E042.1	7/26/2017 15:44	WT_LAP-17-134432	1400	0.532	24,900	7.72	107	3.51	1.11	27.6	51.8	11,900	0.338	-9450	24.1	119	4.85	0.783	0.236	-0.0646	-0.207	35.7	57
E042.1	7/26/2017 16:04	WT_LAP-17-134433	1100	0.525	23,800	7.52	59	3.31	1.03	26.8	50.8	10,100	0.331	-10,200	23.1	117	4.81	0.749	0.002	-0.0789	-0.448	33.5	33.4
E042.1	7/26/2017 16:24	WT_LAP-17-134434	900	0.52	23,100	7.39	27	3.18	0.98	26.3	50.2	8880	0.327	-10,700	22.4	115	4.78	0.725	-0.154	-0.0883	-0.608	32.1	17.6
E042.1	9/27/2017 20:14	WT_LAP-17-134581	5600	0.632	40,000	10.5	779	6.34	2.17	38.3	65.3	37,000	0.429	1090	38.6	155	5.42	1.27	3.51	0.134	3.16	66.8	388
E042.1	9/27/2017 20:16	WT_LAP-17-134582	5200	0.622	38,600	10.2	715	6.07	2.07	37.3	64	34,600	0.42	90	37.2	152	5.37	1.22	3.2	0.115	2.84	63.8	356

Table 4.4-1 (continued)

Station	Sample Collection Date and Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																			
				Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) −117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) −12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) −0.856 + 0.00078[c] * SSC	U-235/236 (pCi/L) −0.131 + 0.0000474 * SSC	U-238 (pCi/L) −1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) −53.3 + 0.0788 * SSC
E042.1	9/27/2017 20:18	WT_LAP-17-134583	4900	0.615	37,500	10	667	5.87	2	36.5	63.1	32,800	0.414	-663	36.2	149	5.33	1.19	2.97	0.101	2.6	61.6	333
E042.1	9/27/2017 20:20	WT_LAP-17-134584	4700	0.61	36,800	9.91	635	5.73	1.94	36	62.4	31,600	0.409	-1170	35.5	148	5.3	1.17	2.81	0.0918	2.44	60.1	317
E042.1	9/27/2017 20:22	WT_LAP-17-134585	4700	0.61	36,800	9.91	635	5.73	1.94	36	62.4	31,600	0.409	-1170	35.5	148	5.3	1.17	2.81	0.0918	2.44	60.1	317
E042.1	9/27/2017 20:24	WT_LAP-17-134586	4200	0.599	35,000	9.57	555	5.4	1.82	34.7	60.8	28,600	0.399	-2420	33.7	143	5.23	1.11	2.42	0.0681	2.04	56.4	278
E042.1	9/27/2017 20:26	WT_LAP-17-134587	3900	0.591	33,900	9.38	507	5.19	1.74	33.9	59.9	26,800	0.392	-3170	32.7	141	5.19	1.07	2.19	0.0539	1.8	54.2	254
E042.1	9/27/2017 20:28	WT_LAP-17-134588	3500	0.582	32,500	9.11	443	4.93	1.64	32.9	58.6	24,500	0.383	-4180	31.3	137	5.14	1.03	1.87	0.0349	1.48	51.3	222
E042.1	9/27/2017 20:30	WT_LAP-17-134589	3300	0.577	31,700	8.98	411	4.79	1.59	32.4	57.9	23,300	0.379	-4680	30.7	136	5.11	1	1.72	0.0254	1.32	49.8	207
E042.1	9/27/2017 20:32	WT_LAP-17-134590	3000	0.57	30,700	8.78	363	4.59	1.51	31.6	57	21,500	0.372	-5430	29.6	133	5.07	0.969	1.48	0.0112	1.08	47.6	183
E042.1	9/27/2017 20:34	WT_LAP-17-133420	3100	0.572	31,000	8.85	379	4.66	1.54	31.9	57.3	22,100	0.375	-5180	30	134	5.08	0.981	1.56	0.0159	1.16	48.3	191
E042.1	9/27/2017 20:34	WT_LAP-17-134591	2600	0.561	29,200	8.51	299	4.32	1.41	30.6	55.7	19,100	0.364	-6440	28.2	129	5.01	0.923	1.17	-0.00776	0.755	44.6	152
E042.1	9/27/2017 20:36	WT_LAP-17-134592	2500	0.558	28,900	8.45	283	4.25	1.39	30.4	55.4	18,500	0.362	-6690	27.9	129	5	0.911	1.09	-0.0125	0.675	43.9	144
E042.1	9/27/2017 20:38	WT_LAP-17-134593	2500	0.558	28,900	8.45	283	4.25	1.39	30.4	55.4	18,500	0.362	-6690	27.9	129	5	0.911	1.09	-0.0125	0.675	43.9	144
E042.1	9/27/2017 20:40	WT_LAP-17-134594	2400	0.556	28,500	8.38	267	4.19	1.36	30.1	55	17,900	0.359	-6940	27.6	128	4.99	0.899	1.02	-0.0172	0.595	43.1	136
E042.1	9/27/2017 20:42	WT_LAP-17-134595	1800	0.542	26,400	7.98	171	3.78	1.21	28.6	53.1	14,300	0.346	-8440	25.5	123	4.9	0.83	0.548	-0.0457	0.114	38.7	88.5
E042.1	9/27/2017 20:44	WT_LAP-17-134596	1300	0.53	24,600	7.65	91	3.44	1.08	27.3	51.5	11,300	0.335	-9700	23.8	118	4.84	0.772	0.158	-0.0694	-0.287	35	49.1
E042.1	9/27/2017 20:52	WT_LAP-17-134603	2400	0.556	28,500	8.38	267	4.19	1.36	30.1	55	17,900	0.359	-6940	27.6	128	4.99	0.899	1.02	-0.0172	0.595	43.1	136
E042.1	9/27/2017 21:04	WT_LAP-17-134597	1200	0.527	24,200	7.59	75	3.38	1.06	27.1	51.2	10,700	0.333	-9950	23.4	117	4.82	0.76	0.08	-0.0741	-0.368	34.3	41.3
E042.1	9/27/2017 21:24	WT_LAP-17-134598	1000	0.523	23,500	7.45	43	3.24	1	26.6	50.5	9480	0.329	-10,500	22.7	116	4.8	0.737	-0.076	-0.0836	-0.528	32.8	25.5
E042.1	9/27/2017 21:44	WT_LAP-17-134599	1800	0.542	26,400	7.98	171	3.78	1.21	28.6	53.1	14,300	0.346	-8440	25.5	123	4.9	0.83	0.548	-0.0457	0.114	38.7	88.5
E042.1	9/27/2017 22:04	WT_LAP-17-134600	3400	0.58	32,100	9.04	427	4.86	1.61	32.7	58.2	23,900	0.381	-4430	31	136	5.12	1.02	1.8	0.0302	1.4	50.5	215
E042.1	9/27/2017 22:24	WT_LAP-17-134601	2100	0.549	27,400	8.18	219	3.98	1.28	29.4	54.1	16,100	0.353	-7690	26.5	125	4.95	0.865	0.782	-0.0315	0.354	40.9	112
E042.1	9/27/2017 22:44	WT_LAP-17-134602	1600	0.537	25,600	7.85	139	3.65	1.16	28.1	52.5	13,100	0.342	-8950	24.8	121	4.88	0.807	0.392	-0.0552	-0.0468	37.2	72.8
E042.1	9/29/2017 0:44	WT_LAP-17-134749	9200	0.717	52,900	12.9	1360	8.76	3.09	47.5	76.9	58,600	0.508	10,100	50.9	186	5.91	1.69	6.32	0.305	6.05	93.4	672
E042.1	9/29/2017 0:46	WT_LAP-17-134750	9000	0.712	52,200	12.8	1320	8.63	3.04	47	76.3	57,400	0.503	9630	50.3	185	5.88	1.66	6.16	0.296	5.89	91.9	656
E042.1	9/29/2017 0:48	WT_LAP-17-134751	9100	0.715	52,600	12.8	1340	8.69	3.06	47.2	76.6	58,000	0.505	9880	50.6	186	5.9	1.68	6.24	0.3	5.97	92.6	664
E042.1	9/29/2017 0:50	WT_LAP-17-134752	8400	0.698	50,100	12.4	1230	8.22	2.88	45.4	74.3	53,800	0.49	8120	48.2	180	5.8	1.6	5.7	0.267	5.41	87.5	609
E042.1	9/29/2017 0:52	WT_LAP-17-134753	7600	0.679	47,200	11.8	1100	7.68	2.68	43.4	71.8	49,000	0.473	6110	45.4	173	5.69	1.5	5.07	0.229	4.77	81.6	546
E042.1	9/29/2017 0:54	WT_LAP-17-134754	7200	0.67	45,700	11.6	1040	7.42	2.58	42.4	70.5	46,600	0.464	5110	44.1	169	5.64	1.46	4.76	0.21	4.44	78.6	514
E042.1	9/29/2017 0:56	WT_LAP-17-134755	6500	0.653	43,200	11.1	923	6.94	2.4	40.6	68.2	42,400	0.449	3350	41.7	163	5.54	1.38	4.21	0.177	3.88	73.4	459
E042.1	9/29/2017 0:58	WT_LAP-17-134756	6100	0.644	41,800	10.8	859	6.68	2.3	39.6	66.9	40,000	0.44	2350	40.3	160	5.49	1.33	3.9	0.158	3.56	70.5	427
E042.1	9/29/2017 1:00	WT_LAP-17-134757	5700	0.634	40,400	10.6	795	6.41	2.2	38.5	65.7	37,600	0.431	1340	38.9	156	5.44	1.28	3.59	0.139	3.24	67.5	396
E042.1	9/29/2017 1:04	WT_LAP-17-133435	6100	0.644	41,800	10.8	859	6.68	2.3	39.6	66.9	40,000	0.44	2350	40.3	160	5.49	1.33	3.9	0.158	3.56	70.5	427

Table 4.4-1 (continued)

Station	Sample Collection Date and Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																			
				Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) −117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) −12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) −0.856 + 0.00078[c]* SSC	U-235/236 (pCi/L) −0.131 + 0.0000474 * SSC	U-238 (pCi/L) −1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) −53.3 + 0.0788 * SSC
E042.1	9/29/2017 1:04	WT_LAP-17-134758	5200	0.622	38,600	10.2	715	6.07	2.07	37.3	64	34,600	0.42	90	37.2	152	5.37	1.22	3.2	0.115	2.84	63.8	356
E042.1	9/29/2017 1:08	WT_LAP-17-134759	5100	0.62	38,200	10.2	699	6	2.05	37	63.7	34,000	0.418	-161	36.8	151	5.35	1.21	3.12	0.111	2.76	63.1	349
E042.1	9/29/2017 1:10	WT_LAP-17-134760	5000	0.617	37,800	10.1	683	5.94	2.02	36.8	63.4	33,400	0.416	-412	36.5	150	5.34	1.2	3.04	0.106	2.68	62.4	341
E042.1	9/29/2017 1:12	WT_LAP-17-134761	5100	0.62	38,200	10.2	699	6	2.05	37	63.7	34,000	0.418	-161	36.8	151	5.35	1.21	3.12	0.111	2.76	63.1	349
E042.1	9/29/2017 1:14	WT_LAP-17-134762	5100	0.62	38,200	10.2	699	6	2.05	37	63.7	34,000	0.418	-161	36.8	151	5.35	1.21	3.12	0.111	2.76	63.1	349
E042.1	9/29/2017 1:22	WT_LAP-17-134771	6300	0.648	42,500	11	891	6.81	2.35	40.1	67.6	41,200	0.444	2850	41	161	5.52	1.35	4.06	0.168	3.72	72	443
E042.1	9/29/2017 1:34	WT_LAP-17-134763	5500	0.629	39,600	10.4	763	6.27	2.15	38	65	36,400	0.427	843	38.2	155	5.41	1.26	3.43	0.13	3.08	66	380
E042.1	9/29/2017 1:54	WT_LAP-17-134764	3700	0.587	33,200	9.24	475	5.06	1.69	33.4	59.2	25,700	0.388	-3680	32	139	5.16	1.05	2.03	0.0444	1.64	52.7	238
E042.1	9/29/2017 2:14	WT_LAP-17-134765	3100	0.572	31,000	8.85	379	4.66	1.54	31.9	57.3	22,100	0.375	-5180	30	134	5.08	0.981	1.56	0.0159	1.16	48.3	191
E042.1	9/29/2017 2:34	WT_LAP-17-134766	2500	0.558	28,900	8.45	283	4.25	1.39	30.4	55.4	18,500	0.362	-6690	27.9	129	5	0.911	1.09	-0.0125	0.675	43.9	144
E042.1	9/29/2017 2:54	WT_LAP-17-134767	2300	0.554	28,200	8.31	251	4.12	1.34	29.9	54.7	17,300	0.357	-7190	27.2	127	4.97	0.888	0.938	-0.022	0.515	42.4	128
E042.1	9/29/2017 3:14	WT_LAP-17-134768	2100	0.549	27,400	8.18	219	3.98	1.28	29.4	54.1	16,100	0.353	-7690	26.5	125	4.95	0.865	0.782	-0.0315	0.354	40.9	112
E042.1	9/29/2017 3:34	WT_LAP-17-134769	1700	0.539	26,000	7.92	155	3.71	1.18	28.3	52.8	13,700	0.344	-8700	25.1	122	4.89	0.818	0.47	-0.0504	0.0334	38	80.7
E042.1	9/29/2017 3:54	WT_LAP-17-134770	1300	0.53	24,600	7.65	91	3.44	1.08	27.3	51.5	11,300	0.335	-9700	23.8	118	4.84	0.772	0.158	-0.0694	-0.287	35	49.1
E042.1	10/4/2017 22:04	WT_LAP-17-134917	60,800	1.94	238,000	47.1	9610	43.5	16.2	179	243	368,000	1.63	140,000	228	632	12.9	7.67	46.6	2.75	47.4	475	4740
E042.1	10/4/2017 22:06	WT_LAP-17-134918	57,600	1.86	227,000	45	9100	41.3	15.4	171	233	349,000	1.56	132,000	217	605	12.5	7.3	44.1	2.6	44.9	451	4490
E042.1	10/4/2017 22:08	WT_LAP-17-134919	52,600	1.75	209,000	41.7	8300	38	14.1	158	217	319,000	1.45	119,000	200	561	11.8	6.72	40.2	2.36	40.9	414	4090
E042.1	10/4/2017 22:10	WT_LAP-17-134920	46,500	1.6	187,000	37.6	7320	33.9	12.6	143	197	282,000	1.32	104,000	179	509	11	6.02	35.4	2.07	36	369	3610
E042.1	10/4/2017 22:12	WT_LAP-17-134921	41,100	1.47	167,000	34	6460	30.2	11.2	129	180	250,000	1.2	90,200	161	462	10.2	5.39	31.2	1.82	31.6	329	3190
E042.1	10/4/2017 22:14	WT_LAP-17-133450	37,700	1.39	155,000	31.8	5920	27.9	10.3	120	169	229,000	1.13	81,700	149	433	9.79	4.99	28.6	1.66	28.9	304	2920
E042.1	10/4/2017 22:14	WT_LAP-17-134922	37,800	1.39	156,000	31.9	5930	28	10.4	120	169	230,000	1.13	81,900	149	434	9.8	5.01	28.6	1.66	29	305	2930
E042.1	10/4/2017 22:16	WT_LAP-17-134923	34,400	1.31	143,000	29.6	5390	25.7	9.49	112	158	210,000	1.06	73,400	138	404	9.34	4.61	26	1.5	26.3	280	2660
E042.1	10/4/2017 22:18	WT_LAP-17-134924	31,800	1.25	134,000	27.9	4970	24	8.83	105	150	194,000	1	66,900	129	382	8.98	4.31	23.9	1.38	24.2	260	2450
E042.1	10/4/2017 22:20	WT_LAP-17-134925	29,800	1.21	127,000	26.5	4650	22.6	8.32	100	143	182,000	0.957	61,800	122	364	8.71	4.08	22.4	1.28	22.6	246	2290
E042.1	10/4/2017 22:24	WT_LAP-17-134926	25,900	1.11	113,000	24	4030	20	7.33	90	131	159,000	0.872	52,000	108	331	8.18	3.63	19.3	1.1	19.4	217	1990
E042.1	10/4/2017 22:28	WT_LAP-17-134927	22,300	1.03	1.00E+05	21.6	3450	17.6	6.42	80.9	119	137,000	0.793	43,000	96	300	7.69	3.21	16.5	0.926	16.6	190	1700
E042.1	10/4/2017 22:30	WT_LAP-17-134928	20,900	0.994	94,900	20.6	3230	16.6	6.06	77.3	115	129,000	0.763	39,500	91.2	288	7.5	3.05	15.4	0.86	15.4	180	1590
E042.1	10/4/2017 22:31	WT_LAP-17-134939	20,200	0.978	92,400	20.2	3120	16.2	5.88	75.5	112	124,000	0.747	37,700	88.8	282	7.41	2.96	14.9	0.826	14.9	175	1540
E042.1	10/4/2017 22:32	WT_LAP-17-134929	19,600	0.964	90,300	19.8	3020	15.8	5.73	74	110	121,000	0.734	36,200	86.7	276	7.33	2.89	14.4	0.798	14.4	170	1490
E042.1	10/4/2017 22:34	WT_LAP-17-134930	18,300	0.933	85,600	18.9	2810	14.9	5.4	70.7	106	113,000	0.706	33,000	82.3	265	7.15	2.74	13.4	0.736	13.3	161	1390
E042.1	10/4/2017 22:54	WT_LAP-17-134931	11,800	0.779	62,300	14.6	1770	10.5	3.75	54.1	85.3	74,200	0.564	16,700	59.9	209	6.26	1.99	8.35	0.428	8.13	113	877
E042.1	10/4/2017 23:14	WT_LAP-17-134932	6800	0.66	44,300	11.3	971	7.15	2.48	41.3	69.2	44,200	0.455	4110	42.7	166	5.58	1.41	4.45	0.191	4.12	75.7	483

Table 4.4-1 (continued)

Station	Sample Collection Date and Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																			
				Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) −117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) −12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) −0.856 + 0.00078[c]* SSC	U-235/236 (pCi/L) −0.131 + 0.0000474 * SSC	U-238 (pCi/L) −1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) −53.3 + 0.0788 * SSC
E042.1	10/4/2017 23:34	WT_LAP-17-134933	5100	0.62	38,200	10.2	699	6	2.05	37	63.7	34,000	0.418	-161	36.8	151	5.35	1.21	3.12	0.111	2.76	63.1	349
E042.1	10/4/2017 23:54	WT_LAP-17-134934	3800	0.589	33,500	9.31	491	5.13	1.72	33.7	59.5	26,300	0.39	-3420	32.4	140	5.18	1.06	2.11	0.0491	1.72	53.5	246
E042.1	10/5/2017 0:14	WT_LAP-17-134935	3000	0.57	30,700	8.78	363	4.59	1.51	31.6	57	21,500	0.372	-5430	29.6	133	5.07	0.969	1.48	0.0112	1.08	47.6	183
E042.1	10/5/2017 0:34	WT_LAP-17-134936	1700	0.539	26,000	7.92	155	3.71	1.18	28.3	52.8	13,700	0.344	-8700	25.1	122	4.89	0.818	0.47	-0.0504	0.0334	38	80.7
E042.1	10/5/2017 0:54	WT_LAP-17-134937	8700	0.705	51,100	12.6	1280	8.43	2.96	46.2	75.3	55,600	0.497	8870	49.2	182	5.84	1.63	5.93	0.281	5.65	89.7	632
E042.1	10/5/2017 1:14	WT_LAP-17-134938	3100	0.572	31,000	8.85	379	4.66	1.54	31.9	57.3	22,100	0.375	-5180	30	134	5.08	0.981	1.56	0.0159	1.16	48.3	191
E050.1	9/27/2017 0:19	WT_LAP-17-134454	600	0.513	22,000	7.19	-21	2.97	0.903	25.5	49.2	7080	0.32	-11,500	21.4	112	4.74	0.691	-0.388	-0.103	-0.849	29.8	-6.02
E050.1	9/27/2017 0:39	WT_LAP-17-134455	600	0.513	22,000	7.19	-21	2.97	0.903	25.5	49.2	7080	0.32	-11,500	21.4	112	4.74	0.691	-0.388	-0.103	-0.849	29.8	-6.02
E050.1	9/27/2017 0:59	WT_LAP-17-134456	600	0.513	22,000	7.19	-21	2.97	0.903	25.5	49.2	7080	0.32	-11,500	21.4	112	4.74	0.691	-0.388	-0.103	-0.849	29.8	-6.02
E050.1	9/27/2017 1:19	WT_LAP-17-134457	500	0.511	21,700	7.12	-37	2.91	0.878	25.3	48.9	6480	0.318	-11,700	21	111	4.73	0.679	-0.466	-0.107	-0.929	29.1	-13.9
E050.1	9/27/2017 22:29	WT_LAP-17-134438	800	0.518	22,800	7.32	11	3.11	0.954	26	49.9	8280	0.324	-11,000	22.1	114	4.77	0.714	-0.232	-0.0931	-0.688	31.3	9.74
E050.1	9/27/2017 22:31	WT_LAP-17-134439	700	0.516	22,400	7.25	-5	3.04	0.929	25.8	49.6	7680	0.322	-11,200	21.7	113	4.76	0.702	-0.31	-0.0978	-0.769	30.6	1.86
E050.1	9/27/2017 22:35	WT_LAP-17-134440	900	0.52	23,100	7.39	27	3.18	0.98	26.3	50.2	8880	0.327	-10,700	22.4	115	4.78	0.725	-0.154	-0.0883	-0.608	32.1	17.6
E050.1	9/27/2017 22:38	WT_LAP-17-134441	900	0.52	23,100	7.39	27	3.18	0.98	26.3	50.2	8880	0.327	-10,700	22.4	115	4.78	0.725	-0.154	-0.0883	-0.608	32.1	17.6
E050.1	9/27/2017 22:42	WT_LAP-17-134442	900	0.52	23,100	7.39	27	3.18	0.98	26.3	50.2	8880	0.327	-10,700	22.4	115	4.78	0.725	-0.154	-0.0883	-0.608	32.1	17.6
E050.1	9/27/2017 22:43	WT_LAP-17-134443	900	0.52	23,100	7.39	27	3.18	0.98	26.3	50.2	8880	0.327	-10,700	22.4	115	4.78	0.725	-0.154	-0.0883	-0.608	32.1	17.6
E050.1	9/27/2017 22:45	WT_LAP-17-134444	900	0.52	23,100	7.39	27	3.18	0.98	26.3	50.2	8880	0.327	-10700	22.4	115	4.78	0.725	-0.154	-0.0883	-0.608	32.1	17.6
E050.1	9/27/2017 22:48	WT_LAP-17-134445	900	0.52	23,100	7.39	27	3.18	0.98	26.3	50.2	8880	0.327	-10700	22.4	115	4.78	0.725	-0.154	-0.0883	-0.608	32.1	17.6
E050.1	9/27/2017 22:53	WT_LAP-17-134446	1000	0.523	23,500	7.45	43	3.24	1	26.6	50.5	9480	0.329	-10500	22.7	116	4.8	0.737	-0.076	-0.0836	-0.528	32.8	25.5
E050.1	9/27/2017 22:59	WT_LAP-17-134450	900	0.52	23,100	7.39	27	3.18	0.98	26.3	50.2	8880	0.327	-10700	22.4	115	4.78	0.725	-0.154	-0.0883	-0.608	32.1	17.6
E050.1	9/27/2017 23:19	WT_LAP-17-134451	800	0.518	22,800	7.32	11	3.11	0.954	26	49.9	8280	0.324	-11000	22.1	114	4.77	0.714	-0.232	-0.0931	-0.688	31.3	9.74
E050.1	9/27/2017 23:23	WT_LAP-17-133407	700	0.516	22,400	7.25	-5	3.04	0.929	25.8	49.6	7680	0.322	-11200	21.7	113	4.76	0.702	-0.31	-0.0978	-0.769	30.6	1.86
E050.1	9/27/2017 23:39	WT_LAP-17-134452	700	0.516	22,400	7.25	-5	3.04	0.929	25.8	49.6	7680	0.322	-11200	21.7	113	4.76	0.702	-0.31	-0.0978	-0.769	30.6	1.86
E050.1	9/27/2017 23:59	WT_LAP-17-134453	700	0.516	22,400	7.25	-5	3.04	0.929	25.8	49.6	7680	0.322	-11200	21.7	113	4.76	0.702	-0.31	-0.0978	-0.769	30.6	1.86
E050.1	9/28/2017 1:39	WT_LAP-17-134458	500	0.511	21,700	7.12	-37	2.91	0.878	25.3	48.9	6480	0.318	-11700	21	111	4.73	0.679	-0.466	-0.107	-0.929	29.1	-13.9
E050.1	9/29/2017 0:56	WT_LAP-17-134614	500	0.511	21,700	7.12	-37	2.91	0.878	25.3	48.9	6480	0.318	-11700	21	111	4.73	0.679	-0.466	-0.107	-0.929	29.1	-13.9
E050.1	9/29/2017 0:59	WT_LAP-17-134615	900	0.52	23,100	7.39	27	3.18	0.98	26.3	50.2	8880	0.327	-10700	22.4	115	4.78	0.725	-0.154	-0.0883	-0.608	32.1	17.6
E050.1	9/29/2017 1:39	WT_LAP-17-134620	1800	0.542	26,400	7.98	171	3.78	1.21	28.6	53.1	14,300	0.346	-8440	25.5	123	4.9	0.83	0.548	-0.0457	0.114	38.7	88.5
E050.1	9/29/2017 1:53	WT_LAP-17-133422	1800	0.542	26,400	7.98	171	3.78	1.21	28.6	53.1	14,300	0.346	-8440	25.5	123	4.9	0.83	0.548	-0.0457	0.114	38.7	88.5
E050.1	9/29/2017 1:59	WT_LAP-17-134621	1800	0.542	26,400	7.98	171	3.78	1.21	28.6	53.1	14,300	0.346	-8440	25.5	123	4.9	0.83	0.548	-0.0457	0.114	38.7	88.5
E050.1	9/29/2017 2:11	WT_LAP-17-134627	1600	0.537	25,600	7.85	139	3.65	1.16	28.1	52.5	13,100	0.342	-8950	24.8	121	4.88	0.807	0.392	-0.0552	-0.0468	37.2	72.8
E050.1	9/29/2017 2:19	WT_LAP-17-134622	1500	0.535	25,300	7.78	123	3.58	1.13	27.8	52.1	12,500	0.34	-9200	24.5	120	4.86	0.795	0.314	-0.0599	-0.127	36.5	64.9

Table 4.4-1 (continued)

Station	Sample Collection Date and Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																			
				Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) −117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) −12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) −0.856 + 0.00078[c] * SSC	U-235/236 (pCi/L) −0.131 + 0.0000474 * SSC	U-238 (pCi/L) −1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) −53.3 + 0.0788 * SSC
E050.1	9/29/2017 2:39	WT_LAP-17-134623	1300	0.53	24,600	7.65	91	3.44	1.08	27.3	51.5	11,300	0.335	-9700	23.8	118	4.84	0.772	0.158	-0.0694	-0.287	35	49.1
E050.1	9/29/2017 2:59	WT_LAP-17-134624	1200	0.527	24,200	7.59	75	3.38	1.06	27.1	51.2	10,700	0.333	-9950	23.4	117	4.82	0.76	0.08	-0.0741	-0.368	34.3	41.3
E050.1	9/29/2017 3:19	WT_LAP-17-134625	1100	0.525	23,800	7.52	59	3.31	1.03	26.8	50.8	10,100	0.331	-10200	23.1	117	4.81	0.749	0.002	-0.0789	-0.448	33.5	33.4
E050.1	9/29/2017 3:39	WT_LAP-17-134626	900	0.52	23,100	7.39	27	3.18	0.98	26.3	50.2	8880	0.327	-10700	22.4	115	4.78	0.725	-0.154	-0.0883	-0.608	32.1	17.6
E050.1	10/4/2017 0:08	WT_LAP-17-134795	1600	0.537	25,600	7.85	139	3.65	1.16	28.1	52.5	13,100	0.342	-8950	24.8	121	4.88	0.807	0.392	-0.0552	-0.0468	37.2	72.8
E050.1	10/4/2017 23:13	WT_LAP-17-134774	2500	0.558	28,900	8.45	283	4.25	1.39	30.4	55.4	18,500	0.362	-6690	27.9	129	5	0.911	1.09	-0.0125	0.675	43.9	144
E050.1	10/4/2017 23:15	WT_LAP-17-134775	2600	0.561	29,200	8.51	299	4.32	1.41	30.6	55.7	19,100	0.364	-6440	28.2	129	5.01	0.923	1.17	-0.00776	0.755	44.6	152
E050.1	10/4/2017 23:17	WT_LAP-17-134776	2600	0.561	29,200	8.51	299	4.32	1.41	30.6	55.7	19,100	0.364	-6440	28.2	129	5.01	0.923	1.17	-0.00776	0.755	44.6	152
E050.1	10/4/2017 23:19	WT_LAP-17-134777	2500	0.558	28,900	8.45	283	4.25	1.39	30.4	55.4	18,500	0.362	-6690	27.9	129	5	0.911	1.09	-0.0125	0.675	43.9	144
E050.1	10/4/2017 23:21	WT_LAP-17-134778	2400	0.556	28,500	8.38	267	4.19	1.36	30.1	55	17,900	0.359	-6940	27.6	128	4.99	0.899	1.02	-0.0172	0.595	43.1	136
E050.1	10/4/2017 23:23	WT_LAP-17-134779	2400	0.556	28,500	8.38	267	4.19	1.36	30.1	55	17,900	0.359	-6940	27.6	128	4.99	0.899	1.02	-0.0172	0.595	43.1	136
E050.1	10/4/2017 23:25	WT_LAP-17-134780	2300	0.554	28,200	8.31	251	4.12	1.34	29.9	54.7	17,300	0.357	-7190	27.2	127	4.97	0.888	0.938	-0.022	0.515	42.4	128
E050.1	10/4/2017 23:29	WT_LAP-17-134781	2300	0.554	28,200	8.31	251	4.12	1.34	29.9	54.7	17,300	0.357	-7190	27.2	127	4.97	0.888	0.938	-0.022	0.515	42.4	128
E050.1	10/4/2017 23:35	WT_LAP-17-134782	2200	0.551	27,800	8.25	235	4.05	1.31	29.6	54.4	16,700	0.355	-7440	26.9	126	4.96	0.876	0.86	-0.0267	0.434	41.7	120
E050.1	10/4/2017 23:37	WT_LAP-17-134783	1700	0.539	26,000	7.92	155	3.71	1.18	28.3	52.8	13,700	0.344	-8700	25.1	122	4.89	0.818	0.47	-0.0504	0.0334	38	80.7
E050.1	10/4/2017 23:41	WT_LAP-17-134785	2100	0.549	27,400	8.18	219	3.98	1.28	29.4	54.1	16,100	0.353	-7690	26.5	125	4.95	0.865	0.782	-0.0315	0.354	40.9	112
E050.1	10/4/2017 23:43	WT_LAP-17-134786	2100	0.549	27,400	8.18	219	3.98	1.28	29.4	54.1	16,100	0.353	-7690	26.5	125	4.95	0.865	0.782	-0.0315	0.354	40.9	112
E050.1	10/4/2017 23:58	WT_LAP-17-133437	1700	0.539	26,000	7.92	155	3.71	1.18	28.3	52.8	13,700	0.344	-8700	25.1	122	4.89	0.818	0.47	-0.0504	0.0334	38	80.7
E050.1	10/5/2017 0:03	WT_LAP-17-134787	1700	0.539	26,000	7.92	155	3.71	1.18	28.3	52.8	13,700	0.344	-8700	25.1	122	4.89	0.818	0.47	-0.0504	0.0334	38	80.7
E050.1	10/5/2017 0:23	WT_LAP-17-134788	1500	0.535	25,300	7.78	123	3.58	1.13	27.8	52.1	12,500	0.34	-9200	24.5	120	4.86	0.795	0.314	-0.0599	-0.127	36.5	64.9
E050.1	10/5/2017 0:43	WT_LAP-17-134789	1300	0.53	24,600	7.65	91	3.44	1.08	27.3	51.5	11,300	0.335	-9700	23.8	118	4.84	0.772	0.158	-0.0694	-0.287	35	49.1
E050.1	10/5/2017 1:03	WT_LAP-17-134790	1200	0.527	24,200	7.59	75	3.38	1.06	27.1	51.2	10,700	0.333	-9950	23.4	117	4.82	0.76	0.08	-0.0741	-0.368	34.3	41.3
E050.1	10/5/2017 1:23	WT_LAP-17-134791	1300	0.53	24,600	7.65	91	3.44	1.08	27.3	51.5	11,300	0.335	-9700	23.8	118	4.84	0.772	0.158	-0.0694	-0.287	35	49.1
E050.1	10/5/2017 1:43	WT_LAP-17-134792	1100	0.525	23,800	7.52	59	3.31	1.03	26.8	50.8	10,100	0.331	-10,200	23.1	117	4.81	0.749	0.002	-0.0789	-0.448	33.5	33.4
E050.1	10/5/2017 2:03	WT_LAP-17-134793	1000	0.523	23,500	7.45	43	3.24	1	26.6	50.5	9480	0.329	-10,500	22.7	116	4.8	0.737	-0.076	-0.0836	-0.528	32.8	25.5
E050.1	10/5/2017 2:23	WT_LAP-17-134794	900	0.52	23,100	7.39	27	3.18	0.98	26.3	50.2	8880	0.327	-10,700	22.4	115	4.78	0.725	-0.154	-0.0883	-0.608	32.1	17.6
E055	9/27/2017 19:04	WT_LAP-17-133408	9000	0.712	52,200	12.8	1320	8.63	3.04	47	76.3	57,400	0.503	9630	50.3	185	5.88	1.66	6.16	0.296	5.89	91.9	656
E055	9/27/2017 19:22	WT_LAP-17-133651	900	0.52	23,100	7.39	27	3.18	0.98	26.3	50.2	8880	0.327	-10,700	22.4	115	4.78	0.725	-0.154	-0.0883	-0.608	32.1	17.6
E055	9/29/2017 0:14	WT_LAP-17-133423	200	0.504	20,600	6.92	-85	2.7	0.802	24.5	47.9	4690	0.311	-12,500	20	109	4.69	0.644	-0.7	-0.122	-1.17	26.9	-37.5
E055	9/29/2017 0:32	WT_LAP-17-133666	200	0.504	20,600	6.92	-85	2.7	0.802	24.5	47.9	4690	0.311	-12,500	20	109	4.69	0.644	-0.7	-0.122	-1.17	26.9	-37.5
E055.5	7/26/2017 11:51	WT_LAP-17-133653	2600	0.561	29,200	8.51	299	4.32	1.41	30.6	55.7	19,100	0.364	-6440	28.2	129	5.01	0.923	1.17	-0.00776	0.755	44.6	152
E055.5	7/26/2017 11:55	WT_LAP-17-133410	1800	0.542	26,400	7.98	171	3.78	1.21	28.6	53.1	14,300	0.346	-8440	25.5	123	4.9	0.83	0.548	-0.0457	0.114	38.7	88.5

Table 4.4-1 (continued)

Station	Sample Collection Date and Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																			
				Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) −117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) −12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) −0.856 + 0.00078[c] * SSC	U-235/236 (pCi/L) −0.131 + 0.0000474 * SSC	U-238 (pCi/L) −1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) −53.3 + 0.0788 * SSC
E055.5	7/27/2017 20:44	WT_LAP-17-133425	3300	0.577	31,700	8.98	411	4.79	1.59	32.4	57.9	23,300	0.379	-4680	30.7	136	5.11	1	1.72	0.0254	1.32	49.8	207
E055.5	7/27/2017 21:03	WT_LAP-17-133668	1900	0.544	26,700	8.05	187	3.85	1.23	28.8	53.4	14,900	0.348	-8190	25.8	123	4.92	0.841	0.626	-0.0409	0.194	39.4	96.4
E055.5	7/29/2017 19:29	WT_LAP-17-133440	30600	1.22	130,000	27.1	4780	23.2	8.52	102	146	187,000	0.974	63,800	125	371	8.82	4.17	23	1.32	23.2	252	2360
E055.5	7/29/2017 19:52	WT_LAP-17-133683	2900	0.568	30,300	8.71	347	4.52	1.49	31.4	56.6	20,900	0.37	-5680	29.3	132	5.05	0.957	1.41	0.00646	0.996	46.8	175
E056	7/8/2017 13:40	WT_LAP-17-133397	1500	0.535	25,300	7.78	123	3.58	1.13	27.8	52.1	12,500	0.34	-9200	24.5	120	4.86	0.795	0.314	-0.0599	-0.127	36.5	64.9
E056	7/8/2017 13:58	WT_LAP-17-133639	700	0.516	22,400	7.25	-5	3.04	0.929	25.8	49.6	7680	0.322	-11,200	21.7	113	4.76	0.702	-0.31	-0.0978	-0.769	30.6	1.86
E056	7/26/2017 11:35	WT_LAP-17-133411	5500	0.629	39,600	10.4	763	6.27	2.15	38	65	36,400	0.427	843	38.2	155	5.41	1.26	3.43	0.13	3.08	66	380
E056	7/26/2017 11:53	WT_LAP-17-133654	2200	0.551	27,800	8.25	235	4.05	1.31	29.6	54.4	16,700	0.355	-7440	26.9	126	4.96	0.876	0.86	-0.0267	0.434	41.7	120
E056	7/29/2017 19:50	WT_LAP-17-133426	2100	0.549	27,400	8.18	219	3.98	1.28	29.4	54.1	16,100	0.353	-7690	26.5	125	4.95	0.865	0.782	-0.0315	0.354	40.9	112
E056	7/29/2017 20:08	WT_LAP-17-133669	600	0.513	22,000	7.19	-21	2.97	0.903	25.5	49.2	7080	0.32	-11,500	21.4	112	4.74	0.691	-0.388	-0.103	-0.849	29.8	-6.02
E056	8/23/2017 12:20	WT_LAP-17-133441	1400	0.532	24,900	7.72	107	3.51	1.11	27.6	51.8	11,900	0.338	-9450	24.1	119	4.85	0.783	0.236	-0.0646	-0.207	35.7	57
E056	8/23/2017 12:38	WT_LAP-17-133684	700	0.516	22,400	7.25	-5	3.04	0.929	25.8	49.6	7680	0.322	-11,200	21.7	113	4.76	0.702	-0.31	-0.0978	-0.769	30.6	1.86
E059.5	9/29/2017 1:30	WT_LAP-17-133645	3300	0.577	31,700	8.98	411	4.79	1.59	32.4	57.9	23,300	0.379	-4680	30.7	136	5.11	1	1.72	0.0254	1.32	49.8	207
E059.5	9/29/2017 1:33	WT_LAP-17-134364	4000	0.594	34,300	9.44	523	5.26	1.77	34.2	60.2	27,400	0.394	-2920	33.1	142	5.2	1.08	2.26	0.0586	1.88	55	262
E059.5	9/29/2017 1:35	WT_LAP-17-134365	3600	0.584	32,800	9.18	459	4.99	1.67	33.2	58.9	25,100	0.385	-3930	31.7	138	5.15	1.04	1.95	0.0396	1.56	52	230
E059.5	9/29/2017 1:38	WT_LAP-17-134366	3700	0.587	33,200	9.24	475	5.06	1.69	33.4	59.2	25,700	0.388	-3680	32	139	5.16	1.05	2.03	0.0444	1.64	52.7	238
E059.5	9/29/2017 1:40	WT_LAP-17-134367	3400	0.58	32,100	9.04	427	4.86	1.61	32.7	58.2	23,900	0.381	-4430	31	136	5.12	1.02	1.8	0.0302	1.4	50.5	215
E059.5	9/29/2017 1:43	WT_LAP-17-134368	3600	0.584	32,800	9.18	459	4.99	1.67	33.2	58.9	25,100	0.385	-3930	31.7	138	5.15	1.04	1.95	0.0396	1.56	52	230
E059.5	9/29/2017 1:45	WT_LAP-17-134369	2900	0.568	30,300	8.71	347	4.52	1.49	31.4	56.6	20,900	0.37	-5680	29.3	132	5.05	0.957	1.41	0.00646	0.996	46.8	175
E059.5	9/29/2017 1:48	WT_LAP-17-134370	3200	0.575	31,400	8.91	395	4.72	1.56	32.2	57.6	22,700	0.377	-4930	30.3	135	5.1	0.992	1.64	0.0207	1.24	49	199
E059.5	9/29/2017 1:50	WT_LAP-17-134371	3500	0.582	32,500	9.11	443	4.93	1.64	32.9	58.6	24,500	0.383	-4180	31.3	137	5.14	1.03	1.87	0.0349	1.48	51.3	222
E059.5	9/29/2017 1:53	WT_LAP-17-134372	3300	0.577	31,700	8.98	411	4.79	1.59	32.4	57.9	23,300	0.379	-4680	30.7	136	5.11	1	1.72	0.0254	1.32	49.8	207
E059.5	9/29/2017 1:55	WT_LAP-17-134373	2600	0.561	29,200	8.51	299	4.32	1.41	30.6	55.7	19,100	0.364	-6440	28.2	129	5.01	0.923	1.17	-0.00776	0.755	44.6	152
E059.5	9/29/2017 2:00	WT_LAP-17-134378	3400	0.58	32,100	9.04	427	4.86	1.61	32.7	58.2	23,900	0.381	-4430	31	136	5.12	1.02	1.8	0.0302	1.4	50.5	215
E059.5	9/29/2017 2:20	WT_LAP-17-134379	2500	0.558	28,900	8.45	283	4.25	1.39	30.4	55.4	18,500	0.362	-6690	27.9	129	5	0.911	1.09	-0.0125	0.675	43.9	144
E059.5	9/29/2017 2:40	WT_LAP-17-134380	2600	0.561	29,200	8.51	299	4.32	1.41	30.6	55.7	19,100	0.364	-6440	28.2	129	5.01	0.923	1.17	-0.00776	0.755	44.6	152
E059.5	9/29/2017 3:00	WT_LAP-17-134381	1800	0.542	26,400	7.98	171	3.78	1.21	28.6	53.1	14,300	0.346	-8440	25.5	123	4.9	0.83	0.548	-0.0457	0.114	38.7	88.5
E059.5	9/29/2017 3:20	WT_LAP-17-134382	1500	0.535	25,300	7.78	123	3.58	1.13	27.8	52.1	12,500	0.34	-9200	24.5	120	4.86	0.795	0.314	-0.0599	-0.127	36.5	64.9
E059.5	9/29/2017 3:40	WT_LAP-17-134383	1500	0.535	25,300	7.78	123	3.58	1.13	27.8	52.1	12,500	0.34	-9200	24.5	120	4.86	0.795	0.314	-0.0599	-0.127	36.5	64.9
E059.5	9/29/2017 4:00	WT_LAP-17-134384	4600	0.608	36,400	9.84	619	5.67	1.92	35.7	62.1	31,000	0.407	-1420	35.1	147	5.29	1.15	2.73	0.087	2.36	59.4	309
E059.5	9/29/2017 4:20	WT_LAP-17-134385	3300	0.577	31,700	8.98	411	4.79	1.59	32.4	57.9	23,300	0.379	-4680	30.7	136	5.11	1	1.72	0.0254	1.32	49.8	207
E059.5	9/29/2017 4:40	WT_LAP-17-134386	6700	0.658	43,900	11.2	955	7.08	2.45	41.1	68.9	43,600	0.453	3860	42.3	165	5.57	1.4	4.37	0.187	4.04	74.9	475

Table 4.4-1 (continued)

Station	Sample Collection Date and Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																			
				Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) −117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) −12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) −0.856 + 0.00078[c] * SSC	U-235/236 (pCi/L) −0.131 + 0.0000474 * SSC	U-238 (pCi/L) −1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) −53.3 + 0.0788 * SSC
E059.8	9/29/2017 11:19	WT_LAP-17-133403	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.8	9/29/2017 11:26	WT_LAP-17-134390	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.8	9/29/2017 11:29	WT_LAP-17-134391	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	9/29/2017 11:35	WT_LAP-17-134392	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.8	9/29/2017 11:37	WT_LAP-17-134393	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	9/29/2017 11:41	WT_LAP-17-134394	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.8	9/29/2017 11:44	WT_LAP-17-134402	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.8	9/29/2017 12:04	WT_LAP-17-134403	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.8	9/29/2017 12:24	WT_LAP-17-134404	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.8	9/29/2017 12:44	WT_LAP-17-134405	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.8	9/29/2017 13:04	WT_LAP-17-134406	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.8	9/29/2017 13:24	WT_LAP-17-134407	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	9/29/2017 13:44	WT_LAP-17-134408	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	10/5/2017 0:29	WT_LAP-17-133661	500	0.511	21,700	7.12	-37	2.91	0.878	25.3	48.9	6480	0.318	-11,700	21	111	4.73	0.679	-0.466	-0.107	-0.929	29.1	-13.9
E059.8	10/5/2017 0:33	WT_LAP-17-134556	500	0.511	21,700	7.12	-37	2.91	0.878	25.3	48.9	6480	0.318	-11,700	21	111	4.73	0.679	-0.466	-0.107	-0.929	29.1	-13.9
E059.8	10/5/2017 0:37	WT_LAP-17-134557	500	0.511	21,700	7.12	-37	2.91	0.878	25.3	48.9	6480	0.318	-11,700	21	111	4.73	0.679	-0.466	-0.107	-0.929	29.1	-13.9
E059.8	10/5/2017 0:41	WT_LAP-17-134558	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	10/5/2017 0:44	WT_LAP-17-134559	500	0.511	21,700	7.12	-37	2.91	0.878	25.3	48.9	6480	0.318	-11,700	21	111	4.73	0.679	-0.466	-0.107	-0.929	29.1	-13.9
E059.8	10/5/2017 0:48	WT_LAP-17-134560	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	10/5/2017 0:52	WT_LAP-17-134561	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	10/5/2017 0:55	WT_LAP-17-134562	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	10/5/2017 0:59	WT_LAP-17-133418	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	10/5/2017 0:59	WT_LAP-17-134570	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	10/5/2017 2:19	WT_LAP-17-134574	400	0.508	21,300	7.06	-53	2.84	0.853	25	48.6	5880	0.316	-12,000	20.7	110	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	10/5/2017 2:39	WT_LAP-17-134575	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.8	10/5/2017 2:59	WT_LAP-17-134576	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.8	10/5/2017 3:19	WT_LAP-17-134577	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.8	10/5/2017 3:39	WT_LAP-17-134578	300	0.506	21,000	6.99	-69	2.77	0.827	24.8	48.3	5290	0.314	-12,200	20.3	110	4.7	0.656	-0.622	-0.117	-1.09	27.6	-29.7

Note: Cells are shaded in gray when estimated metals and isotopic uranium concentrations (µg/L or pCi/L) normalized to measured SSC (mg/L) exceed background concentrations expected in sediment (mg/kg).

[a] Unit of inorganic slope is µg/L/mg/L.

[b] Unit of SSC measurement is mg/L.

[c] Unit of radioisotope slope is pCi/L/mg/L.

Table 4.4-2
Relative Percent Difference between Measured and Estimated Metals Concentrations at E050.1

Parameter (unit)	Linear Equation for Unfiltered Metal Concentration	E050.1 Collected 9/27/2017 22:53 Field Sample ID WT_LAP-17-134446	E050.1 Collected 9/27/2017 22:55 Field Sample ID WT_LAP-17-134994	RPD between Estimated Total Metals Concentrations at WTLAP-16-118843 and Measured Concentrations at WTLAP-16-119140
SSC (mg/L)	Measured	3100 (Measured)	3100 (Estimated)	n/a[a]
Ag (µg/L)	0.499+0.0000237[b] * SSC[c]	0.57247 (Estimated)	ND[d] (Measured)	n/a
Al (µg/L)	19,895+3.59 * SSC	31024 (Estimated)	46,800 (Measured)	41%
As (µg/L)	6.79+0.000663 * SSC	8.8453 (Estimated)	9.54 (Measured)	8%
Ba (µg/L)	−117+0.16 * SSC	379 (Estimated)	601 (Measured)	45%
Be (µg/L)	2.57+0.000673 * SSC	4.66 (Estimated)	5.53 (Measured)	4%
Cd (µg/L)	0.751+0.000254 * SSC	1.5384 (Estimated)	0.813 (Measured)	62%
Co (µg/L)	−21.3+0.00672 * SSC	−0.468 (Estimated)	14.9 (Measured)	213%
Cr (µg/L)	24+0.00255 * SSC	31.905 (Estimated)	30.8 (Measured)	4%
Cu (µg/L)	47.3+0.00322 * SSC	57.282 (Estimated)	48.2 (Measured)	17%
Fe (µg/L)	3489+5.99 * SSC	22,058 (Estimated)	36,700 (Measured)	50%
Hg (µg/L)	0.307+0.0000218 * SSC	0.37458 (Estimated)	0.253 (Measured)	39%
Mn (µg/L)	−12962+2.51 * SSC	−5181 (Estimated)	2650 (Measured)	−619%
Ni (µg/L)	19.3+0.00344 * SSC	29.964 (Estimated)	28.5 (Measured)	5%
Pb (µg/L)	107+0.00864 * SSC	133.784 (Estimated)	141 (Measured)	5%
Se (µg/L)	4.66+0.000136 * SSC	5.0816 (Estimated)	4.51 (Measured)	12%
Tl (µg/L)	0.621+0.000116 * SSC	0.9806 (Estimated)	1.19 (Measured)	19%
V (µg/L)	25.4+0.00739 * SSC	48.309 (Estimated)	53.6 (Measured)	10%
Zn (µg/L)	-53.3+0.0788 * SSC	190.98 (Estimated)	422 (Measured)	75%

Table 4.4-2 (continued)

Parameter (unit)	Linear Equation for Unfiltered Metal Concentration	E050.1 9/27/2017 22:55 WT_LAP-17-134994 Measured Concentration	E050.1 9/27/17 22:53 WT_LAP-17-133446 SSC = 1000 mg/L Estimated Concentration	RPD between Measured Concentrations and Estimated Concentrations
Ag (µg/L)	0.499+0.0000237 * SSC	ND	0.523	n/a
Al (µg/L)	19,895+3.59 * SSC	15,500	23,500	41
As (µg/L)	6.79+0.000663 * SSC	3.89	7.45	63
Ba (µg/L)	−117+0.16 * SSC	159	43	115
Be (µg/L)	2.57+0.000673 * SSC	1.5	3.24	73
Cd (µg/L)	0.751+0.000254 * SSC	ND	1	n/a
Co (µg/L)	−21.3+0.00672 * SSC	4.23	-14.6	363
Cr (µg/L)	24+0.00255 * SSC	11.1	26.6	82
Cu (µg/L)	47.3+0.00322 * SSC	17.3	50.5	98
Fe (µg/L)	3489+5.99 * SSC	11,600	9480	20
Mn (µg/L)	−12,962+2.51 * SSC	659	−10,500	227
Ni (µg/L)	19.3+0.00344 * SSC	9.35	22.7	83
Pb (µg/L)	107+0.00864 * SSC	36.4	116	104
Se (µg/L)	4.66+0.000136 * SSC	ND	4.8	n/a
Tl (µg/L)	0.621+0.000116 * SSC	ND	0.737	n/a
V (µg/L)	25.4+0.00739 * SSC	17.9	32.8	59
Zn (µg/L)	−53.3+0.0788 * SSC	147	25.5	141

Table 4.4-2 (continued)

Parameter (unit)	Linear Equation for Unfiltered Metal Concentration	E050.1 9/27/2017 00:59 WT_LAP-17-135000 Measured Concentration	E050.1 9/29/2017 00:59 WT_LAP-17-134615 SSC = 900 mg/L Estimated Concentration	RPD between Measured Concentrations and Estimated Concentrations
Ag (µg/L)	0.499+0.0000237 * SSC	ND	0.52	n/a
Al (µg/L)	19,895+3.59 * SSC	15,000	23,100	43
As (µg/L)	6.79+0.000663 * SSC	3.46	7.39	72
Ba (µg/L)	−117+0.16 * SSC	182	27	148
Be (µg/L)	2.57+0.000673 * SSC	1.69	3.18	61
Cd (µg/L)	0.751+0.000254 * SSC	ND	0.98	n/a
Co (µg/L)	−21.3+0.00672 * SSC	4.64	−15.3	374
Cr (µg/L)	24+0.00255 * SSC	9.44	26.3	94
Cu (µg/L)	47.3+0.00322 * SSC	16.2	50.2	102
Fe (µg/L)	3489+5.99 * SSC	11,800	8880	28
Mn (µg/L)	−12962+2.51 * SSC	740	-10,700	230
Ni (µg/L)	19.3+0.00344 * SSC	8.67	22.4	88
Pb (µg/L)	107+0.00864 * SSC	39.6	115	98
Se (µg/L)	4.66+0.000136 * SSC	ND	4.78	n/a
Tl (µg/L)	0.621+0.000116 * SSC	ND	0.725	n/a
V (µg/L)	25.4+0.00739 * SSC	18.7	32.1	53
Zn (µg/L)	−53.3+0.0788 * SSC	150	17.6	158

Table 4.4-2 (continued)

Parameter (unit)	Linear Equation for Unfiltered Metal Concentration	E050.1 10/4/2017 23:37 WT_LAP-17-135006 Measured Concentration	E050.1 10/4/2017 23:37 WT_LAP-17-134783 SSC = 1700 mg/L Estimated Concentration	Relative Percent Difference between Measured Concentrations and Estimated Concentrations
Ag (µg/L)	0.499+0.0000237 * SSC	ND	0.539	n/a
Al (µg/L)	19895+3.59 * SSC	30900	26000	17
As (µg/L)	6.79+0.000663 * SSC	7.17	7.92	10
Ba (µg/L)	−117+0.16 * SSC	301	155	64
Be (µg/L)	2.57+0.000673 * SSC	3.48	3.71	6
Cd (µg/L)	0.751+0.000254 * SSC	0.524	1.18	77
Co (µg/L)	−21.3+0.00672 * SSC	10.1	-9.88	18164
Cr (µg/L)	24+0.00255 * SSC	19.7	28.3	36
Cu (µg/L)	47.3+0.00322 * SSC	29.5	52.8	57
Fe (µg/L)	3489+5.99 * SSC	20800	13700	41
Mn (µg/L)	−12962+2.51 * SSC	1110	-8700	258
Ni (µg/L)	19.3+0.00344 * SSC	18.4	25.1	31
Pb (µg/L)	107+0.00864 * SSC	82.6	122	39
Se (µg/L)	4.66+0.000136 * SSC	4.76	4.89	3
Tl (µg/L)	0.621+0.000116 * SSC	ND	0.818	n/a
V (µg/L)	25.4+0.00739 * SSC	32.3	38	16
Zn (µg/L)	-53.3+0.0788 * SSC	206	80.7	87

[a] n/a = Not applicable.

[b] Unit of inorganic slope is µg/L/mg/L.

[c] Unit of SSC measurements is mg/L.

[d] ND = Not detected.

Appendix A

2017 Geomorphic Changes
at Sediment Transport Mitigation Sites
in the Los Alamos and Pueblo Canyons Watershed

CONTENTS

A-1.0 INTRODUCTION A-1

A-2.0 HYDROLOGIC EVENTS DURING 2017 MONSOON SEASON A-1

A-3.0 GROUND-BASED SURVEY METHODS OF THE LOS ALAMOS/PUEBLO CANYON WATERSHED A-1

A-3.1 Ground-Based Survey of Thalweg and Channel Bank........ A-1

A-4.0 GEOMORPHIC SURVEY RESULTS........ A-2

A-4.1 Pueblo Canyon Background Area above the WWTF A-2
A-4.2 Pueblo Canyon Upper Willow Planting Area A-2
A-4.3 Pueblo Canyon Wing Ditch Area A-2
A-4.4 Pueblo Canyon Lower Willow Planting Area A-3
A-4.5 Pueblo Canyon Grade-Control Structure Area A-3
A-4.6 Upper Los Alamos Canyon Retention Basins A-4
A-4.7 Los Alamos Canyon Low-Head Weir........ A-4
A-4.8 DP Canyon GCS Area A-4

A-5.0 GEOMORPHIC SURVEYS DISCUSSION........ A-4

A-6.0 OBSERVATIONS AND MONITORING OF WILLOWS IN PUEBLO CANYON A-4

A-6.1 Willow Monitoring Survey Methods A-5
A-6.2 Willow Monitoring Survey Results A-5
A-6.3 Willow Monitoring Survey Conclusions/Recommendations A-5

A-7.0 SOUTH FORK OF ACID CANYON INSPECTION A-6

A-8.0 RECOMMENDATIONS........ A-6

A-9.0 REFERENCES AND MAP DATA SOURCES A-6

A-9.1 References A-6
A-9.2 Map Data Sources........ A-7

Figures

Figure A-1.0-1 Los Alamos, Pueblo, and DP Canyon channel systems showing sediment transport monitoring areas, monitoring area extents, and stream gages A-9

Figure A-3.1-1 Thalweg profile in Pueblo Canyon above Pueblo GCS (~11 times vertical exaggeration) A-10

Figure A-4.2-1 2014 orthophoto with 2016 hillshade DEM and 2016 versus 2017 surveyed channel banks and thalweg at the Pueblo Canyon upper willow planting area A-11

Figure A-4.2-2 Thalweg profile of the Pueblo Canyon upper willow planting and wing ditch areas (~38 times vertical exaggeration)........ A-12

Figure A-4.3-1 2014 orthophoto with 2016 hillshade DEM and 2016 versus 2017 surveyed channel banks and thalweg at the Pueblo Canyon wing ditch area........ A-13

Figure A-4.4-1 2014 orthophoto with 2016 hillshade DEM and 2016 versus 2017 surveyed channel banks and thalweg at the Pueblo Canyon lower willow planting area A-14

Figure A-4.4-2 Thalweg profile of the Pueblo Canyon lower willow planting area (~25 times vertical exaggeration) A-15

Figure A-4.5-1 2014 orthophoto with 2016 hillshade DEM and 2016 versus 2017 surveyed channel banks and thalweg at the Pueblo Canyon GCS area A-16
Figure A-4.5-2 Thalweg profile of the Pueblo Canyon GCS area (~25 times vertical exaggeration) ... A-17
Figure A-4.8-1 2014 orthophoto with 2016 hillshade DEM and 2016 versus 2017 surveyed channel banks and thalweg at the DP Canyon GCS area A-18
Figure A-4.8-2 Thalweg profile in DP Canyon GCS area (~25 times vertical exaggeration)................ A-19

Table

Table A-6.1-1 September 2017 Pueblo Canyon Willow Community Monitoring Results.................... A-21

Attachments

Attachment A-1 Photographs of Sediment Transport Mitigation Sites in the Los Alamos and Pueblo Canyons Watershed
Attachment A-2 Ground-Based Survey Data (on CD included with this document)
Attachment A-3 Geomorphic Change Detection Analysis of Sediment Transport Mitigation Sites in the Los Alamos and Pueblo Canyons Watershed for a Three-Year Interval

A-1.0 INTRODUCTION

This report evaluates geomorphic changes that occurred from October 2016 to November 2017 at sediment transport mitigation sites in the Los Alamos and Pueblo Canyon watershed within and near Los Alamos National Laboratory (LANL or the Laboratory). This appendix contains a comparison of the global positioning system (GPS) surveys encompassing accumulated change over one annual monsoon season. Ground-based survey data in Pueblo and DP Canyons were reported previously (LANL 2011, 200902; LANL 2012, 218411; LANL 2015, 600439; LANL 2016, 601433; LANL 2017, 602343). Figure A-1.0-1 shows site locations discussed in this appendix. Attachment A-1 presents photographs of the sediment transport mitigation sites. The New Mexico Environment Department (NMED) has also specified that monitoring reports include information on the health and success of willow plantings as well as photographic documentation of willow plantings, grade-control structures (GCSs), and examples of erosion and deposition at surveyed cross-sections (NMED 2011, 204349); these observations are included herein with photographs included in Attachment A-1. Data tables of thalweg and bank survey points and distances are included in Attachment A-2 (on CD included with this document). Following NMED approval of the Laboratory's recommendation to reduce light detection and ranging (LiDAR) monitoring of the watershed from annual monitoring to a period of every 3 yr, or following significant storm events, the baseline results are presented (i.e., geomorphic change detection [GCD] digital elevation model [DEM] comparison) for a 3-yr window in which rainfall amounts were average to below average in Attachment A-3 to this appendix.

A-2.0 HYDROLOGIC EVENTS DURING 2017 MONSOON SEASON

Discharge in 2017 was similar to the 2016 discharge at all gage stations, being near or well below the mean for the 10-yr period of record. There were eleven sample-triggering storm events in 2017, with the largest runoff-producing event occurring following heavy rains on July 26 (see section 2.1 in the main text for more details).

A-3.0 GROUND-BASED SURVEY METHODS OF THE LOS ALAMOS/PUEBLO CANYON WATERSHED

Ground-based surveying in monitoring reaches of the Los Alamos/Pueblo Canyon watershed included channel banks and primary thalweg. These features were surveyed using real-time kinematic differentially corrected GPS surveying equipment. Survey data was collected in June and July of 2017 before the 2017 northern New Mexico monsoon season and in December 2017 after the 2017 northern New Mexico monsoon season. Stability of stream-channel features in areas near engineered erosion-control mitigation features in Pueblo Canyon are points of interest.

A-3.1 Ground-Based Survey of Thalweg and Channel Bank

Surveying of 2016 post monsoon channel banks occurred in mid-2017 before the start of the 2017 annual monsoon season. Channel bank locations for the various monitoring areas from 2016 and 2017 are compared in section 4.0 of this appendix.

Thalweg elevations surveyed in 2016 and 2017 in Pueblo Canyon are compared in Figure A-3.1-1. Thalweg surveys were collected in 2016 and 2017 at the upper willow planting area, wing ditch area, lower willow planting area, and above the Pueblo GCS. Similarly to the 2016 profile, the 2017 longitudinal channel thalweg profile was surveyed continually from the Pueblo GCS up to the Pueblo drop structure. A continuous thalweg survey was collected in 2016 and again in 2017 from below the wing ditch area upstream into the upper willow planting area. All efforts were made to capture active as well as previously established channel banks during surveying. All ground-based survey data points are listed in Attachment A-2.

A-4.0 GEOMORPHIC SURVEY RESULTS

Los Alamos/Pueblo Watershed underwent minor geomorphologic changes during the 2017 monsoon season. Repeat GPS survey data support the conclusion that features within the watershed have remained stable since they were last surveyed before the 2017 monsoon season. The monsoon season of 2017, being generally average to below average in its intensity of rainfalls, has resulted in minor annual changes to morphology of monitored features and caused no significant geomorphic changes within the watershed.

A-4.1 Pueblo Canyon Background Area above the WWTF

The Pueblo Canyon background area above the Los Alamos County wastewater treatment facility (WWTF) upstream extent is west of the western edge of reach P-2W, and the eastern extent is downstream of the furthest downstream former cross-vane structure (Figure A-1.0-1).

No ground-based surveying is conducted in this area; see Attachment A-3 for results of GCD analysis over the 3-yr window in the background area.

A-4.2 Pueblo Canyon Upper Willow Planting Area

The upper willow planting area upstream extent is west of the western edge of reach P-3FW (i.e., P-3 Far West), and the downstream extent is the eastern edge of reach P-3 West (P-3W) (Figure A-4.2-1).

Comparison of the 2016 and 2017 surveyed channel bank positions shows no changes, confirming bank stability in this area since 2016 (Figure A-4.2-1). Field observations validate the GPS survey results. (Photo A1-1 in Attachment A-1).

Thalweg profile comparisons in 2016 and 2017 show no change (Figure A-4.2-1). The overall thalweg gradient between 2016 and 2017 has remained unchanged (Figure A-4.2-2).

Overall, the Pueblo Canyon upper willow planting area has been geomorphically stable since 2016. Refer to Attachment A-3 for results of GCD analysis over the 3-yr window in the Pueblo Canyon upper willow planting area.

A-4.3 Pueblo Canyon Wing Ditch Area

The wing ditch area is a short distance downstream of the road leading to the Los Alamos County WWTF. The road was rebuilt in 2011 to better withstand large runoff events and to pass flow more effectively (LANL 2011, 200902). This area and the downstream extent of reach P-3 East (P-3E) are dominated by a reed canary grass wetland, without defined banks to survey. The thalweg below the road crossing in contiguous reaches P-3 Central (P-3C) and P-3E, and continuing upstream into the upper willow planting area, was surveyed in 2016 to establish a baseline to compare against future years. The thalweg was resurveyed in 2017 downstream of the bridge, as well as upstream to the upper willow planting area (Figure A-4.3-1).

Comparison of the 2016 and 2017 surveyed channel bank positions demonstrates the bank positions remain unchanged, confirming bank stability in this area (Figure A-4.3-1). Field observations validate the GPS survey results, showing no change to the primary channel around the bridge and culvert structures since 2016 (Photos A1-2 and A1-3 in Attachment A-1). Any differences in the surveyed bank line are due to poorly defined banks and surveyor choice of what constitutes the most appropriate path of survey.

Thalweg profiles were surveyed in 2016 and 2017. The thalweg was unchanged between the 2016 and 2017 surveys (Figure A-4.3-1). A thalweg was not surveyed in the reed canary grass area downstream of the culverts in 2017 because the channel is poorly defined with frequent branching and distributed flow. The overall thalweg gradient between 2016 and 2017 has remained unchanged (Figure A-4.2-2).

Overall, the Pueblo Canyon wing ditch area has been geomorphically stable since 2016. See Attachment A-3 for results of GCD analysis over the 3-yr window in the Pueblo Canyon wing ditch area.

A-4.4 Pueblo Canyon Lower Willow Planting Area

The Pueblo Canyon lower willow planting area is within reaches P-3 Far East (P-3FE) and P-4 West (P-4W) in an area where willows were planted in 2014 (Figure A-4.4-1). A headcut in this area (near gage station E059.8) propagated upstream from flooding in September 2013. From 2014 to 2015, the Pueblo Canyon drop structure was constructed to prevent further headcut erosion.

Comparison of the 2016 and 2017 surveyed channel bank positions demonstrates the bank positions remain unchanged, confirming bank stability in this area since 2016 (Figure A-4.4-1). Field checks below the drop structure vaildate GPS survey results (Photos A1-4 and A1-5 in Attachment A-1).

Thalweg surveys were conducted in 2017 along the entire length of the Pueblo Canyon lower willow planting area. The thalweg was unchanged between the 2016 and 2017 surveys (Figure A-4.4-1). The overall thalweg gradient between 2016 and 2017 has remained unchanged (Figure A-4.4-2).

Overall, the Pueblo Canyon lower willow planting area has been geomorphically stable since 2016. See Attachment A-3 for results of GCD analysis over the 3-yr window in the Pueblo Canyon GCS lower willow planting area.

A-4.5 Pueblo Canyon Grade-Control Structure Area

The thalweg was surveyed in 2017 throughout the Pueblo GCS area, which is within reach P-4 Central (P-4C) and reach P-4 East (P-4E) (Figure A-4.5-1).

Comparison of the 2016 and 2017 surveyed channel bank positions demonstrates the bank positions remain unchanged, confirming bank stability both above and below the GCS since 2016 (Figure A-4.5-1). Field checks in reaches P-4C and P-4E validate GPS survey results (Photo A1-6 in Attachment A-1).

The eastern part of reach P-4C, and reach P-4E, is dominated by a broad, braided channel system. Changes in surveyed thalweg position in 2016 and 2017 are attributed to different parts of the braided channel system being occupied during low-flow versus storm-flow conditions (Figure A-4.5-1 and Photo A1-7 in Attachment A-1). No permanent or singular channel development is implied or observed. The overall thalweg gradient between 2016 and 2017 has remained unchanged (Figure A-4.5.2).

Overall, the Pueblo GCS area has been geomorphically stable with only minor changes since 2016. See Attachment A-3 for results of GCD analysis over the 3-yr window in the Pueblo Canyon GCS Area.

A-4.6 Upper Los Alamos Canyon Retention Basins

The upper Los Alamos Canyon sediment retention basins are located at the base of the drainage below Solid Waste Management Unit 01-001(f) (LA-SMA-2 or Hillside 140) and are shown in Figure A-1.0-1. Watershed mitigation inspection results are presented in Appendix C.

A-4.7 Los Alamos Canyon Low-Head Weir

The Los Alamos Canyon Low-Head weir is located above the confluence with Pueblo Canyon, near the intersection with NM 4 and Omega Rd shown in Figure A-1.0-1. Watershed mitigation inspection results are presented in Appendix C. No sediments were excavated during the 2016–2017 time period.

A-4.8 DP Canyon GCS Area

The DP Canyon GCS in reach DP-2 is shown in Figure A-4.8-1.

Comparison of the 2016 and 2017 surveyed channel bank positions demonstrates the bank positions remain unchanged, confirming bank stability in this area (Figure A-4.8-1). Field checks above the GCS validate GPS survey results (Photo A1-8 in Attachment A-1).

Thalweg surveys were conducted in 2017 along the DP Canyon GCS area. The thalweg was relatively unchanged between the 2016 and 2017 surveys (Figure A-4.8-1 and Photo A1-9 in Attachment A-1). The overall thalweg gradient between 2016 and 2017 has remained unchanged (Figure A-4.8-2).

Overall, the DP Canyon GCS area has been geomorphically stable since 2016.See Attachment A-3 for results of GCD analysis over the 3-yr window in reach DP-2 above the DP Canyon GCS.

A-5.0 GEOMORPHIC SURVEYS DISCUSSION

While shown to be effective at detecting and modeling magnitudes of geomorphic change, LiDAR monitoring was not conducted during the 2017 monsoon year as rains and runoff were deemed not to have had a large enough effect on the monitoring areas.

The field-checked channel bank and thalweg surveys presented in the report support the conclusion of overall stability of the channels and banks in Los Alamos, DP, and Pueblo Canyons. Active processes that contribute to nonsignificnat but observed changes are characterized by typical arid-region mass wasting processes, specifcally minor slides, flows, slumps, and falls of unconsolidated sediment on steep bedrock or soil surfaces.

A-6.0 OBSERVATIONS AND MONITORING OF WILLOWS IN PUEBLO CANYON

Willows were planted in Pueblo Canyon to aid in surface stabilization, reduce flow velocity, and encourage sediment accumulation (LANL 2016, 601433; LANL 2017, 602343). Baseline coyote willow (Salix exigua) qualitative monitoring in Pueblo Canyon was first conducted in November of 2016. A second qualitative monitoring campaign was conducted in September of 2017. Monitoring activities have continued to be completed annually and will be compared with previous years' monitoring results.

A-6.1 Willow Monitoring Survey Methods

To monitor willow communities in Pueblo Canyon, average range of plant growth (height) and spatial distribution of willow populations were used to characterize and define discrete willow populations. Willow populations in Pueblo Canyon were divided into five distinct categories (listed in Table A-6.1-1) based on measurements of individual willows for growth (height and basal diameter) and stand growth habit (spatial distribution). Height and basal-diameter measurements were used as the metrics representative of growth stage. Growth habit was qualitatively determined in the field by characterizing the spatial distribution of willow populations into one of two categories: continuous or dispersed. Continuous populations are defined as stands of willows where individuals overlap and take up greater than 50% of the total mapped area. Dispersed populations are defined as stands of willows where individuals do not overlap and make up less than 50% of the community area. When willows within these communities are measured, new and sprouting willows less than 2 ft in height are not included because their viability has yet to be established.

A-6.2 Willow Monitoring Survey Results

Table A-6.1-1 presents the qualitative data from willow community survey methods described in section A-6.1. Short-height, spatially dispersed (P-1) communities (Photo A1-10b in Attachment A-1) were found in areas dominated by sand/gravel bars with lower water table and limited water access, as discussed in piezometer data in Appendix B of this report. The spatial density of the P-1 community is consistent with 2014 planting requirements in Restoration Area 4, as described in Appendix B of the “2014 Monitoring Report for Los Alamos/Pueblo Watershed Transport Mitigation Project” (LANL 2015, 600439). Short-height, spatially continuous (P-2) communities (Photo A1-11b in Attachment A 1) were usually found in sand/gravel-dominated areas with more consistent water access and areas whose spatial density is consistent with planting requirements in Restoration Areas 2 and 3 (LANL 2015, 600439, Appendix B). Medium-height, spatially dispersed (P-3) communities (Photo A1-12b in Attachment A-1) were found within reed canary grass (Phalaris arundinacea) clusters and close to continuously saturated substrates and with spatial density consistent with planting requirements in Restoration Areas 1, 2, and 3 (LANL 2015, 600439). Medium-height, spatially continuous (P-4) communities (Photo A1-13b in Attachment A-1) were found in areas generally devoid of clusters of reed canary grass and other plant species and close to continuously saturated substrates and with a spatial density consistent with planting requirements in Restoration Areas 1, 2, and 3 (LANL 2015, 600439, Appendix B). Tall-height, spatially continuous (P-5) communities (Photo A1-14b in Attachment A-1) were found along the channel axis and closest to more continuously saturated substrate that allows for vigorous growth and outcompeting of other vegetation. The P-5 community had a spatial density consistent with planting requirements in Restoration Areas 2 and 3 (LANL 2015, 600439, Appendix B). There were no observed changes in Pueblo Canyon willow communities between 2016 and 2017.

A-6.3 Willow Monitoring Survey Conclusions/Recommendations

Qualitative analyses of the willow communities in Pueblo Canyon indicate vegetative growth in this area is variable because of inconsistent discharge reaching the extent of the areas where willows are planted. Three main factors influenced successful growth of the willow communities: proximity to saturated substrate, original planting distribution, and competition with reed canary grass. The best growth occurred in the P-5 communities, with an initial close planting along the saturated channel axis without competing reed canary grass. Healthy growth was observed in the P-3 and P-4 communities, with P-4 communities doing better than P-3 willows because of a lack of competition with canary grass (unlike the P-3 communities). Finally, the poorest growth was observed in the P-2 and P-1 communities because of a combination of sparse initial planting and lack of consistently saturated substrate, often because plantings were located on sand/gravel bars, away from the channel axis where the water table was much deeper.

Continued monitoring of willow growth in Pueblo Canyon using the same methods discussed in this section is recommended as the willow communities and other plant species continue to establish.

A-7.0 SOUTH FORK OF ACID CANYON INSPECTION

NMED has specified that results of inspections of stream bank armoring in the south fork of Acid Canyon be included in the annual report on geomorphic changes in the Los Alamos and Pueblo Canyon watershed (NMED 2010, 109693). The stream bank armoring was placed in the south fork of Acid Canyon in April 2010 (LANL 2010, 109280) and has been inspected every year since, including in 2016. Enhanced controls, specifically log check dams, were installed at Site Monitoring Area (SMA) Acid-SMA-2.1 as a response to Individual Permit requirements in 2016, as shown in the comparison Photo A1-27 in Attachment A-1 of the “2016 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project” (LANL 2017, 602343). Continued inspections of this enhanced control are conducted through the IP stormwater program and results are reported in the Storm Water Individual Permit Annual Report (LANL 2018, 602910)

A-8.0 RECOMMENDATIONS

Continued annual GPS-based surveying of features such as channel banks and primary thalweg location provides a useful assessment of the magnitude of geomorphic changes affected on the reach from the monsoon season. Continued surveying of monitoring areas also provides an assessment of any developing features such as channel incision, meanders, aggradation of channel surfaces, retreating channel banks, or other major mass wasting events like slumps and slides of channel bank materials that may require additional controls.

In 2018, and in the future, aerial LiDAR surveys are recommended only if there are major channel-forming runoff events. If there are no major changes to the reaches, the next scheduled LiDAR survey would be following the 2019 monsoon season.

Continued vegetative monitoring of the willow plantings in 2018 for comparison with 2017 is recommended. Willow health will continue to be assessed by measuring stand height and stem diameter at representative locations within the planted willow areas. Additionally, photographs will be taken to document conditions.

A-9.0 REFERENCES AND MAP DATA SOURCES

A-9.1 References

The following reference list includes documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ERID or ESHID. This information is also included in text citations. ERIDs were assigned by the Associate Directorate for Environmental Management’s (ADEM’s) Records Processing Facility (IDs through 599999), and ESHIDs are assigned by the Environment, Safety, and Health Directorate (IDs 600000 and above). IDs are used to locate documents in the Laboratory’s Electronic Document Management System and in the Master Reference Set. The NMED Hazardous Waste Bureau and ADEM maintain copies of the Master Reference Set. The set ensures that NMED has the references to review documents. The set is updated when new references are cited in documents.

LANL (Los Alamos National Laboratory), April 2010. "Documentation of Completion of Stream Bank Stabilization in the South Fork of Acid Canyon," Los Alamos National Laboratory document LA-UR-10-1877, Los Alamos, New Mexico. (LANL 2010, 109280)

LANL (Los Alamos National Laboratory), February 2011. "Baseline Geomorphic Conditions at Sediment Transport Mitigation Sites in the Los Alamos and Pueblo Canyon Watersheds, Revision 1," Los Alamos National Laboratory document LA-UR-11-0936, Los Alamos, New Mexico. (LANL 2011, 200902)

LANL (Los Alamos National Laboratory), May 2012. "2011 Geomorphic Changes at Sediment Transport Mitigation Sites in the Los Alamos and Pueblo Canyon Watersheds," Los Alamos National Laboratory document LA-UR-12-21330, Los Alamos, New Mexico. (LANL 2012, 218411)

LANL (Los Alamos National Laboratory), May 2015. "2014 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," Los Alamos National Laboratory document LA-UR-15-21413, Los Alamos, New Mexico. (LANL 2015, 600439)

LANL (Los Alamos National Laboratory), April 2016. "2015 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," Los Alamos National Laboratory document LA-UR-16-22705, Los Alamos, New Mexico. (LANL 2016, 601433)

LANL (Los Alamos National Laboratory), April 2017. "2016 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," Los Alamos National Laboratory document LA-UR-17-23308, Los Alamos, New Mexico. (LANL 2017, 602343)

LANL (Los Alamos National Laboratory), February 2018. "Storm Water Individual Permit Annual Report, Reporting Period: January 1–December 31, 2017, NPDES Permit No. NM0030759," Los Alamos National Laboratory document LA-UR-18-21185, Los Alamos, New Mexico. (LANL 2018, 602910)

NMED (New Mexico Environment Department), May 11, 2010. "Approval, Documentation of Completion of Armoring of Stream Banks in South Fork Acid Canyon," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M.J. Graham (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2010, 109693)

NMED (New Mexico Environment Department), July 1, 2011. "Approval with Modifications, 2010 Geomorphic Changes at Sediment Transport Mitigation Sites in the Los Alamos and Pueblo Canyon Watersheds," 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 2011, 204349)

A-9.2 Map Data Sources

The following list provides data sources for maps included in the main body of this report.

Drainage; Los Alamos National Laboratory, Environment and Remediation Support Services; 1:24,000; May 15, 2006.

Gaging stations; Los Alamos National Laboratory, Waste and Environmental Services Division; 1:2,500; March 19, 2011.

Geomorphic Reach Boundaries (DP Canyon), Los Alamos National Laboratory, Earth and Environmental Science, GISLab, 1993

Geomorphic Reach Boundaries (LA Canyon), Los Alamos National Laboratory, Earth and Environmental Science, GISLab, 2000

Geomorphic Reach Boundaries (Pueblo Canyon), Los Alamos National Laboratory, Earth and Environmental Science, GISLab, 2004

Grade control structures; Los Alamos National Laboratory, Environment and Remediation Support Services; Unknown; May 17, 2011.

LANL boundary; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; Unknown; August 16, 2010.

LANL area orthophoto; Los Alamos National Laboratory, 2014.

Other property boundary; Los Alamos National Laboratory, Earth and Environmental Sciences GIS Lab; Unknown; August 16, 2010.

Roads, surfaced; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; Unknown; November 30, 2010.

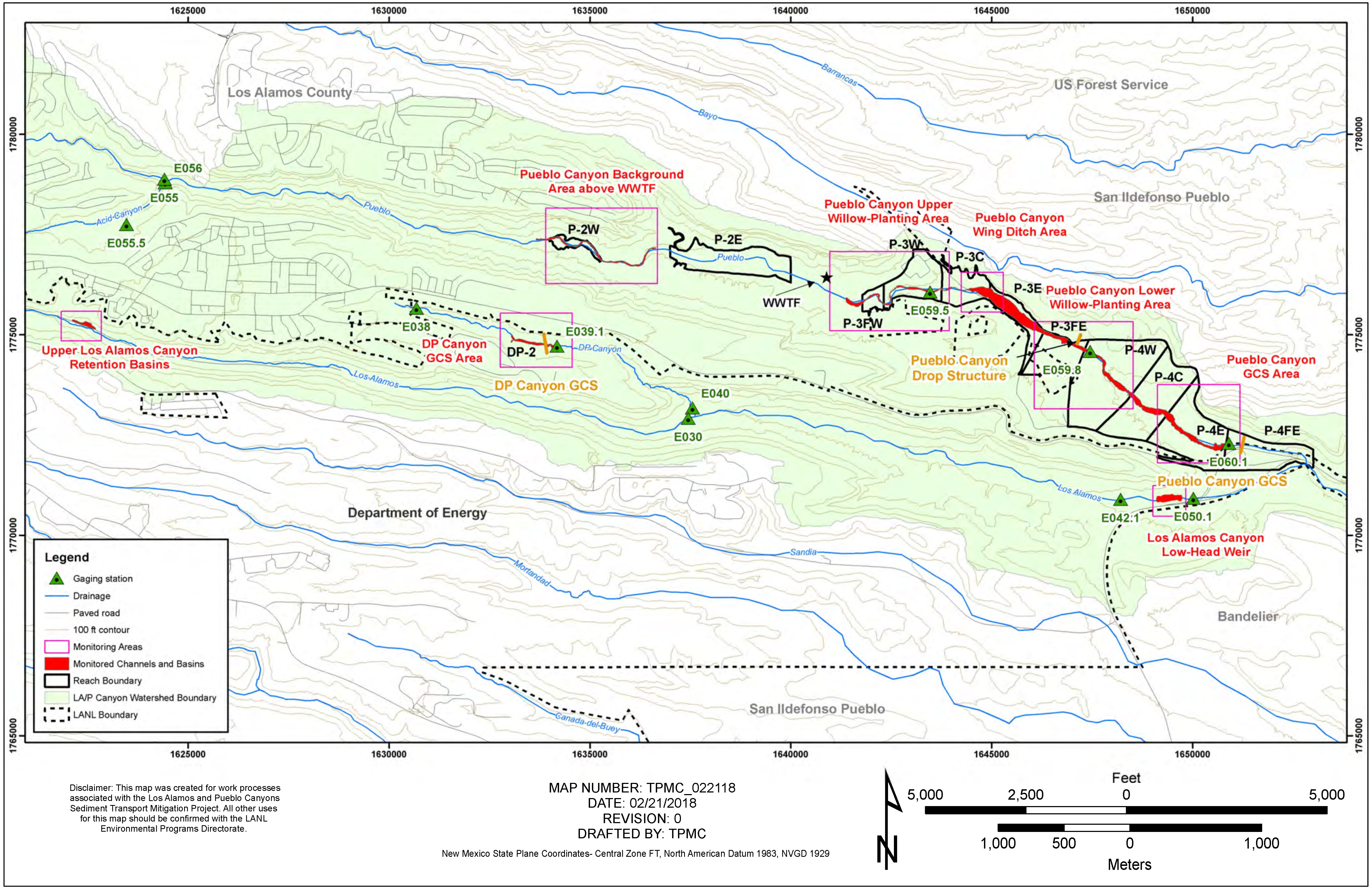


Figure A-1.0-1 Los Alamos, Pueblo, and DP Canyon channel systems showing sediment transport monitoring areas, monitoring area extents, and stream gages

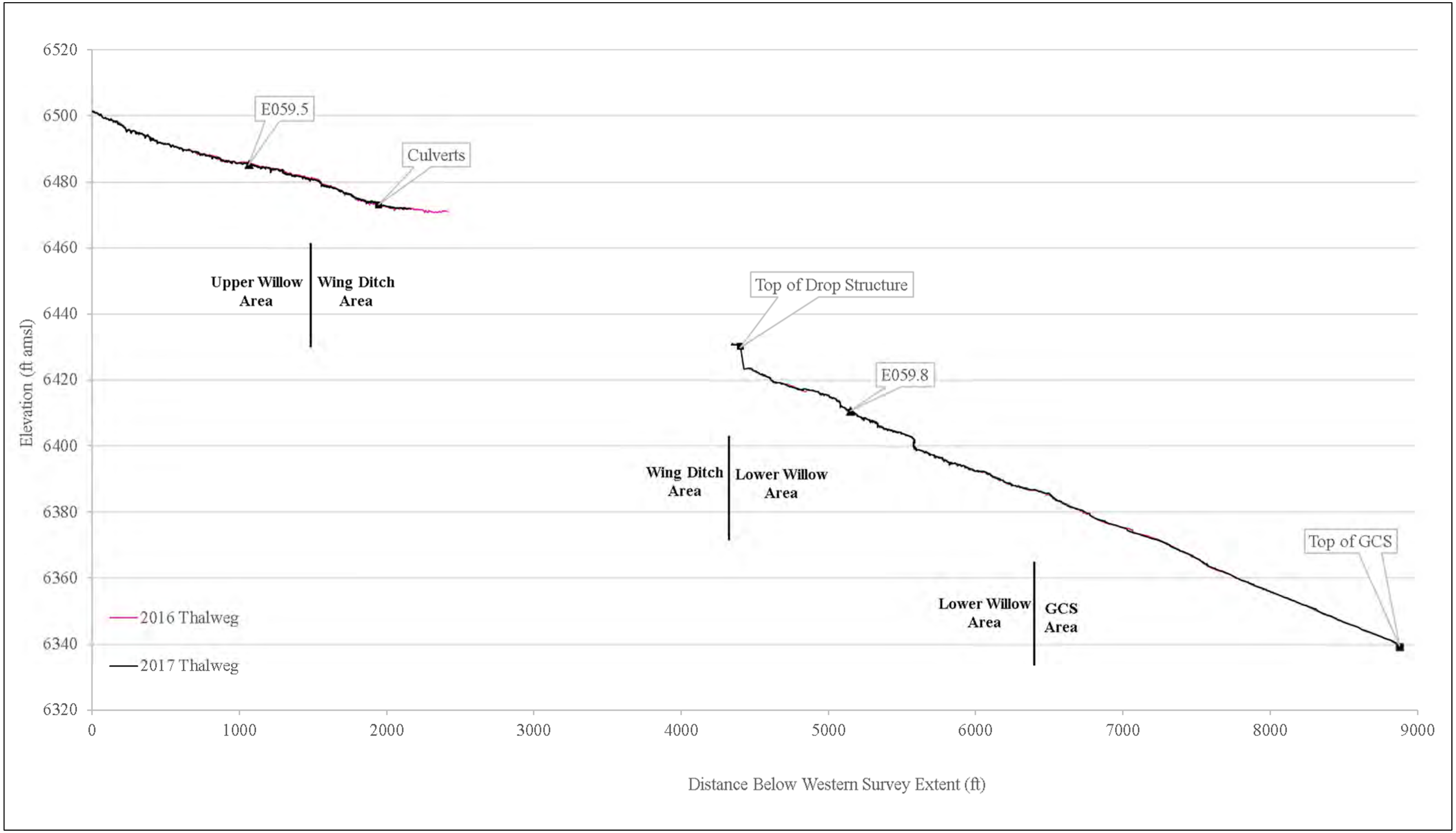


Figure A-3.1-1 Thalweg profile in Pueblo Canyon above Pueblo GCS (~11 times vertical exaggeration)

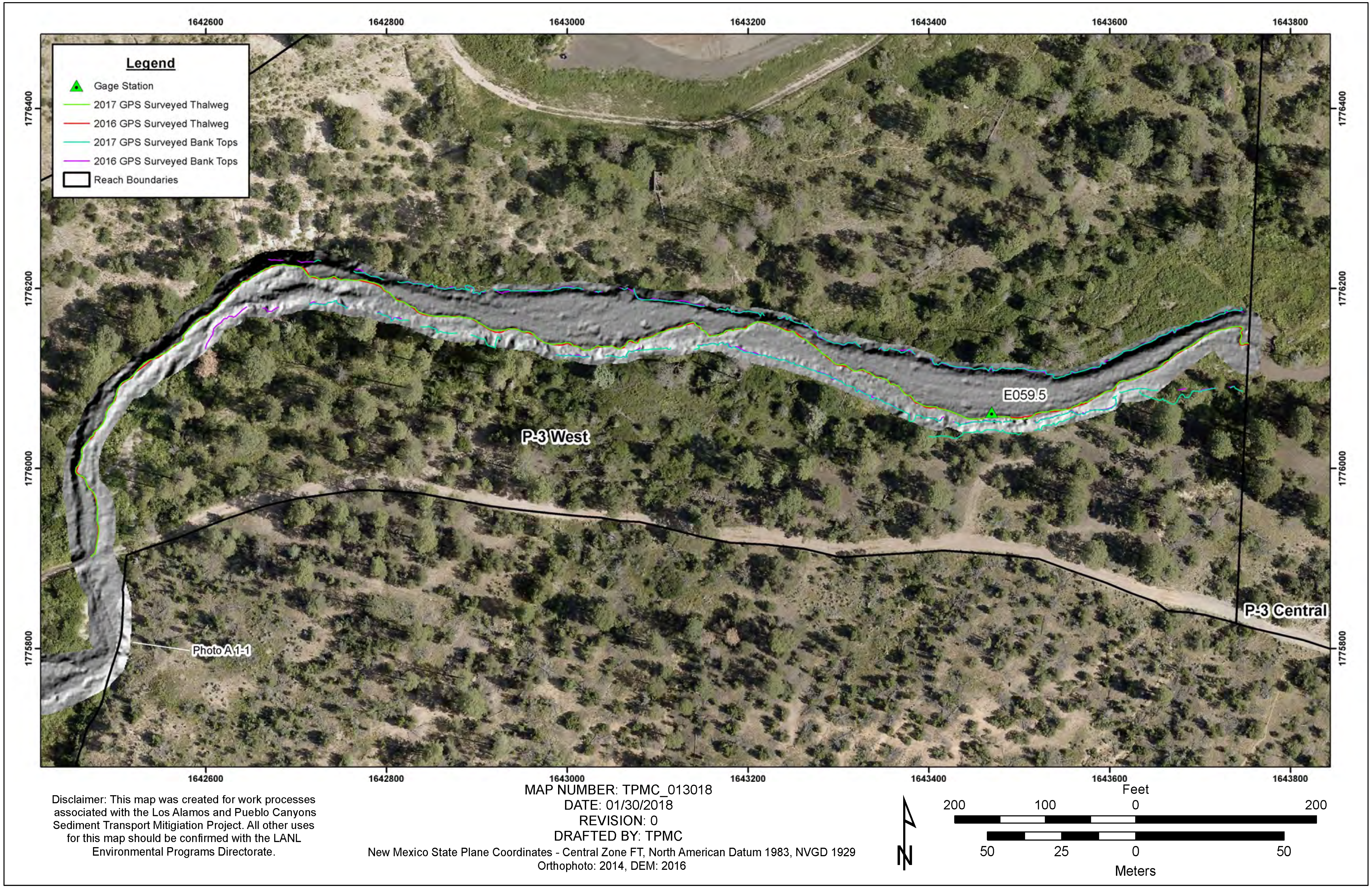


Figure A-4.2-1 2014 orthophoto with 2016 hillshade DEM and 2016 versus 2017 surveyed channel banks and thalweg at the Pueblo Canyon upper willow planting area

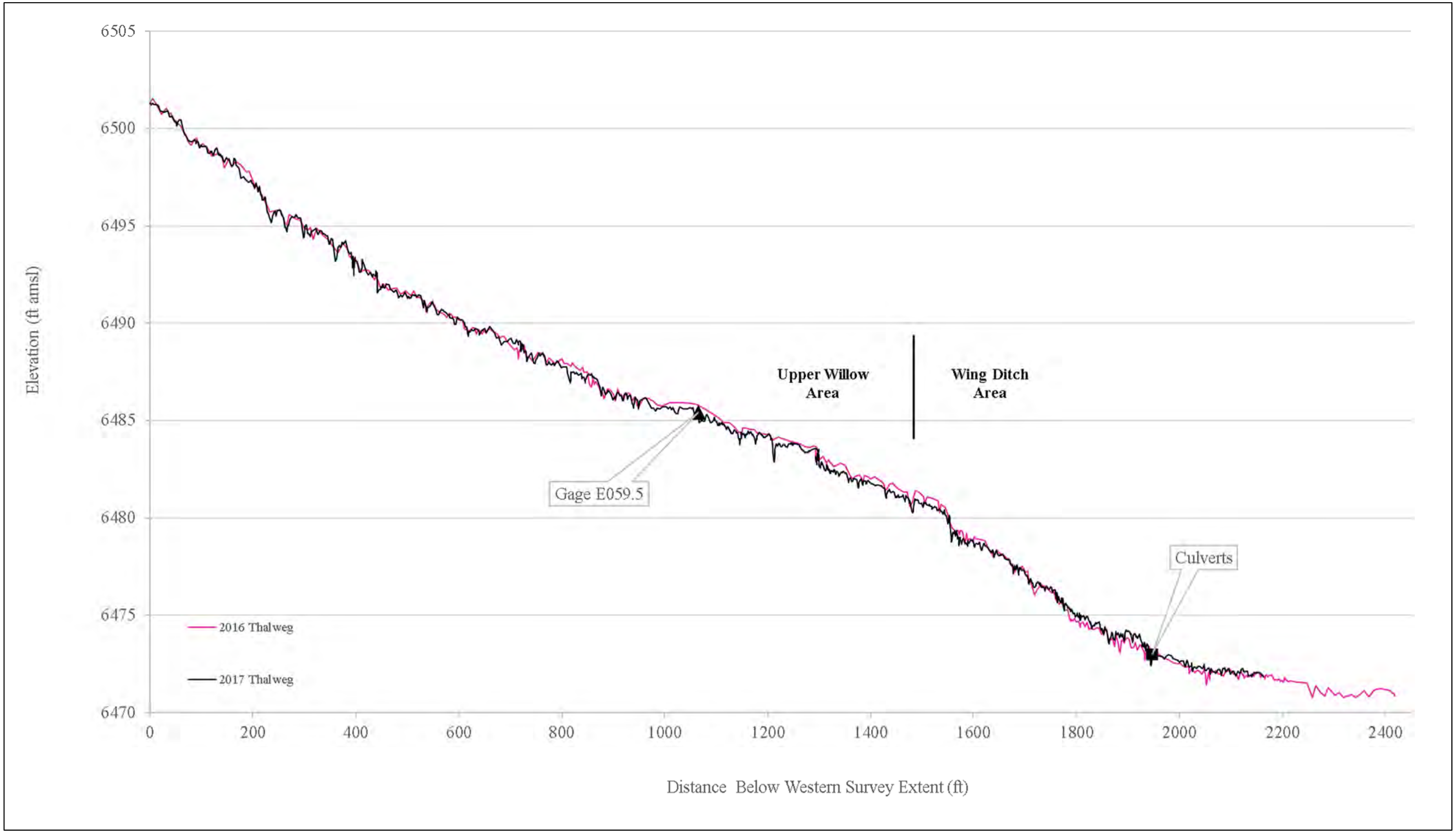


Figure A-4.2-2 Thalweg profile of the Pueblo Canyon upper willow planting and wing ditch areas (~38 times vertical exaggeration)

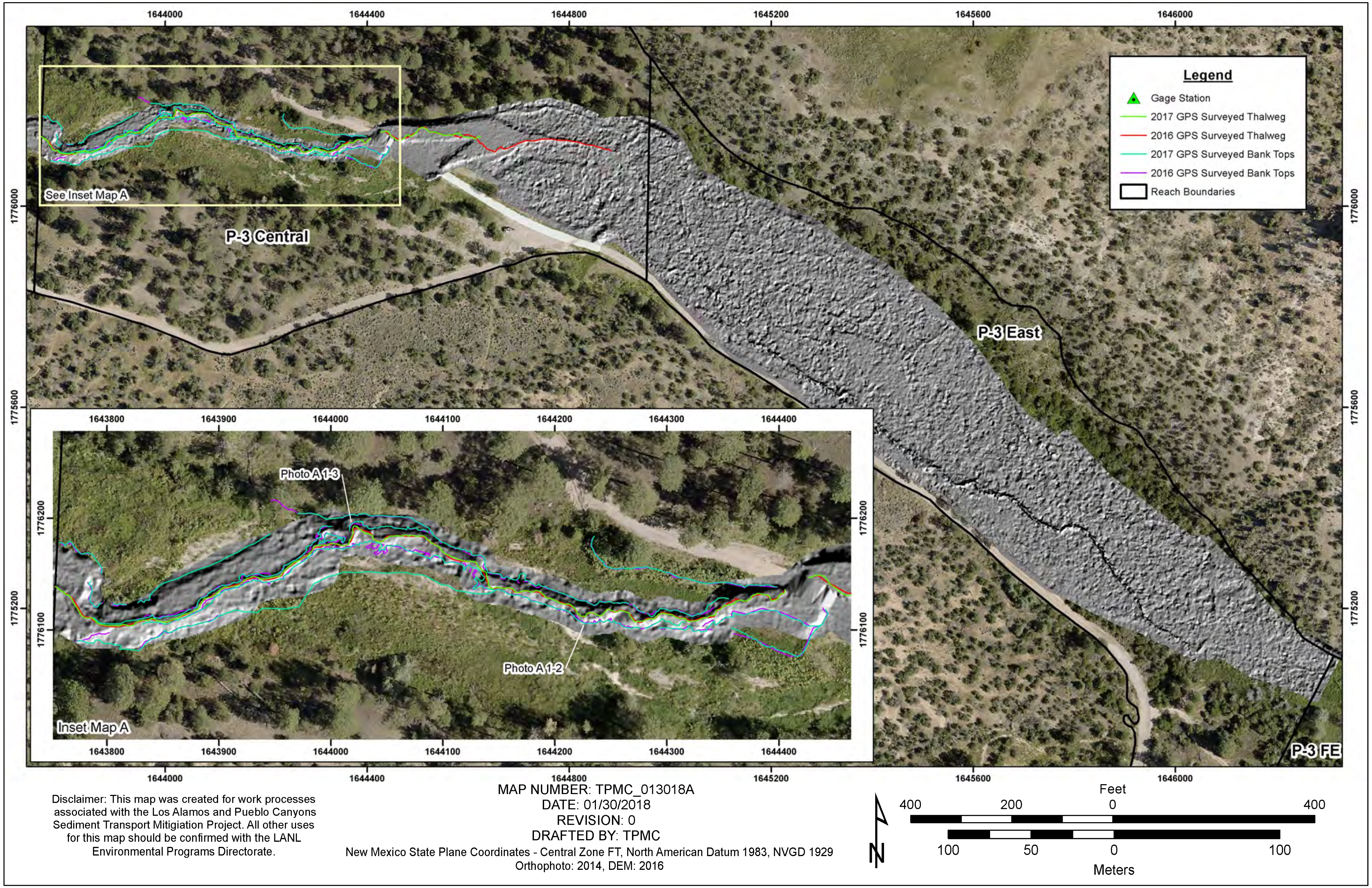


Figure A-4.3-1 2014 orthophoto with 2016 hillshade DEM and 2016 versus 2017 surveyed channel banks and thalweg at the Pueblo Canyon wing ditch area

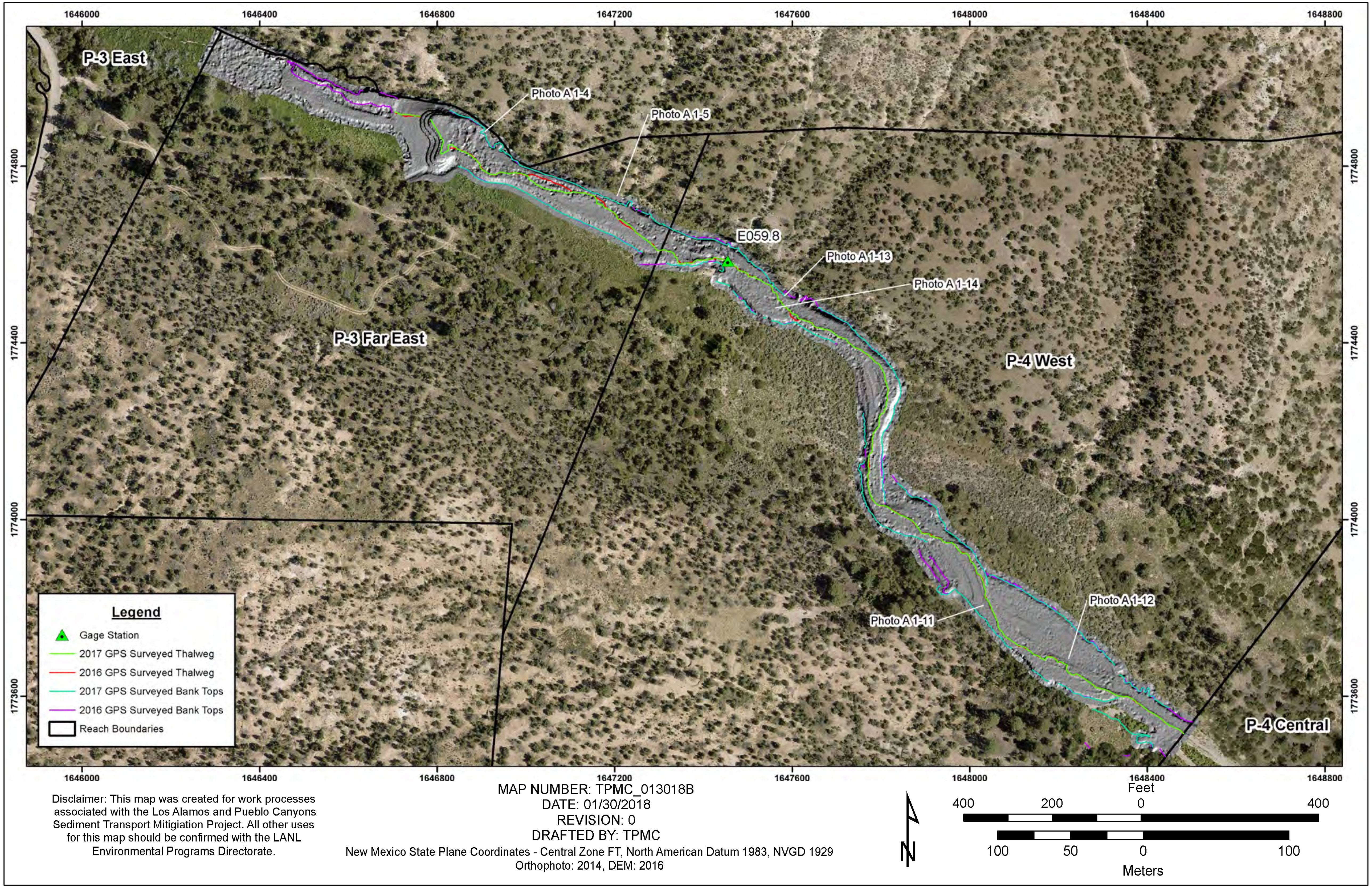


Figure A-4.4-1 2014 orthophoto with 2016 hillshade DEM and 2016 versus 2017 surveyed channel banks and thalweg at the Pueblo Canyon lower willow planting area

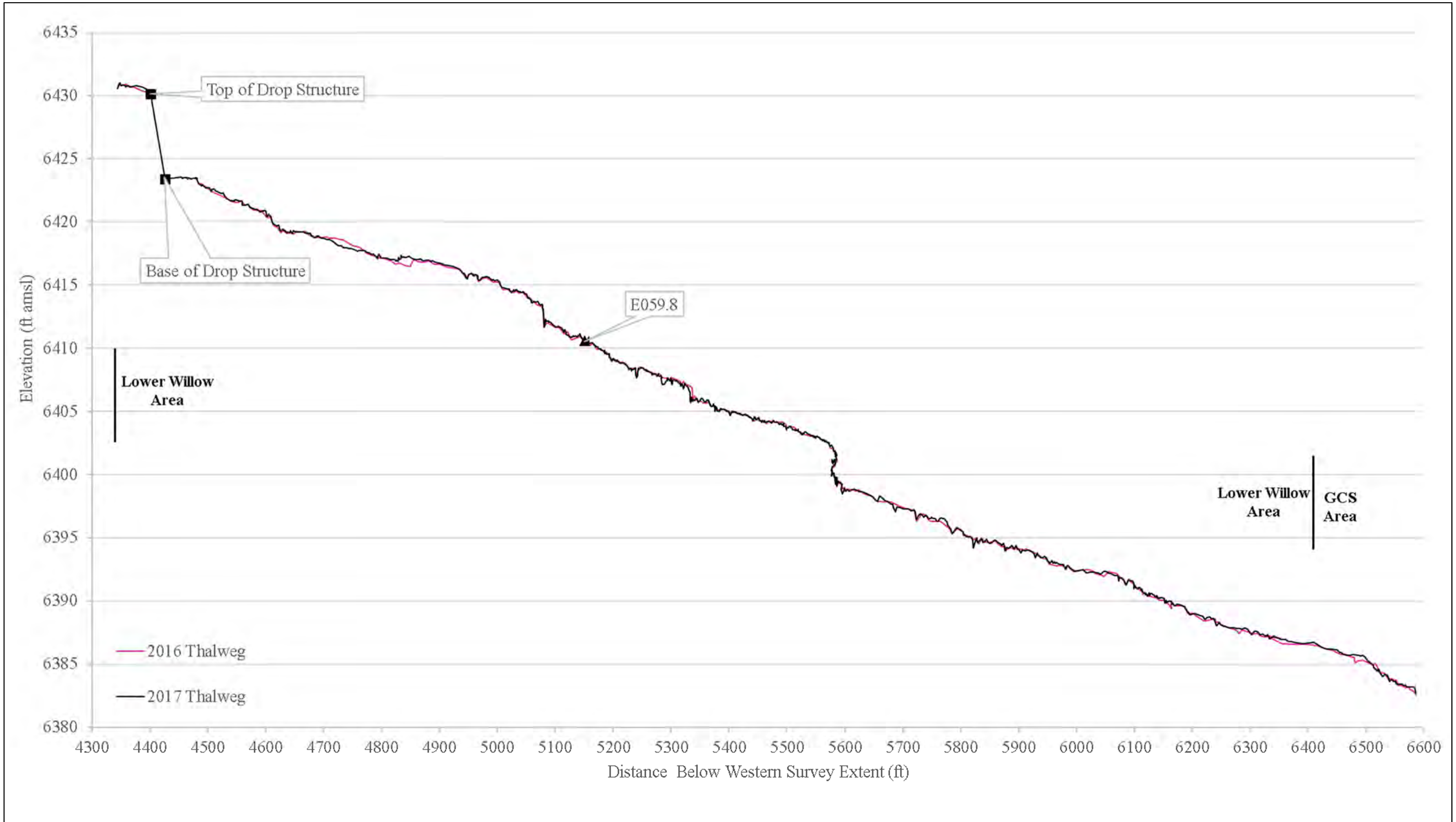


Figure A-4.4-2 **Thalweg profile of the Pueblo Canyon lower willow planting area (~25 times vertical exaggeration)**

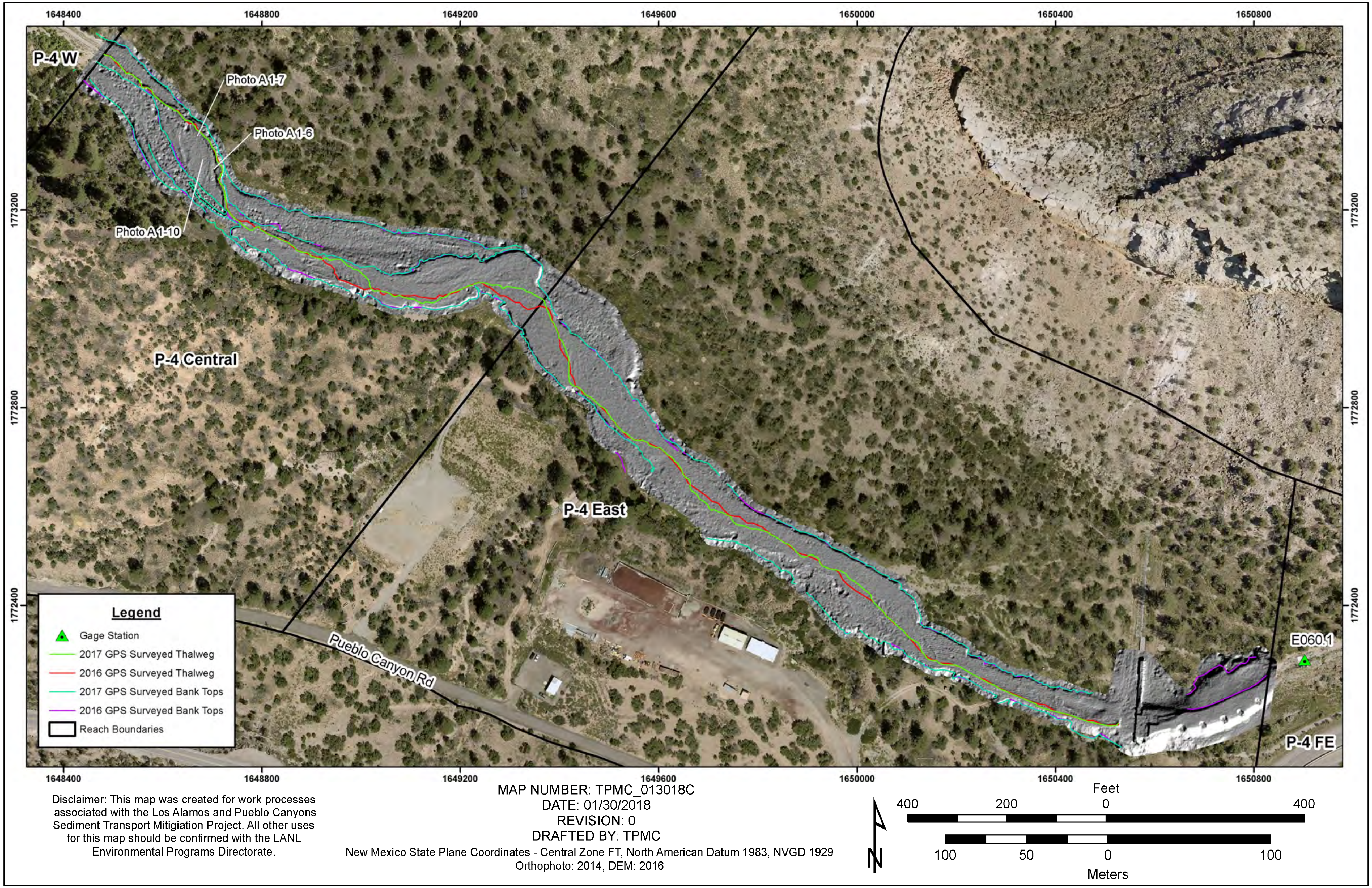


Figure A-4.5-1 2014 orthophoto with 2016 hillshade DEM and 2016 versus 2017 surveyed channel banks and thalweg at the Pueblo Canyon GCS area

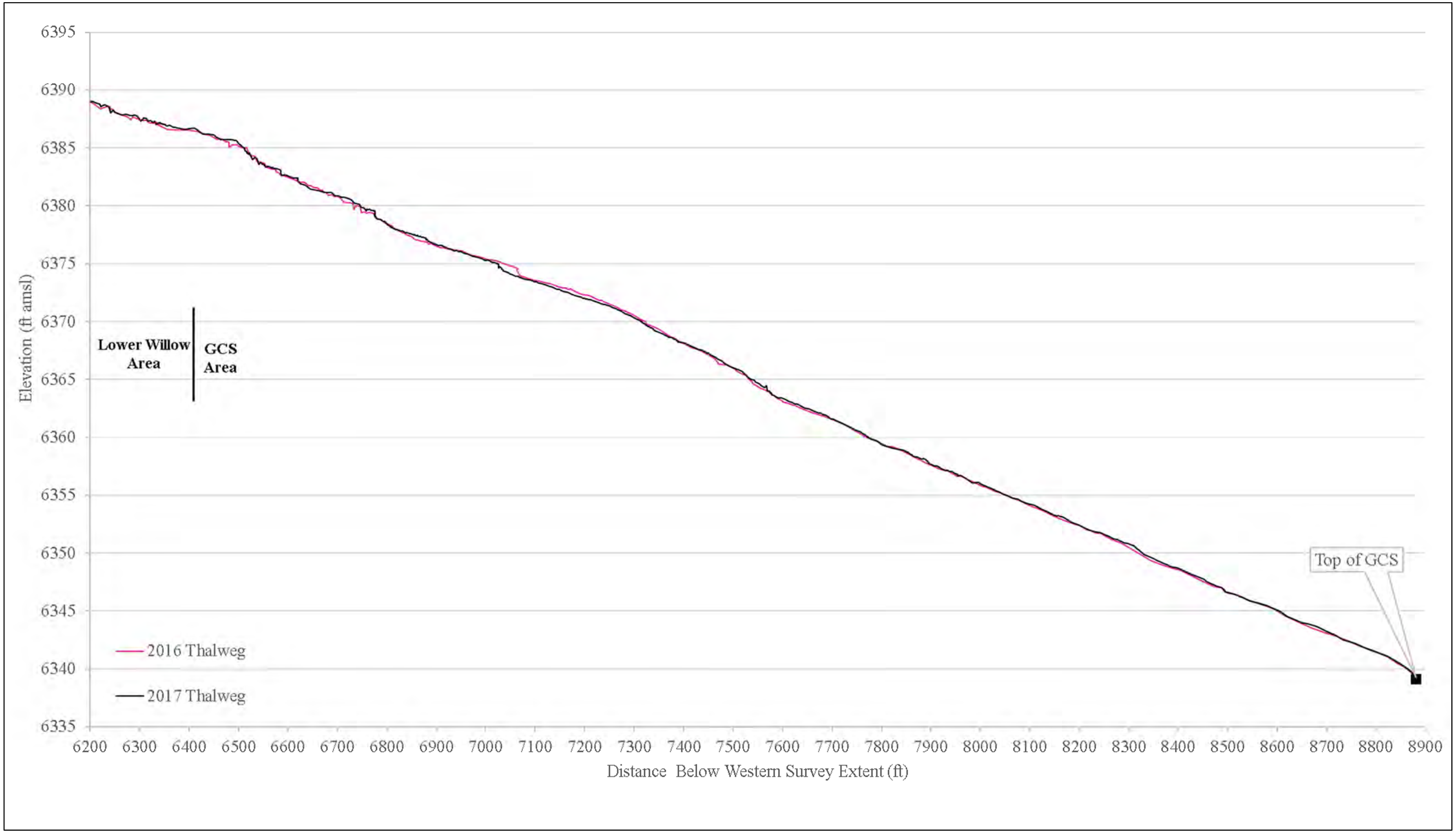


Figure A-4.5-2 Thalweg profile of the Pueblo Canyon GCS area (~25 times vertical exaggeration)

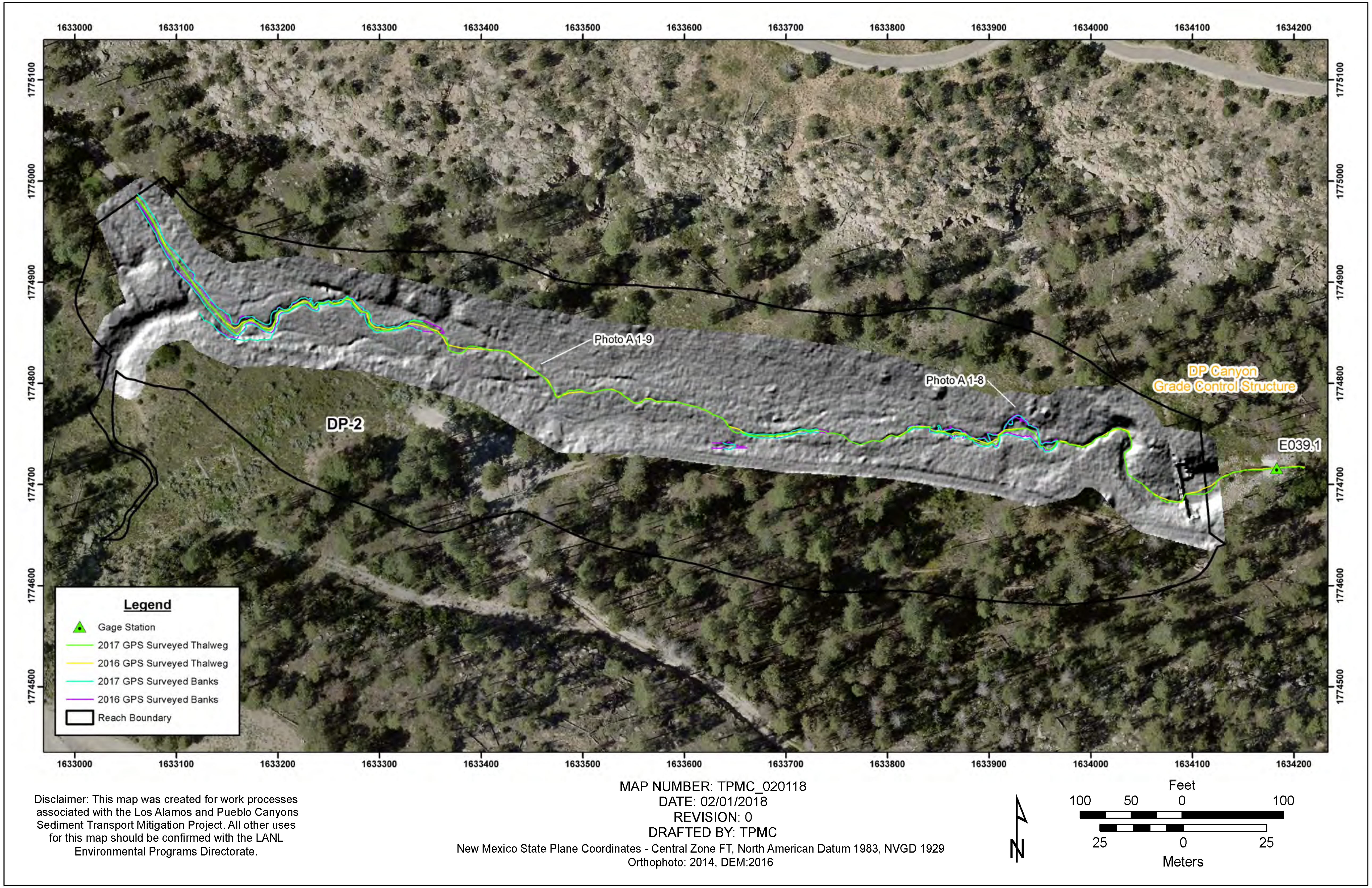


Figure A-4.8-1 2014 orthophoto with 2016 hillshade DEM and 2016 versus 2017 surveyed channel banks and thalweg at the DP Canyon GCS area

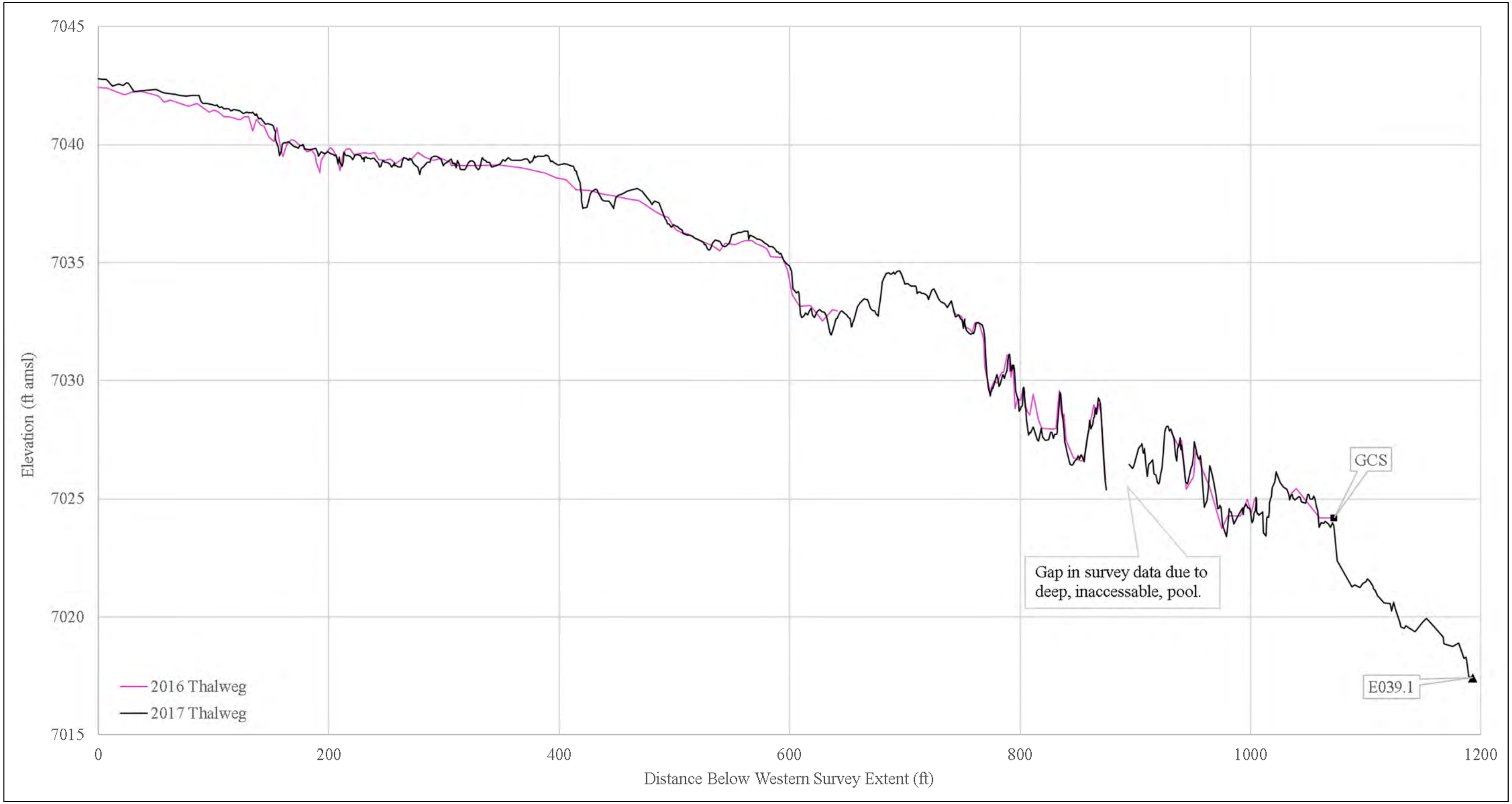


Figure A-4.8-2 Thalweg profile in DP Canyon GCS area (~25 times vertical exaggeration)

Table A-6.1-1
September 2017 Pueblo Canyon Willow Community Monitoring Results

Willow Community	No. of Observed Communities	Height (ft)	Diameter (ft)	Growth Habit Qualifier	
				Height	Spatial Distribution
P-1	2	<5.0	<0.13	Short	Dispersed
P-2	5	<5.0	<0.13	Short	Continuous
P-3	3	5.0–7.0	0.13–0.21	Medium	Dispersed
P-4	8	5.0–7.0	0.13–0.21	Medium	Continuous
P-5	12	7.0–10.0	>0.21	Tall	Continuous

Attachment A-1

Photographs of Sediment Transport Mitigation Sites in the Los Alamos and Pueblo Canyons Watershed


(a)


(b)

Photo A1-1 Detected bank sloughing in Pueblo Canyon in 2016 (top) compared with the same view in 2017 (bottom), showing no observable change


(a)


(b)

Photo A1-2 Detected change in Pueblo Canyon in 2016 (erosion of ~2 ft) (top) compared with the same view in 2017 (bottom), showing no observable change in 2017


(a)


(b)

Photo A1-3 Detected change in Pueblo Canyon in 2016 (erosion of ~2 ft) (top) compared with the same view in 2017 (bottom), showing no observable change in 2017


(a)


(b)

Photo A1-4 Detected change in Pueblo Canyon lower willow planting area in 2016 (erosion of ~4 ft) (top) compared with the same view in 2017 (bottom), showing no observable change in 2017. View is northeast.


(a)

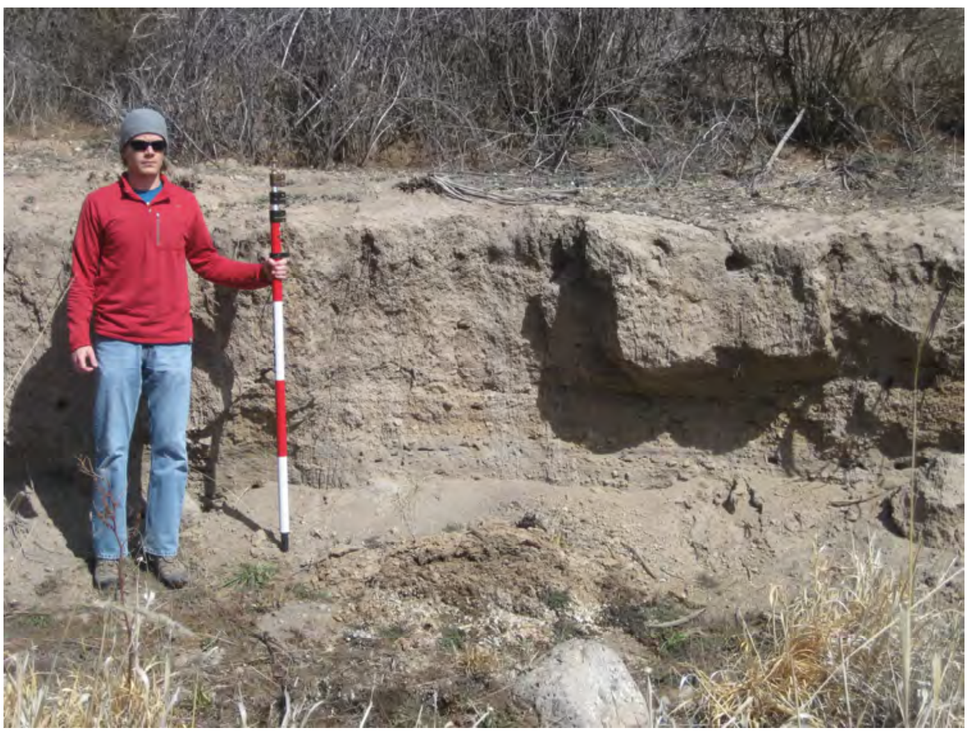

(b)

Photo A1-5 Detected change in Pueblo Canyon lower willow planting area in 2016 due to bank collapse (deposition of ~2 ft) (top) compared with the same view in 2017 (bottom), showing no observable change in 2017. View is north.

(a)

(b)

Photo A1-6 **Detected change near the western edge of Reach P-4C in Pueblo Canyon GCS Area in 2016 (incision of ~1 ft) (top) compared with the same view in 2017 (bottom), showing no observable change in 2017. View is northwest.**


(a)


(b)

Photo A1-7 Detected change near the western edge of Reach P-4C in Pueblo Canyon GCS Area in 2016 (incision of ~1 ft) (top) compared with the same view in 2017 (bottom), showing no observable change in 2017. View is east.


(a)


(b)

Photo A1-8 Detected change above the DP Canyon GCS in 2016 due to bank collapse (erosion of ~1 ft) (top) compared with the same view in 2017 (bottom), showing no observable change in 2017


(a)


(b)

Photo A1-9 Detected change in braided channel above the DP Canyon GCS in 2016 (deposition of ~1ft) (top) compared with the same view in 2017 (bottom), showing minor observable change in 2017. View is east.


(a)


(b)

Photo A1-10 (a) Willows planted in 2014 in Pueblo Canyon lower willow-planting area, from northern stake at P4C+800, in November 2016 and (b) short-height, spatially dispersed community (P-1) example in September 2017


(a)


(b)

Photo A1-11 (a) Willows planted in 2014 in Pueblo Canyon lower willow-planting area, looking downstream from PU+1100, in November 2016 and (b) short-height, spatially continuous community (P-2) example in September 2017


(a)


(b)

Photo A1-12 (a) Willows planted in 2014 in Pueblo Canyon lower willow-planting area, looking downstream from P4C+200, in November 2016 and (b) medium-height, spatially dispersed community (P-3) example in September 2017


(a)


(b)

Photo A1-13 (a) Willows planted in 2014 in Pueblo Canyon lower willow-planting area, looking upstream from PU+300, in November 2016 and (b) medium-height, spatially continuous community (P-4) example in September 2017


(a)


(b)

Photo A1-14 (a) Willows planted in 2014 in Pueblo Canyon lower willow-planting area, looking downstream from PU+400, in November 2016 and (b) tall-height, spatially continuous community (P-5) example (center) in September 2017

Attachment A-2

Ground-Based Survey Data
(on CD included with this document)

Attachment A-3

Geomorphic Change Detection Analysis of Sediment Transport Mitigation Sites in the Los Alamos and Pueblo Canyons Watershed for a Three-Year Interval

CONTENTS

A3-1.0 INTRODUCTION A3-1

A3-2.0 METHODS AND DATA COLLECTION A3-1

A3-2.1 Aerial LiDAR Survey Data Collection and Processing A3-2
A3-2.2 Digital Elevation Model Generation and Geomorphic Change Estimation Procedures A3-2
A3-2.3 Error Modeling Procedures A3-3
A3-2.4 Calibrating Error Models with Observed Results A3-4

A3-3.0 RESULTS A3-5

A3-3.1 GCD Analysis Outputs A3-5
A3-3.2 LiDAR DEM Error Assessment A3-5

A3-4.0 DISCUSSION A3-6

A3-4.1 Spatially Variable Error A3-6
A3-4.2 Modeling Geomorphic Change and Forecasting A3-6
A3-4.2.1 Pueblo Canyon Background Monitoring Area A3-7
A3-4.2.2 Upper Pueblo Canyon Willow Planting Monitoring Area A3-7
A3-4.2.3 Wing Ditch Monitoring Area A3-7
A3-4.2.4 Lower Pueblo Canyon Willow Planting Monitoring Area A3-7
A3-4.2.5 Pueblo GCS Monitoring Area A3-7
A3-4.2.6 DP Canyon Monitoring Area A3-8

A3-5.0 CONCLUSIONS AND RECOMMENDATIONS A3-8

A3-6.0 REFERENCES AND MAP DATA SOURCES A3-9

A3-6.1 References A3-9
A3-6.2 Map Data Sources A3-9

Figures

Figure A3-1.0-1 Los Alamos, Pueblo, and DP Canyon channel systems showing sediment transport monitoring areas, monitoring area extents, and stream gages A3-11

Figure A3-2.3-1 FIS error modeling concept of defining an error value for each pixel based on the quality of the surface as influenced by three characteristics: slope, point density, and surface roughness A3-12

Figure A3-2.4-1 GCD analysis with a Min. LoD of 0.55 ft. 2014 orthophoto with 2016 hillshade DEM and 2014 to 2016 GCD results at the Pueblo Canyon grade-control structure area A3-13

Figure A3-2.4-2 GCD analysis was set to detect changes above a propagated error threshold defined by a FIS-calculated range of errors derived from GPS and DEM differences A3-14

Figure A3-2.4-3 GCD analysis was set to detect changes above propagated error threshold defined by calculated ranges of errors derived from GPS and DEM differences, as well as magnitudes of observed and confirmed changes in the field A3-15

Figure A3-3.1-1 2014 orthophoto with 2016 hillshade DEM and 2014 to 2016 GCD results at the Pueblo Canyon Background Monitoring Area A3-16

Figure A3-3.1-2 2014 orthophoto with 2016 hillshade DEM and 2014 to 2016 GCD results at the Upper Pueblo Canyon Willow Planting Monitoring Area A3-17
Figure A3-3.1-3 2014 orthophoto with 2016 hillshade DEM and 2014 to 2016 GCD results at the Pueblo Canyon Wing Ditch Monitoring Area A3-18
Figure A3-3.1-4 2014 orthophoto with 2016 hillshade DEM and 2014 to 2016 GCD results at the Lower Pueblo Canyon Willow Planting Monitoring Area A3-19
Figure A3-3.1-5 2014 orthophoto with 2016 hillshade DEM and 2014 to 2016 GCD results at the Pueblo Canyon GCS Monitoring Area... A3-20
Figure A3-3.1-6 2014 orthophoto with 2016 hillshade DEM and 2014 to 2016 GCD results at the DP Canyon Monitoring Area... A3-21

Tables

Table A3-3.1-1 Sediment Accumulation at Los Alamos/Pueblo Canyon Monitoring Areas, 2014 to 2016 .... A3-23
Table A3-3.1-2 Calibrated Error Values for Los Alamos and Pueblo Canyon Monitoring Area GCD Analyses, 2014 to 2016 .... A3-23

A3-1.0 INTRODUCTION

Assessing volumetric and morphologic changes with aerial light detection and ranging (LiDAR) scanning is an effective and dynamic approach to monitoring sediment flux in a fluvial environment. Weather patterns, geologic setting, and surface water runoff dynamics are generally the most significant contributing factors to observed morphological changes. Using LiDAR scans and change detection software in conjunction has established that advantageous modeling of dynamic fluvial environments is possible.

This Appendix A attachment presents the cumulative results from three monsoon seasons of incremental changes and documents the magnitude and distribution of developing geomorphologic features. The establishment of a baseline for a 3-yr monitoring interval will allow for comparison of future LiDAR scans, whether annual or following the 2019 monsoon season. Further, modeling the changes observed from 2014 to 2016 allows for forecast scenarios related to the nature and magnitude of evolving geomorphic features, for example, cut-bank retreat, point bar formation, and channel incision or aggradation.

The precipitation and discharge recorded in the Los Alamos and Pueblo (LA/P) watersheds was near or below the 10-yr mean for the three monsoon seasons monitored from 2014 to 2016. Following the New Mexico Environment Department's (NMED's) approval of Los Alamos National Laboratory's (LANL's or the Laboratory's) recommendation to reduce LiDAR monitoring of the watershed from annual monitoring to a period of every 3 yr, or following significant storm events, the baseline results are presented for a 3-yr window in which rainfall amounts were average to below average and thus had minimal to no effect on the monitoring areas. Conducting geomorphic change detection (GCD) analysis over three monsoon seasons (2014–2016) using digital elevation model (DEM) comparisons for average to below-average storm events reveals the monsoon seasons' cumulative effect and establishes the magnitude and nature of expected geomorphic change (Figure A3-1.0-1).

Modeling of annual changes to geomorphic features within the LA/P watershed during low-intensity monsoon seasons has demonstrated that a consistent and detectable level of change occurs over the course of a single monsoon season (LANL 2017, 602343). Additionally, annual analyses demonstrate that the monitoring areas are stable over the course of one low-intensity monsoon season and do not significantly change in relation to geomorphology. In contrast, the features that define the whole monitoring area (e.g., channel banks and thalweg) experience incremental and minor changes accumulated throughout the year. Accordingly, the results of previous studies support the conclusion that for most of those features surveyed and characterized, the overwhelming majority of them are not significantly different since the previous year's results.

A3-2.0 METHODS AND DATA COLLECTION

Aerial LiDAR surveys were flown over the Laboratory in June 2014 before the annual New Mexico monsoon season and in December 2015 and October 2016 following the New Mexico monsoon season. The monitoring period includes three summer monsoon seasons: 2014, 2015, and 2016. The June 2014 LiDAR survey represents the baseline for comparison. Aerial LiDAR data were collected in 2014 for the entire Laboratory and in 2015 and 2016 with a specific focus on canyon-bottom areas of interest, including the LA/P Canyon watershed. Comparison results from analyses conducted for this and previous reports (LANL 2015, 600439; LANL 2016, 601433; LANL 2017, 602343) use LiDAR point clouds collected and classified by The Atlantic Group, LLC, as well as the Geomorphic Change Detection plug-in for ESRI ArcGIS originally developed by Joe Wheaton (Utah State University Department of Watershed Sciences) and James Brasington (Queen Mary University). DEMs created from the point clouds were used in conjunction with ground-based surveying of geomorphic features of concern (channel banks and thalweg) within monitoring reaches. Volume and propagated error were calculated using methods detailed in Wheaton et al. 2010 (601298).

A3-2.1 Aerial LiDAR Survey Data Collection and Processing

Aerial LiDAR data were collected in 2014 for the entire Laboratory and in 2015 and 2016 with a specific focus on canyon-bottom areas of interest, including Los Alamos, DP and Pueblo Canyons (Figure A3-1.0-1). The LiDAR surveys were accompanied by ground-based global positioning system (GPS) surveys of check points, which were used to further constrain the spatial position and accuracy of the LiDAR point cloud. The LiDAR points were then classified as ground points or nonground points (e.g., vegetation) using appropriate software and filtering methodologies, along with manual editing.

A3-2.2 Digital Elevation Model Generation and Geomorphic Change Estimation Procedures

When repeat surveys of an area are conducted, elevation changes will be observed. Actual elevation changes can occur from a variety of geomorphic processes (herein defined strictly as sediment erosion or deposition) as well as other non-geomorphic processes. However, apparent elevation changes can also occur as a result of error inherent to the survey data acquisition and classification methods. In this report, non-geomorphic processes encompass vegetation changes, burrowing by animals, road blading or slope stabilization efforts, differences in soil saturation or compaction between measurements, and any other processes not directly related to downslope sediment transport.

Reasonable error assessment of the survey methods yields thresholds above which all detected change is assumed to be actual elevation change of the surface—although this elevation change includes changes caused by geomorphic and non-geomorphic processes. However, some small-magnitude actual elevation changes, for example deposition of a very thin sediment layer, may also fall below the threshold and thus be discounted from change detection calculations, even if physically observed. Above the threshold, field observations and vegetation maps can provide context to distinguish between geomorphic sediment erosion or deposition and non-geomorphic elevation changes. Non-geomorphic changes could include elevation increase from cattail mound development between surveys, shrubs and trees classified out of subsequent DEMs that were inlcuded in previous DEMs, or differences in how bare earth was described when the DEM algorithm was trying to filter out shrubs and trees.

The points designated as “ground” in the aerial LiDAR data set from each survey year were used to generate (DEMs that were clipped to the geographic boundaries of the study reach before further analysis. The 2016 and 2014 DEMs were defined or clipped using the extents defined in the 2015 Monitoring Report (LANL 2016, 601433) (Figure A3-1.0-1) in order to exclude topographic abnormalities such as trees and shrubs included in the 2014 DEM.The 2014 DEM was then subtracted from the 2016 DEM to create a DEM of Difference (DoD) using the geomorphic change detection plug-in for ArcGIS (Wheaton et al. 2010, 601298). Positive values of the DoD indicate deposition between the 2014 and 2016 surveys; negative values indicate erosion over the same time period. A range of red pixels designates negative change (erosion); similarly a range of blue pixels identifies positive change (deposition) at a given pixel. Grid resolution for the DEMs, and DoD output, are both 1 × 1 ft. Areas of DoD-predicted geomorphic change were confirmed with field observations. Detected positive and negative changes in elevation are specifically evaluated in the field to confirm whether they are the result of geomorphic or non-geomorphic processes.

A3-2.3 Error Modeling Procedures

In previous iterations of this report (LANL 2016, 601433), error was estimated by simply comparing agreement of the predicted surface or DEM with a more accurate measurement of the actual surface as determined with GPS-surveyed points. Computing the root-mean-squared error (RMSE) of the difference in measured or GPS values versus predicted or DEM values supplies an estimate of the error in values of the modeled surface. This value was previously applied in a uniform fashion to the calculations. However, not all surfaces will reflect this uniformly applied error value and may in fact have less, or more, inherent error. This is in part due to the limitations of aerial LiDAR to accurately capture data on a variable surface.

Precision of the data collected during an aerial LiDAR survey is affected by variation of the ground surface, which in turn influences the accuracy of any surface interpolated from a point cloud of elevation values. Primary among these attributes are slope, point density, and surface roughness.

a. **Slope:** Measurements collected on an inclined surface have a higher inherent error than those collected on a relatively level one, as points are not reflected back to the laser scanner as effectively. In general, the more inclined the surface, the less accurate the elevation (Z) values derived by LiDAR will be, resulting in a higher uncertainty.

b. **Point Density:** Only ground-classified points are used to build the DEM; therefore, high point density is expected to yield a more realistic representation of ground surface. When points are sparse, the modeling of ground surface is less realistic. An indicator of low point density in a DEM surface is the presence of irregular polygons on the DEM surface. Presence of these polygons indicates that the low point density resulted in an over-interpolated model of the actual surface. Low point density areas have inherently higher error because of their less accurate representation of actual ground surface.

c. **Surface Roughness:** Measurement of local differences in elevation between individual neighboring points gives an assessment of surface roughness. A surface with high local variability in Z values is less well represented by LiDAR than a smooth continuous surface. Therefore, a high degree of surface roughness results in an inherent decrease of elevation accuracy. In general, smooth surfaces are represented well and rougher, or more variable surfaces, less well.

To compute the spatially variable error of a DEM surface, raster models of the previously mentioned point-cloud-derived attributes are required, as was done in the 2016 monitoring report (LANL 2017, 602343). A set of rules defining a “fuzzy inference system,” or FIS, determines the amount of error applied to any given pixel involved in a DoD calculation. The FIS is structured with a set of membership functions (MFs) that categorize individual point-cloud attributes into discreet groups based on the distribution of values the surface represents [e.g., slope is grouped into Low (0–20), Medium (20–45), and High (45–90)]. After the surfaces have been analyzed and grouped, the rules are processed that determine the pixel’s individual value of error. Below is an example of how a level, relatively well represented surface would be assigned an appropriate error value.

Example of a Low Error Value Assignment:

Properties of the pixel: 1. Slope = 03 deg 2. Point Density = 2.0 pt/ft^2 3. Roughness = 0.3 ft

Membership function grouping: 1. Low Slope 2. High Point Density 3. Low Roughness

After the pixel is categorized into a group, it is assigned an appropriate error value based on the rule sets. The first rule set says that if slope is low, then it should fall in the low error MF. The second rule says that if point density is high then the pixel should again be assigned a low error. The third rule states that if roughness is low, a low error is applied. The range of values applied to the best-case scenario error are assigned to the low error MF. So this pixel would be represented by an error value within that best-case scenario range (Figure A3-2.3-1).

For the purposes of calculating net volume change, all elevation changes above the threshold defined in this appendix are assumed to represent sediment erosion or deposition. This assumption necessarily excluded small, but real, changes that occurred below the threshold and included elevation changes that occurred above the threshold that are due to non-geomorphic processes. Non-geomorphic elevation changes are often represented by a mottling on the DoD of both positive and negative detections in areas of steep terrain and dense tree canopy that do not represent actual geomorphic changes. These detections can often be attributed to misclassification of point-cloud data.

A3-2.4 Calibrating Error Models with Observed Results

Defining values in membership functions of the FIS is an iterative process tailored to site conditions affecting each analysis. In areas where ground conditions lower the quality of the LiDAR returns, and thus lower the accuracy of the DEM, a large enough error value is assigned to threshold out non-geomorphic changes. In areas that have ground conditions more accurately measured by LiDAR, using the calculated RMSE values can often be too aggressive. This has the effect of excluding observable and verifiable geomorphic change from the GCD analysis. To accurately depict observed changes and filter out non-geomorphic changes, a balance between (1) using calculated error values and (2) using error values that prevent exclusion of observed changes must be attained. Relying strictly on calculated results for determining membership functions of error ranges for DEM surfaces has the effect of being too aggressive and discounting changes detected on well-represented surfaces.

Applying a well-calibrated FIS to the modeling of error on a surface is crucial to determining an accurate volume of detected geomorphic change. Examples are presented here that depict the iterative process undertaken to determine which modeling approach results in an accurate estimate of actual geomorphic change given the surface conditions of the analysis area.

Example 1. Using a minimum level of detection (Min. LoD) to detect change

> Change detection results from an analysis conducted with a Min. LoD of 0.55 ft are presented in Figure A3-2.4-1. This method results in the most detected changes from 2014 to 2016 and a spatially uniform uncertainty value. While this method captures observed geomorphic changes, it also includes detections from non-geomorphic changes such as growth of plants on the channel surface, as well as detections that are artifacts of the lower quality of the 2014 DEM (e.g., positive and negative surface change near steep cut bank). This method does, however, provide an initial assessment for the overall development of features within this monitoring area (e.g., channel development via incision and minor lateral migration and aggradation on channel surface where reach becomes a losing stream).

Example 2. Using an FIS calibrated to the calculated differences of GPS/DEM error values

> Change detection results from an analysis conducted with an error surface that was designed around calculated differences in GPS points and the predictive DEM surface will threshold out most of the detectable changes (Figure A3-2.4-2). The result is that only most significant geomorphic changes (e.g., channel incision) and non-geomorphic changes (e.g., tree growth) are depicted in the results. The range of error used in the FIS was too aggressive and resulted in an output that does not reflect observed changes within this monitoring area.

Example 3. Using an FIS calibrated to allow observed changes to appear in GCD results

> Change detection results from an analysis conducted with an error surface that was calibrated to reflect independently and field-verified observed geomorphic changes are shown in Figure A3-2.4-3. When a less aggressive range of errors is used on the most accurately measured/defined surfaces (e.g., open, sandy channel) in the lower Pueblo Canyon monitoring area, the results most accurately depict changes of the channel surface from 2014 to 2016.

The results achieved with the method described in Example 3 of error surface calibration provides the most robust estimate for actual changes over the analysis time frame on well-represented surfaces.

A3-3.0 RESULTS

A3-3.1 GCD Analysis Outputs

Two complications arise when interpreting the DoD analyses for reach-scale volume change calculations. First, some LiDAR points, which do not represent the actual ground surface, were likely misclassified as ground points. In areas of dense vegetation, for example, reed canary grass or dense tree canopy, the improper assignment of vegetation points as ground-classified points is more likely than in areas of sparse vegetation cover. When these “ground” (actually vegetation) points are used as part of the three-dimensional point cloud to generate the ground-surface DEM, they contribute to elevation change anomalies. The DoD calculations will therefore identify some elevation changes that are from changes in vegetation height rather than changes in the ground surface caused by either channel processes (e.g., sediment erosion or deposition) or other geomorphic processes occuring outside the channel itself.

The second complication arises because the edges of the reach are characterized by cliffs, steep embankments, and large boulders. These steep areas are not captured particularly well within the LiDAR data sets, and therefore, large amounts of elevation change may be apparent in the DoD even if no real topographic change has occurred at the canyon edges. Comparison of DoD results with 2015 GPS surveyed channel banks revealed very few detections of topographic change along banks and mostly minor changes in lateral position of banks over the various monitoring areas.

Geomorphic changes are highlighted and described in Figures A3-3.1-1 through A3-3.1-6. Ranges of elevation differences for confirmed locations of geomorphic changes are called out in the figues, as well as locations which had detections as a result of non geomorphic processes: vegetation growth, point-cloud missclasification, steep slopes, and DEM accuracy near large trees or shrubs.

Volume and propagated error were calculated using methods detailed in Wheaton et al. (2010, 601298). Net volume changes and error surface calculation results for each monitoring area are listed in Table A3-3.1-1 and Table A3-3.1-2.

A3-3.2 LiDAR DEM Error Assessment

It is important to recognize that certain areas are better represented by LiDAR data than others. The best represented surfaces fall within the low error grouping and are more likely to reflect lower amplitude geomorphic change. However, it is also important to recognize that some areas that have no geomorphic change, no matter how well defined within the FIS, will still result in a detected change. These detections are typically the result of either misclassified or poorly classified vegetation (e.g., primarily tree canopy), features that were not previously classified as ground (e.g., boulders), or a result of the overall adjustment up or down of the DEM to align with neighboring DEM tiles.

An estimate of the 95% confidence interval (2 standard deviations) of the RMSE for the DEM elevations was obtained by comparing a subset of aerial LiDAR-derived point elevations with ground-surveyed GPS point elevations (vertical accuracy for these GPS points is better than 0.1 ft). In general, error values for the DEM surface within areas vegetated with reed canary grass and cattails are much higher than the unvegetated channel surfaces. A spatially variable error value was generated for each sediment mitigation monitoring area. The RMSE error value of each pixel is subject to the area's individual FIS model to compute the spatially variable error of the DEM surface. The lower limit of detection for each analysis area is defined by standard error propagation in addition/subtraction opertaions of the lowest value in the legend of each error map. Variable error surfaces values are reported in Table A3-3.1-2.

The propagated error values provide the threshold above/below which any values in the DoD are assumed to represent actual elevation change. The variable error surfaces were calibrated to the 95% confidence interval RMSE values calculated for respective monsoon year DEMs and propagated through the DoD calculations. Net changes for the study reach are then calculated by summing the DoD over areas of erosion/deposition above or below the error threshold. As mentioned previously, DoD values above the threshold are assumed to represent geomorphic erosion or deposition. These identified elevation changes were field verified using visual inspection methods to determine if geomorphic change occurred. Areas of confirmed or rejected geomorphic change are identified and documented in this appendix in Figures A3-3.1-1 through A3-3.1-6. Regardless of field verification confirmation, all DoD values were used to calculate net volume changes as discussed in the results. Topographic elevation changes were classified as either channel erosion/deposition processes (e.g, aggradation or incision) or as other types of mass wasting, such as falls and slides/slumps. Because of the nature of rock/soil falls and slumps, large topographic changes may be evident (i.e., detected above the uncertainty threshold and confirmed in the field) that actually have small (if any) contribution to the net volume change within the channels. Therefore, these types of topographic elevation changes detected during DoD analyses may not yeild results that can be thought of as volumetrically equivalent to within-channel geomorphic processes.

A3-4.0 DISCUSSION

A3-4.1 Spatially Variable Error

Using a spatially variable error in DoD calculations has made it possible to more accurately assess geomorphic processes on surfaces that have been traditionally difficult to model with LiDAR data. The incorporation of spatially variable error surfaces into the DoD calculations improves the analysis of steeply inclined surfaces (i.e., banks) and has allowed for an accurate assesement of geomorphic activity on such features for the comparison between 2014 and 2016 DEMs. Geomorphic processes identified by the DoD results are typified by channel aggradation and incision that over the course of one monsoon season result in nonsignificant changes to the system. Other active processes that contribute to observed changes are characterized by typical arid-region mass wasting processes, specifcally minor slides, flows, slumps, and falls of unconsolidated sediment on steep bedrock or soil surfaces. Results from vegetation growth are minimized with this method but cannot be entirely eliminated. Variable error surfaces for 2014 and 2016 are produced during the DoD analysis but are not presented here.

A3-4.2 Modeling Geomorphic Change and Forecasting

Modeling a monitoring area based on past weather patterns (strength of monsoon season, output at gages) and known magnitudes of field-verified geomorphic changes allows for the forecasting of continued geomorphic changes. Geomorphic changes of monitoring interest include channel banks prone to collapse because of either bankfull storm events or thalweg rearrangement, and the development of headcuts/knickpoints. Based on this 3-yr analysis, an assessment of the locations within the monitoring areas that are experiencing geomorphic changes is possible.

A3-4.2.1 Pueblo Canyon Background Monitoring Area

Net sediment deposition likely occurred within the Pueblo Canyon Background Monitoring Area from 2014–2016 (Table A3-3.1-1). Aggradation occurred in the Pueblo Canyon Background Monitoring Area within channels and on bars from 0.75 ft to 1.45 ft (Figure A3-3.1-1). The 3-yr analysis does not identify any erosive features.

A3-4.2.2 Upper Pueblo Canyon Willow Planting Monitoring Area

Net sediment deposition likely occurred within the Upper Pueblo Canyon Willow Planting Monitoring Area from 2014–2016 (Table A3-3.1-1). Some erosion occurred (Table A3-3.1-1) as bank collapse and thalweg migration; however, aaggradation dominated the Upper Pueblo Canyon Willow Planting Monitoring Area typically as small side-channel inputs, depositional pockets from nearby eroded banks, and thalweg migration from 0.85 ft to 2.4 ft (Figure A3-3.1-2). The 3-yr analysis does not identify any developing geomorphic changes.

A3-4.2.3 Wing Ditch Monitoring Area

Net sediment deposition likely occurred within the Wing Ditch Monitoring Area from 2014–2016 (Table A3-3.1-1). However more erosion was detected in this monitoring area than at either the Pueblo Canyon Background Monitoring Area or the Upper Pueblo Canyon Willow planting Monitoring Area. Additionally, non-geomorphic changes due to constuction activities and vegetation growth obscured these volume change values (Figure A3-3.1-3). Deposition occurred at the upper part of this monitoring area as overbank deposits from 0.85 ft to 1.5 ft (Figure A3-3.1-3). The channel immediately above the Wing Ditch culverts has experienced a range of −1.2 ft to −4.5 ft of erosion in reach P-3 Central (Figure A3-3.1-3). Sediment eroded in this part of the channel is due to minor bank collapses and channel incision. Erosion within this channel may indicate the presence of a developing headcut.

A3-4.2.4 Lower Pueblo Canyon Willow Planting Monitoring Area

Net sediment volume change was within the estimated uncertainty at the Lower Pueblo Canyon Willow Planting Monitoring Area from 2014–2016 (Table A3-3.1-1). However, the most erosion during the 3-yr analysis was detected in this monitoring area. Importantly, most of this negative elevation change is easily attributed to non-geomorphic construction activities associated with the new grade-control structure (GCS) (Figure A3-3.1-4). Field-verified deposition occurred at the lower part of this monitoring area as side channel input from 0.8 ft to 1.4 ft, along with erosion due to channel incision from −0.9 ft to −1.35 ft (Figure A3-3.1-4). The detected channel incision is attributed to concentrating the flow of runoff into a defined channel in this part of the monitoring area and immediately upstream. The 3-yr analysis does not identify any developing geomorphic changes.

A3-4.2.5 Pueblo GCS Monitoring Area

Net sediment deposition likely occurred within the Pueblo Canyon GCS Monitoring Area from 2014–2016 (Table A3-3.1-1). Most of the detected erosion during the 3-yr analysis is negative elevation change attributed to non-geomorphic constuction activities conducted at and below the GCS (Figure A3-3.1-5).

Field-verified deposition occurred at the lower part of this monitoring area as side channel input and channel aggradation at the GCS from 0.75 ft to 5.1 ft (Figure A3-3.1-5, Inset Map B). Channel incision in the upper part of the monitoring area from −0.7 ft to −1.85 ft has occurred because of thalweg migration (Figure A-3.1-5, Inset Map A). The 3-yr analysis potentially indicates that further thalweg migration in this area (upper part of reach P-4C) could lead to the loss of steeply sloped bank material (where the channel turns abruptly to the south) during a larger runoff event at this location.

A3-4.2.6 DP Canyon Monitoring Area

Net sediment deposition likely occurred within the DP Canyon Monitoring Area from 2014–2016 (Table A3-3.1-1). Aggradation occurred in the DP Canyon Monitoring Area within channels and as overbank deposits from 0.95 ft to 1.45 ft (Figure A3-3.1-6). The 3-yr analysis identifies ongoing aggradation in the upper part of the reach (Figure A3-3.1-6, Inset Map A) due to overbank flows. Flow in Reach DP-2 is generally confined to the narrow and deep channel that defines the western portion of the reach. However, if this trend of "filling in" the primary channel in this part of the reach continues, overbank flows will become more regular and possibly result in the reshaping of the channel.

A3-5.0 CONCLUSIONS AND RECOMMENDATIONS

Over the course of three relatively minor monsoon seasons, channel features have developed on the post-2013 monsoon season erosion surface, suggesting that incision and downstream redistribution of channel material will continue even with minimal storm event input.

Deposition dominated the Pueblo Canyon monitoring areas as channel aggradation side-channel input, depositional pockets from nearby eroded banks, and overbank flow (specifically in DP Canyon). Erosion occurred as defined channels were established via incision into the post-2013 storm event diffuse and nonchannelized depositional surfaces.

Two specific areas, indicated by the 3-yr analysis, have developing geomorphic changes. One area in the upper part of the Wing Ditch Monitoring Area shows evidence of a developing headcut. The other area, in the upper part of reach P-4C in the Pueblo Canyon GCS Monitoring Area, is the establishment and continued incision of the channel against steeply sloped bank material that could be over-steepened and eroded during a larger runoff event at this location.

Reported volume changes, even using the calibrated FIS model, include positive and negative non-geomorphic changes leading to net sedimentation volumes that are not specific to geomorphic changes. More precise modelling of geomorphic changes are possible with further post processing. The output raster can be converted to vector data and recomputed to isolated the geomorphic change subset of the GCD result data.

One recommendation is to evaluate the use of unmanned aerial vehicles for the collection of LiDAR data with the LA/P watershed. Both cost reduction (as compared with scanning the entire Laboratory) and response time (e.g., quicker deployment) are benefits of this now well-established technology.

A3-6.0 REFERENCES AND MAP DATA SOURCES

A3-6.1 References

The following reference list includes documents cited in this attachment. Parenthetical information following each reference provides the author(s), publication date, and ERID or ESHID. This information is also included in text citations. ERIDs were assigned by the Associate Directorate for Environmental Management's (ADEM's) Records Processing Facility (IDs through 599999), and ESHIDs are assigned by the Environment, Safety, and Health Directorate (IDs 600000 and above). IDs are used to locate documents in the Laboratory's Electronic Document Management System and in the Master Reference Set. The NMED Hazardous Waste Bureau and ADEM maintain copies of the Master Reference Set. The set ensures that NMED has the references to review documents. The set is updated when new references are cited in documents.

LANL (Los Alamos National Laboratory), May 2015. "2014 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," Los Alamos National Laboratory document LA-UR-15-21413, Los Alamos, New Mexico. (LANL 2015, 600439)

LANL (Los Alamos National Laboratory), April 2016. "2015 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," Los Alamos National Laboratory document LA-UR-16-22705, Los Alamos, New Mexico. (LANL 2016, 601433)

LANL (Los Alamos National Laboratory), April 2017. "2016 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," Los Alamos National Laboratory document LA-UR-17-23308, Los Alamos, New Mexico. (LANL 2017, 602343)

Wheaton, J.M., J. Brasington, S.E. Darby, and D.A. Sear, February 2010. "Accounting for Uncertainty in DEMs from Repeat Topographic Surveys: Improved Sediment Budgets," *Earth Surface Processes and Landforms,* Vol. 35, No. 2, pp. 136-156. (Wheaton et al. 2010, 601298)

A3-6.2 Map Data Sources

The following list provides data sources for maps included in the main body of this attachment.

Drainage; Los Alamos National Laboratory, Environment and Remediation Support Services; 1:24,000; May 15, 2006.

Gaging stations; Los Alamos National Laboratory, Waste and Environmental Services Division; 1:2,500; March 19, 2011.

Geomorphic Reach Boundaries (DP Canyon), Los Alamos National Laboratory, Earth and Environmental Science, GISLab, 1993

Geomorphic Reach Boundaries (LA Canyon), Los Alamos National Laboratory, Earth and Environmental Science, GISLab, 2000

Geomorphic Reach Boundaries (Pueblo Canyon), Los Alamos National Laboratory, Earth and Environmental Science, GISLab, 2004

Grade control structures; Los Alamos National Laboratory, Environment and Remediation Support Services; Unknown; May 17, 2011.

LANL boundary; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; Unknown; August 16, 2010.

LANL area orthophoto; Los Alamos National Laboratory, 2014.

Other property boundary; Los Alamos National Laboratory, Earth and Environmental Sciences GIS Lab; Unknown; August 16, 2010.

Roads, surfaced; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; Unknown; November 30, 2010.

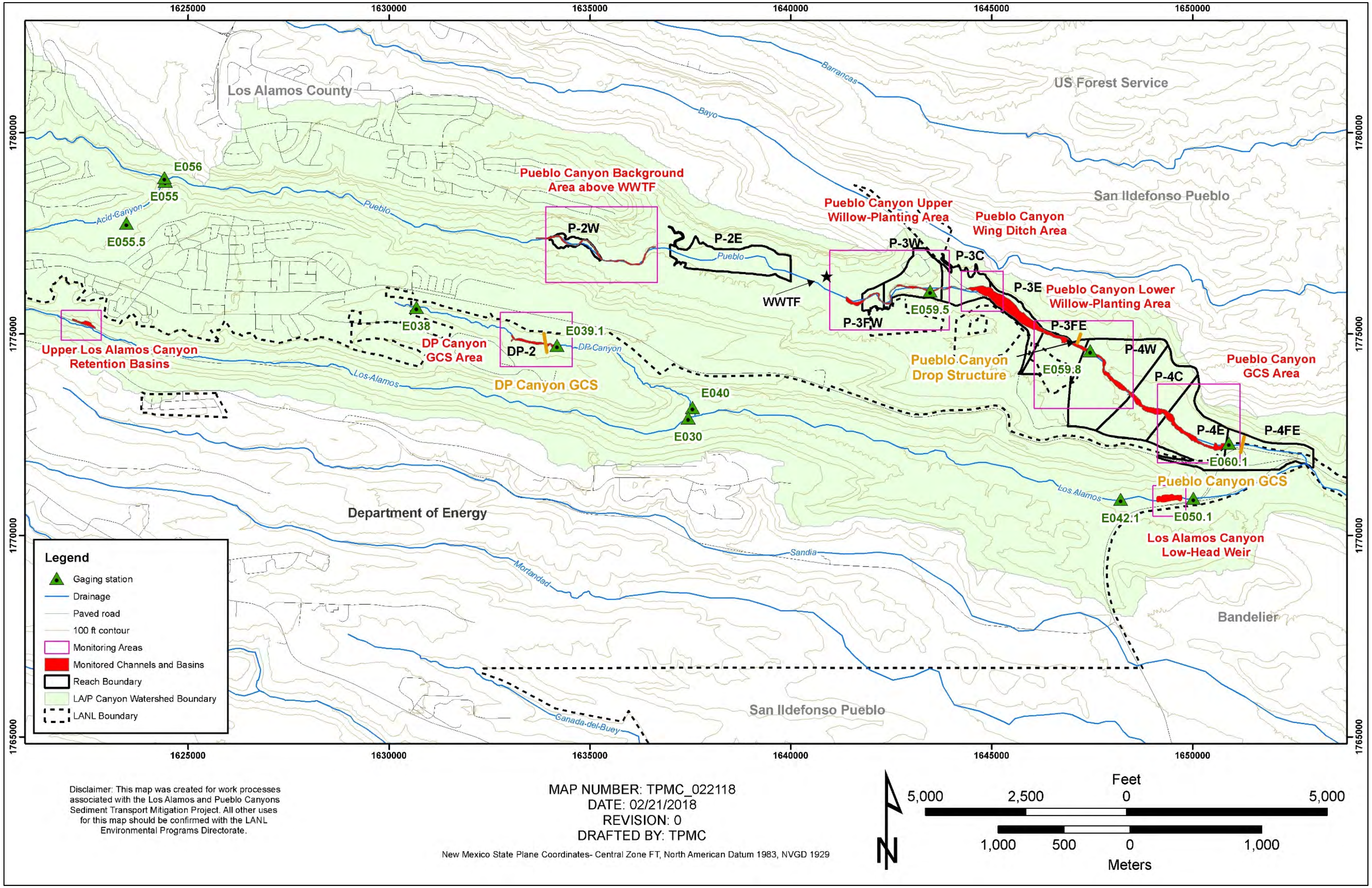


Figure A3-1.0-1 **Los Alamos, Pueblo, and DP Canyon channel systems showing sediment transport monitoring areas, monitoring area extents, and stream gages**

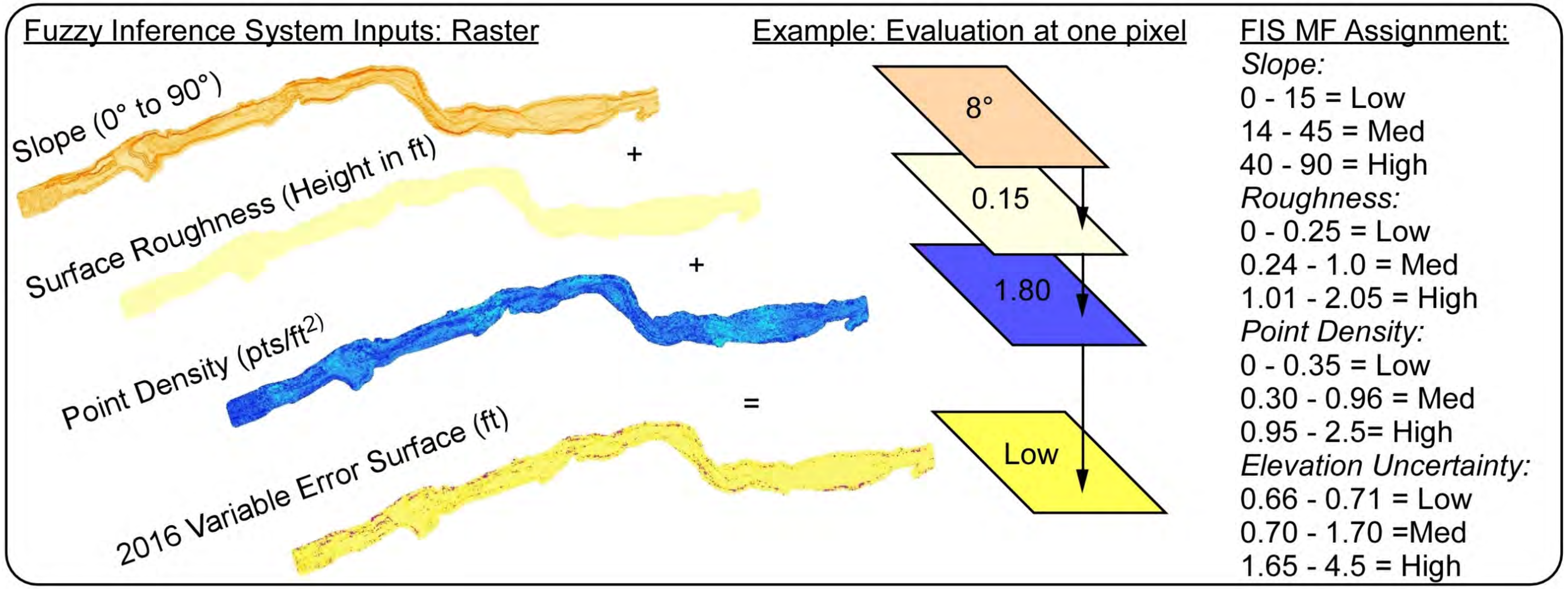


Figure A3-2.3-1 FIS error modeling concept of defining an error value for each pixel based on the quality of the surface as influenced by three characteristics: slope, point density, and surface roughness

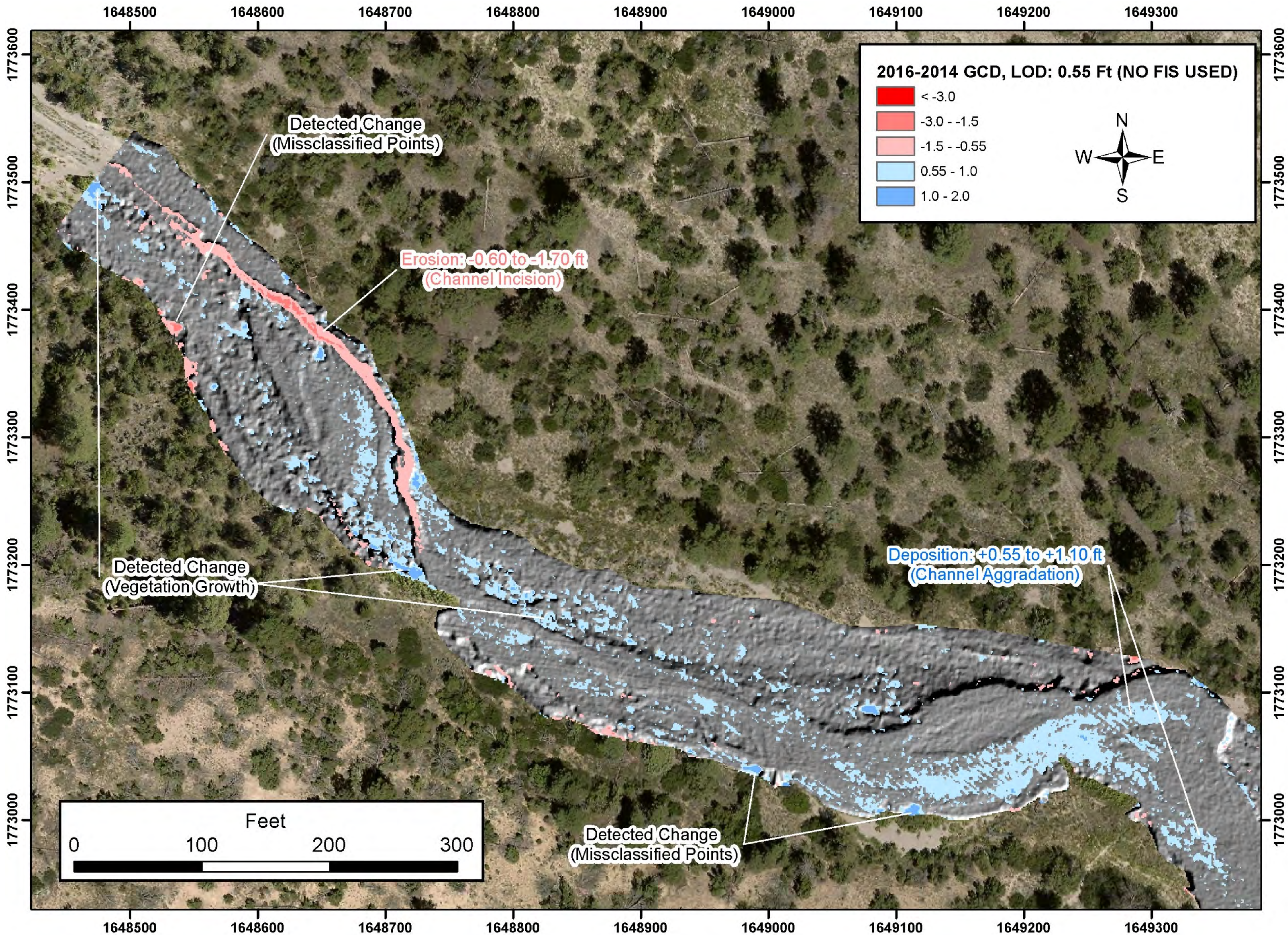


Figure A3-2.4-1 **GCD analysis with a Min. LoD of 0.55 ft. 2014 orthophoto with 2016 hillshade DEM and 2014 to 2016 GCD results at the Pueblo Canyon grade-control structure area. Many non-geomorphic detections from vegetation growth, issues with modeling steep banks, and poor point classification are evident using the Min. LoD method for thresholding changes.**

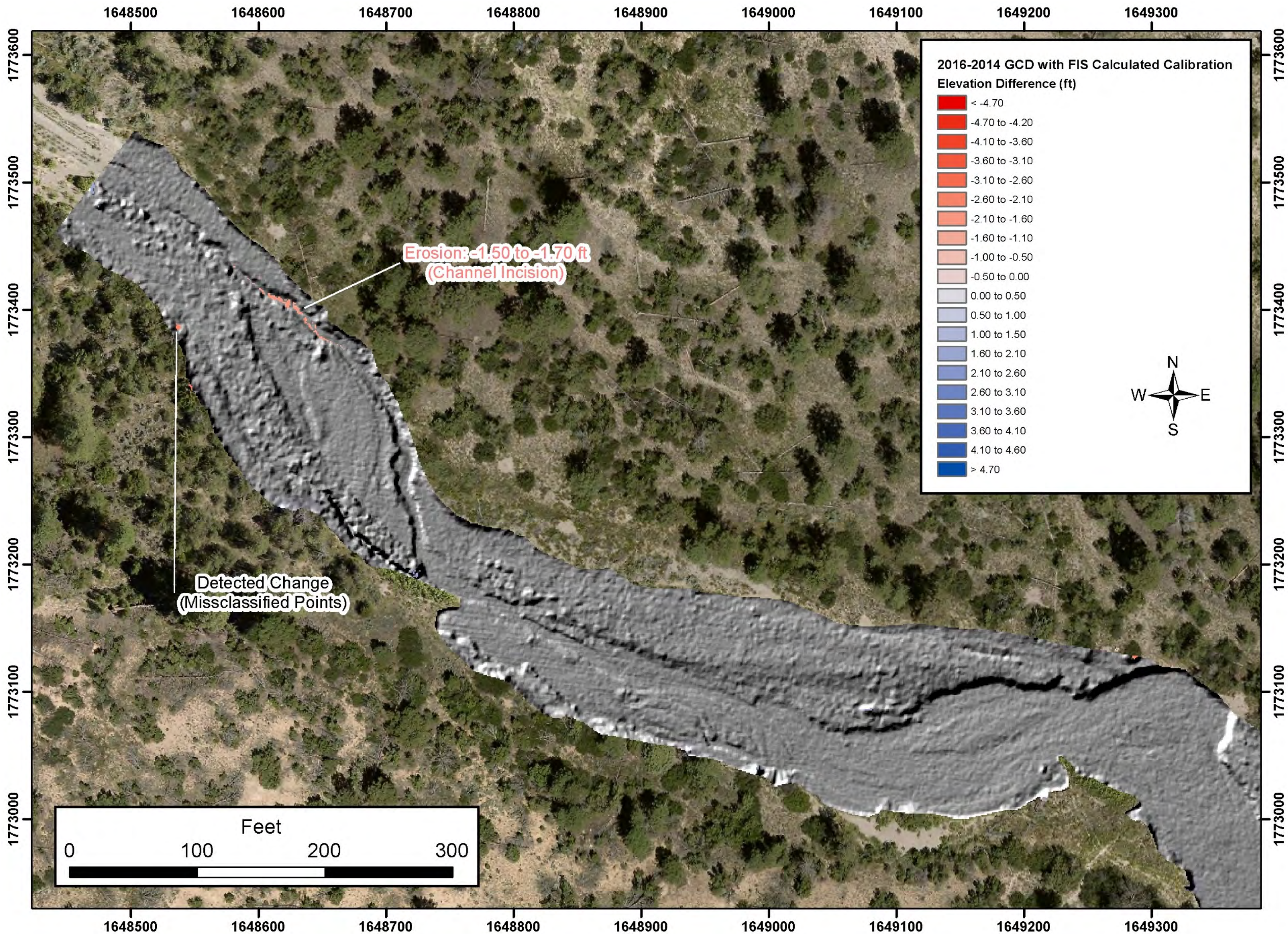


Figure A3-2.4-2 GCD analysis was set to detect changes above a propagated error threshold defined by a FIS-calculated range of errors derived from GPS and DEM differences. 2014 orthophoto with 2016 hillshade DEM and 2014 to 2016 GCD results at the Pueblo Canyon grade-control structure area. Results from this method are very minimal, as using the strictly calculated error values results in thresholding out much of the detectable change, as well as detections from vegetation growth and poor point classification.

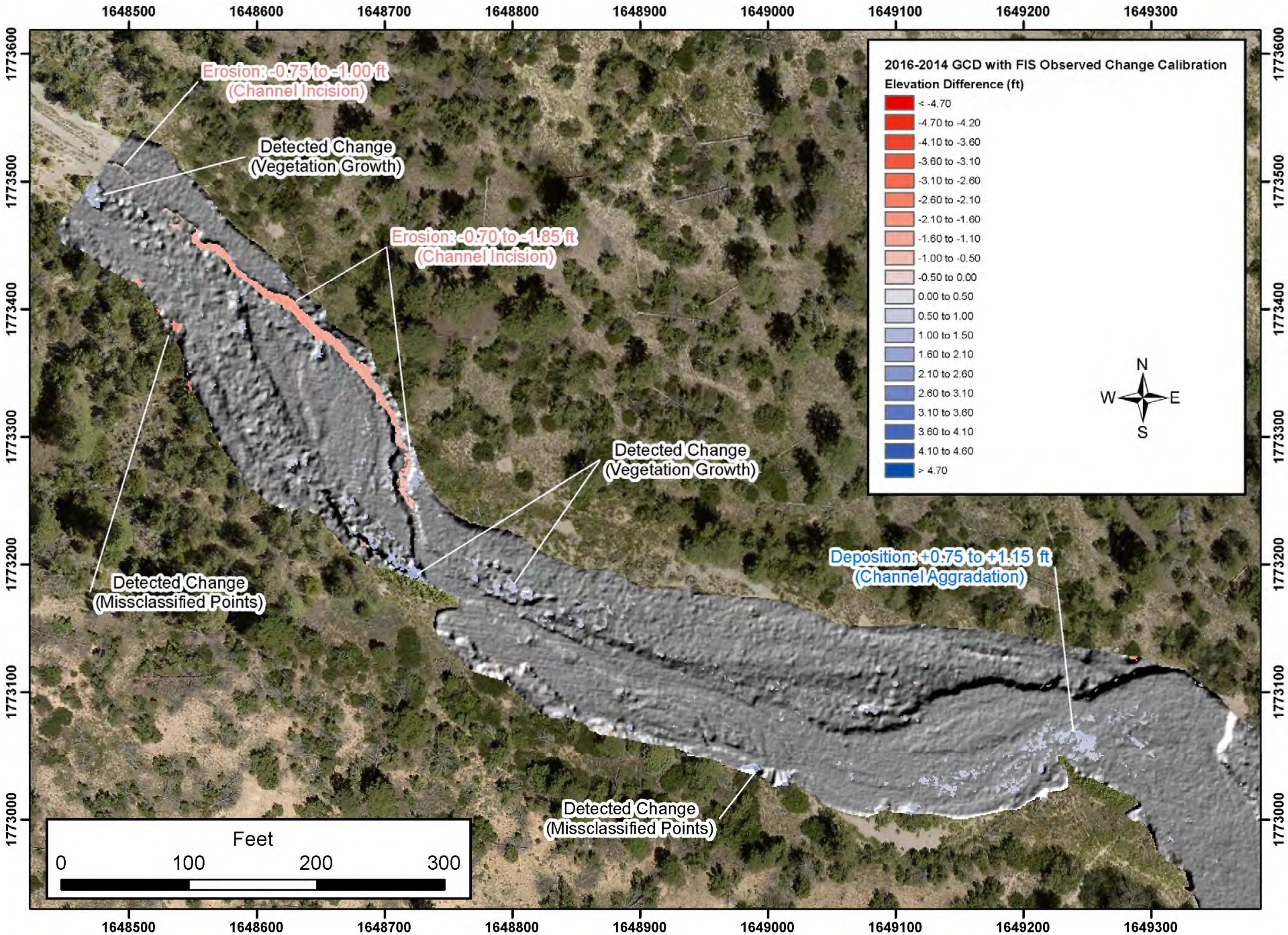
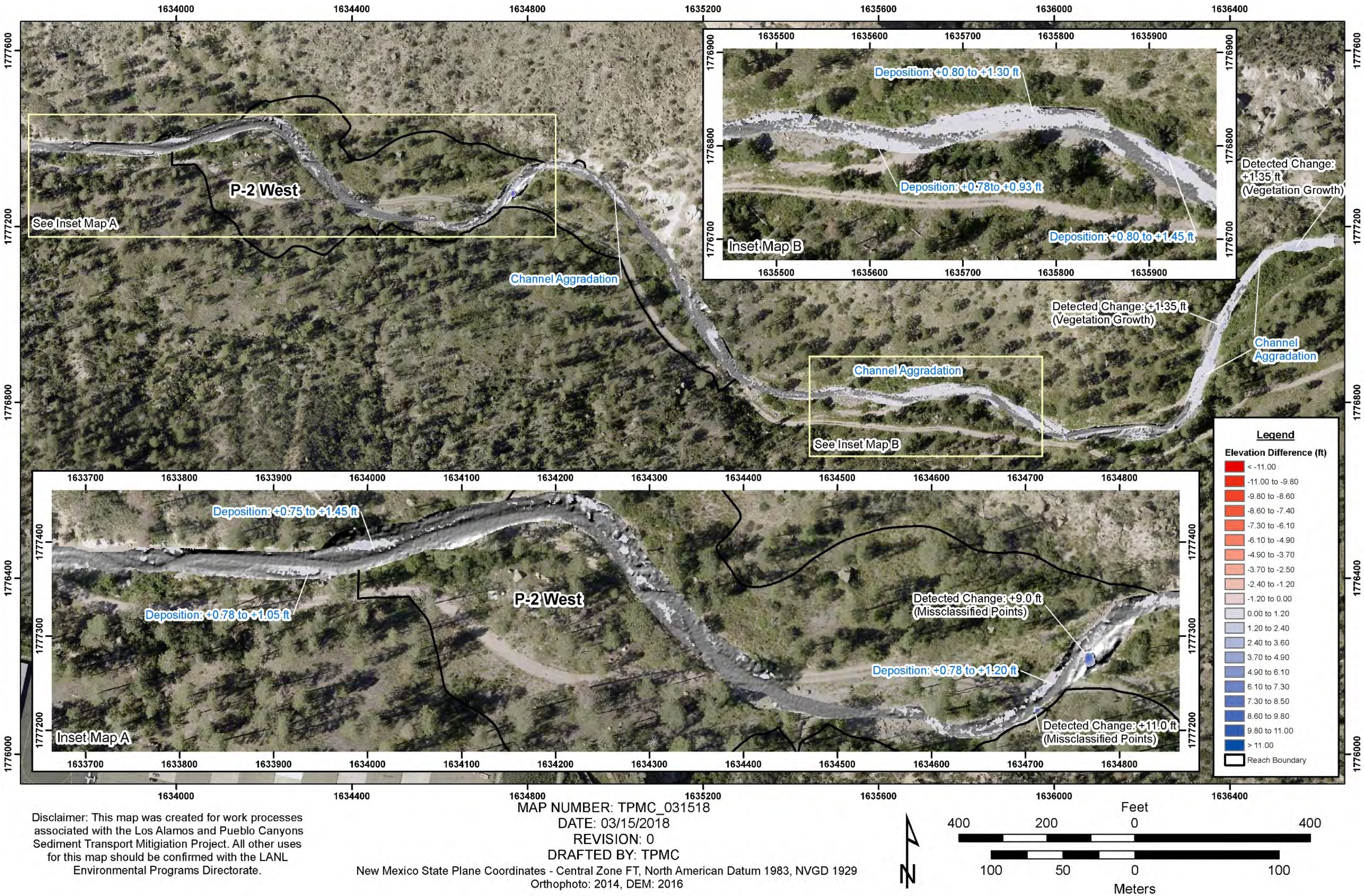


Figure A3-2.4-3 **GCD analysis was set to detect changes above propagated error threshold defined by calculated ranges of errors derived from GPS and DEM differences, as well as magnitudes of observed and confirmed changes in the field. 2014 orthophoto with 2016 hillshade DEM and 2014 to 2016 GCD results at the Pueblo Canyon grade-control structure area. Results from this method are the most "realistic" depiction of changes between the two DEMs. Detections from issues with modeling steep banks and vegetation, which grew on the channel surface between 2014 and 2016, are minimized with this FIS configuration.**



Disclaimer: This map was created for work processes associated with the Los Alamos and Pueblo Canyons Sediment Transport Mitigiation Project. All other uses for this map should be confirmed with the LANL Environmental Programs Directorate.

MAP NUMBER: TPMC_031518
DATE: 03/15/2018
REVISION: 0
DRAFTED BY: TPMC
New Mexico State Plane Coordinates - Central Zone FT, North American Datum 1983, NVGD 1929
Orthophoto: 2014, DEM: 2016

Figure A3-3.1-1 2014 orthophoto with 2016 hillshade DEM and 2014 to 2016 GCD results at the Pueblo Canyon Background Monitoring Area. FIS calibration was based on observable changes between DEMs.

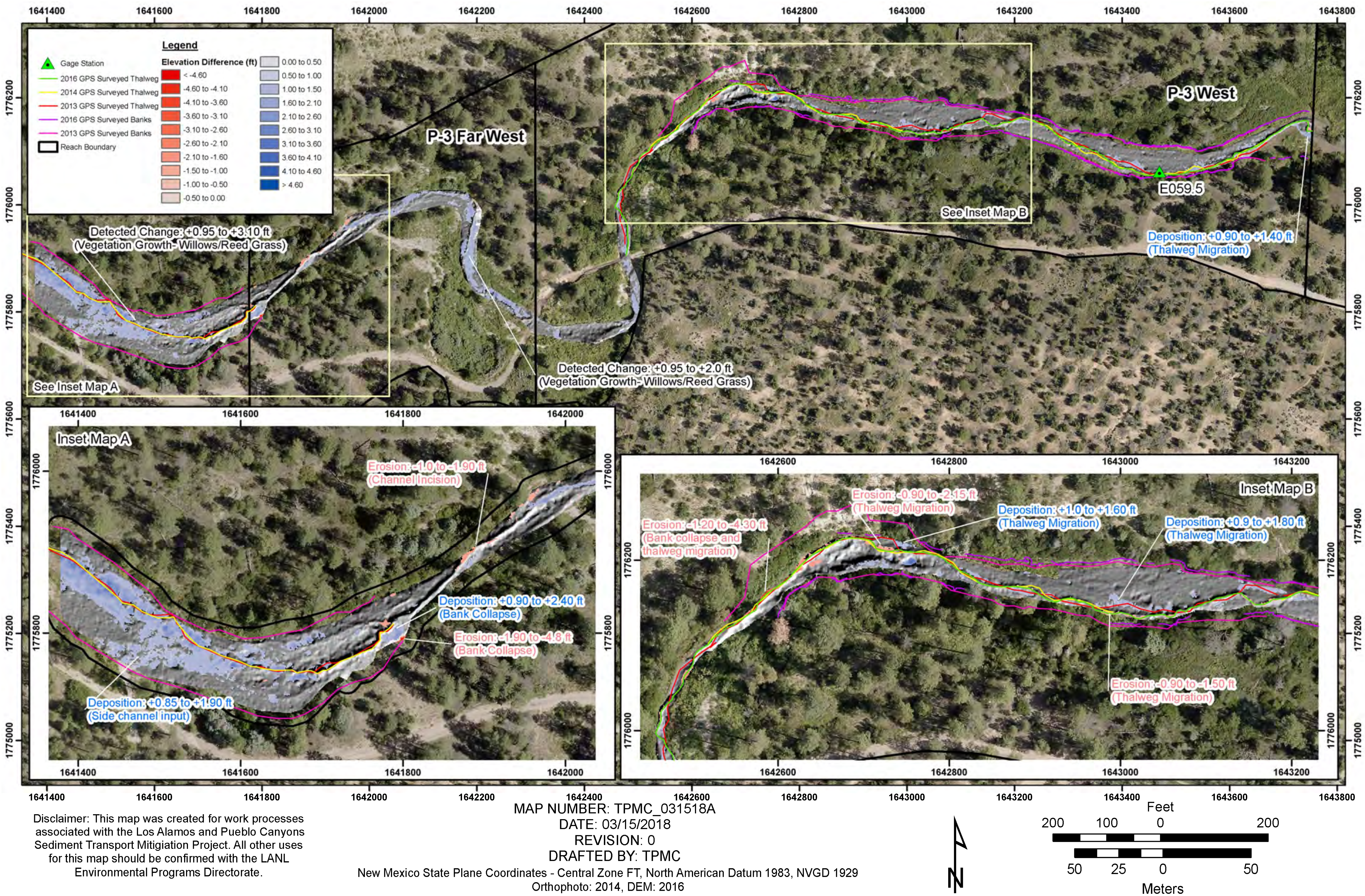


Figure A3-3.1-2 2014 orthophoto with 2016 hillshade DEM and 2014 to 2016 GCD results at the Upper Pueblo Canyon Willow Planting Monitoring Area. FIS calibration was based on observable changes between DEMs.

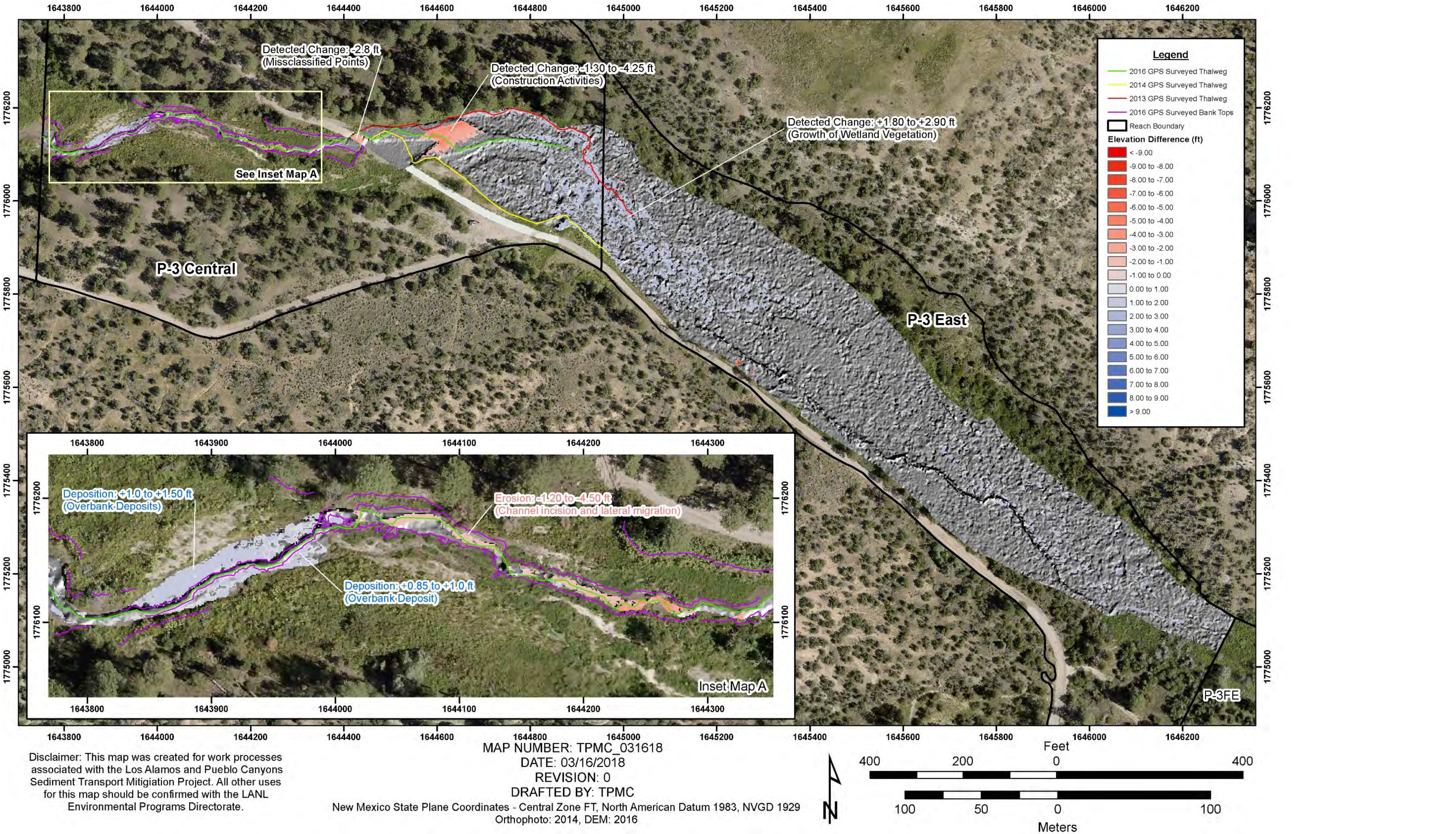
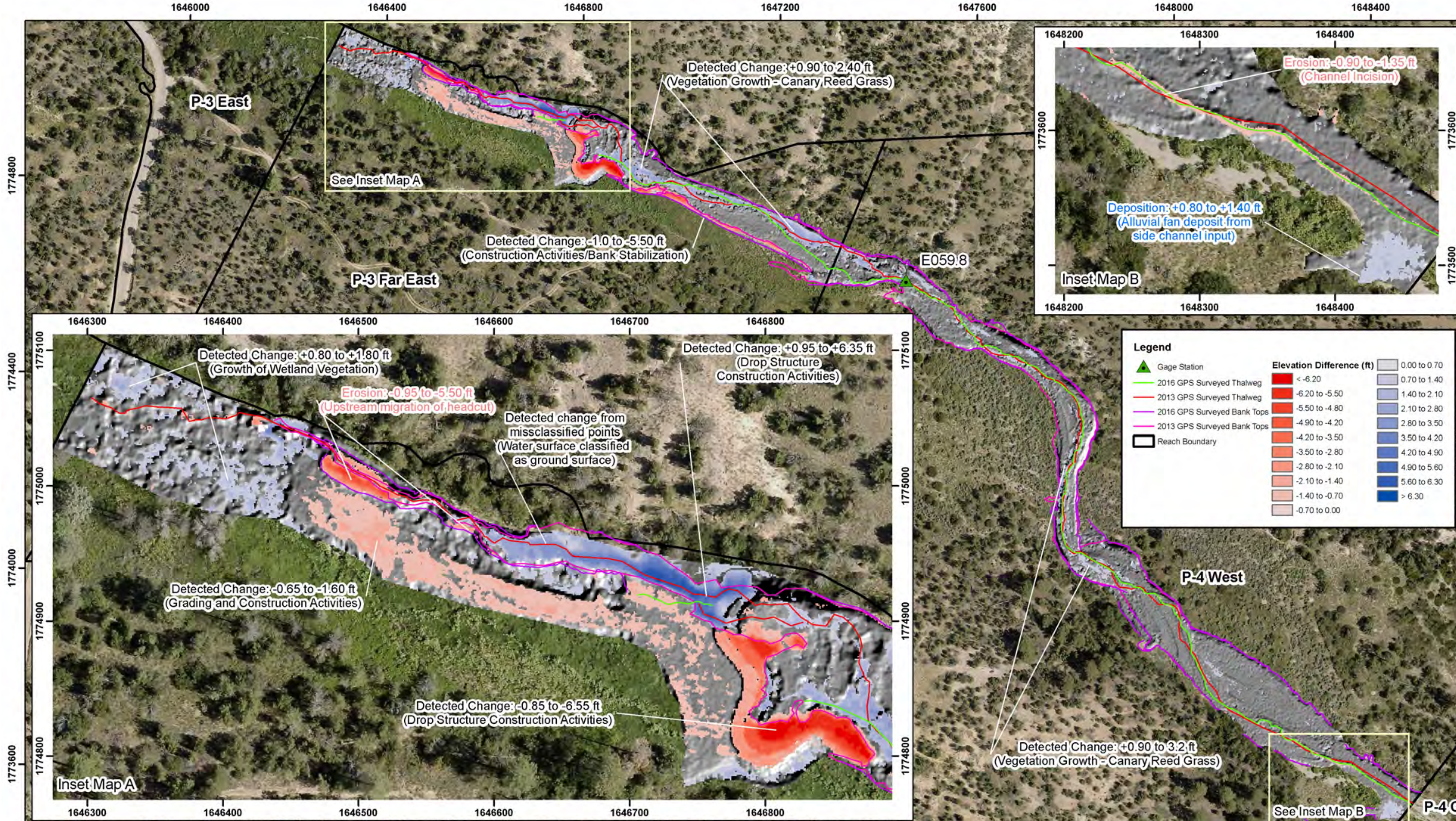


Figure A3-3.1-3 **2014 orthophoto with 2016 hillshade DEM and 2014 to 2016 GCD results at the Pueblo Canyon Wing Ditch Monitoring Area. FIS calibration was based on calculated difference between GPS and DEM elevation values.**



Disclaimer: This map was created for work processes associated with the Los Alamos and Pueblo Canyons Sediment Transport Mitigiation Project. All other uses for this map should be confirmed with the LANL Environmental Programs Directorate.

MAP NUMBER: TPMC_031618A
DATE: 03/16/2018
REVISION: 0
DRAFTED BY: TPMC

New Mexico State Plane Coordinates - Central Zone FT, North American Datum 1983, NVGD 1929
Orthophoto: 2014, DEM: 2016

Figure A3-3.1-4 2014 orthophoto with 2016 hillshade DEM and 2014 to 2016 GCD results at the Lower Pueblo Canyon Willow Planting Monitoring Area. FIS calibration was based on observed differences between DEMs and field observations.

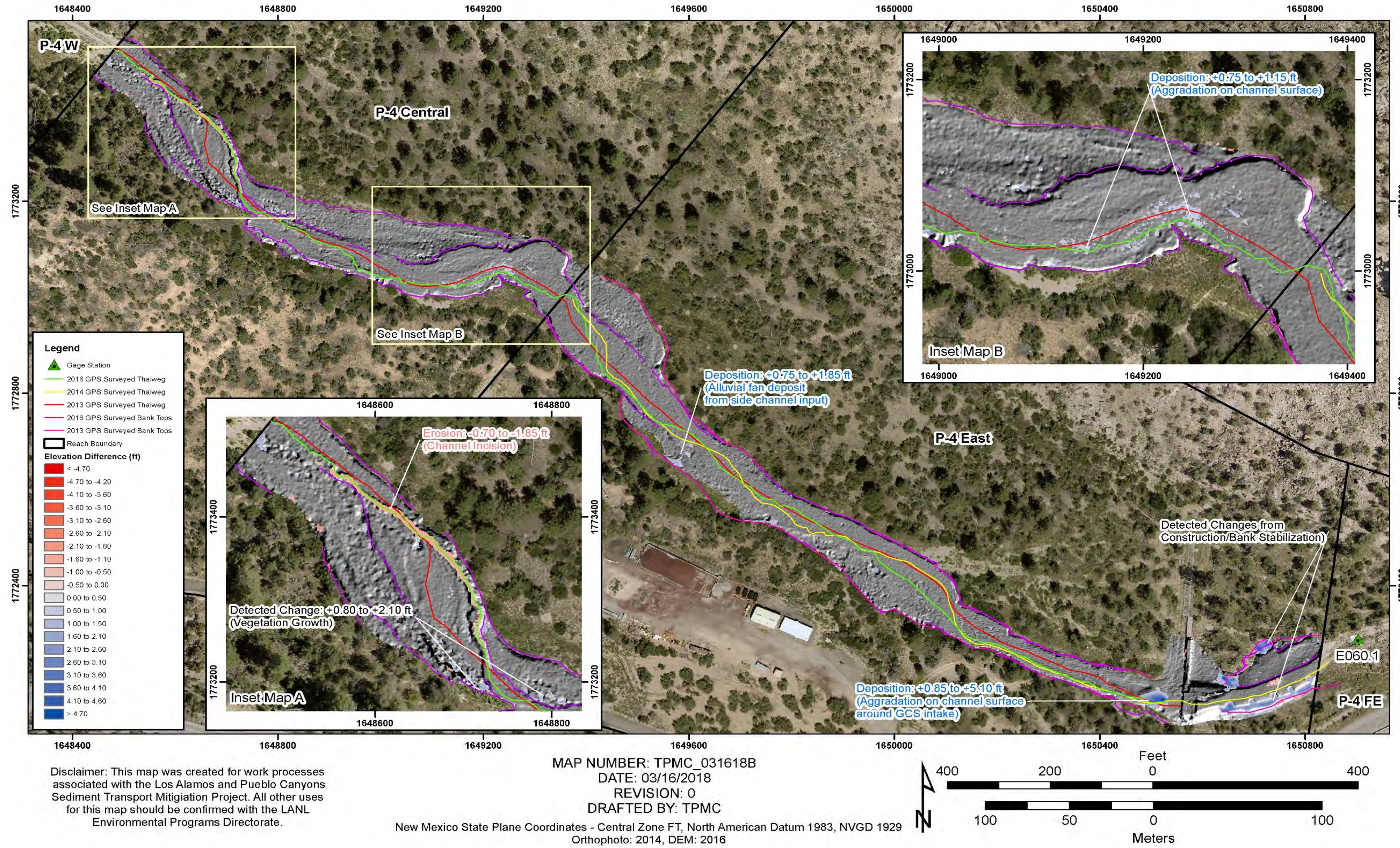


Figure A3-3.1-5 2014 orthophoto with 2016 hillshade DEM and 2014 to 2016 GCD results at the Pueblo Canyon GCS Monitoring Area. FIS calibration was based on observed differences between DEMs and field observations.

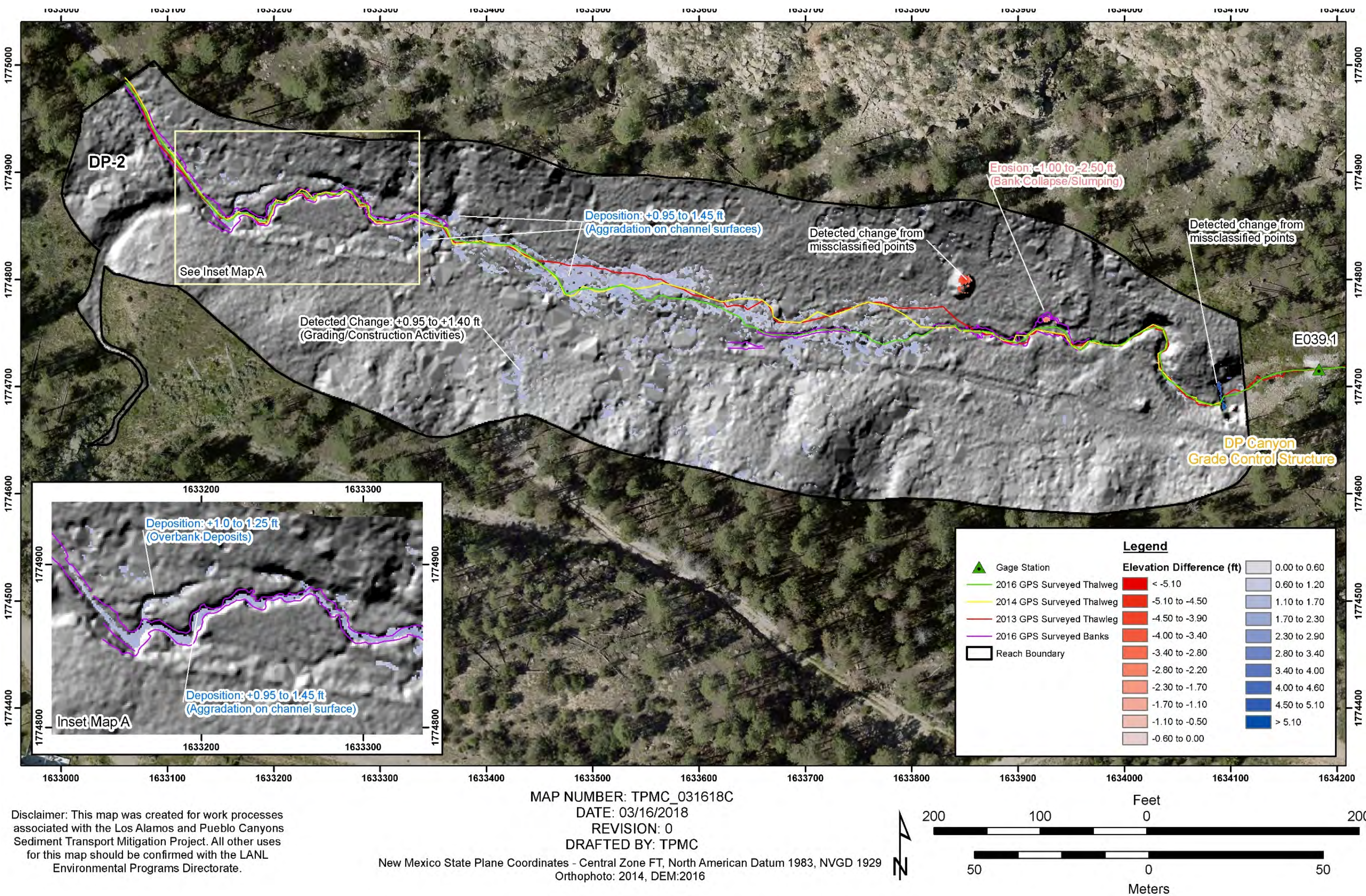


Figure A3-3.1-6 2014 orthophoto with 2016 hillshade DEM and 2014 to 2016 GCD results at the DP Canyon Monitoring Area. FIS calibration was based on observed differences between DEMs and field observations.

Table A3-3.1-1
Sediment Accumulation at
Los Alamos/Pueblo Canyon Monitoring Areas, 2014 to 2016

Area	Net Volume Change[a] (ft³)	Uncertainty ± (ft³)	Percent Change	
			Erosion	Deposition
Pueblo Canyon				
Background area above the WWTF[b]	29,276	22,519	0.46	99.54
Upper willow planting area	28,901	22,116	8.10	91.90
Wing ditch area	92,066	80,729	15.77	84.23
Lower willow planting area	12,243	30,592	42.47	57.53
GCS area	13,535	9,341	16.33	83.67
DP Canyon				
DP	14,740	12,558	3.20	96.80

[a] All DoD detections were used to calculate net volume changes.

[b] WWTF = Wastewater treatment facility.

Table A3-3.1-2
Calibrated Error Values for
Los Alamos and Pueblo Canyon Monitoring Area GCD Analyses, 2014 to 2016

Area	2014 Error (ft)	2016 Error (ft)	Propagated Error (ft/LoD)
Pueblo Canyon			
Background area above the WWTF*	0.46	0.48	0.66
Upper willow planting area	0.60	0.76	0.75
Wing ditch area	0.60	0.55	0.85
Lower willow planting area	0.46	0.45	0.64
GCS area	0.46	0.48	0.66
DP Canyon			
DP	0.74	0.51	0.94

*WWTF = Wastewater treatment facility.

Appendix B

Pueblo Canyon Wetland Piezometer Levels

B-1.0 INTRODUCTION

This appendix describes alluvial water-level monitoring within the lower section of Pueblo Canyon between the drop structure and the grade control structure. Eight piezometers were installed in this section of Pueblo Canyon in December 2014 to monitor water levels within and downstream of the willow planting area planted in May 2014 (Figure B-1.0-1). The piezometers were installed along three transects. Three piezometers, PUPZ-1, PUPZ-2, and PUPZ-3, were installed on the uppermost transect in the downstream part of the willow planting area. Three piezometers, PUPZ-4, PUPZ-5, and PUPZ-6, were installed on the middle transect located downstream of the willow planting area. Two piezometers, PUPZ-7 and PUPZ-8, were installed on the third and lowermost transect. The piezometers are 2-in.-inner-diameter galvanized steel drive points with 4-ft screened intervals and a 0.025-ft slot size. Piezometers were installed to bedrock or refusal. Table B-1.0-1 lists the screen depths, total depths, and coordinates of the piezometers. Attachment B-1 contains the piezometer data over the past 3 yr, 2015 to 2017.

B-2.0 WATER-LEVEL RESULTS FROM PIEZOMETERS

Water-level data were continuously recorded in eight piezometers in lower Pueblo Canyon using Level TROLL water-level transducers. Transducers were initially installed in each piezometer approximately 0.5 ft from the total depth. Water-level data collected at the piezometers are presented in Figures B-2.0-1 through B-2.0-3. The plots are arranged to show the individual piezometers on each transect from up- to downstream. Note that data are not displayed when the water levels dropped below the transducer measuring point. This does not mean the alluvium was completely dry; rather, the water elevation had dropped below the measuring point. A 7-d moving average of effluent discharge from the Los Alamos County wastewater treatment facility (WWTF [referred to as the wastewater treatment plant (WWTP) in Figures B-2.0-1 through B-2.0-3]), daily mean discharges at gaging stations E059.5 and E059.8, and daily total precipitation records from rain gage E042.1 are plotted along with the piezometer water-level data.

For the 2017 monitoring period, the alluvium remained saturated from January until the end of March. From April through October, the alluvium was either dry or the water level was below the monitoring depth of the transducers. Rain storms at the end of September and early October produced a short-lived pulse of water to the alluvium. Sustained saturation of the alluvium did not resume until late November. Overall, the precipitation in the summer was not enough to sustain saturation in the alluvium. The discharge from the WWTF was reduced in the summer and was not sufficient to maintain saturated conditions. To maintain saturated conditions in the alluvium, WWTF discharge needs to exceed 1 cubic foot per second for an extended period. The results for the three individual transects are discussed below.

B-2.1 2017 Upper Piezometer Transect

PUPZ-1 to PUPZ-3: The data for this transect (Figure B-2.0-1) showed that water levels responded quickly (within 1–2 d) to changes in effluent discharge from the WWTF. The response to long-term decreases in WWTF discharge was a decrease in water level below the level of the transducer, and further changes were not recorded until the water level again increased above the transducer elevation. It appears that multiple weeks of decreases in WWTF discharge resulted in an increased rate of decrease in water levels, but the lack of data below the transducer elevations makes it impossible to determine exactly how water levels in the channel alluvium responded to longer-term decreases in effluent discharge. In addition, the piezometer water levels markedly increased during and after large storm water flow events recorded at gaging station E059.5 and E059.8, with an apparent delay of 0–1 d. Elevated water levels are brief and quickly return to preflow levels within a day after storm water flow events.

B-2.2 2017 Middle Piezometer Transect

PUPZ-4 to PUPZ-6: The data for this transect (Figure B-2.0-2) showed that water levels responded quickly (within 1–2 d) to changes in effluent discharge from the WWTF and show a strong influence from storm water flow events. The response to long-term decreases in WWTF discharge was a decrease in water level below the level of the transducer, and further changes were not recorded until the water level again increased above the transducer elevation. Water-level changes of 2 ft or more occurred rapidly as a result of changes to WWTF discharge, indicating aquifer material at this transect is relatively transmissive and storage is minimal. Piezometer water levels quickly increased during/after large storm water flow events recorded at gaging station E059.5 and E059.8, with an apparent delay of 0–1 d, and then quickly returned to pre-flow levels. Water levels during the peak growing season show a less pronounced connection with changes in WWTF discharge, where water levels are below the level of the transducer when the WWTF discharge is at its highest. Evapotranspiration in the summer months could have a comparable influence with the effect of WWTF discharge on water levels.

B-2.3 2017 Lower Piezometer Transect

PUPZ-7 and PUPZ-8: The data for this transect (Figure B-2.0-3) showed that water levels responded to changes in effluent discharge from the WWTF within 1–2 wk. Unlike the two transects farther upstream, water levels at this transect dropped below the level of the transducer only during multiweek decreases in WWTF effluent discharge. Increasing water levels occurred quickly but decreases occurred more slowly, indicating that aquifer material at this transect is less transmissive than upstream and has higher storage capacity. Additionally, these two piezometers were installed approximately 10 ft below ground surface (bgs), whereas the upper piezometers were installed only approximately 5 ft bgs. Piezometer water levels appeared to increase during and after large storm water flow events recorded at gaging stations E059.5 and E059.8, with an apparent delay of 0–1 d, and water levels decreased more slowly after storm events than at transects farther upstream.

B-2.4 Three-Year Piezometer Summary

Data collected from all piezometers in Pueblo Canyon (Figure B-2.0-4) showed that water levels dropped below the measuring point of the transducer in all wells except PUPZ-7 in response to long-term decreases in WWTF discharge (referred to as WWTP in the figure). Water levels typically drop below the measuring point during summer months when effluent discharge from the WWTF decreases and evapotranspiration increases. During the summer, water levels usually increase only in response to precipitation events exceeding 0.5 in. The alluvial water level response is short, and the water levels quickly decrease below the measuring point of the transducer.

Discharge data from E059.5 and E059.8 provide valuable information about water availability for the willow plantings in this section of Pueblo Canyon. In the summer months, the alluvial water levels are below the measuring capability of the piezometers. Effluent discharge from WWTF and gage stations E059.5 and E059.8 prove to be a more reliable source in determining water availability in and below the willow planting areas. Transducers from all Pueblo Canyon piezometers were removed on January 3, 2018. Discharge measurements at E059.5 and E059.8 will continue and will provide sufficient information to evaluate water availability for willow plantings.

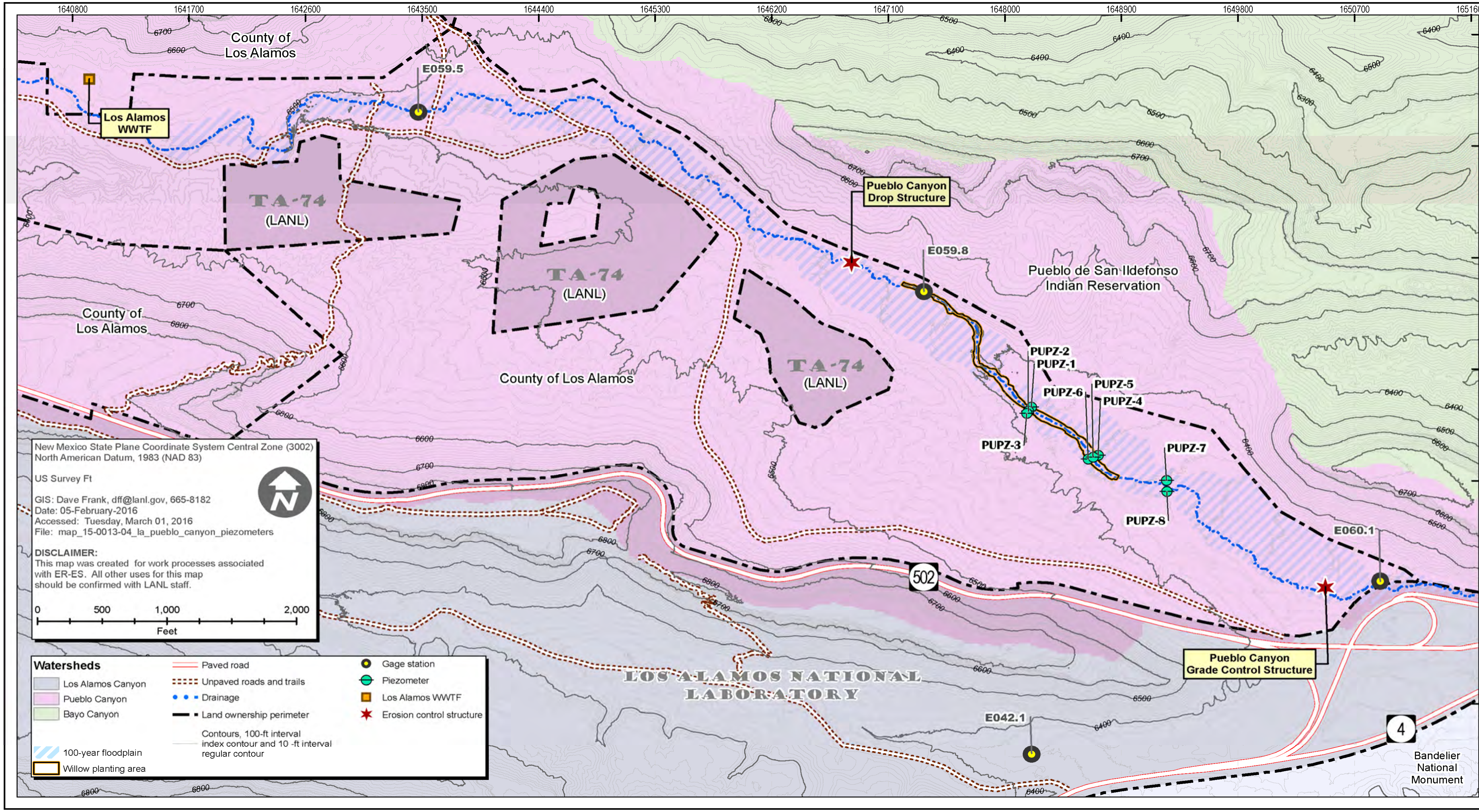


Figure B-1.0-1 Piezometer locations, 2014 willow planting area; Los Alamos wastewater treatment facility; gaging stations E059.5, E059.8, and E060.1; precipitation gage E042.1; new Pueblo Canyon drop structure; and Pueblo Canyon grade-control structure

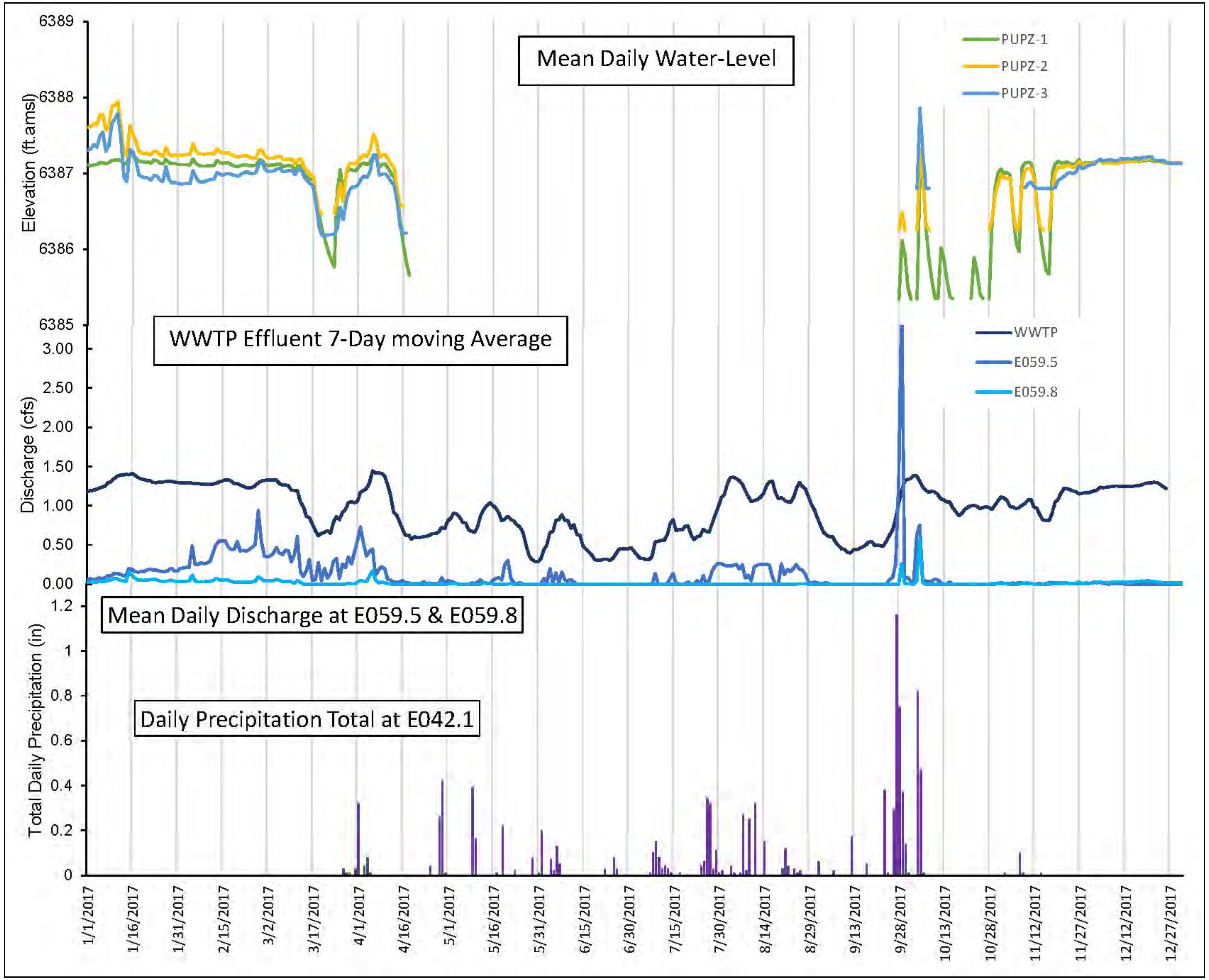


Figure B-2.0-1 **Mean daily water level (ft above mean sea level [amsl]) in piezometers PUPZ-1, PUPZ-2, and PUPZ-3; 7-d moving average of Los Alamos wastewater treatment plant (WWTP) effluent discharge; mean daily discharge at gaging stations E059.5 and E059.8; and total daily precipitation at E042.1**

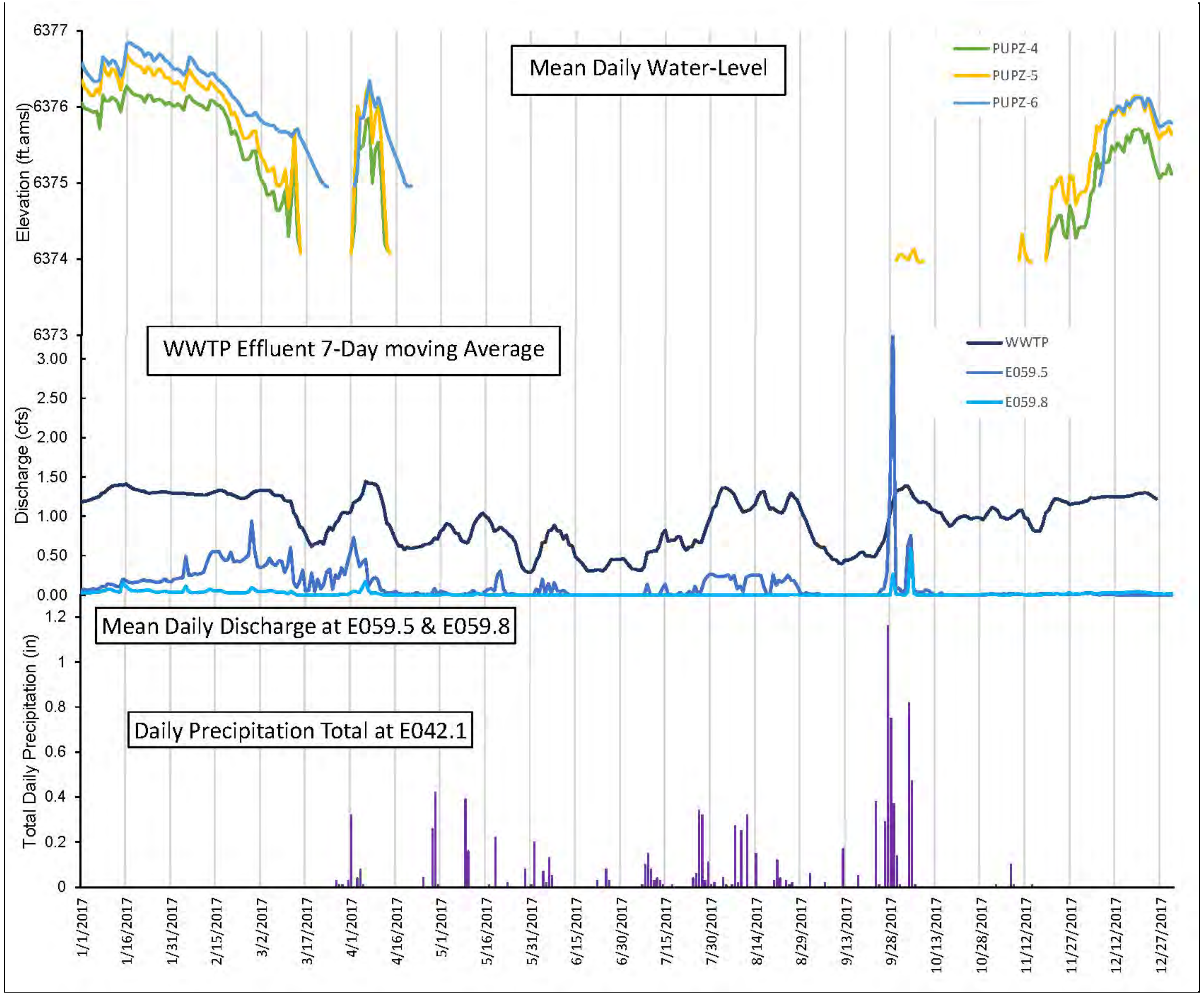


Figure B-2.0-2 **Mean daily water level (ft amsl) in piezometers PUPZ-4, PUPZ-5, and PUPZ-6; 7-d moving average of Los Alamos WWTP effluent discharge; mean daily discharge at gaging stations E059.5 and E059.8; and total daily precipitation at E042.1**

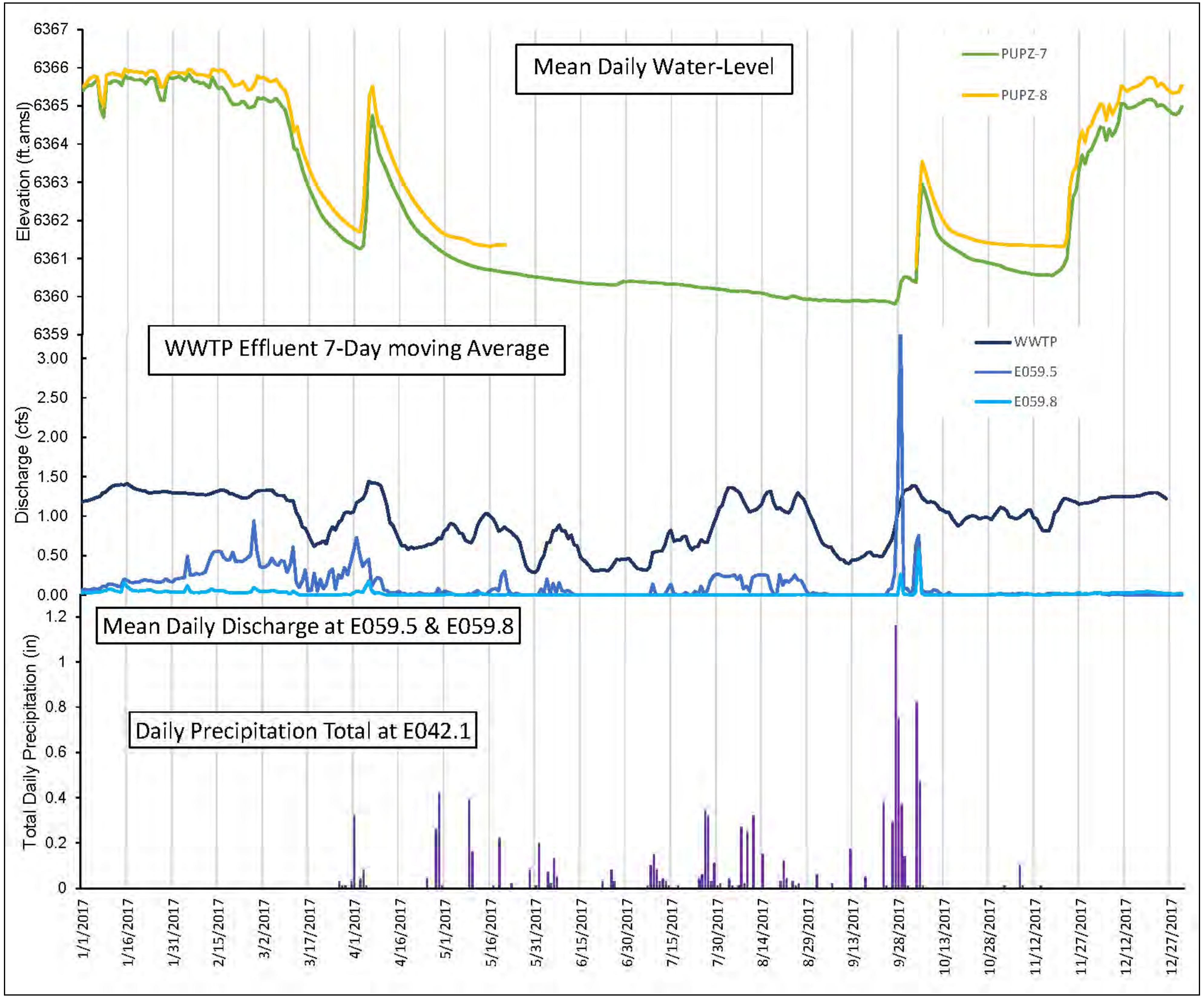


Figure B-2.0-3 **Mean daily water level (ft amsl) in piezometers PUPZ-7 and PUPZ-8; 7-d moving average of Los Alamos WWTP effluent discharge; mean daily discharge at gaging stations E059.5 and E059.8; and total daily precipitation at E042.1**

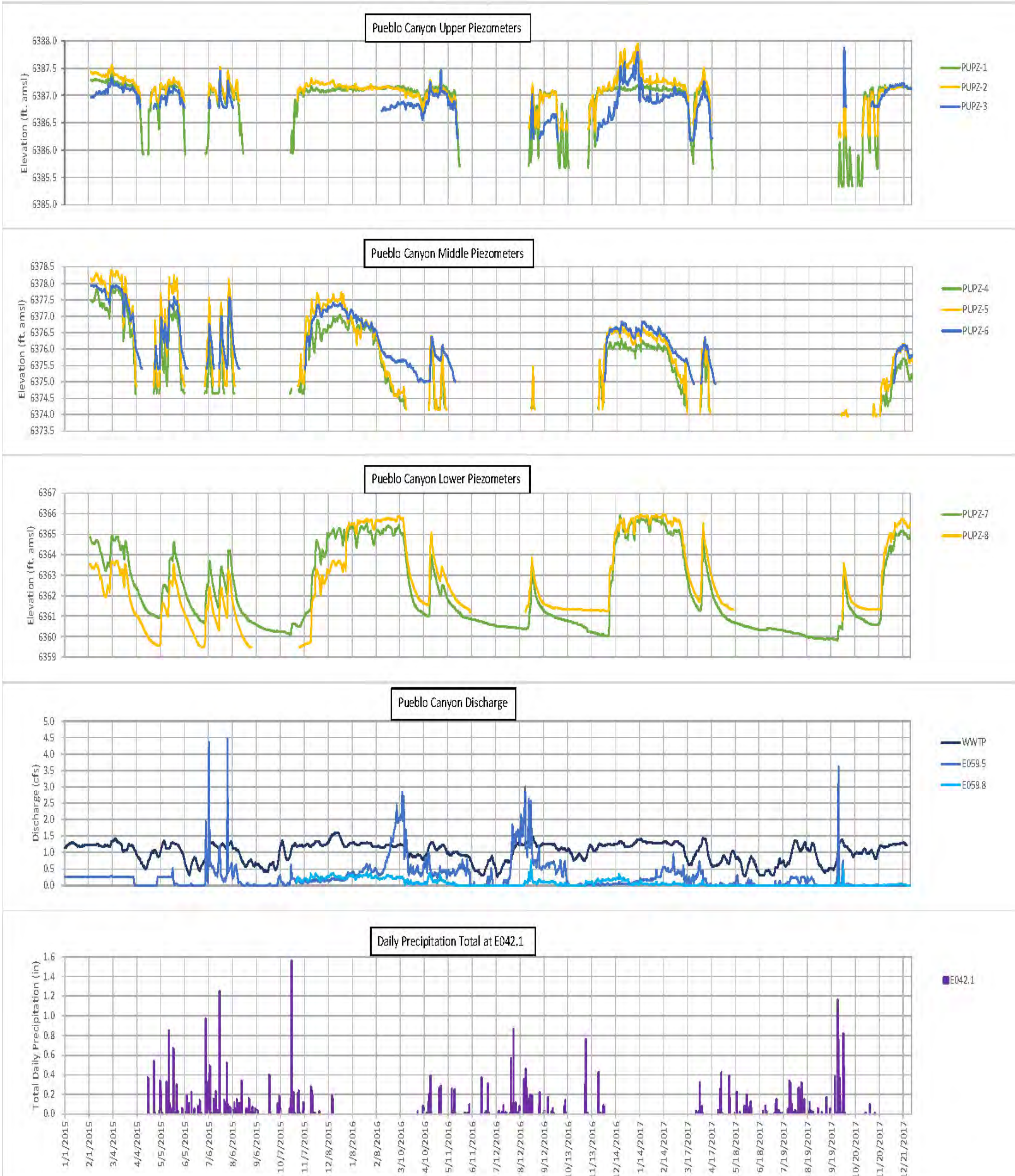


Figure B-2.0-4 Three-year mean daily water level (ft amsl) in piezometers PUPZ-1 through PUPZ-8, 7-d moving average of Los Alamos WWTP effluent discharge, mean daily discharge at gaging stations E059.5 and E059.8, and total daily precipitation at E042.

Table B-1.0-1
Piezometer Depth and Survey Coordinates

Piezometer Name	PUPZ-1	PUPZ-2	PUPZ-3	PUPZ-4	PUPZ-5	PUPZ-6	PUPZ-7	PUPZ-8
Piezometer Stickup (ft)	1.87	2.54	2.61	2.15	4.25	3.98	3.00	0.93
Outter Casing Sitckup (ft)	3.13	3.48	3.39	2.15	4.25	3.98	3.16	1.14
Top of Screen (ft bgs)	0.30	0.17	0.00	2.60	0.45	0.86	7.33	4.05
Bottom of Screen (ft bgs)	4.30	4.17	4.00	6.60	4.45	4.86	11.33	8.05
Total Depth of Casing (ft bgs)	4.80	4.67	4.50	7.10	4.95	5.36	11.83	8.55
Total Casing Length (ft)	6.67	7.21	7.11	9.25	9.20	9.34	14.83	9.48
Northing	1773693.24	1773660.55	1773643.08	1773306.33	1773290.78	1773275.67	1773102.27	1773012.96
Easting	1648206.33	1648183.89	1648170.87	1648722.09	1648684.42	1648646.21	1649249.76	1649253.18
Ground Surface Elevation (ft amsl)	6389.07	6388.43	6388.46	6380.28	6378.27	6379.48	6368.21	6368.71

Attachment B-1

Piezometer Data
(on CD included with this document)

Appendix C

2017 Watershed Mitigation Inspections

C-1.0 INTRODUCTION

Watershed storm water controls and grade-control structures (GCSs) are inspected on a routine basis (biannually: January–June, July–December) and after significant flow events (greater than 50 cubic feet per second [cfs] at locations with gaging stations or greater than 0.5 in. in 30 min at locations without gaging stations). These inspections are completed to ensure the watershed mitigations are functioning properly and to identify if maintenance may be required. Examples of items evaluated during inspections include the following:

- Debris/sediment accumulation that could impede operation
- Water levels behind retention structures
- Physical damage of structure, or failure of structural components
- Undermining, piping, flanking, settling, movement, or breeching of structure
- Vegetation establishment and vegetation that may negatively impact structural components
- Rodent damage
- Vandalism
- Erosion

The photographs in this appendix depict biannual or significant flow-event-driven storm water inspections of watershed mitigations in Los Alamos and Pueblo Canyons. Each group of photographs is associated with a specific feature (e.g., standpipe, weir, upstream, downstream, etc.) that has the potential to develop issues. The photographs are presented in chronological order and depict the feature throughout 2017. Photographs of features were taken to mirror previous inspection photographs as closely as possible. Certain findings were discovered as the year progressed and thus appear later during the year.

C-2.0 DP CANYON GRADE-CONTROL STRUCTURE

C-2.1 Upslope Embankment

Photo C-2.1-1 May 2017—Embankment is stable and operating as designed. Well-established vegetation with no erosion occurring from hillslope. Some woody debris located on riprap. Removed debris while on site.

Photo C-2.1-2 October 2017—No change in condition from prior inspection (May 2017). Embankment is stable and operating as designed.

C-2.2 Overflow Weir Structure

Photo C-2.2-1 May 2017—Upslope face of weir at roughly 50 percent capacity for sediment storage. Operating effectively. No structural issues identified during inspection.

Photo C-2.2-2 October 2017—Willows more established since last inspection. No change in condition from the last inspection (May 2017).

C-2.3 Crest of Weir Structure

Photo C-2.3-1 May 2017—No deteriorated joints present on upslope side of weir. Minor bulging of a gabion basket but gabion basket is still structurally intact and in stable condition. Will continue to monitor for changes.

Photo C-2.3-2 October 2017—No change in gabion basket noted in prior inspection. No change in condition from the last inspection (May 2017).

C-2.4 Separation of Concrete on Weir Overflow

Photo C-2.4-1 May 2017—Separation of concrete has not changed from inspections conducted in 2016. Will continue to monitor for changes.

Photo C-2.4-2 October 2017—No change in condition from the last inspection (May 2017)

C-2.5 Downstream of Weir Structure Overflow

Photo C-2.5-1 May 2017—Crest of structure is in alignment with no visual deformities.

Photo C-2.5-2 October 2017—No change in condition from the last inspection (May 2017)

C-2.6 GCS Standpipe

Photo C-2.6-1 May 2017—No sediment intrusion into standpipe and debris (tire) has been removed from structure. No apparent corrosion to standpipe.

Photo C-2.6-2 October 2017—Willows more established near standpipe since last inspection. No other change in condition from the last inspection (May 2017).

C-2.7 GCS Spillway

Photo C-2.7-1 May 2017—Spillway operating as designed. No signs of improper alignment, deterioration, or trash/debris on spillway.

Photo C-2.7-2 October 2017—No change in condition from the last inspection (May 2017)

C-2.8 GCS Outlet

Photo C-2.8-1 May 2017—Outlet appears to be working as designed. No seepage/piping, undercutting, or erosion occurring near or from outlet.

Photo C-2.8-2 October 2017—No change in condition from the last inspection (May 2017)

C-3.0 UPPER LOS ALAMOS CANYON SEDIMENT DETENTION PONDS

C-3.1 Lower Basin Embankment and Pond

Photo C-3.1-1 May 2017—No breaching/slides/cracks/sloughs present on embankment and pond. No erosion occurring on slope. No trash or debris present in control.

Photo C-3.1-2 October 2017—No change in condition from the last inspection (May 2017)

C-3.2 Upper Basin Embankment and Pond

Photo C-3.2-1 May 2017—No breaching/slides/cracks/sloughs present on embankment and pond. No erosion occurring on slope. No trash or debris present in control.

Photo C-3.2-2 October 2017—No change in condition from the last inspection (May 2017)

C-3.3 Lower Basin Spillway

Photo C-3.3-1 May 2017—No signs of erosion occurring on or near spillway. Spillway is maintaining alignment. No rodent burrows present and control appears stable.

Photo C-3.3-2 October 2017—No change in condition from the last inspection (May 2017)

C-3.4 Wetland and Culvert

Photo C-3.4-1 May 2017—Geotextile matting noted in several 2016 inspections was removed near culvert intake and properly disposed of. Willows and wetland vegetation well established and clear of trash/debris. No seepage or piping occurring.

Photo C-3.4-2 October 2017—No change in condition from the last inspection (May 2017)

C-3.5 Upstream Pipeline and Appurtenances

Photo C-3.5-1 May 2017—Headwall functioning as designed. Removed needlecast and leaf buildup behind intake, as well as some trash.

Photo C-3.5-2 October 2017—Removed needlecast and minor trash buildup behind culvert intake. No change in condition from the last inspection (May 2017).

C-3.6 Upstream Pipeline Vacuum Breaker

Photo C-3.6-1 May 2017—Control is operating as designed with no apparent issues to structure. No change in nick to pipeline near bridge cross-over.

Photo C-3.6-2 October 2017— No change in condition from the last inspection (May 2017)

C-3.7 Pipeline Outlet and Energy Dissipater

Photo C-3.7-1 May 2017—Pipeline outlet and energy dissipater is clear of debris with minor established vegetation occurring through turf reinforcement matting (TRM). Culvert outlet and inlets appear functional.

Photo C-3.7-2 October 2017—Thick established vegetation on TRM-lined slope. Retention area has minor layer of sediment. All outlets and inlets functioning as designed.

C-4.0 LOS ALAMOS CANYON WEIR AND DETENTION PONDS

C-4.1 Weir Upstream Slope Embankment

Photo C-4.1-1 May 2017—Slope embankment is relatively stable with established vegetation. Majority of sediment in stream bed is from upstream.

Photo C-4.1-2 October 2017—No significant change since last inspection (May 2017)

C-4.2 Weir Embankment Abutment

Photo C-4.2-1 May 2017—Vegetation well established along weir embankment. Sediment loads at approximately 20 percent of total capacity.

Photo C-4.2-2 October 2017—No change in condition from the last inspection (May 2017). Control at same sediment capacity and standing water at same level.

C-4.3 Weir Embankment Downstream Slope

Photo C-4.3-1 May 2017—No erosion or sloughing of gabion baskets occurring. All gabion baskets appear to be structurally intact and operating as designed. Minor gully forming downgradient of control. Continue to monitor.

Photo C-4.3-2 October 2017—Sediment and established vegetation have filled in areas of previously inspected gully. No other changes noted in condition from the last inspection (May 2017).

C-4.4 Upper Pond

Photo C-4.4-1 May 2017—Sediment pond level is at approximately 30 percent of total capacity.

Photo C-4.4-2 October 2017—No change in condition from the last inspection (May 2017)

C-4.5 Middle Pond

Photo C-4.5-1 May 2017—Sediment pond level is at approximately 30 percent of total capacity.

Photo C-4.5-2 October 2017—No change in condition from the last inspection (May 2017)

C-4.6 Lower Pond

Photo C-4.6-1 May 2017—Sediment pond level is at approximately 20 percent of total capacity. Pond has approximately 2−3 feet of standing water.

Photo C-4.6-2 October 2017—No change in condition from the last inspection (May 2017)

C-4.7 Upslope Face and Crest of Overflow Weir Structure

Photo C-4.7-1 May 2017—Areas where piping was previously noted have been either sedimented in or filled with woody debris. Recommend monitoring.

Photo C-4.7-2 October 2017—No change in condition from the last inspection (May 2017)

C-4.8 Weir Standpipe

Photo C-4.8-1 May 2017—Height of inlet is 3½ ft above wood debris. Inlet is clear of debris and functional. Slight erosion from outlet pipe but well vegetated and stable. Continue to monitor.

Photo C-4.8-2 October 2017— No change in condition from the last inspection (May 2017)

C-4.9 Borrow Pit Runoff Control Berm

Photo C-4.9-1 May 2017 —The borrow pit runoff control berm is operating effectively. Sediment accumulated behind berm is stable with thick established vegetation.

Photo C-4.9-2 October 2017—No change in condition from the last inspection (May 2017)

C-5.0 PUEBLO CANYON GRADE-CONTROL STRUCTURE

C-5.1 Upstream Embankment

Photo C-5.1-1 May 2017—Tire present in 2016 inspection was removed from channel. Well-established vegetation on embankment. No signs of erosion or undermining.

Photo C-5.1-2 October 2017—No change in condition from the last inspection (May 2017)

C-5.2 Embankment Abutment

Photo C-5.2-1 May 2017—Well-established vegetation surrounding control. No presence of trash/debris. Several rodent burrows noticed along control but appear to have no impact on abutment. Continue to monitor.

Photo C-5.2-2 October 2017—No change in condition from the last inspection (May 2017)

C-5.3 Downstream Embankment

Photo C-5.3-1 May 2017—Control is operating as designed. No buckling of embankment occurring. Riprap functioning as designed.

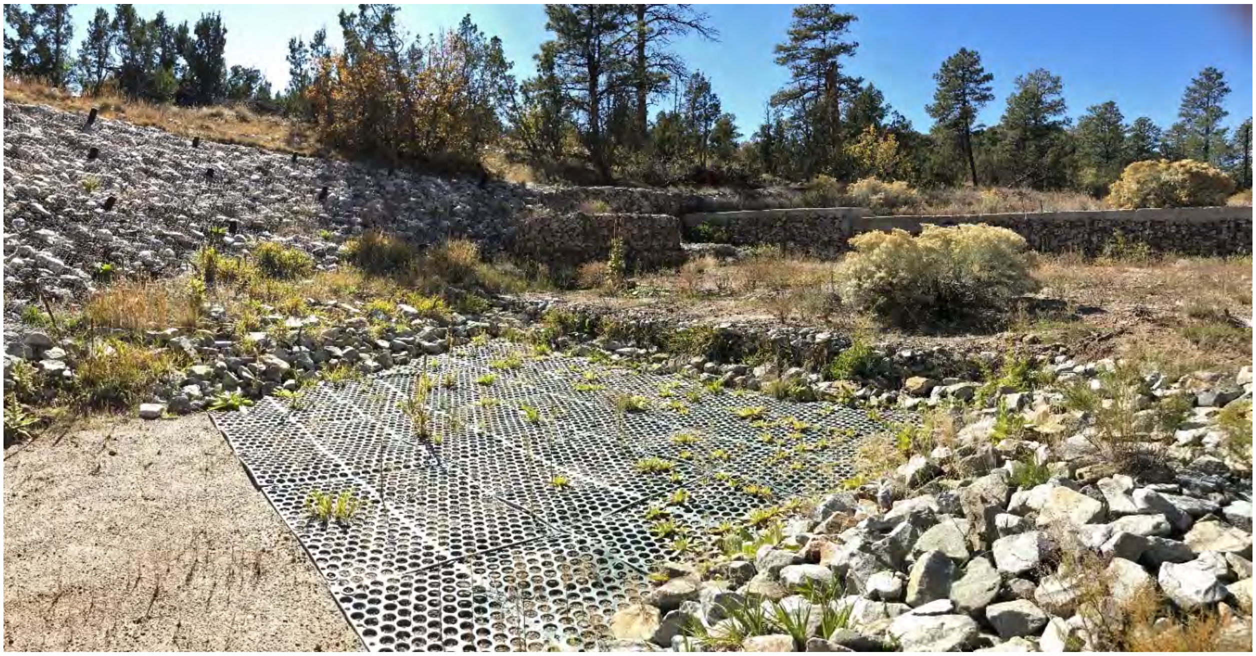


Photo C-5.3-2 October 2017—No change in condition from the last inspection (May 2017)

C-5.4 Crest of Overflow Weir Structure

Photo C-5.4-1 May 2017—No cracks present in concrete. Structure and gabion baskets are in alignment and functioning as designed.

Photo C-5.4-2 October 2017—No change in condition from the last inspection (May 2017)

C-5.5 Downstream Face of Overflow Weir Structure Showing Outlet and Spurs

Photo C-5.5-1 May 2017—Well-established vegetation along all hillslopes. No erosion apparent along slopes or near TRM matting. All structures functioning as designed.

Photo C-5.5-2 October 2017—No change in condition from the last inspection (May 2017)

C-6.0 PUEBLO CANYON WETLAND STABILIZATION STRUCTURE

C-6.1 Upper, Middle, and Lower Pueblo Wetland Structure

Photo C-6.1-1 May 2017—Redi-Rock structure shows no evidence of displacement or settling. Reed canary grace is well established both upstream and downstream of control.

Photo C-6.1-2 October 2017—No change in condition from the last inspection (May 2017)

C-6.2 Wetland North Bank

Photo C-6.2-1 May 2017—Minor growth of established vegetation occurring through matting. Slope is stable.

Photo C-6.2-2 October 2017—The vegetation is better established since prior visit (May 2017). No further changes of the bank have occurred.

C-6.3 Wetland South Bank

Photo C-6.3-1 May 2016—Reed canary grass well established. Structure functioning as designed with no evidence of erosion where riprap is located.

Photo C-6.3-2 October 2017—Vegetation better established since prior visit (May 2017). No change in site condition.

C-6.4 Downstream South Bank

Photo C-6.4-1 May 2017—Upstream vegetation is minor. Minor channelization occurring from upstream flow. Established vegetation upstream of control would help disperse flow.

Photo C-6.4-2 October 2017—Reed canary grass transplant occurred since last site inspection (May 2017). Reed canary grass is barely infiltrating soil as of site visit. Continue to monitor for increased growth.

C-6.5 Upstream Area of Wetland

Photo C-6.5-1 May 2017—Roughly 2 ft of water in upstream wetland area. Sediment capacity at roughly 30 percent.

Photo C-6.5-2 October 2017—Roughly 5–6 ft of water in upstream wetland area. Area appears to be healthy. Minor channelization occurring downstream but reed canary grass transplant should help disperse future overflows of wetland area.

Appendix D

Analytical Results and Instantaneous
(5-Minute) Gaging Station Stage and Discharge Data
for the Los Alamos/Pueblo Watershed
(on CD included with this document)