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

Subject: 2016 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 2016 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 2016 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 in the Approval with Comments [for the] 2016 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project, dated July 15, 2016, during a pre-report submittal meeting on January 30, 2017, and in subsequent emails. This document satisfies Appendix B, Milestones and Targets, Milestone 7, 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,

Bruce Robinson, Program Director
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Sincerely,

David S. Rhodes, Director
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Enclosures: Two hard copies with electronic files – 2016 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project (EP2017-0042)

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LA-UR-17-23308
April 2017
EP2017-0042

2016 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

EP2017-0042

2016 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project

April 2017

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EXECUTIVE SUMMARY

This seventh 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 2016. 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 March) 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 and suspended sediment concentration (SSC) 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 runoff events and a significant reduction in the volume of suspended sediment being transported downstream. In fact, only one storm event produced runoff at E050.1 throughout the entire monitoring year. The 2016 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. Aerial light detecting and ranging (LiDAR) data collected in 2015 and 2016 were compared to estimate geomorphic change greater than calculated detection limits in and around the sediment transport mitigation sites. The LiDAR-based digital elevation model (DEM) comparison indicates net deposition has occurred in the Pueblo and DP Canyon monitoring areas between 2015 and 2016. However, the error is larger than the calculated deposition in most areas, suggesting the amount of change is less than the method detection limit. In the wing ditch and Pueblo Canyon GCS areas, the DEM of difference (DoD) results are greater than the error; however, the net deposition is because of vegetation growth in the wing ditch area and construction activities in the Pueblo Canyon GCS areas, respectively. In DP Canyon, the net depositon is because of the misclassification of LiDAR data on the GCS itself. In Los Alamos Canyon, the DEM comparison indicates that net deposition in the upper Los Alamos Canyon retention basins is solely from

construction activites. At the Los Alamos low-head weir, net depostion occurred in all three upstream detention basins. The field-checked DoD analyses and thalweg surveys presented support the conclusion of overall stability of the channels and banks in Pueblo, DP, and Los Alamos Canyons and establish the geomorphic change between 2015 and 2016 as minor and localized, indicating that the mitigations are performing as designed.

Based on the correlations between concentrations of metals, radioisotopes, and polychlorinated biphenyls (PCBs) in unfiltered storm water and SSC 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 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 the 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 2017 is expected to confirm the sediment transport mitigations in the LA/P watershed are performing as designed and to document the performance of the newly constructed drop structure in Pueblo Canyon.

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Acronyms and Abbreviations

3-D	three-dimensional
amsl	above mean sea level
ASER	Annual Site Environmental Report
ASTM	American Society for Testing and Materials
BDD	Buckman Direct Diversion
bgs	below ground surface
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.)
ECB	erosion-control blanket
EPA	Environmental Protection Agency (U.S.)
ESH	Environment, Safety, and Health
F	filtered
FIS	fuzzy inference system
GCS	grade-control structure
GIS	geographical information system
GPS	global positional 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
MDL	method detection limit
MF	membership functions
ND	not detected
NMAC	New Mexico Administrative Code
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
PCB	polychlorinated biphenyl
PQL	practical quantitation limit
Q	quarter
ROW	right of way
RPD	relative percent difference
RMSE	root mean square error
SIMWP	supplemental interim measures work plan
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
TEQ	toxic equivalent quotient
TRM	turf-reinforcement mat
TSS	total suspended solids
UF	unfiltered
WWTF	wastewater treatment facility

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 seventh 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 2016. In addition, the geomorphic changes at the sediment transport mitigation sites in the LA/P watershed are also 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 2016 was performed in accordance with the “2016 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project” (LANL 2016, 601434).

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; and 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 were monitored in 2016. 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 reach DP-2 in 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 in the lower part of reach DP-2 with a height that encourages channel aggradation, thus reducing the potential for erosion of contaminated sediment deposits in adjacent banks during floods. Channel aggradation in reach DP-2 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 or 2016 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 2016. 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 of Acid Canyon (E055.5), Acid above Pueblo (E056), Los Alamos below Ice Rink (E026), Los Alamos above DP Canyon (E030), DP above Technical Area 21 (TA-21) (E038), E059.5 Pueblo below the 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.

A complete record of 5-min stage-height measurements for the monitoring period from June 1, 2016, to October 31, 2016, exists at E026, E030, E038, E040, E042.1, E050.1, E055, E055.5, E056, E059.5, and E059.8. Five-minute stage height measurements are incomplete at E039.1 and E060.1 because of stage-height sensor equipment failure or data logger failure. Equipment malfunctioned at E060.1 on June 1 and 2, 2016. Stage monitoring equipment was not functional at E039.1 from August 16 to September 6, 2016.

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 2016 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 geographic information system, 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: E026, 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. The placement of trip levels and sampler intake lines is presented in Table 2.1-1.

Sampling equipment at gaging stations in 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.

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

In 2016, samples were collected during five storm water sampling events with automated samplers 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). 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 2016.

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

During the monitoring period in 2016 (June 1 to approximately October 31, depending on the weather), 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 26 storm events occurring on 9 d as presented in Table 2.3-1. No precipitation events exceeding a sample-triggering discharge occurred before June 1, and 4 precipitation events exceeding a sample-triggering discharge occurred after October 31. A total of 20 sampling events occurred during the monitoring period, and 4 sampling events occurred after 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 memorandum of understanding between DOE and Buckman Direct Diversion Board, 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 2016. The summary 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 be analyzed for SSC only.

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.

In 2016, the Laboratory performed weekly inspections at gaging stations and samplers in the LA/P watershed. Inspections of sampling and gaging station equipment were performed following a rain event that resulted in discharge. 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. If inspectors were unable to repair damaged equipment at the time of inspection, additional resources were made available as quickly as possible to make repairs.

2.5 Deviations from Monitoring Plan

The 2016 monitoring plan (LANL 2016, 601434) 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:

- Lower watershed at E042.1, E050.1, E059.5, E059.8, and E060.1: Two of four samples were collected within 1 business day.

- Upper watershed at E026, E030, E055, E055.5, E056, CO101038, and CO111041: Seven of thirteen samples were collected within 1 business day.
- DP Canyon at E038, E039.1, and E040: Seven of twelve samples were collected within 1 business day.

In 2016, 29 sample sets were collected, retrieved, and analyzed from gaging stations and from the sampler at CO111041. Samples were collected 16 times within the first business day.

If the stage could not be correctly measured because of damage or silting that occurred, these instances are documented in Table 2.5-2. In 2016, 6 gaging stations were damaged or malfunctioned a total of 11 times. The gaging stations and sampling equipment were repaired within 5 business days on 6 of these occasions. Samples were not collected but discharge could have exceeded sample-triggering thresholds at E039.1 and at E055.5 because of silting or equipment malfunction, 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, 2016, and November 2016. The dates of each physical inspection at each gaging station are documented in Table 2.5-3.

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 geographical information system (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 5 yr of monitoring. As expected, Los Alamos Canyon had high concentrations of suspended sediment as a result of the Las Conchas fire (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, with the exception of E059.5 and E060.1, are 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. The influence of Guaje Canyon post-fire is extreme because 15% of the 21,000-acre watershed experienced moderate- to high-burn severity during the Las Conchas fire. Gaging station E109.9 was not operational, and sampling was not performed at E099 in 2014 through 2016. 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. The DP Canyon floodplains area and GCS decrease the flow velocity before it reaches E039.1, presumably removing sediment; however, 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. While not enough data are available at E059.8 (only one storm event has been sampled since the establishment of the gaging station) to draw conclusions regarding SSC trends through the Pueblo wetlands area, gaging station E060.1, which is below the Pueblo Canyon wetlands, GCS, and willow plantings, generally had SSC values less than those at E059.5 in 2015 and no flow large enough to sample was measured at E060.1 in 2012, 2013, 2014, or 2016.

For runoff events exceeding sampling triggers in 2016, Figure 3.2-3 shows hydrographs for DP, Los Alamos, and Pueblo/Acid 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 2016. 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, and E059.5 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 3.2-1**

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 3.2-2**

$$\overline{SSC} = \frac{\sum_{t=0}^{n} SSC_t}{n}$$ **Equation 3.2-3**

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 or a few beginning-of-the-year storm events when the ephemeral channels tended to have additional sediment made available over the winter. 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 5 yr of monitoring; Table 3.2-3 presents the 2012 through 2016 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 3.2-4**

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 3.2-5**

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, like Figure 3.2-5, 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 5 yr.

3.3 Geomorphic Changes

A digital elevation model (DEM) was produced from the LiDAR data set for 2015 and 2016, and a DEM of difference (DoD) was produced by subtracting the 2015 DEM from the 2016 DEM (Appendix A) (Wheaton et al. 2010, 601298). DoD comparisons were made at the reach scale for Los Alamos, DP, and Pueblo Canyons. An appropriate threshold to indicate real change above measurement error was determined by comparing global positioning survey point elevations to elevations from each year's DEM. Areas which showed detectable change were verified by field inspection. In addition to the DEM comparison, the thalweg and stream banks were surveyed using high-precision ground-based methods and compared with data from the previous year.

The LiDAR-based DEM comparison indicates net deposition has occurred in the Pueblo and DP Canyon monitoring areas between 2015 and 2016. However, the error is larger than the calculated deposition in most areas, suggesting the amount of change is less than the method detection limit. In the wing ditch and Pueblo Canyon GCS areas, the DoD results are greater than the error; however, the net deposition is from vegetation growth in the wing ditch area and construction activities in the Pueblo Canyon GCS areas, respectively. In DP Canyon, the net depositon is from the misclassification of LiDAR data on the GCS itself. In Los Alamos Canyon, the DEM comparison indicates that net deposition in the upper Los Alamos Canyon retention basins is solely from construction activites. At the Los Alamos low-head weir, net depostion occurred in all basins.

When areas are classified as ground in the LiDAR data set for one year and nonground in another year, then the DoD calculations identify erosion or deposition in that area even in the absence of real topographic change. These areas have been verified as not related to geomorphic processes using field observations and are discussed in the results; however, these detections are above the error thresholds and do contribute to overall DoD volume calculations. Because of the inlcusion of these nongeomorphic changes, net erosion and deposition volumes are generally overestimated and should be considered upper limits.

Using a spatially variable error in DoD calculations has made it possible to assess more accurately geomoprhic 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 assesment of geomorphic activity on such features for the comparison between 2015 and 2016 DEMs. Geomorphic processes identified by the DoD results are typified by channel aggradation and incision that, over the course of the 2015 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.

Repeat stream-channel thalwegs were measured in the Pueblo Canyon monitoring areas, and these surveys indicate few changes in the overall thalweg gradients between the 2015 and 2016 surveys. Locally, small areas of channel incision were identified, which are attributed to local elevation adjustments. Channel-bank stability was assessed using DEM comparison, and the DoD results were compared with the 2015 ground-based bank survey. Only local, spatially discontinuous, small-magnitude bank collapses were observed in the active channel on steep cutbanks of unconsolidated sediment. The field-checked DoD evaluation and ground-based thalweg surveys presented in Appendix A support the conculsion of overall stability of the thalweg and channel banks, which is consistent with the confinement of the 2016 storm water runoff to the channel defined by the September 2013 floods. Notably, all elevation change (regardless of cause of change) greater than 1.5 ft in all areas has been detected and identified using this method at the 95% confidence level. These results establish the geomorphic change between 2015 and 2016 as minor and localized.

3.4 Impact and Efficiency of Watershed Mitigations

The DP and Pueblo Canyon GCSs were constructed to help reduce erosive flood energy and to cause upstream aggradation to bury existing stream channels, potentially to bury existing floodplain deposits, and in Pueblo Canyon, to stabilize an eroding wetland. As a result, the GCSs help to reduce sediment transport in that they immobilize the headcuts and prevent further headcutting that potentially could have led to additional sediment transport. The new drop structure built in 2015 in Pueblo Canyon operates much as a GCS.

Willows were planted in Pueblo Canyon to aid in surface stabilization, reduce flow velocity, and promote sediment accumulation. 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 during 2016.

DP Canyon: In 2016, no SSC analyses were performed in DP Canyon above (E038) and below (E039.1) the GCS and upstream wetland for the same runoff event (Table 2.3-1). Therefore, overall statistics over the past 5–7 yr of monitoring must be used to assess 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 5–7 years, 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 2016, the peak discharge decreased in one of five measureable runoff events between E038 and E039.1, with a decrease of 50% relative percent difference (RPD), and increased in four of five events, with an average increase of 24% RPD (Table 3.2-1).

Pueblo Canyon: In 2016, 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) for the same runoff event (Table 2.3-1). Therefore, overall statistics over the past 5–7 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 nine measureable storm events recorded in 2016, the peak discharge at E059.8 was less than peak discharge at E059.5, with an average decrease of 63% RPD (Table 3.2-1). The peak discharge between E059.8 and E060.1 decreased in one of two runoff events, with a decrease of 100% RPD, increased in one of two runoff events, with an increase of 98% RPD, and during five runoff events, the downstream peak occurred before the upstream peak, indicating subtributaries and hillslopes accounted for a significant portion 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. In addition, SSC magnitude was reduced through the mitigation structures in 2015. At E060.1, no samples were collected in 2012, 2013, or 2016, SSC was not analyzed for the one sample collected in 2014, and two samples were collected in 2015 and analyzed for SSC. Only one sample has been collected at E059.8 (in 2015); thus, no conclusions can currently be drawn regarding the operation of the new drop structure with respect to SSC.

Los Alamos Canyon: Sampling was performed in Los Alamos Canyon on August 27, 2016 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 this runoff event allow direct evaluation of the effect of the weir and associated basins on flow and sediment transport (Figure 3.4-2). 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 27.1 yd^3 and 4.4 yd^3 on August 27 (Table 3.2-3). Between these two stations, or from above to below the basins/weir, there is a 144% RPD decrease in sediment yield for this event. The runoff volume between E042.1 and E050.1 decreased during the August 27 event with a 29% RPD decrease (4.0 acre-ft for E042.1 and 3.0 acre-ft for E050.1). In addition, in 2016, peak discharge decreased in four of four measureable runoff events between E042.1 and E050.1, with an average decrease of 80% RPD (Table 3.2-1), and only one storm event was measured downstream of the basins/weir (August 27). 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 5–7 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, and 2015.

4.0 ANALYTICAL RESULTS

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 2016.

The Laboratory planned to analyze at least one storm-flow event at gages E050.1 and E060.1 for dissolved metals, total metals (in water), SSC, and TAL metals in the sample-sediment fraction on a dry-weight basis. An administrative oversight resulted in the failure to perform analyses of TAL metals in the sample-sediment fraction of the sample collected at E050.1 on August 27, 2016.

Analysis of total organic carbon was planned but not conducted at CO111041 samples collected during 2016.

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 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 and DP Canyons 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 9.99 mg/L and 41.2 mg/L (average value is 22.2 mg/L) calcium carbonate ($CaCO_3$) calculated from calcium and magnesium values from storm water collected in 2016. 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 2016 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, South fork Acid Canyon, and upper Pueblo Canyon. Most of the exceedances observed in 2016 are metals and PCBs detected at gage stations located directly downstream from these routing pathways. Thirty-five 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.

There are 29 aluminum exceedances in storm water ranging from 538 to 1410 µg/L; the average exceedance value is 867 µg/L. Hardness-dependent water quality criteria range from 58.4 to 725 µg/L, all less than the national acute aquatic life criteria of 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 range from 2.34 to 5.73 µg/L; the average exceedance value is 3 µg/L. The corresponding acute and chronic aquatic life screening criteria range between 1.25 µg/L and 2.92 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.

Six lead results were observed above the acute and chronic screening criteria in 2016. Exceedance concentrations range between 1.11 µg/L and 2.11 µg/L; the average 2016 exceedance was 1.54 µg/L. The hardness-dependent aquatic life screening criteria range between 0.191 µg/L and 0.526 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 two gross alpha radioactivity concentrations were observed above the 15 pCi/L screening level threshold in 2016. The exceedances range from a minimum of 17.2 pCi/L to a maximum radioactivity concentration of 316 pCi/L; average exceedance value is 85.3 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).

Several persistent organic compounds were observed above the water quality criteria screening level. PCBs are by far the most common compound that exceeded water quality criteria. Total PCB concentrations range from 0.0028 µg/L to 13.0 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 2016 is 1.22 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 0.0472 µg/L, which is slightly more 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.

Other organic compounds exceeding screening levels include dioxin/furan compounds. Dioxins/furans are persistent organic compounds that have no common use but mostly exist as byproducts of industrial processes and are most likely associated with incineration and combustion products from past forest fires and current wood burning in Los Alamos County. Because of their recalcitrant nature and low solubility, dioxins/furans are archived in sediment that are mobilized and transported in storm water discharge.

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 interval 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. Because of the low bias inherent in total suspended solids (TSS) analyses, TSS was not measured in 2016.

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 4.3-1**

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 and isotopic uranium 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 and isotopic uranium were less than 50% for aluminum, arsenic, barium, beryllium, chromium, copper, iron, mercury, nickel, lead, selenium, thallium, vanadium, and uranium-234. Silver, and uranium-235/236 were not detected in unfiltered samples measured at E050.1. The RPD of the measured and calculated cadmium, manganese, zinc, and uranium-238 were greater than 50%.

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

Results for the four storm water samples analyzed for total PCBs collected at the inlet to the upper detention basin below the SWMU 01-001(f) drainage range from 4.68 µg/L to 13 µg/L. Total PCB results are within the range of results for samples collected from 2011 to 2015. 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 2015 REPORT

Based on changes that occurred in 2016, this report has been updated from the 2015 report. The changes are summarized below:

- Appendix D, Evaluation of Unfiltered Storm Water and Canyon Sediments, of the “2015 Monitoring Report for Los Alamos/Pueblo Watershed” (LANL 2016, 601433) has been removed.
- Appendix D now contains the analytical results (including data packages), 5-min stage and discharge data from the gaging stations, and the clipped LiDAR data (only the geomorphic monitoring areas) for the LA/P watershed (on CD included with this document).
- Monitoring conducted as part of the 2016 monitoring plan to determine whether or not waters of the state are attaining designed uses is included in this report.
- Projected total metal concentrations for each sample using measured SSC analyses are calculated using equations presented in Appendix D of the “2015 Monitoring Report for Los Alamos/Pueblo Watershed” (LANL 2016, 601433), and these projected values are compared with background concentrations expected in sediment.
- The difference between measured and estimated total metals concentrations is analyzed at E050.1, the only gaging station where total metals were analyzed in 2016 (no runoff event larger than 5 cfs, the sampler trip level, was measured at E060.1).

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 and SSC 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 runoff events and a significant reduction in the volume of suspended sediment being transported downstream. In fact, only one storm event produced runoff at E050.1 throughout the entire monitoring year. The 2016 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. Aerial LiDAR data collected in 2015 and 2016 were compared with estimated geomorphic change greater than calculated detection limits in and around the sediment transport mitigation sites. The LiDAR-based DEM comparison indicates net deposition has occurred in the Pueblo and DP Canyon monitoring areas between 2015 and 2016. However, the error is larger than the calculated deposition in most areas, suggesting the amount of change is less than the method detection limit. In the wing ditch and Pueblo Canyon GCS areas, the DoD results are greater than the error; however, the net deposition is because of vegetation growth in the wing ditch area and construction activities in the Pueblo Canyon GCS areas, respectively. In DP Canyon, the net depositon is because of the misclassification of LiDAR data on the GCS itself. In Los Alamos Canyon, the DEM comparison indicates that net deposition in the upper Los Alamos Canyon retention basins is solely from construction activites. At the Los Alamos low-head weir, net depostion occurred in all three upstream detention basins. The field-checked DoD analyses and thalweg surveys presented support the conclusion of overall stability of the channels and banks in Pueblo, DP, and Los Alamos Canyons and establish the geomorphic change between 2015 and 2016 as minor and localized, indicating that the 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 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 TAL metals and isotopic uranium at E050.1 and E060.1 per the memorandum of understanding between DOE 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 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.

7.0 REFERENCES AND MAP DATA SOURCES

7.1 References

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ER ID or ESH ID. This information is also included in text citations. ER IDs were assigned by the Environmental Programs Directorate’s Records Processing Facility (IDs through 599999), and ESH IDs are assigned by the Environment, Safety, and Health (ESH) Directorate (IDs 600000 and above). IDs are used to locate documents in the Laboratory’s Electronic Document Management System and, where applicable, in the master reference set.

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

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7.2 Map Data Sources

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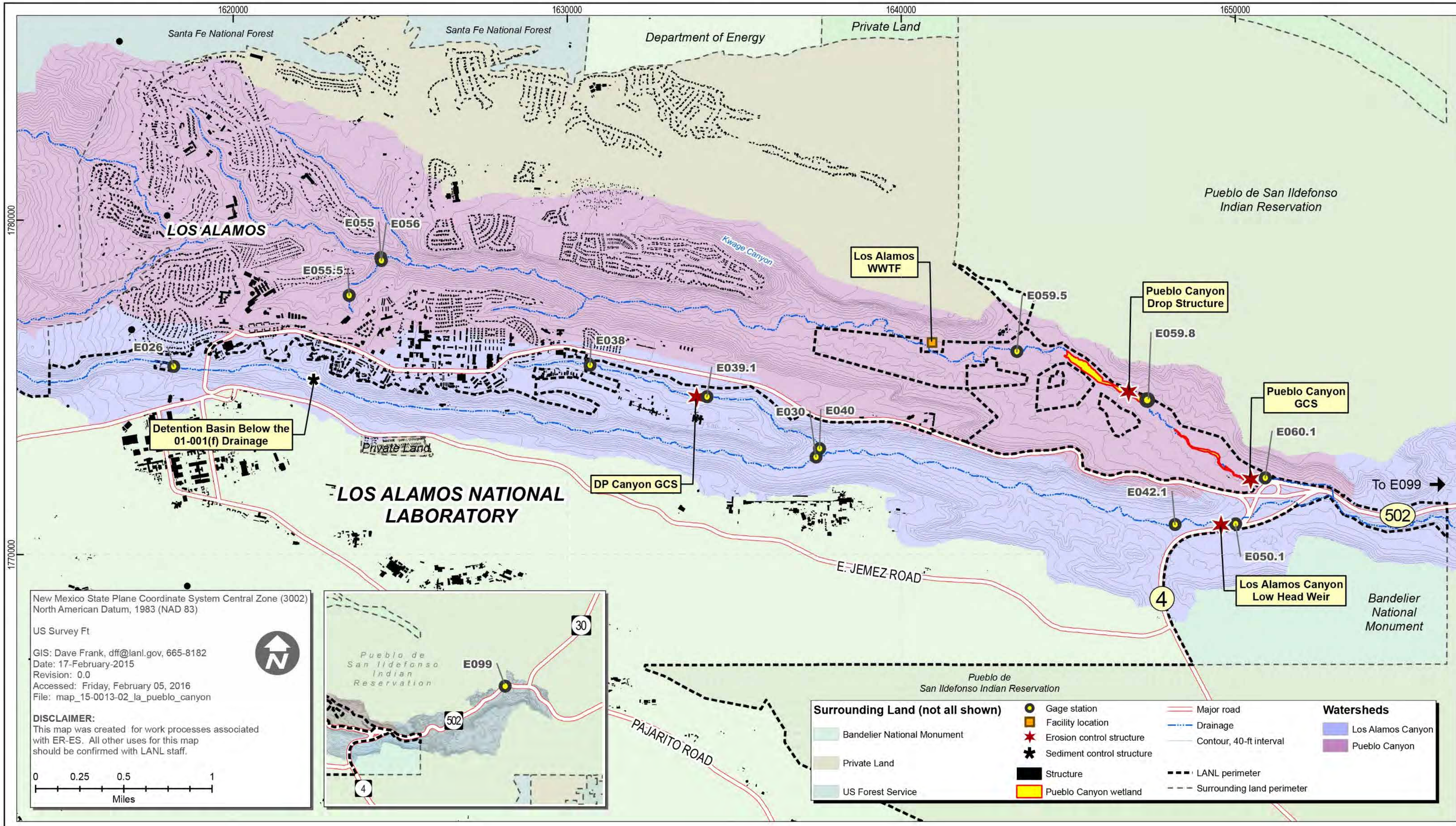


Figure 1.1-1 Los Alamos and Pueblo Canyons showing monitoring locations and sediment transport mitigation sites

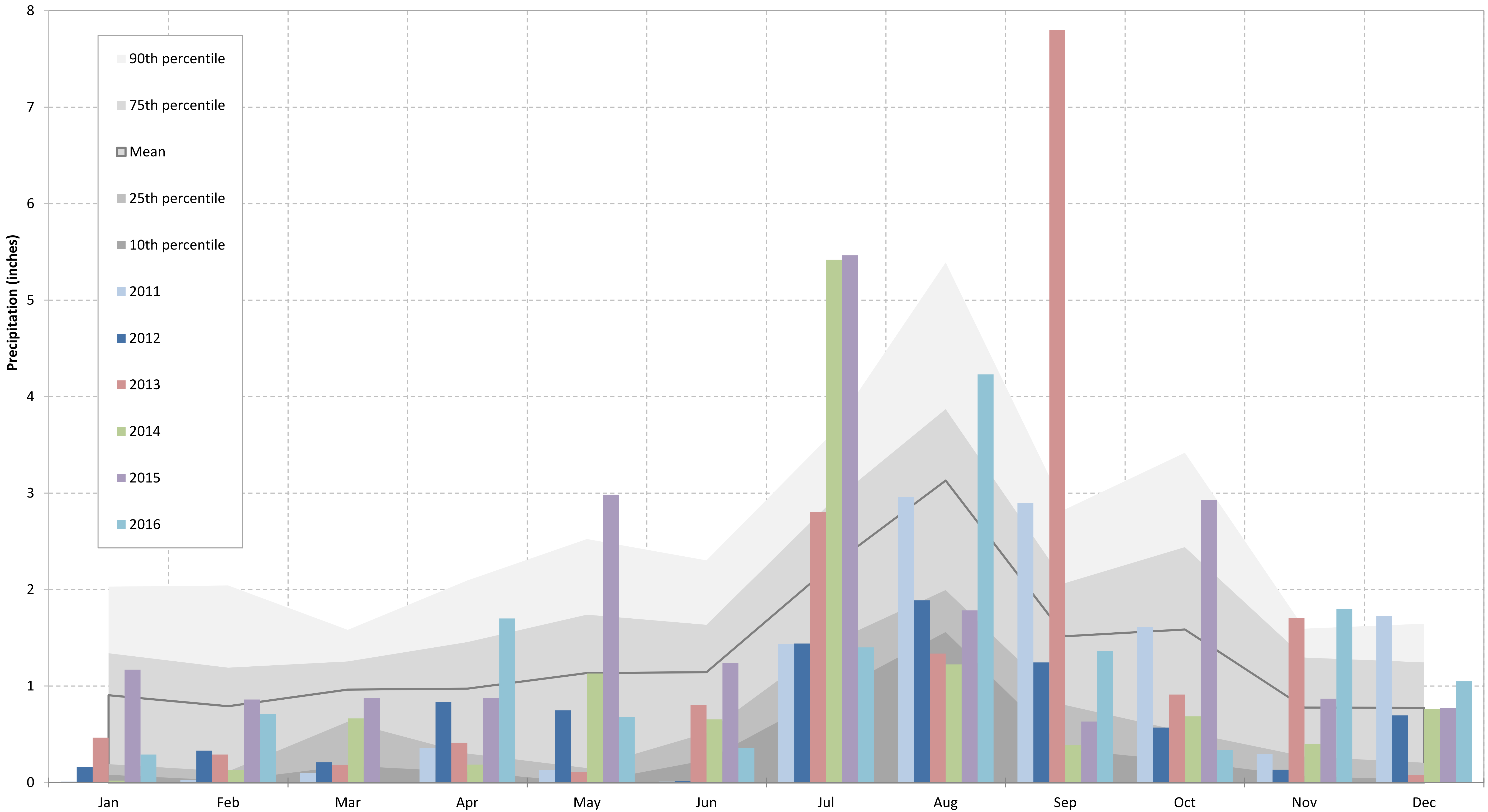


Figure 2.1-1 Total precipitation for each month between 2011 and 2016 based on meteorological tower data averaged across the Laboratory (mean and percentiles are based on data from 1992 to 2010)

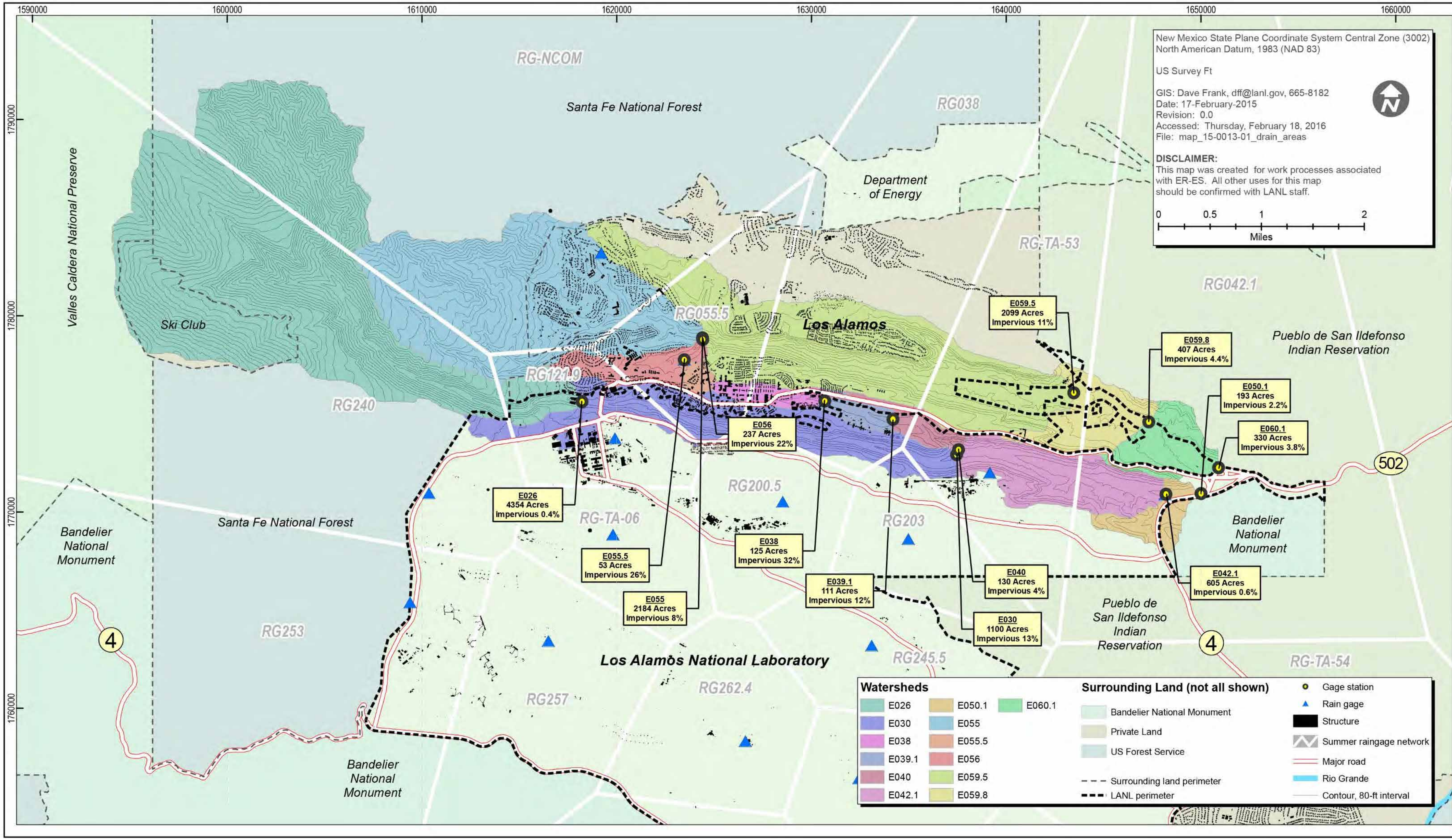


Figure 2.1-2 Los Alamos and Pueblo Canyons watershed showing drainage areas for each stream gaging station and associated rain gages and Thiessen polygons

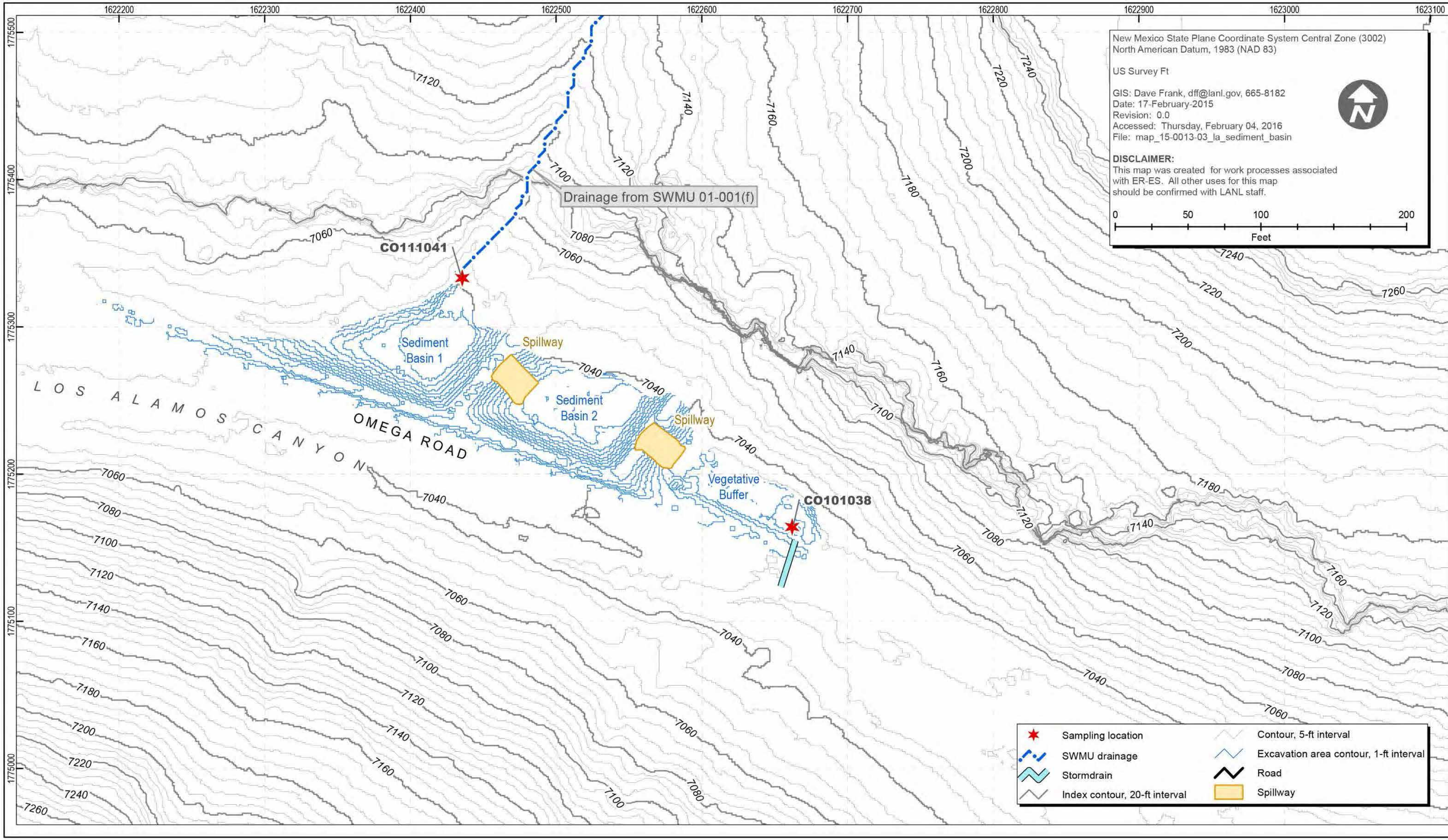


Figure 2.2-1 Sediment detention basins and sampling locations below the SWMU 01-001(f) drainage

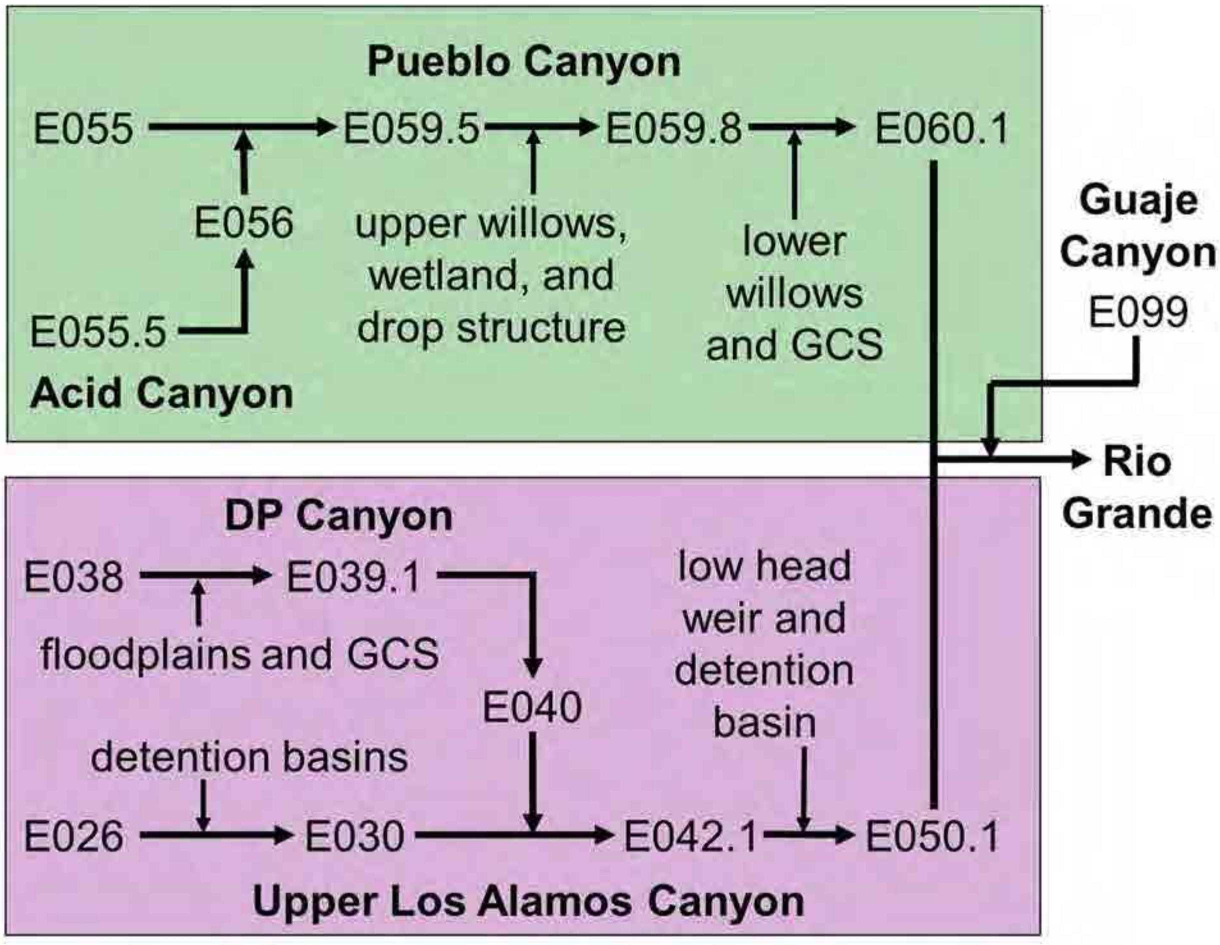


Figure 3.2-1 Flow diagram of gaging stations and sediment transport mitigation sites in the LA/P watershed

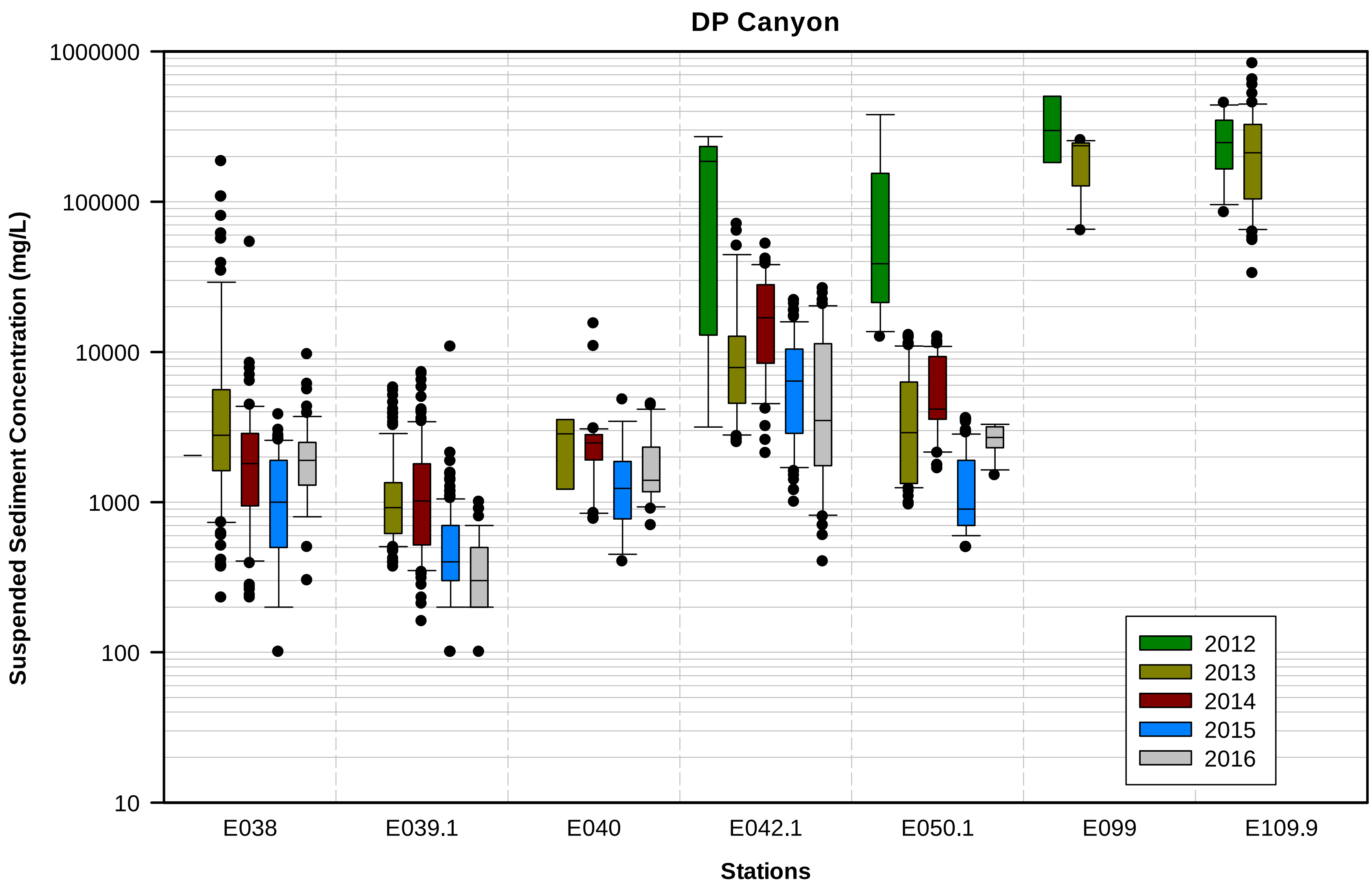


Figure 3.2-2 Box-and-whisker plots of SSC for all gaging stations in the LA/P watershed over the past 5 yr of monitoring

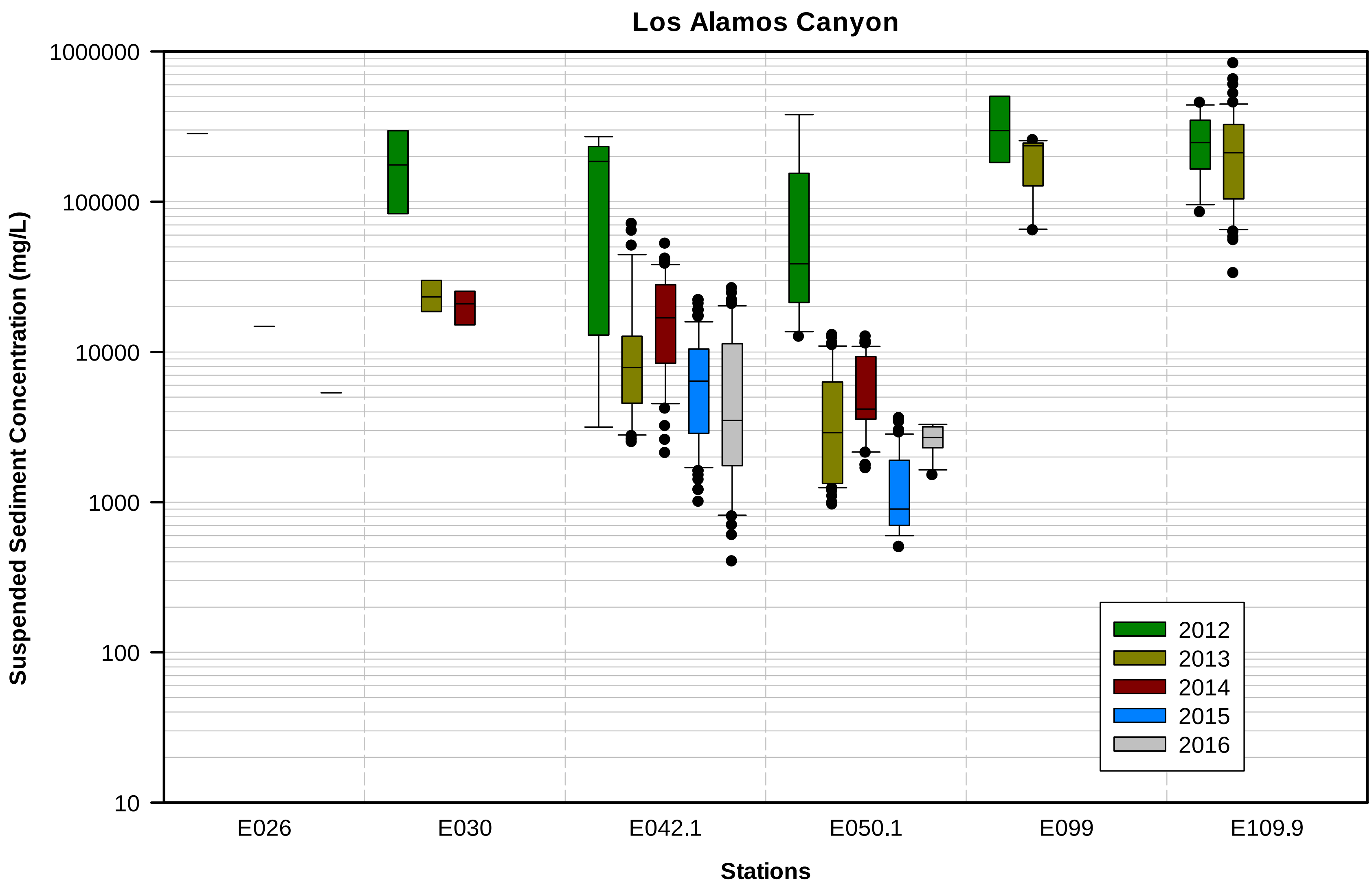


Figure 3.2-2 (continued) **Box-and-whisker plots of SSC for all gaging stations in the LA/P watershed over the past 5 yr of monitoring**

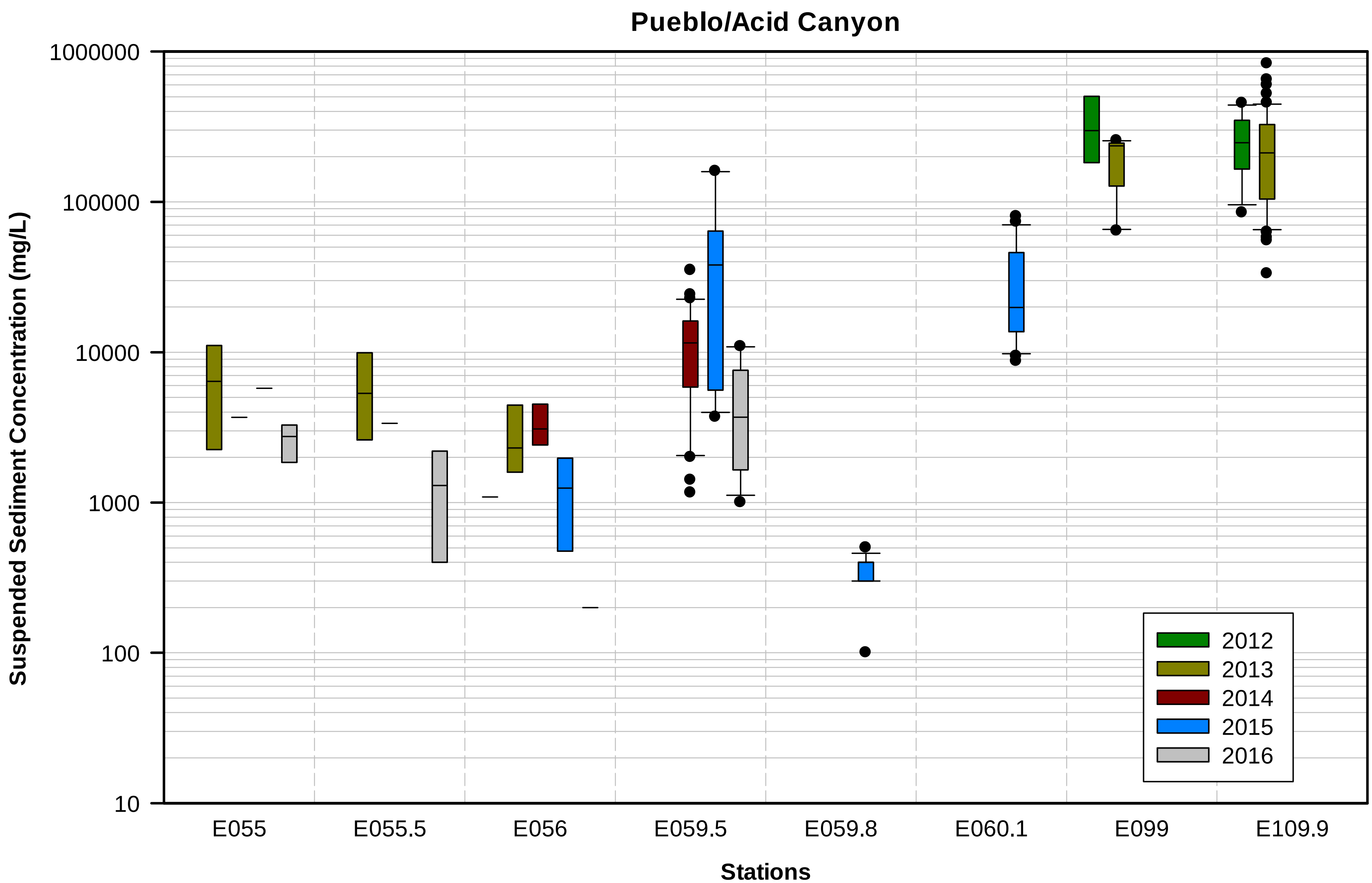


Figure 3.2-2 (continued) **Box-and-whisker plots of SSC for all gaging stations in the LA/P watershed over the past 5 yr of monitoring**

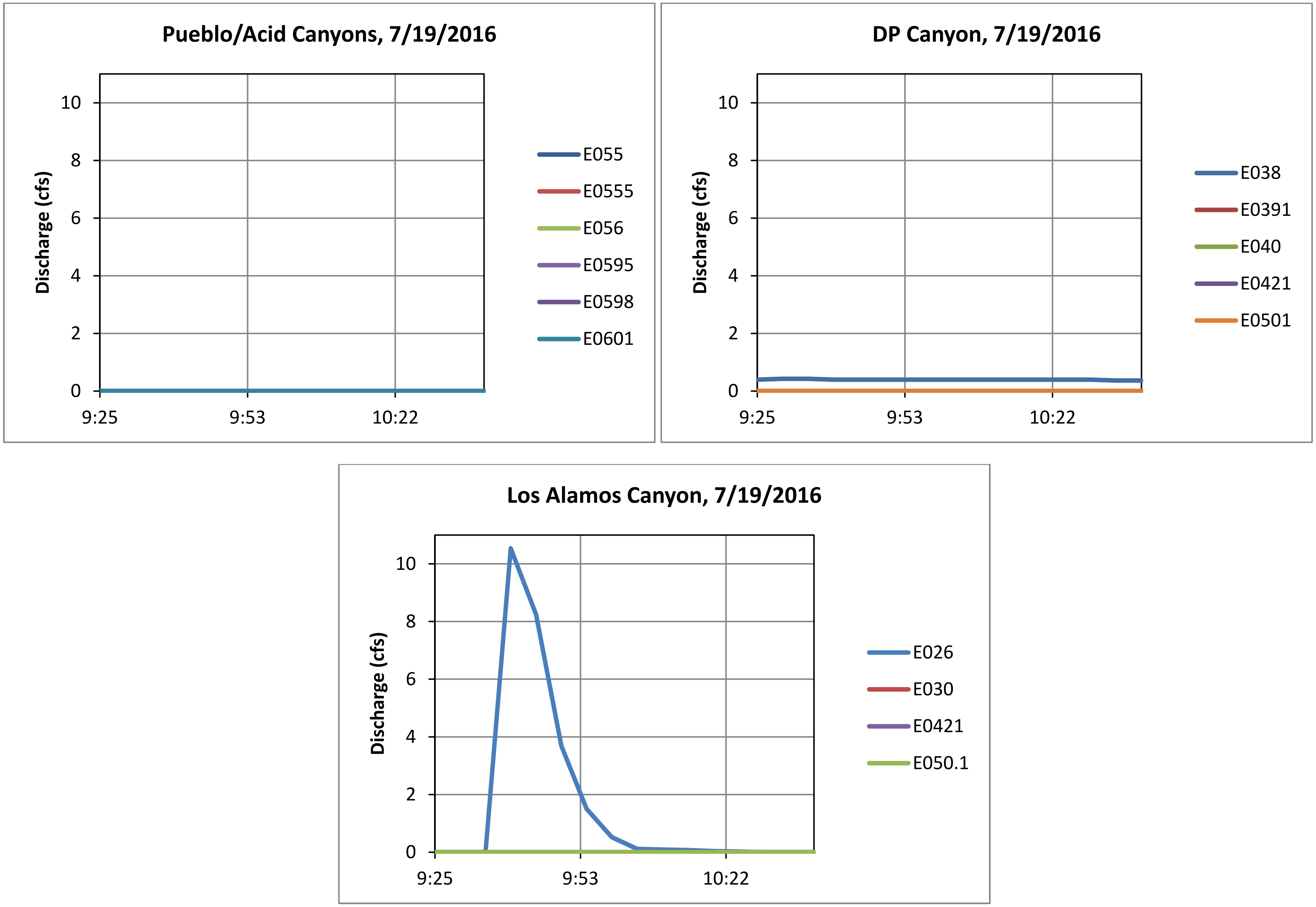


Figure 3.2-3 Hydrographs during each sample-triggering runoff event for each canyon from up- to downstream reaches

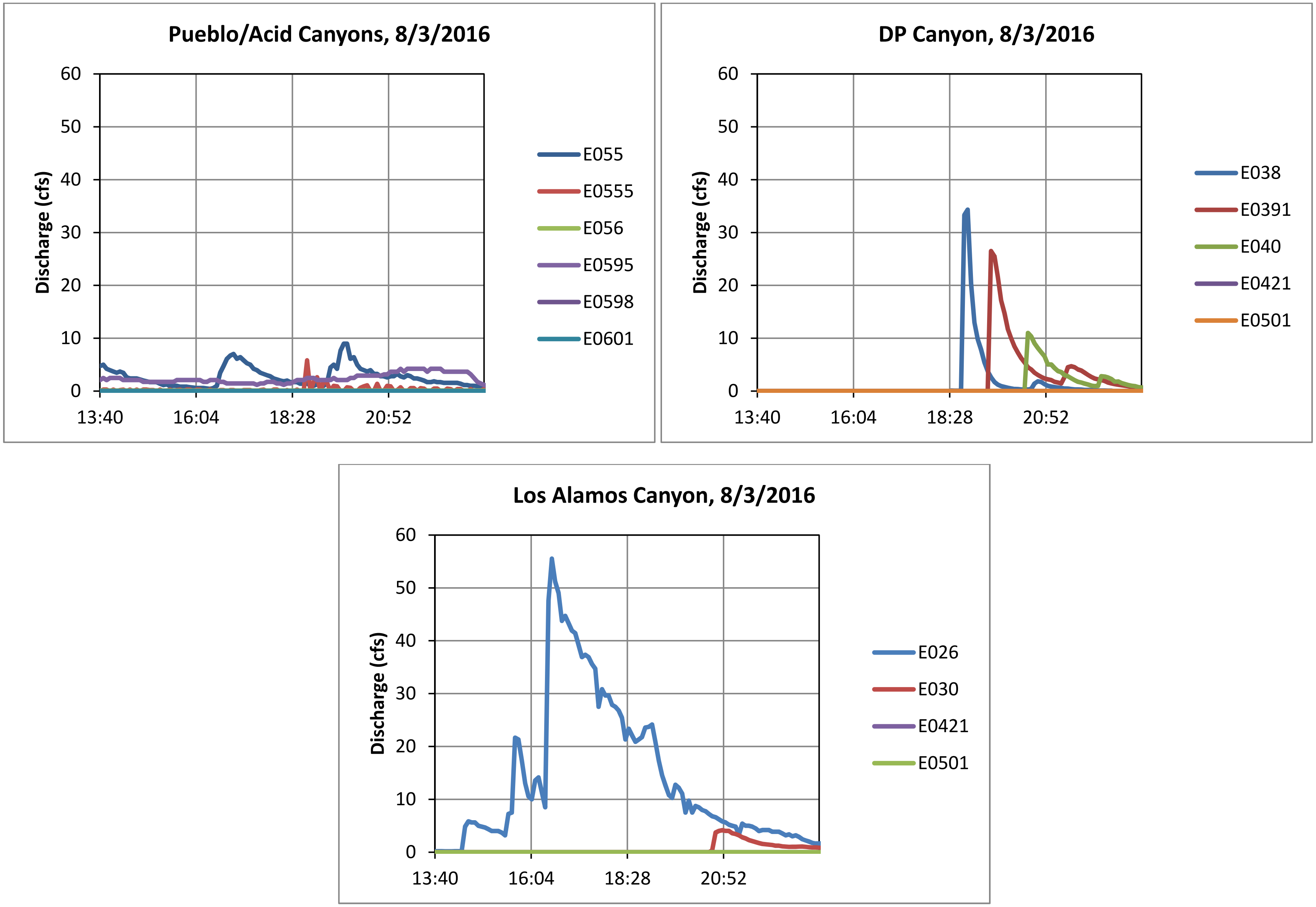


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from up- to downstream reaches**

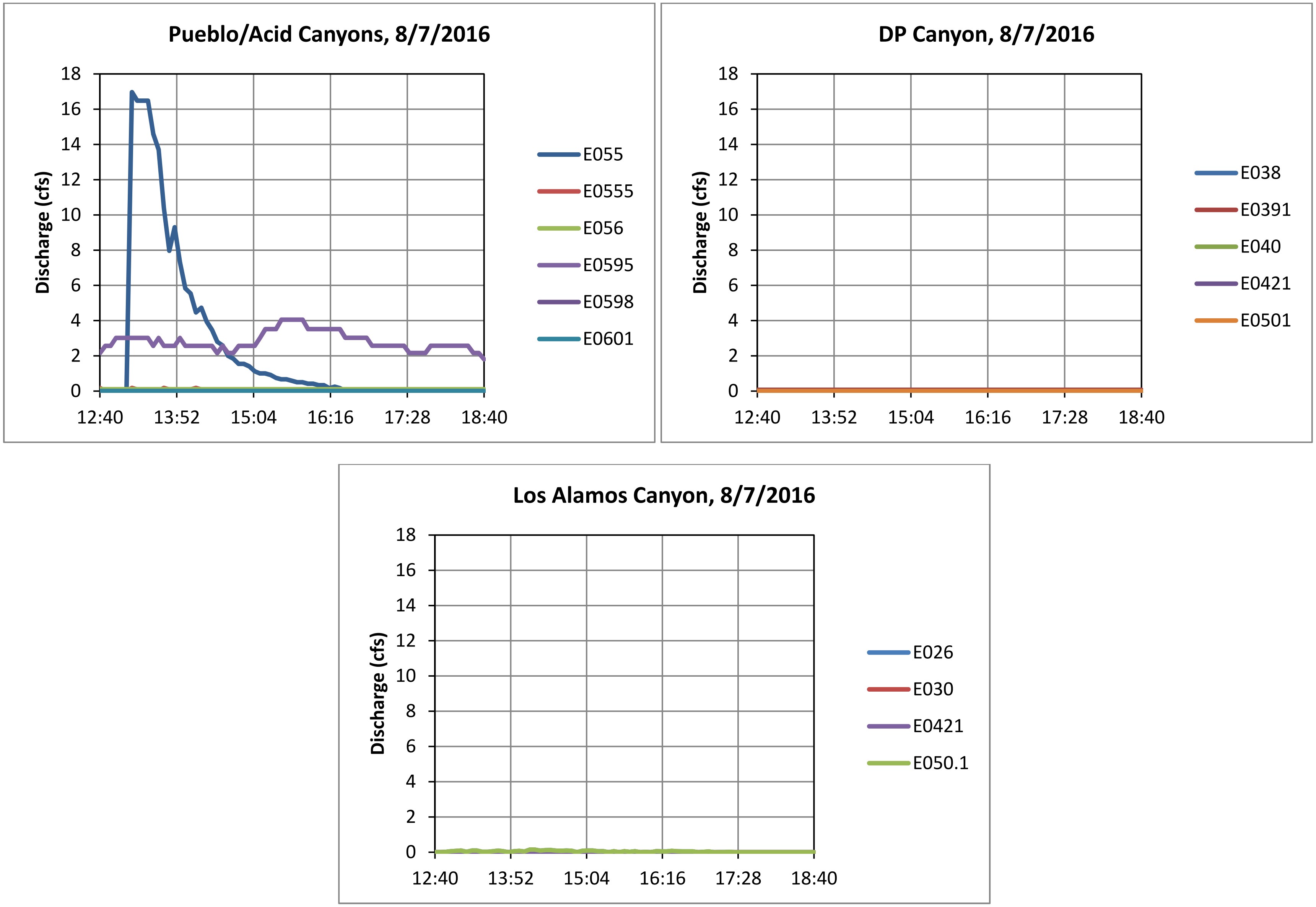
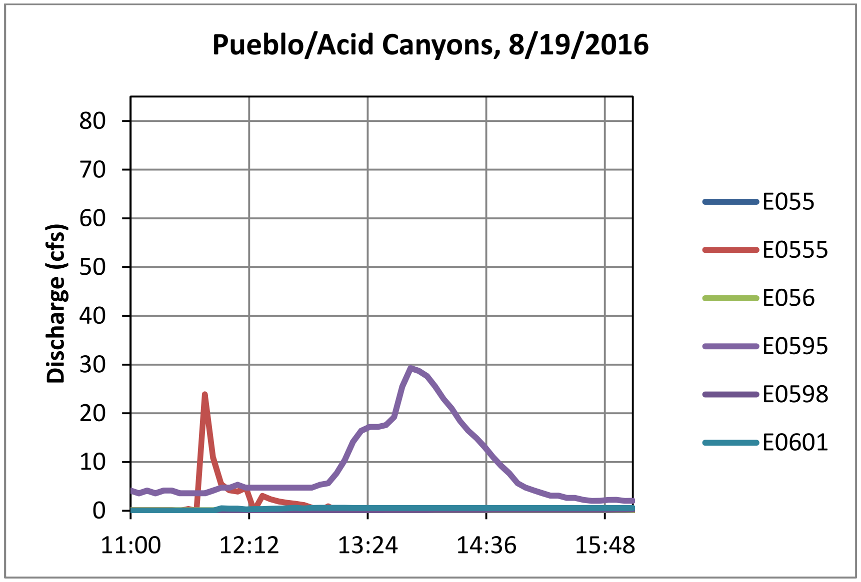
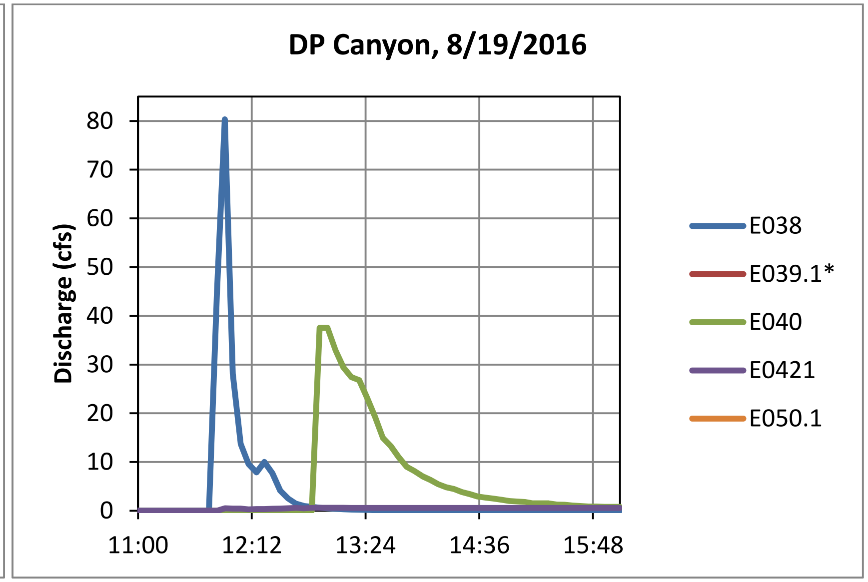


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from up- to downstream reaches**





* E039.1 was not operational due to mechanical issues

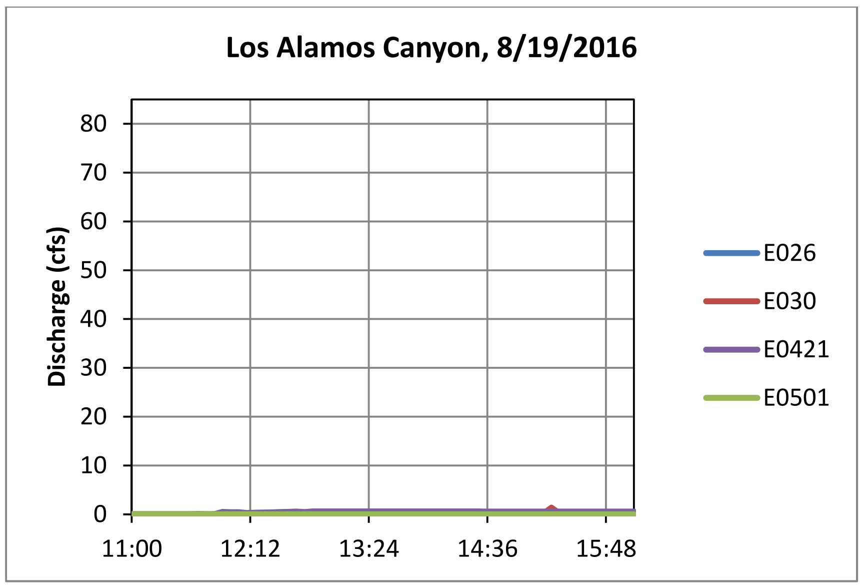
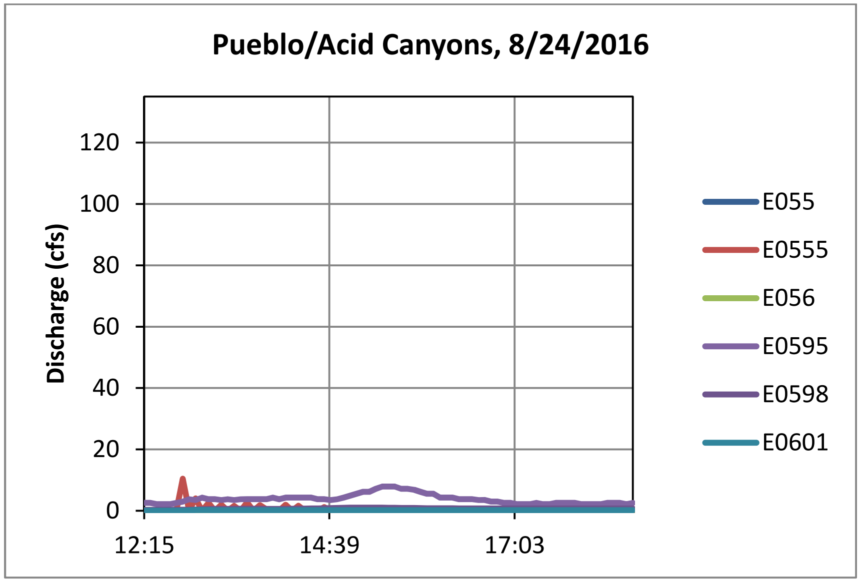
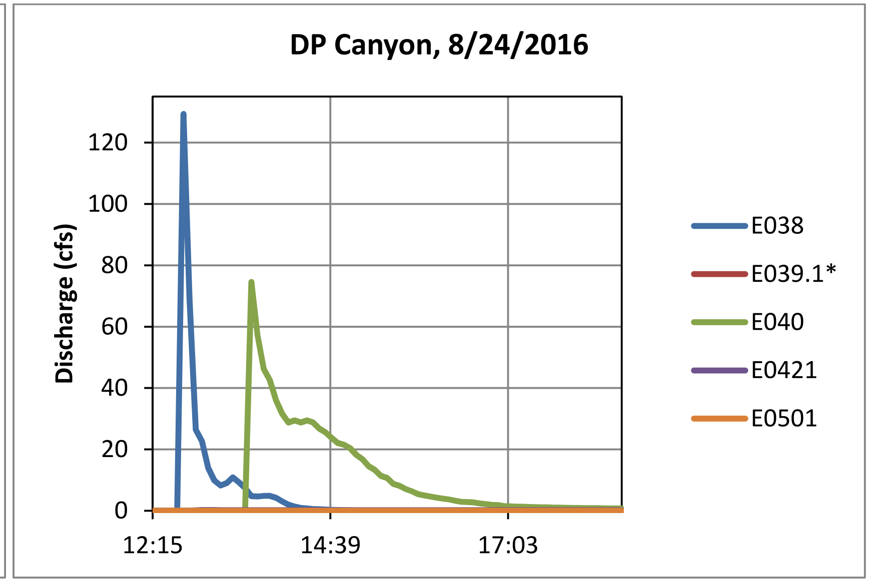


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from up- to downstream reaches**





* E039.1 was not operational due to mechanical issues

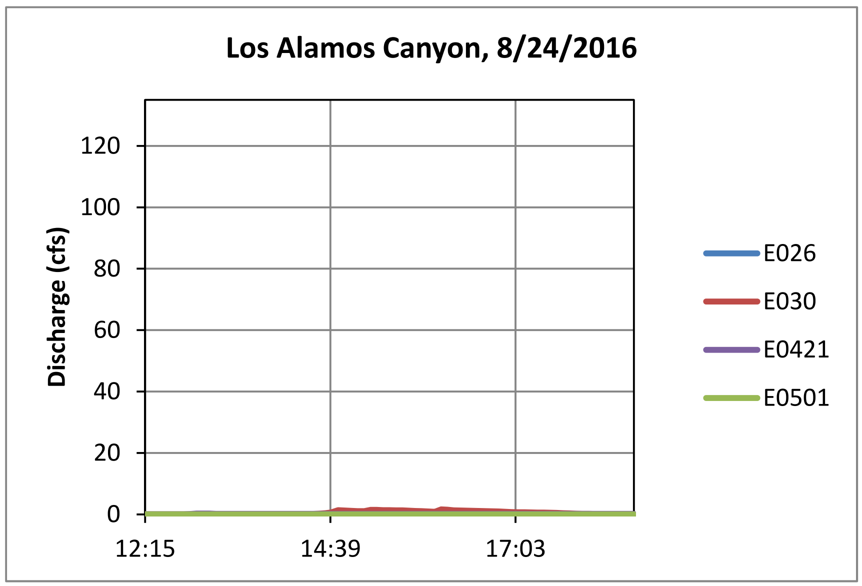
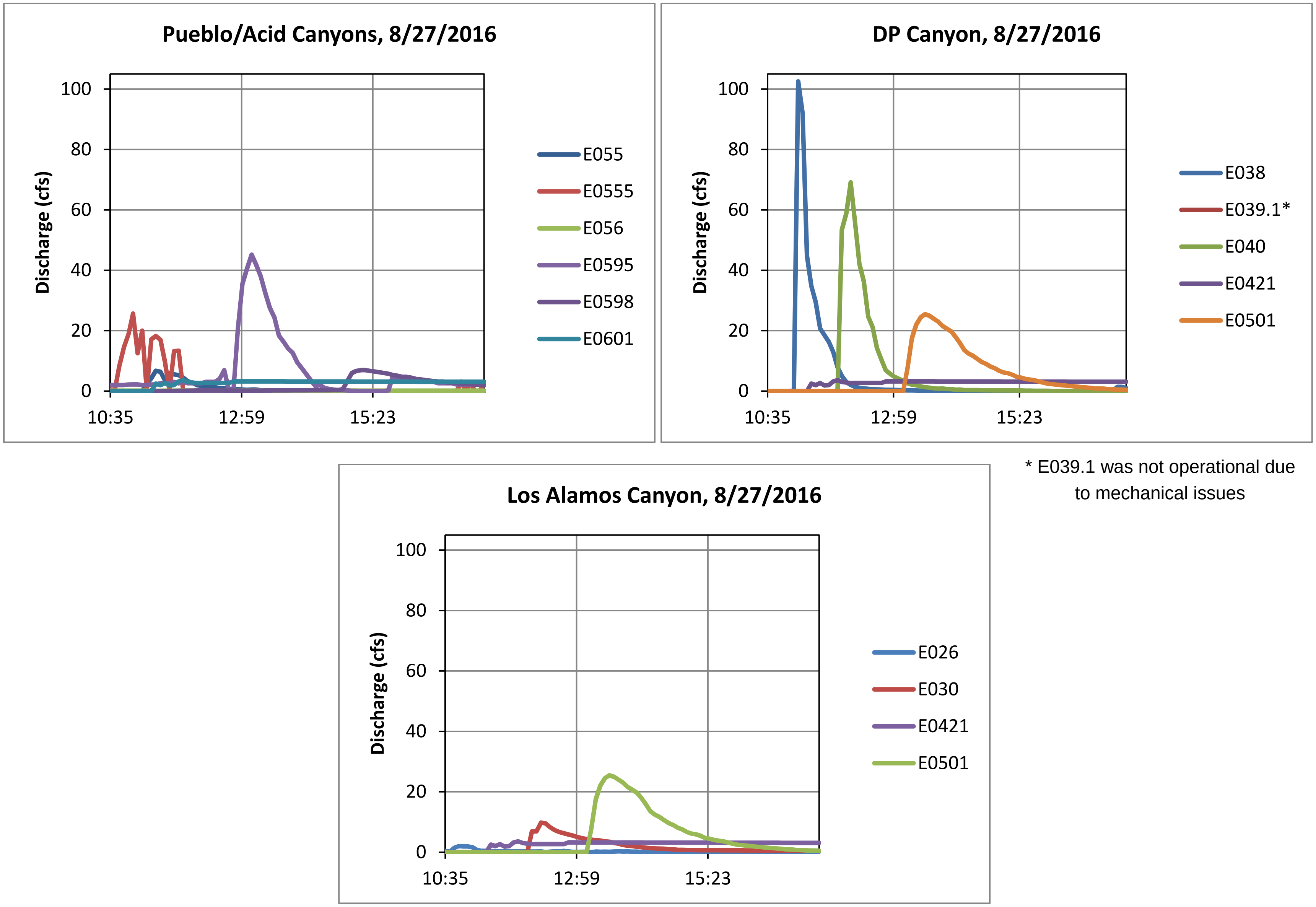


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from up- to downstream reaches**



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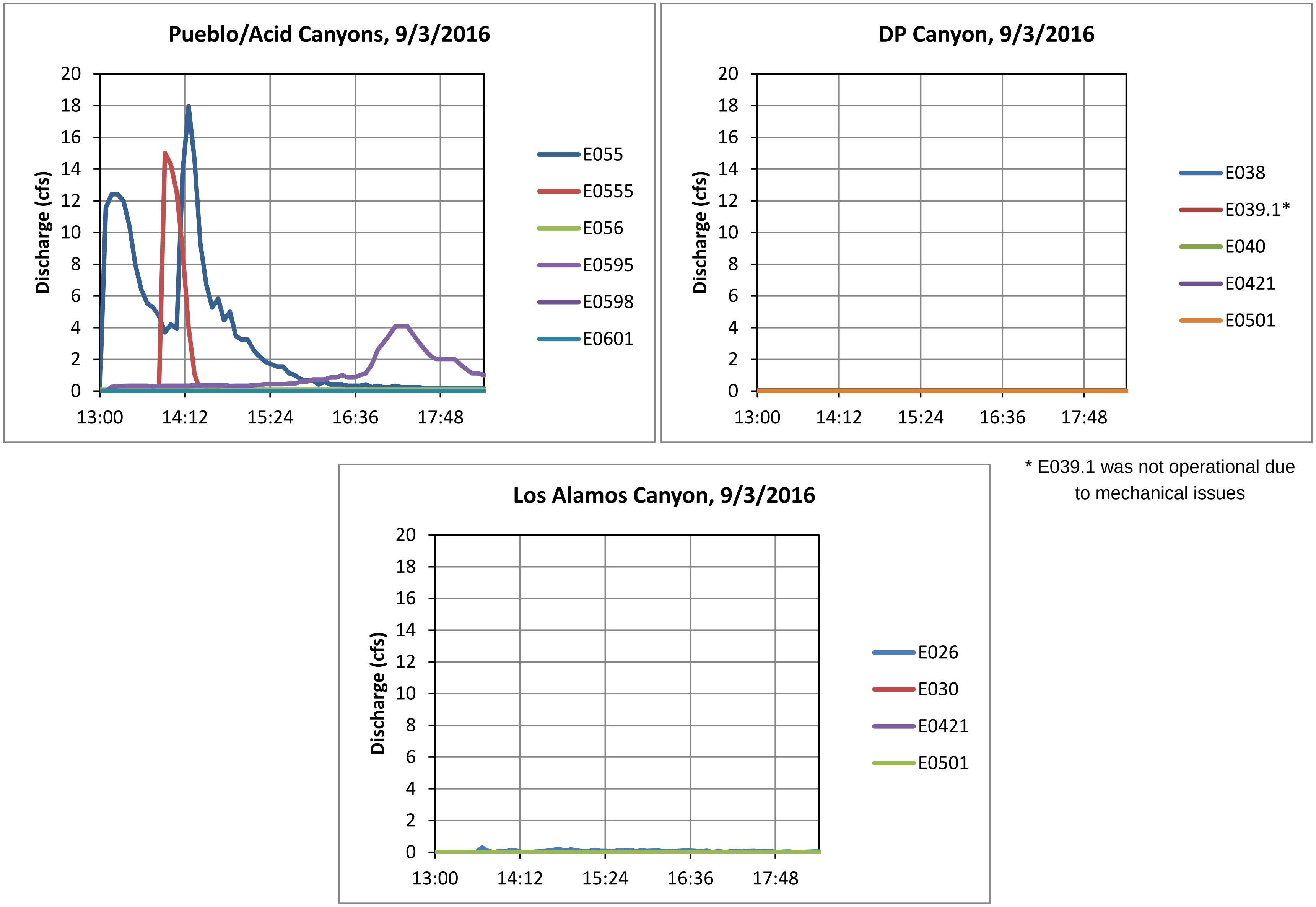

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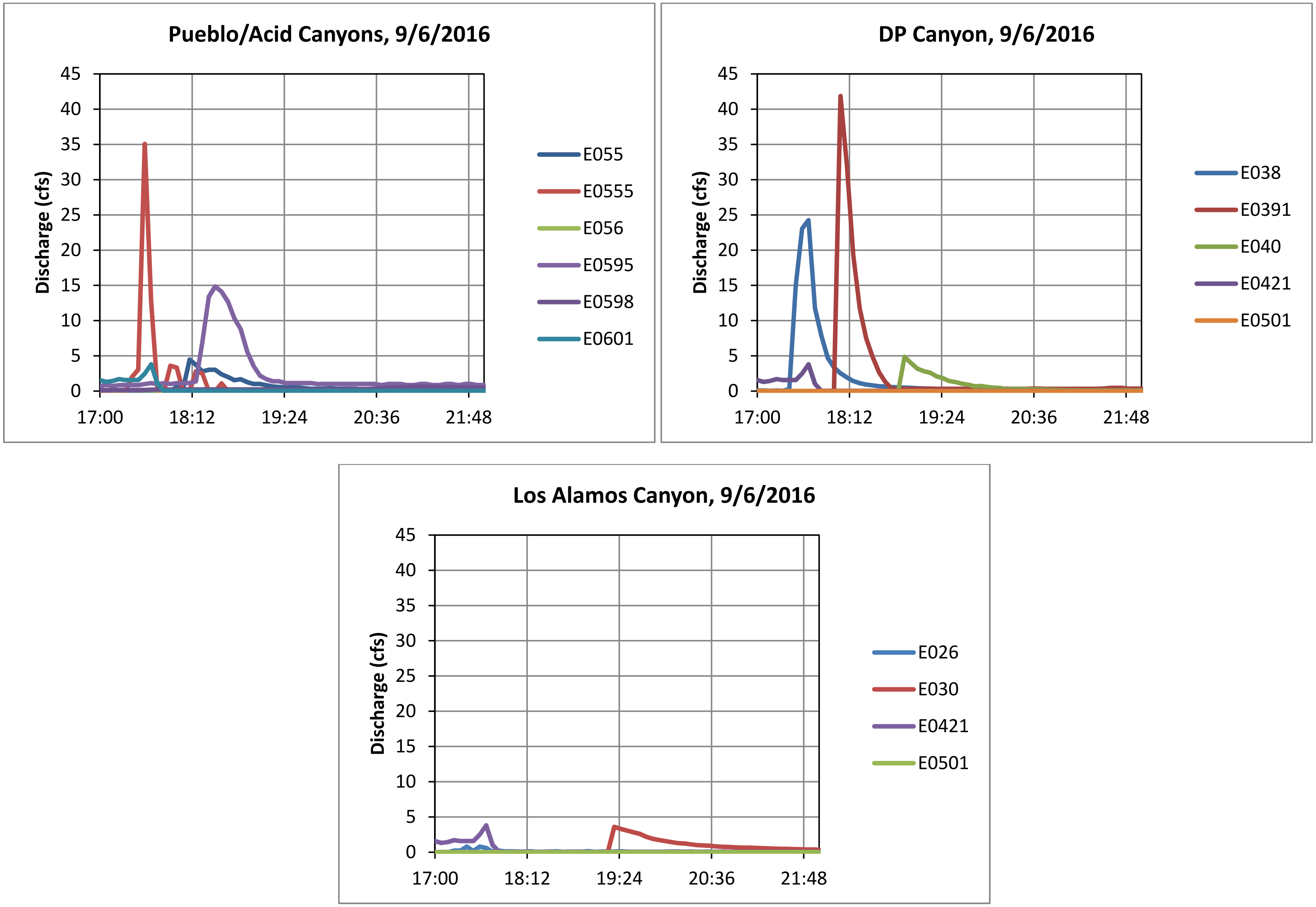

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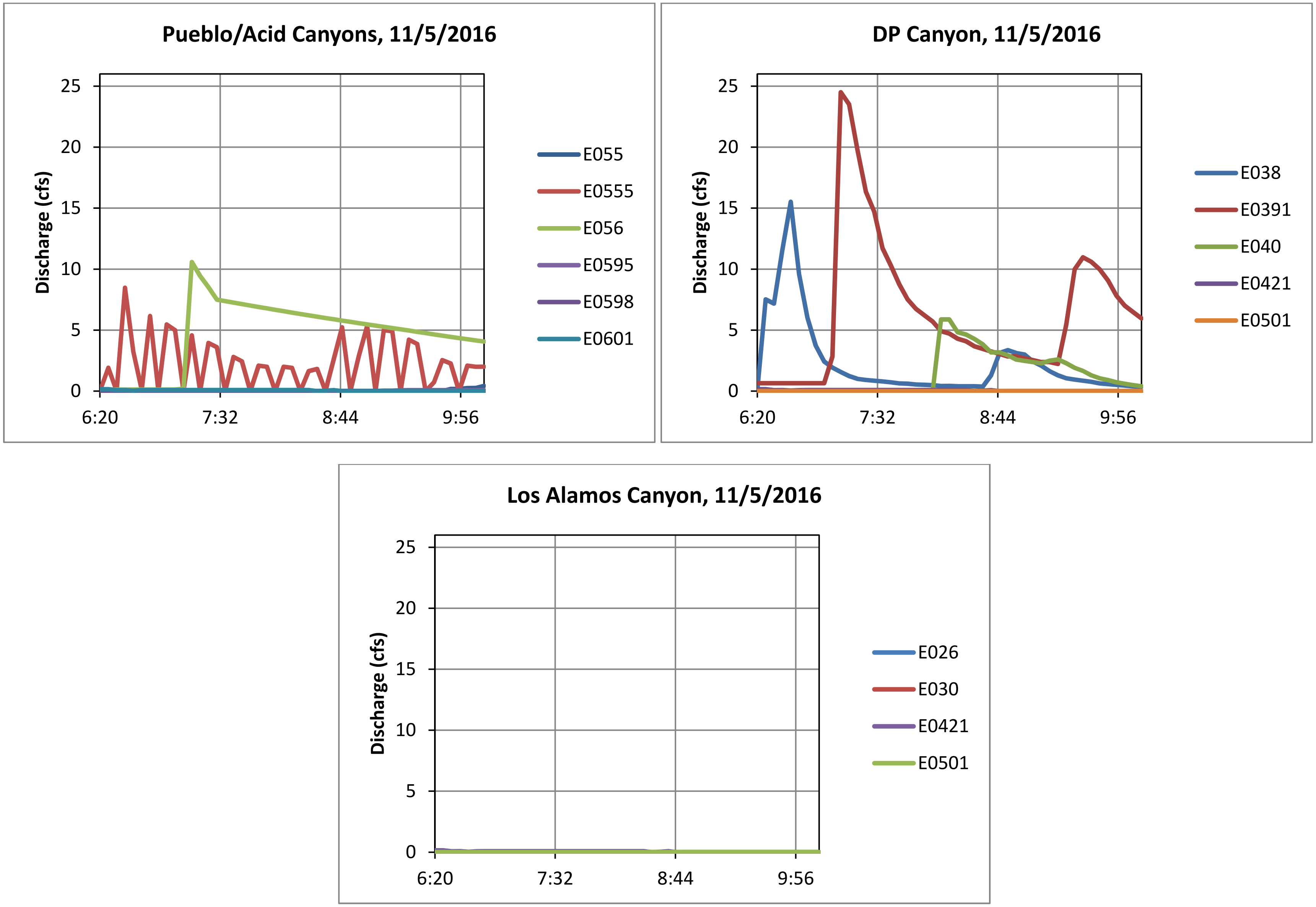

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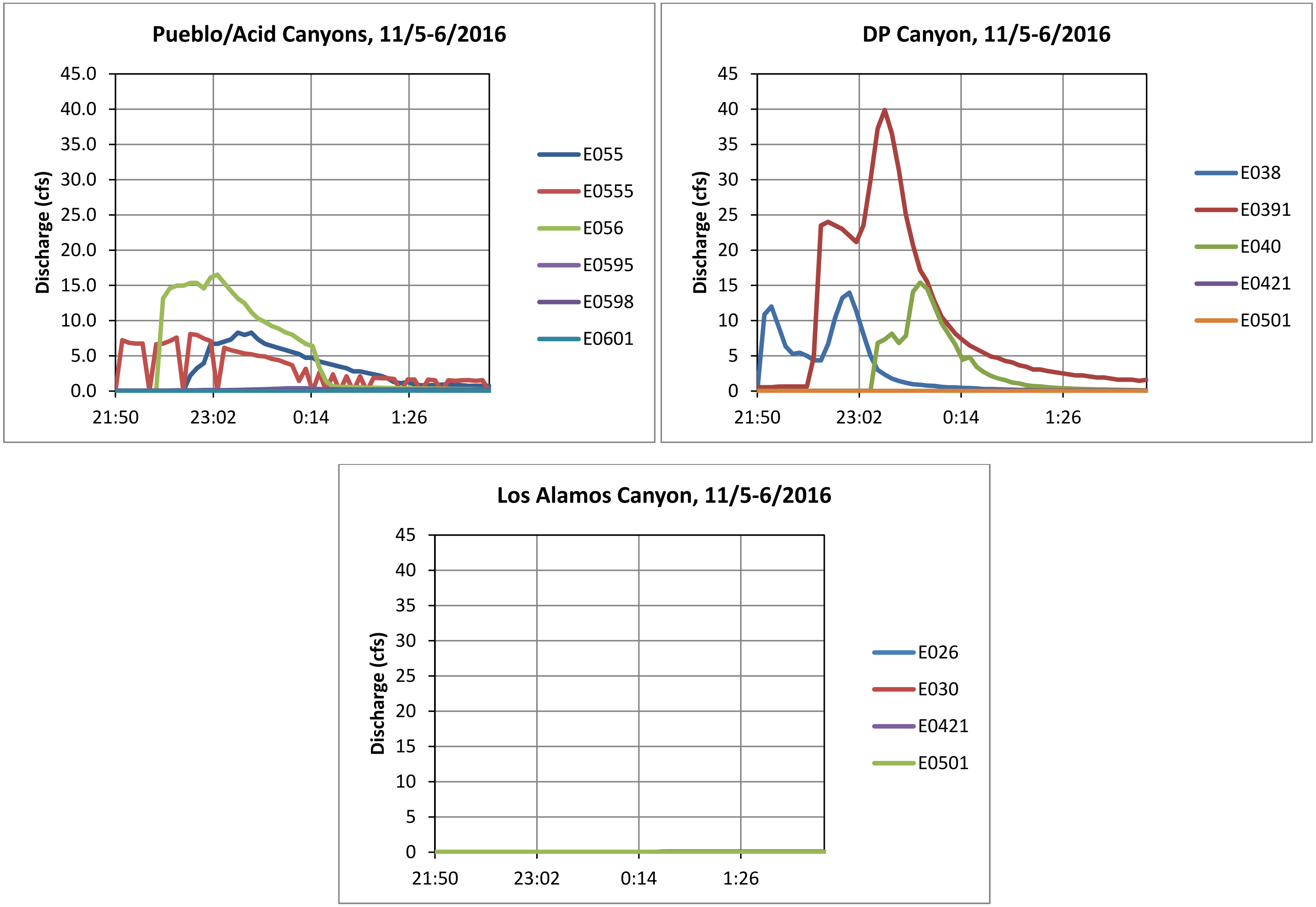

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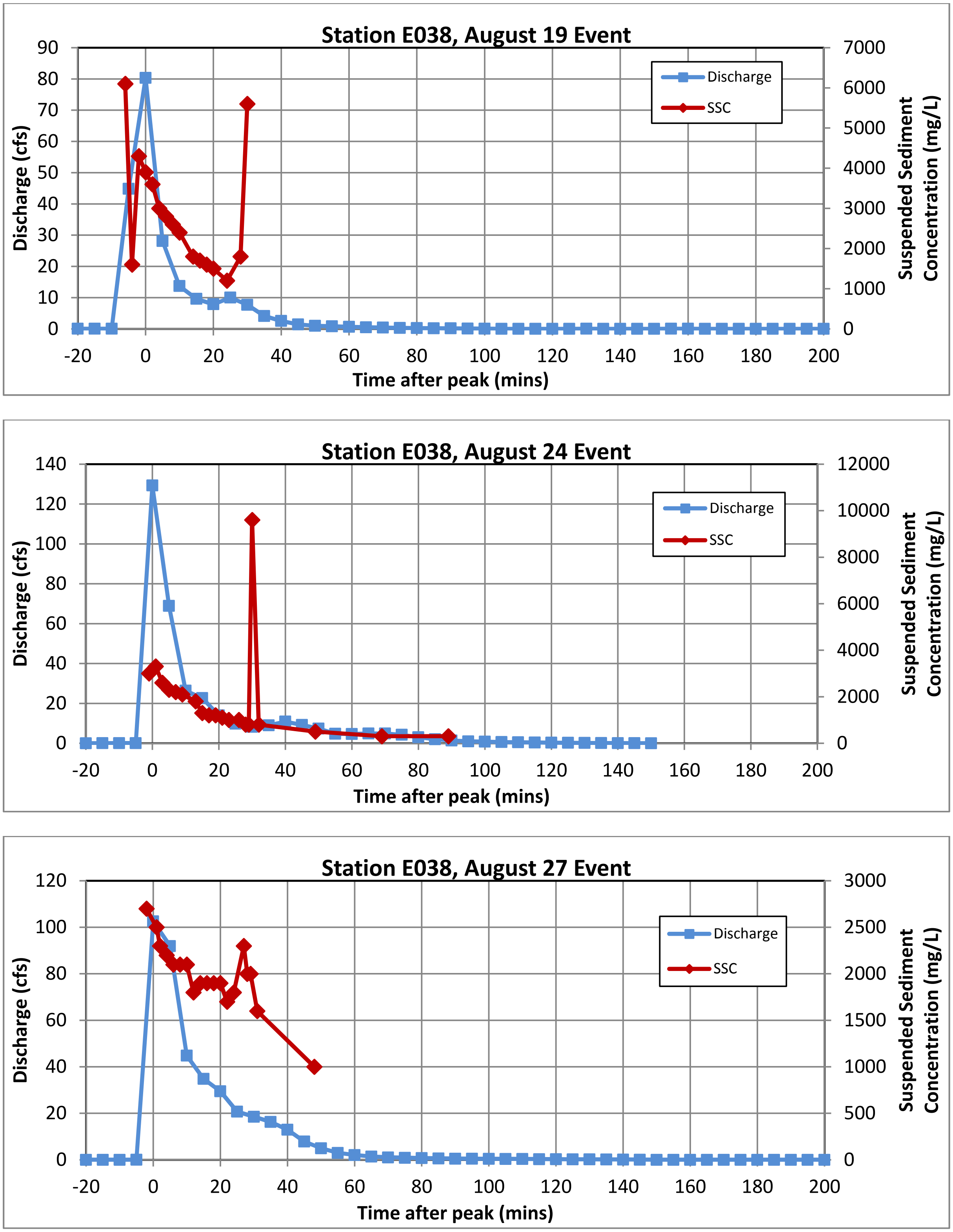
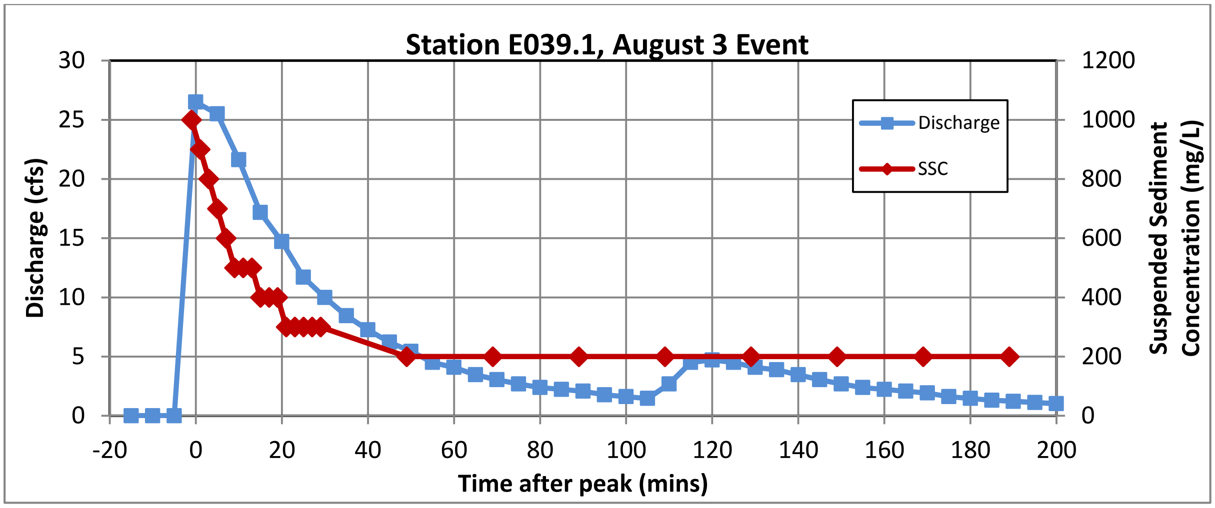
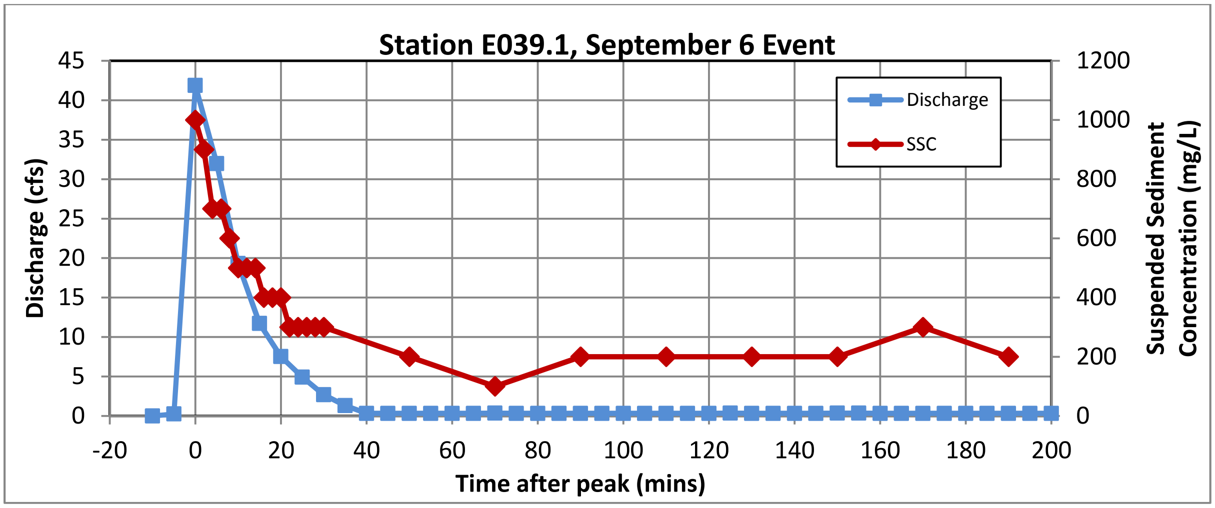


Figure 3.2-4 Discharge and SSC for events sampled at E038, E039.1, E042.1, E050.1, and E059.5





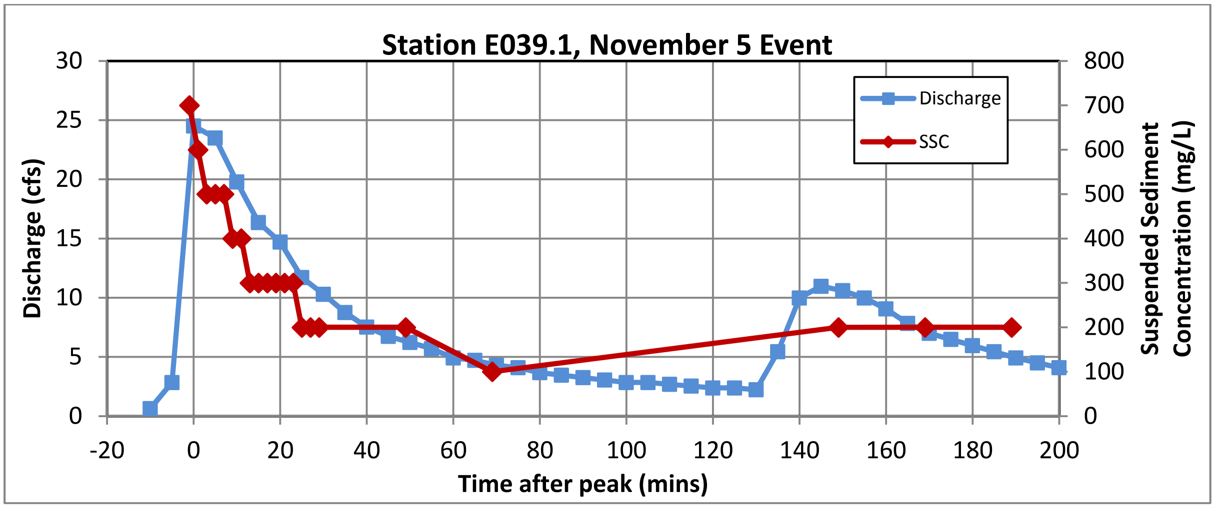
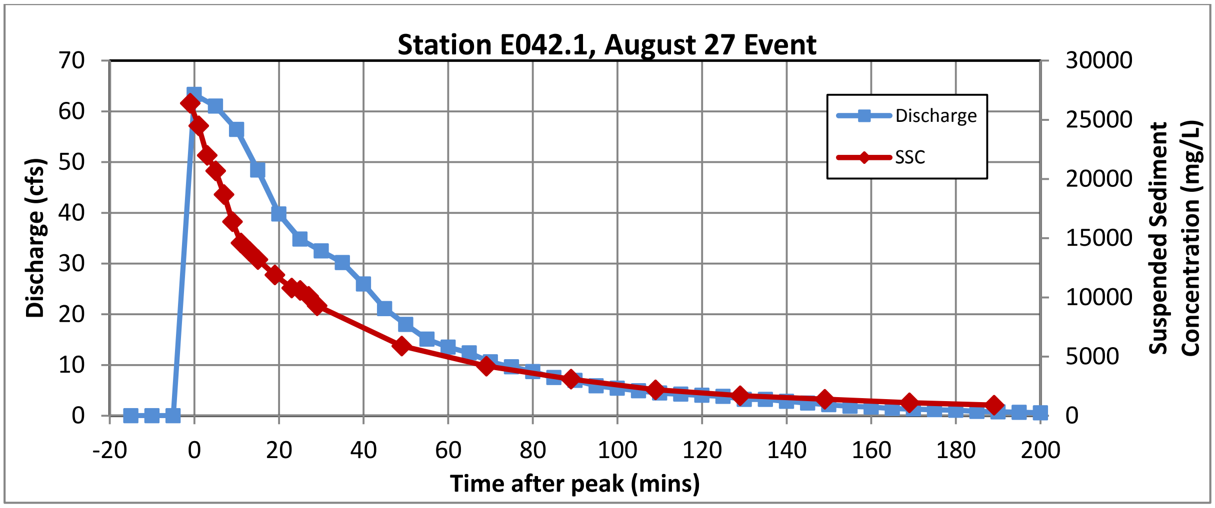
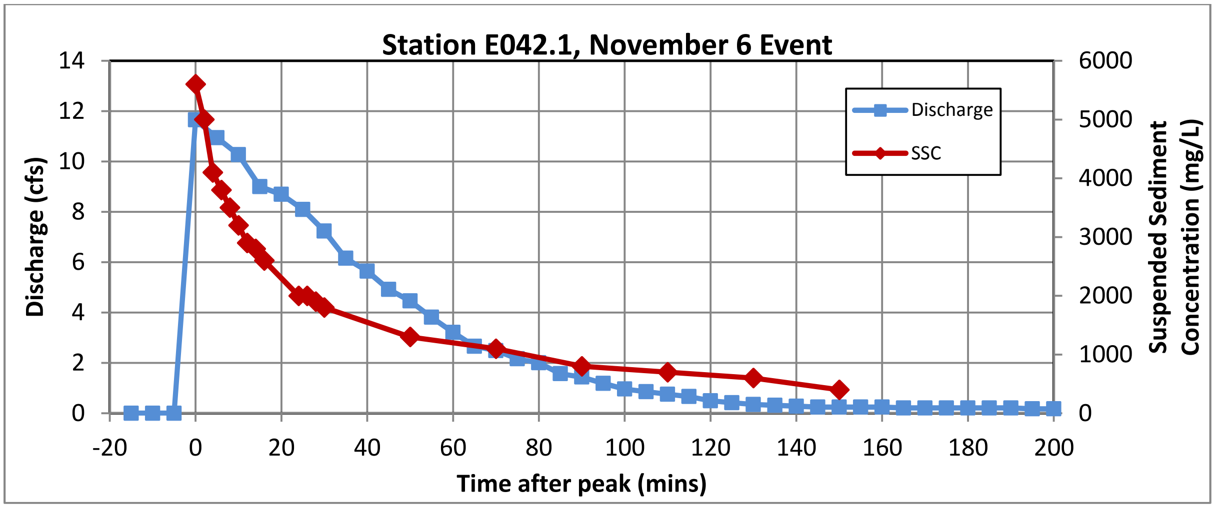


Figure 3.2-4 (continued) **Discharge and SSC for events sampled at E038, E039.1, E042.1, E050.1, and E059.5**





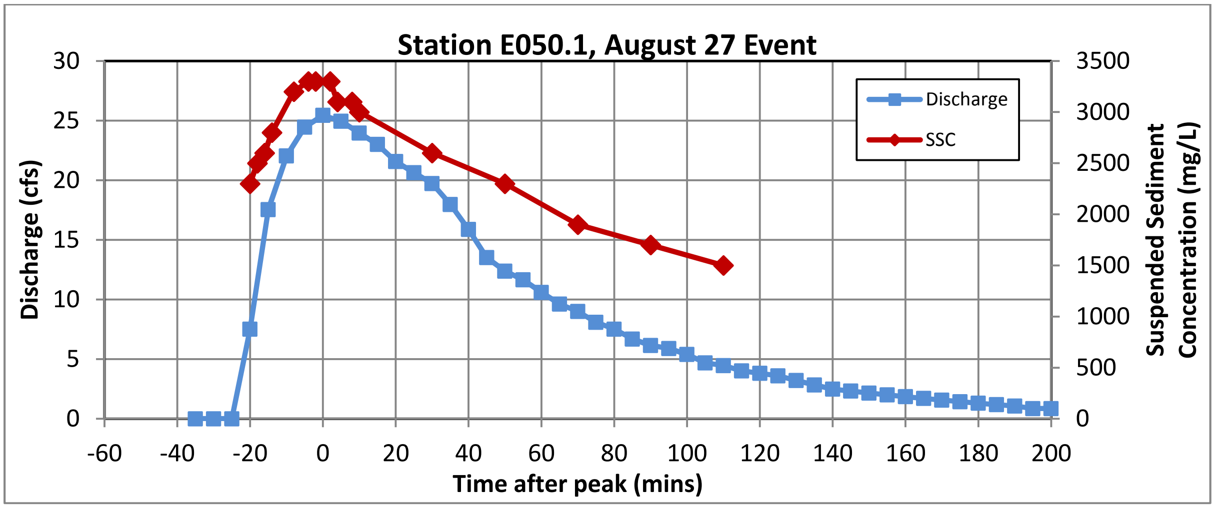


Figure 3.2-4 (continued) **Discharge and SSC for events sampled at E038, E039.1, E042.1, E050.1, and E059.5**

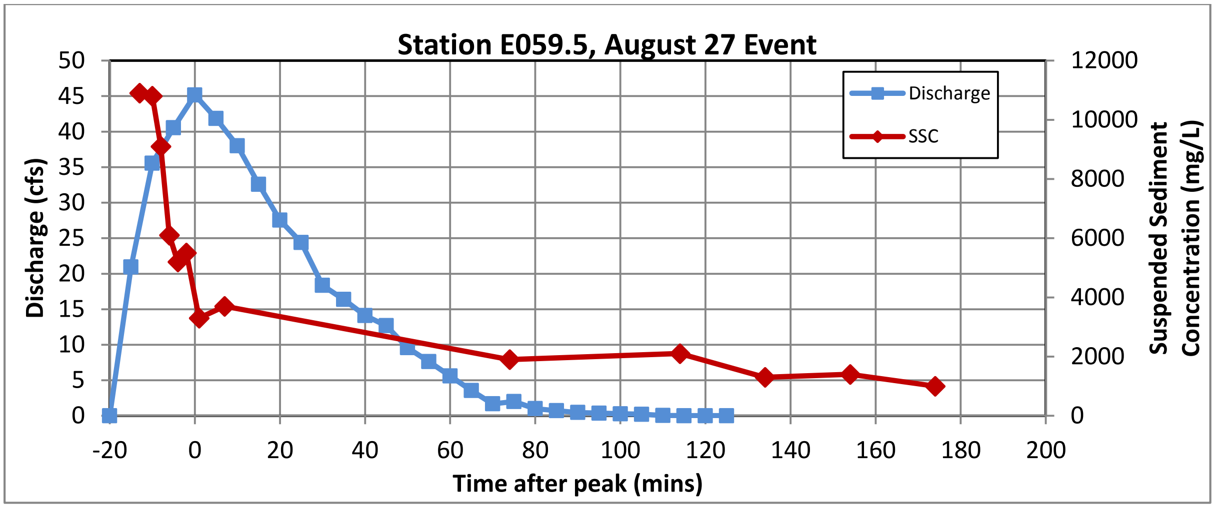


Figure 3.2-4 (continued) **Discharge and SSC for events sampled at E038, E039.1, E042.1, E050.1, and E059.5**

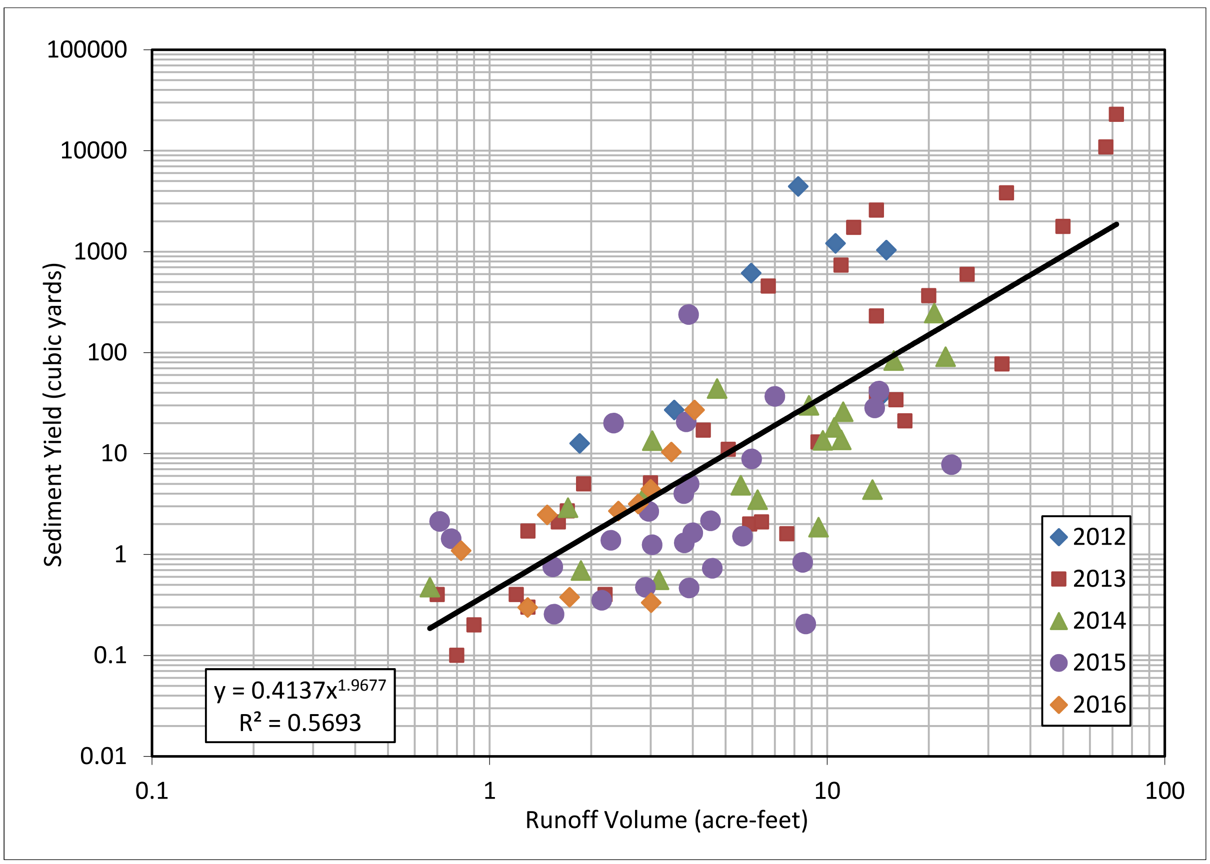


Figure 3.2-5 **Relationship between SSC-based sediment yield and runoff volume over the past 5 yr of monitoring**

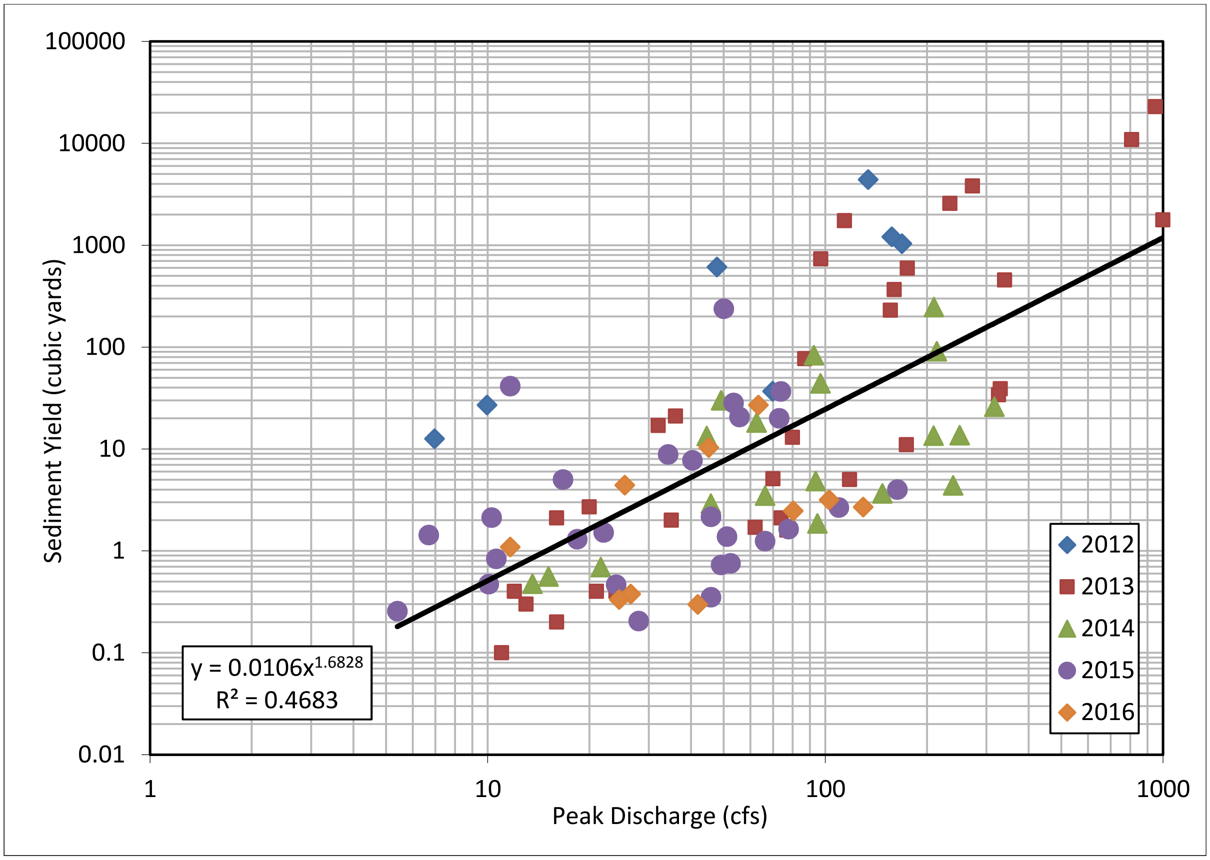


Figure 3.2-6 Relationship between SSC-based sediment yield and peak discharge over the past 5 yr of monitoring

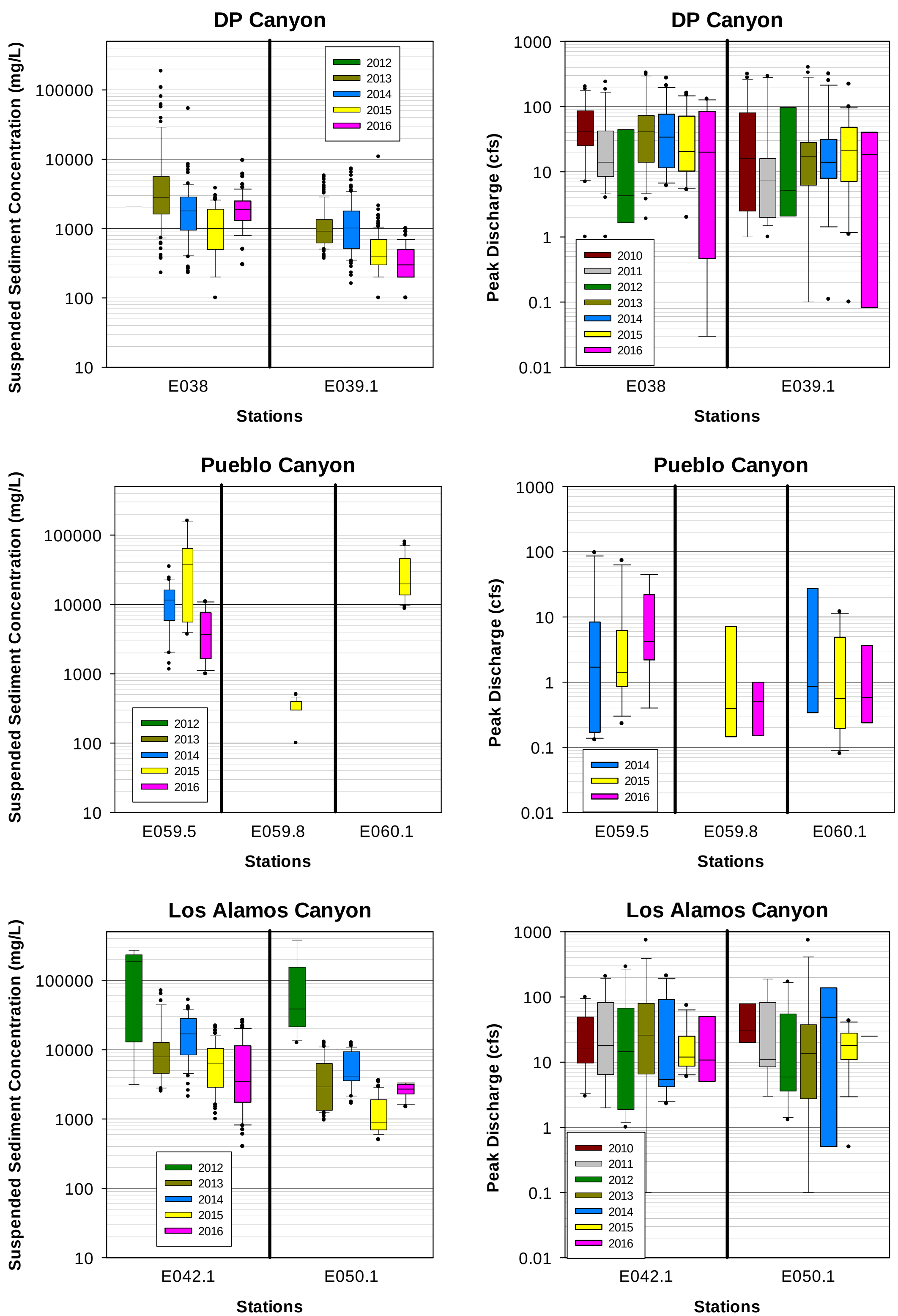


Figure 3.4-1 Box-and-whisker plots of SSC (left) and peak discharge (right) upstream and downstream of the watershed mitigations in DP (top), Pueblo (middle), and Los Alamos (bottom) Canyons over the past 5–7 yr of monitoring

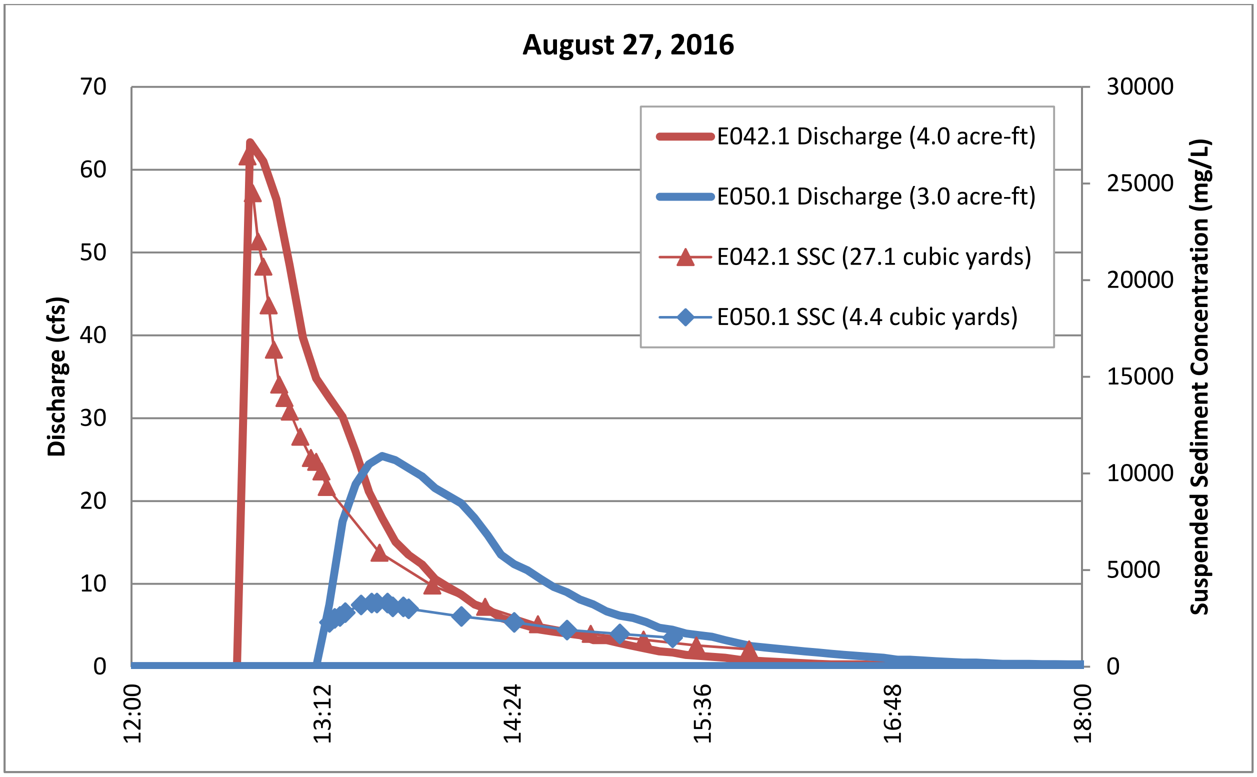


Figure 3.4-2 Discharge and SSC at E042.1 and E050.1 in upper Los Alamos Canyon on days when sampling of the same runoff event occurred

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

Gaging Station	Stage Measurement Sensor	Communication Method with Data Logger	Sampler Trip Level (Aboveground) (ft)	Sampler Intake Level (Aboveground) (in.)
E026	Probe	Radio telemetry	0.67	4
E030	Encoder	Radio telemetry	1.54	4
E038	Bubbler	Radio telemetry	2.28	4
E039.1	Encoder, bubbler	Radio telemetry	0.58	4
E040	Probe	Radio telemetry	2.73	4
E042.1	Encoder, bubbler	Radio telemetry	0.58	4
E050.1	Encoder, bubbler, probe	Radio telemetry	0.4	2.4
E055	Bubbler	Radio telemetry	0.9	4
E055.5	Bubbler	Radio telemetry	4.32	4
E056	Bubbler	Radio telemetry	1.89	4
E059.5	Bubbler	Radio telemetry	1.35	4
E059.8	Bubbler	Radio telemetry	1.5	4
E060.1	Encoder, bubbler, probe	Radio telemetry	0.4	2.4

Table 2.3-1
Maximum Daily Discharge and Storm Water Sampling in the LA/P Watershed during 2016

Date	Los Alamos Canyon Discharge (cfs)							Pueblo and Acid Canyon Discharge (cfs)					
	DP Canyon			Los Alamos Canyon				Acid Canyon		Pueblo Canyon			
	E038	E039.1	E040	E026	E030	E042.1	E050.1	E055.5	E056	E055	E059.5	E059.8	E060.1
7/19/2016	1.5 BT[a]	0 BT	0 BT	11 CT[b]	0 BT	0 BT	0 BT	0.3 BT	0 BT	0 BT	0 BT	0 BT	0 BT
8/3/2016	34 BT	26 S[c]	11 S	56 S	4 BT	0 BT	0 BT	5.8 BT	0.1 BT	9 BT	4.2 BT	0.1 BT	0 BT
8/7/2016	0.03 BT	0.1 BT	0 BT	0.4 BT	0 BT	0 BT	0 BT	0.2 BT	0.1 BT	17 S	4.0 BT	0 BT	0 BT
8/19/2016	80 S	EF[d] NS[e]	38 S	0.1 BT	1.4 BT	3.6 BT	0 BT	24 S	0.1 BT	0.1 BT	29 NS	0.5 BT	0.6 BT
8/24/2016	130 S	EF NS	75 S	0 BT	1.6 BT	9.6 BT	0 BT	10 S	0.1 BT	0 BT	7.9 BT	1.0 BT	0.3 BT
8/27/2016	100 S	EF NS	69 S	2 BT	9.8 BT	63 S	25 S	26 S	0.1 BT	6.7 BT	45 S	6.9 BT	3.6 BT
9/3/2016	0.03 BT	EF	0 BT	0.3 BT	0 BT	0 BT	0 BT	15 S	0.1 BT	18 S	4.1 BT	0.1 BT	0 BT
9/6/2016	24 BT	42 S	5 S	0.8 BT	3.6 BT	0 BT	0 BT	35 NS	0.1 BT	4.5 BT	15 NS	0.6 BT	3.8 BT
11/5/2016	16 BT	25 S	15 S	0 BT	0 BT	0 BT	0 BT	8.5 BT	17 S	8.3 BT	0.1 BT	0.01 BT	0.6 BT
11/5-11/6/2016	14 BT	40 CT	9.6 BT	0 BT	0 BT	12 S	0 BT	3.7 BT	8 BT	5.6 BT	0.4 BT	0.3 BT	0.1 BT

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

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

[c] 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.

[d] EF = Equipment failure. Equipment did not provide a discharge measurement.

[e] 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.

Table 2.3-2
Sampling Operational Issues during the 2016 Monitoring Year

Gaging Station	Date	Peak Discharge (cfs)	Reason	Comment
E026	7/19/2016	11	Trip level error margin	Sampler did not trigger because the peak discharge was close to the trip level and within the margin of error of +/- 2 cfs.
E039.1	8/19/2016	Not available	Equipment failure	Peak discharge was likely above trip level. Sensing equipment malfunctioned and no discharge measurement is available. Sampler did not attempt to sample.
E039.1	8/24/2016	Not available	Equipment failure	Peak discharge was likely above trip level. Sensing equipment malfunctioned and no discharge measurement is available. Sampler did not attempt to sample.
E039.1	8/27/2016	Not available	Equipment failure	Peak discharge was likely above trip level. Sensing equipment malfunctioned and no discharge measurement is available. Sampler did not attempt to sample.
E039.1	11/5-11/6/2016	40	Sampler full	Sampler was full from the previous storm 12 hours earlier, both of which occurred over the weekend
E055.5	9/6/2016	35	Silting	Silting at sampler intakes prevented sampler from attempting to sample. Controls built downstream of gage have caused silting at gage site.
E059.5	8/19/2016	29	Equipment calibration	Trip level was above flow levels. The equipment needs additional calibration.
E059.5	9/6/2016	15	Equipment calibration	Trip level was above flow levels. The equipment needs additional calibration.

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

[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
Aluminum	EPA:200.8	X	X	X	X	X	X	X
Americium-241	HASL-300:AM-241	X	—[c]	—	X	X	—	X
Chloride	EPA:300.0	X	X	X	X	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	—
Isotopic uranium	HASL-300:ISOU	X	X	—	X	X	—	—
Mercury	EPA:245.2	—	X	X	X	X	X	X
Particle size	ASTM:D3977-97	X	X	X	X	X	X	X
PCBs	EPA:1668A	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	—	—
SSC	ASTM:D3977-97	X	X	X	X	X	X	X
Selenium	EPA:200.8	—	X	X	X	X	X	X
Silver	EPA:200.7	—	—	—	—	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[d], dissolved	EPA:200.7/200.8/245.2	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	Aluminum (F10µm[c])	Yes	Yes	0.25
	8	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	Aluminum (F10µm)	Yes	Yes	0.25
	8	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	Aluminum (F10µm)	Yes	Yes	0.25
	6	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	Aluminum (F10µm)	Yes	Yes	0.25
	8	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	Aluminum (F10µm)	Yes	Yes	0.25
	7	Radium-226 and Radium-228 (UF)	Yes	Yes	2
	8	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	Aluminum (F10µm)	Yes	Yes	0.25
	6	Strontium-90	Yes	Yes	1
	7	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	Aluminum (F10µm)	Yes	Yes	0.25
	7	Radium-226 and Radium-228 (UF)	Yes	Yes	2
	8	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	Aluminum (F10µm)	Yes	Yes	0.25
	5	Gross alpha	Yes	Yes	1

[a] F = Analyses of filtered sample.

[b] UF = Analyses unfiltered sample.

[c] F10µm = Analyses total recoverable aluminum after 10-µm filtration.

Table 2.4-4
Planned and Actual Sampling Events

Planned					Actual
Gaging Station	Sampling Events Planned	Analytical Suite	Analytical Method	Analytical Suite Code	Sampling Events Collected
CO111 041	4	Alkalinity	EPA:150.1	SW-ALK+pH (UF[a])	4
		Aluminum	EPA: 200.8	SW-IP-AL (F10u[b])	4
		Chloride	EPA:300.0	SW-SO4+Cl (F[c])	4
		Dissolved organic carbon	SW-846:9060	SW-DOC (F)	4
		Gross alpha	EPA:900	SW-Gross Alpha (UF)	4
		Hardness	SM:A2340B	SW-IP-Hg+Se+U (UF)	4
		Mercury	EPA:245.2	SW-IP-Hg+Se+U (UF)	4
		Particle size	ASTM:D3977-97	SW-Particle Size - 1L (UF)	4
		PCBs	EPA:1668A	SW-PCB-1668A-MDL (UF)	4
		pH	EPA:310.1	SW-ALK+pH (UF)	4
		SSC	ASTM:D3977-97	SW-SSC (UF)	5
		Selenium	EPA:200.8	SW-IP-Hg+Se+U (UF)	4
		Sulfate	EPA:300.0	SW-SO4+Cl (F)	4
		TAL metals, dissolved	EPA:200.7/200.8/245.2	SW-TAL+B+U (F)	4
		Uranium	EPA:200.8	SW-IP-Hg+Se+U (UF)	4
E026	4	Alkalinity	EPA:150.1	SW-ALK+pH (UF)	1
		Aluminum	EPA: 200.8	SW-IP-AL (F10u)	1
		Chloride	EPA:300.0	SW-SO4+Cl (F)	1
		Dioxins/furans	EPA:1613B	SW-D/F-1613B (UF)	1
		Dissolved organic carbon	SW-846:9060	SW-DOC (F)	1
		Gamma spectroscopy	EPA:901.1	SW-GS+IsoPu (UF)	1
		Gross alpha	EPA:900	SW-Gross Alpha (UF)	1
		Hardness	SM:A2340B	SW-IP-Hg+Se+U (UF)	1
		Isotopic plutonium	HASL-300:ISOPU	SW-GS+IsoPu (UF)	1
		Mercury	EPA:245.2	SW-IP-Hg+Se+U (UF)	1
		Particle size	ASTM:D3977-97	SW-Particle Size - 1L (UF)	1
		PCBs	EPA:1668A	SW-PCB-1668A-MDL (UF)	1
		pH	EPA:310.1	SW-ALK+pH (UF)	1
		SSC	ASTM:D3977-97	SW-SSC (UF)	1
		Selenium	EPA:200.8	SW-IP-Hg+Se+U (UF)	1
		Strontium-90	EPA:905.0	SW-SR90 (UF)	1

Table 2.4-4 (continued)

Planned					Actual
Gaging Station	Sampling Events Planned	Analytical Suite	Analytical Method	Analytical Suite Code	Sampling Events Collected
E026	4	Sulfate	EPA:300.0	SW-SO4+Cl (F)	1
		TAL metals[d], dissolved	EPA:200.7/200.8/245.2	SW-TAL+B+U (F)	1
		Uranium	EPA:200.8	SW-IP-Hg+Se+U (UF)	1
E038	4	Alkalinity	EPA:150.1	SW-ALK+pH (UF)	3
		Aluminum	EPA:200.8	SW-IP-AL (F10u)	3
		Chloride	EPA:300.0	SW-SO4+Cl (F)	3
		Dissolved organic carbon	SW-846:9060	SW-DOC (F)	3
		Gamma spectroscopy	EPA:901.1	SW-GS+IsoPu (UF)	3
		Gross alpha	EPA:900	SW-Gross Alpha (UF)	3
		Hardness	SM:A2340B	SW-IP-Hg+Se+U (UF)	3
		Isotopic plutonium	HASL-300:ISOPU	SW-GS+IsoPu (UF)	3
		Mercury	EPA:245.2	SW-IP-Hg+Se+U (UF)	3
		Particle size	ASTM:C1070-01	SW-Particle Size - 1L (UF)	2
		PCBs	EPA:1668A	SW-PCB-1668A-MDL (UF)	3
		pH	EPA:310.1	SW-ALK+pH (UF)	3
		SSC	ASTM:D3977-97	SW-SSC (UF)	3
		Selenium	EPA:200.8	SW-IP-Hg+Se+U (UF)	3
		Strontium-90	EPA:905.0	SW-SR90 (UF)	3
		Sulfate	EPA:300.0	SW-SO4+Cl (F)	3
		TAL metals, dissolved	EPA:200.7/200.8/245.2	SW-TAL+B+U (F)	3
		Uranium	EPA:200.8	SW-IP-Hg+Se+U (UF)	3
E039.1	4	Alkalinity	EPA:150.1	SW-ALK+pH (UF)	3
		Aluminum	EPA:200.8	SW-IP-AL (F10u)	3
		Chloride	EPA:300.0	SW-SO4+Cl (F)	3
		Dissolved organic carbon	SW-846:9060	SW-DOC (F)	3
		Gamma spectroscopy	EPA:901.1	SW-GS+IsoPu (UF)	3
		Gross alpha	EPA:900	SW-Gross Alpha (UF)	3
		Hardness	SM:A2340B	SW-IP-Hg+Se+U (UF)	3
		Isotopic plutonium	HASL-300:ISOPU	SW-GS+IsoPu (UF)	3
		Mercury	EPA:245.2	SW-IP-Hg+Se+U (UF)	3
		Particle size	A`STM:D3977-97	SW-Particle Size - 1L (UF)	3
		PCBs	EPA:1668A	SW-PCB-1668A-MDL (UF)	3
		pH	EPA:310.1	SW-ALK+pH (UF)	3
		SSC	ASTM:D3977-97	SW-SSC (UF)	3

Table 2.4-4 (continued)

Planned					Actual
Gaging Station	**Sampling Events Planned**	**Analytical Suite**	**Analytical Method**	**Analytical Suite Code**	**Sampling Events Collected**
E039.1	4	Selenium	EPA:200.8	SW-IP-Hg+Se+U (UF)	3
		Strontium-90	EPA:905.0	SW-SR90 (UF)	3
		Sulfate	EPA:300.0	SW-SO4+Cl (F)	3
		TAL metals, dissolved	EPA:200.7/200.8/245.2	SW-TAL+B+U (F)	3
		Uranium	EPA:200.8	SW-IP-Hg+Se+U (UF)	3
E040	4	Alkalinity	EPA:150.1	SW-ALK+pH (UF)	5
		Aluminum	EPA:200.8	SW-IP-AL (F10u)	5
		Chloride	EPA:300.0	SW-SO4+Cl (F)	5
		Dissolved organic carbon	SW-846:9060	SW-DOC (F)	5
		Gamma spectroscopy	EPA:901.1	SW-GS+IsoPu (UF)	5
		Gross alpha	EPA:900	SW-Gross Alpha (UF)	5
		Hardness	SM:A2340B	SW-IP-Hg+Se+U (UF)	5
		Isotopic plutonium	HASL-300:ISOPU	SW-GS+IsoPu (UF)	5
		Mercury	EPA:245.2	SW-IP-Hg+Se+U (UF)	5
		Particle size	ASTM:D3977-97	SW-Particle Size - 1L (UF)	5
		PCBs	EPA:1668A	SW-PCB-1668A-MDL (UF)	5
		pH	EPA:310.1	SW-ALK+pH (UF)	5
		SSC	ASTM:D3977-97	SW-SSC (UF)	6
		Selenium	EPA:200.8	SW-IP-Hg+Se+U (UF)	5
		Strontium-90	EPA:905.0	SW-SR90 (UF)	5
		Sulfate	EPA:300.0	SW-SO4+Cl (F)	5
		TAL metals, dissolved	EPA:200.7/200.8/245.2	SW-TAL+B+U (F)	5
		Uranium	EPA:200.8	SW-IP-Hg+Se+U (UF)	5
E042.1	4	Alkalinity	EPA:150.1	SW-ALK+pH (UF)	2
		Aluminum	EPA:200.8	SW-IP-AL (F10u)	2
E042.1	4	Americium-241	HASL-300:AM-241	SW-IsoPu/U/Am241 (UF)	2
		Chloride	EPA:300.0	SW-SO4+Cl (F)	2
		Dioxins/furans	EPA:1613B	SW-D/F-1613B (UF)	2
		Dissolved organic carbon	SW-846:9060	SW-DOC (F)	2
		Gamma spectroscopy	EPA:901.1	SW-GS+GrossA (UF)	2
		Gross alpha	EPA:900	SW-GS+GrossA (UF)	2
		Hardness	SM:A2340B	SW-IP-Hg+Se+U (UF)	2
		Isotopic plutonium	HASL-300:ISOPU	SW-IsoPu/U/Am241 (UF)	2
		Mercury	EPA:245.2	SW-IP-Hg+Se+U (UF)	2

Table 2.4-4 (continued)

Planned					Actual
Gaging Station	**Sampling Events Planned**	**Analytical Suite**	**Analytical Method**	**Analytical Suite Code**	**Sampling Events Collected**
E042.1	4	Particle size	ASTM:D3977-97	SW-Particle Size - 1L (UF)	2
		PCBs	EPA:1668A	SW-PCB-1668A-MDL (UF)	2
		pH	EPA:310.1	SW-ALK+pH (UF)	2
		SSC	ASTM:D3977-97	SW-SSC (UF)	2
		Selenium	EPA:200.8	SW-IP-Hg+Se+U (UF)	2
		Strontium-90	EPA:905.0	SW-SR90 (UF)	2
		Sulfate	EPA:300.0	SW-SO4+Cl (F)	2
		TAL metals, dissolved	EPA:200.7/200.8/245.2	SW-TAL+B+U (F)	2
		Uranium	EPA:200.8	SW-IP-Hg+Se+U (UF)	2
E050.1	4	Alkalinity	EPA:150.1	SW-ALK+pH (UF)	1
		Aluminum	EPA:200.8	SW-IP-AL (F10u)	1
		Americium-241	HASL-300:AM-241	SW-IsoPu/U/Am241 (UF)	1
		Chloride	EPA:300.0	SW-SO4+Cl (F)	1
		Dioxins/furans	EPA:1613B	SW-D/F-1613B (UF)	1
		Dissolved organic carbon	SW-846:9060	SW-DOC (F)	1
		Gamma spectroscopy	EPA:901.1	SW-GS+GrossA (UF)	1
		Gross alpha	EPA:900	SW-GS+GrossA (UF)	1
		Gross beta	EPA:900	SW-GrossB (UF)	1
		Hardness	SM:A2340B	SW-IP-Hg+Se+U (UF)	1
		Isotopic plutonium	HASL-300:ISOPU	SW-IsoPu/U/Am241 (UF)	1
		Isotopic uranium	HASL-300:ISOU	SW-IsoPu/U/Am241 (UF)	1
		Particle size	ASTM:D3977-97	SW-Particle Size - 1L (UF)	1
		PCBs	EPA:1668A	SW-PCB-1668A-MDL (UF)	1
		pH	EPA:310.1	SW-ALK+pH (UF)	1
		Radium-226/radium-228	EPA:903.1/904	SW-Ra226/Ra228 (UF)	1
E050.1	4	SSC	ASTM:D3977-97	SW-SSC (UF)	1
		Strontium-90	EPA:905.0	SW-SR90 (UF)	1
		Sulfate	EPA:300.0	SW-SO4+Cl (F)	1
		TAL metals, dissolved	EPA:200.7/200.8/245.2	SW-TAL+B+U (F)	1
		TAL metals, total	EPA:200.7/200.8/245.2	SW-TAL+B+U (UF)	1
E055	4	Alkalinity	EPA:150.1	SW-ALK+pH (UF)	2
		Aluminum	EPA:200.8	SW-IP-AL (F10u)	2
		Americium-241	HASL-300:AM-241	SW-Am241+ISOPU (UF)	2
		Chloride	EPA:300.0	SW-SO4+Cl (F)	2

Table 2.4-4 (continued)

Planned					Actual
Gaging Station	**Sampling Events Planned**	**Analytical Suite**	**Analytical Method**	**Analytical Suite Code**	**Sampling Events Collected**
E055	4	Dissolved organic carbon	SW-846:9060	SW-DOC (F)	2
		Gamma spectroscopy	EPA:901.1	SW-GS+GrossA (UF)	2
		Gross alpha	EPA:900	SW-GS+GrossA (UF)	2
		Hardness	SM:A2340B	SW-TAL+B+U (F)	2
		Mercury	EPA:245.2	SW-IP-Hg+Se+U (UF)	2
		Isotopic plutonium	HASL-300:ISOPU	SW-Am241+ISOPU (UF)	2
		Particle size	ASTM:D3977-97	SW-Particle Size - 1L (UF)	2
		PCBs	EPA:1668A	SW-PCB-1668A-MDL (UF)	2
		pH	EPA:310.1	SW-ALK+pH (UF)	2
		SSC	ASTM:D3977-97	SW-SSC (UF)	2
		Selenium	EPA:200.8	SW-IP-Hg+Se+U (UF)	2
		Silver	EPA:200.7	SW-Ag (UF)	2
		Sulfate	EPA:300.0	SW-SO4+Cl (F)	2
		TAL metals, dissolved	EPA:200.7/200.8/245.2	SW-TAL+B+U (F)	2
		Uranium	EPA:200.8	SW-IP-Hg+Se+U (UF)	2
E055.5	4	Alkalinity	EPA:150.1	SW-ALK+pH (UF)	4
		Aluminum	EPA:200.8	SW-IP-AL (F10u)	3
		Americium-241	HASL-300:AM-241	SW-Am241+ISOPU (UF)	4
		Chloride	EPA:300.0	SW-SO4+Cl (F[c])	3
		Dissolved organic carbon	SW-846:9060	SW-DOC (F)	3
		Gamma spectroscopy	EPA:901.1	SW-GS+GrossA (UF)	4
		Gross alpha	EPA:900	SW-GS+GrossA (UF)	4
		Hardness	SM:A2340B	SW-TAL+B+U (F)	3
		Isotopic plutonium	HASL-300:ISOPU	SW-Am241+ISOPU (UF)	4
		Mercury	EPA:245.2	SW-IP-Hg+Se+U (UF)	3
		Particle size	ASTM:D3977-97	SW-Particle Size - 1L (UF)	4
E055.5	4	PCBs	EPA:1668A	SW-PCB-1668A-MDL (UF)	4
		pH	EPA:310.1	SW-ALK+pH (UF)	4
		SSC	ASTM:D3977-97	SW-SSC (UF)	4
		Selenium	EPA:200.8	SW-IP-Hg+Se+U (UF)	3
		Silver	EPA:200.7	SW-Ag (UF)	3
		Sulfate	EPA:300.0	SW-SO4+Cl (F)	3
		TAL metals, dissolved	EPA:200.7/200.8/245.2	SW-TAL+B+U (F)	3
		Uranium	EPA:200.8	SW-IP-Hg+Se+U (UF)	3

Table 2.4-4 (continued)

Planned					Actual
Gaging Station	Sampling Events Planned	Analytical Suite	Analytical Method	Analytical Suite Code	Sampling Events Collected
E056	4	Alkalinity	EPA:150.1	SW-ALK+pH (UF)	0
		Aluminum	EPA:200.8	SW-IP-AL (F10u)	0
		Americium-241	HASL-300:AM-241	SW-Am241+ISOPU (UF)	1
		Chloride	EPA:300.0	SW-SO4+Cl (F)	0
		Dissolved organic carbon	SW-846:9060	SW-DOC (F)	0
		Gamma spectroscopy	EPA:901.1	SW-GS+GrossA (UF)	1
		Gross alpha	EPA:900	SW-GS+GrossA (UF)	1
		Hardness	SM:A2340B	SW-TAL+B+U (F)	0
		Isotopic plutonium	HASL-300:ISOPU	SW-Am241+ISOPU (UF)	1
		Mercury	EPA:245.2	SW-IP-Hg+Se+U (UF)	0
		Particle size	ASTM:D3977-97	SW-Particle Size - 1L (UF)	0
		PCBs	EPA:1668A	SW-PCB-1668A-MDL (UF)	0
		pH	EPA:310.1	SW-ALK+pH (UF)	0
		SSC	ASTM:D3977-97	SW-SSC (UF)	1
		Selenium	EPA:200.8	SW-IP-Hg+Se+U (UF)	0
		Silver	EPA:200.7	SW-Ag (UF)	0
		Sulfate	EPA:300.0	SW-SO4+Cl (F)	0
		TAL metals, dissolved	EPA:200.7/200.8/245.2	SW-TAL+B+U (F)	0
		Uranium	EPA:200.8	SW-IP-Hg+Se+U (UF)	0
E059.5	4	Alkalinity	EPA:150.1	SW-ALK+pH (UF)	1
		Aluminum	EPA:200.8	SW-IP-AL (F10u)	1
		Americium-241	HASL-300:AM-241	SW-/Am241+ISOPU (UF)	1
		Chloride	EPA:300.0	SW-SO4+Cl (F)	1
		Dissolved organic carbon	SW-846:9060	SW-DOC (F)	1
		Gamma spectroscopy	EPA:901.1	SW-GS+GrossA (UF)	1
		Gross alpha	EPA:900	SW-GS+GrossA (UF)	1
		Hardness	SM:A2340B	SW-TAL+B+U (F)	1
		Isotopic plutonium	HASL-300:ISOPU	SW-Am241+ISOPU (UF)	1
		Mercury	EPA:245.2	SW-IP-Hg+Se+U (UF)	1
		Particle size	ASTM:D3977-97	SW-Particle Size - 1L (UF)	1
		PCBs	EPA:1668A	SW-PCB-1668A-MDL (UF)	1
		pH	EPA:310.1	SW-ALK+pH (UF)	1
		SSC	ASTM:D3977-97	SW-SSC (UF)	1
		Selenium	EPA:200.8	SW-IP-Hg+Se+U (UF)	1

Table 2.4-4 (continued)

Planned					Actual
Gaging Station	Sampling Events Planned	Analytical Suite	Analytical Method	Analytical Suite Code	Sampling Events Collected
E059.5	4	Silver	EPA:200.7	SW-Ag (UF)	1
		Strontium-90	EPA:905.0	SW-SR90	1
		Sulfate	EPA:300.0	SW-SO4+Cl (F)	1
		TAL metals, dissolved	EPA:200.7/200.8/245.2	SW-TAL+B+U (F)	1
		Uranium	EPA:200.8	SW-IP-Hg+Se+U (UF)	1

[a] UF = Unfiltered.

[b] F10u = Filtered with 10-µm pore-size filter.

[c] F = Filtered.

[d] TAL = components of the TAL list plus boron and uranium.

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

Gaging Station/ Location	Count of Sampled Storm Events	Count Retrieved on First Working Day	Count Retrieved after First Working Day	Comment
CO111041	5	3	2	2 working days between sample collection on 08/19/2016 and sample retrieval on 08/23/2016. 1 working day between sample collection on 08/24/2016 and sample retrieval on 08/25/2016. 2 working days between sample collection on 08/27/2016 and sample retrieval on 08/30/2016. 1 working day between sample collection on 09/06/2016 and sample retrieval on 09/07/2016. 1 working day between sample collection on 11/05/2016 and sample retrieval on 11/07/2016.
E026	1	1	0	1 working day between sample collection on 08/03/2016 and sample retrieval on 08/04/2016.
E038	3	2	1	1 working day between sample collection on 08/19/2016 and sample retrieval on 08/22/2016. 1 working day between sample collection on 08/24/2016 and sample retrieval on 08/25/2016. 3 working days between sample collection on 08/27/2016 and sample retrieval on 08/31/2016.
E039.1	3	2	1	2 working days between sample collection on 08/03/2016 and sample retrieval on 08/05/2016. 1 working day between sample collection on 09/06/2016 and sample retrieval on 09/07/2016. 1 working day between sample collection on 11/05/2016 and sample retrieval on 11/07/2016.
E040	6	3	3	2 working days between sample collection on 08/03/2016 and sample retrieval on 08/05/2016. 2 working days between sample collection on 08/19/2016 and sample retrieval on 08/23/2016. 1 working day between sample collection on 08/24/2016 and sample retrieval on 08/25/2016. 2 working days between sample collection on 08/27/2016 and sample retrieval on 08/30/2016. 1 working day between sample collection on 09/06/2016 and sample retrieval on 09/07/2016. 1 working day between sample collection on 11/05/2016 and sample retrieval on 11/07/2016.
E042.1	2	1	1	1 working day between sample collection on 08/27/2016 and sample retrieval on 08/29/2016. 2 working days between sample collection on 11/06/2016 and sample retrieval on 11/08/2016.
E050.1	1	1	0	1 working day between sample collection on 08/27/2016 and sample retrieval on 08/29/2016.

Table 2.5-1 (continued)

Gaging Station/ Location	Count of Sampled Storm Events	Count Retrieved on First Working Day	Count Retrieved after First Working Day	Comment
E055	2	1	1	2 working days between sample collection on 08/07/2016 and sample retrieval on 08/09/2016. 1 working day between sample collection on 09/03/2016 and sample retrieval on 09/06/2016.
E055.5	4	2	2	1 working day between sample collection on 08/19/2016 and sample retrieval on 08/22/2016. 2 working days between sample collection on 08/24/2016 and sample retrieval on 08/26/2016. 3 working days between sample collection on 08/27/2016 and sample retrieval on 08/31/2016. 1 working day between sample collection on 09/03/2016 and sample retrieval on 09/06/2016.
E056	1	0	1	3 working days between sample collection on 11/05/2016 and sample retrieval on 11/09/2016.
E059.5	1	0	1	2 working days between sample collection on 08/27/2016 and sample retrieval on 08/30/2016.

Table 2.5-2
Gaging Station Operational Issues during the 2016 Monitoring Year

Gaging Station	Operational Issue	Issue Date	Repair Date	Working Days from Issue to Repair	Potential Missed Discharge above Trigger
E039.1	Equipment failure	8/18/2016	9/6/2016	12	Yes
E040	Silting	8/3/2016	8/5/2016	2	None
E040	Silting	8/5/2016	8/10/2016	3	None
E040	Silting	8/20/2016	8/23/2016	1	None
E040	Silting	8/24/2016	9/7/2016	8	None
E040	Silting	11/5/2016	4/3/2017[a]	n/a[b]	None
E055.5	Silting	8/27/2016	To be determined[c]	n/a	Yes

[a] The silting occurred during the last storm event of the monitoring year, during which samples were collected. Samplers were disabled after this event.

[b] n/a = Not applicable.

[c] The silting at E055.5 is because of an Individual Permit control that was installed downstream of the gaging station and which, unfortunately, inundated the station. LANL is planning to install an ultrasonic probe or radar stage sensor instead of the bubbler that is currently there, and that would be more appropriate in an open channel with a depositional/erosional stream bed. This will be performed before the beginning of the 2017 monitoring year.

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
12-May-16	—[a]	—	—	—	—	—	—	—	7 SA[b] & GI[c]	—	—	—	—	—	7 SA & GI
17-May-16	—	—	—	—	28 SA & GI	—	—	—	—	—	—	—	—	—	—
18-May-16	—	—	—	—	—	29 SA & GI	—	—	6 GSI[d]	—	—	—	—	—	—
19-May-16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7 GSI
20-May-16	—	—	—	—	—	—	—	—	—	30 SA & GI	30 SA & GI	30 GI	—	—	—
23-May-16	—	—	26 SA & GI	—	—	—	—	—	—	—	—	3 SA & GI	—	—	—
24-May-16	—	—	—	—	—	—	—	—	—	—	—	—	26 SA & GI	27 SA & GI	—
25-May-16	—	—	—	28 SA & GI	—	—	28 SA & GI	28 SA & GI	—	—	—	—	—	—	—
26-May-16	Initial SA	Initial SA	—	—	—	—	—	—	8 GSI	—	—	—	—	—	7 GSI
1-Jun-16	6 SI[e]	6 SI	9 GSI	7 GSI	—	—	7 GSI	7 GSI	6 GSI	12 GSI	—	9 GSI	8 GSI	8 GSI	6 GSI
2-Jun-16	—	—	—	—	16 GSI	15 GSI	—	—	—	—	13 GSI	—	—	—	—
3-Jun-16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2 GM[f]
6-Jun-16	—	—	—	—	4 GSI	4 GSI	—	—	—	—	—	—	5 GSI	5 GSI	3 GSI
7-Jun-16	6 SI	6 SI	6 GSI	6 GSI	—	—	6 GSI	6 GSI	6 GSI	—	—	—	—	—	—
9-Jun-16	—	—	—	—	—	—	—	—	—	8 GSI	7 GSI	8 GSI	—	—	—
13-Jun-16	—	—	—	—	7 GSI	7 GSI	—	—	—	—	—	—	7 GSI	7 GSI	7 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
16-Jun-16	—	9 SI	9 GSI	9 GSI	—	—	9 GSI	9 GSI	9 GSI	—	—	—	—	—	—
17-Jun-16	10 SI	—	—	—	—	—	—	—	—	8 GSI	8 GSI	8 GSI	—	—	—
21-Jun-16	4 SI	5 SI	5 GSI	5 GSI	—	—	5 GSI	5 GSI	5 GSI	—	—	—	—	—	—
22-Jun-16	—	—	—	—	—	—	—	—	—	—	—	—	9 GSI	9 GSI	9 GSI & GM
23-Jun-16	—	—	—	—	10 GSI	10 GSI	—	—	—	—	—	—	—	—	—
24-Jun-16	—	—	—	—	—	—	—	—	—	7 GSI	7 GSI	7 GSI	—	—	—
28-Jun-16	7 SI	7 SI	7 GSI	7 GSI	—	5 GSI	7 GSI	7 GSI	7 GSI	—	—	—	6 GSI	6 GSI	6 GSI
29-Jun-16	—	—	—	—	6 GSI	—	—	—	—	—	—	—	—	—	—
30-Jun-16	—	—	—	—	—	—	—	—	—	6 GSI	6 GSI	6 GSI	—	—	—
6-Jul-16	8 SI	8 SI	8 GSI	8 GSI	—	8 GSI	8 GSI	8 GSI	8 GSI	—	—	—	8 GSI	8 GSI	8 GSI
7-Jul-16	—	—	—	—	8 GSI	—	—	—	—	7 GSI	7 GSI	7 GSI	—	—	—
12-Jul-16	6 SI	6 SI	6 GSI	6 GSI	—	—	6 GSI	6 GSI	6 GSI	—	—	—	6 GSI	6 GSI	—
13-Jul-16	—	—	—	—	—	7 GSI	—	—	—	—	—	—	—	—	—
14-Jul-16	—	—	—	—	7 GSI	—	—	—	—	7 GSI	7 GSI	7 GSI	—	—	8 GSI
19-Jul-16	7 SI	7 SI	7 GSI	7 GSI	—	—	7 GSI	7 GSI	7 GSI	—	—	—	7 GSI	7 GSI	5 GSI
21-Jul-16	—	—	—	—	7 GSI	8 GSI	—	—	—	7 GSI	7 GSI	7 GSI	—	—	—
25-Jul-16	—	—	—	—	—	4 GSI	—	—	—	4 GSI	—	4 GSI	6 GSI	6 GSI	6 GSI
26-Jul-16	—	—	—	—	5 GM	—	—	—	—	—	—	—	—	—	—
27-Jul-16	—	—	—	—	1 GSI	—	—	—	—	—	6 GSI	—	—	—	—
28-Jul-16	9 SI	9 SI	9 GSI	9 GSI	—	—	9 GSI	9 GSI	9 GSI	—	—	—	—	—	—
2-Aug-16	—	—	—	—	—	8 GSI	—	—	—	—	—	—	8 GSI	8 GSI	8 GSI
3-Aug-16	6 SI	6 SI	6 GSI	6 GSI	7 GSI	—	6 GSI	6 GSI	6 GSI	9 GSI	7 GSI	9 GSI	—	—	—
4-Aug-16	—	—	1 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
5-Aug-16	—	—	—	—	—	3 GSI	2 GSI	—	—	—	—	—	—	—	—
9-Aug-16	—	—	—	—	—	—	—	—	—	6 GSI	6 GSI	6 GSI	—	—	7 GSI
10-Aug-16	7 SI	7 SI	6 GSI	7 GSI	—	—	5 GSI	7 GSI	7 GSI	—	—	—	—	—	—
11-Aug-16	—	—	—	—	8 GSI	6 GSI	—	—	—	—	—	—	9 GSI	9 GSI	—
16-Aug-16	—	—	—	—	5 GSI	5 GSI	—	—	—	—	—	—	5 GSI	5 GSI	7 GSI
17-Aug-16	7 SI	7 SI	7 GSI	7 GSI	—	—	7 GSI	7 GSI	7 GSI	—	—	—	—	—	—
18-Aug-16	—	—	—	—	—	—	—	—	—	9 GSI	9 GSI	9 GSI	—	—	—
22-Aug-16	—	—	—	—	6 GSI	—	—	—	—	—	4 GSI	—	—	—	6 GSI
23-Aug-16	6 SI	6 SI	6 GSI	6 GSI	—	—	6 GSI	—	—	—	—	—	—	—	—
25-Aug-16	—	2 SI	—	—	3 SI	—	2 SI	8 GSI	8 GSI	—	—	—	—	—	—
26-Aug-16	—	—	—	—	—	10 GSI	—	—	—	8 GSI	4 SI	8 GSI	10 GSI	10 GSI	—
29-Aug-16	—	—	—	—	—	3 SI	—	4 GSI	4 GSI	—	—	—	—	—	7 GSI
30-Aug-16	7 SI	5 SI	7 GSI	7 GSI	—	—	5 GSI	—	—	—	—	—	4 GSI	4 GSI	—
31-Aug-16	—	—	—	—	6 GSI	—	—	—	—	—	5 GSI	—	—	—	—
1-Sep-16	—	—	—	—	—	3 GI	—	—	—	—	—	—	—	—	—
2-Sep-16	—	—	—	—	—	—	—	—	—	7 GSI	—	7 GSI	—	—	—
6-Sep-16	—	—	—	—	—	—	—	—	—	4 GSI	6 SI	4 GSI	—	—	—
7-Sep-16	8 SI	8 SI	8 GSI	8 GSI	7 GSI	6 GSI	8 GSI	—	—	—	—	—	—	—	—
8-Sep-16	—	—	—	—	—	—	—	10 GSI	10 GSI	—	—	—	9 GSI	9 GSI	10 GSI
9-Sep-16	—	—	—	—	—	—	—	—	—	—	3 GI	—	—	—	—
12-Sep-16	5 SI	5 SI	5 GSI	5 GSI	5 GSI	5 GM & SI	5 GSI	4 GSI	4 GSI	—	—	—	—	—	—
13-Sep-16	—	—	—	—	—	—	—	—	—	7 GSI	4 GSI	7 GM & SI	5 GSI	5 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
14-Sep-16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6 GSI
15-Sep-16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19-Sep-16	—	—	—	—	—	—	—	—	—	6 GSI	6 GSI	6 GSI	—	—	—
20-Sep-16	8 SI	8 SI	8 GSI	8 GSI	8 GSI	—	8 GSI	8 GSI	—	—	—	—	—	—	—
21-Sep-16	—	—	—	—	—	—	—	—	9 GSI	—	—	—	8 GSI	8 GSI	—
22-Sep-16	—	—	—	—	—	10 GSI	—	—	—	—	—	—	—	—	8 GSI
27-Sep-16	7 SI	7 SI	7 GSI	7 GSI	—	—	7 GSI	7 GSI	—	—	—	—	6 GSI	6 GSI	—
28-Sep-16	—	—	—	—	8 GSI	6 GSI	—	—	—	—	—	—	—	—	—
29-Sep-16	—	—	—	—	—	—	—	—	8 GSI	10 GSI	10 GSI	10 GSI	—	—	7 GSI
4-Oct-16	7 SI	7 SI	7 GSI	7 GSI	—	—	7 GSI	7 GSI	5 GSI	—	—	—	—	—	—
6-Oct-16	—	—	—	—	8 GSI	8 GSI	—	—	—	7 GSI	7 GSI	7 GSI	9 GSI	9 GSI	7 GSI
12-Oct-16	8 SI	8 SI	8 GSI	8 GSI	—	—	8 GSI	8 GSI	8 GSI	—	—	—	—	—	—
13-Oct-16	—	—	—	—	7 GSI	7 GSI	—	—	—	—	—	—	7 GSI	7 GSI	7 GSI
14-Oct-16	—	—	—	—	—	—	—	—	—	8 GSI	8 GSI	8 GSI	—	—	—
17-Oct-16	5 SI	5 SI	5 GSI	5 GSI	—	—	5 GSI	5 GSI	5 GSI	—	—	—	—	—	—
18-Oct-16	—	—	—	—	5 GI	—	—	—	—	—	—	—	—	—	—
19-Oct-16	—	—	—	—	1 SI	6 GSI	—	—	—	—	—	—	—	—	—
20-Oct-16	—	—	—	—	—	—	—	—	—	6 GSI	6 GSI	6 GSI	7 GSI	7 GSI	7 GSI
27-Oct-16	10 SI	10 SI	10 GSI	10 GSI	—	—	10 GSI	10 GSI	10 GSI	—	—	—	7 GSI	7 GSI	7 GSI
28-Oct-16	—	—	—	—	9 GSI	9 GSI	—	—	—	8 GSI	8 GSI	8 GSI	—	—	—
1-Nov-16	5 SI	5 SI	5 GSI	5 GSI	—	—	5 GSI	5 GSI	5 GSI	—	—	—	—	—	—
2-Nov-16	—	—	—	—	5 GSI	5 GSI	—	1 GM	—	—	—	—	—	—	—
3-Nov-16	—	—	—	—	—	—	—	—	—	—	—	—	7 GSI	7 GSI	7 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-Nov-16	—	6 SSD[g]	—	—	—	5 GI & SSD	6 GSI	—	—	—	—	—	—	—	—
8-Nov-16	7 SSD	—	7 GI & SSD	7 GI & SSD	—	—	—	6 GI & SSD	—	—	—	—	—	—	—
9-Nov-16	—	—	—	—	—	—	—	—	—	12 GI & SSD	12 GI & SSD	12 GI & SSD	—	—	—
10-Nov-16	—	—	—	—	8 GI & SSD	—	—	—	9 GI & SSD	—	—	—	7 GI & SSD	7 GI & SSD	7 GI & SSD
17-Nov-16	—	—	—	—	—	—	—	—	7 GI	—	—	—	—	—	7 GI
22-Nov-16	—	—	—	—	—	—	—	—	5 GI	—	—	—	—	—	5 GI
28-Nov-16	—	—	—	—	—	—	—	—	—	—	—	—	—	18 GI	6 GI
30-Nov-16	—	—	22 GI	—	—	—	—	—	—	—	—	—	—	—	—
1-Dec-16	—	—	—	23 GI	21 GI	—	24 GI & SSD	23 GI	—	—	—	—	—	—	—

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

[a] — = No inspection performed.

[b]SA = Sampler activation

[c]GI = Gage inspection

[d]GSI = Gage and sampler inspection

[e] SI = Sampler inspection

[f]GM = Gage maintenance

[g] 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 2016 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		
8/3	35	34	26	−	24	—[b]	0	0	—	—
8/7	35	0.03	0.1	+	57	—	0	0	—	—
8/19	—	80	EF[c]	—	—	—	3.6	0	−	100
8/24	—	130	EF	—	—	—	9.6	0	−	100
8/27	—	100	EF	—	—	55	63	25	−	60
9/3	—	0.3	EF	—	—	—	0	0	—	—
9/6	30	24	42	+	43	—	0	0	—	—
11/5	35	16	25	+	36	—	0	0	—	—
11/5-6	30	14	40	+	65	—	12	0	−	100
Min	30	0	0.1	—	24	55	0	0	—	60
Mean	33	45	27	—	45	55	1	2.8	—	90
Max	35	130	42	—	65	55	63	25	—	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		
8/3	—	4.2	0.1	−	100	—	0.1	0	−	100
8/7	—	4.1	0	−	100	—	0	0	—	—
8/19	180	29	0.5	−	98	G[d]	0.5	0.6	G	G
8/24	G	7.9	1.0	G	G	G	1.0	0.3	G	G
8/27	125	45	6.9	−	85	G	6.9	3.6	G	G
9/3	290	4.1	0.1	−	98	—	0.1	0	−	100
9/6	150	15	0.6	−	96	G	0.6	3.8	G	G
11/5	20	0.1	0.01	−	90	135	0.01	0.6	+	98
11/5-6	180	0.4	0.3	−	25	G	0.3	0.1	G	G
Min	20	0	0	—	25	—	0	0	—	98
Mean	158	12	1.1	—	81	—	1.1	1.0	—	99
Max	290	45	6.9	—	100	—	6.9	3.8	—	100

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

[b] — = Result not applicable.

[c] EF = Equipment failure. Gaging equipment failed to yield a discharge measurement.

[d] 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 2016

Time Lag	E038			E039.1			E042.1		E050.1	E059.5
	8/19	8/24	8/27	8/3	9/6	11/5	8/27	11/6	8/27	8/27
Q_t, TSS_t	0.42	0.26	0.66	0.87	0.98	0.88	0.94	0.90	0.96	0.61
Q_t, TSS_{t-5}	0.65	0.25	0.81	0.93	0.98	0.90	0.97	0.90	0.96	0.69
Q_t, TSS_{t-10}	0.56	0.22	0.81	0.93	0.98	0.93	0.96	0.90	0.78	0.78
Q_t, TSS_{t-15}	0.65	0.16	0.83	0.94	0.98	0.95	0.96	0.90	0.43	0.78
Q_t, TSS_{t-20}	0.66	0.05	0.78	0.94	0.97	0.92	0.96	0.90	−0.03	0.85
Q_t, TSS_{t-25}	0.65	0.93	0.94	0.94	0.97	0.88	0.95	0.91	−0.42	0.93
Q_t, TSS_{t-30}	0.55	0.96	0.95	0.94	0.97	0.90	0.95	0.90	−0.63	0.80

Note: First maximum correlations are shaded in gray.

Table 3.2-3
SSC-Based Sediment Yield and Runoff Volume for Sampled 2012 to 2016 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

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					
E109.9	7/25/2013	1639	734	11	100
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

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					
E039.1	10/21/2015	0.5	0.2	8.6	28
E042.1	07/03/2015	4.7	2.1	0.7	10
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

Note: 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 Figure 3.2-3); thus, sediment yields may be underestimated.

Table 4.2-1
Comparison of Detected Analytical Results from 2016 with the Water Quality Criteria

Location	Location Alias	Sample Date	Analyte	Field Prep Code Result	Result	MDL	PQL[a]	Unit[b]	Screening Level	Screening Level Type[c]	Hardness Used[d]
CO111041	LA-2	9/6/2016	Aluminum	F10u[e]	462	15	50	µg/L	437	AAL	Average
CO111041	LA-2	8/27/2016	Aluminum	F10u	515	15	50	µg/L	437	AAL	Average
CO111041	LA-2	8/24/2016	Aluminum	F10u	607	15	50	µg/L	437	AAL	Average
CO111041	LA-2	8/19/2016	Aluminum	F10u	665	15	50	µg/L	437	AAL	Average
CO111041	LA-2	9/6/2016	Copper	F[f]	2.73	0.35	1	µg/L	1.82	AAL	Measured
CO111041	LA-2	8/24/2016	Copper	F	3.09	0.35	1	µg/L	1.98	AAL	Measured
CO111041	LA-2	8/27/2016	Gross alpha	UF[g]	134	—[h]	—	pCi/L	15	LW	n/a[i]
CO111041	LA-2	8/19/2016	Gross alpha	UF	50.4	—	—	pCi/L	15	LW	n/a
CO111041	LA-2	9/6/2016	Total PCB	UF	4.68	—	—	µg/L	0.014	WH	n/a
CO111041	LA-2	9/6/2016	Total PCB	UF	4.68	—	—	µg/L	0.00064	HH-OO	n/a
CO111041	LA-2	9/6/2016	Total PCB	UF	4.68	—	—	µg/L	2	AAL	n/a
CO111041	LA-2	8/27/2016	Total PCB	UF	7.69	—	—	µg/L	0.014	WH	n/a
CO111041	LA-2	8/27/2016	Total PCB	UF	7.69	—	—	µg/L	0.00064	HH-OO	n/a
CO111041	LA-2	8/27/2016	Total PCB	UF	7.69	—	—	µg/L	2	AAL	n/a
CO111041	LA-2	8/24/2016	Total PCB	UF	5.04	—	—	µg/L	0.014	WH	n/a
CO111041	LA-2	8/24/2016	Total PCB	UF	5.04	—	—	µg/L	0.00064	HH-OO	n/a
CO111041	LA-2	8/24/2016	Total PCB	UF	5.04	—	—	µg/L	2	AAL	n/a
CO111041	LA-2	8/19/2016	Total PCB	UF	13	—	—	µg/L	0.014	WH	n/a
CO111041	LA-2	8/19/2016	Total PCB	UF	13	—	—	µg/L	0.00064	HH-OO	n/a
CO111041	LA-2	8/19/2016	Total PCB	UF	13	—	—	µg/L	2	AAL	n/a
DP above Los Alamos Canyon	E040	9/6/2016	Aluminum	F10u	5050	15	50	µg/L	437	AAL	Average
DP above Los Alamos Canyon	E040	9/6/2016	Aluminum	F	776	15	50	µg/L	725	AAL	Measured
DP above Los Alamos Canyon	E040	8/27/2016	Aluminum	F10u	823	15	50	µg/L	437	AAL	Average
DP above Los Alamos Canyon	E040	8/24/2016	Aluminum	F10u	7040	15	50	µg/L	437	AAL	Average

Table 4.2-1 (continued)

Location	Location Alias	Sample Date	Analyte	Field Prep Code Result	Result	MDL	PQL[a]	Unit[b]	Screening Level	Screening Level Type[c]	Hardness Used[d]
DP above Los Alamos Canyon	E040	8/24/2016	Aluminum	F	1060	15	50	µg/L	457	AAL	Measured
DP above Los Alamos Canyon	E040	8/19/2016	Aluminum	F10u	5990	15	50	µg/L	437	AAL	Average
DP above Los Alamos Canyon	E040	8/19/2016	Aluminum	F	1060	15	50	µg/L	673	AAL	Measured
DP above Los Alamos Canyon	E040	8/3/2016	Aluminum	F10u	3600	15	50	µg/L	437	AAL	Average
DP above Los Alamos Canyon	E040	8/3/2016	Aluminum	F	847	15	50	µg/L	718	AAL	Measured
DP above Los Alamos Canyon	E040	9/6/2016	Gross alpha	UF	40.6	—	—	pCi/L	15	LW	n/a
DP above Los Alamos Canyon	E040	8/27/2016	Gross alpha	UF	138	—	—	pCi/L	15	LW	n/a
DP above Los Alamos Canyon	E040	8/24/2016	Gross alpha	UF	29.7	—	—	pCi/L	15	LW	n/a
DP above Los Alamos Canyon	E040	8/19/2016	Gross alpha	UF	32.3	—	—	pCi/L	15	LW	n/a
DP above Los Alamos Canyon	E040	8/3/2016	Gross alpha	UF	44.3	—	—	pCi/L	15	LW	n/a
DP above Los Alamos Canyon	E040	9/6/2016	Total PCB	UF	0.0154	—	—	µg/L	0.014	WH	n/a
DP above Los Alamos Canyon	E040	9/6/2016	Total PCB	UF	0.0154	—	—	µg/L	0.00064	HH-OO	n/a
DP above Los Alamos Canyon	E040	8/27/2016	Total PCB	UF	0.0226	—	—	µg/L	0.014	WH	n/a
DP above Los Alamos Canyon	E040	8/27/2016	Total PCB	UF	0.0226	—	—	µg/L	0.00064	HH-OO	n/a
DP above Los Alamos Canyon	E040	8/24/2016	Total PCB	UF	0.0517	—	—	µg/L	0.014	WH	n/a
DP above Los Alamos Canyon	E040	8/24/2016	Total PCB	UF	0.0517	—	—	µg/L	0.00064	HH-OO	n/a
DP above Los Alamos Canyon	E040	8/19/2016	Total PCB	UF	0.0876	—	—	µg/L	0.014	WH	n/a
DP above Los Alamos Canyon	E040	8/19/2016	Total PCB	UF	0.0876	—	—	µg/L	0.00064	HH-OO	n/a
DP above Los Alamos Canyon	E040	8/3/2016	Total PCB	UF	0.0214	—	—	µg/L	0.014	WH	n/a
DP above Los Alamos Canyon	E040	8/3/2016	Total PCB	UF	0.0214	—	—	µg/L	0.00064	HH-OO	n/a
DP above TA-21	E038	8/27/2016	Aluminum	F10u	3510	15	50	µg/L	437	AAL	Average
DP above TA-21	E038	8/27/2016	Aluminum	F	762	15	50	µg/L	337	AAL	Measured
DP above TA-21	E038	8/24/2016	Aluminum	F10u	2280	15	50	µg/L	437	AAL	Average
DP above TA-21	E038	8/24/2016	Aluminum	F	556	15	50	µg/L	234	AAL	Measured
DP above TA-21	E038	8/19/2016	Aluminum	F10u	1630	15	50	µg/L	437	AAL	Average
DP above TA-21	E038	8/19/2016	Aluminum	F	667	15	50	µg/L	377	AAL	Measured

Table 4.2-1 (continued)

Location	Location Alias	Sample Date	Analyte	Field Prep Code Result	Result	MDL	PQL[a]	Unit[b]	Screening Level	Screening Level Type[c]	Hardness Used[d]
DP above TA-21	E038	8/24/2016	Copper	F	2.34	0.35	1	µg/L	2.12	AAL	Measured
DP above TA-21	E038	8/27/2016	Gross alpha	UF	97.5	—	—	pCi/L	15	LW	n/a
DP above TA-21	E038	8/24/2016	Gross alpha	UF	17.2	—	—	pCi/L	15	LW	n/a
DP above TA-21	E038	8/19/2016	Gross alpha	UF	40.1	—	—	pCi/L	15	LW	n/a
DP above TA-21	E038	8/27/2016	Total PCB	UF	0.0318	—	—	µg/L	0.014	WH	n/a
DP above TA-21	E038	8/27/2016	Total PCB	UF	0.0318	—	—	µg/L	0.00064	HH-OO	n/a
DP above TA-21	E038	8/24/2016	Total PCB	UF	0.192	—	—	µg/L	0.014	WH	n/a
DP above TA-21	E038	8/24/2016	Total PCB	UF	0.192	—	—	µg/L	0.00064	HH-OO	n/a
DP above TA-21	E038	8/19/2016	Total PCB	UF	0.163	—	—	µg/L	0.014	WH	n/a
DP above TA-21	E038	8/19/2016	Total PCB	UF	0.163	—	—	µg/L	0.00064	HH-OO	n/a
DP below grade ctrl structure	E039.1	11/5/2016	Aluminum	F	538	15	50	µg/L	372	AAL	Measured
DP below grade ctrl structure	E039.1	9/6/2016	Aluminum	F10u	2860	15	50	µg/L	437	AAL	Average
DP below grade ctrl structure	E039.1	8/3/2016	Aluminum	F10u	2470	15	50	µg/L	437	AAL	Average
DP below grade ctrl structure	E039.1	8/3/2016	Aluminum	F	724	15	50	µg/L	569	AAL	Measured
DP below grade ctrl structure	E039.1	11/5/2016	Copper	F	3.1	0.35	1	µg/L	2.92	AAL	Measured
DP below grade ctrl structure	E039.1	11/5/2016	Gross alpha	UF	33.7	—	—	pCi/L	15	LW	n/a
DP below grade ctrl structure	E039.1	9/6/2016	Gross alpha	UF	44.3	—	—	pCi/L	15	LW	n/a
DP below grade ctrl structure	E039.1	11/5/2016	Total PCB	UF	0.00965	—	—	µg/L	0.00064	HH-OO	n/a
DP below grade ctrl structure	E039.1	9/6/2016	Total PCB	UF	0.0353	—	—	µg/L	0.014	WH	n/a
DP below grade ctrl structure	E039.1	9/6/2016	Total PCB	UF	0.0353	—	—	µg/L	0.00064	HH-OO	n/a
DP below grade ctrl structure	E039.1	8/3/2016	Total PCB	UF	0.0474	—	—	µg/L	0.014	WH	n/a
DP below grade ctrl structure	E039.1	8/3/2016	Total PCB	UF	0.0474	—	—	µg/L	0.00064	HH-OO	n/a
E059.5 Pueblo below LAC WWTF	E059.5	8/27/2016	Aluminum	F10u	1890	15	50	µg/L	175	CAL	Average
E059.5 Pueblo below LAC WWTF	E059.5	8/27/2016	Aluminum	F	1410	15	50	µg/L	160	CAL	Measured
E059.5 Pueblo below LAC WWTF	E059.5	8/27/2016	Copper	F	3.19	0.35	1	µg/L	2.34	CAL	Measured
E059.5 Pueblo below LAC WWTF	E059.5	8/27/2016	Gross alpha	UF	316	—	—	pCi/L	15	LW	n/a

Table 4.2-1 (continued)

Location	Location Alias	Sample Date	Analyte	Field Prep Code Result	Result	MDL	PQL[a]	Unit[b]	Screening Level	Screening Level Type[c]	Hardness Used[d]
E059.5 Pueblo below LAC WWTF	E059.5	8/27/2016	Lead	F	1.94	0.5	2	µg/L	0.44	CAL	Measured
E059.5 Pueblo below LAC WWTF	E059.5	8/27/2016	Total PCB	UF	0.0354	—	—	µg/L	0.014	WH	n/a
E059.5 Pueblo below LAC WWTF	E059.5	8/27/2016	Total PCB	UF	0.0354	—	—	µg/L	0.00064	HH-OO	n/a
E059.5 Pueblo below LAC WWTF	E059.5	8/27/2016	Total PCB	UF	0.0354	—	—	µg/L	0.014	CAL	n/a
E059.5 Pueblo below LAC WWTF	E059.5	8/27/2016	Total PCB	UF	0.0234	—	—	µg/L	0.014	WH	n/a
E059.5 Pueblo below LAC WWTF	E059.5	8/27/2016	Total PCB	UF	0.0234	—	—	µg/L	0.00064	HH-OO	n/a
E059.5 Pueblo below LAC WWTF	E059.5	8/27/2016	Total PCB	UF	0.0234	—	—	µg/L	0.014	CAL	n/a
E059.5 Pueblo below LAC WWTF	E059.5	8/27/2016	Total PCB	UF	0.0188	—	—	µg/L	0.014	WH	n/a
E059.5 Pueblo below LAC WWTF	E059.5	8/27/2016	Total PCB	UF	0.0188	—	—	µg/L	0.00064	HH-OO	n/a
E059.5 Pueblo below LAC WWTF	E059.5	8/27/2016	Total PCB	UF	0.0188	—	—	µg/L	0.014	CAL	n/a
Los Alamos above low-head weir	E042.1	11/6/2016	Aluminum	F10u	3070	15	50	µg/L	437	AAL	Average
Los Alamos above low-head weir	E042.1	11/6/2016	Aluminum	F	1010	15	50	µg/L	441	AAL	Measured
Los Alamos above low-head weir	E042.1	8/27/2016	Aluminum	F10u	9520	15	50	µg/L	437	AAL	Average
Los Alamos above low-head weir	E042.1	8/27/2016	Aluminum	F	1060	15	50	µg/L	601	AAL	Measured
Los Alamos above low-head weir	E042.1	11/6/2016	Gross alpha	UF	190	—	—	pCi/L	15	LW	n/a
Los Alamos above low-head weir	E042.1	8/27/2016	Gross alpha	UF	67.8	—	—	pCi/L	15	LW	n/a
Los Alamos above low-head weir	E042.1	8/27/2016	Selenium	UF	8.03	2	5	µg/L	5	WH	n/a
Los Alamos above low-head weir	E042.1	11/6/2016	TCDD TEQ[j]	UF	2.5E-06	—	—	µg/L	5.10E-08	HH-OO	n/a
Los Alamos above low-head weir	E042.1	8/27/2016	TCDD TEQ	UF	2.9E-06	—	—	µg/L	5.10E-08	HH-OO	n/a
Los Alamos above low-head weir	E042.1	11/6/2016	Total PCB	UF	0.0455	—	—	µg/L	0.014	WH	n/a
Los Alamos above low-head weir	E042.1	11/6/2016	Total PCB	UF	0.0455	—	—	µg/L	0.00064	HH-OO	n/a
Los Alamos above low-head weir	E042.1	11/6/2016	Total PCB	UF	0.0291	—	—	µg/L	0.014	WH	n/a
Los Alamos above low-head weir	E042.1	11/6/2016	Total PCB	UF	0.0291	—	—	µg/L	0.00064	HH-OO	n/a
Los Alamos above low-head weir	E042.1	11/6/2016	Total PCB	UF	0.0201	—	—	µg/L	0.014	WH	n/a
Los Alamos above low-head weir	E042.1	11/6/2016	Total PCB	UF	0.0201	—	—	µg/L	0.00064	HH-OO	n/a
Los Alamos above low-head weir	E042.1	8/27/2016	Total PCB	UF	0.0634	—	—	µg/L	0.014	WH	n/a

Table 4.2-1 (continued)

Location	Location Alias	Sample Date	Analyte	Field Prep Code Result	Result	MDL	PQL[a]	Unit[b]	Screening Level	Screening Level Type[c]	Hardness Used[d]
Los Alamos above low-head weir	E042.1	8/27/2016	Total PCB	UF	0.0634	—	—	µg/L	0.00064	HH-OO	n/a
Los Alamos above low-head weir	E042.1	8/27/2016	Total PCB	UF	0.0227	—	—	µg/L	0.014	WH	n/a
Los Alamos above low-head weir	E042.1	8/27/2016	Total PCB	UF	0.0227	—	—	µg/L	0.00064	HH-OO	n/a
Los Alamos above low-head weir	E042.1	8/27/2016	Total PCB	UF	0.0225	—	—	µg/L	0.014	WH	n/a
Los Alamos above low-head weir	E042.1	8/27/2016	Total PCB	UF	0.0225	—	—	µg/L	0.00064	HH-OO	n/a
Los Alamos below Ice Rink	E026	8/3/2016	Aluminum	F10u	5280	15	50	µg/L	437	AAL	Average
Los Alamos below Ice Rink	E026	8/3/2016	Gross alpha	UF	85.1	—	—	pCi/L	15	LW	n/a
Los Alamos below Ice Rink	E026	8/3/2016	Total PCB	UF	0.00282	—	—	µg/L	0.00064	HH-OO	n/a
Los Alamos below low-head weir	E050.1	8/27/2016	Aluminum	UF	46,800	15	50	µg/L	437	AAL	Average
Los Alamos below low-head weir	E050.1	8/27/2016	Aluminum	F10u	9710	15	50	µg/L	437	AAL	Average
Los Alamos below low-head weir	E050.1	8/27/2016	Aluminum	F	1280	15	50	µg/L	628	AAL	Measured
Los Alamos below low-head weir	E050.1	8/27/2016	Aluminum	F	926	15	50	µg/L	646	AAL	Measured
Los Alamos below low-head weir	E050.1	8/27/2016	Gross alpha	UF	48.9	—	—	pCi/L	15	LW	n/a
Los Alamos below low-head weir	E050.1	8/27/2016	TCCD TEQ	UF	2E-06	—	—	µg/L	5.10E-08	HH-OO	n/a
Los Alamos below low-head weir	E050.1	8/27/2016	Total PCB	UF	0.0798	—	—	µg/L	0.014	WH	n/a
Los Alamos below low-head weir	E050.1	8/27/2016	Total PCB	UF	0.0798	—	—	µg/L	0.00064	HH-OO	n/a
Los Alamos below low-head weir	E050.1	8/27/2016	Total PCB	UF	0.0696	—	—	µg/L	0.014	WH	n/a
Los Alamos below low-head weir	E050.1	8/27/2016	Total PCB	UF	0.0696	—	—	µg/L	0.00064	HH-OO	n/a
Los Alamos below low-head weir	E050.1	8/27/2016	Total PCB	UF	0.0474	—	—	µg/L	0.014	WH	n/a
Los Alamos below low-head weir	E050.1	8/27/2016	Total PCB	UF	0.0474	—	—	µg/L	0.00064	HH-OO	n/a
Pueblo above Acid	E055	9/3/2016	Aluminum	F10u	1040	15	50	µg/L	175	CAL	Average
Pueblo above Acid	E055	9/3/2016	Aluminum	F	849	15	50	µg/L	139	CAL	Measured
Pueblo above Acid	E055	8/7/2016	Aluminum	F10u	4200	15	50	µg/L	175	CAL	Average
Pueblo above Acid	E055	8/7/2016	Aluminum	F	879	15	50	µg/L	199	CAL	Measured
Pueblo above Acid	E055	9/3/2016	Copper	F	2.39	0.35	1	µg/L	2.15	CAL	Measured
Pueblo above Acid	E055	8/7/2016	Copper	F	2.71	0.35	1	µg/L	2.68	CAL	Measured

Table 4.2-1 (continued)

Location	Location Alias	Sample Date	Analyte	Field Prep Code Result	Result	MDL	PQL[a]	Unit[b]	Screening Level	Screening Level Type[c]	Hardness Used[d]
Pueblo above Acid	E055	9/3/2016	Gross alpha	UF	221	—	—	pCi/L	15	LW	n/a
Pueblo above Acid	E055	8/7/2016	Gross alpha	UF	70.8	—	—	pCi/L	15	LW	n/a
Pueblo above Acid	E055	9/3/2016	Lead	F	2.11	0.5	2	µg/L	0.392	CAL	Measured
Pueblo above Acid	E055	8/7/2016	Lead	F	1.37	0.5	2	µg/L	0.526	CAL	Measured
Pueblo above Acid	E055	9/3/2016	Total PCB	UF	0.0715	—	—	µg/L	0.014	WH	n/a
Pueblo above Acid	E055	9/3/2016	Total PCB	UF	0.0715	—	—	µg/L	0.00064	HH-OO	n/a
Pueblo above Acid	E055	9/3/2016	Total PCB	UF	0.0715	—	—	µg/L	0.014	CAL	n/a
Pueblo above Acid	E055	8/7/2016	Total PCB	UF	0.0514	—	—	µg/L	0.014	WH	n/a
Pueblo above Acid	E055	8/7/2016	Total PCB	UF	0.0514	—	—	µg/L	0.00064	HH-OO	n/a
Pueblo above Acid	E055	8/7/2016	Total PCB	UF	0.0514	—	—	µg/L	0.014	CAL	n/a
South Fork of Acid Canyon	E055.5	9/3/2016	Aluminum	F10u	687	15	50	µg/L	175	CAL	Average
South Fork of Acid Canyon	E055.5	9/3/2016	Aluminum	F	655	15	50	µg/L	108	CAL	Measured
South Fork of Acid Canyon	E055.5	8/27/2016	Aluminum	F10u	925	15	50	µg/L	175	CAL	Average
South Fork of Acid Canyon	E055.5	8/27/2016	Aluminum	F	847	15	50	µg/L	58.4	CAL	Measured
South Fork of Acid Canyon	E055.5	8/19/2016	Aluminum	F10u	1090	15	50	µg/L	175	CAL	Average
South Fork of Acid Canyon	E055.5	8/19/2016	Aluminum	F	561	15	50	µg/L	108	CAL	Measured
South Fork of Acid Canyon	E055.5	9/3/2016	Copper	F	5.73	0.35	1	µg/L	1.83	CAL	Measured
South Fork of Acid Canyon	E055.5	8/27/2016	Copper	F	2.64	0.35	1	µg/L	1.25	CAL	Measured
South Fork of Acid Canyon	E055.5	8/19/2016	Copper	F	2.71	0.35	1	µg/L	1.83	CAL	Measured
South Fork of Acid Canyon	E055.5	9/3/2016	Gross alpha	UF	53.4	—	—	pCi/L	15	LW	n/a
South Fork of Acid Canyon	E055.5	8/27/2016	Gross alpha	UF	54.7	—	—	pCi/L	15	LW	n/a
South Fork of Acid Canyon	E055.5	8/19/2016	Gross alpha	UF	67.4	—	—	pCi/L	15	LW	n/a
South Fork of Acid Canyon	E055.5	9/3/2016	Lead	F	1.16	0.5	2	µg/L	0.317	CAL	Measured
South Fork of Acid Canyon	E055.5	8/27/2016	Lead	F	1.55	0.5	2	µg/L	0.191	CAL	Measured
South Fork of Acid Canyon	E055.5	8/19/2016	Lead	F	1.11	0.5	2	µg/L	0.317	CAL	Measured
South Fork of Acid Canyon	E055.5	9/3/2016	Total PCB	UF	0.0113	—	—	µg/L	0.00064	HH-OO	n/a

Table 4.2-1 (continued)

Location	Location Alias	Sample Date	Analyte	Field Prep Code Result	Result	MDL	PQL[a]	Unit[b]	Screening Level	Screening Level Type[c]	Hardness Used[d]
South Fork of Acid Canyon	E055.5	8/27/2016	Total PCB	UF	0.0334	—	—	µg/L	0.014	WH	n/a
South Fork of Acid Canyon	E055.5	8/27/2016	Total PCB	UF	0.0334	—	—	µg/L	0.00064	HH-OO	n/a
South Fork of Acid Canyon	E055.5	8/27/2016	Total PCB	UF	0.0334	—	—	µg/L	0.014	CAL	n/a
South Fork of Acid Canyon	E055.5	8/24/2016	Total PCB	UF	0.0189	—	—	µg/L	0.014	WH	n/a
South Fork of Acid Canyon	E055.5	8/24/2016	Total PCB	UF	0.0189	—	—	µg/L	0.00064	HH-OO	n/a
South Fork of Acid Canyon	E055.5	8/24/2016	Total PCB	UF	0.0189	—	—	µg/L	0.014		
South Fork of Acid Canyon	E055.5	8/19/2016	Total PCB	UF	0.0504		—	µg/L	0.014	WH	n/a
South Fork of Acid Canyon	E055.5	8/19/2016	Total PCB	UF	0.0504	—	—	µg/L	0.00064	HH-OO	n/a
South Fork of Acid Canyon	E055.5	8/19/2016	Total PCB	UF	0.0504	—	—	µg/L	0.014	CAL	n/a

[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] Type of hardness used to compute the screening level for hardness-based standards. If hardness was analyzed during the storm event, the measured hardness was used. If hardness was not analyzed during the storm event, the average hardness of all 2016 LA/P results (22.2 mg/L $CaCO_3$) was used.

[e] F10u = Filtered with 10-µm pore-size filter.

[f] F = Filtered.

[g] UF = Unfiltered.

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

[i] n/a = not applicable.

[j] TEQ = toxic equivalent quotient.

Table 4.3-1
Calculated SSC and Instantaneous Discharge Determined for Each Sample Collected during 2016 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)
E026	8/3/2016 15:50	UF[b]	WTLAP-16-116722	SSC	7400	17
E026	8/3/2016 15:52	UF	WTLAP-16-116730	Estimated	7000	16
E026	8/3/2016 15:56	UF	WTLAP-16-116738	Estimated	6200	13
E026	8/3/2016 15:56	UF	WTLAP-16-116755	Estimated	6200	13
E026	8/3/2016 16:00	UF	WTLAP-16-116746	Estimated	5400	11
E026	8/3/2016 16:02	UF	WTLAP-16-116763	Estimated	4900	10
E026	8/3/2016 16:06	F[c]	WTLAP-16-116771	Estimated	4100	11
E026	8/3/2016 16:06	F10u[d]	WTLAP-16-116779	Estimated	4100	11
E026	8/3/2016 16:08	UF	WTLAP-16-116787	Estimated	3700	12
E026	8/3/2016 16:10	UF	WTLAP-16-116795	SSC	3300	14
E026	8/3/2016 16:12	F	WTLAP-16-116803	Estimated	3300	14
E026	8/3/2016 16:12	UF	WTLAP-16-116811	Estimated	3300	14
E038	8/19/2016 11:49	UF	WTLAP-16-118036	SSC	6100	36
E038	8/19/2016 11:51	UF	WTLAP-16-118037	SSC	1600	52
E038	8/19/2016 11:53	UF	WTLAP-16-118038	SSC	4300	66
E038	8/19/2016 11:55	UF	WTLAP-16-118039	SSC	3900	80
E038	8/19/2016 11:57	UF	WTLAP-16-118040	SSC	3600	59
E038	8/19/2016 11:59	UF	WTLAP-16-118041	SSC	3000	39
E038	8/19/2016 12:01	UF	WTLAP-16-118042	SSC	2800	25
E038	8/19/2016 12:03	UF	WTLAP-16-118043	SSC	2600	19
E038	8/19/2016 12:04	UF	WTLAP-16-117192	Estimated	2500	17
E038	8/19/2016 12:05	UF	WTLAP-16-118044	SSC	2400	14
E038	8/19/2016 12:09	UF	WTLAP-16-118045	SSC	1800	10
E038	8/19/2016 12:09	UF	WTLAP-16-117208	Estimated	1800	10
E038	8/19/2016 12:11	UF	WTLAP-16-118046	SSC	1700	9.3
E038	8/19/2016 12:11	UF	WTLAP-16-117224	Estimated	1700	9.3
E038	8/19/2016 12:13	UF	WTLAP-16-118047	SSC	1600	8.6
E038	8/19/2016 12:15	UF	WTLAP-16-118048	SSC	1500	7.9
E038	8/19/2016 12:16	UF	WTLAP-16-117240	Estimated	1400	8.3
E038	8/19/2016 12:18	F10u	WTLAP-16-117272	Estimated	1300	9.2
E038	8/19/2016 12:18	F	WTLAP-16-117256	Estimated	1300	9.2
E038	8/19/2016 12:19	UF	WTLAP-16-118050	SSC	1200	9.6
E038	8/19/2016 12:20	UF	WTLAP-16-117288	Estimated	1400	10
E038	8/19/2016 12:22	F	WTLAP-16-117304	Estimated	1600	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)
E038	8/19/2016 12:22	UF	WTLAP-16-117336	Estimated	1600	9.1
E038	8/19/2016 12:23	UF	WTLAP-16-118049	SSC	1800	8.6
E038	8/19/2016 12:25	UF	WTLAP-16-118051	SSC	5600	7.7
E038	8/24/2016 12:39	UF	WTLAP-16-118105	SSC	3000	100
E038	8/24/2016 12:41	UF	WTLAP-16-118106	SSC	3300	120
E038	8/24/2016 12:43	UF	WTLAP-16-118107	SSC	2600	93
E038	8/24/2016 12:45	UF	WTLAP-16-118108	SSC	2300	69
E038	8/24/2016 12:47	UF	WTLAP-16-118109	SSC	2200	52
E038	8/24/2016 12:49	UF	WTLAP-16-118110	SSC	2100	35
E038	8/24/2016 12:50	UF	WTLAP-16-117195	Estimated	2000	26
E038	8/24/2016 12:53	UF	WTLAP-16-118112	SSC	1800	24
E038	8/24/2016 12:54	UF	WTLAP-16-117211	Estimated	1600	23
E038	8/24/2016 12:55	UF	WTLAP-16-118113	SSC	1300	23
E038	8/24/2016 12:56	UF	WTLAP-16-117227	Estimated	1200	21
E038	8/24/2016 12:57	UF	WTLAP-16-118423	SSC	1200	19
E038	8/24/2016 12:59	UF	WTLAP-16-118114	SSC	1200	16
E038	8/24/2016 13:00	UF	WTLAP-16-117243	Estimated	1200	14
E038	8/24/2016 13:01	UF	WTLAP-16-118115	SSC	1100	13
E038	8/24/2016 13:02	F	WTLAP-16-117259	Estimated	1000	12
E038	8/24/2016 13:02	F10u	WTLAP-16-117275	Estimated	1000	12
E038	8/24/2016 13:03	UF	WTLAP-16-118116	SSC	1000	11
E038	8/24/2016 13:04	UF	WTLAP-16-117291	Estimated	1000	11
E038	8/24/2016 13:06	UF	WTLAP-16-118117	SSC	1000	9.5
E038	8/24/2016 13:06	F	WTLAP-16-117307	Estimated	1000	9.5
E038	8/24/2016 13:06	UF	WTLAP-16-117323	Estimated	1000	9.5
E038	8/24/2016 13:08	UF	WTLAP-16-118118	SSC	800	8.9
E038	8/24/2016 13:09	UF	WTLAP-16-118119	SSC	800	8.6
E038	8/24/2016 13:10	UF	WTLAP-16-118123	SSC	9600	8.2
E038	8/24/2016 13:12	UF	WTLAP-16-118124	SSC	800	8.5
E038	8/24/2016 13:29	UF	WTLAP-16-118120	SSC	500	7.7
E038	8/24/2016 13:49	UF	WTLAP-16-118121	SSC	300	4.9
E038	8/24/2016 14:09	UF	WTLAP-16-118122	SSC	300	1.5
E038	8/27/2016 11:08	UF	WTLAP-16-118128	SSC	2700	62
E038	8/27/2016 11:11	UF	WTLAP-16-118129	SSC	2500	100
E038	8/27/2016 11:12	UF	WTLAP-16-118130	SSC	2300	98
E038	8/27/2016 11:14	UF	WTLAP-16-118131	SSC	2200	94
E038	8/27/2016 11:16	UF	WTLAP-16-118132	SSC	2100	83

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	8/27/2016 11:18	UF	WTLAP-16-118133	SSC	2100	64
E038	8/27/2016 11:19	UF	WTLAP-16-117196	Estimated	2100	54
E038	8/27/2016 11:20	UF	WTLAP-16-118134	SSC	2100	45
E038	8/27/2016 11:22	UF	WTLAP-16-118135	SSC	1800	41
E038	8/27/2016 11:23	UF	WTLAP-16-117212	Estimated	1800	39
E038	8/27/2016 11:24	UF	WTLAP-16-118136	SSC	1900	37
E038	8/27/2016 11:25	UF	WTLAP-16-117228	Estimated	1900	35
E038	8/27/2016 11:26	UF	WTLAP-16-118424	SSC	1900	34
E038	8/27/2016 11:28	UF	WTLAP-16-118137	SSC	1900	32
E038	8/27/2016 11:29	UF	WTLAP-16-117244	Estimated	1900	31
E038	8/27/2016 11:30	UF	WTLAP-16-118138	SSC	1900	29
E038	8/27/2016 11:31	F	WTLAP-16-117260	Estimated	1800	28
E038	8/27/2016 11:31	F10u	WTLAP-16-117276	Estimated	1800	28
E038	8/27/2016 11:32	UF	WTLAP-16-118139	SSC	1700	26
E038	8/27/2016 11:33	UF	WTLAP-16-117292	Estimated	1800	24
E038	8/27/2016 11:34	UF	WTLAP-16-118140	SSC	1800	22
E038	8/27/2016 11:35	F	WTLAP-16-117308	Estimated	2000	21
E038	8/27/2016 11:35	UF	WTLAP-16-117324	Estimated	2000	21
E038	8/27/2016 11:37	UF	WTLAP-16-118141	SSC	2300	20
E038	8/27/2016 11:38	UF	WTLAP-16-118142	SSC	2000	19
E038	8/27/2016 11:39	UF	WTLAP-16-118144	SSC	2000	19
E038	8/27/2016 11:41	UF	WTLAP-16-118145	SSC	1600	18
E038	8/27/2016 11:58	UF	WTLAP-16-118143	SSC	1000	6.2
E039.1	8/3/2016 19:29	UF	WTLAP-16-118059	SSC	1000	21
E039.1	8/3/2016 19:31	UF	WTLAP-16-118060	SSC	900	26
E039.1	8/3/2016 19:33	UF	WTLAP-16-118061	SSC	800	26
E039.1	8/3/2016 19:35	UF	WTLAP-16-118062	SSC	700	26
E039.1	8/3/2016 19:37	UF	WTLAP-16-118063	SSC	600	24
E039.1	8/3/2016 19:39	UF	WTLAP-16-118064	SSC	500	22
E039.1	8/3/2016 19:39	UF	WTLAP-16-117193	Estimated	500	22
E039.1	8/3/2016 19:41	UF	WTLAP-16-118065	SSC	500	21
E039.1	8/3/2016 19:43	UF	WTLAP-16-118066	SSC	500	19
E039.1	8/3/2016 19:43	UF	WTLAP-16-117209	Estimated	500	19
E039.1	8/3/2016 19:45	UF	WTLAP-16-118067	SSC	400	17
E039.1	8/3/2016 19:45	UF	WTLAP-16-117225	Estimated	400	17
E039.1	8/3/2016 19:47	UF	WTLAP-16-118421	SSC	400	16
E039.1	8/3/2016 19:49	UF	WTLAP-16-118068	SSC	400	15

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	8/3/2016 19:49	UF	WTLAP-16-117241	Estimated	400	15
E039.1	8/3/2016 19:51	UF	WTLAP-16-118069	SSC	300	14
E039.1	8/3/2016 19:51	F10u	WTLAP-16-117273	Estimated	300	14
E039.1	8/3/2016 19:51	F	WTLAP-16-117257	Estimated	300	14
E039.1	8/3/2016 19:53	UF	WTLAP-16-118070	SSC	300	13
E039.1	8/3/2016 19:53	UF	WTLAP-16-117289	Estimated	300	13
E039.1	8/3/2016 19:55	UF	WTLAP-16-118071	SSC	300	12
E039.1	8/3/2016 19:55	F	WTLAP-16-117305	Estimated	300	12
E039.1	8/3/2016 19:55	UF	WTLAP-16-117321	Estimated	300	12
E039.1	8/3/2016 19:57	UF	WTLAP-16-118072	SSC	300	11
E039.1	8/3/2016 19:59	UF	WTLAP-16-118073	SSC	300	10
E039.1	8/3/2016 20:19	UF	WTLAP-16-118074	SSC	200	5.6
E039.1	8/3/2016 20:39	UF	WTLAP-16-118075	SSC	200	3.1
E039.1	8/3/2016 20:59	UF	WTLAP-16-118076	SSC	200	2.1
E039.1	8/3/2016 21:19	UF	WTLAP-16-118077	SSC	200	2.4
E039.1	8/3/2016 21:39	UF	WTLAP-16-118078	SSC	200	4.2
E039.1	8/3/2016 21:59	UF	WTLAP-16-118079	SSC	200	2.8
E039.1	8/3/2016 22:19	UF	WTLAP-16-118080	SSC	200	2
E039.1	8/3/2016 22:39	UF	WTLAP-16-118081	SSC	200	1.2
E039.1	9/6/2016 18:05	UF	WTLAP-16-118082	SSC	1000	42
E039.1	9/6/2016 18:07	UF	WTLAP-16-118083	SSC	900	38
E039.1	9/6/2016 18:09	UF	WTLAP-16-118084	SSC	700	34
E039.1	9/6/2016 18:11	UF	WTLAP-16-118085	SSC	700	29
E039.1	9/6/2016 18:13	UF	WTLAP-16-118086	SSC	600	24
E039.1	9/6/2016 18:15	UF	WTLAP-16-118087	SSC	500	19
E039.1	9/6/2016 18:15	UF	WTLAP-16-117194	Estimated	500	19
E039.1	9/6/2016 18:17	UF	WTLAP-16-118088	SSC	500	16
E039.1	9/6/2016 18:19	UF	WTLAP-16-118089	SSC	500	13
E039.1	9/6/2016 18:19	UF	WTLAP-16-117210	Estimated	500	13
E039.1	9/6/2016 18:21	UF	WTLAP-16-118090	SSC	400	11
E039.1	9/6/2016 18:21	UF	WTLAP-16-117226	Estimated	400	11
E039.1	9/6/2016 18:23	UF	WTLAP-16-118422	SSC	400	9.2
E039.1	9/6/2016 18:25	UF	WTLAP-16-118091	SSC	400	7.5
E039.1	9/6/2016 18:25	UF	WTLAP-16-117242	Estimated	400	7.5
E039.1	9/6/2016 18:27	UF	WTLAP-16-118092	SSC	300	6.5
E039.1	9/6/2016 18:27	F	WTLAP-16-117258	Estimated	300	6.5
E039.1	9/6/2016 18:29	UF	WTLAP-16-118093	SSC	300	5.4

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	9/6/2016 18:29	UF	WTLAP-16-117290	Estimated	300	5.4
E039.1	9/6/2016 18:31	UF	WTLAP-16-118094	SSC	300	4.5
E039.1	9/6/2016 18:31	F	WTLAP-16-117306	Estimated	300	4.5
E039.1	9/6/2016 18:33	UF	WTLAP-16-118095	SSC	300	3.6
E039.1	9/6/2016 18:33	UF	WTLAP-16-117322	Estimated	300	3.6
E039.1	9/6/2016 18:35	UF	WTLAP-16-118096	SSC	300	2.7
E039.1	9/6/2016 18:35	F10u	WTLAP-16-117274	Estimated	300	2.7
E039.1	9/6/2016 18:55	UF	WTLAP-16-118097	SSC	200	0.32
E039.1	9/6/2016 19:15	UF	WTLAP-16-118098	SSC	100	0.35
E039.1	9/6/2016 19:35	UF	WTLAP-16-118099	SSC	200	0.32
E039.1	9/6/2016 19:55	UF	WTLAP-16-118100	SSC	200	0.32
E039.1	9/6/2016 20:15	UF	WTLAP-16-118101	SSC	200	0.32
E039.1	9/6/2016 20:35	UF	WTLAP-16-118102	SSC	200	0.35
E039.1	9/6/2016 20:55	UF	WTLAP-16-118103	SSC	300	0.32
E039.1	9/6/2016 21:15	UF	WTLAP-16-118104	SSC	200	0.32
E039.1	11/5/2016 7:09	UF	WTLAP-16-118151	SSC	700	20
E039.1	11/5/2016 7:11	UF	WTLAP-16-118152	SSC	600	24
E039.1	11/5/2016 7:13	UF	WTLAP-16-118153	SSC	500	24
E039.1	11/5/2016 7:15	UF	WTLAP-16-118154	SSC	500	24
E039.1	11/5/2016 7:17	UF	WTLAP-16-118155	SSC	500	22
E039.1	11/5/2016 7:19	UF	WTLAP-16-118156	SSC	400	21
E039.1	11/5/2016 7:19	UF	WTLAP-16-117197	Estimated	400	21
E039.1	11/5/2016 7:21	UF	WTLAP-16-118157	SSC	400	19
E039.1	11/5/2016 7:23	UF	WTLAP-16-118158	SSC	300	18
E039.1	11/5/2016 7:23	UF	WTLAP-16-117213	Estimated	300	18
E039.1	11/5/2016 7:25	UF	WTLAP-16-118159	SSC	300	16
E039.1	11/5/2016 7:25	UF	WTLAP-16-117229	Estimated	300	16
E039.1	11/5/2016 7:27	UF	WTLAP-16-118425	SSC	300	16
E039.1	11/5/2016 7:29	UF	WTLAP-16-118160	SSC	300	15
E039.1	11/5/2016 7:29	UF	WTLAP-16-117245	Estimated	300	15
E039.1	11/5/2016 7:31	UF	WTLAP-16-118161	SSC	300	14
E039.1	11/5/2016 7:31	F	WTLAP-16-117261	Estimated	300	14
E039.1	11/5/2016 7:31	F10u	WTLAP-16-117277	Estimated	300	14
E039.1	11/5/2016 7:33	UF	WTLAP-16-118162	SSC	300	13
E039.1	11/5/2016 7:33	UF	WTLAP-16-117293	Estimated	300	13
E039.1	11/5/2016 7:35	UF	WTLAP-16-118163	SSC	200	12
E039.1	11/5/2016 7:35	F	WTLAP-16-117309	Estimated	200	12

Table 4.3-1 (continued)

Station	Sample Collection Date and Time	Field Prep	Sample ID	SSC[a] Source	Calculated SSC (m/gL)	Calculated Instantaneous Discharge (cfs)
E039.1	11/5/2016 7:37	UF	WTLAP-16-118164	SSC	200	11
E039.1	11/5/2016 7:37	UF	WTLAP-16-117325	Estimated	200	11
E039.1	11/5/2016 7:39	UF	WTLAP-16-118165	SSC	200	11
E039.1	11/5/2016 7:59	UF	WTLAP-16-118166	SSC	200	6.3
E039.1	11/5/2016 8:19	UF	WTLAP-16-118167	SSC	100	4.4
E039.1	11/5/2016 9:39	UF	WTLAP-16-118171	SSC	200	11
E039.1	11/5/2016 9:59	UF	WTLAP-16-118172	SSC	200	7.2
E039.1	11/5/2016 10:19	UF	WTLAP-16-118173	SSC	200	5
E040	8/3/2016 20:34	UF	WTLAP-16-117352	SSC	1400	9.3
E040	8/3/2016 20:36	UF	WTLAP-16-117356	Estimated	1300	8.9
E040	8/3/2016 20:40	UF	WTLAP-16-117360	Estimated	1200	8.2
E040	8/3/2016 20:42	UF	WTLAP-16-117368	Estimated	1200	7.8
E040	8/3/2016 20:46	UF	WTLAP-16-117376	Estimated	1100	7.2
E040	8/3/2016 20:48	F	WTLAP-16-117380	Estimated	1000	6.9
E040	8/3/2016 20:48	F10u	WTLAP-16-117384	Estimated	1000	6.9
E040	8/3/2016 20:50	UF	WTLAP-16-117388	Estimated	960	6.6
E040	8/3/2016 20:52	UF	WTLAP-16-117392	SSC	900	6
E040	8/3/2016 20:54	F	WTLAP-16-117396	Estimated	900	5.3
E040	8/3/2016 20:54	UF	WTLAP-16-117400	Estimated	900	5.3
E040	8/19/2016 13:03	UF	WTLAP-16-117353	SSC	4400	35
E040	8/19/2016 13:05	UF	WTLAP-16-117357	Estimated	4200	33
E040	8/19/2016 13:09	UF	WTLAP-16-117361	Estimated	3700	30
E040	8/19/2016 13:11	UF	WTLAP-16-117369	Estimated	3500	29
E040	8/19/2016 13:15	UF	WTLAP-16-117377	Estimated	3000	27
E040	8/19/2016 13:17	F	WTLAP-16-117381	Estimated	2800	27
E040	8/19/2016 13:17	F10u	WTLAP-16-117385	Estimated	2800	27
E040	8/19/2016 13:19	UF	WTLAP-16-117389	Estimated	2500	27
E040	8/19/2016 13:21	UF	WTLAP-16-117393	SSC	2300	26
E040	8/19/2016 13:23	F	WTLAP-16-117397	Estimated	2300	25
E040	8/19/2016 13:25	UF	WTLAP-16-117401	Estimated	2300	23
E040	8/24/2016 13:44	UF	WTLAP-16-117354	SSC	3600	48
E040	8/24/2016 13:46	UF	WTLAP-16-117358	Estimated	3500	45
E040	8/24/2016 13:50	UF	WTLAP-16-117362	Estimated	3200	43
E040	8/24/2016 13:52	UF	WTLAP-16-117370	Estimated	3100	40
E040	8/24/2016 13:56	UF	WTLAP-16-117378	Estimated	2800	35
E040	8/24/2016 13:58	F	WTLAP-16-117382	Estimated	2700	33
E040	8/24/2016 13:58	F10u	WTLAP-16-117386	Estimated	2700	33

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	8/24/2016 14:00	UF	WTLAP-16-117390	Estimated	2500	32
E040	8/24/2016 14:02	UF	WTLAP-16-117394	SSC	2400	30
E040	8/24/2016 14:04	F	WTLAP-16-117398	Estimated	2400	29
E040	8/24/2016 14:06	UF	WTLAP-16-117402	Estimated	2400	29
E040	8/27/2016 12:18	UF	WTLAP-16-117355	SSC	4500	48
E040	8/27/2016 12:20	UF	WTLAP-16-117359	Estimated	4300	42
E040	8/27/2016 12:24	UF	WTLAP-16-117363	Estimated	3900	37
E040	8/27/2016 12:26	UF	WTLAP-16-117371	Estimated	3700	34
E040	8/27/2016 12:30	UF	WTLAP-16-117379	Estimated	3400	25
E040	8/27/2016 12:32	F	WTLAP-16-117383	Estimated	3200	23
E040	8/27/2016 12:32	F10u	WTLAP-16-117387	Estimated	3200	23
E040	8/27/2016 12:34	UF	WTLAP-16-117391	Estimated	3000	22
E040	8/27/2016 12:36	UF	WTLAP-16-117395	SSC	2800	20
E040	8/27/2016 12:38	F	WTLAP-16-117399	Estimated	2800	17
E040	8/27/2016 12:40	UF	WTLAP-16-117403	Estimated	2800	14
E040	9/6/2016 19:04	UF	WTLAP-16-126008	SSC	1100	3.3
E040	9/6/2016 19:06	UF	WTLAP-16-126009	Estimated	1100	3.1
E040	9/6/2016 19:10	UF	WTLAP-16-126010	Estimated	990	2.8
E040	9/6/2016 19:12	UF	WTLAP-16-126011	Estimated	950	2.7
E040	9/6/2016 19:16	UF	WTLAP-16-126012	Estimated	880	2.5
E040	9/6/2016 19:18	F	WTLAP-16-126013	Estimated	850	2.3
E040	9/6/2016 19:18	F10u	WTLAP-16-126014	Estimated	850	2.3
E040	9/6/2016 19:20	UF	WTLAP-16-126015	Estimated	810	2.1
E040	9/6/2016 19:22	F	WTLAP-16-126017	Estimated	770	2
E040	9/6/2016 19:22	F	WTLAP-16-126018	Estimated	770	2
E040	9/6/2016 19:24	UF	WTLAP-16-126019	Estimated	740	1.9
E040	9/6/2016 19:26	UF	WTLAP-16-126016	SSC	700	1.7
E040	11/5/2016 23:34	UF	WTLAP-16-127610	SSC	1300	7.7
E040	11/5/2016 23:36	UF	WTLAP-16-127611	SSC	1400	9.1
E040	11/5/2016 23:38	UF	WTLAP-16-127612	SSC	1500	12
E040	11/5/2016 23:40	UF	WTLAP-16-127613	SSC	1600	14
E040	11/5/2016 23:42	UF	WTLAP-16-127614	SSC	1600	15
E040	11/5/2016 23:44	UF	WTLAP-16-127615	SSC	1600	15
E040	11/5/2016 23:46	UF	WTLAP-16-127616	SSC	1400	15
E040	11/5/2016 23:48	UF	WTLAP-16-127617	SSC	1300	15
E040	11/5/2016 23:50	UF	WTLAP-16-127618	SSC	1300	15
E040	11/5/2016 23:52	UF	WTLAP-16-127619	SSC	1200	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)
E040	11/5/2016 23:54	UF	WTLAP-16-127620	SSC	1100	13
E040	11/5/2016 23:56	UF	WTLAP-16-127621	SSC	1000	12
E042.1	8/27/2016 12:44	UF	WTLAP-16-121545	SSC	26,000	51
E042.1	8/27/2016 12:46	UF	WTLAP-16-121546	SSC	24,000	63
E042.1	8/27/2016 12:48	UF	WTLAP-16-121547	SSC	22,000	62
E042.1	8/27/2016 12:50	UF	WTLAP-16-121548	SSC	21,000	61
E042.1	8/27/2016 12:52	UF	WTLAP-16-121549	SSC	19,000	59
E042.1	8/27/2016 12:53	UF	WTLAP-16-117100	Estimated	18,000	58
E042.1	8/27/2016 12:54	UF	WTLAP-16-121550	SSC	16,000	57
E042.1	8/27/2016 12:56	UF	WTLAP-16-121551	SSC	15,000	55
E042.1	8/27/2016 12:57	UF	WTLAP-16-117108	Estimated	14,000	53
E042.1	8/27/2016 12:58	UF	WTLAP-16-121552	SSC	14,000	52
E042.1	8/27/2016 12:59	UF	WTLAP-16-117116	Estimated	14,000	50
E042.1	8/27/2016 13:00	UF	WTLAP-16-117980	SSC	13,000	48
E042.1	8/27/2016 13:02	UF	WTLAP-16-118004	Estimated	13,000	45
E042.1	8/27/2016 13:03	UF	WTLAP-16-117124	Estimated	12,000	43
E042.1	8/27/2016 13:04	UF	WTLAP-16-121553	SSC	12,000	41
E042.1	8/27/2016 13:05	F10u	WTLAP-16-117132	Estimated	12,000	40
E042.1	8/27/2016 13:05	F	WTLAP-16-117140	Estimated	12,000	40
E042.1	8/27/2016 13:06	UF	WTLAP-16-118028	Estimated	11,000	39
E042.1	8/27/2016 13:06	F	WTLAP-16-121487	Estimated	11,000	39
E042.1	8/27/2016 13:07	UF	WTLAP-16-117150	Estimated	11,000	38
E042.1	8/27/2016 13:08	UF	WTLAP-16-121554	SSC	11,000	37
E042.1	8/27/2016 13:10	UF	WTLAP-16-121555	SSC	11,000	35
E042.1	8/27/2016 13:12	UF	WTLAP-16-121556	SSC	10,000	34
E042.1	8/27/2016 13:14	UF	WTLAP-16-121557	SSC	9300	33
E042.1	8/27/2016 13:34	UF	WTLAP-16-117988	SSC	5900	19
E042.1	8/27/2016 13:43	UF	WTLAP-16-117158	Estimated	5100	14
E042.1	8/27/2016 13:43	UF	WTLAP-16-117168	Estimated	5100	14
E042.1	8/27/2016 13:54	UF	WTLAP-16-121558	SSC	4200	11
E042.1	8/27/2016 14:14	UF	WTLAP-16-117989	SSC	3100	7.1
E042.1	8/27/2016 14:28	UF	WTLAP-16-117184	Estimated	2500	5.1
E042.1	8/27/2016 14:28	UF	WTLAP-16-117176	Estimated	2500	5.1
E042.1	8/27/2016 14:34	UF	WTLAP-16-121559	SSC	2200	4.6
E042.1	8/27/2016 14:54	UF	WTLAP-16-121560	SSC	1700	3.3
E042.1	8/27/2016 15:14	UF	WTLAP-16-121561	SSC	1400	2.2
E042.1	8/27/2016 15:34	UF	WTLAP-16-121562	SSC	1100	1.3

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	8/27/2016 15:54	UF	WTLAP-16-121563	SSC	900	0.78
E042.1	11/6/2016 0:30	UF	WTLAP-16-121564	SSC	5600	12
E042.1	11/6/2016 0:32	UF	WTLAP-16-121565	SSC	5000	11
E042.1	11/6/2016 0:34	UF	WTLAP-16-121566	SSC	4100	11
E042.1	11/6/2016 0:36	UF	WTLAP-16-121567	SSC	3800	11
E042.1	11/6/2016 0:38	UF	WTLAP-16-121568	SSC	3500	11
E042.1	11/6/2016 0:39	UF	WTLAP-16-117101	Estimated	3400	10
E042.1	11/6/2016 0:40	UF	WTLAP-16-121569	SSC	3200	10
E042.1	11/6/2016 0:42	UF	WTLAP-16-121570	SSC	2900	9.8
E042.1	11/6/2016 0:43	UF	WTLAP-16-117109	Estimated	2800	9.5
E042.1	11/6/2016 0:44	UF	WTLAP-16-121571	SSC	2800	9.3
E042.1	11/6/2016 0:45	UF	WTLAP-16-117117	Estimated	2700	9
E042.1	11/6/2016 0:46	UF	WTLAP-16-117981	SSC	2600	8.9
E042.1	11/6/2016 0:48	UF	WTLAP-16-118005	Estimated	2400	8.8
E042.1	11/6/2016 0:49	UF	WTLAP-16-117125	Estimated	2400	8.8
E042.1	11/6/2016 0:51	F10u	WTLAP-16-117133	Estimated	2200	8.6
E042.1	11/6/2016 0:51	F	WTLAP-16-117141	Estimated	2200	8.6
E042.1	11/6/2016 0:52	UF	WTLAP-16-118029	Estimated	2200	8.5
E042.1	11/6/2016 0:52	F	WTLAP-16-121488	Estimated	2200	8.5
E042.1	11/6/2016 0:53	UF	WTLAP-16-117151	Estimated	2100	8.3
E042.1	11/6/2016 0:54	UF	WTLAP-16-121573	SSC	2000	8.2
E042.1	11/6/2016 0:56	UF	WTLAP-16-121574	SSC	2000	7.9
E042.1	11/6/2016 0:58	UF	WTLAP-16-121575	SSC	1900	7.6
E042.1	11/6/2016 1:00	UF	WTLAP-16-121576	SSC	1800	7.2
E042.1	11/6/2016 1:20	UF	WTLAP-16-117991	SSC	1300	4.5
E042.1	11/6/2016 1:29	UF	WTLAP-16-117159	Estimated	1200	3.3
E042.1	11/6/2016 1:40	UF	WTLAP-16-121577	SSC	1100	2.5
E042.1	11/6/2016 2:00	UF	WTLAP-16-117990	SSC	800	1.4
E042.1	11/6/2016 2:14	UF	WTLAP-16-117177	Estimated	730	0.88
E042.1	11/6/2016 2:20	UF	WTLAP-16-121578	SSC	700	0.76
E042.1	11/6/2016 2:40	UF	WTLAP-16-121579	SSC	600	0.35
E042.1	11/6/2016 3:00	UF	WTLAP-16-121580	SSC	400	0.24
E050.1	8/27/2016 13:15	UF	WTLAP-16-118836	SSC	2300	7.5
E050.1	8/27/2016 13:17	UF	WTLAP-16-118837	SSC	2500	12
E050.1	8/27/2016 13:19	UF	WTLAP-16-118838	SSC	2600	16
E050.1	8/27/2016 13:21	UF	WTLAP-16-118839	SSC	2800	18
E050.1	8/27/2016 13:23	UF	WTLAP-16-119220	Estimated	2900	20

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	8/27/2016 13:27	UF	WTLAP-16-118840	SSC	3200	23
E050.1	8/27/2016 13:29	UF	WTLAP-16-119236	Estimated	3200	24
E050.1	8/27/2016 13:31	UF	WTLAP-16-118841	SSC	3300	25
E050.1	8/27/2016 13:33	UF	WTLAP-16-119092	SSC	3300	25
E050.1	8/27/2016 13:35	F	WTLAP-16-119188	Estimated	3300	25
E050.1	8/27/2016 13:35	UF	WTLAP-16-119204	Estimated	3300	25
E050.1	8/27/2016 13:37	UF	WTLAP-16-118842	SSC	3300	25
E050.1	8/27/2016 13:39	UF	WTLAP-16-118843	SSC	3100	25
E050.1	8/27/2016 13:39	UF	WTLAP-16-119140	Estimated	3100	25
E050.1	8/27/2016 13:39	F	WTLAP-16-119156	Estimated	3100	25
E050.1	8/27/2016 13:43	UF	WTLAP-16-118844	SSC	3100	24
E050.1	8/27/2016 13:44	UF	WTLAP-16-116818	Estimated	3000	24
E050.1	8/27/2016 13:45	UF	WTLAP-16-118845	SSC	3000	24
E050.1	8/27/2016 13:48	UF	WTLAP-16-116931	Estimated	2900	23
E050.1	8/27/2016 13:50	UF	WTLAP-16-116947	Estimated	2900	23
E050.1	8/27/2016 13:54	UF	WTLAP-16-116963	Estimated	2800	22
E050.1	8/27/2016 13:56	F	WTLAP-16-116979	Estimated	2800	21
E050.1	8/27/2016 13:56	F10u	WTLAP-16-117011	Estimated	2800	21
E050.1	8/27/2016 13:58	UF	WTLAP-16-117019	Estimated	2700	21
E050.1	8/27/2016 14:05	UF	WTLAP-16-119093	SSC	2600	20
E050.1	8/27/2016 14:25	UF	WTLAP-16-118846	SSC	2300	12
E050.1	8/27/2016 14:34	UF	WTLAP-16-117035	Estimated	2100	11
E050.1	8/27/2016 14:34	UF	WTLAP-16-117051	Estimated	2100	11
E050.1	8/27/2016 14:45	UF	WTLAP-16-119094	SSC	1900	9
E050.1	8/27/2016 15:05	UF	WTLAP-16-118847	SSC	1700	6.2
E050.1	8/27/2016 15:19	UF	WTLAP-16-117068	Estimated	1600	4.8
E050.1	8/27/2016 15:19	UF	WTLAP-16-117084	Estimated	1600	4.8
E050.1	8/27/2016 15:25	UF	WTLAP-16-118848	SSC	1500	4.5
E055	8/7/2016 13:20	UF	WTLAP-16-117405	SSC	3200	16
E055	8/7/2016 13:22	UF	WTLAP-16-117417	Estimated	3000	16
E055	8/7/2016 13:26	UF	WTLAP-16-117429	Estimated	2600	16
E055	8/7/2016 13:28	UF	WTLAP-16-117441	Estimated	2400	15
E055	8/7/2016 13:32	F	WTLAP-16-117453	Estimated	2100	14
E055	8/7/2016 13:32	F10u	WTLAP-16-117465	Estimated	2100	14
E055	8/7/2016 13:34	UF	WTLAP-16-117477	Estimated	1900	14
E055	8/7/2016 13:34	UF	WTLAP-16-117489	Estimated	1900	14
E055	8/7/2016 13:36	UF	WTLAP-16-117501	SSC	1700	13

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	8/7/2016 13:38	F	WTLAP-16-117513	Estimated	1700	12
E055	8/7/2016 13:40	UF	WTLAP-16-117525	Estimated	1700	10
E055	9/3/2016 13:20	UF	WTLAP-16-117408	SSC	3300	12
E055	9/3/2016 13:22	UF	WTLAP-16-117420	Estimated	3200	11
E055	9/3/2016 13:26	UF	WTLAP-16-117432	Estimated	2900	9.9
E055	9/3/2016 13:28	UF	WTLAP-16-117444	Estimated	2800	8.9
E055	9/3/2016 13:32	F	WTLAP-16-117456	Estimated	2600	7.3
E055	9/3/2016 13:34	UF	WTLAP-16-117480	Estimated	2400	6.7
E055	9/3/2016 13:36	UF	WTLAP-16-117504	SSC	2300	6.2
E055	9/3/2016 13:38	F	WTLAP-16-117516	Estimated	2300	5.9
E055	9/3/2016 13:38	UF	WTLAP-16-117528	Estimated	2300	5.9
E055	9/3/2016 13:40	F10u	WTLAP-16-117468	Estimated	2300	5.5
E055	9/3/2016 13:42	UF	WTLAP-16-117492	Estimated	2300	5.4
E055.5	8/19/2016 11:54	UF	WTLAP-16-117406	SSC	1300	6.6
E055.5	8/19/2016 11:57	UF	WTLAP-16-117418	Estimated	1500	5
E055.5	8/19/2016 12:02	UF	WTLAP-16-117430	Estimated	1700	4.1
E055.5	8/19/2016 12:04	UF	WTLAP-16-117442	Estimated	1800	4
E055.5	8/19/2016 12:07	UF	WTLAP-16-118420	SSC	2000	4.3
E055.5	8/19/2016 12:09	F	WTLAP-16-117454	Estimated	1500	4.6
E055.5	8/19/2016 12:11	UF	WTLAP-16-117478	Estimated	1100	3.8
E055.5	8/19/2016 12:14	UF	WTLAP-16-117502	SSC	400	0.95
E055.5	8/19/2016 12:16	F	WTLAP-16-117514	Estimated	400	0.61
E055.5	8/19/2016 12:16	UF	WTLAP-16-117526	Estimated	400	0.61
E055.5	8/19/2016 12:19	UF	WTLAP-16-117490	Estimated	400	2.5
E055.5	8/19/2016 12:21	F10u	WTLAP-16-117466	Estimated	400	2.9
E055.5	8/24/2016 12:54	UF	WTLAP-16-117407	SSC	300	3.2
E055.5	8/24/2016 12:58	UF	WTLAP-16-117419	Estimated	300	1.6
E055.5	8/24/2016 13:01	UF	WTLAP-16-117431	Estimated	300	0.51
E055.5	8/24/2016 13:04	UF	WTLAP-16-117527	Estimated	300	2
E055.5	8/24/2016 13:32	UF	WTLAP-16-117443	Estimated	300	1.1
E055.5	8/27/2016 11:09	UF	WTLAP-16-117412	SSC	2200	19
E055.5	8/27/2016 11:12	UF	WTLAP-16-117424	Estimated	2400	12
E055.5	8/27/2016 11:17	UF	WTLAP-16-117436	Estimated	2800	6.9
E055.5	8/27/2016 11:19	UF	WTLAP-16-117448	Estimated	3000	14
E055.5	8/27/2016 11:24	F	WTLAP-16-117460	Estimated	3300	18
E055.5	8/27/2016 11:27	UF	WTLAP-16-117484	Estimated	3600	18
E055.5	8/27/2016 11:27	UF	WTLAP-16-117496	Estimated	3600	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)
E055.5	8/27/2016 11:29	UF	WTLAP-16-117508	SSC	3700	17
E055.5	8/27/2016 11:32	F	WTLAP-16-117520	Estimated	3700	14
E055.5	8/27/2016 11:34	UF	WTLAP-16-117532	Estimated	3700	11
E055.5	8/27/2016 11:37	F10u	WTLAP-16-117472	Estimated	3700	5.8
E055.5	9/3/2016 14:05	UF	WTLAP-16-117413	SSC	800	13
E055.5	9/3/2016 14:08	UF	WTLAP-16-117425	Estimated	800	10
E055.5	9/3/2016 14:10	F	WTLAP-16-117521	Estimated	800	8.9
E055.5	9/3/2016 14:10	UF	WTLAP-16-117533	Estimated	800	8.9
E055.5	9/3/2016 14:12	UF	WTLAP-16-117437	Estimated	800	6.9
E055.5	9/3/2016 14:15	UF	WTLAP-16-117449	Estimated	800	4
E055.5	9/3/2016 14:19	F	WTLAP-16-117461	Estimated	800	1.7
E055.5	9/3/2016 14:19	F10u	WTLAP-16-117473	Estimated	800	1.7
E055.5	9/3/2016 14:22	UF	WTLAP-16-117485	Estimated	800	0.65
E055.5	9/3/2016 14:22	UF	WTLAP-16-117497	Estimated	800	0.65
E056	11/5/2016 7:25	UF	WTLAP-16-117500	SSC	200	8.5
E056	11/5/2016 7:27	UF	WTLAP-16-117440	Estimated	200	8.1
E056	11/5/2016 10:06	UF	WTLAP-16-117428	Estimated	200	4.1
E059.5	8/27/2016 12:57	UF	WTLAP-16-118437	SSC	11,000	27
E059.5	8/27/2016 13:00	UF	WTLAP-16-118438	SSC	11,000	36
E059.5	8/27/2016 13:02	UF	WTLAP-16-118439	SSC	9100	38
E059.5	8/27/2016 13:04	UF	WTLAP-16-118440	SSC	6100	40
E059.5	8/27/2016 13:06	UF	WTLAP-16-118441	SSC	5200	41
E059.5	8/27/2016 13:08	UF	WTLAP-16-118442	SSC	5500	43
E059.5	8/27/2016 13:11	UF	WTLAP-16-118443	SSC	3300	44
E059.5	8/27/2016 13:15	F	WTLAP-16-118804	Estimated	3600	42
E059.5	8/27/2016 13:15	UF	WTLAP-16-118820	Estimated	3600	42
E059.5	8/27/2016 13:17	UF	WTLAP-16-118444	SSC	3700	40
E059.5	8/27/2016 13:19	UF	WTLAP-16-117536	Estimated	3600	39
E059.5	8/27/2016 13:24	UF	WTLAP-16-117552	Estimated	3500	34
E059.5	8/27/2016 13:26	UF	WTLAP-16-117568	Estimated	3500	32
E059.5	8/27/2016 13:31	F	WTLAP-16-117584	Estimated	3300	27
E059.5	8/27/2016 13:31	F10u	WTLAP-16-117600	Estimated	3300	27
E059.5	8/27/2016 14:04	UF	WTLAP-16-117616	Estimated	2400	8
E059.5	8/27/2016 14:24	UF	WTLAP-16-118758	SSC	1900	1.9
E059.5	8/27/2016 14:44	UF	WTLAP-16-117633	Estimated	2000	0.39
E059.5	8/27/2016 14:54	UF	WTLAP-16-117650	Estimated	2000	0.21
E059.5	8/27/2016 14:54	UF	WTLAP-16-117666	Estimated	2000	0.21

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	8/27/2016 15:04	UF	WTLAP-16-118452	SSC	2100	0.0066
E059.5	8/27/2016 15:14	UF	WTLAP-16-117722	Estimated	1700	0
E059.5	8/27/2016 15:14	UF	WTLAP-16-117682	Estimated	1700	0
E059.5	8/27/2016 15:24	UF	WTLAP-16-118453	SSC	1300	0
E059.5	8/27/2016 15:44	UF	WTLAP-16-118454	SSC	1400	4
E059.5	8/27/2016 16:04	UF	WTLAP-16-118455	SSC	1000	3.6

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

[b] UF = Unfiltered.

[c] F = Filtered.

[d] F10u = Filtered with 10-µm pore-size filter.

Table 4.4-1
Calculated Total Metal and Isotopic Uranium Concentrations Determined for Each Sample Analyzed for SSC during 2016 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
E026	8/3/2016 15:50	WTLAP-16-116722	7400	0.674	46,500	11.7	1070	7.55	2.63	42.9	71.1	47,800	0.468	5610	44.8	171	5.67	1.48	4.92	0.22	4.6	80.1	530
E026	8/3/2016 16:10	WTLAP-16-116795	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
E038	8/19/2016 11:49	WTLAP-16-118036	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
E038	8/19/2016 11:51	WTLAP-16-118037	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	8/19/2016 11:53	WTLAP-16-118038	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
E038	8/19/2016 11:55	WTLAP-16-118039	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	8/19/2016 11:57	WTLAP-16-118040	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
E038	8/19/2016 11:59	WTLAP-16-118041	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	8/19/2016 12:01	WTLAP-16-118042	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	8/19/2016 12:03	WTLAP-16-118043	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	8/19/2016 12:05	WTLAP-16-118044	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	8/19/2016 12:09	WTLAP-16-118045	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	8/19/2016 12:11	WTLAP-16-118046	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	8/19/2016 12:13	WTLAP-16-118047	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	8/19/2016 12:15	WTLAP-16-118048	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	8/19/2016 12:19	WTLAP-16-118050	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	8/19/2016 12:23	WTLAP-16-118049	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	8/19/2016 12:25	WTLAP-16-118051	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
E038	8/24/2016 12:39	WTLAP-16-118105	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	8/24/2016 12:41	WTLAP-16-118106	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
E038	8/24/2016 12:43	WTLAP-16-118107	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	8/24/2016 12:45	WTLAP-16-118108	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	8/24/2016 12:47	WTLAP-16-118109	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	8/24/2016 12:49	WTLAP-16-118110	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	8/24/2016 12:53	WTLAP-16-118112	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	8/24/2016 12:55	WTLAP-16-118113	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	8/24/2016 12:57	WTLAP-16-118423	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	8/24/2016 12:59	WTLAP-16-118114	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	8/24/2016 13:01	WTLAP-16-118115	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

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 * SSC	Al (µg/L) 19895 + 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) -12962 + 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	8/24/2016 13:03	WTLAP-16-118116	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
E038	8/24/2016 13:06	WTLAP-16-118117	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
E038	8/24/2016 13:08	WTLAP-16-118118	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	8/24/2016 13:09	WTLAP-16-118119	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	8/24/2016 13:10	WTLAP-16-118123	9600	0.727	54,400	13.2	1420	9.03	3.19	48.5	78.2	61000	0.516	11,100	52.3	190	5.97	1.73	6.63	0.324	6.37	96.3	703
E038	8/24/2016 13:12	WTLAP-16-118124	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	8/24/2016 13:29	WTLAP-16-118120	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
E038	8/24/2016 13:49	WTLAP-16-118121	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	8/24/2016 14:09	WTLAP-16-118122	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	8/27/2016 11:08	WTLAP-16-118128	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	8/27/2016 11:11	WTLAP-16-118129	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	8/27/2016 11:12	WTLAP-16-118130	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	8/27/2016 11:14	WTLAP-16-118131	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	8/27/2016 11:16	WTLAP-16-118132	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	8/27/2016 11:18	WTLAP-16-118133	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	8/27/2016 11:20	WTLAP-16-118134	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	8/27/2016 11:22	WTLAP-16-118135	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	8/27/2016 11:24	WTLAP-16-118136	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	8/27/2016 11:26	WTLAP-16-118424	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	8/27/2016 11:28	WTLAP-16-118137	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	8/27/2016 11:30	WTLAP-16-118138	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	8/27/2016 11:32	WTLAP-16-118139	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	8/27/2016 11:34	WTLAP-16-118140	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	8/27/2016 11:37	WTLAP-16-118141	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	8/27/2016 11:38	WTLAP-16-118142	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	8/27/2016 11:39	WTLAP-16-118144	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	8/27/2016 11:41	WTLAP-16-118145	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	8/27/2016 11:58	WTLAP-16-118143	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	8/3/2016 19:29	WTLAP-16-118059	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	8/3/2016 19:31	WTLAP-16-118060	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	8/3/2016 19:33	WTLAP-16-118061	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

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 * SSC	Al (µg/L) 19895 + 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) -12962 + 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	8/3/2016 19:35	WTLAP-16-118062	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	8/3/2016 19:37	WTLAP-16-118063	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	8/3/2016 19:39	WTLAP-16-118064	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	8/3/2016 19:41	WTLAP-16-118065	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	8/3/2016 19:43	WTLAP-16-118066	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	8/3/2016 19:45	WTLAP-16-118067	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	8/3/2016 19:47	WTLAP-16-118421	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	8/3/2016 19:49	WTLAP-16-118068	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	8/3/2016 19:51	WTLAP-16-118069	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	8/3/2016 19:53	WTLAP-16-118070	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	8/3/2016 19:55	WTLAP-16-118071	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	8/3/2016 19:57	WTLAP-16-118072	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	8/3/2016 19:59	WTLAP-16-118073	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	8/3/2016 20:19	WTLAP-16-118074	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	8/3/2016 20:39	WTLAP-16-118075	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	8/3/2016 20:59	WTLAP-16-118076	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	8/3/2016 21:19	WTLAP-16-118077	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	8/3/2016 21:39	WTLAP-16-118078	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	8/3/2016 21:59	WTLAP-16-118079	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	8/3/2016 22:19	WTLAP-16-118080	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	8/3/2016 22:39	WTLAP-16-118081	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	9/6/2016 18:05	WTLAP-16-118082	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	9/6/2016 18:07	WTLAP-16-118083	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	9/6/2016 18:09	WTLAP-16-118084	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	9/6/2016 18:11	WTLAP-16-118085	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	9/6/2016 18:13	WTLAP-16-118086	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	9/6/2016 18:15	WTLAP-16-118087	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	9/6/2016 18:17	WTLAP-16-118088	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	9/6/2016 18:19	WTLAP-16-118089	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	9/6/2016 18:21	WTLAP-16-118090	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	9/6/2016 18:23	WTLAP-16-118422	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

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 * SSC	Al (µg/L) 19895 + 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) -12962 + 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	9/6/2016 18:25	WTLAP-16-118091	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	9/6/2016 18:27	WTLAP-16-118092	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	9/6/2016 18:29	WTLAP-16-118093	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	9/6/2016 18:31	WTLAP-16-118094	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	9/6/2016 18:33	WTLAP-16-118095	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	9/6/2016 18:35	WTLAP-16-118096	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	9/6/2016 18:55	WTLAP-16-118097	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	9/6/2016 19:15	WTLAP-16-118098	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	9/6/2016 19:35	WTLAP-16-118099	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	9/6/2016 19:55	WTLAP-16-118100	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	9/6/2016 20:15	WTLAP-16-118101	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	9/6/2016 20:35	WTLAP-16-118102	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	9/6/2016 20:55	WTLAP-16-118103	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	9/6/2016 21:15	WTLAP-16-118104	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	11/5/2016 7:09	WTLAP-16-118151	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	11/5/2016 7:11	WTLAP-16-118152	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	11/5/2016 7:13	WTLAP-16-118153	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	11/5/2016 7:15	WTLAP-16-118154	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	11/5/2016 7:17	WTLAP-16-118155	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	11/5/2016 7:19	WTLAP-16-118156	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	11/5/2016 7:21	WTLAP-16-118157	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	11/5/2016 7:23	WTLAP-16-118158	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	11/5/2016 7:25	WTLAP-16-118159	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	11/5/2016 7:27	WTLAP-16-118425	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	11/5/2016 7:29	WTLAP-16-118160	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	11/5/2016 7:31	WTLAP-16-118161	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	11/5/2016 7:33	WTLAP-16-118162	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	11/5/2016 7:35	WTLAP-16-118163	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	11/5/2016 7:37	WTLAP-16-118164	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	11/5/2016 7:39	WTLAP-16-118165	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	11/5/2016 7:59	WTLAP-16-118166	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

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 * SSC	Al (µg/L) 19895 + 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) -12962 + 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	11/5/2016 8:19	WTLAP-16-118167	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	11/5/2016 9:39	WTLAP-16-118171	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	11/5/2016 9:59	WTLAP-16-118172	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	11/5/2016 10:19	WTLAP-16-118173	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	8/3/2016 20:34	WTLAP-16-117352	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
E040	8/3/2016 20:52	WTLAP-16-117392	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
E040	8/19/2016 13:03	WTLAP-16-117353	4400	0.603	35,700	9.71	587	5.53	1.87	35.2	61.5	29,800	0.403	-1920	34.4	145	5.26	1.13	2.58	0.0776	2.2	57.9	293
E040	8/19/2016 13:21	WTLAP-16-117393	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	8/24/2016 13:44	WTLAP-16-117354	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	8/24/2016 14:02	WTLAP-16-117394	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
E040	8/27/2016 12:18	WTLAP-16-117355	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
E040	8/27/2016 12:36	WTLAP-16-117395	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
E040	9/6/2016 19:04	WTLAP-16-126008	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	9/6/2016 19:26	WTLAP-16-126016	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
E040	11/5/2016 23:34	WTLAP-16-127610	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
E040	11/5/2016 23:36	WTLAP-16-127611	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
E040	11/5/2016 23:38	WTLAP-16-127612	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	11/5/2016 23:40	WTLAP-16-127613	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
E040	11/5/2016 23:42	WTLAP-16-127614	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
E040	11/5/2016 23:44	WTLAP-16-127615	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
E040	11/5/2016 23:46	WTLAP-16-127616	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
E040	11/5/2016 23:48	WTLAP-16-127617	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
E040	11/5/2016 23:50	WTLAP-16-127618	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
E040	11/5/2016 23:52	WTLAP-16-127619	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
E040	11/5/2016 23:54	WTLAP-16-127620	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	11/5/2016 23:56	WTLAP-16-127621	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	8/27/2016 12:44	WTLAP-16-121545	26400	1.12	115,000	24.3	4110	20.3	7.46	91.3	132	162,000	0.883	53,300	110	335	8.25	3.68	19.7	1.12	19.8	220	2030
E042.1	8/27/2016 12:46	WTLAP-16-121546	24500	1.08	108,000	23	3800	19.1	6.97	86.5	126	150,000	0.841	48,500	104	319	7.99	3.46	18.3	1.03	18.3	206	1880
E042.1	8/27/2016 12:48	WTLAP-16-121547	22000	1.02	98,900	21.4	3400	17.4	6.34	80.1	118	135,000	0.787	42,300	95	297	7.65	3.17	16.3	0.912	16.3	188	1680
E042.1	8/27/2016 12:50	WTLAP-16-121548	20700	0.99	94,200	20.5	3200	16.5	6.01	76.8	114	127,000	0.758	39,000	90.5	286	7.48	3.02	15.3	0.85	15.3	178	1580
E042.1	8/27/2016 12:52	WTLAP-16-121549	18700	0.942	87,000	19.2	2880	15.2	5.5	71.7	108	116,000	0.715	34,000	83.6	269	7.2	2.79	13.7	0.755	13.7	164	1420

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 * SSC	Al (µg/L) 19895 + 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) -12962 + 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	8/27/2016 12:54	WTLAP-16-121550	16,400	0.888	78,800	17.7	2510	13.6	4.92	65.8	100	102,000	0.665	28,200	75.7	249	6.89	2.52	11.9	0.646	11.8	147	1240
E042.1	8/27/2016 12:56	WTLAP-16-121551	14,600	0.845	72,300	16.5	2220	12.4	4.46	61.2	94.3	90,900	0.625	23,700	69.5	233	6.65	2.31	10.5	0.561	10.4	133	1100
E042.1	8/27/2016 12:58	WTLAP-16-121552	13,900	0.828	69,800	16	2110	11.9	4.28	59.4	92.1	86,800	0.61	21,900	67.1	227	6.55	2.23	9.99	0.528	9.82	128	1040
E042.1	8/27/2016 13:00	WTLAP-16-117980	13,200	0.812	67,300	15.5	2000	11.5	4.1	57.7	89.8	82,600	0.595	20,200	64.7	221	6.46	2.15	9.44	0.495	9.26	123	987
E042.1	8/27/2016 13:04	WTLAP-16-121553	11,900	0.781	62,600	14.7	1790	10.6	3.77	54.3	85.6	74,800	0.566	16,900	60.2	210	6.28	2	8.43	0.433	8.21	113	884
E042.1	8/27/2016 13:08	WTLAP-16-121554	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	8/27/2016 13:10	WTLAP-16-121555	10,600	0.75	57,900	13.8	1580	9.7	3.44	51	81.4	67,000	0.538	13,600	55.8	199	6.1	1.85	7.41	0.371	7.17	104	782
E042.1	8/27/2016 13:12	WTLAP-16-121556	10,100	0.738	56,200	13.5	1500	9.37	3.32	49.8	79.8	64,000	0.527	12,400	54	194	6.03	1.79	7.02	0.348	6.77	100	743
E042.1	8/27/2016 13:14	WTLAP-16-121557	9300	0.719	53,300	13	1370	8.83	3.11	47.7	77.2	59,200	0.51	10,400	51.3	187	5.92	1.7	6.4	0.31	6.13	94.1	680
E042.1	8/27/2016 13:34	WTLAP-16-117988	5900	0.639	41,100	10.7	827	6.54	2.25	39	66.3	38,800	0.436	1850	39.6	158	5.46	1.31	3.75	0.149	3.4	69	412
E042.1	8/27/2016 13:54	WTLAP-16-121558	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	8/27/2016 14:14	WTLAP-16-117989	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	8/27/2016 14:34	WTLAP-16-121559	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
E042.1	8/27/2016 14:54	WTLAP-16-121560	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	8/27/2016 15:14	WTLAP-16-121561	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	8/27/2016 15:34	WTLAP-16-121562	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	8/27/2016 15:54	WTLAP-16-121563	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	11/6/2016 0:30	WTLAP-16-121564	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	11/6/2016 0:32	WTLAP-16-121565	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	11/6/2016 0:34	WTLAP-16-121566	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
E042.1	11/6/2016 0:36	WTLAP-16-121567	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	11/6/2016 0:38	WTLAP-16-121568	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	11/6/2016 0:40	WTLAP-16-121569	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	11/6/2016 0:42	WTLAP-16-121570	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
E042.1	11/6/2016 0:44	WTLAP-16-121571	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
E042.1	11/6/2016 0:46	WTLAP-16-117981	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	11/6/2016 0:54	WTLAP-16-121573	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
E042.1	11/6/2016 0:56	WTLAP-16-121574	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
E042.1	11/6/2016 0:58	WTLAP-16-121575	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
E042.1	11/6/2016 1:00	WTLAP-16-121576	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	11/6/2016 1:20	WTLAP-16-117991	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

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 * SSC	Al (µg/L) 19895 + 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) -12962 + 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	11/6/2016 1:40	WTLAP-16-121577	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	11/6/2016 2:00	WTLAP-16-117990	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
E042.1	11/6/2016 2:20	WTLAP-16-121578	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
E042.1	11/6/2016 2:40	WTLAP-16-121579	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
E042.1	11/6/2016 3:00	WTLAP-16-121580	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
E050.1	8/27/2016 13:15	WTLAP-16-118836	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	8/27/2016 13:17	WTLAP-16-118837	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	8/27/2016 13:19	WTLAP-16-118838	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	8/27/2016 13:21	WTLAP-16-118839	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
E050.1	8/27/2016 13:27	WTLAP-16-118840	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
E050.1	8/27/2016 13:31	WTLAP-16-118841	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
E050.1	8/27/2016 13:33	WTLAP-16-119092	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
E050.1	8/27/2016 13:37	WTLAP-16-118842	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
E050.1	8/27/2016 13:39	WTLAP-16-118843	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	8/27/2016 13:43	WTLAP-16-118844	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	8/27/2016 13:45	WTLAP-16-118845	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
E050.1	8/27/2016 14:05	WTLAP-16-119093	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	8/27/2016 14:25	WTLAP-16-118846	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	8/27/2016 14:45	WTLAP-16-119094	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
E050.1	8/27/2016 15:05	WTLAP-16-118847	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	8/27/2016 15:25	WTLAP-16-118848	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
E055	8/7/2016 13:20	WTLAP-16-117405	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
E055	8/7/2016 13:36	WTLAP-16-117501	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
E055	9/3/2016 13:20	WTLAP-16-117408	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	9/3/2016 13:36	WTLAP-16-117504	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
E055.5	8/19/2016 11:54	WTLAP-16-117406	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
E055.5	8/19/2016 12:07	WTLAP-16-118420	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
E055.5	8/19/2016 12:14	WTLAP-16-117502	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
E055.5	8/24/2016 12:54	WTLAP-16-117407	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
E055.5	8/27/2016 11:09	WTLAP-16-117412	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
E055.5	8/27/2016 11:29	WTLAP-16-117508	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

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 * SSC	Al (µg/L) 19895 + 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) -12962 + 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	9/3/2016 14:05	WTLAP-16-117413	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
E056	11/5/2016 7:25	WTLAP-16-117500	200	0.504	20,600	6.92	-85	2.7	0.802	24.5	47.9	4690	0.311	-12500	20	109	4.69	0.644	-0.7	-0.122	-1.17	26.9	-37.5
E059.5	8/27/2016 12:57	WTLAP-16-118437	10,900	0.757	59,000	14	1630	9.91	3.52	51.8	82.4	68,800	0.545	14400	56.8	201	6.14	1.89	7.65	0.386	7.41	106	806
E059.5	8/27/2016 13:00	WTLAP-16-118438	10,800	0.755	58,700	14	1610	9.84	3.49	51.5	82.1	68,200	0.542	14100	56.5	200	6.13	1.87	7.57	0.381	7.33	105	798
E059.5	8/27/2016 13:02	WTLAP-16-118439	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
E059.5	8/27/2016 13:04	WTLAP-16-118440	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
E059.5	8/27/2016 13:06	WTLAP-16-118441	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
E059.5	8/27/2016 13:08	WTLAP-16-118442	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
E059.5	8/27/2016 13:11	WTLAP-16-118443	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	8/27/2016 13:17	WTLAP-16-118444	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	8/27/2016 14:24	WTLAP-16-118758	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
E059.5	8/27/2016 15:04	WTLAP-16-118452	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
E059.5	8/27/2016 15:24	WTLAP-16-118453	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
E059.5	8/27/2016 15:44	WTLAP-16-118454	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
E059.5	8/27/2016 16:04	WTLAP-16-118455	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

Note: Values of cells shaded in gray exceed background concentrations expected in sediment.

[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 Concentrations at E050.1

Station	Linear Equation for Unfiltered Metal Concentration	E050.1 (µg/L) Collected 8/27/2016 13:39 Field Sample ID WTLAP-16-118843	E050.1 (µg/L) Collected 8/27/2016 13:39 Field Sample ID WTLAP-16-119140	Relative Percent Difference 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)	19895+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	22058 (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)

Station	Linear Equation for Unfiltered Metal Concentration	E050.1 (pCi/L) Collected 8/27/2016 13:45 Field Sample ID WTLAP-16-118845	E050.1 (pCi/L) Collected 8/27/2016 13:50 Field Sample ID WTLAP-16-116947	RPD between calculated isotopic uranium activities at WTLAP-16-118845 and measured activities at WTLAP-16-116947.
SSC (mg/L)	Measured	3000 (Measured)	2900 (Estimated)	n/a
U-234 (pCi/L)	-0.856+0.00078[e] * SSC	1.484 (Estimated)	2.2 (Measured)	39%
U-235/236 (pCi/L)	-0.131+0.0000474 * SSC	0.0112 (Estimated)	ND (Measured)	n/a
U-238 (pCi/L)	-1.33+0.000802 * SSC	1.076 (Estimated)	2.02 (Measured)	61%

[a] n/a = not applicable.

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

[c] SSC = Units of SSC measurement is mg/L.

[d] ND = Not detected.

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

Appendix A

2015–2016 Geomorphic Changes at Sediment Transport Mitigation Sites in the Los Alamos and Pueblo Canyon Watershed

CONTENTS

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A-1.0 INTRODUCTION

This appendix evaluates geomorphic changes that occurred in 2016 at sediment transport mitigation sites in the Los Alamos and Pueblo Canyon watershed within and near Los Alamos National Laboratory (LANL or the Laboratory). Geomorphic change was evaluated using aerial light detection and ranging (LiDAR) data collected in June 2014 before the 2014 northern New Mexico monsoon season and in December 2015 after the 2015 northern New Mexico monsoon season. This appendix compares the LiDAR surveys encompassing accumulated change over two annual monsoon seasons: 2015 and 2016. Additionally, post-monsoon ground-based surveys of the thalweg conducted between November and April are presented, representing change over the 2016 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). 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.

A-2.0 HYDROLOGIC EVENTS DURING 2016 MONSOON SEASON

The largest storm water runoff events in 2016 at the sediment transport mitigation sites in the Los Alamos and Pueblo Canyon watershed occurred as follows (see Table 2.3-1 of the report for additional detail):

- Pueblo Canyon (gaging station E059.5 and E060.1) – August 19, August 27, and September 6;
- DP Canyon (gaging stations E038 and E039.1) – August 3, August 19, August 24, August 27, September 6, and November 5; and
- Los Alamos Canyon (gaging stations E042.1 and E050.1) – August 27 and November 6.

The maximum measured discharge at these sites occurred in Pueblo Canyon on August 27 at E059.5 (45 cubic feet per second [cfs]) and September 6 at E060.1 (3.8 cfs); in DP Canyon on August 24 at E038 (130 cfs) and September 6 at E039.1 (42 cfs); and in Los Alamos Canyon on August 27 at E042.1 (63 cfs) and E050.1 (25 cfs). The 2016 peak discharges were similar in magnitude to the 2015 flood events. Runoff from 2016 precipitation events flowed within the channel caused by 2013 floods, as observed during Annual Site Environmental Report sediment sampling and confirmed with channel bank and thalweg surveying.

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

LiDAR surveying is a process by which laser beams are directed at a surface and the resulting reflections are used to calculate the distance to the surface. Aerial LiDAR surveying involves mounting the LiDAR equipment in an airplane and flying a known course while directing lasers at the ground surface to generate a three-dimensional (3-D) point cloud of the surface. Aerial LiDAR surveys were flown over the Laboratory in June 2014 before the annual New Mexico monsoon season, in November 2015, and in October 2016 following the New Mexico monsoon season.

Aerial LiDAR surveying is the only known technology that can evaluate topographic change over large areas such as the watercourses of Los Alamos and Pueblo Canyons. Other survey techniques either require extensive field work, making the surveying cost prohibitive, or provide only estimates of the overall area of interest, resulting in large propagated error estimates of topographic change. Two known disadvantages of aerial LiDAR compared with the ground-based transect surveys are that (1) dense vegetation can result in misclassification of some LiDAR points as “ground” that should actually be “nonground,” resulting in elevation discrepancies, and (2) water is opaque to LiDAR, so sediment erosion/deposition features that are submerged at the time of the survey are not captured. As a result, the ground survey of the thalweg and plunge pool is critical to capture these submerged sediment changes, particularly in areas of dense vegetation.

A-3.1 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. 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.

A-3.2 Digital Elevation Model Generation and Geomorphic Change Estimation Procedures

When surveys of an area are repeated, 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 nongeomorphic processes. However, apparent elevation changes can also occur as a result of error inherent to the survey data acquisition and classification methods. In this appendix, nongeomorphic 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 those caused by geomorphic and nongeomorphic processes. However, some small-magnitude actual elevation changes (e.g., deposition of a very thin sediment layer) may also fall below the threshold and thus be discounted from change detection calculations, even if they were physically observed. Above the threshold, field observations and vegetation maps can provide context to distinguish between geomorphic (e.g., sediment erosion or deposition) and nongeomorphic elevation changes (e.g., elevation increase from cattail mound development between surveys).

The points designated as “ground” in the aerial LiDAR data set from each survey year were used to generate digital elevation models (DEMs) that were clipped to the geographic boundaries of the study reach before further analysis. The 2016 and 2015 DEMs were defined (i.e., clipped) using an additional 15-ft buffer away from the clipped DEM extents of the 2015 monitoring report (LANL 2016, 601433) to incorporate an evaluation of channel banks.The 2015 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 2015 and 2016 surveys; negative values indicate erosion over the same time period. A range of red pixels designate annual negative change (erosion); similarly, a range of blue pixels identifies annual 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. Maximum detected positive and negative changes in elevation are specifically evaluated in the field to confirm whether they are the result of geomorphic or nongeomorphic processes.

In previous iterations of this appendix, error was estimated by simply comparing agreement of the predicted surface (the DEM) with a more accurate measurement of the actual surface (points surveyed by GPS). Computing the root mean squared error (RMSE) of the difference in measured (GPS) versus predicted (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 from 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 that, 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. 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, it is expected that high point density will yield a more realistic representation of ground surface. When points are sparse, the modelling 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. The 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 their representation of actual ground surface is less accurate.

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. 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 degrees 2. Point Density = 2.0 pts/ft^2 3. Roughness = 0.3 ft

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

After the group into which the pixel falls is assessed, the pixel is assigned an appropriate error value based 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, and therefore, this pixel would be represented by an error value within that best-case scenario range.

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 because of nongeomorphic processes. Nongeomorphic elevation changes are often represented by a mottling on the DoD of both positive and negative detects in areas of steep terrain and dense tree canopy that does not represent actual geomorphic changes. These detects can often be attributed to misclassification of point cloud data.

A-3.3 Ground-based Survey of Thalweg and Channel Bank

The 2016 post-monsoon thalweg locations were surveyed in Pueblo Canyon using ground-based methods to document change. These features were surveyed using real-time kinematic differentially corrected GPS surveying equipment rather than LiDAR because of interference caused by dense vegetation and standing water in the LiDAR data acquisition. Surveys were conducted between January and February following the monsoon seasons in 2016, as discussed below in section 4.0. Stability of stream channel features in areas near engineered erosion control mitigation features in Pueblo Canyon are particular points of interest.

Surveying of channel banks did not occur in 2016. Instead, the analyzed areas for both 2015 and 2016 DEM surfaces in Pueblo and DP Canyons were expanded to calculate geomorphic changes of steeply inclined channel banks.

Thalweg elevations surveyed in 2015 and 2016 in Pueblo Canyon are compared in Figure A-3.3-1. Thalweg surveys were collected in 2016 at the upper willow planting area, wing ditch area, lower willow planting area, and above the Pueblo GCS. As with the 2015 survey, the 2016 longitudinal channel thalweg profile was surveyed continually from the Pueblo GCS up to the Pueblo drop structure. A continuous thalweg survey was also collected this year from below the wing ditch area upstream into the upper willow planting area. All ground-based survey data points are listed in Attachment A-2 (on CD).

A-4.0 RESULTS

Two complications arise when interpreting the DoD analyses for reach-scale volume change calculations. First, some LiDAR points were likely misclassified as ground points that do not represent the actual ground surface. In areas of dense vegetation (i.e., reed canarygrass 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 3-D 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 occurring outside the channel itelf.

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 to 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.

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 Tables A-4.0-1 and A-4.0-2, respectively, and for the Los Alamos low-head weir in Table A-4.0-3.

A-4.1 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 show lower amplitude geomorphic change. However, it is also important to recognize that some areas, 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) or of features (e.g., boulders) that were not previously classified as ground.

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). Data tables of surveyed checkpoints are included in Attachment A-2 (on CD). In general, comparison of check points to the DEM within vegetated areas yields higher error values than check points collected on open, less vegetated surfaces. In general, error values for the DEM surface within areas vegetated with reed canarygrass and cattails are much higher than those unvegetated channel surfaces. A spatially variable error value was generated for each sediment mitigation monitoring area. The uniform RMSE values 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 operations of the lowest value in the legend of each error map. Variable error surfaces are shown in Figures A-4.1-1 through A-4.1-16 and reported in Table A-4.0-2.

The propagated error values provide the threshold above or 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 geomophoric change occurred. Areas of confirmed or rejected geomorphic change are identified and documented in this appendix. Regardless of confirmation by field verification, all DoD values were used to calculate net volume changes as discussed in the results section. 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. Given 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 yield results that can be considered volumetrically equivalent to within-channel geoporphic processes

A-4.2 Pueblo Canyon Background Area above the WWTF

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

The DoD shows no detected changes within the channel but highlights two specific areas where geomorphic change is expected and defined by soil and rock falls. The geomoprhic elevation changes are indicated on Inset Maps A and B of Figure A-4.2-1. Field observations confirm that the detected −8.1 and −5.5 ft of elevation change is from side drainage incision paired with soil/rock falls on steeply inclined banks (Photo A1-1 in Attachment A-1) and lateral bank migration from soil/rock falls (Photo A1-2 in Attachment A-1), respectively. The maximum detected change is indicated on Inset Map B of Figure A-4.2-1.

This detected positive elevation change is attributed to the classification of large boulders (Photos A1-3 and A1-4 in Attachment A-1) as ground in the 2016 point cloud but not in the 2015 point cloud. Net volume change detected in the Pueblo Canyon background area above the wastewater treatnent facility (WWTF) is 854 ft^3 ± 1143 ft^3 (Table A-4.0-1).

A-4.3 Pueblo Canyon Upper Willow Planting Area

The upper willow planting area DoD's upstream extent is west of the western edge of reach P-3 Far West (P-3FW), and the downstream extent is eastern edge of reach P-3 West (P-3W) (Figure A-4.3-1).

Comparison of DoD results to 2015 channel bank survey (banks were not surveyed in this area in 2016) revealed very few, mostly minor changes in bank position over the monitoring area. Field checks indicate the variations do not reflect bank erosion or deposition, confirming bank stability in this area (Figure A-4.3-1).

Thalweg profiles were surveyed in 2015 and 2016. The thalweg was mostly unchanged between the 2015 and 2016 surveys (Figures A-3.3-1 and A-4.3-2). The slight seperation between the 2015 and 2016 (lower) elevation profiles of about 200 ft above gage E095.5 likely represents minor incision below the threshold of the DoD analysis (Figure A-4.3-2). The overall thanlweg gradient between 2015 and 2016 has remained unchanged (Figures A-3.3-1 and A-4.3.2).

The thresholded DoD in this area detected a maximum negative elevation change of −11.3 ft as shown in Inset Map A of Figure A-3.3-1 and Photo A1-5 in Attachment A-1. Mass wasting processes on this cutbank have resulted in small amounts soil and rock falls that have been verified in the field; however, the large magnitude (−11.3 ft) of topographic change detected is somewhat misleading. The slope in question is defined by a steep and, in places, overhanging bank of unconsolidated sediments and boulders. The fall of a small overhanging portion of the slope will result in a large magnitude change in elevation that does not necessarliy reflect a volumetrically equivalent amount of sediment movement. These mass wasting processes at steep banks are typical along the study area.

An area of positive elevation change was detected near gage station E059.5. This area represents another example of topographic elevation change detected during the DoD analysis, and confirmed in the field, that is not specifically related to channel aggradation or incision. The positive elevation change of +5.3 ft on the steep bank slumping over the active channel is the result of slow bank creep (see Inset Map B of Figure A-3.3-1 and Photo A1-6 in Attachment A-1). Many smaller detects for positive elevation change are attributed to growing clumps of cattails, willows, and reed canarygrass along the thalweg. Net volume change detected in the Pueblo Canyon upper willow planting area is 991 ft^3 ± 1097 ft^3 (Table A-4.0-1).

A-4.4 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 canarygrass wetland, without defined banks to survey.

The thalweg below the road crossing in contiguous reaches P-3 Central (P-3C) and P-3E was not surveyed in 2015 because the channel was braided (i.e., no single thalweg) following construction. The thalweg in this area was resurveyed in 2016 and continued upstream into the upper willow planting area to establish a baseline for future years (Figures A-3.3-1 and A-4.3.2).

The upstream edge of the DoD is at the eastern edge of the reach P-3W and is continguous with the upstream survey area (Pueblo Canyon upper willow planting area) (Figure A-4.4-1). The downstream edge of the DoD extent incorporates this reed canarygrass wetland and is contiguous with the next downstream area at the eastern edge of reach P-3E (Pueblo Canyon lower willow planting area) (Figure A-4.4-1).

Field observations confirm the thresholded DoD results showing no change in the primary channel around the bridge and culvert structures. However, a small area of erosion was detected near where the road surface and culvert structures meet. The detected geomoprhic change (−2.4 ft) is shown in Inset Map A of Figure A-4.4-1 and Photo A1-7. Other small, detectable, and verified geomoprhic changes were confirmed in the channelized area west of the bridge. Small bank collapses on the order of −2.39 ft to −1.9 ft observed in the active channel on steep cutbanks of unconsolidated sediment (Inset Map B of Figure A-4.4-1 and Photos A1-8 and A1-9 in Attachment A-1) are attributed to typical channel processes. Areas of apparent deposition scattered throughout the heavily vegetated portion of the area are interpreted to be the result of new vegetation growth misclassified as ground points. This change in vegetation height contributed to the large net positive volume change in this area. A thalweg was not surveyed in this area because the channel is poorly defined with branching and distributed flow. Net volume change detected in the Pueblo Canyon wing ditch area is 21905 ft^3 ± 18659 ft^3 (Table A-4.0-1).

A-4.5 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 2009 and 2014 (Figure A-4.5-1). A headcut in this area (near gage station E059.8) propogated upstream from flooding in September 2013. From 2014 to 2015, the Pueblo Canyon drop structure was constructed to prevent further headcut erosion.

Thalweg surveys were conducted in 2016 along the entire length of Pueblo Canyon lower willow planting area. Comparison of the 2016 and 2015 thalweg surveys shows minimal change in channel gradient (Figures A-3.3-1 and A-4.5.2).

The thresholded DoD extent includes the main channel within reaches P-3FE and P-4W and shows minor areas of topographic change along steep banks of uncolidated sediment (Figure A-4.5-1). The largest apparent change of −3.2 ft was at the ponded area above the drop structure (Inset Map A of Figure A-4.5-1 and Photo A1-10 in Attachment A-1). This detect is likely the result of variance in the depth of water (on average 1.5 ft lower than last year) between LiDAR surveys because no geomorphic change was evident during field verifications. Positive elevation changes (deposition) detected between the drop structure and stream gage E059.8 are attributed to the continued growth of reed canarygrass from the elevated surfaces south of the channel and within the channel. Detected and confirmed geomorphic changes (−3.9 ft and +2.4 ft) shown in Figure A-4.5-1 Inset Maps A and B, respectively, were the result of minor elevation changes defined by soil falls along steep banks of unconsolidated sediment downstream of the drop structure (Photos A1-11 and A1-12 in Attachment A-1). No deposition or erosion was detected along the remainder of this area, indicating the channel in the lower willow planting area is stable. Net volume change detected in the Pueblo Canyon lower willow planting area is 791 ft^3 ± 3918 ft^3 (Table A-4.0-1).

Comparison of DoD results of the 2015 channel bank surveys suggests very minor changes along the bank over the monitoring area (Inset Map A of Figure A-4.5-1 and Photos A1-11 and A1-12 in Attachment A-1). Field checks below the drop structure confirm overall bank stablility.

A-4.6 Pueblo Canyon Grade-Control Structure Area

The thalweg was surveyed in 2016 throughout the Pueblo GCS area, which is within reach P-4 Central (P-4C) and reach P-4 East (P-4E) (Figure A-4.6-1). Channel incision (Figure A-4.6.2) is observed in the thalweg profile comparison data and is consistent with the DoD results discussed below. The obvious change in thalweg location is evident in Figure A-4.6-1 at the easternmost edge of reach P-4C in the large north-trending meander. The thalweg profile comparison shows elevation increase at this location;

however, this change in thalweg location is attributed to the diffuse and braided flow of water rather than to downcutting (Figure A-4.6-2). The overall thanlweg gradient between 2015 and 2016 has remained unchanged (Figures A-3.3-1 and A-4.6.2).

Stream banks in this monitoring area were not surveyed in 2016, but field observations and DoD results suggest the banks were stable both above and below the GCS (Figure A-4.6-1). Field checks in reaches P-4C and P-4E confirm overall bank stablility.

The thresholded DoD in the Pueblo GCS area shows minor change in the channel at the western edge of Reach P-4C (Figure A-4.6-1 and Inset Map A). Geomorphic change related to typical channel processes (−1.26 ft) was detected near the northwest side of reach P-4C and is attributed to continued incision of the primary channel (Photos A1-13 and A1-14 in Attachment A-1). A similar incision was observed and documented in 2015, suggesting continued development of the primary channel. Areas of maximum detected positive (+7.2 ft) and negative (−3.26 ft) elevation change, located downstream of the GCS, are from the construction of bank stabilization structures installed by the Laboratory (Photo A1-15 in Attachment A-1).

Overall, the Pueblo GCS area has been geomorphically stable with only minor changes since the 2015 LiDAR survey. Net positive volume change detected in the Pueblo Canyon GCS area is 6958 ft^3 ± 4421 ft^3 (Table A-4.0-1).

A-4.7 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. The thresholded DoD for Basin 1 shows areas of topographic change (maximum elevation changes ranging from +0.57 ft to +7.4 ft) where construction activities occurred (Figure A-4.7-1 and Photo A1-16 in Attachment A-1). The December 2015 aerial LiDAR survey did not capture the final configuration of the construction that was completed within Basin 1 in January 2016. Topographic changes within Basin 1 are entirely related to construction activities, specifically the installation of a gabion wall, concrete storm vault, and cobble- to boulder-sized riprap.

A-4.8 Los Alamos Canyon Low-Head Weir

The thresholded DoD at the sediment retention basins above the Los Alamos Canyon low-head weir represent changes from the 2016 monsoon season (Figure A-4.8-1). Recent rain events in early 2017 have resulted in the water level in Basin 3 rising substantially from what was observed in the fall/winter of 2016, making field verification of some DoD results impossible. The maximum detected changes (+1.38 ft and −1.35 ft) within Basin 3 are now under water. In addition, but to a lesser extent, detected erosion in Basin 3 of −0.8 ft is also now under water (Photo A1-17 in Attachment A-1). However, during the 2016 sediment sampling campaign in Basin 3, this area was not submerged and sampling was conducted on this detected depositional lobe. Channel incision in this part of Basin 3 was also observed during sampling. The deposition within Basin 2 is attributed to channel aggradation in a secondary channel (Photo A1-18 in Attachment A-1). The remaining positive detected geomorphic changes were the result of overbank deposition of the primary channel in Basin 1 (Photo A1-19 in Attachment A-1). No sediments were excavated during the 2015 to 2016 time period. The submerged part of Basin 3 was not included in the calculations (Table A-4.0-3).

A-4.9 DP Canyon GCS Area

DP Canyon GCS in reach DP-2 is shown in Figure A-4.9-1. The thresholded DoD shows an area of field-verified channel aggredation (maximum 1.21 ft) at the upstream end of the wetland area above the DP Canyon GCS (Figure A-4.9-1 and Photo A1-20 in Attachment A-1). The thresholded DoD shows two small areas of erosion in DP Canyon: one at the western-central end of the reach near the previously mentioned deposition (Photo A1-20 in Attachment A-1) and the other ~200 ft upstream of the DP Canyon GCS (Photos A1-21a and A-1-21b in Attachment A-1). Field verifications of eroded areas (maximum −1.0 ft) indicate the western area was the result of incision into an existing channel, and the area near the GCS was attributed to minor bank collapses along the established channel. The maximum detected positive and negative elevation change in this monitoring area is located at the GCS (Figure A-4.9-1). Field observations confirm no topographic change has occurred around the GCS, and these detected changes are the result of misclassification of LiDAR survey data. Overall, the area has been stable since the 2015 LiDAR survey. Net volume change detected in the DP Canyon GCS area is 879 ft^3 ± 662 ft^3 (Table A-4.0-1).

A-5.0 DISCUSSION OF GEOMORPHIC SURVEYS

Repeat stream channel thalwegs were measured in the Pueblo Canyon monitoring areas, and these surveys indicate few changes in the overall thalweg gradients between the 2015 and 2016 surveys. Locally, small areas of channel incision were identified and are attributed to local elevation adjustments as the channels were redefined following the 2013 flooding. Channel-bank stability was assessed using DEM comparison, and the DoD results were compared with the 2015 ground-based bank survey. Only local, spatially discontinuous, small-magnitude bank collapses were observed in the active channel on steep cutbanks of unconsolidated sediment. The field-checked DoD evaluation and ground-based thalweg surveys support the conclusion of overall stability of the thalweg and channel banks, which is consistent with the confinement of runoff from 2016 precipitation events to the channel defined by the 2013 floods.

The LiDAR-based DEM comparison indicates net deposition has occurred in the Pueblo and DP Canyon monitoring areas between 2015 and 2016 (Table A-4.0-1). However, the error is larger than the calculated deposition in most areas, suggesting the amount of change is less than the method detection limit (Table A-4.0-1). In the wing ditch and Pueblo Canyon GCS areas, the DoD results are greater than the error; however, the net deposition is from vegetation growth in the wing ditch area and construction activities in the Pueblo Canyon GCS area, respectively. In DP Canyon, the net depositon is from the misclassification of LiDAR data on the GCS itself (Table A-4.0-1). In Los Alamos Canyon, the DEM comparison indicates net deposition in the Upper Los Alamos Canyon retention basins is solely from construction activites (Table A-4.0-1). At the Los Alamos low-head weir, net depostion occurred in all basins (Table A-4.0-3).

When areas are classified as ground in LiDAR data set for 1 yr and nonground in the other year, the DoD calculations identify erosion or deposition in that area even in the absence of real topographic change. These areas have been verified as not related to geomorphic processes through field observations and the results are discussed below; however, these detections are above the error thresholds and contribute to overall DoD volume calculations. Because these nongeomorphic changes are included, net erosion and deposition volumes are generally overestimated and should be considered upper limits.

Utilizing a spatially variable error in DoD calculations has made it possible to assess more accurately geomoprhic 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 assessment of geomorphic activity on such features for the comaprison between 2015 and 2016 DEMs. Geomorphic processes identified by the DoD results are typified by channel aggradation and incision that over the course of the 2015 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, specifically minor slides, flows, slumps, and falls of unconsolidated sediment on steep bedrock or soil surfaces.

The field-checked DoD analyses 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. Notably, all elevation change (regardless of cause of change) greater than 1.5 ft (Table A-4.0-2) in all areas has been detected and identified using this method at the 95% confidence level. These DoD results establish the geomorphic change between 2015 and 2016 as minor and localized.

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 inhibit sediment accumulation. Willows were initially planted in 2010 in the Pueblo Canyon upper and lower willow planting area. Willows that had been laid down by 2013 monsoonal floods in the upper willow planting area have resprouted and appear to be growing vigorously. Very few willows in the lower willow planting area planted in 2009 survived the 2013 flood event, with the exception of one small area just above the new E059.8 gage station. In 2014, an additional 9000 willows were planted in the Pueblo Canyon lower willow planting area and downstream in reach P-4C. Willow observations and repeat photographs in 2015 concluded willows planted in 2014 appear to have a greater than 90% survival rate and continue to show robust growth (LANL 2016, 601433).

Baseline coyote willow (*Salix exigua)* qualitative monitoring in Pueblo Canyon was conducted in November of 2016 to assess vegetation growth and community success in surface stabilization, reduced flow velocity, and inhibited sediment accumulation. The functionality of willow communities in Pueblo Canyon were evaluated using a qualitative approach (as defined in the 2015 Los Alamos/Pueblo watershed monitoring report [LANL 2016, 601433]) where discrete willow zones were defined and measured for height (i.e., growth) and spatial distribution (i.e., stand growth habit). Monitoring activities will 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 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 >50% of the total area. Dispersed populations are defined as stands of willows where individuals do not overlap and make up <50% of the area. When willows within these communities are measured, new and sprouting willows <2 ft in height are not included because their viability has yet to be established.

A-6.2 Willow Monitoring Survey Results

Table A-6.2-1 presents the qualitative data from willow community survey methods described in section A-6.1. Short-height, spatially dispersed (P-1) communities (Photo A1-22b 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 A1-23b 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 A1-24b in Attachment A-1) were found within reed canarygrass (*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 A1-25b in Attachment A-1) were found in areas generally devoid of clusters of reed canarygrass 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 A1-26b 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. P-5 community had a spatial density consistent with planting requirements in Restoration Areas 2 and 3 (LANL 2015, 600439, Appendix B).

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 canarygrass. The best growth occurred in the P-5 communities located along the saturated channel axis without competing reed canarygrass and original closely placed planting. 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 canarygrass (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 original 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 these same methods is recommended as the willow communities and other plant species continue to establish.

A-7.0 SOUTH FORK OF ACID CANYON INSPECTION

The New Mexico Environment Department (NMED) has specified that the Laboratory include the results of inspections of stream bank armoring in the south fork of Acid Canyon in the annual report on geomorphic changes in the Los Alamos and Pueblo Canyon watershed (NMED 2010, 109693). 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 ACID-SMA-2.1 in 2016 because of requirements under the Individual Permit, as shown in the comparison Photo A1-27a and A1-27b in Attachment A-1 (Figure A-1.0-1).

A-8.0 RECOMMENDATIONS

In 2017, and in the future, it is recommended that LiDAR surveys are conducted only if significiant storm events occur. If LiDAR surveys are conducted in 2017, they should be planned to measure points at least as densely and with an error rate comparable to the 2015 and 2016 LiDAR data set. In addition, future bank and thalweg surveys or other ground-based surveys should be conducted within the same time frame as the LiDAR flight so that surveyed features represent the same ground conditions the LiDAR point cloud measures. Spatially variable error surfaces using FIS methods, coupled with comprehensive GPS surveyed elevation check data, should continue.

Continued vegetative monitoring of the willow plantings in 2017 for comparison with 2016 is recommended. Willow health will continue to be assessed by measuring stand height and stem diameter at representative locations within the planted willow areas and the conditions documented in photographs.

A-9.0 REFERENCES AND MAP DATA SOURCES

A-9.1 References

The following list includes all documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ER ID or ESH ID. This information is also included in text citations. ER IDs were assigned by the Environmental Programs Directorate's Records Processing Facility (IDs through 599999), and ESH IDs are assigned by the Environment, Safety, and Health (ESH) Directorate (IDs 600000 and above). IDs are used to locate documents in the Laboratory's Electronic Document Management System and, where applicable, in the master reference set.

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

LANL (Los Alamos National Laboratory), 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)

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)

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)

A-9.2 Map Data Sources

The following list provides data sources for maps included in this appendix.

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.

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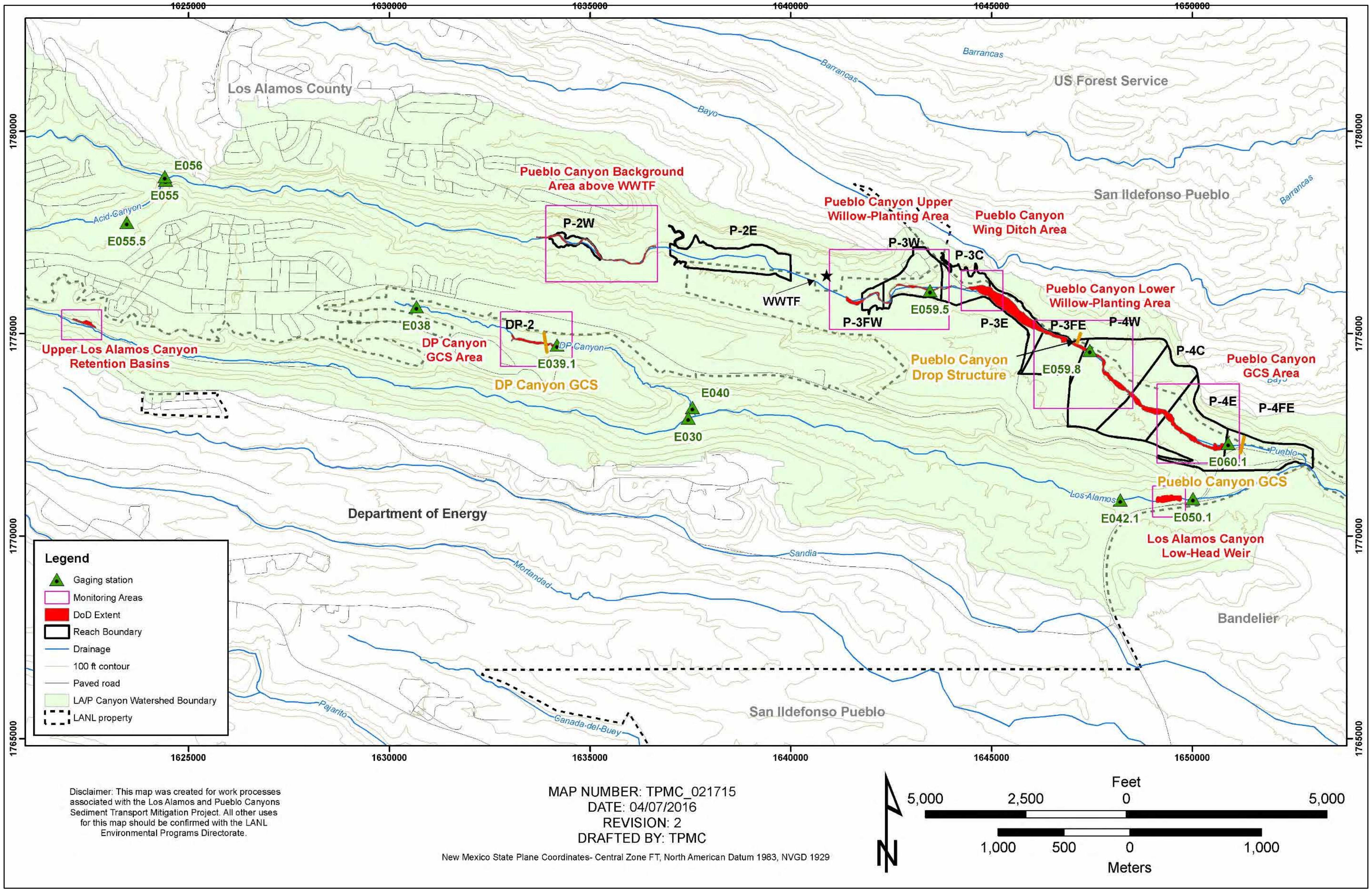


Figure A-1.0-1 Los Alamos, Pueblo, and DP Canyon channel systems showing sediment transport monitoring areas, DoD extents, and stream gages

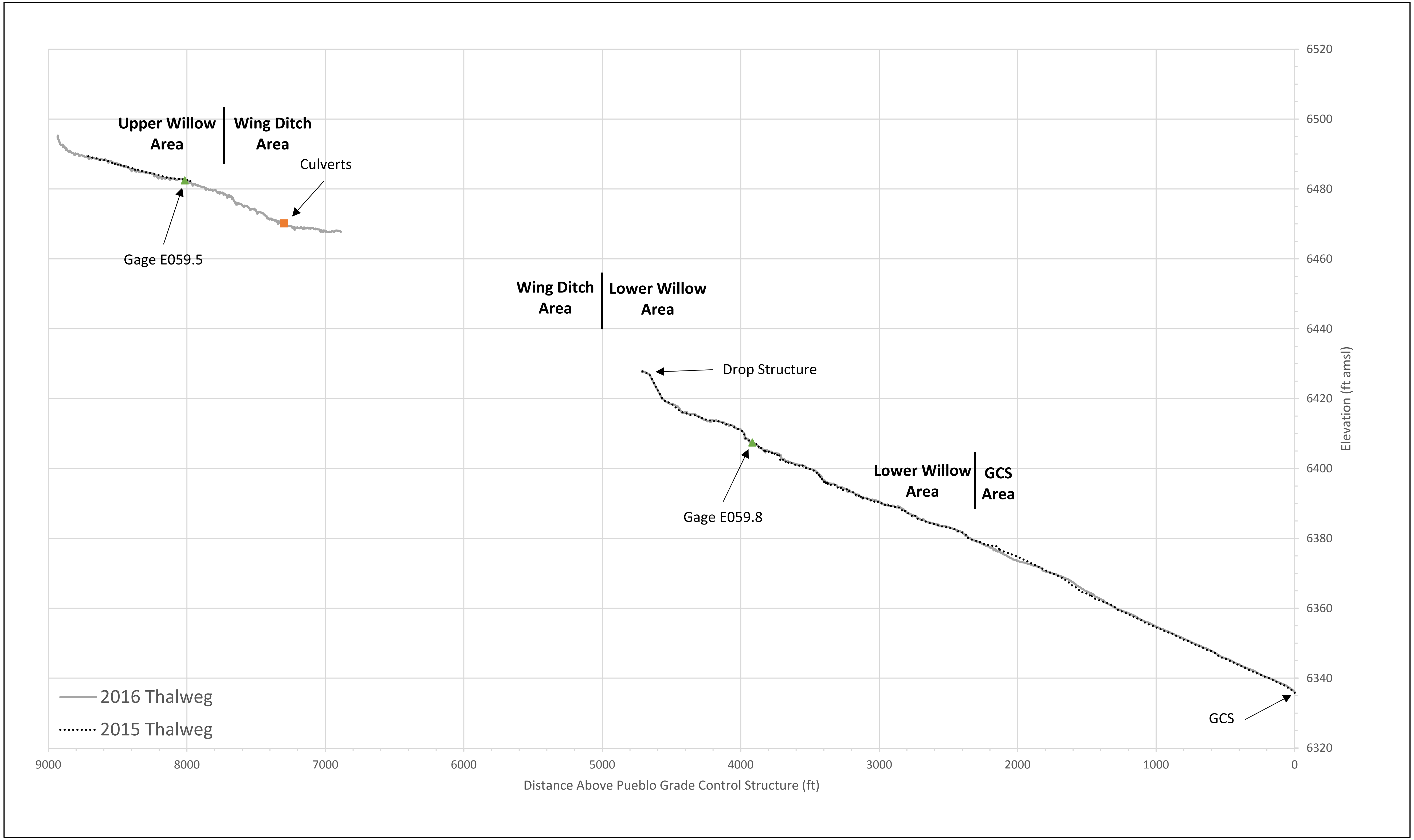


Figure A-3.3-1 Thalweg profile in Pueblo Canyon above Pueblo GCS (25 times vertical exaggeration)

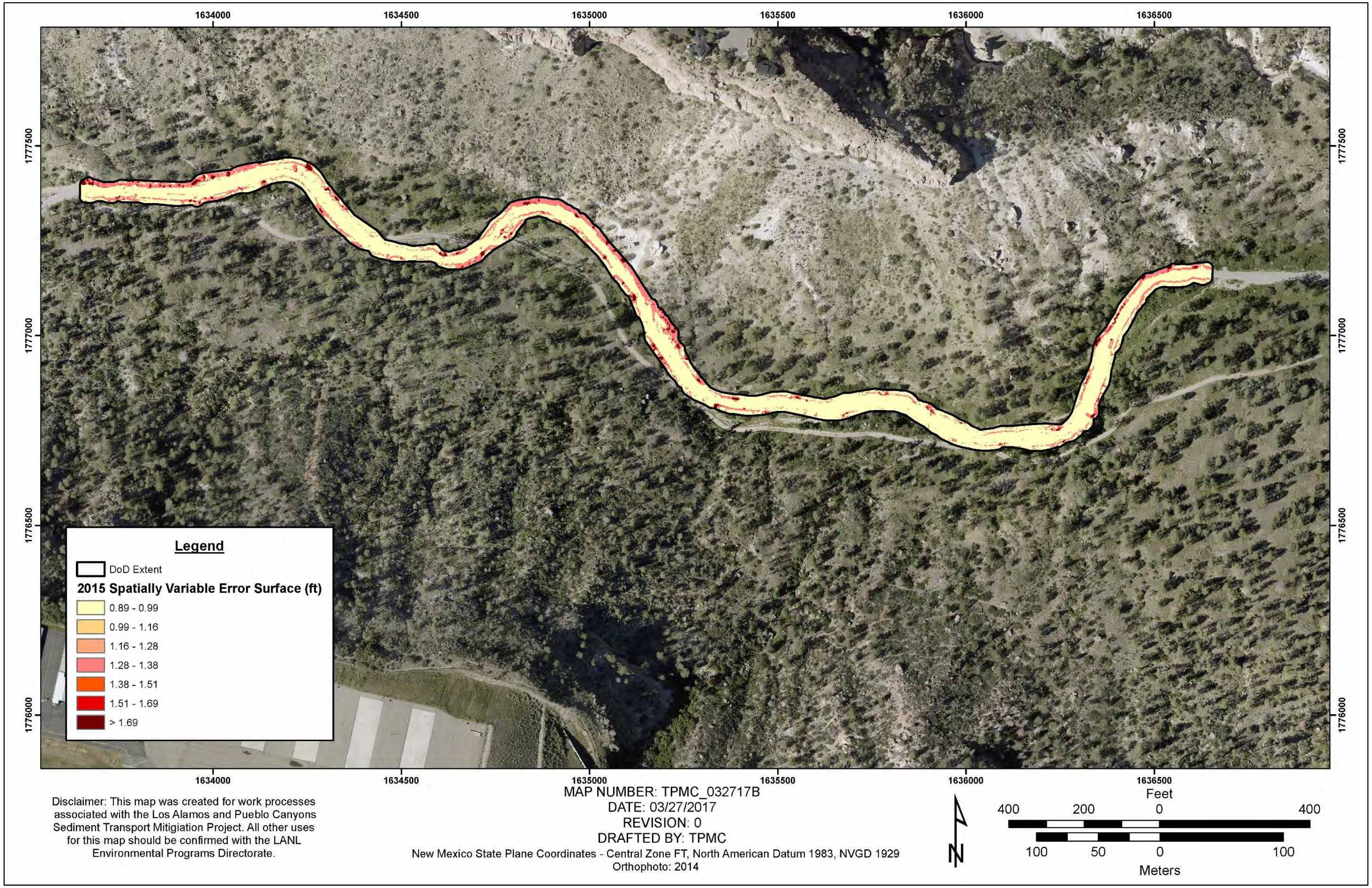


Figure A-4.1-1 Orthophoto with 2015 spatially variable error surface computed from the point cloud depicting the channel areas at the Pueblo Canyon background area above the WWTF

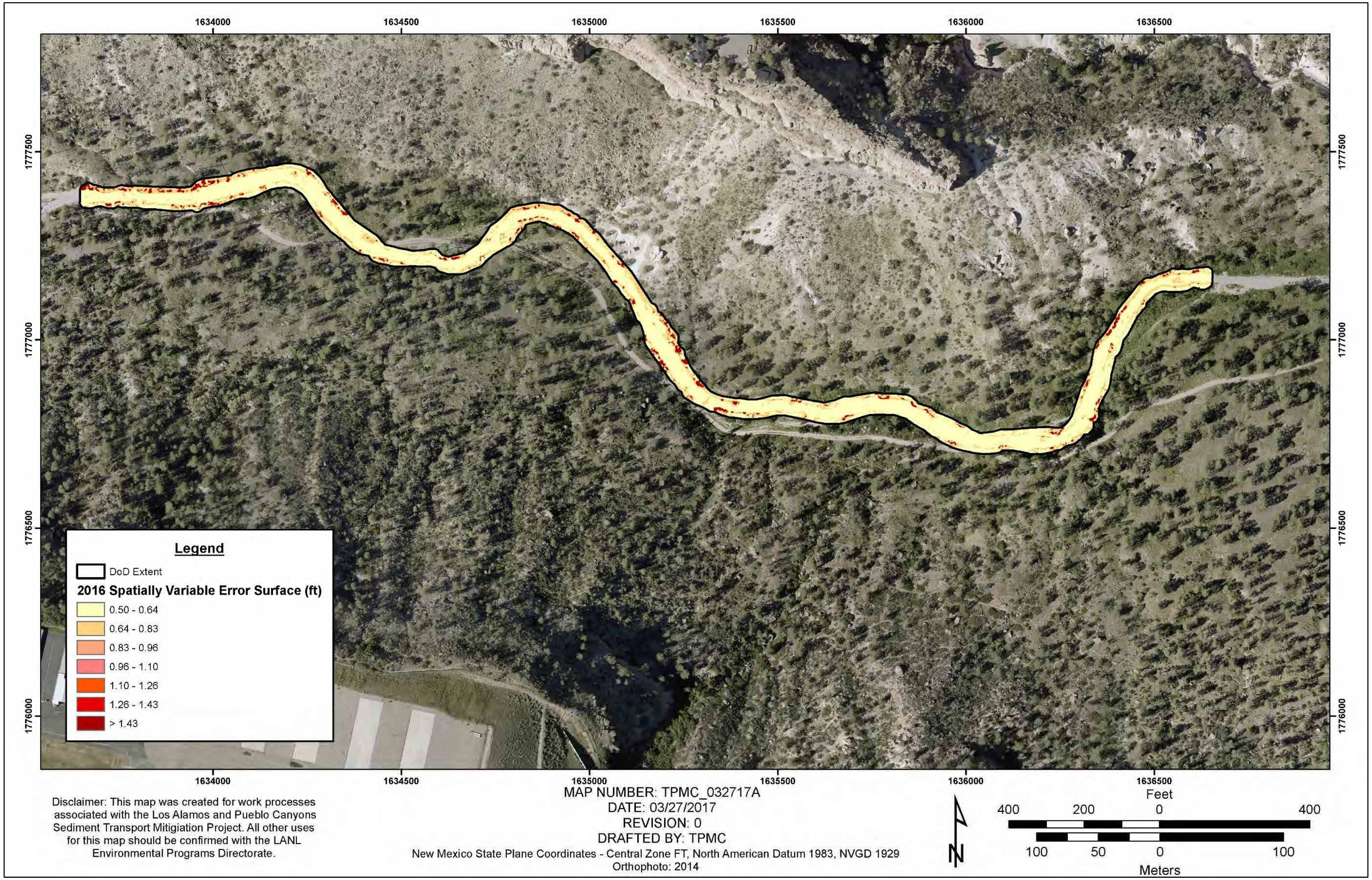


Figure A-4.1-2 Orthophoto with 2016 spatially variable error surface computed from the point cloud depicting the channel areas at the Pueblo Canyon background area above the WWTF

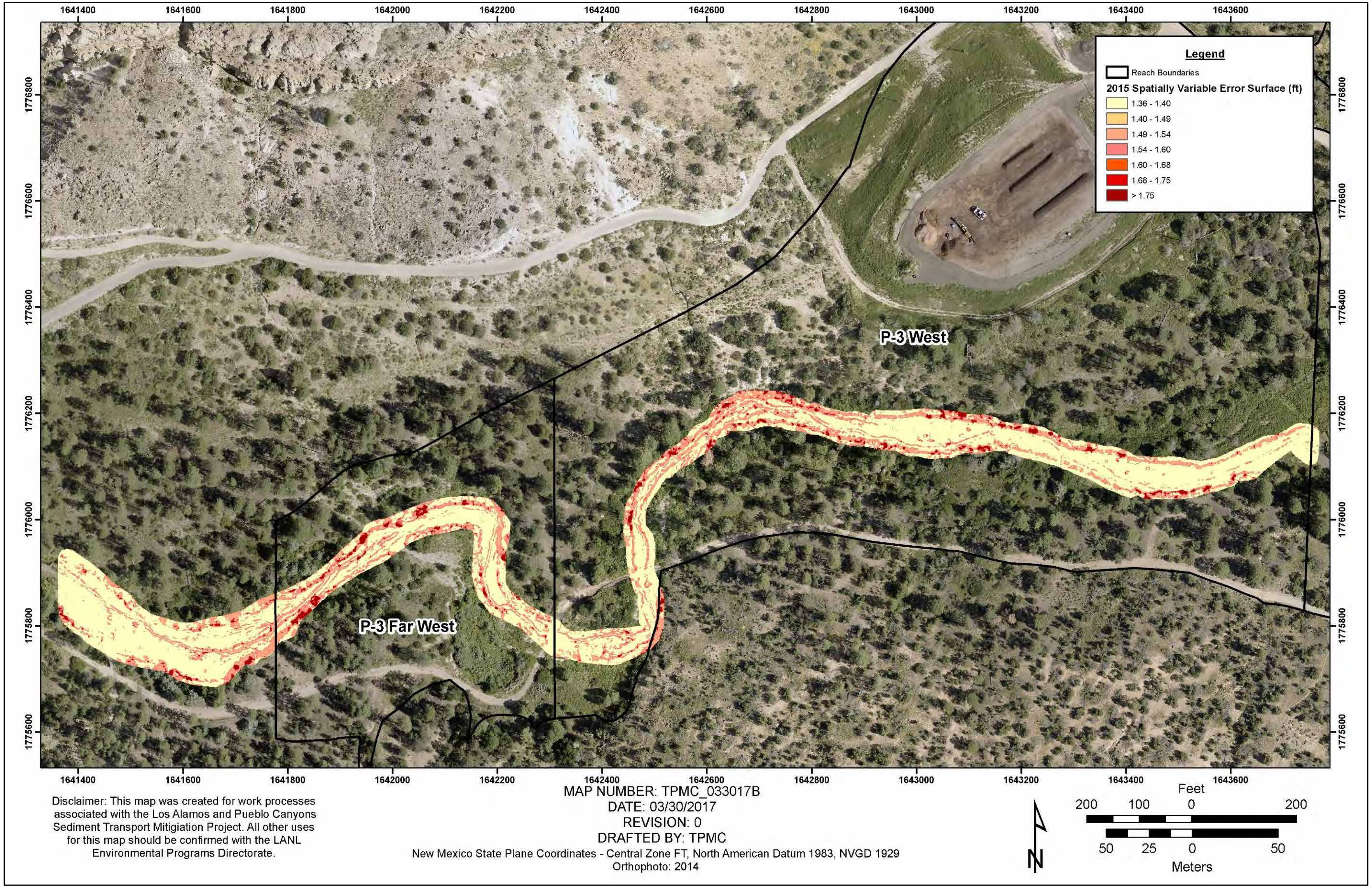


Figure A-4.1-3 Orthophoto with 2015 spatially variable error surface computed from the point cloud depicting the channel areas at the Pueblo Canyon upper willow planting area

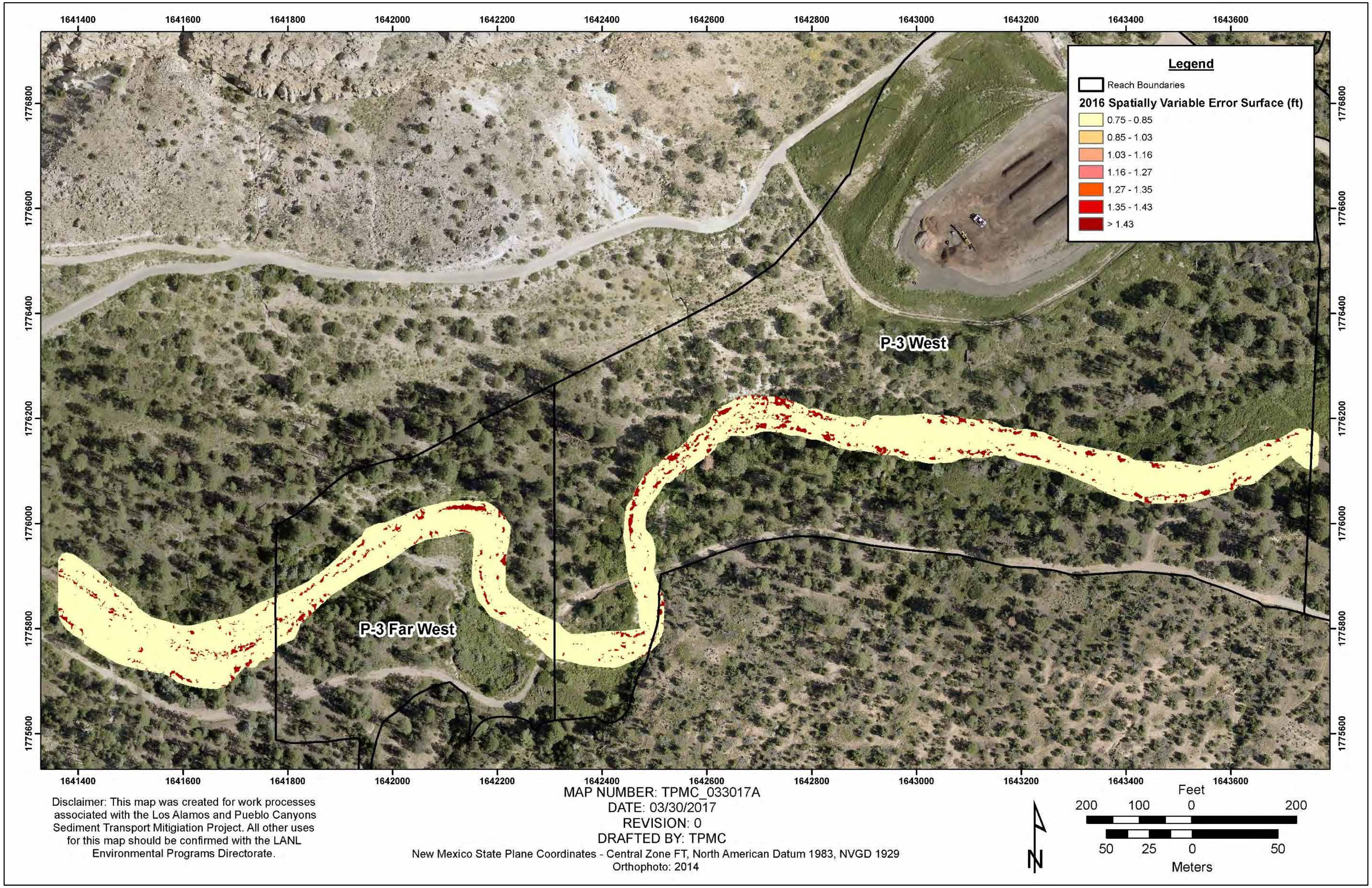


Figure A-4.1-4 Orthophoto with 2016 spatially variable error surface computed from the point cloud depicting the channel areas at the Pueblo Canyon upper willow planting area

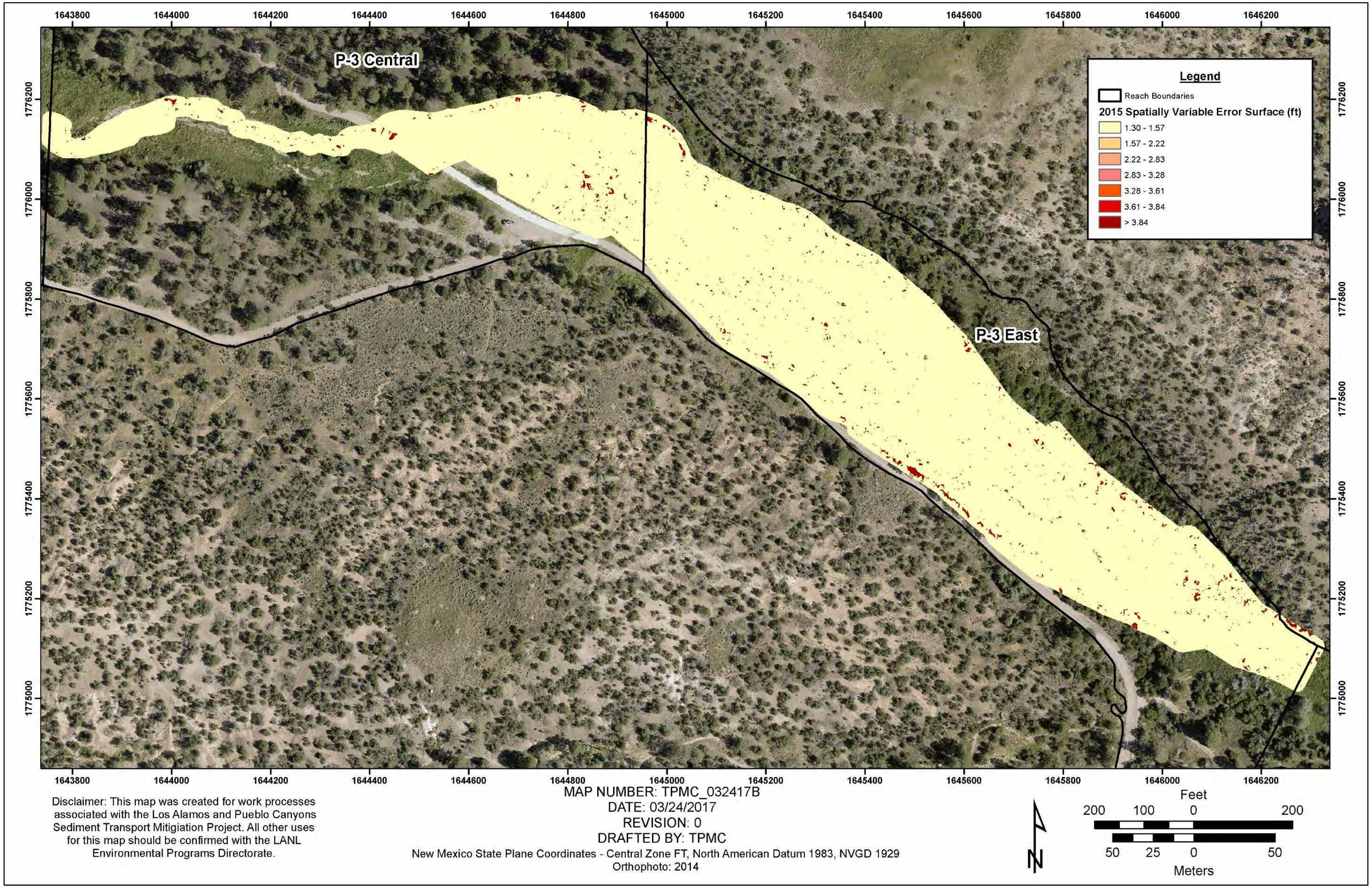


Figure A-4.1-5 Orthophoto with 2015 spatially variable error surface computed from the point cloud depicting the channel areas at the Pueblo Canyon wing ditch area

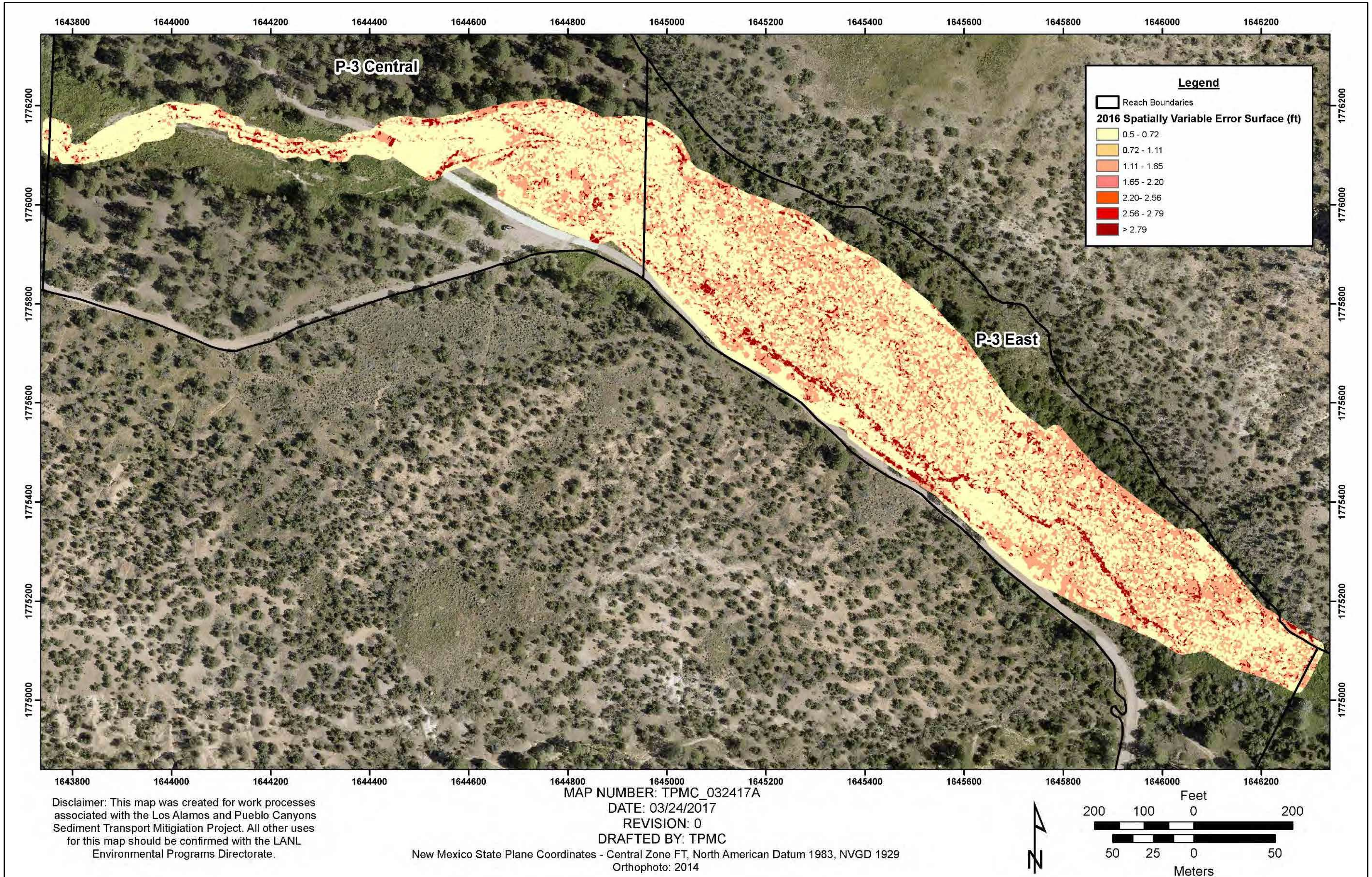


Figure A-4.1-6 Orthophoto with 2016 spatially variable error surface computed from the point cloud depicting the channel areas at the Pueblo Canyon wing ditch area

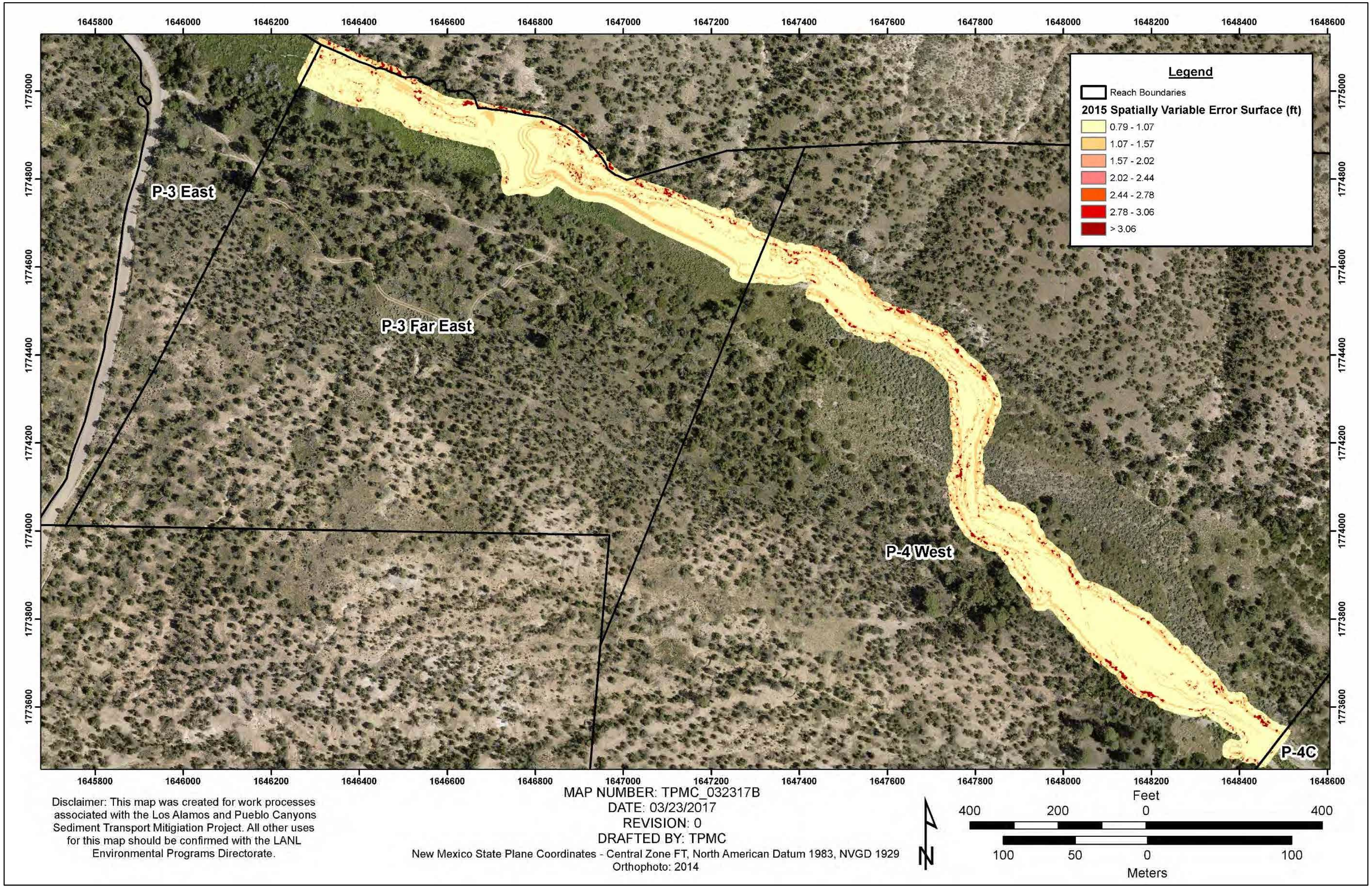


Figure A-4.1-7 Orthophoto with 2015 spatially variable error surface computed from the point cloud depicting the channel areas at the Pueblo Canyon lower willow planting area

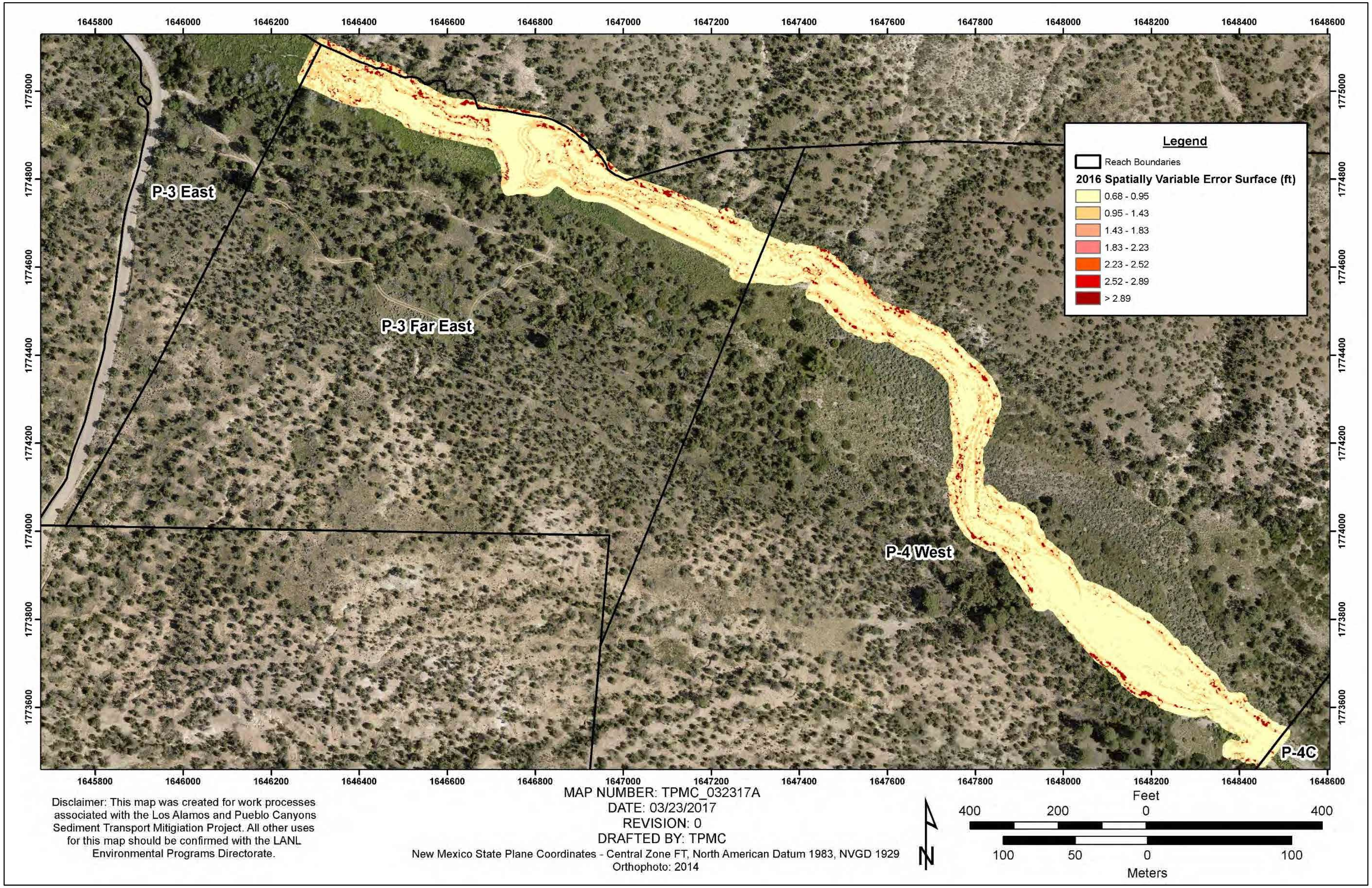


Figure A-4.1-8 Orthophoto with 2016 spatially variable error surface computed from the point cloud depicting the channel areas at the Pueblo Canyon lower willow planting area

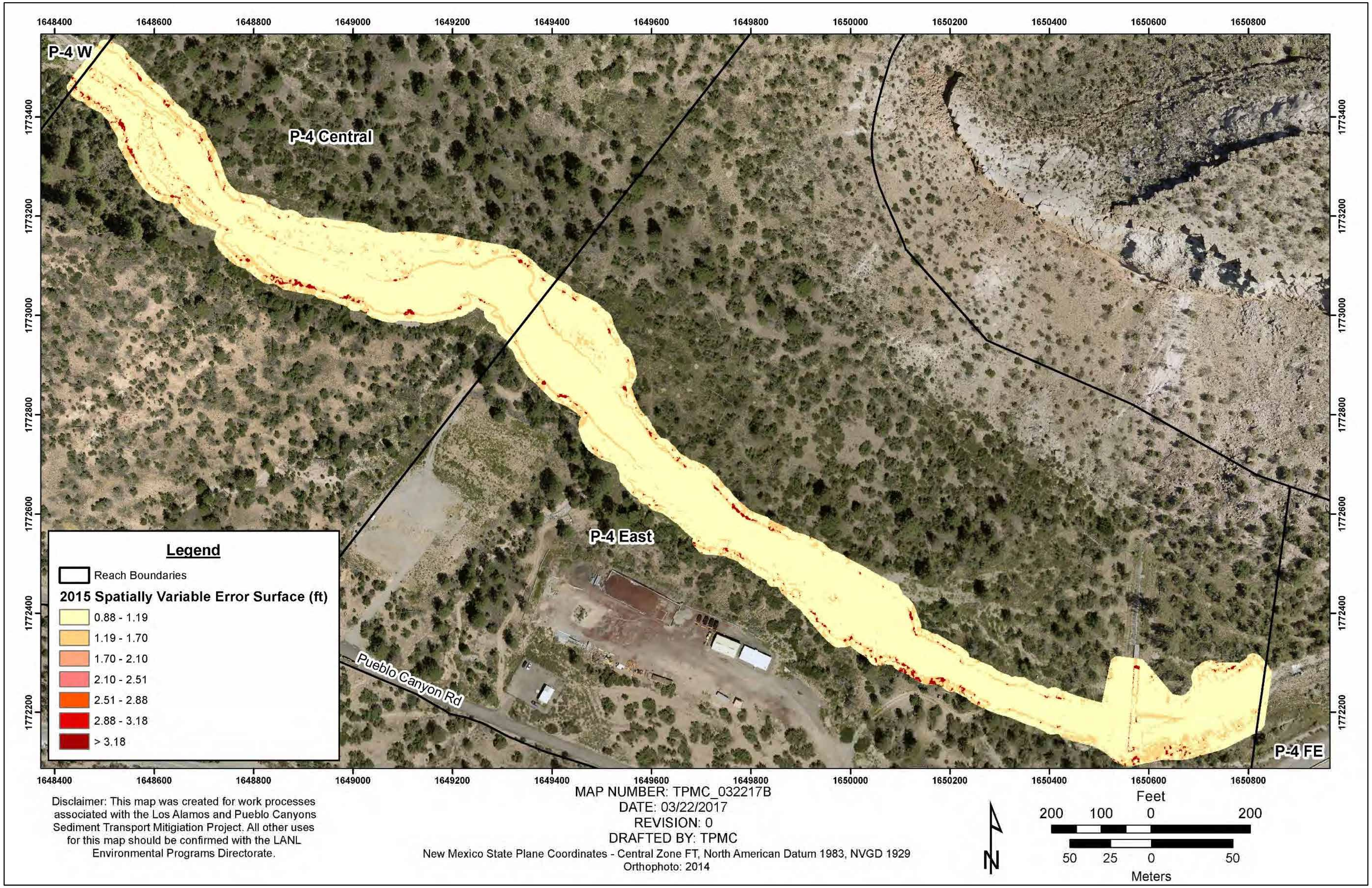


Figure A-4.1-9 Orthophoto with 2015 spatially variable error surface computed from the point cloud depicting the channel areas at the Pueblo Canyon GCS area

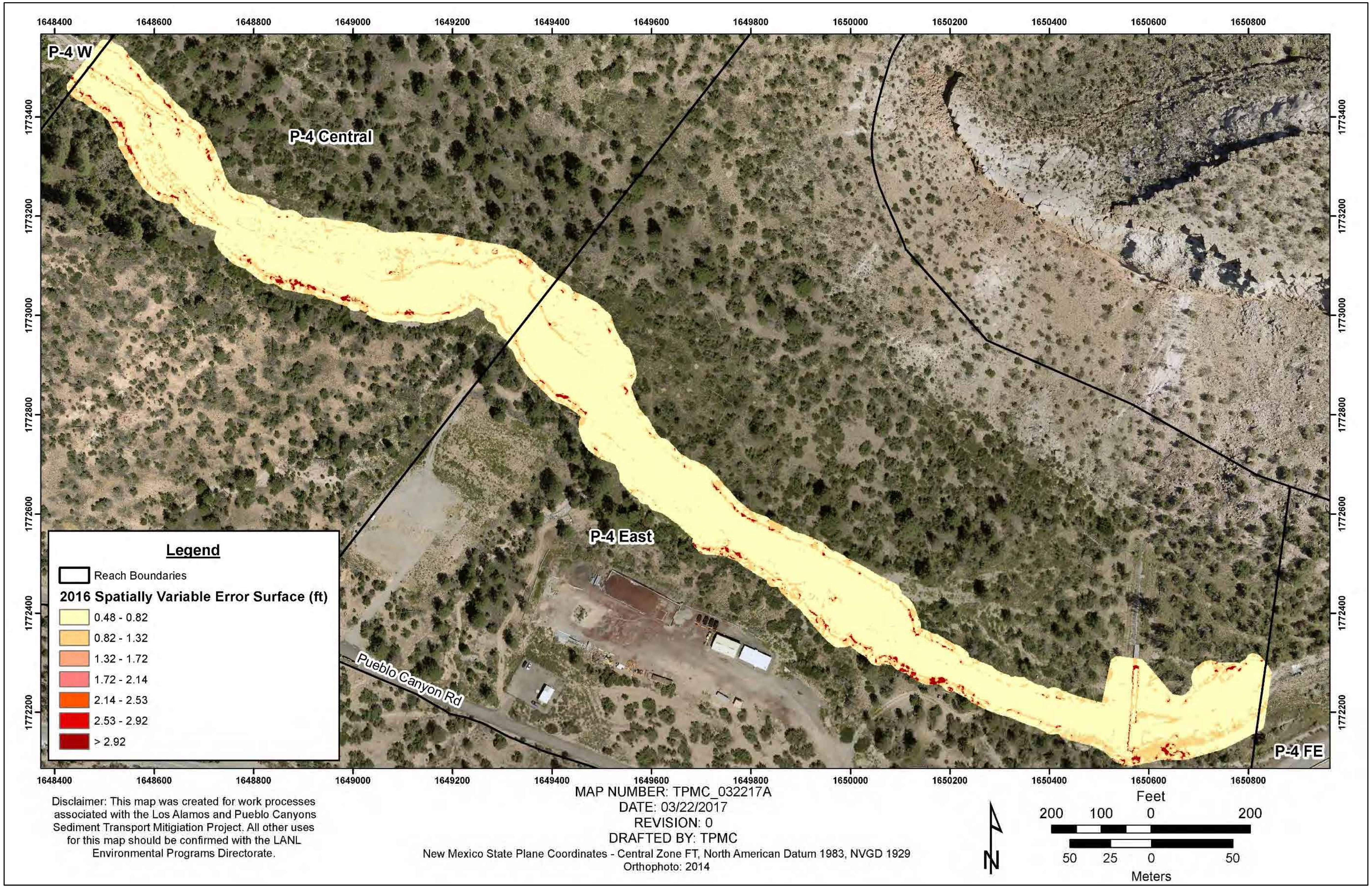


Figure A-4.1-10 **Orthophoto with 2016 spatially variable error surface computed from the point cloud depicting the channel areas at the Pueblo Canyon lower willow planting area**

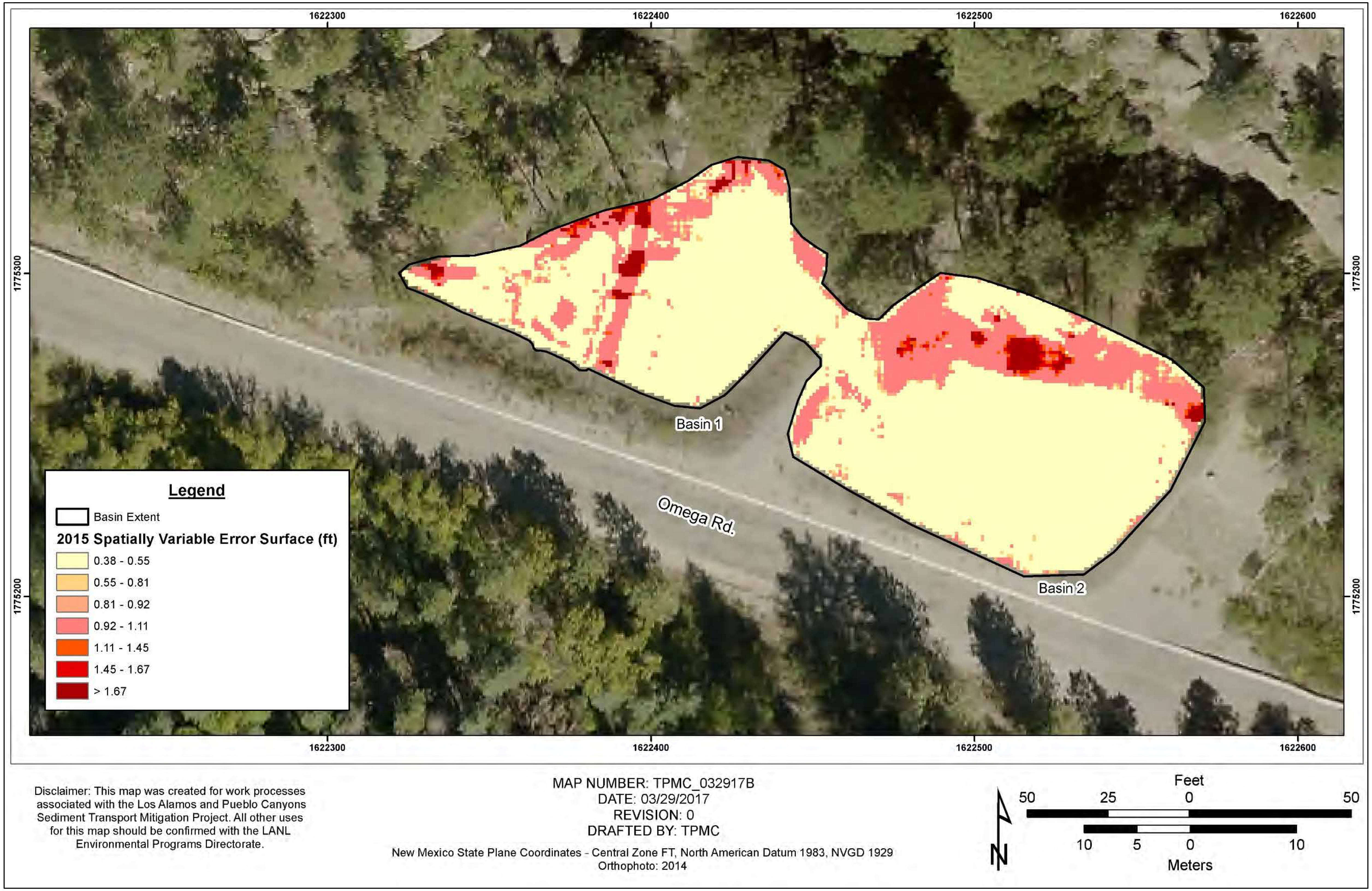


Figure A-4.1-11 **Orthophoto with 2015 spatially variable error surface computed from the point cloud depicting the basin areas at the Upper Los Alamos Canyon retention basins**

Figure A-4.1-12 **Orthophoto with 2016 spatially variable error surface computed from the point cloud depicting the basin areas at the Upper Los Alamos Canyon retention basins**

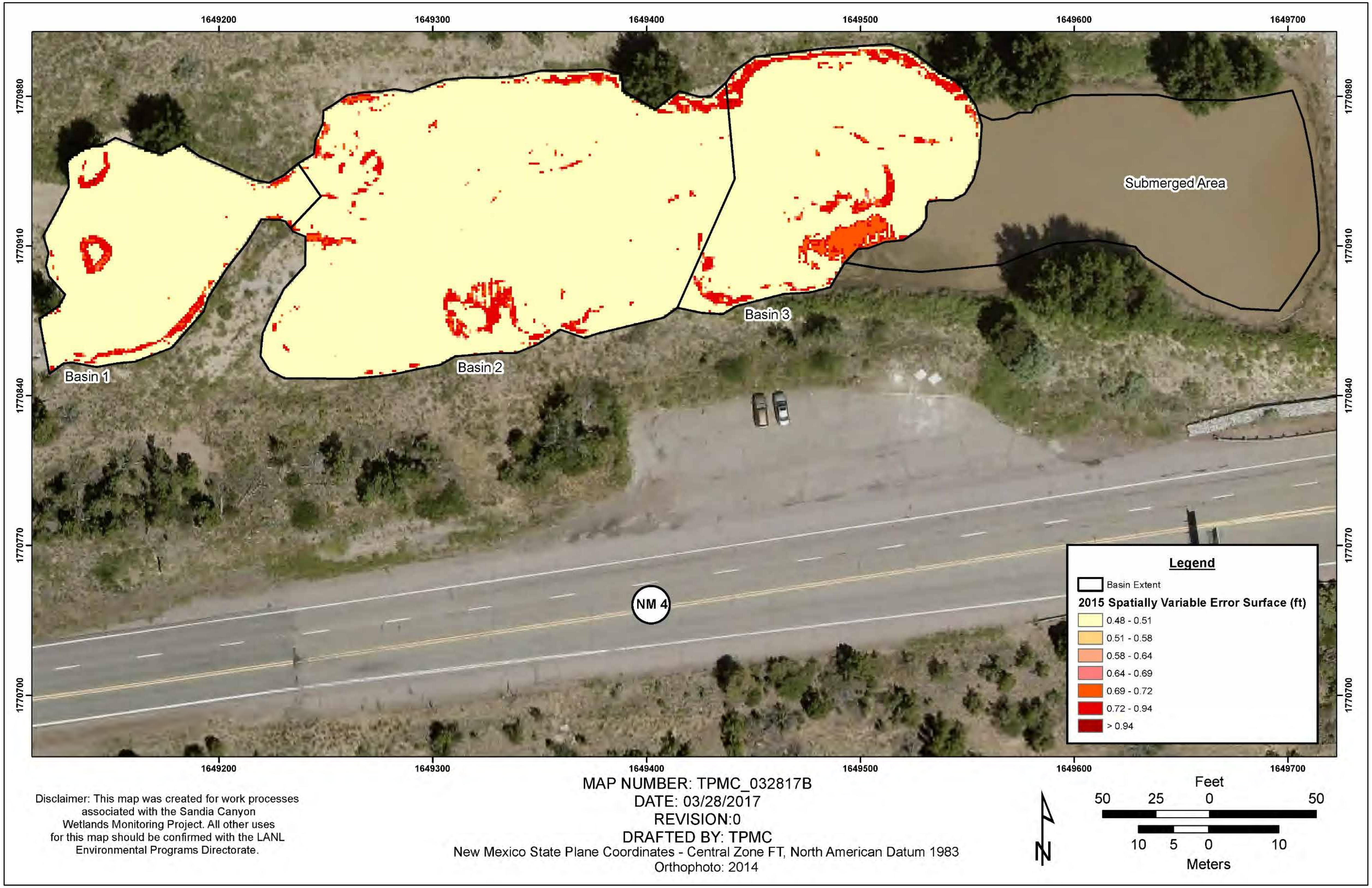


Figure A-4.1-13 Orthophoto with 2015 spatially variable error surface computed from the point cloud depicting the basin areas above the Los Alamos Canyon low-head weir

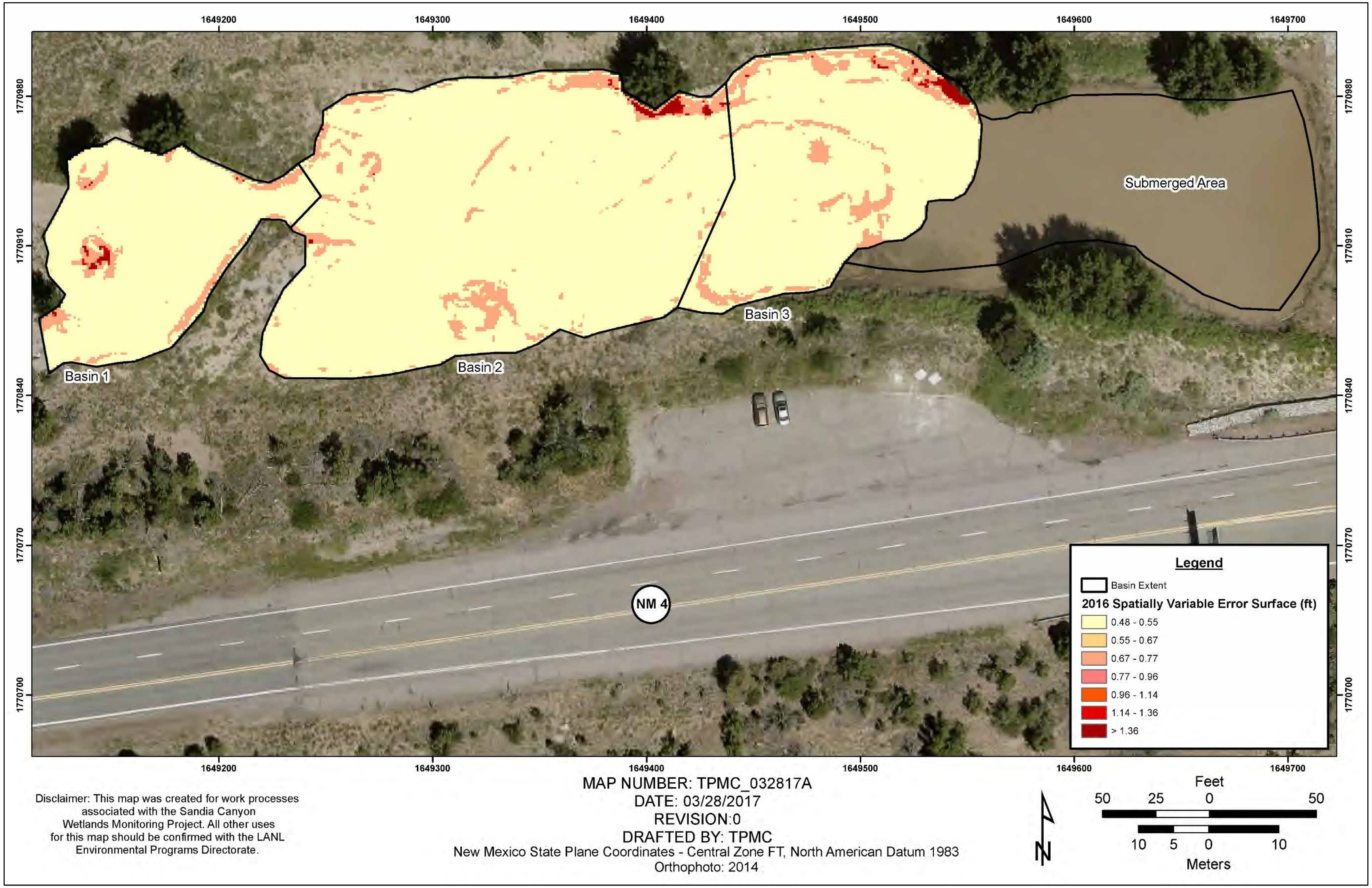


Figure A-4.1-14 **Orthophoto with 2015 spatially variable error surface computed from the point cloud depicting the basin areas above the Los Alamos Canyon low-head weir**

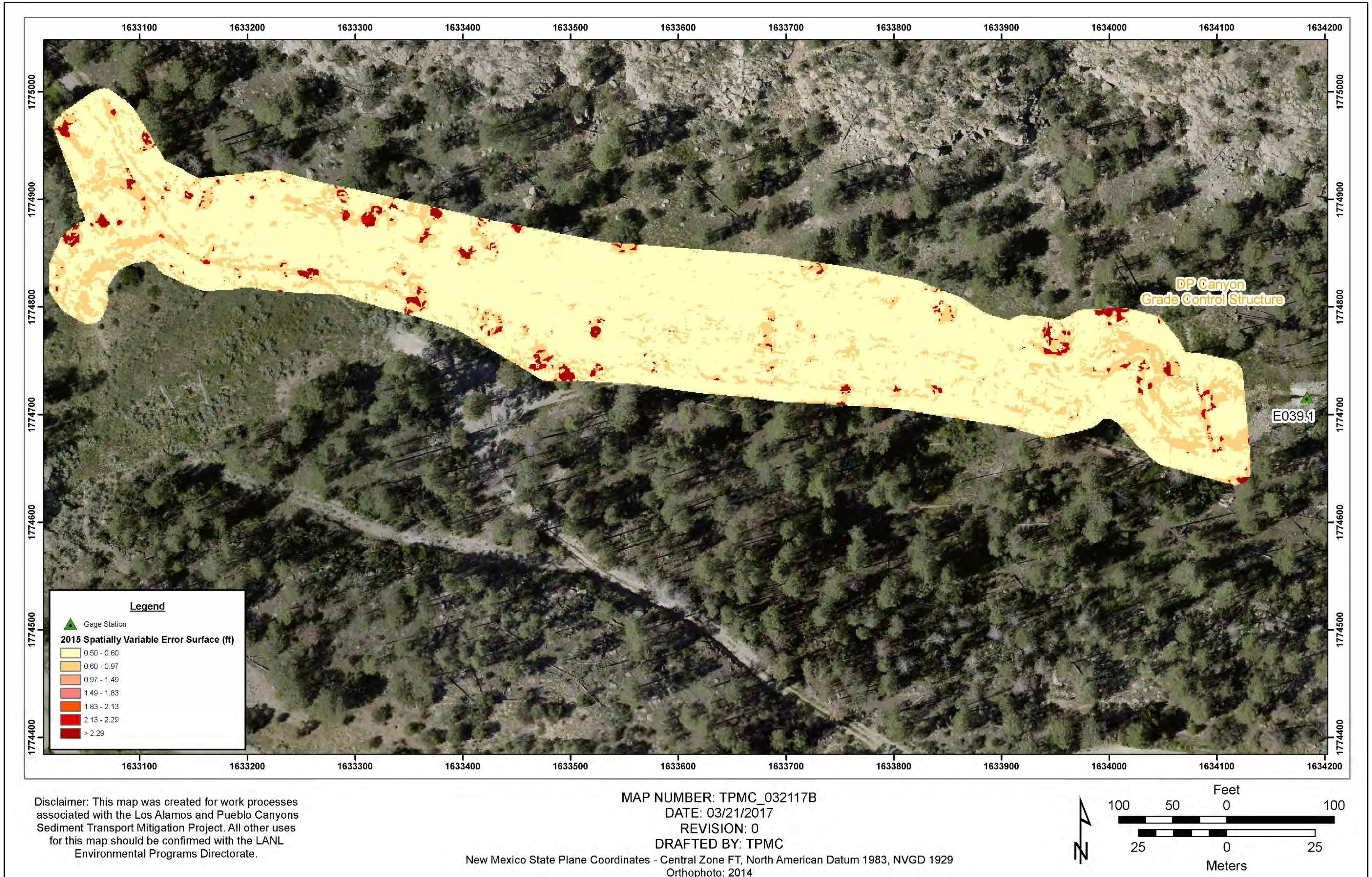
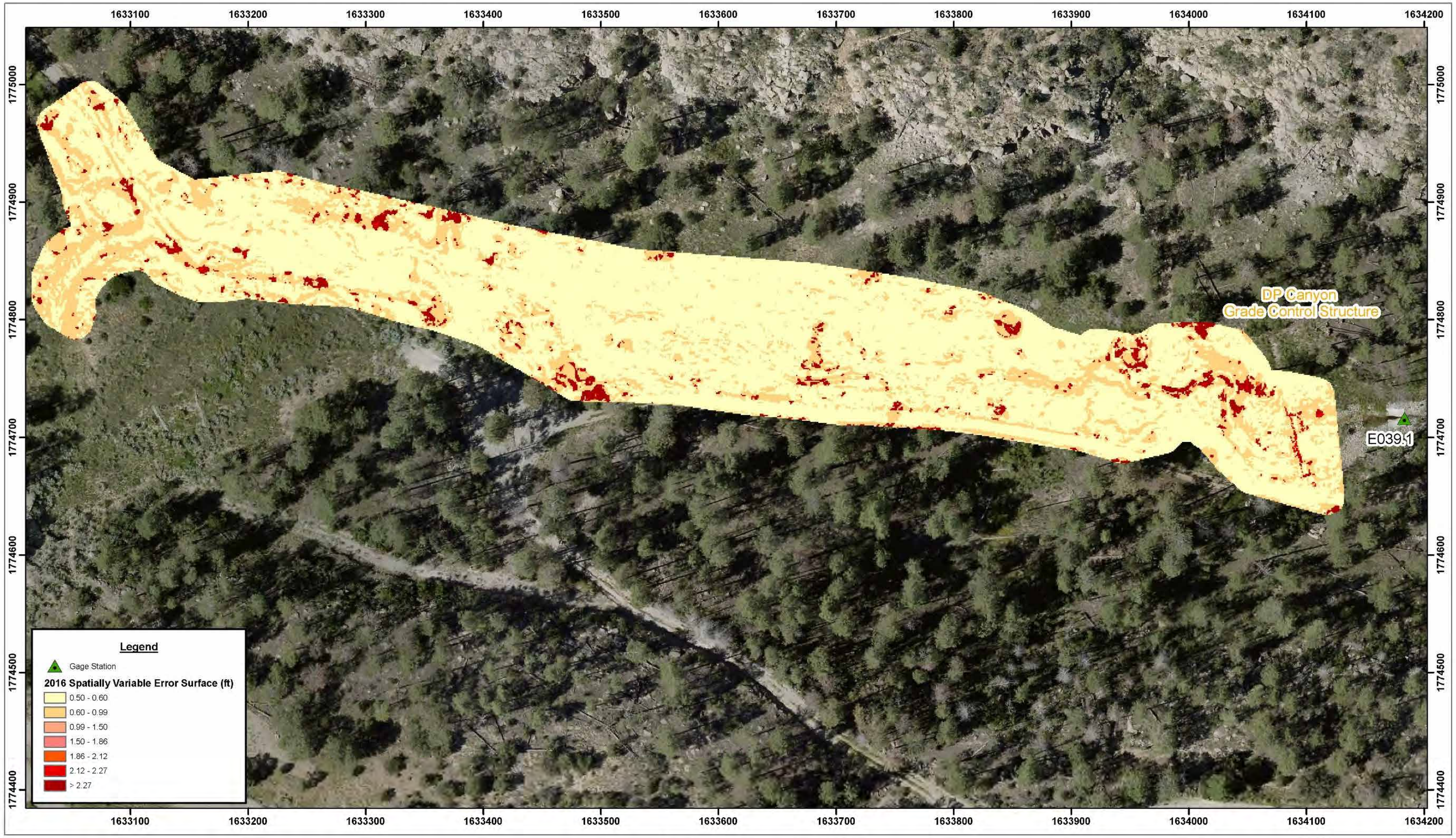


Figure A-4.1-15 **Orthophoto with 2015 spatially variable error surface computed from the point cloud depicting the channel areas above the DP Canyon GCS**



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

MAP NUMBER: TPMC_032117A
DATE: 03/21/2017
REVISION: 0
DRAFTED BY: TPMC
New Mexico State Plane Coordinates - Central Zone FT, North American Datum 1983, NVGD 1929
Orthophoto: 2014

N
Feet
100 50 0 100
25 0 25
Meters

Figure A-4.1-16 **Orthophoto with 2016 spatially variable error surface computed from the point cloud depicting the channel areas above the DP Canyon GCS**

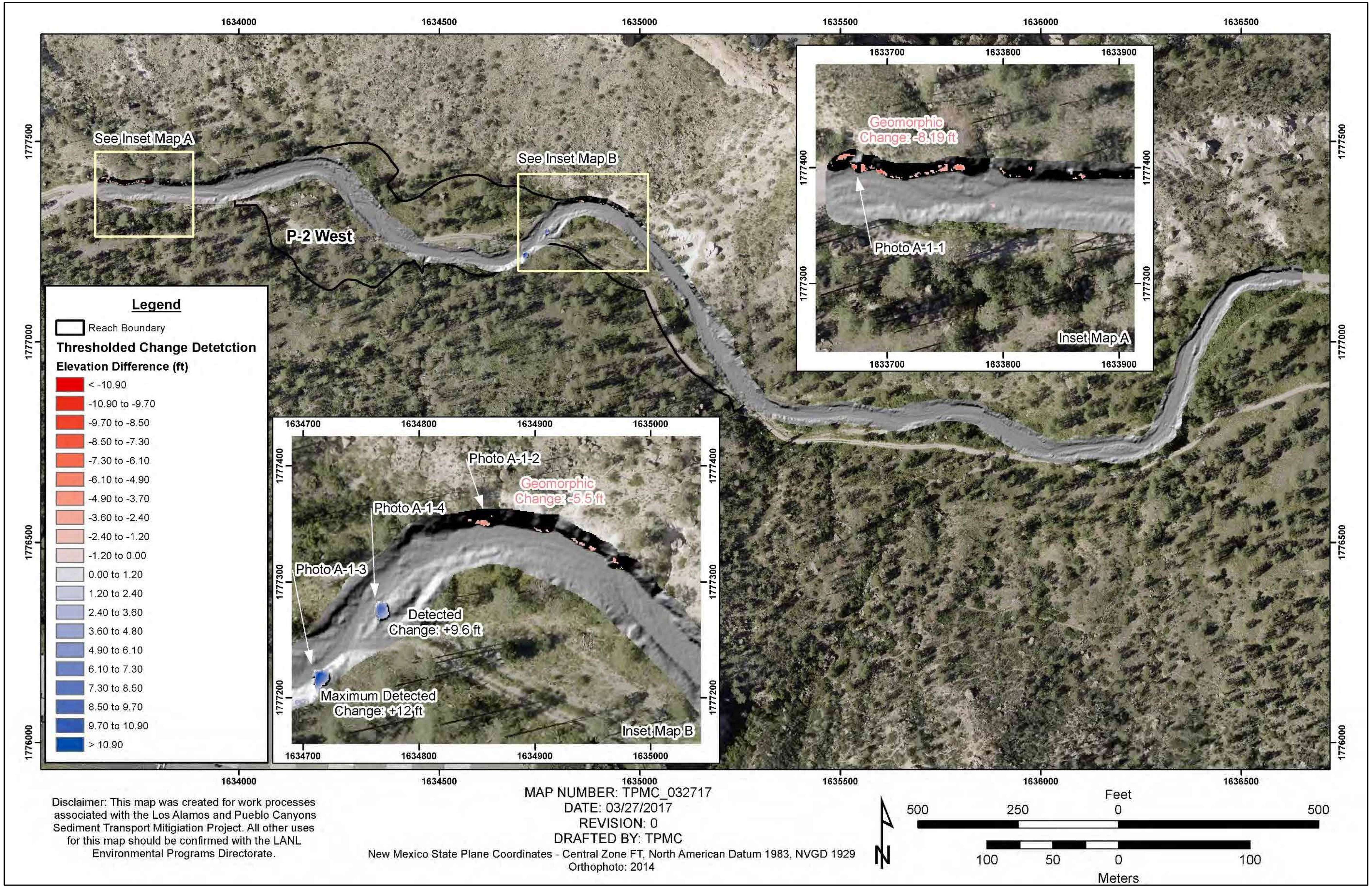


Figure A-4.2-1 Orthophoto with 2016 hillshade DEM and 2015–2016 DoD for the channel areas at the Pueblo Canyon background area above the WWTF

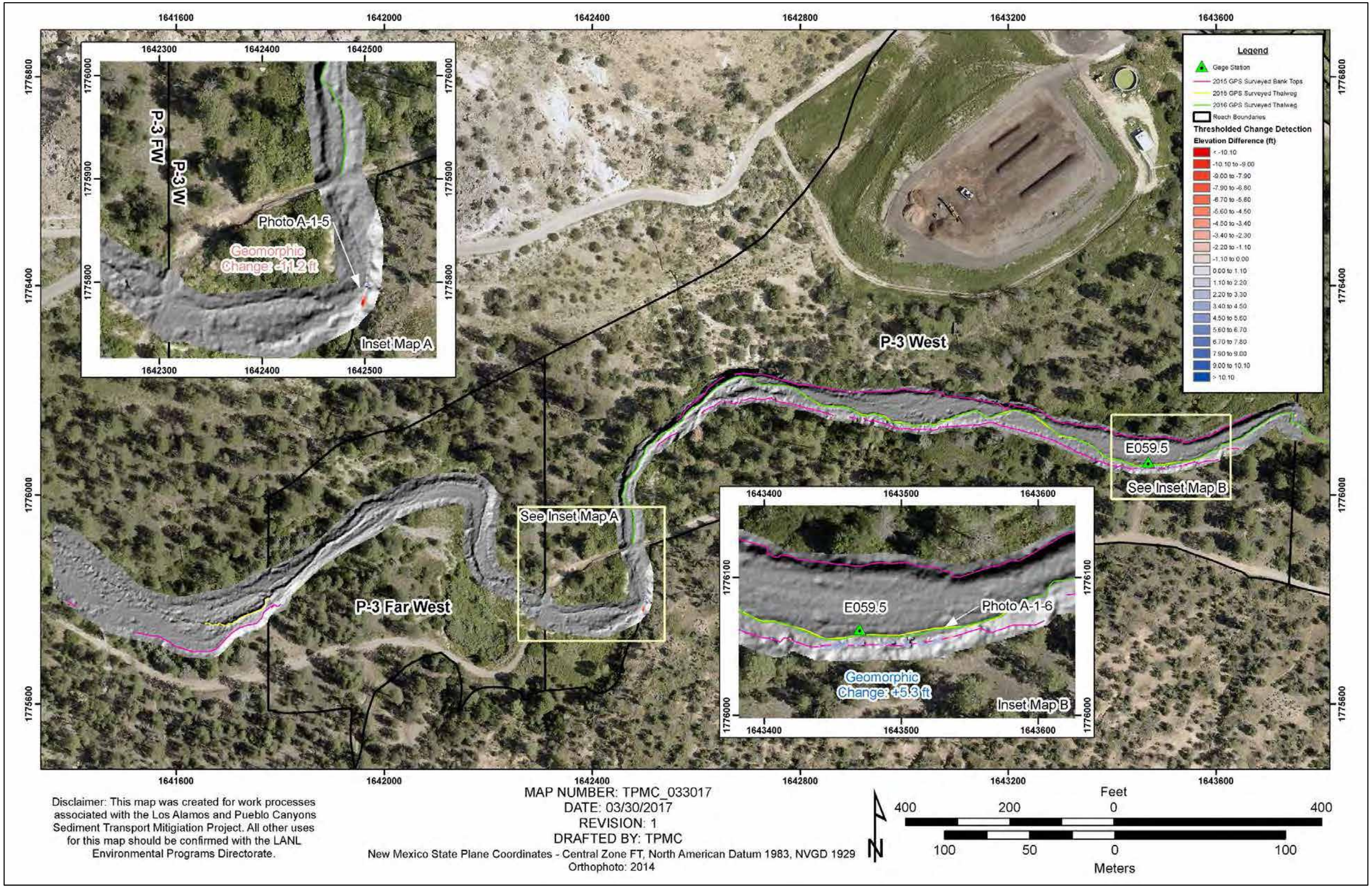


Figure A-4.3-1 Orthophoto with 2016 hillshade DEM, 2015–2016 DoD for the channel areas, and surveyed banks and thalweg at the Pueblo Canyon upper willow planting area.

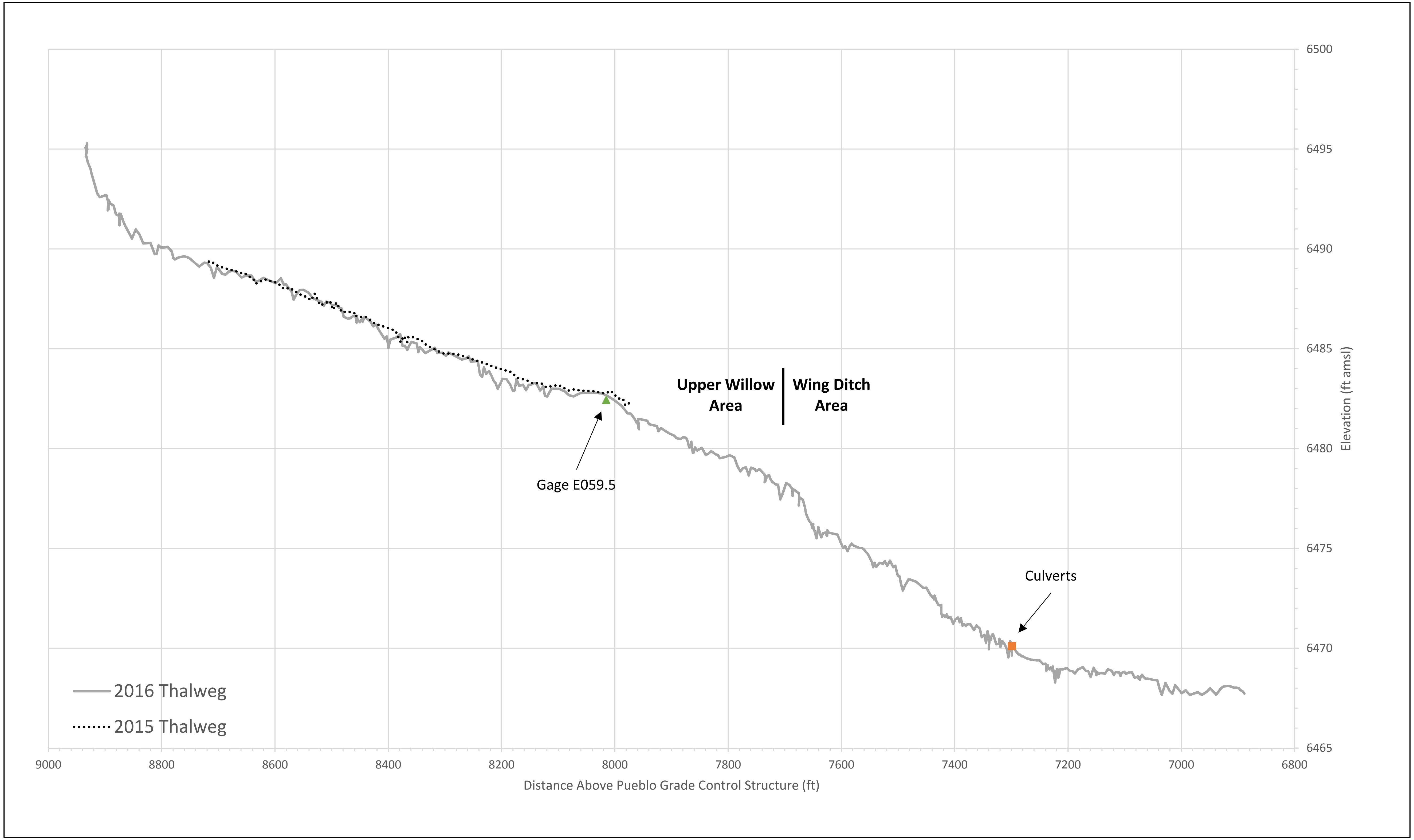


Figure A-4.3-2 Thalweg profile in Pueblo Canyon of the upper willow planting and wing ditch areas (36 times vertical exaggeration)

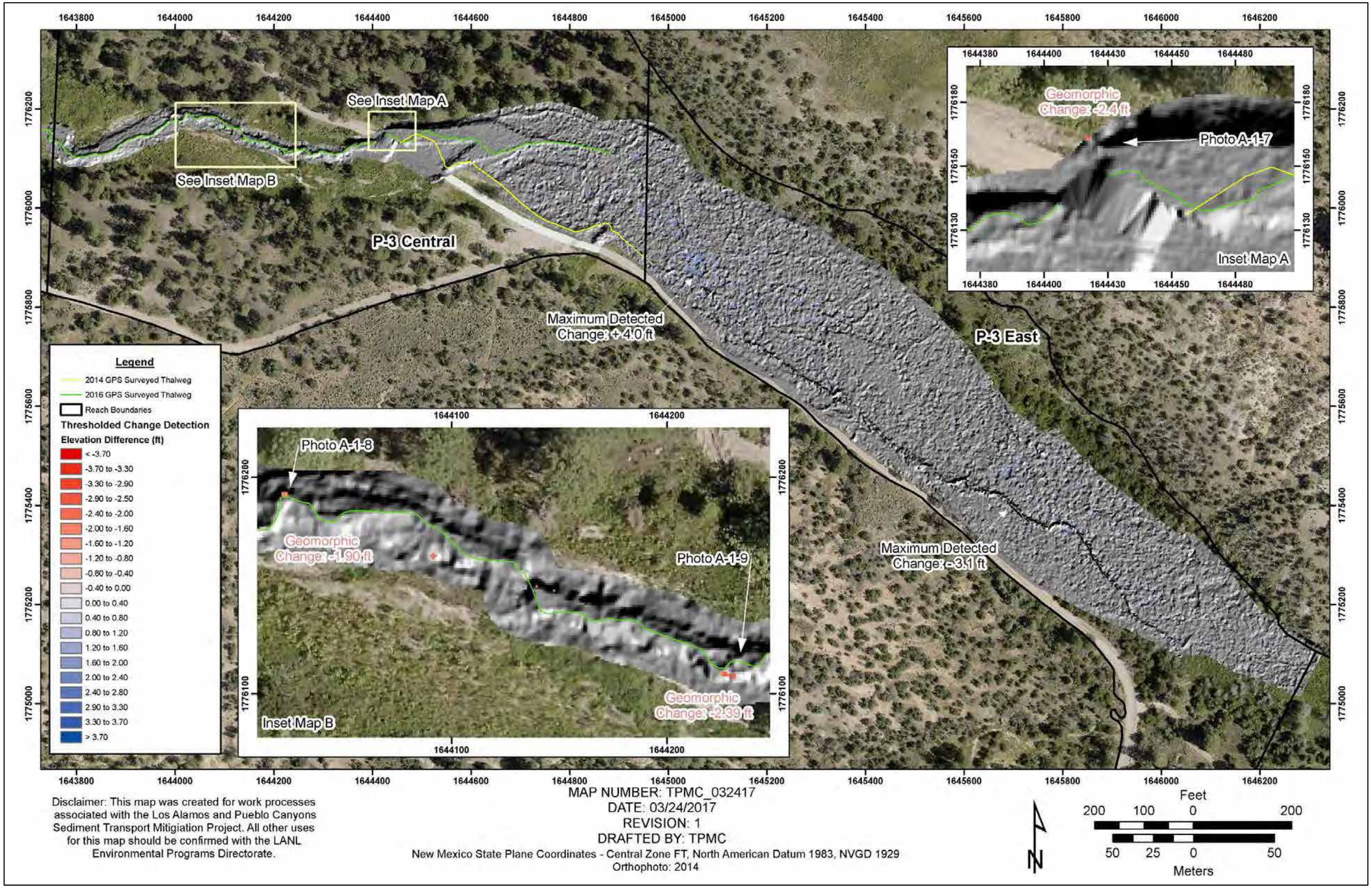


Figure A-4.4-1 Orthophoto with 2016 hillshade DEM, 2015–2016 DoD for the channel areas, and surveyed thalweg at the Pueblo Canyon wing ditch area

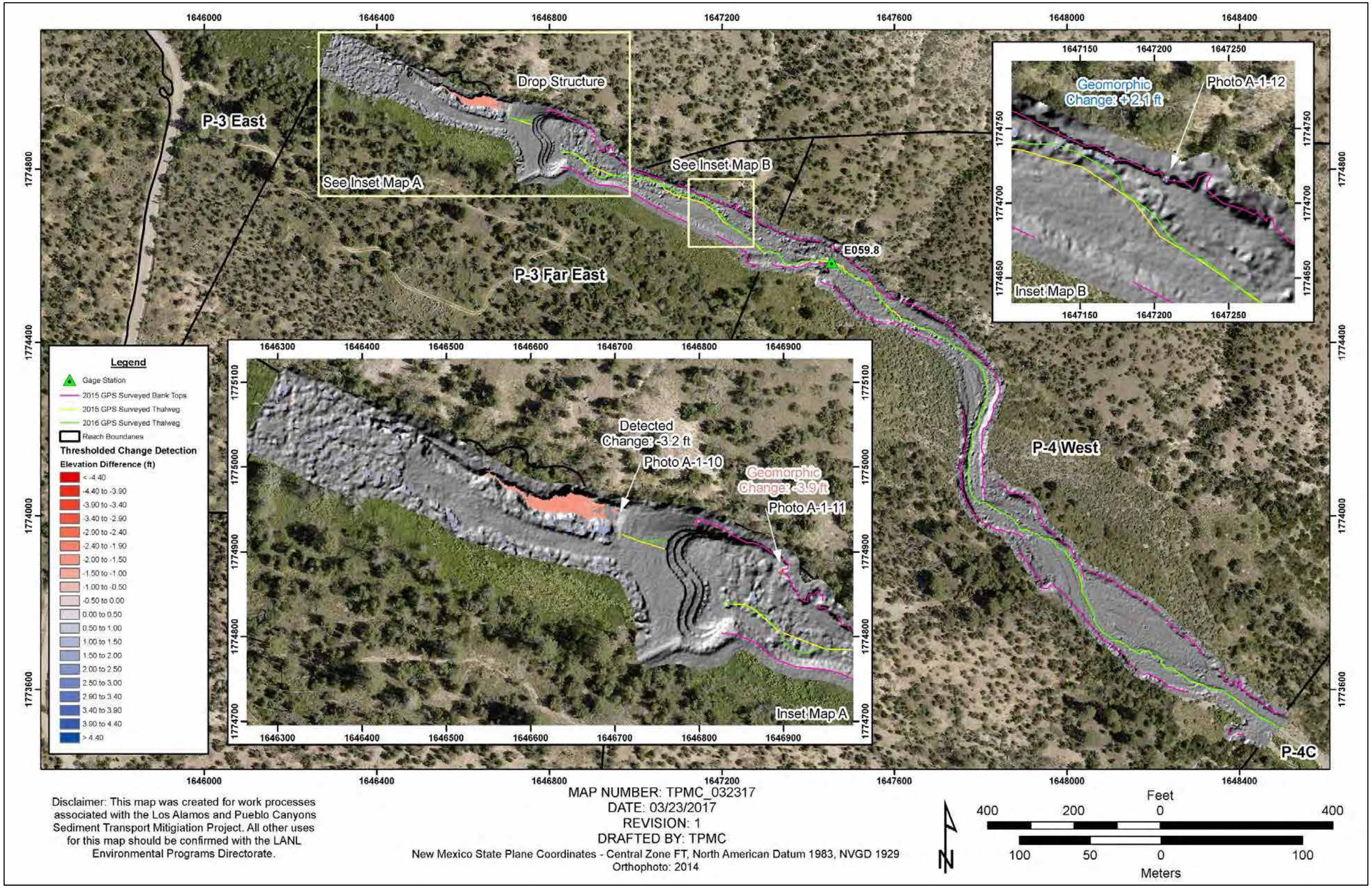


Figure A-4.5-1 Orthophoto with 2016 hillshade DEM, 2015–2016 DoD for the channel areas, and surveyed banks and thalweg at the Pueblo Canyon lower willow planting area

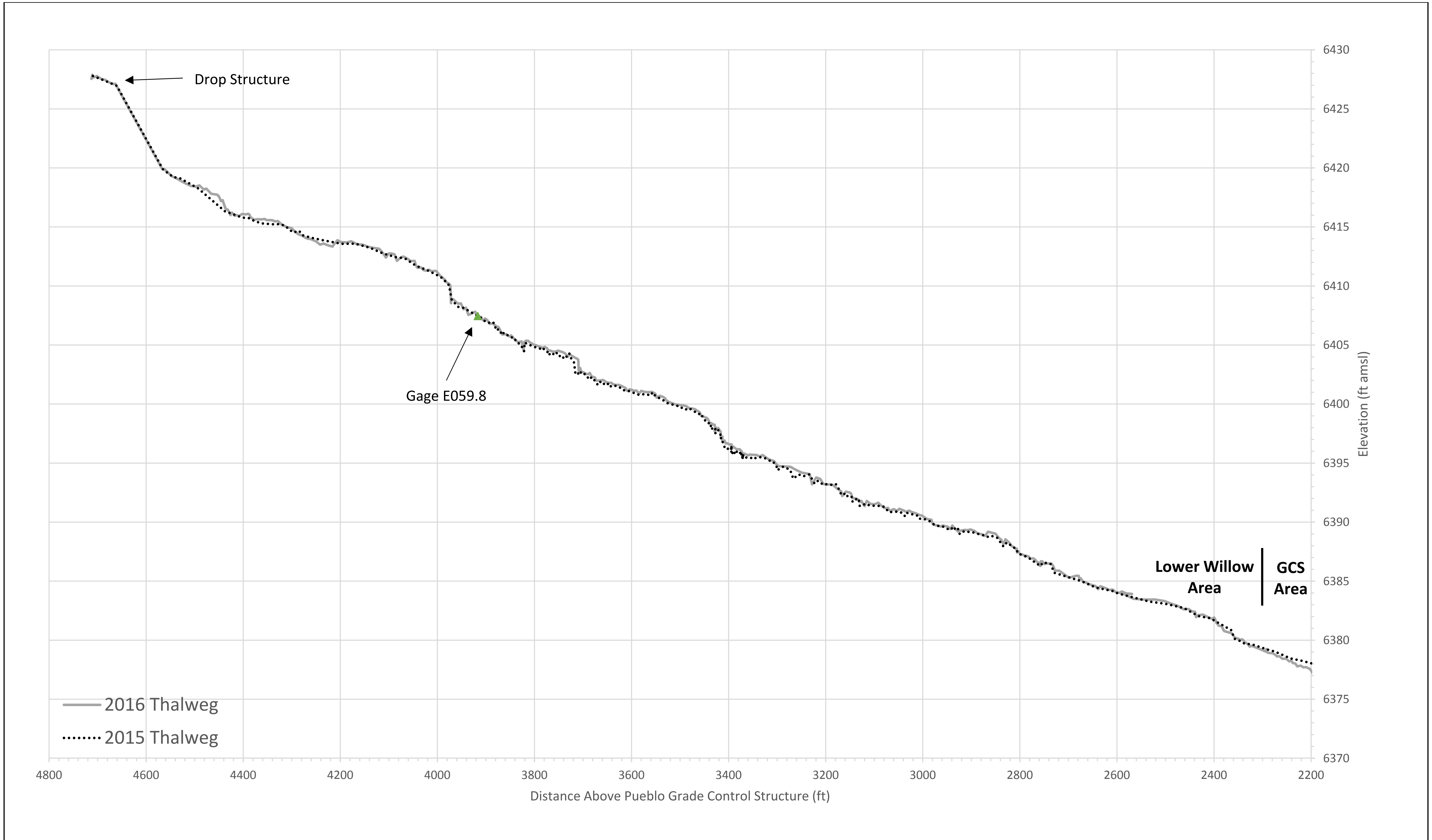


Figure A-4.5-2 Thalweg profile in Pueblo Canyon of the lower willow planting area (25 times vertical exaggeration)

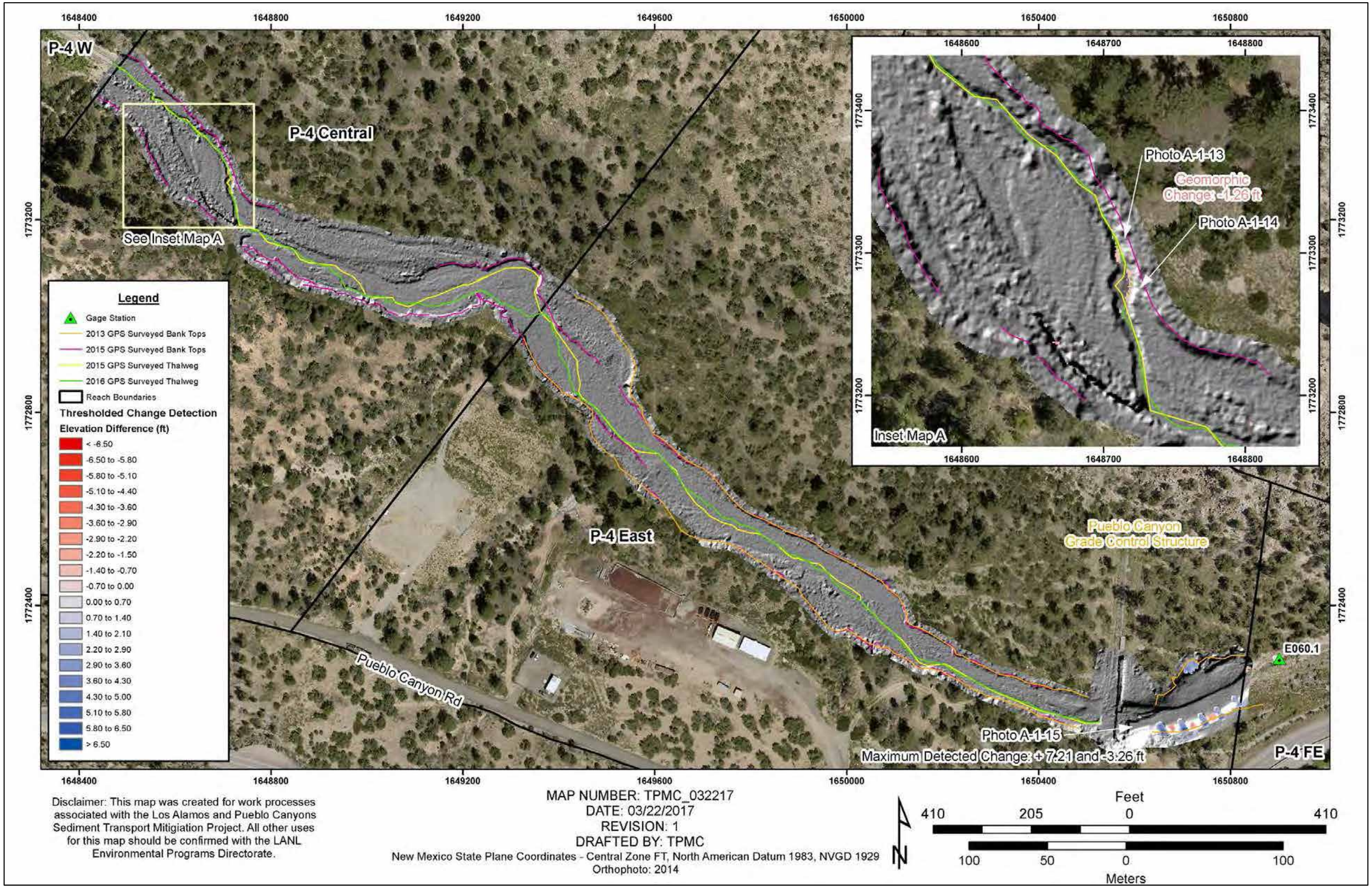


Figure A-4.6-1 Orthophoto with 2016 hillshade DEM, 2015–2016 DoD for the channel areas, and surveyed banks and thalweg at the Pueblo Canyon GCS area

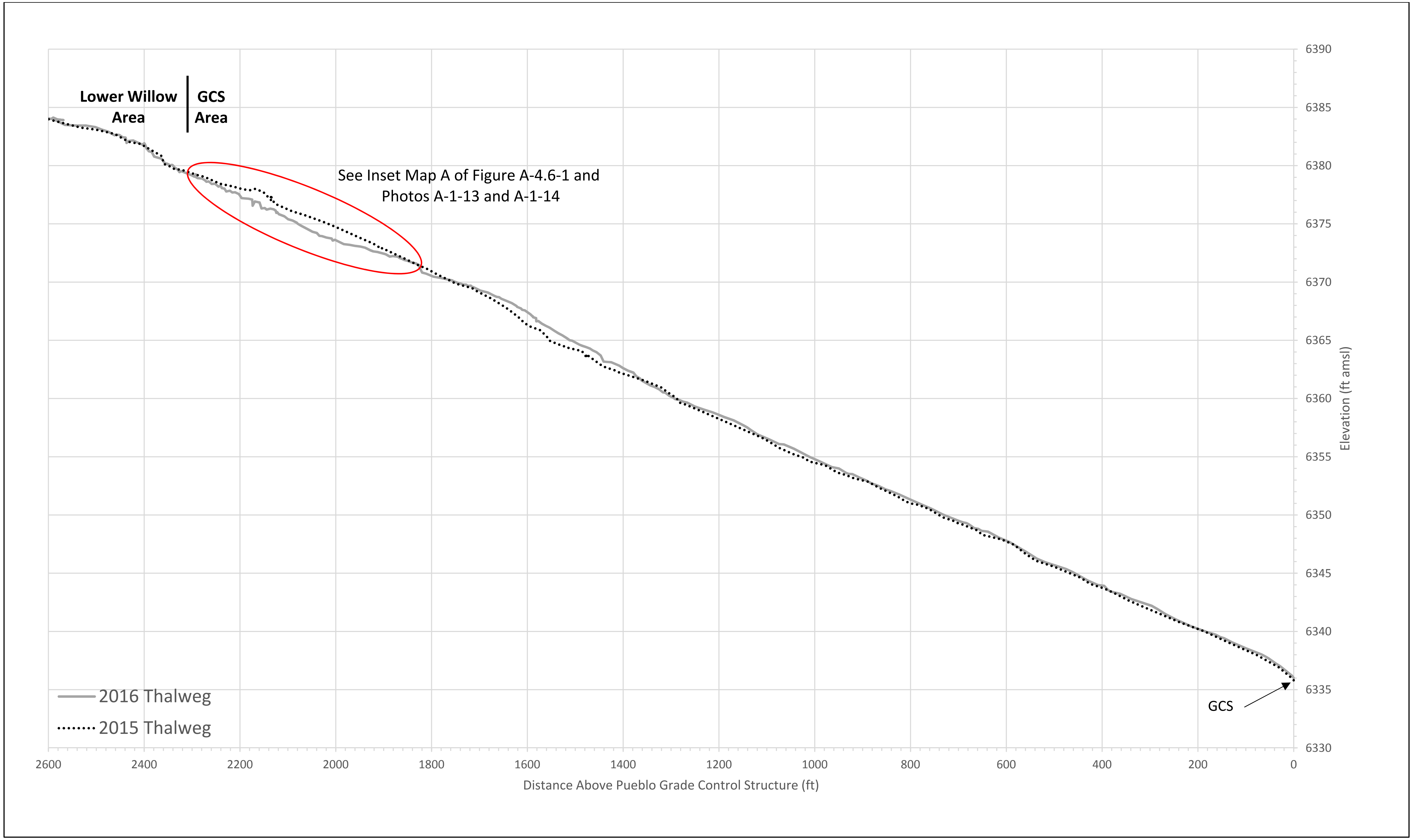
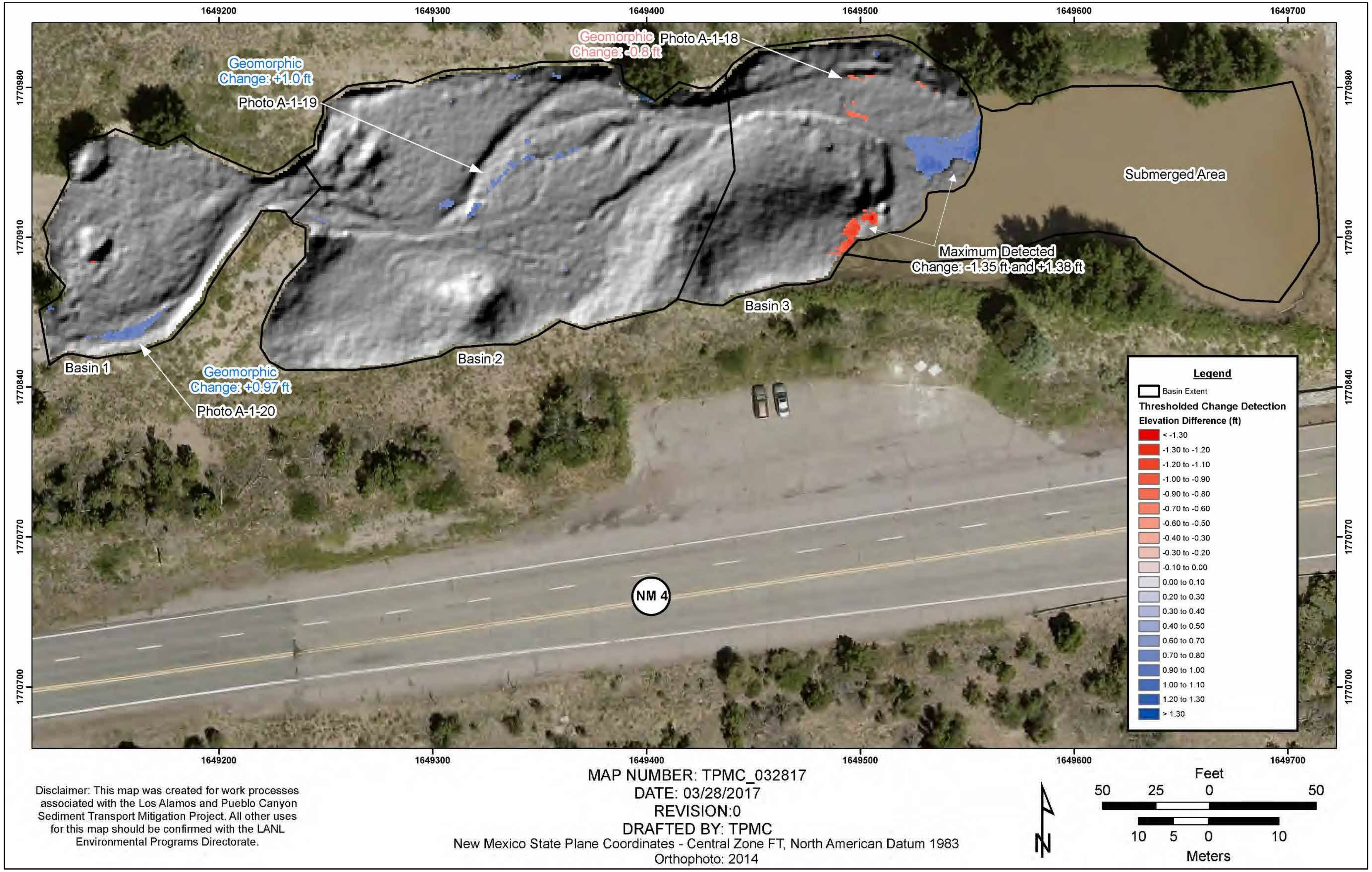


Figure A-4.6-2 Thalweg profile in Pueblo Canyon of the GCS area (25 times vertical exaggeration)

Figure A-4.7-1 Orthophoto with 2016 hillshade DEM and 2015–2016 DoD at the Upper Los Alamos Canyon retention basins



Note: At the time of field verifications in early 2017, recent rain events resulted in the submerged area of Basin 3 extending farther west to cover the areas of DoD detections.

Figure A-4.8-1 DoD of accumulated sediment in Basins 1, 2, and 3 from the 2016 monsoon season in sediment retention basins above the Los Alamos Canyon low-head weir.

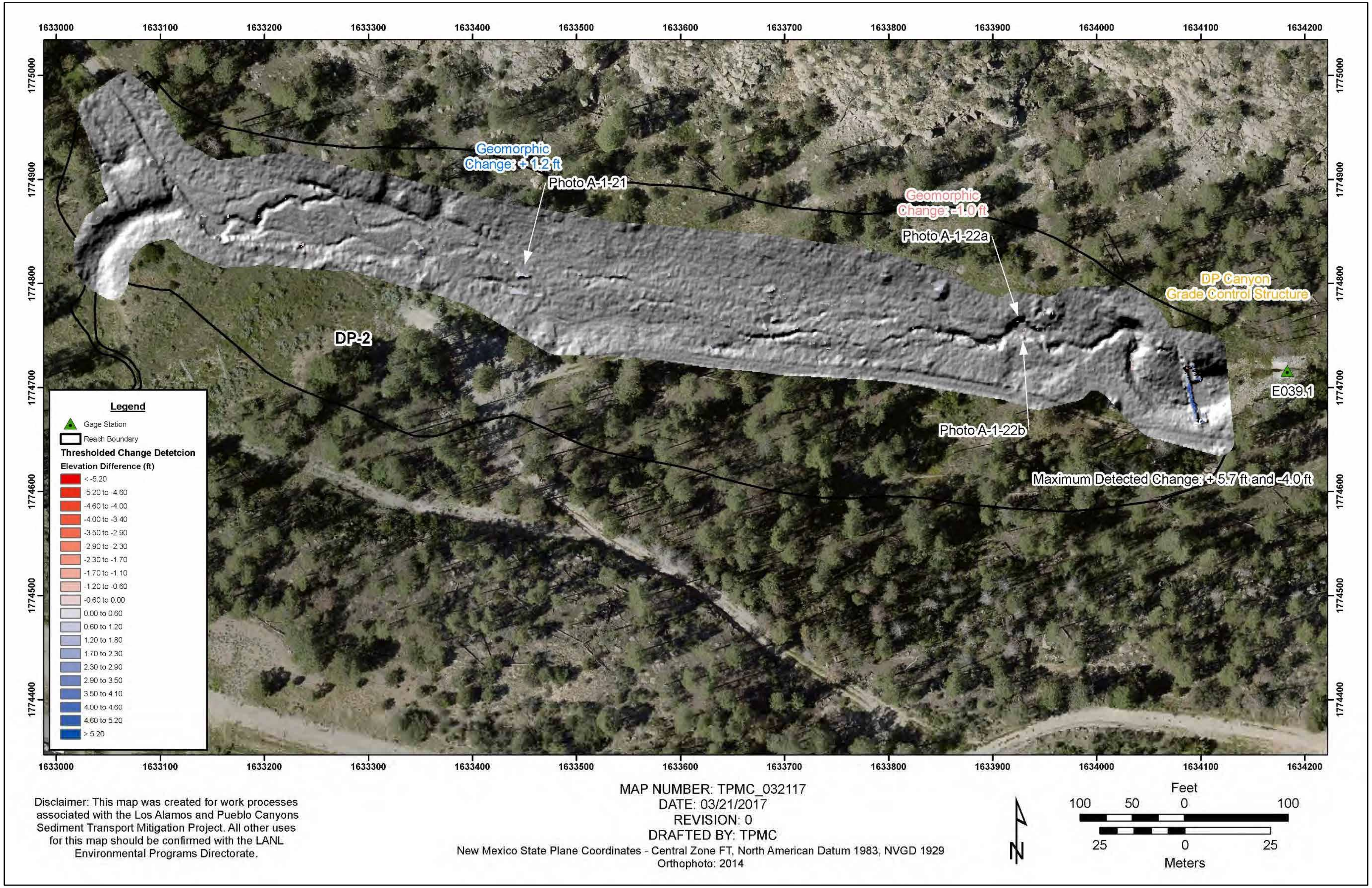


Figure A-4.9-1 Orthophoto with 2016 hillshade DEM and 2015–2016 DoD for the channel areas at the DP Canyon GCS area

Table A-4.0-1
Sediment Accumulation at
Los Alamos/Pueblo Canyon Monitoring Areas, June 2014–November 2015

Area	Net Volume Change* (ft^3)	Uncertainty ± (ft^3)
Pueblo Canyon		
Background Area above the WWTF	854	1143
Upper willow planting area	991	1097
Wing ditch area	21905	18659
Lower willow planting area	791	3918
GCS area	6958	4421
Los Alamos Canyon		
Upper retention basins	2423	1156
DP Canyon		
DP	29	28

* Regardless of field verification confirmation, all DoD values were used to calculate net volume changes as discussed in the results section.

Table A-4.0-2
Spatially Variable Error Values for
Los Alamos and Pueblo Canyon Monitoring Areas, June 2014–November 2015

Area	2015 Error (ft)	2016 Error (ft)	Propagated Error (ft)
Pueblo Canyon			
Background area above the WWTF[a]	0.89	0.48	1.01
Upper willow planting area	1.34	0.76	1.50
Wing ditch area	1.30	0.55	1.41
Lower willow planting area	0.79	0.68	1.04
GCS area	0.89	0.48	1.01
DP Canyon			
DP	0.79	0.51	0.94
Los Alamos Canyon			
Upper retention basins[b]	0.38	0.41	0.56
Low head weir basins[c]	0.79	0.51	0.94

[a] Values used for the background area are typified by a broad, mostly flat channel area with steep, subvertical channel banks.

[b] Values used for the upper retention basins are typified by a somewhat narrow canyon with steep walls and tall tree vegetation.

[c] Values used for the low-head weir basin area are typified by a somewhat open canyon area with a mix of braided and channelized flow.

Table A-4.0-3
Sediment Accumulation at Los Alamos Canyon Low-Head Weir, June 2014–November 2015

Site	Net Volume Change (ft^3)	Uncertainty ± (ft^3)
June 2014 to November 2015		
Basin 1 (west)	106	91
Basin 2 (central)	112	100
Basin 3 (east)*	283	313

*Most of the eastern basin was submerged with water (and perhaps ice) and therefore was not included in this calculation.

Table A-6.2-1
Pueblo Canyon Willow Community Monitoring Results November 2016

Willow Community	Number 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

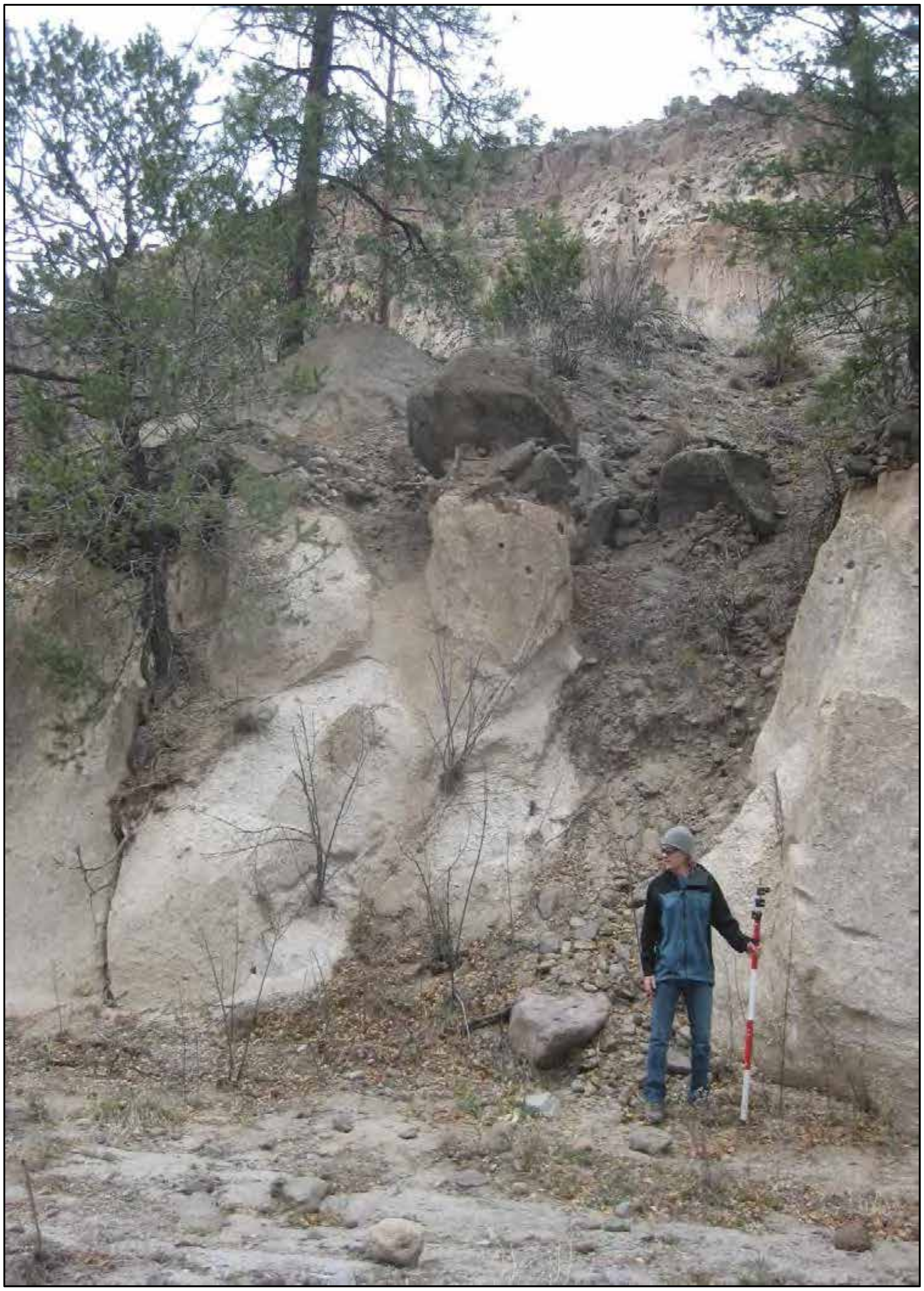


Photo A1-1 Maximum detected negative elevation change (−8.1 ft) in Pueblo Canyon background area, looking north. Unconsolidated colluvium draped on top of the channel bank (defined by exposed bedrock) has fallen or slid downslope in 2016. Loss of overhanging slope sediments and/or rocks has resulted in a large magnitude of elevation change on this bank.

Photo A1-2 Additional area of detected change (−5.5 ft) in Pueblo Canyon background area, looking northwest. Channel banks are eroding via rock/soil fall into the main channel.

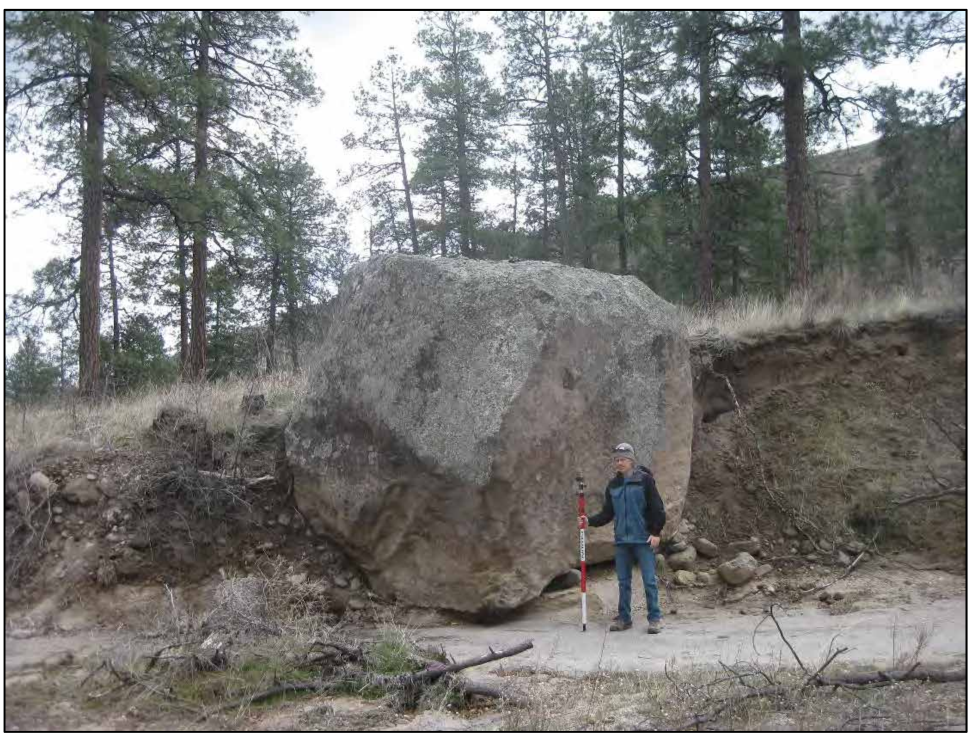


Photo A1-3 Area of detected positive elevation change because of misclassification of light detection and ranging (LiDAR) point cloud in Pueblo Canyon background area, looking east

Photo A1-4 Area of detected positive elevation change because of misclassification of LiDAR point cloud in Pueblo Canyon background area, looking east

Photo A1-5 Maximum negative elevation change (−11.3 ft) Pueblo Canyon upper willow planting area, looking east. Loss of overhanging slope sediments and rocks resulted in large magnitude of elevation change detected on this bank. Actual volume change of observed sediments at the base of the bank is minor.

Photo A1-6 Detected geomorphic change near stream gage E059.5 in the Pueblo Canyon upper willow planting area, looking west. Geomorphic change at this location is characterized by the slumping/creeping of unconsolidated sediment and boulders that comprise the channel bank. No channel process change is observed.

Photo A1-7 Detected erosion (−2.4 ft) around wing ditch culverts/bridge, looking west

Photo A1-8 Detected erosion (−2.39 ft) on active channel banks at upstream area of wing ditch, looking south

Photo A1-9 Detected erosion (−1.9 ft) on active channel banks at upstream area of wing ditch, looking northeast

Photo A1-10 Detected change (−3.2 ft) at the ponded area above Pueblo Canyon drop structure. No significant geomorphic change was observed at this area. View is west.

Photo A1-11 Detected change (−3.9 ft) in Pueblo Canyon lower willow planting area of unconsolidated bank material. View is northeast.

Photo A1-12 Detected change (+2.1 ft) from collapse of channel bank sediments in Pueblo Canyon lower willow planting area, looking north

Photo A1-13 Lateral channel migration and incision (−1.26 ft) detected near the western edge of reach P-4 Central in Pueblo Canyon grade-control structure (GCS) area, looking northwest

Photo A1-14 Channel incision (−1.26 ft) detected near the western edge of reach P-4 Central in Pueblo Canyon GCS area, looking east

Photo A1-15 Change-detection analyses highlighted the results of construction and grading activities below Pueblo Canyon GCS, looking east

Photo A1-16 Change detection analyses highlighted the results of construction and installation of storm water runoff mitigation structures, looking northeast

Photo A1-17 Erosion (−0.8 ft) on cut bank in Basin 3 above Los Alamos Canyon low-head weir, looking east

Photo A1-18 Deposition (+1.0 ft) in channel of Basin 2 above Los Alamos Canyon low-head weir, looking west

Photo A1-19 Deposition (+0.97 ft) of overbank materials in Basin 1 above Los Alamos Canyon low-head weir

Photo A1-20 Deposition (+1.21 ft) of channel fill materials detected in area of braided channels above DP Canyon GCS, looking east


(a)


(b)

Photo A1-21 Erosion (−1.0 ft) of bank materials detected in area of well-defined channel directly upstream of DP Canyon GCS: (a) looking north at left bank and (b) looking south at right bank


(a)


(b)

Photo A1-22 Willows planted in 2014 in Pueblo Canyon lower willow-planting area, from northern stake at P4C+800: (a) in April 2014 and (b) short-height, spatially dispersed community (P-1) example in November 2016

(a)

(b)

Photo A1-23 Willows planted in 2014 in Pueblo Canyon lower willow planting area, looking downstream from PU+1100: (a) April 2014 and (b) short-height, spatially continuous community (P-2) example in November 2016

(a)

(b)

Photo A1-24 Willows planted in 2014 in Pueblo Canyon lower willow planting area, looking downstream from P4C+200: (a) in April 2014 and (b) medium-height, spatially dispersed community (P-3) example in November 2016

(a)

(b)

Photo A1-25 Willows planted in 2014 in Pueblo Canyon lower willow planting area, looking upstream from P4C+300: (a) in April 2014 and (b) example of medium-height, spatially continuous community (P-4) in November 2016


(a)


(b)

Photo A1-26 Willows planted in 2014 in Pueblo Canyon lower willow planting area, looking downstream from PU+400: (a) in April 2014 and (b) example of tall-height, spatially continuous community (P-5) (center) in November 2016

(a)

(b)

Photo A1-27 Rock armoring along stream banks in the south fork of Acid Canyon: (a) looking upstream in April 2016 and (b) log check dams in November 2016

Attachment A-2

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

Attachment A-3

Monitoring Area Digital Elevation Model Clips
(on CD included with this document)

Appendix B

Pueblo Canyon Wetland Willow Plantings and Associated Piezometer Levels

B-1.0 INTRODUCTION

This appendix describes alluvial water-level piezometer monitoring to observe the performance of willows planted during the first phase of the Pueblo Canyon Wetland Area Mitigation project. Heavy rains and subsequent runoff events during September 2013 resulted in the upstream migration and widening of a headcut within the wetland area downstream of the Los Alamos Wastewater Treatment Facility (WWTF) in lower Pueblo Canyon (LANL 2014, 257592). The primary objective of the plantings was to promote stabilization, ecological functions, sediment aggradation, and hydraulic stability of the Pueblo wetlands in areas damaged by 2013 floods. More specifically, willow plantings in the wetland area of Pueblo Canyon were performed to address legacy contaminant migration and other nonpoint source pollutants, minimize potential Los Alamos National Laboratory (LANL or the Laboratory) impacts to downstream stakeholders, maintain and/or reduce risks associated with off-site sediment transport beyond the facility boundary, and reduce peak discharges at the Laboratory boundary.

Eight piezometers were installed in lower Pueblo Canyon in December 2014 to monitor water levels within and downstream of the willows 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 consist of 2-in.-inner-diameter galvanized steel drive points with 4-ft screened intervals. The screens were 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.

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 when the water levels dropped below the transducer measuring point, the graphs flatline. 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 WWTF, daily mean discharges at gaging stations E059.5 and E059.8, and daily total precipitation records from rain gage RG042.1 are plotted along with the piezometer water-level data. The results are discussed below.

B-2.1 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 increase during and after large storm water runoff events recorded at gaging stations E059.5 and E059.8, with an apparent delay of 0–1 d. Elevated water levels are brief and quickly return to pre-flow levels within a day after storm water runoff events.

B-2.2 Middle Piezometer Transect

PUPZ-4 to PUPZ-6: The data for this transect (Figure B-2.0-2) are different from those for the upper transect in that water levels are not as responsive to changes in effluent discharge from the WWTF and show a stronger influence from storm water runoff 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 increase during and after large storm water runoff events recorded at gaging stations E059.5 and E059.8, with an apparent delay of 0–1 d, and then quickly return to pre-flow levels. Water levels during the peak growing season show a less pronounced connection with changes in WWTF discharge; at that time, water levels are below the level of the transducer when the WTTF discharge is at its highest. Evapotranspiration in the summer months may have an influence comparable to the effect of WWTF discharge on water levels.

B-2.3 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 a 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 appear to increase during and after large storm water runoff events recorded at gaging stations E059.5 and E059.8, with an apparent delay of 0–1 d, and water levels decrease more slowly after storm events than at transects farther upstream.

B-3.0 CONCLUSIONS

Alluvial water-level piezometers were installed in the Pueblo wetland to monitor the performance of willows planted in 2014 during the first phase of the Pueblo Canyon Wetland Area Mitigation project. During 2014, rainfall was below normal to above normal, depending on the month; however, the May rainfall, and especially July rainfall, allowed the willows to establish a stable root system and thrive. During 2015, rainfall was above normal to normal, depending on the month, and the storm events were less intense than typical monsoon storms, allowing the willows to continue to thrive. During 2016, the rainfall was below normal (with the exception of August); however, the willows were not affected by the reduced rainfall because of the constant influx from the WWTF and because they were already well established. To fully characterize the interactions between the alluvial system and the willows, the alluvial water levels will continue to be monitored in 2017.

B-4.0 REFERENCES

The following list includes all documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ER ID or ESH ID. This information is also included in text citations. ER IDs were assigned by the Environmental Programs Directorate's Records Processing Facility (IDs through 599999), and ESH IDs are assigned by the Environment, Safety, and Health (ESH) Directorate (IDs 600000 and above). IDs are used to locate documents in the Laboratory's Electronic Document Management System and, where applicable, in the master reference set.

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

LANL (Los Alamos National Laboratory), March 2014. "Storm Water Performance Monitoring in the Los Alamos/Pueblo Watershed during 2013," Los Alamos National Laboratory document LA-UR-14-24516, Los Alamos, New Mexico. (LANL 2014, 257592)

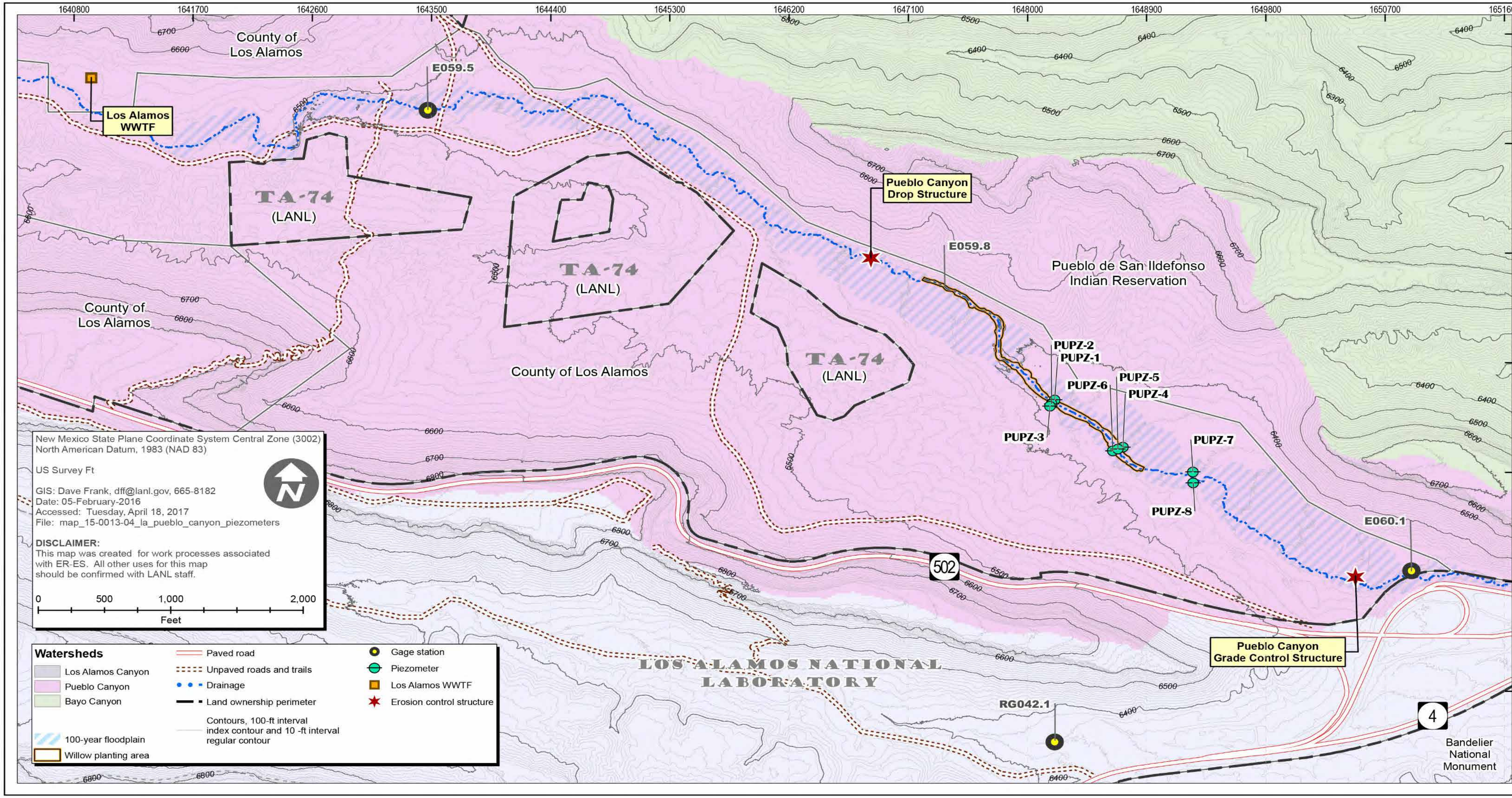


Figure B-1.0-1 Piezometer locations, 2014 willow planting area, Los Alamos WWTF, gaging stations E059.5, E059.8, and E060.1, precipitation gage RG042.1, new Pueblo Canyon drop structure, and Pueblo Canyon grade-control structure

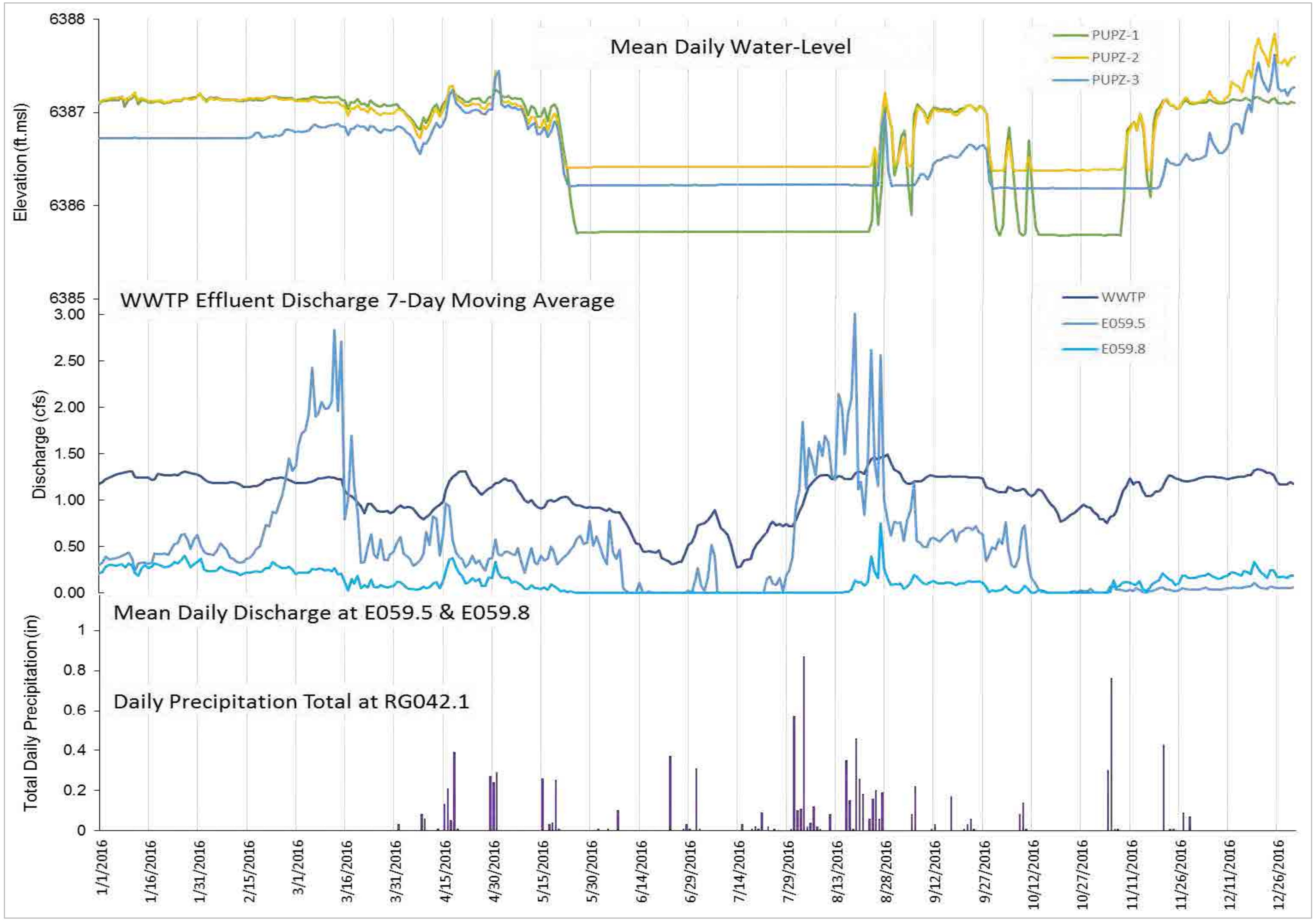


Figure B-2.0-1 **Mean daily water level (ft above mean sea level) in piezometers PUPZ-1, PUPZ-2, and PUPZ-3, 7-d moving average of Los Alamos WWTP effluent discharge, mean daily discharge at gaging stations E059.5 and E059.8, and total daily precipitation at RG042.1**

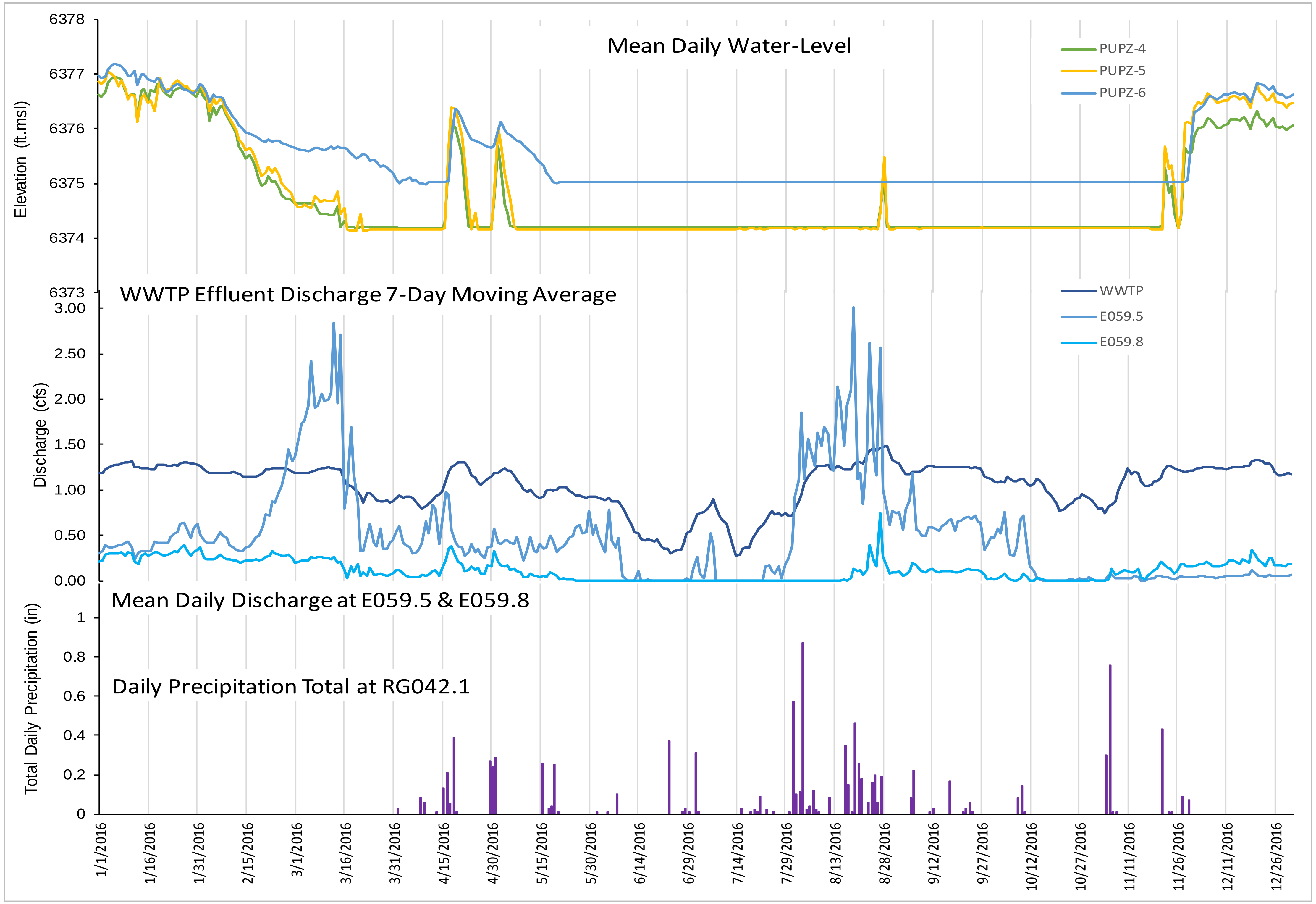


Figure B-2.0-2 Mean daily water level (ft above mean sea level) in piezometers PUPZ-4, PUPZ-5, and PUPZ-6, 7-d moving average of Los Alamos WWTP effluent discharge, mean daily discharge at gaging stations E059.5 and E059.8, and total daily precipitation at RG042.1

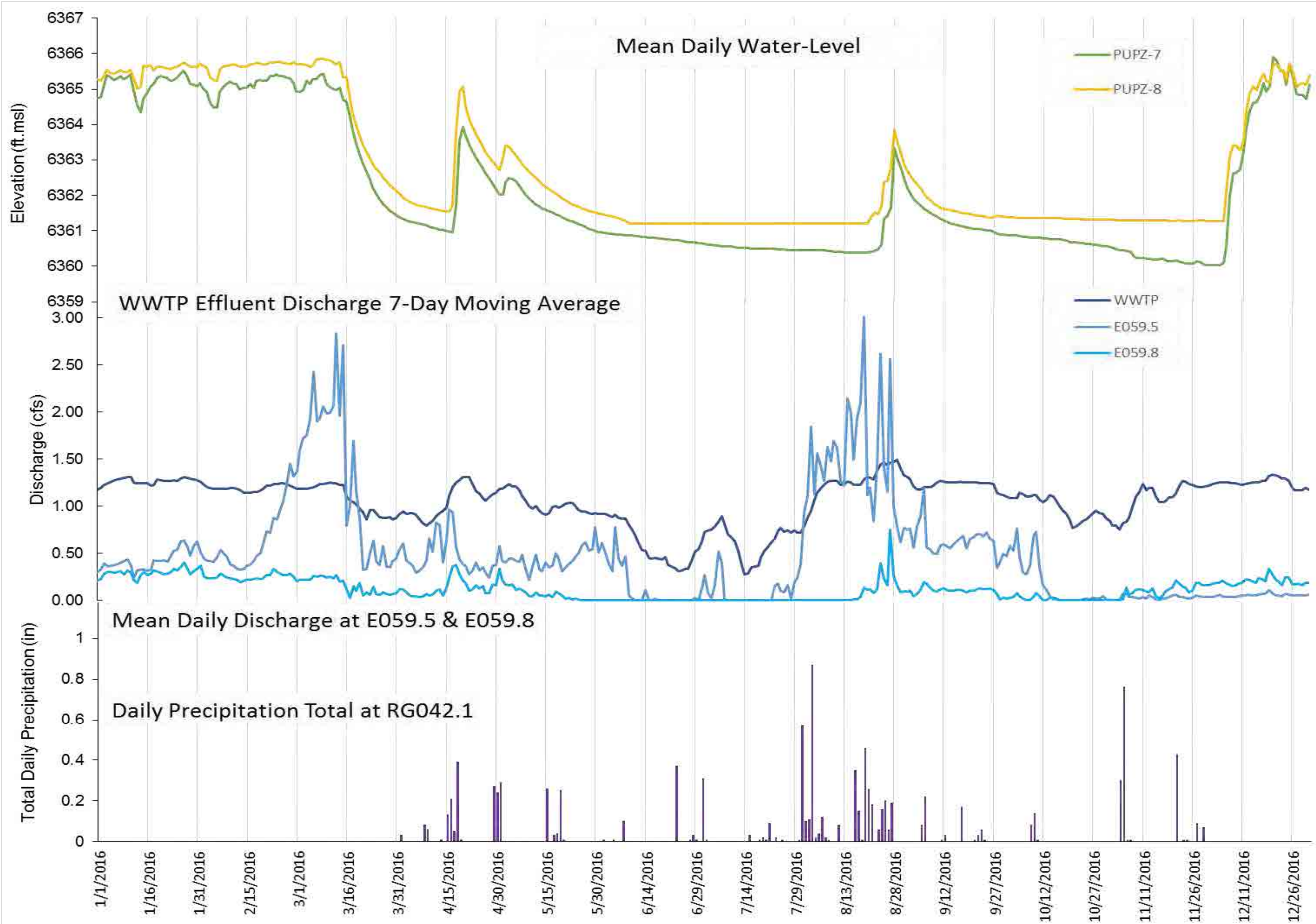


Figure B-2.0-3 Mean daily water level (ft above mean sea level) in piezometers PUPZ-7 and PUPZ-8, 7-d moving average of Los Alamos WWTP effluent discharge, mean daily discharge at gaging stations E059.5 and E059.8, and total daily precipitation at RG042.1

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

* amsl = Above mean sea level.

Appendix C

2016 Watershed Mitigations Inspections

C-1.0 INTRODUCTION

Watershed storm water controls and grade-control structures (GGSs) are inspected on a routine basis (quarterly: Quarter 1 [Q1] Jan–March, Q2 April–June, Q3 July–Sept, Q4 Oct–Dec) 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 quarterly 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 2016. 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. Fourth-quarter inspections are considered annual inspections and are more thorough; therefore, certain photographs do not parallel previous feature photos. Features that were noted in the inspection reports but were missing pictures are marked by “Missing Photo.” The DP Canyon GCS and Los Alamos Canyon weir were not inspected during Q3.

C-2.0 DP CANYON GRADE-CONTROL STRUCTURE

C-2.1 Grade-Control Structure and Outlet

Photo C-2.1-1 March 2016 — Downslope side shows standing water present in pond. The pipe is about ¼ full, difficult to determine at the time if sediment is an issue. Recommend monitoring.

Photo C-2.1-2 June 2016 — Standing water in downslope side pond still shows standing water. No visible seepage or piping issue present. Pipe is about 1/8 full. Recommend monitoring.

Photo C-2.1-3 **Nov 2016 — Standing water in downslope side pond still shows standing water. No visible seepage or piping issue present. Pipe is about 1/8 full and is consistent with the last inspection. Recommend monitoring.**

C-2.2 Joint on Northern Portion of Weir Crest with Indications of Separation

Photo C-2.2-1 **March 2016 — The joint located on the northern portion of the crest directly above the bulging gabion basket shows signs of separation (approximately 0.25 in.). No change in condition from the last inspection (Q3 2015). Recommend monitoring.**

C-2.3 Concrete Cracks on Weir

Photo C-2.3-1 March 2016 — Cracks are consistent with previous inspection. Recommend monitoring.

Photo C-2.3-2 June 2016 — Cracks are consistent with previous inspection. Recommend monitoring.

Photo C-2.3-3 Nov 2016 — Cracks are consistent with previous inspection. Recommend monitoring.

C-2.4 Standpipe

Photo C-2.4-1 March 2016 — Approximate height between channel bed and top of weir is 3.5 ft (no change from the last inspection [Q4 2015]). The height of the standpipe inlet is approximately 1 ft above the soil profile in front of the weir. This may represent a lower height than was present during the last inspection when 1.45 ft was reported. Tire present in standpipe. Recommend monitoring and removal of tire.

Photo C-2.4-2 **June 2016 — Approximate height between channel bed and top of weir is 3.5 ft (no change from previous inspection [Q1 2016]). Tire is still present in the standpipe. Recommend monitoring and removal of tire.**

Photo C-2.4-3 **Nov 2016 — Approximate height between channel bed and top of weir is 3.5 ft (unchanged from last inspection [Q2 2016]). Tire is still present in the standpipe. Recommend monitoring and removal of tire.**

C-2.5 Bulging Gabion Basket on Downstream Face of Weir

Photo C-2.5-1 March 2016 — Bulging gabion basket located on the downstream face and below crest of weir. Consistent with previous inspection.

Missing Photo C-2.5-2 June 2016 — Bulging gabion basket is consistent with previous inspection.

Missing Photo C-2.5-3 Nov 2016 — Bulging gabion basket is consistent with previous inspection.

C-2.6 Upstream Slope Face of Weir

Photo C-2.6-1 March 2016 — Large tree and woody debris shown on upstream slope face of weir. Recommend removal of tree.

Photo C-2.6-2 June 2016 — Debris (trash and sticks) shown on upstream slope face of weir. Recommend monitoring.

Photo C-2.6-3 Nov 2016 — Minor trash and woody debris present on upstream slope face of weir. Recommend monitoring.

C-2.7 Downstream Embankments

Photo C-2.7-1 June 2016 — Downstream embankments with burrows present. Recommend monitoring.

Photo C-2.7-2 Nov 2016 — Presence of rodent burrows consistent with previous inspection. Burrows do not appear to be active. Recommend monitoring.

C-2.8 Miscellaneous Inspection Photos

Photo C-2.8-1 Nov 2016 — Erosion feature near northeast corner of spillway. Hole is approximately 2 ft deep and is not described in previous inspection reports.

C-3.0 UPPER LOS ALAMOS CANYON SEDIMENT DETENTION PONDS

C-3.1 Upper Basin Pond

Photo C-3.1-1 March 2016 — Floatable debris found in upper basin marked by red circles. Recommend removal and disposal of debris. Sloughing on north bank not pictured. Recommend monitoring sloughing.

Photo C-3.1-2 June 2016 — Floatable debris found in upper basin marked by red circles. Sloughing on north bank not pictured. Recommend monitoring both.

Photo C-3.1-3 Flow Event on August 3, 2016 — Upper basin shows ponding due to recent rain events.

Photo C-3.1-4 Sept 2016 — Floatable debris present in ponded water (consistent with last inspection).

Photo C-3.1-5 Nov 2016 — Floatable debris encountered in upper basin. Bottom of basin is wet.

C-3.2 Construction Spoils in Upper Basin

Photo C-3.2-1 March 2016 — Construction excavation spoils found in upper basin. Construction spoils decrease basin capacity. Recommend removal of construction spoils.

Photo C-3.2-2 June 2016 — Construction spoils remaining from pipeline construction still present. Recommend removal of construction spoils.

Missing Photo C-3.2-3 Flow Event on August 3, 2016 — Construction spoils still present.

Photo C-3.2-4 Sept 2016 — Recent maintenance removed pipeline construction spoils and placed north of pond with seed and mulch.

C-3.3 Upper Basin Spillway

Photo C-3.3-1 March 2016 — Slumping failure of riprap below wire mesh resulting from insufficient number of wire ties to bottom mesh. Recommend repair slumping.

Photo C-3.3-2 June 2016 — Slumping failure of riprap still present. Newly noted animal burrows present. Recommend repair burrows and slumping.

Photo C-3.3-3 Flow Event on August 3, 2016 — Animal burrows present. Slumping failure still present. Recommend repair burrows and slumping.

Photo C-3.3-4 Sept 2016 — Slumping on upper portion of spillway still present (consistent with previous inspection). Animal burrows present (consistent with previous inspection). Recommend repair burrows and slumping.

Photo C-3.3-5 Nov 2016 — Spillway wire enclosed riprap repair recently completed under maintenance work order.

C-3.4 Lower Basin Pond

Photo C-3.4-1 March 2016 — Lower basin has sloughing on north bank.

Photo C-3.4-2 June 2016 — Battery boxes in lower basin. Sloughing on north bank present but minimal (not pictured). Recommend removal of debris.

Photo C-3.4-3 Flow Event on August 3, 2016 — Floating battery boxes found (not pictured). No other floating debris present. Basin filled with water due to recent rain events. Recommend removal of debris

Photo C-3.4-4 Sept 2016 — Sloughing on north bank present (unchanged from previous inspections). Ponded water still present. Battery boxes still present in pond. Recommend removal of debris

Photo C-3.4-5 Nov 2016 — Debris present in lower basin. Bottom of basin damp from previous flow events. Recommend removal of debris.

C-3.5 Lower Basin Spillway

Photo C-3.5-1 March 2016 — Animal burrows in lower embankment south of spillway. Recommend repair of animal burrows.

Photo C-3.5-2 June 2016 — Animal burrows on lower basin spillway. Based on visual inspection, number and size of holes appear to be consistent with last inspection (Q1 2016). Recommend repair of animal burrows.

Photo C-3.5-3 Flow Event August 3, 2016 — Animal burrows still present. No change in size and shape since last inspection (Q2 2016). No evidence of flow. Recommend repair of animal burrows.

Photo C-3.5-4 Sept 2016 — Animal burrows still present. No change in size and shape since last inspection (flow event on August 3, 2016). No evidence of flow. Recommend repair of animal burrows.

Photo C-3.5-5 Nov 2016 — Lower basin spillway looking east. Animal burrows recently repaired under maintenance work order.

C-3.6 Wetland Health

Photo C-3.6-1 March 2016 — Wetland shows well-established vegetation downstream of coir log. Monitor vegetation and level of sediment.

Photo C-3.6-2 June 2016 — Wetland shows well-established vegetation. Consistent with previous inspections. Monitor vegetation and level of sediment.

Photo C-3.6-3 Sept 2016 — Wetland shows well-established vegetation. Monitor vegetation and level of sediment.

Photo C-3.6-4 Flow Event on August 3, 2016 — Wetland shows well-established vegetation. Monitor vegetation and level of sediment.

Photo C-3.6-5 Nov 2016 — Wetland shows well-established vegetation. Monitor vegetation and level of sediment.

C-3.7 Construction Debris in Wetland

Photo C-3.7-1 March 2016 — Silt fence and pipe materials (construction debris) at southeast side of the wetland pond, near sampler. Recommend removing debris and monitor geotextile.

Photo C-3.7-2 June 2016 — Debris (silt fence and geotextile debris) on north bank in wetland. Recommend removing debris and monitor geotextile.

Missing Photo C-3.7-3 Flow Event on August 3, 2016 — Debris on north bank of wetland still present. Recommend removing debris and monitor geotextile.

Missing Photo C-3.7-4 Sept 2016 — Debris on north bank still present (consistent with previous inspection). Recommend removing debris and monitor geotextile.

C-3.8 Deteriorated Wattles

Photo C-3.8-1 March 2016 — Deteriorating wattles downstream of lower spillway at entrance to wetlands. Recommend repairing deteriorated wattles.

Photo C-3.8-2 June 2016 — Deteriorating wattles downstream of lower spillway at entrance to wetlands. Recommend repairing deteriorated wattles.

Photo C-3.8-3 Flow Event on August 3, 2016 — Deteriorated wattles. Recommend repairing deteriorated wattles.

Photo C-3.8-4 Sept 2016 — Deteriorated wattles downstream of lower spillway (consistent with previous inspection). Recommend repairing deteriorated wattles.

Photo C-3.8-5 Nov 2016 — Straw wattles recently replaced under maintenance work order.

C-3.9 Pipeline Nick

Photo C-3.9-1 March 2016 — Nick in pipe 6 ft east of pipe bridge structure. Recommend monitoring nick.

Photo C-3.9-2 June 2016 — Pipeline and supports (nick not pictured). Recommend monitoring nick.

Photo C-3.9-3 Flow Event on August 3, 2016 — Nick on pipe (circled in red above). Recommend monitoring nick.

Missing Photo C-3.9-4 Sept 2016 — Nick on pipe 6 ft east of pipe bridge structure. Recommend monitoring nick.

Photo C-3.9-5 Q4 — Nick in pipe found 6 ft east of pipe bridge structure (circled in red). Recommend monitoring nick.

C-3.10 Pipeline Cable Corrosion

Photo C-3.10-1 June 2016 — Uppermost support cable shows fraying and corrosion (fraying not pictured). Recommend monitoring cables.

Photo C-3.10-2 Flow Event on August 3, 2016 — Uppermost support cable with fraying and corrosion. Recommend monitoring cables.

Missing Photo C-3.10-3 Sept 2016 — Uppermost pipe support cable has fraying and corrosion.

Photo C-3.10-4 Nov 2016 — Uppermost pipe cable anchor fraying and corrosion where it rubs against the canyon rocks. Recommend monitoring cables.

C-3.11 Lower I-Beam Rolling Pipe Support

Photo C-3.11-1 March 2016 — Rolling pipe support on lower I-beam (upstream of vacuum breaker) has skewed alignment and is bearing incorrectly. Recommend monitoring I-beam.

Photo C-3.11-2 June 2016 — Lower rolling pipe support on I-beam with skewed alignment and incorrect bearing. Recommend monitoring I-beam.

Photo C-3.11-3 Flow Event on August 3, 2016 — Lower rolling pipe support on I-beam with skewed alignment and incorrect bearing. Recommend monitoring I-beam.

Missing Photo C-3.11-4 Sept 2016 — Lower rolling pipe support on I-beam with skewed alignment and incorrect bearing (not pictured). Recommend monitoring I-beam.

Photo C-3.11-5 Nov 2016 — Lower rolling pipe support on I-beam with skewed alignment and incorrect bearing. Recommend monitoring I-beam.

C-3.12 Crack in Bridge Support

Photo C-3.12-1 March 2016 — Crack found in mortar on southeast corner pipe bridge support. Recommend monitoring crack.

Photo C-3.12-2 June 2016 — Crack found in mortar on southeast corner pipe bridge support. Recommend monitoring crack.

Missing Photo C-3.12-3 Flow Event on August 3, 2016 — Crack in pipe bridge support consistent with previous inspection. Recommend monitoring crack.

Missing Photo C-3.12-4 Sept 2016 — Crack in pipe bridge support consistent with previous inspection. Recommend monitoring crack.

Missing Photo C-3.12-5 Nov 2016 — Crack in pipe bridge support consistent with previous inspection. Recommend monitoring crack.

C-3.13 Missing Nut near LA-SMA-2.1 Sampler

Photo C-3.13-1 June 2016 — Pipe support bolt with missing nut. Recommend installing missing nut.

Photo C-3.13-2 Flow Event on August 3, 2016: Pipe support bolt with missing nut (circled in red) consistent with previous inspection. Recommend installing missing nut.

Missing Photo C-3.13-3 Sept 2016 — Pipe support bolt with missing nut consistent with previous inspections. Recommend installing missing nut.

Photo C-3.13-4 Nov 2016 — Previously missing nut recently installed at southwest corner top of plate under maintenance work order.

C-3.14 Pipe Inlet

Missing Photo C-3.14-1 March 2016 — Floatable trash and debris present near pipe inlet. Recommend removal of debris.

Photo C-3.14-2 June 2016 — Debris present upstream of pipe inlet. Recommend removal of debris.

Photo C-3.14-3 Flow Event on August 3, 2016 — Pipe inlet plugged with debris from recent rain event. Recommend removal of debris.

Photo C-3.14-4 Sept 2016 — Pipe inlet still plugged with debris. Recommend removal of debris.

Photo C-3.14-5 Nov 2016 — Debris present at pipe inlet. Recommend removal of debris.

C-3.15 Pipe Outlet and Energy Dissipater

Photo C-3.15-1 March 2016 — Bare soils on steep slopes found on south and north bank upstream of the gabion overflow structure to upper pond. Pipe outlet circled in red above.

Photo C-3.15-2 June 2016 — Debris around energy dissipater present. Bare soil on south and north banks is exposed and in need of stabilization. Recommend removal of debris.

Photo C-3.15-3 Flow Event of August 3, 2016 — Pipe outlet contains trash and debris. Standing water present due to recent rain event. Recommend removal of debris.

Photo C-3.15-4 Sept 2016 — Banks near pipeline outlet in need of stabilization (consistent with previous inspections). No standing water present. Recommend removal of debris.

Photo C-3.15-5 Nov 2016 — Pipe outlet looking northeast. Riprap on banks recently installed under maintenance work order. Recent rodent activity on south bank.

C-3.16 Gabion Overflow Structure in Upper Pond

Missing Photo C-3.16-1 March 2016 — Filter fabric left after construction near gabion baskets. Recommend cutting filter fabric outside of riprap.

Missing Photo C-3.16-2 June 2016 — Filter fabric left after construction near gabion baskets.

Photo C-3.16-3 Sept 2016 — Filter fabric left after construction. North and south banks of overflow structure still exposed (consistent with previous inspection). Sediment deposition encountered below top of gabion spillway into upper pond indicating water levels in the diversion area did not reach a level to spill into the upper pond. Recommend removal of debris.

Photo C-3.16-4 Nov 2016 — Filter fabric removed.

C-3.17 Basin Outlet Culvert

Missing Photo C-3.17-1 March 2016: Bare soils on steep slopes found downstream of culvert outlet.

Photo C-3.17-2 June 2016 — Basin outlet area with exposed, unstable bank.

Photo C-3.17-3 Flow Event on August 3, 2016 — Basin outlet with evidence of flow from recent rain event.

Photo C-3.17-4 Sept 2016 — Bare soil areas on opposite bank of discharge culvert outlet. Evidence of flow at culvert discharge. Consistent with previous inspections.

Photo C-3.17-5 Nov 2016 — Culvert outlet riprap extension completed under maintenance order.

C-3.18 Riser Pipes

Missing Photo C-3.18-1 March 2016 — Recommend installing trash racks on riser pipes.

Photo C-3.18-2 June 2016 — Recommend installing trash racks and 3-in.-diameter holes on riser pipes. Bank erosion present.

Photo C-3.18-3 Flow Event on August 3, 2016 — Tall vegetation encountered near new culvert pipe inlet risers. Bank erosion present. Recommend installing trash racks and 3-in.-diameter holes on riser pipes.

Missing Photo C-3.18-4 Sept 2016 — Recommend installing trash racks and 3-in.-diameter holes on riser pipes. Consistent with previous inspections.

Photo C-3.18-5 Nov 2016 — Riser pipes consistent with previous inspection. Recommend installing trash racks and 3-in.-diameter holes on riser pipes.

C-3.19 Collapsed Road

Photo C-3.19-1 March 2016 — Road collapse under Jersey barrier at southeast end of wetland. Recommend repair of road.

Photo C-3.19-2 June 2016 — Road collapse under Jersey barrier. Recommend repair of road.

Photo C-3.19-3 Flow Event August 3, 2016 — Road collapse under Jersey barrier. Recommend repair of road.

Photo C-3.19-4 Sept 2016 — Road collapse under Jersey barrier (consistent with previous inspection). Recommend repair of road.

Photo C-3.19-5 Nov 2016 — Road collapse repair recently completed under maintenance work order.

C-3.20 Miscellaneous Inspection Photos

Photo C-3.20-1 June 2016 — Road with visible holes and damage. Recommend repair of road.

Photo C-3.20-2 Sept 2016 — Construction spoils circled in red. Recommend removal of spoils.

C-4.0 LOS ALAMOS CANYON WEIR AND DETENTION PONDS

C-4.1 Weir Standpipe in Lower Pond

Photo C-4.1-1 March 2016 — Standpipe is unobstructed for top four holes, five holes buried. Staff gage reads 5.7 ft.

Photo C-4.1-2 June 2016 — Standpipe is unobstructed for top four holes. Staff gage reads 5.7 ft.

Photo C-4.-1-3 Oct 2016 — Standpipe is unobstructed for top four holes. Staff gage reads 5.8 ft. Note: Though piping could be discouraged by clearing debris from around the standpipe, the New Mexico Environment Department wants all water upstream of the weir to filter through the gabions.

C-4.2 Lower Pond Outlet Downstream of Weir

Photo C-4.2-1 March 2016 — Outlet pipe shows evidence of erosion. Recommend monitoring.

Photo C-4.2-2 June 2016 — Downstream side of outlet pipe shows evidence of erosion. Recommend monitoring.

Photo C-4.2-3 Oct 2016 — Downstream side of outlet pipe shows signs of erosion. Recommend monitoring.

C-4.3 Lower Pond

Photo C-4.3-1 March 2016 — Lower pond filled with estimated 2–3 ft of standing water.

Photo C-4.3-2 June 2016 — Lower pond with estimated 5–6 ft of sediment below top of spillway.

Photo C-4.3-3 Oct 2016 — Lower pond with estimated 5–6 ft of standing water below top of spillway.

C-4.4 Middle and Upper Ponds

Photo C-4.4-1 March 2016 — Sediment levels at middle and upper ponds at unknown depth.

Photo C-4.4-2 June 2016 — Sediment levels in middle and upper ponds at unknown depth. Consistent with previous inspection.

Photo C-4.4-3 Oct 2016 — Sediment levels consistent with previous inspection.

C-4.5 Downslope Embankments

Photo C-4.5-1 March 2016 — Downstream embankments with erosion under former erosion-control blanket (ECB). Erosion could be creeping toward New Mexico Department of Transportation (NMDOT) right of way (ROW).

Photo C-4.5-2 June 2016 — Southside of embankment shows erosion approaching NMDOT ROW.

Photo C-4.5-3 Q4 — South bank continues to show erosion.

C-4.6 Undercutting of Gabion Basket

Photo C-4.6-1 March 2016 — Downstream end of gabion basket shows minor erosion and undercutting. Recommend monitoring.

Photo C-4.6-2 June 2016 — Gabion baskets on stream face of weir appear to have undercutting with erosion immediately downstream. Recommend monitoring.

Photo C-4.6-3 Oct 2016 — Gabion baskets show undercutting and erosion immediately downstream. Conditions similar to previous inspections. Recommend monitoring.

C-4.7 Piping Erosion

Photo C-4.7-1 March 2016 — Piping on upstream side of weir consistent with previous inspection. Recommend monitoring.

Photo C-4.7-2 June 2016 — Piping erosion consistent with previous inspections. Recommend monitoring.

Photo C-4.7-3 Oct 2016 — Occurrences of piping have increased since last inspection. Piping appears to be occurring above the bottom of the weir's lowest level of gabion baskets and mattresses. Estimated 11 locations of piping along the weir. Large voids in gabions could allow fine sediment transport downstream. Recommend monitoring.

C-4.8 Flow Path Development near Parking Lot

Photo C-4.8-1 March 2016 — Preferential flow path developing on upstream south embankment near the fence. Recommend monitoring.

Photo C-4.8-2 June 2016 — Preferential flow path continuing to develop on upstream south embankment near the fence.

C-4.9 Borrow Pit Runoff Control Berm

Photo C-4.9-1 March 2016: Borrow pit runoff control berm looking north. The borrow pit runoff control berm appears to be in good hydrologic condition and is functioning correctly to reduce runoff and sediment migration from the area. Recommend monitoring.

Photo C-4.9-2 June 2016 — Borrow pit runoff control in good condition and is functioning correctly. Recommend monitoring.

Photo C-4.9-3 Oct 2016 — Borrow pit runoff control in good condition. Recommend monitoring.

C-4.10 Miscellaneous Inspection Photos

Photo C-4.10-1 March 2016 — Erosion feature located outside of borrow pit sediment storage area to the west. Recommend monitoring.

Photo C-4.10-2 Oct 2016 — Bulging gabion baskets found near areas with piping. Recommend monitoring.

C-5.0 PUEBLO CANYON GRADE-CONTROL STRUCTURE

C-5.1 Trash and Debris

Photo C-5.1-1 March 2016 — Tire in channel upstream of flow way. Recommend removal of tire.

Photo C-5.1-2 June 2016 — Tire present in channel upstream of flow way. Recommend removal of tire.

Photo C-5.1-3 Sept 2016 — Tire present in channel upstream of flow way. Recommend removal of tire.

Photo C-5.1-4 Nov 2016 — Tire present in channel upstream of flow way. Recommend removal of tire.

C-5.2 Rodent Holes in Embankment

Missing Photo C-5.2-1 March 2016 — Rodent holes on downstream side of embankments. Recommend monitoring rodent holes.

Photo C-5.2-2 June 2016 — Rodent holes on downstream side of embankments. No change from previous inspection. Recommend monitoring rodent holes.

Photo C-5.2-3 Sept 2016 — Rodent holes consistent with previous inspection. Recommend monitoring rodent holes.

Missing Photo C-5.2-4 Q4 — Rodent holes consistent with previous inspection. Recommend monitoring rodent holes.

C-5.3 Cracking Joints on Weir Structure

Photo C-5.3-1 March 2016 — Cracking apparent on joints of spillway. No change from previous inspections. Recommend monitoring.

Photo C-5.3-2 June 2016 — Cracking occurring at the joints on the spillway. No change from previous inspection. Recommend monitoring.

Photo C-5.3-3 Sept 2016 — Cracking occurring at the joints along the spillway. Consistent with previous inspection. Recommend monitoring.

Photo C-5.3-4 Nov 2016 — Joint cracking consistent with previous inspection. Recommend monitoring.

C-5.4 Cracking across Concrete Crest

Photo C-5.4-1 March 2016 — Cracking across the concrete crest in a few locations. No change from previous inspection. Recommend monitoring.

Photo C-5.4-2 June 2016 — Cracking/spalling occurring across the crest in several locations. One significant crack is present; however, no apparent settlement of the crest is noted. Consistent with previous inspection. Recommend monitoring.

Photo C-5.4-3 Sept 2016 — Cracking across crest in several locations. Consistent with previous inspection. Recommend monitoring.

Photo C-5.4-4 Nov 2016 — Cracking across crest in several locations. Consistent with previous inspection. Recommend monitoring.

C-5.5 Downstream Face of Overflow Weir Structure

Photo C-5.5-1 March 2016 — Spalling present on the downstream side of the spillway crest. Recommend monitoring.

Photo C-5.5-2 June 2016 — Spalling and cracks present on the downstream side of the spillway crest. Consistent with previous inspection. Recommend monitoring.

Photo C-5.5-3 Sept 2016 — Spalling and cracks on the downstream face of the spillway. Consistent with previous inspection. Recommend monitoring.

Photo C-5.5-4 Nov 2016 — Spalling and cracks consistent with previous inspection. Recommend monitoring.

C-5.6 Bulging Gabion Baskets adjacent to Overflow Catchment

Photo C-5.6-1 March 2016 — Gabion baskets located adjacent to the overflow catchment are bowing out of alignment. No change from last inspection (Sept 2015). Recommend monitoring.

Photo C-5.6-2 June 2016 — Gabion baskets located adjacent to the overflow catchment are bowing out of alignment. No change from last inspection. Recommend monitoring.

Photo C-5.6-3 Sept 2016 — Gabion baskets adjacent to overflow catchment are bowing out. Consistent with previous inspection. Recommend monitoring.

Photo C-5.6-4 Nov 2016 — Gabion baskets adjacent to overflow catchment are bowing out. Consistent with previous inspection. Recommend monitoring.

C-5.7 Flow Way Sediment Accumulation

Photo C-5.7-1 March 2016 — The north side of the flow way has sediment accumulation and evidence of standing water (vegetation). Recommend monitoring.

Missing Photo C-5.7-2 June 2016 — The north side of the flow way has sediment accumulation and evidence of standing water (vegetation). Recommend monitoring.

Photo C-5.7-3 Sept 2016 — Sediment accumulation on downstream side of the spillway. Vegetation exists, which suggests standing water. Recommend monitoring.

Photo C-5.7-4 Q4 — Sediment accumulation on downstream side of the spillway. Recommend monitoring.

C-5.8 Deteriorating Gabion Basket Downstream Side of Spillway

Photo C-5.8-1 March 2016: Gabion basket (located downstream on the south side of spillway) has deteriorated and no longer contains rock supporting the basket. Condition has not changed since previous two inspections. Recommend monitoring.

Photo C-5.8-2 June 2016 — Gabion basket settling and missing rocks. Consistent with previous inspections. Recommend monitoring.

Missing Photo C-5.8-3 Sept 2016 — Gabion basket settling and missing rocks. Consistent with previous inspections. Recommend monitoring.

Photo C-5.8-4 Nov 2016 — Gabion basket on south side of spillway failed and is empty of rock. Recommend maintenance.

C-5.9 ScourStop

Photo C-5.9-1 Q1 — ScourStop shows evidence of expansion with some overlap. Recommend monitoring.

Photo C-5.9-2 June 2016 — ScourStop shows evidence of expansion with minor vegetative growth. Because of expansion, sheets exhibit some bowing but are still anchored to the ground. Recommend monitoring.

Photo C-5.9-3 Sept 2016 — ScourStop consistent with previous inspection. Recommend monitoring.

Photo C-5.9-4 Nov 2016 — ScourStop sheets consistent with previous inspection. Recommend monitoring.

C-5.10 Spurs

Photo C-5.10-1 Q1 — Spurs and associated riprap have been added to inspection form.

Photo C-5.10-2 June 2016 — Spurs and associated riprap in good condition.

Photo C-5.10-3 Sept 2016 — Rilling occurring at the tip of Spur 4. Recommend monitoring.

Photo C-5.10-4 Nov 2016 — Rilling occurring at the tip of Spur 4. Consistent with previous inspection. Recommend monitoring.

C-5.11 Vegetation

Photo C-5.11-1 Q1 — Bank on the opposite side of the spurs requires seeding.

Photo C-5.11-2 June 2016 — Disturbed area north of spurs requires seeding.

Photo C-5.11-3 Sept 2016 — Vegetation coming in on slopes.

Photo C-5.11-4 Nov 2016 — Vegetation coming in on slopes.

C-5.12 Miscellaneous Inspection Photos

Photo C-5.12-1 March 2016 — Gabion basket on the upstream south side of the spillway appears to be degrading. Recommend monitoring.

Photo C-5.12-2   June 2016 — Broken fence. Recommend repair.

Photo C-5.12-3   Sept 2016 — Tire found near GCS.

C-6.0 PUEBLO CANYON WETLAND STABALIZATION STRUCTURE

C-6.1 All Levels — Redi-Rock Structure

Photo C-6.1-1 March 2016 — Redi-Rock structure shows minor cracks in the concrete. Recommend monitoring cracks.

Photo C-6.1-2 June 2016 — Redi-Rock structure shows minor shrinkage cracks. Recommend monitoring cracks.

Photo C-6.1-3 Sept 2016 — Shrinkage cracks consistent with previous inspection. Recommend monitoring cracks.

Photo C-6.1-4 Nov 2016 — Shrinkage cracks consistent with previous inspection. Recommend monitoring cracks.

C-6.2 Upper Level: Upstream Vegetation

Photo C-6.2-1 March 2016 — Limited growth due to 2015/2016 winter season. Continue to monitor for growth.

Photo C-6.2-2 June 2016 — Sparse areas with light vegetation growing. Recommend monitoring for growth.

Photo C-6.2.3 Sept 2016 — Upstream vegetation has improved since last inspection. Erosion matting has deteriorated beyond useful life. Recommend monitoring for growth.

Photo C-6.2-4 Q4 — Upstream vegetation consistent with previous inspection. Recommend monitoring for growth.

C-6.3 Upper Level: Upstream Channelization

Photo C-6.3-1 March 2016 — Channelization noted, upstream portion of the structure directly behind the Redi-Rock blocks. Recommend monitoring.

Photo C-6.3-2 June 2016 — Channel forming at original low-flow channel outlet from wetland (upstream of structure). Suggest sand bag to better distribute flow.

Photo C-6.3-3 Sept 2016 — Spreader sand bags installed since last inspection. Several have been moved, allowing channelization to continue, and one is damaged (noted in red circle). There is evidence of improved sheet flow.

Photo C-6.3-4 Nov 2016 — Channelization present at location of sandbags. Repair sandbags to encourage the spread of water.

C-6.4 Upper Level: Upstream Riprap

Photo C-6.4-1 March 2016 — Metal debris in T-post section (noted in red circle). Recommend removal.

Photo C-6.4-2 June 2016 — Upstream side of upper Redi-Rock structure with settling and erosion. Recommend repairing.

Photo C-6.4-3 Sept 2016 — Monitor area behind Redi-Rock for future erosion. This area was repaired with a mix of gravel and bentonite plugs, which are allowing for a better distribution of flow over the wall in this area.

Photo C-6.4-4 Nov 2016 — Monitor behind Redi-Rock for future erosion. Controls previously put in place are allowing for a better distribution of flow over the wall in this area.

C-6.5 Middle Level: Upstream Riprap

Photo C-6.5-1 June 2016 — Geotextile covered by riprap. Recommend monitoring.

Photo C-6.5-2 Sept 2016 — Some geotextile under riprap has been uncovered. Consistent with previous inspection. Recommend monitoring.

Photo C-6.5-3 Nov 2016 — Condition of geotextile consistent with previous inspection. Recommend monitoring.

C-6.6 Lower Level: Downstream Gabions

Photo C-6.6-1 March 2016 — Gabions partially covered with sediment. Recommend monitoring.

Missing Photo C-6.6-2 June 2016 — Gabions partially covered with sediment. Consistent with previous inspection. Recommend monitoring.

Photo C-6.6-3 Sept 2016 — Gabions partially covered with sediment. Consistent with previous inspection. Recommend monitoring.

Missing Photo C-6.6-4 Nov 2016 — Gabion consistent with previous inspection. Recommend monitoring.

C-6.7 Lower Level: Vegetation

Photo C-6.7-1 Q1 — Limited growth of vegetation due to 2015/2016 winter season. Monitor for growth in 2016.

Photo C-6.7-2 June 2016 — Replanted reed canarygrass is doing well. Recommend monitoring.

Photo C-6.7-3 Sept 2016 — Replanted reed canarygrass is doing well. Recommend monitoring.

Photo C-6.7-4 Nov 2016 — Vegetation consistent with previous inspection. Recommend monitoring.

C-6.8 North and South Bank: Riprap and Turf-Reinforcement Mat (TRM)

Photo C-6.8-1 June 2016 — Geotextile is covered by riprap except for edges. Recommend monitoring.

Photo C-6.8-2 Sept 2016 — Geotextile is covered by riprap and TRM except on edges. Vegetative growth becoming established through TRM. Recommend monitoring.

Missing Photo C-6.8-3 **Q4 — Geotextile and TRM consistent with previous inspection. Riprap has displaced in several locations. Recommend monitoring.**

C-6.9 South Bank: Berm

Photo C-6.9-1 **Q1 — Limited growth of vegetation due to 2015/2016 winter season. Monitor for growth in 2016.**

Missing Photo C-6.9-2 **June 2016 — Vegetation is sparse to light and brown, and berm is completely dry. Continue to monitor.**

Missing Photo C-6.9-3 **Sept 2016 — Light vegetation has improved since last inspection. Continue to monitor.**

Missing Photo C-6.9-4 **Nov 2016 — Berm is consistent with previous inspection. Continue to monitor.**

C-6.10 Upstream Area: Pond and TRM

Photo C-6.10-1 March 2016 — TRM is beginning to degrade and has unstapled in a few areas. Recommend re-stapling TRM in this area. Monitor for growth in 2016.

Photo C-6.10-2 June 2016 — The pond has no water in it. ECB has deteriorated on bands and vertical “steps” are present and exposed on interior slopes. ECB is at the end of life and should be retired. Vegetation on side slopes has 100% cover due to broad-leafed foliage. Continue to monitor.

Photo C-6.10-3 **Sept 2016 — The pond has water in it. ECB condition consistent with previous inspection. Continue to monitor.**

Missing Photo C-6.10-4 **Nov 2016 — Pond and ECB consistent with previous inspection. Continue to monitor.**

C-6.11 Upstream Area: Pond and Channel- Sediment Level

Photo C-6.11-1 **March 2016 — Some aggradation in pond and channel is evident. Recommend monitoring.**

Photo C-6.11-2 June 2016 — Sediment is present in channel and pond, but there is no way to determine the level or thickness of sediment. There is still a lot of capacity to retain low-flow sediment capture. Recommend monitoring.

Photo C-6.11-3 Sept 2016 — Unable to determine sediment level in pond and channel due to water present. Recommend monitoring.

Photo C-6.11-4 Nov 2016 — Unable to determine sediment level in pond and channel due to water present. Recommend monitoring.

C-6.12 Upstream Area: Channel and Pond Debris

Photo C-6.12-1 March 2016 — Small piece of trash (noted in red circle) found in pond. A piece of rubber near the channel bank and tee-post were also noted (not pictured). Recommend removal.

Appendix D

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