ENTERED

Los Alamos
NATIONAL LABORATORY
EST. 1943

Environmental Programs
P.O. Box 1663, MS M991
Los Alamos, New Mexico 87545
(505) 606-2337/FAX (505) 665-1812

National Nuclear Security Administration
Los Alamos Site Office, MS A316
Environmental Restoration Program
Los Alamos, New Mexico 87544
(505) 667-4255/FAX (505) 606-2132

Date: MAY 30 2012
Refer To: EP2012-0120

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

Subject: Submittal of the Response to the Notice of Disapproval for the 2012 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project and Revision 1

Dear Mr. Kieling:

Enclosed please find two hard copies with electronic files of the Response to the Notice of Disapproval for the 2012 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project and Revision 1.

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@nnsa.doe.gov).

Sincerely,

B-G Schappell for MJG
Michael J. Graham, Associate Director
Environmental Programs
Los Alamos National Laboratory

Sincerely,

Peter Maggiore, Assistant Manager
Environmental Projects Office
Los Alamos Site Office

MG/PM/CD/SV:sm

Enclosures: Two hard copies with electronic files:

(1) Response to the Notice of Disapproval for the 2012 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project (LA-UR-12-21485)

(2) An electronic copy of the redline-strikeout version of the plan that includes all changes and edits to the document

(3) 2012 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project, Revision 1 (LA-UR-12-21486)

Cy: (w/enc.)
Cheryl Rodriguez, DOE-LASO, MS A316
Steve Veenis, EP-CAP, MS M997
Public Reading Room, MS M992 (hard copy)
RPF, MS M707 (electronic copy)

Cy: (Letter and CD and/or DVD)
Laurie King, EPA Region 6, Dallas, TX
Steve Rydeen, San Ildefonso Pueblo
Joe Chavarria, Santa Clara Pueblo
Steve Yanicak, NMED-DOE-OB, MS M894
Paul Mark, Adelante, MS M997 (w/ MS Word files on CD)
William Alexander, EP-BPS, MS M992

Cy: (w/o enc.)
Tom Skibitski, NMED-OB, Santa Fe, NM (date-stamped letter emailed)
Annette Russell, DOE-LASO (date-stamped letter emailed)
Craig Douglass, EP-CAP, MS M992 (date-stamped letter emailed)
Michael J. Graham, ADEP, MS M991 (date-stamped letter emailed)

Response to the Notice of Disapproval for the 2012 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project, Los Alamos National Laboratory, EPA ID No. NM0890010515, HWB-LANL-12-016, Dated April 16, 2012

INTRODUCTION

To facilitate review of this response, the New Mexico Environment Department's (NMED's) comments are included verbatim. The comments are divided into general and specific categories, as presented in the notice of disapproval (NOD). Los Alamos National Laboratory's (LANL's or the Laboratory's) responses follow each NMED comment. This response contains data on radioactive materials, including source, special nuclear, and byproduct material. Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to NMED in accordance with U.S. Department of Energy (DOE) policy.

GENERAL COMMENTS

NMED Comment

1. *Based on the multiple missed sampling opportunities in 2011, in the future, stormwater samples must be removed from the sampler and the samplers restored to ready condition within one business day after any event that triggers the sampler. In addition, during dry periods with no appreciable precipitation, field crews must inspect all gages and samplers on a weekly basis in order to repair any observed malfunctions (e.g., accidental triggering of the sampler or silting of the sampling line). If field crews are unable to repair damaged equipment at the time of sample retrieval or sampler inspection, the equipment must be repaired within two business days of discovery of the need to make repairs.*

LANL Response

1. LANL evaluated the sample retrieval, repair, and inspection requirements specified in NMED's comment to determine the effect on the sampling objective that would have occurred in 2011. The sampling objective is to retrieve samples for chemical and radionuclide analyses from all discharges exceeding 5 cubic feet per second (csf) at E050.1, E060.1, and E109.9 and from four discharges and the largest discharge at other gaging stations. As shown in Table 1, the outcome of the sampling would have been largely unchanged. Retrieval of samples within 1 business day would not have allowed retrieval of more samples. No sample collection was impacted by repairs made beyond 2 d. One discharge not collected at E040 on August 5 might have been collected if an inspection had been performed during the previous week. Overall, increasing collection, inspection, and repair frequencies would have had little benefit in 2011. LANL recognizes the importance of maintaining samplers in an operationally ready condition. LANL is engaged in process improvements that will continue to reduce the length of time between sample collection and sample retrieval and that will improve LANL's ability to keep samplers and gages in an operational state.

   Although LANL will make reasonable efforts to achieve the targets identified in NMED's comment, LANL is unable to commit to removing samples from samplers within 1 business day of collecting them, to inspecting all gages and samplers weekly, or to repairing damaged equipment within 2 business days of discovering the need for repairs. A number of health and safety considerations and LANL-specific restrictions prevent access to sites in Los Alamos and Pueblo Canyon watersheds that make these sample retrieval, inspection, repair, and maintenance targets unrealistic. For example, fieldwork is not permitted at LANL when lightening is present, when red-flag fire conditions are present, when heavy rains in the upper Los Alamos and Pueblo watershed threaten flash flooding, when radiological control technician support is unavailable, when access has been impaired by road damage or blockage from flooding, when San Ildefonso denies access onto its land at E109.9, or when LANL Facility Operations denies access into its facility in DP Canyon to access equipment at E038 and E039.1.

Table 1
Summary of Impact to Sampling of Requested Retrieval, Repair, and Inspection Frequency

Gage Station	Retrieve Samples within 1 Business Day of Collection	Repair Damaged Equipment within 2 Business Days of Discovery	Inspect All Samplers on a Weekly Basis
E026	No effect	No effect	No effect
E030	No effect	No effect	No effect
E042.1	No effect	No effect	No effect
E050.1	No effect	No effect	No effect
E109.9	No effect	No effect	No effect
E055.5	No effect	No effect	No effect
E056	No effect	No effect	No effect
E055	No effect	No effect	No effect
E059	No effect	No effect	No effect
E060.1	No effect	No effect	No effect
E038	No effect	No effect	No effect
E039.1	No effect	No effect	No effect
E040	No effect	No effect	May have allowed collection of discharge on August 5

NMED Comment

2. *In Section 2.4, Damage and Repairs, of the* 2011 Los Alamos/Pueblo Watershed Stormwater Performance Monitoring Report *(2011 Report) the Permittees state, "[t]he flume at E109.9 was cleared of sediment 19 times during the 2011 monitoring season." In addition, the Permittees list at least eight events at E109.9 that were negatively affected by silting of the sampler intake. The Permittees must evaluate the effectiveness of the flume at E109.9 and determine if modifications to the flume will help to avoid sediment trapping in the future.*

   The Permittees must also evaluate the effectiveness of the 5-cfs triggering flow criteria to determine if a higher flow trigger, i.e., 10-cfs, 20-cfs, 30-cfs, is more appropriate for this location. In 2010 and 2011 combined, only one sample was collected during a flow of less than 30-cfs at E109.9. Increasing the flow trigger criteria would allow raising the sample intakes further from the surface of the stream, thereby reducing the chances of sampler intake silting.

   The Permittees must perform similar evaluations, and possibly implement modifications, at other stations that have silting issues in order to minimize missed sampling opportunities. In the future, the Permittees must identify recurring problems and develop solutions to mitigate the problems within the same stormwater sampling season.

LANL Response

2. The silting at E109.9 was caused primarily by the effects of the Las Conchas fire on Guaje Canyon, which transported ash- and sediment-laden runoff to E109.9 numerous times in 2011. LANL expects much of the fire-related sediment from Guaje Canyon to have been transported in 2011, given previous experience after the 2000 Cerro Grande fire in which 90% of the fire-related sediment was transported from burned areas the year after the fire, and suspended sediment concentrations (SSCs) at upper boundary stations returned to pre-fire levels within 5 yr. However, 13% of the upper Los Alamos watershed was classified as high to moderate burn severity from the Las Conchas fire, and a major storm event did not occur over these burn areas during 2011. Therefore, LANL expects to find further sedimentation issues from upper Los Alamos watershed during the 2012 monitoring period. LANL plans to continue its efforts to remove sediment from the stilling well and flume at E109.9 after each storm event, as needed and is installing a Siemens Milltronics Ultrasonic Probe to replace the stilling well to trigger sampling and to replace the bubbler as a secondary stage measurement, thus avoiding sedimentation issues with the stilling well and bubbler. LANL will continue to assess making modifications to the concrete flume and channel at E109.9 to avoid sediment trapping. No silting issues occur at other Los Alamos/Pueblo stations.

   At station E109.9, the Buckman Direct Diversion (BDD) memorandum of understanding (MOU) (DOE and BDD Board 2010, 206259) states, "The samplers shall be capable of collecting samples from flows greater than 5 cfs." Therefore, although LANL can evaluate the effectiveness of alternate flow triggers, any modification to the 5 cfs flow trigger would require approval by BDD and DOE. Because intake silting at E109.9 does take place frequently (particularly last year after the Las Conchas fire), LANL has recommended to BDD that the triggering discharge for sample collection be increased from 5 cfs to 10 cfs. If the BDD agrees, LANL will increase the height of triggering discharge from 5 cfs to 10 cfs. The table below presents the frequency of potential sampling for each year since E110/E109.9 was established, and a triggering discharge of 10 cfs seems reasonable.

Table 2
E110/E109.9 Frequency of Potential Sampling

Year	5 cfs	10 cfs	15 cfs	20 cfs
2003	17	8	4	5
2004	3	2	1	1
2005	12	9	6	4
2006	12	6	4	4
2007	3	1	1	1
2008	2	2	2	1
2009	2	0	0	0
2010	4	4	4	4
2011	20	16	13	12

   LANL also proposes to increase the trigger discharge at E038 because of the large amount of potential sampling associated with a 10-cfs threshold. The table below presents the frequency of potential sampling for each year since station E038 was established. With the exception of drought years 2001–2003, a triggering discharge of 40 cfs seems reasonable. The 2012 monitoring plan was revised to change the trigger flow at E038 to 40 cfs.

Table 3
E038 Frequency of Potential Sampling

Year	10 cfs	20 cfs	30 cfs	40 cfs	50 cfs
2000	19	15	12	11	10
2001	5	3	3	3	3
2002	9	7	7	3	2
2003	12	12	7	5	4
2004	12	10	9	9	6
2005	26	20	19	17	15
2006	27	21	14	9	7
2007	22	17	14	14	11
2008	19	13	10	9	8
2009	23	17	13	10	7
2010	18	16	13	11	9
2011	13	7	7	6	4

LANL plans to develop performance metrics and track them such that recurring problems can be identified and solutions developed to mitigate issues within the current monitoring period.

NMED Comment

3. *In Section 3.2, Water and Sediment Transmission, of the 2011 Report, the Permittees state that, "the wide open channel makes it difficult to develop a reliable rating curve" for Guaje Canyon. Although difficult, it is possible. The Permittees must establish a rating curve for the E099 gage in order to estimate flow discharge from Guaje Canyon.*

LANL Response

3. LANL surveyed station E099 in March 2012 and is in the process of developing a rating curve for this station for the 2012 monitoring period.

SPECIFIC COMMENTS

NMED Comment

4. ***Section 3.0, Monitoring Stormwater Runoff, Page 4, 1st paragraph***

***Permittees' Statement**: "As directed in the approval with modifications for the 2011 monitoring plan (NMED 2011, 203705), sampling was conducted in Graduation Canyon during 2011. The results of these analyses were reported in the March 2012 "Stormwater Performance Monitoring in the Los Alamos/Pueblo Watershed during 2011" (LANL 2012, 211396). Continued monitoring at this location is not proposed."*

***NMED Comment**: The data from this location was not evaluated in the Report and no reason is given in the Plan to discontinue sampling. The average level of PCBs in the suspended sediment at this* *location in 2011 is the second highest of all the locations monitored and is second only to that below SWMU 01-001(f). Continue to monitor at this location. The Permittees may reduce the analytical suite to PCBs and SSC.*

LANL Response

4. LANL will continue monitoring in Graduation Canyon and will reduce the analytical suite to polychlorinated biphenyls and SSC. The 2012 monitoring plan has been revised to include this sampling.

NMED Comment

5. Section 3.2, Sampling and Analysis, page 5, 2nd paragraph

Permittees' Statement: *"Evaluation of stormwater data from the LA/Pueblo watershed and other parts of the Pajarito Plateau (e.g., LANL 2011, 207316) indicate that gross alpha, gross beta, radium-226, and radium-228 results are dominated by background conditions and are not useful for monitoring potential Laboratory impacts on stormwater quality. Therefore, the Laboratory proposes to discontinue these analyses in 2012 for the evaluation of sediment transport mitigation."*

NMED Comment*: Continue to monitor for gross alpha, gross beta, radium-226, and radium-228 only at E050.1, E060.1, and 109.9. Continue monitoring for filtered radionuclides, including Sr-90, at E0109.9 only. The need to monitor for radionuclides may be re-evaluated after the DOE-Buckman Direct Diversion Board memorandum of understanding discontinues the requirement and the effects of the Las Conchas fire have been adequately assessed.*

LANL Response

5. LANL will continue to monitor for gross alpha, gross beta, radium-226, and radium-228 only at stations E050.1, E060.1, and 109.9 and will monitor for filtered radionuclides, including strontium-90, at E0109.9 only. The need to monitor for radionuclides will be reevaluated after the requirement is discontinued per the DOE and BDD MOU and the effects of the Las Conchas fire have been adequately assessed.

NMED Comment

6. Section 4.0, Reporting, page 6

Permittees' Statement: *"Previous plans proposed reporting analytical and discharge data for each water year (October to September) and accompanying discussion, annually on February 28. Beginning in 2011, the Laboratory also included runoff events in October in the annual report because fall storms can be important in the total sediment transport in some years, and providing a complete set of calendar-year events seemed more appropriate than waiting to report on October events until the following year's report. Because the monitoring period has been extended by 1 mo, the Laboratory proposes to extend the reporting date by 1 mo as well, to March 31 of each year, to allow a more complete evaluation of data. This report delivery schedule will allow time to combine analytical data from off-site laboratories with finalized discharge data from the gage stations, the latter of which typically requires 3 mo for data processing (e.g., January 31 for discharge data obtained in October of the previous calendar year) and sufficient time for data evaluation."*

"Because of the proposed changes to the annual report date to March 31, the Laboratory proposes also to change the date for the annual update of the monitoring plan to April 10. This later date to submit the plan will allow insights gained from evaluation of the previous year's data to be better incorporated into the plan."

NMED Comment*: The submittal dates for both the annual report and the annual update to the monitoring plan were negotiated with the Permittees in 2011. The dates were selected based on the ability of NMED and the Permittees to review and revise the updates to the monitoring plan based on the information from the previous year's monitoring report within a timeframe that allowed the Permittees to implement changes before the start of the next sampling season.*

Later submittal dates would return both NMED and the Permittees to the same situation that initiated the change in submittal dates in 2011. The Permittees must submit the annual monitoring report by February 28 of each year and the annual update to the monitoring plan by March 10 of each year.

LANL Response

6. LANL will submit the annual monitoring report by February 28 of each year and will submit the annual update to the monitoring plan by March 10. The 2012 monitoring plan has been revised in incorporate these dates.

ADDITIONAL MODIFICATIONS TO THE MONITORING PLAN

The 2012 monitoring plan was also revised to incorporate two additional modifications. The sample volume collected for analyses of gamma spectroscopy radionuclides has been separated from sample volume collected for analyses of isotopic plutonium, isotopic uranium, and americium-241. Two liters of stormwater (if available) will be provided for analyses of isotopic plutonium, americium-241, and isotopic uranium. Tables 3.2-3, 3.2-4, 3.2-5, 3.2-6, and 3.2-7 of the monitoring plan have been modified to provide additional volume and separate analyses. Separating analyses and providing additional volume will support the analytical laboratory's analyses of these radionuclides in samples containing elevated sediment concentrations.

Particle-size analyses will be conducted for selected samples collected for SSC analyses to support characterization of chemical and radionuclide transport in sediment-laden stormwater. Particle size will be determined in as many as three samples collected simultaneously with samples collected for chemical and radionuclide analyses. Tables 3.0-1, 3.2-1, 3.2-3, 3.2-4, 3.2-5, 3.2-6, and 3.2-7 of the monitoring plan have been modified to include particle-size analyses.

REFERENCES

DOE and BDD Board (U.S. Department of Energy and Buckman Direct Diversion Board), May 12, 2010. "Memorandum of Understanding between the U.S. Department of Energy and the Buckman Direct Diversion Board Regarding Water Quality Monitoring," Santa Fe, New Mexico. (DOE and BDD Board 2010, 206259)

LA-UR-12-21486
May 2012
EP2012-0121

2012 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project, Revision 1

Los Alamos
NATIONAL LABORATORY
EST. 1943

Prepared by the Environmental Programs Directorate

EP2012-0121

2012 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project, Revision 1

May 2012

Responsible project manager:

Printed Name	Signature	Title	Organization	Date
Steve Veenis		Project Manager	Environmental Programs	5.24.12

Responsible LANS representative:

Printed Name	Signature	Title	Organization	Date
Michael J. Graham		Associate Director	Environmental Programs	5/25/12

Responsible DOE representative:

Printed Name	Signature	Title	Organization	Date
Peter Maggiore		Assistant Manager	DOE-LASO	5-30-2012

CONTENTS

1.0 INTRODUCTION **1**

2.0 MONITORING GEOMORPHIC CHANGES **1**
- 2.1 Pueblo Canyon 2
- 2.2 Los Alamos Canyon 3

3.0 MONITORING STORMWATER RUNOFF **3**
- 3.1 Discharge Gaging 4
- 3.2 Sampling and Analysis 4

4.0 REPORTING **6**

5.0 REFERENCES **6**

Figures

Figure 2.0-1 Los Alamos and Pueblo canyons showing monitoring locations and sediment transport mitigation sites 9

Figure 3.0-1 Detention basins and sampling locations below the SWMU 01-001(f) drainage 10

Tables

Table 3.0-1 Locations and Analytical Suites for Stormwater Samples 11

Table 3.2-1 Analytical Requirements for Stormwater Samples 12

Table 3.2-2 Sampling Sequence for Collection of Stormwater Samples at the Detention Basins and Wetland below the SWMU 01-001(f) Drainage and in Graduation Canyon below SWMU 00-019 13

Table 3.2-3 Sampling Sequence for Collection of Stormwater Samples at E030, E040, E055, E055.5, and E056 14

Table 3.2-4 Sampling Sequence for Collection of Stormwater Samples at E026, E038, and E039.1 15

Table 3.2-5 Sampling Sequence for Collection of Stormwater Samples at E042.1 and E059 16

Table 3.2-6 Sampling Sequence for Collection of Stormwater Samples at E050.1 and E060.1 17

Table 3.2-7 Sampling Sequence for Collection of Stormwater Samples at E109.9 18

1.0 INTRODUCTION

This monitoring plan is submitted pursuant to the New Mexico Environment Department's (NMED's) approval with modification letter, dated June 3, 2011 (NMED 2011, 203705), of the "2011 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project" (LANL 2011, 201578). The objective of this monitoring plan is to evaluate the effect of mitigation measures that were undertaken in the Los Alamos and Pueblo Canyons (LA/Pueblo) watershed under the NMED-approved "Interim Measure Work Plan to Mitigate Contaminated Sediment Transport in Los Alamos and Pueblo Canyons" (LANL 2008, 101714) and the "Supplemental Interim Measures Work Plan to Mitigate Contaminated Sediment Transport in Los Alamos and Pueblo Canyons" (LANL 2008, 105716). In accordance with these work plans, several activities have been undertaken to reduce flood energy and associated sediment transport. These activities include willow planting, construction of cross-vane structures (CVSs), a wing ditch, grade-control structures (GCSs), sediment detention basins, and modification of basins above a low-head weir. Because contaminants migrate with sediment entrained in runoff, reduced sediment transport will thereby reduce contaminant transport, which is the primary objective of these activities.

Two types of monitoring that began in 2010 continued in 2011 and will continue in the foreseeable future to meet the objectives of (1) monitoring geomorphic changes in the canyon bottom that are measures of performance of various mitigations and (2) collecting and analyzing stormwater runoff samples at gage and monitoring stations located throughout the watershed. Monitoring conducted during 2010 in the LA/Pueblo watershed was performed per the "Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project" (LANL 2009, 107457) and the "Approval with Modifications, Los Alamos and Pueblo Canyons Sediment Transport Monitoring Plan" (NMED 2010, 108444). Monitoring conducted during 2011 in the LA/Pueblo watershed was performed per the "2011 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project" (LANL 2011, 201578) and the "Approval with Modifications [for the] 2011 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project" (NMED 2011, 203705). This monitoring plan builds upon these previous documents.

Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to NMED in accordance with U.S. Department of Energy (DOE) policy. Water quality results from stormwater events are systematically uploaded to the publically accessible environmental monitoring database, Intellus New Mexico.

2.0 MONITORING GEOMORPHIC CHANGES

Monitoring of geomorphic changes (e.g., sediment deposition or erosion) associated with the mitigation measures has been conducted using three methods: (1) repeat cross-section surveys, (2) channel thalweg surveys, and (3) general area surveys. These surveys have been conducted at the locations described below. Surveys have been conducted annually in late fall, winter, or early spring to document geomorphic changes that may have occurred during the previous summer monsoon season. The optimal time is selected based on the weather, the presence or absence of ponded water in constructed basins, and the ability to work in wetlands after dense vegetation has senesced. Figure 2.0-1 shows the areas where surveys have been conducted, and where repeat surveys are planned after the 2012 monsoon season, as described below.

Evaluation of survey data from previous years (e.g., LANL 2011, 203661) indicates the channel thalweg surveys are not the best method for evaluating changes in channel elevation in the survey areas. Specifically, because of changes in thalweg sinuosity and year-to-year variability in survey point spacing that affect the total cumulative length of the survey, thalweg profiles from 1 yr cannot be reliably overlain on profiles from a previous year to evaluate changes in channel elevation. Instead, potential channel elevation changes (aggradation or incision) can be more effectively monitored by directly comparing thalweg elevation at each surveyed cross-section in successive years. Therefore, the Laboratory proposes to discontinue annual thalweg surveys and instead will evaluate channel elevation changes directly at the cross-sections.

2.1 Pueblo Canyon

A total of 23 cross-sections were originally surveyed in September and October 2009 at 100-ft intervals, for a total of 1100 ft above and below a transition area separating a broad upcanyon wetland (reach P-3FE) from a narrower downcanyon wetland within incised geomorphic surfaces (reach P-4W) (LANL 2011, 203661). A longitudinal survey of the thalweg elevation through this area was also conducted that encompasses an area where willows were planted in spring 2009. Annual resurveys in these reaches are intended to monitor geomorphic changes in this portion of Pueblo Canyon, particularly those related to potential changes in the transition area.

Upper willow-planting area—A total of 18 cross-sections were originally surveyed in October 2009 in the area where willows were planted in spring 2008 and 2009 between the new County of Los Alamos wastewater treatment plant (WWTP) outfall and the wing ditch (Figure 2.0-1). These cross-sections were divided between the upper, middle, and lower thirds of this area. A total of six cross-sections were surveyed in each of these three areas at 100-ft intervals. A longitudinal channel thalweg profile was also surveyed in each of these areas. Annual resurveys at the upper willow-planting area are intended to document anticipated aggradation of floodplain surfaces where willows will slow flood water and trap sediment as well as monitor any changes to thalweg elevation in this area.

Pueblo Canyon GCS—A total of 15 cross-sections were originally surveyed in April 2010 at 100-ft intervals for a distance of 1500 ft above the Pueblo Canyon GCS (Figure 2.0-1). Three cross-sections were also surveyed below the GCS at 100-ft intervals to document any changes to the channel downcanyon of the structure. A longitudinal channel thalweg profile was also surveyed in this area. Annual resurveys in this area are intended to document expected sediment accumulation above the GCS and monitor potential changes in the upcanyon wetland.

CVSs—Two cross-sections were originally surveyed in April and May 2010 in the vicinity of each of the three CVSs (Figure 2.0-1): one 50-ft upcanyon and one 50-ft downcanyon of the apex rock of each structure. A longitudinal thalweg profile was also surveyed over these 100-ft intervals. Although the CVSs were damaged during floods in 2010 (LANL 2010, 111125) and have been abandoned, annual resurveys in this area serve to monitor potential geomorphic changes in Pueblo Canyon upstream from the WWTP outfall.

Wing ditch—Five cross-sections were originally surveyed in November 2009 downcanyon from the wing ditch (Figure 2.0-1) at 100-ft intervals, and a longitudinal channel thalweg profile was also surveyed over this distance. The wing ditch was designed to divert water from the main channel through the upper part of the lower Pueblo Canyon wetland into an abandoned channel to the south. However, the wing ditch is no longer needed for this purpose because new culverts installed during road reconstruction completed by the County of Los Alamos in 2011 immediately upstream from the wing ditch effectively divert water into this formerly abandoned channel. Although no longer needed to perform monitoring, annual resurveys in this area serve to monitor potential geomorphic changes in this part of the wetland.

2.2 Los Alamos Canyon

DP Canyon GCS—A total of 11 cross-sections were originally surveyed in April and May 2010 above the DP Canyon GCS (Figure 2.0-1) at 100-ft intervals upcanyon of the structure. Two cross-sections were also surveyed below the GCS at 100-ft intervals to document any changes to the channel downcanyon of the structure. A longitudinal channel thalweg profile was also surveyed over this area. Annual resurveys in this area are intended to document expected sediment accumulation above the GCS.

Los Alamos Canyon low-head weir—After modifications were made in 2009 to the sediment detention basin above the Los Alamos Canyon low-head weir, including development of three separate basins, an initial topographic survey of this area was conducted in July 2009 (Figure 2.0-1). The basins were reexcavated in June 2011 in preparation for expected floods following the Las Conchas fire, and a new baseline survey was conducted in July 2011. Irregular topography associated with basalt mounds and constructed modifications above the weir warrants a more detailed survey than can be conducted with repeat cross-sections, and instead the topography of the area is surveyed in detail. Annual resurveys of this area enable annual measurements of sediment accumulation within the basins.

Upper Los Alamos Canyon detention basins—A general topographic survey was originally conducted in March 2010 of sediment detention basins constructed below Solid Waste Management Unit (SWMU) 01-001(f). The basins were reexcavated in June 2011 in preparation for expected floods following the Las Conchas fire, and a new baseline survey was conducted in July 2011. Annual resurveys of this area enable annual measurements of sediment accumulation within the basins.

3.0 MONITORING STORMWATER RUNOFF

Stormwater monitoring will be conducted at locations shown in Figure 2.0-1 and listed in Table 3.0-1. These locations are situated to compartmentalize monitoring for effective performance evaluation of the sediment transport mitigation sites within the watershed. Data will also be available to document baseline conditions upcanyon of these sites and evaluate contaminant sources. The goals of the sampling are (1) to collect data that represent variations in contaminant concentrations and suspended sediment concentrations (SSC) within runoff events at each location and (2) to evaluate short-term and long-term trends in SSC, suspended sediment yield, and contaminant concentrations associated with the mitigation sites. The monitoring strategy described below is developed to achieve these goals. After implementation of this plan, data collected during 2010, 2011, and 2012 will be reviewed and recommendations will be made, if appropriate, regarding potential changes to analytical suites and/or sampling.

Large parts of the upper watersheds of Los Alamos Canyon and a major tributary, Guaje Canyon, were affected by the Las Conchas fire in 2011. As documented after the Cerro Grande fire (Gallaher and Koch 2004, 088747), stormwater chemistry can be strongly affected by incorporation of ash from burn areas. To help evaluate the influence of the Las Conchas fire on stormwater quality in 2011, americium-241 and cyanide were added to the analytical suites at E026 and E030, and cyanide was added to the analytical suites at the other Los Alamos Canyon gages (E042.1, E050.1, and E109.9). Additionally, repeat SSC measurements across the hydrograph were made at the upper boundary station at E026 to better characterize sediment flux from the burn area upstream from Laboratory sites. These modifications to the monitoring plan will continue in 2012.

Additionally, samples will be collected using automated pump samplers at the detention basins below SWMU 01-001(f) at the locations CO111041 and CO101038 shown in Figure 3.0-1 and listed in Table 3.0-1. These samples will allow the performance of the sediment detention basins and associated wetland below the basins to be evaluated. Planned monitoring at the detention basins will be unchanged from 2011.

As directed in the approval with modifications for the 2011 monitoring plan (NMED 2011, 203705), sampling was conducted in Graduation Canyon during 2011 (location CO115002 on Figure 2.0-1). The results of these analyses were reported in the March 2012 “Stormwater Performance Monitoring in the Los Alamos/Pueblo Watershed during 2011” (LANL 2012, 211396). Monitoring for PCBs and SSC will continue at this location during 2012.

3.1 Discharge Gaging

Each of the stream gages listed in Table 3.1-1 will be monitored continuously throughout the year for stage. Each gage, except for E099 in lower Guaje Canyon (Figure 2.0-1), has an established rating curve that will be reviewed annually or after large channel-altering floods to enable conversion of stage to discharge. Additionally, a rating curve will be developed for E099 during 2012, if possible.

3.2 Sampling and Analysis

Stormwater runoff sampling for SSC analyses at each of the monitoring locations, except E038, E050.1, E060.1, E109.9, at Graduation Canyon below 00-019 and at the detention basins below SWMU 01-001(f), will be triggered by discharges of approximately 10 cubic feet per second (cfs). Sampling at E038 will be triggered by discharges of approximately 40 cfs. Sampling for SSC analyses at E050.1, E060.1, and E109.9 will be triggered by 5-cfs discharges to ensure sampling at small discharges that may extend to the Rio Grande. Sampling at the detention basins below SWMU 01-001(f) and at Graduation Canyon below SWMU 00-019 will be triggered by an actuator detecting the presence of water above the sampler intake. Stormwater runoff sampling for chemical and radiochemical analyses will be triggered 10-min following the maximum discharge exceeding the triggering discharge. Analytical requirements for stormwater samples are listed in Table 3.2-1. Samples at gages will be collected using automated stormwater samplers that contain a carousel of 24 1-L bottles and/or 12 1-L bottles as specified in Tables 3.2-2, 3.2-3, 3.2-4, 3.2-5, 3.2-6, and 3.2-7. Sample collection inlets will be placed a minimum of 0.33 ft. above the bottom of natural stream channels and a minimum of 0.17 ft above the bottom of supercritical flumes. The sampling approach is intended to allow characterization of suspended sediment flux from the four portions of a typical hydrograph consisting of a rapidly rising limb, a short-duration peak, a rapidly receding limb following the peak, and a longer-duration recessional limb, and contaminant concentrations from the portions of each hydrograph following the peak.

The restriction of samples for chemical and radionuclide analyses to parts of the hydrograph following the peak meets a requirement by NMED to not collect such samples before the peak (NMED 2011, 203705). However, evaluation of monitoring data from 2011 suggests this approach is not optimum for estimating chemical and radionuclide transport because the early parts of the hydrograph, where discharge and SSC are highest, are not sampled directly for contaminant concentrations, resulting in large uncertainties in chemical and radiochemical transport estimates through a hydrograph. Therefore, since a goal of the monitoring is to estimate chemical and radionuclide transport at specific stations, the Laboratory recommends that the sampling approach be modified to include sampling for targeted radionuclides earlier in each hydrograph.

The Laboratory proposes to add analyses of radionuclides before the peak of discharge to help improve estimates of radionuclide transport. One sample collected on the rising limb of the hydrograph near the peak of discharge will be selected for analyses of gamma spectroscopy radionuclides and isotopic plutonium, instead of SSC. The sample for additional radionuclide analyses will be selected based on a visual inspection of the hydrograph following sample collection and prior to shipment to the analytical laboratory.

To characterize water quality entering and leaving the detention basins below the SWMU 01-001(f) drainage, automated pump samplers will collect stormwater from locations above and below the basins up to four times annually when stormwater discharge is occurring (Figure 3.0-1). To assess PCBs in stormwater runoff in Graduation Canyon, an automated pump sampler will collect stormwater below SWMU 00-019 up to four times annually when stormwater discharge is occurring (CO115002 in Figure 2.0.1).

Analytical suites vary according to monitoring groups and are based on key indicator contaminants for a given portion of the watershed. Table 3.0-1 shows the monitoring groups and the analytical suite for each. SSC analyses, which are common to all groups, will allow determination of correlations between contaminant concentrations and SSC. The SSC analyses will also allow calculations of the total mass transported during stormwater runoff events at the gages. Particle-size analyses conducted in conjunction with selected SSC analyses will support characterization of chemical and radionuclide transport.

Evaluation of stormwater data from the LA/Pueblo watershed and other parts of the Pajarito Plateau (e.g., LANL 2011, 207316) indicate that gross alpha, gross beta, radium-226, and radium-228 results are dominated by background conditions and are not useful for monitoring potential Laboratory impacts on stormwater quality. Therefore, the Laboratory, with NMED approval, discontinued these analyses in 2012 for the evaluation of sediment transport mitigation for samples collected from all but gage stations E050.1, E060.1, and E109.9. Additionally, although analyses of filtered radionuclides at E109.9 are not particularly useful for monitoring potential Laboratory impacts on stormwater quality, analyses will be continued at E109.9. DOE and the Buckman Direct Diversion Board are in discussion to remove analyses of gross alpha, gross beta, radium-226, and radium-228 from future analyses at E050.1, E060.1, and E109.9 and to remove analyses of filtered radionuclides at E109.9 from the May 2010 memorandum of understanding between DOE and the board of the Buckman Direct Diversion (DOE and BDD Board 2010, 206259). Implementation of any change depends upon the outcome of the discussion.

Samples collected will be analyzed for the analytical suites described in Table 3.0-1. Samples will be submitted for chemical and radionuclide analyses at gage stations E059 and E042.1 if samples were collected during the event at their paired downstream gages (E060.1 and E050.1, respectively). The list of analyses for each monitoring group is prioritized to guide which analyses will be conducted if the collected water volume for a sample composite is insufficient to fulfill all planned suites. The priority is consistent with the order of the constituents listed in Table 3.0-1. The analytical method, expected method detection limit (MDL), and minimal detectable activity (MDA) (for radionuclides) are presented in Table 3.2-1. The sampling sequence for CO115002, CO101038, and CO111041 is presented in Table 3.2-2. The sampling sequence for E030, E040, E055, E055.5, and E056 is presented in Table 3.2-3. Table 3.2-4 provides the sampling sequence at E026, E038, and E039.1. Table 3.2-5 provides the sampling sequence at E042.1 and E059. Table 3.2-6 provides the sampling sequence at E050.1 and E060.1. Table 3.2-7 provides the sampling sequence at E109.9.

Total suspended sediment transport during a runoff event at a station is determined most accurately when discharge is sampled periodically for SSC analysis through a hydrograph. During 2010, SSC was measured at 2- or 3-min intervals for the first 30 min then at 20-min intervals throughout each runoff event only at lower watershed gages. During 2011, SSC measurements were added at 3-min intervals for the first 30 min then at 20-min intervals throughout runoff events using a second automated sampler containing a carousel of 24 1-L bottles above and below the DP Canyon GCS at E038 and E039.1 to better characterize performance of the GCS and upcanyon floodplains and in upper Los Alamos Canyon below the ice rink at E026 to help characterize Las Conchas fire effects. The second sampler was dedicated to collecting stormwater for SSC analyses with the goal of representing most or all of the duration of runoff. This focus will be maintained during monitoring in 2012; however, all SSC samples will be collected at 2-min intervals during the first 30 min to better characterize the early part of the hydrograph and to provide bottles for the proposed additional radionuclide analyses.

If four runoff events have been sampled at a gaging station, subsequent events with discharge less than the largest discharge will be analyzed for SSC only. At upper watershed gages where a single sampler containing a carousel of 12 1-L bottles is installed, the first and last sample collected from these subsequent storms will be analyzed for SSC. At locations where a sampler containing a carousel of 24 1-L bottles is installed and dedicated to collection of samples throughout the entire hydrograph (i.e., upstream and downstream of watershed mitigations), all samples collected from this 24-bottle carousel from these subsequent storms will be analyzed for SSC. In this way, SSC analyses are obtained at many different times during the hydrograph, and suspended sediment transport for the entire runoff event can be characterized.

4.0 REPORTING

The repeat cross-section and general area surveys will be conducted in late fall to early spring, as described above. The survey data, plotted cross-sections, and discussion will be provided in an annual report submitted on May 30 of each year. Analytical and discharge data for each water year (October through September) will be reported annually on February 28. The report will include discharge data from each gage, analytical results, and discussion. An update to the monitoring plan will be prepared annually and submitted by March 10 of every year.

The objective of both reports is to review the data in the context of the mitigation measures implemented under the work plans as described in section 1.0 and evaluate overall watershed performance. Additionally, evaluations of geomorphic change will include considerations of the need for adaptive management at any of the mitigation sites in the watershed.

5.0 REFERENCES

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

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

DOE and BDD Board (U.S. Department of Energy and Buckman Direct Diversion Board), May 12, 2010. "Memorandum of Understanding between the U.S. Department of Energy and the Buckman Direct Diversion Board Regarding Water Quality Monitoring," Santa Fe, New Mexico. (DOE and BDD Board 2010, 206259)

Gallaher, B.M., and R.J. Koch, September 2004. "Cerro Grande Fire Impacts to Water Quality and Stream Flow near Los Alamos National Laboratory: Results of Four Years of Monitoring," Los Alamos National Laboratory report LA-14177, Los Alamos, New Mexico. (Gallaher and Koch 2004, 088747)

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

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

LANL (Los Alamos National Laboratory), October 2009. "Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project," Los Alamos National Laboratory document LA-UR-09-6563, Los Alamos, New Mexico. (LANL 2009, 107457)

LANL (Los Alamos National Laboratory), October 2010. "Interim Assessment to Report Storm Damage to Sediment Control Structures and Monitoring Stations in Los Alamos and Pueblo Canyons," Los Alamos National Laboratory document LA-UR-10-7281, Los Alamos, New Mexico. (LANL 2010, 111125)

LANL (Los Alamos National Laboratory), March 2011. "2011 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project," Los Alamos National Laboratory document LA-UR-11-0943, Los Alamos, New Mexico. (LANL 2011, 201578)

LANL (Los Alamos National Laboratory), May 2011. "2010 Geomorphic Changes at Sediment Transport Mitigation Sites in the Los Alamos and Pueblo Canyon Watersheds," Los Alamos National Laboratory document LA-UR-11-2970, Los Alamos, New Mexico. (LANL 2011, 203661)

LANL (Los Alamos National Laboratory), September 2011. "Los Alamos National Laboratory Environmental Report 2010," Los Alamos National Laboratory report LA-14445-ENV, Los Alamos, New Mexico. (LANL 2011, 207316)

LANL (Los Alamos National Laboratory), February 2012. "Stormwater Performance Monitoring in the Los Alamos/Pueblo Watershed during 2011," Los Alamos National Laboratory document LA-UR-12-0029, Los Alamos, New Mexico. (LANL 2012, 211396)

NMED (New Mexico Environment Department), January 11, 2010. "Approval with Modifications, Los Alamos and Pueblo Canyons Sediment Transport Monitoring Plan," 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, 108444)

NMED (New Mexico Environment Department), June 3, 2011. "Approval with Modifications, 2011 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project," 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, 203705)

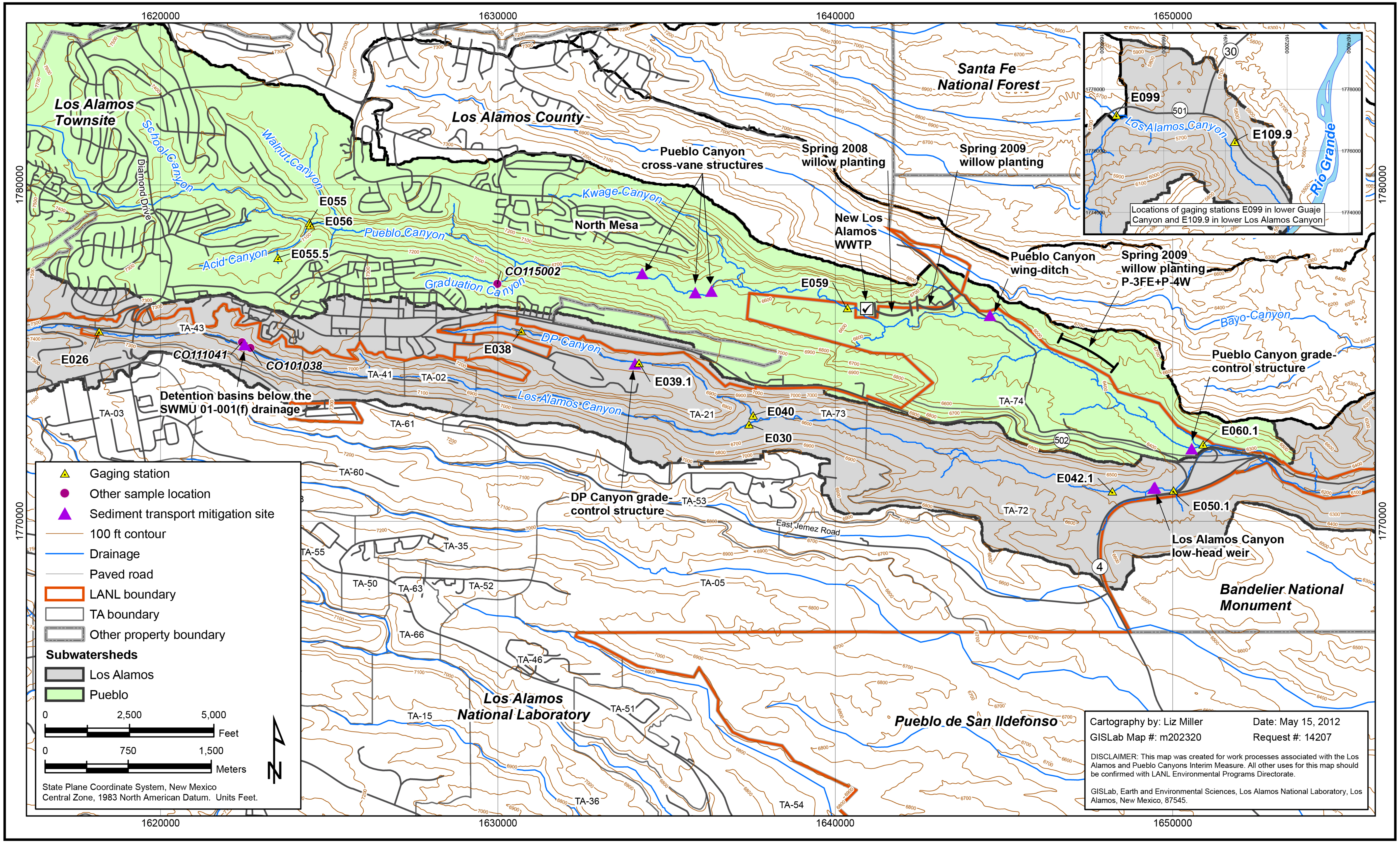


Figure 2.0-1 Los Alamos and Pueblo canyons showing monitoring locations and sediment transport mitigation sites

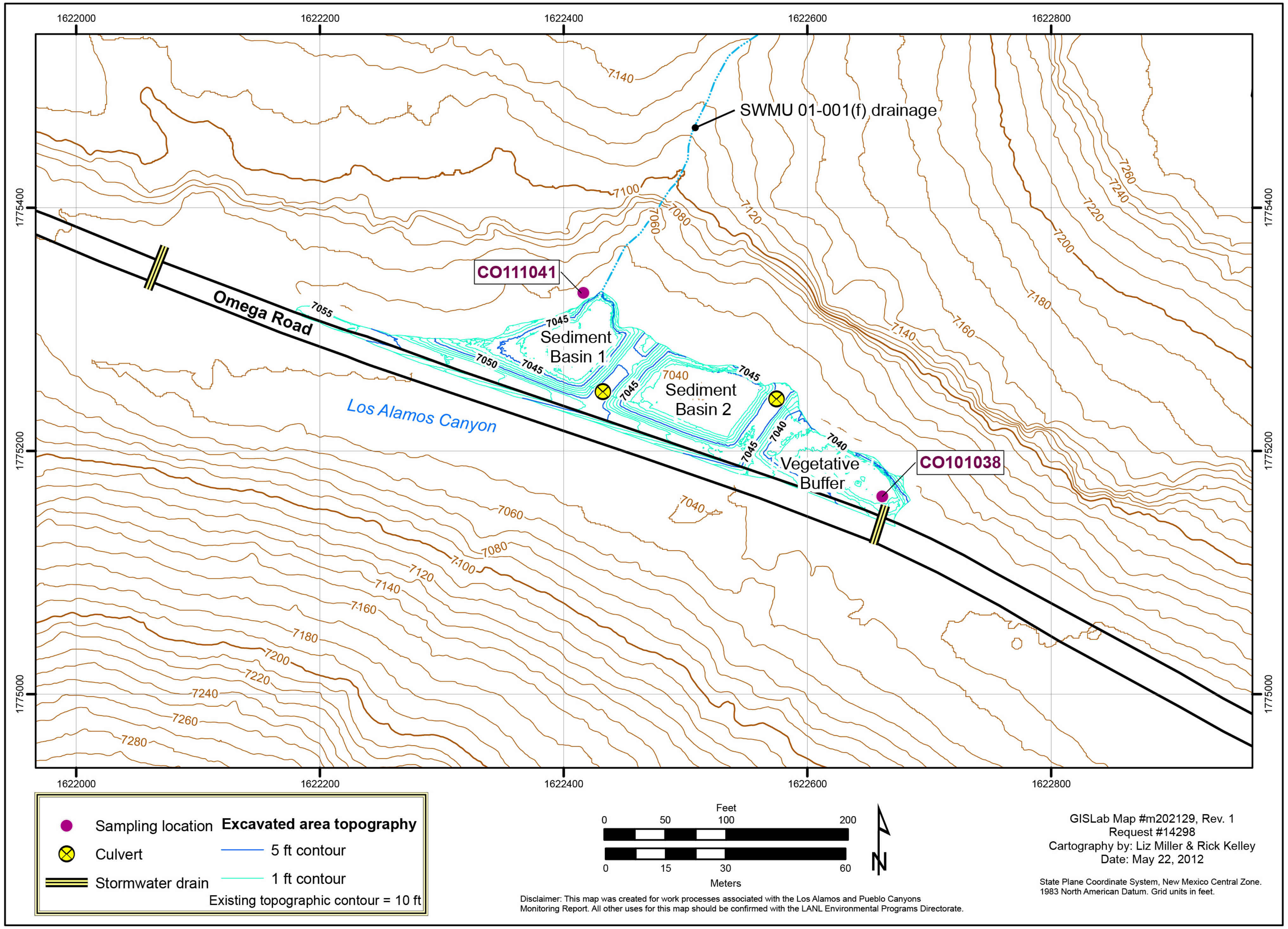


Figure 3.0-1 Detention basins and sampling locations below the SWMU 01-001(f) drainage

Table 3.0-1
Locations and Analytical Suites for Stormwater Samples

Monitoring Group	Locations	Analytical Suites[a,b]
Upper Los Alamos Canyon	E026, E030	PCBs[c] (by Method 1668A), gamma spectroscopy radionuclides, isotopic plutonium, isotopic uranium, americium-241 (by alpha spectroscopy), strontium-90, dioxins and furans, TAL[d] metals, hardness, cyanide, SSC, particle size
DP Canyon gages	E038, E039.1, E040	PCBs (by Method 1668A), gamma spectroscopy radionuclides, isotopic plutonium, isotopic uranium, strontium-90, dioxins and furans, TAL metals, hardness, SSC, particle size
Upper Pueblo Canyon and Acid Canyon gages	E055, E055.5, E056	PCBs (by Method 1668A), isotopic plutonium, dioxins and furans, TAL Metals, hardness, SSC, particle size
Fire-affected lower watershed gages	E042.1, E050.1, E109.9	PCBs (by Method 1668A), isotopic plutonium, gamma spectroscopy radionuclides, isotopic uranium, americium-241 (by alpha spectroscopy), strontium-90, dioxins and furans, TAL metals, hardness, cyanide, SSC, particle size
Lower Pueblo Canyon gages	E059, E060.1	PCBs (by Method 1668A), isotopic plutonium, gamma spectroscopy radionuclides, isotopic uranium, americium-241 (by alpha spectroscopy), strontium-90, dioxins and furans, TAL metals, hardness, SSC, particle size
Detention basins and wetland below the SWMU 01-001(f) drainage	CO101038, CO111041	PCBs (by Method 1668A), TAL metals, hardness, isotopic uranium, total organic carbon, SSC
BDD[e]–Required Monitoring	E050.1, E060.1, E109.9	PCBs (by Method 1668A), gamma spectroscopy radionuclides, isotopic plutonium, isotopic uranium, americium-241 (by alpha spectroscopy), strontium-90, dioxins and furans, gross alpha, gross beta, radium-226/radium-228, TAL metals, Mercury, hardness, SSC
Graduation Canyon below SWMU 00-019	CO115002	PCBs (by Method 1668A), SSC

[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] Radionuclides will be analyzed in filtered and unfiltered samples at E109.9.

[c] PCBs = Polychlorinated biphenyls.

[d] TAL = Target analyte list.

[e] BDD = Buckman Direct Diversion.

Table 3.2-1
Analytical Requirements for Stormwater Samples

Analytical Suite	Method	Detection Limit[a]	Upper Los Alamos Canyon	DP Canyon	Upper Pueblo Canyon and Acid Canyon	Fire Affected Lower Watershed	Lower Pueblo Canyon	BDD[b] Required Monitoring	Detention Basins below the SWMU 01-001(f) Drainage	Graduation Canyon below SWMU 00-019
PCBs[c]	EPA:1668A	25 pg/L	√[d]	√	√	√	√	—[e]	√	√
Isotopic plutonium	HASL-300	0.5 pCi/L	√	√	√	√	√	—	—	—
Gamma spectroscopy	EPA:901.1	10 pCi/L (cesium-137)	√	√	—	√	√	—	√	—
Isotopic uranium	HASL-300	0.5 pCi/L	√	√	—	√	√	—	√	—
Americium-241	HASL-300	0.5 pCi/L	√	—	—	√	√	—	√	—
Strontium-90	EPA:905.0	0.5 pCi/L	√	√	—	√	√	—	—	—
TAL[f] metals	EPA:200.7/200.8/245.2	Variable	√	√	√	√	√	—	√	—
Cyanide	EPA:335.4	1.5 µg/L	√	—	—	√	—	—	—	—
Dioxins and furans	EPA:1613B	50 pg/L	√	√	√	√	√	—	—	—
Gross alpha	EPA:900	10 pCi/L	—	—	—	—	—	√	—	—
Gross beta	EPA:900	10 pCi/L	—	—	—	—	—	√	—	—
Radium-226/radium-228	EPA:903.1/EPA:904	0.5/0.5 pCi/L	—	—	—	—	—	√	—	—
SSC	EPA:160.2	10 mg/L	√	√	√	√	√	—	√	√
Total organic carbon	SW-846:9060	0.5 mg/L	—	—	—	—	—	—	√	—
Particle size	ASTM:C1070	0.01%	√	√	√	√	√	—	—	—

[a] MDL or MDA for radionuclides.

[b] BDD = Buckman Direct Diversion.

[c] PCBs = Polychlorinated biphenyls.

[d] √ = Monitoring planned.

[e] — = Monitoring not planned.

[f] TAL = Target analyte list.

Table 3.2-2
Sampling Sequence for Collection of Stormwater Samples at the Detention Basins and Wetland below the SWMU 01-001(f) Drainage and in Graduation Canyon below SWMU 00-019

Sample Bottle (1 L)	CO115002		CO101038, CO111041	
	Start Time (min) 12-Bottle ISCO	Analytical Suite	Start Time (min) 12-Bottle ISCO	Analytical Suite
1	Trigger	SSC	Trigger	SSC
2	Trigger +1	PCB (UF[a])	Trigger +1	PCB (UF)
3	Trigger +2	PCB (UF)	Trigger +2	PCB (UF)
4	Trigger +3	Extra bottle	Trigger +3	TAL[b] metals (F[c]/UF)
5	Trigger +4	Extra bottle	Trigger +4	Isotopic uranium (UF)
6	Trigger +5	Extra bottle	Trigger +5	TOC[d] (UF)
7	Trigger +6	Extra bottle	Trigger +6	Extra bottle
8	Trigger +7	Extra bottle	Trigger +7	Extra bottle
9	Trigger +8	Extra bottle	Trigger +8	Extra bottle
10	Trigger +9	Extra bottle	Trigger +9	Extra bottle
11	Trigger +10	Extra bottle	Trigger +10	Extra bottle
12	Trigger +11	Extra bottle	Trigger +11	Extra bottle

[a] UF = Unfiltered.
[b] TAL = Target analyte list.
[c] F = Filtered.
[d] TOC = Total organic carbons.

Table 3.2-3
Sampling Sequence for Collection of Stormwater Samples at E030, E040, E055, E055.5, and E056

Sample Bottle (1 Liter)	Start Time (min) 12-Bottle ISCO	E055, E055.5, and E056	E030	E040
		Analytical Suites	Analytical Suites	Analytical Suites
1	Max+10	SSC (UF[a]); particle size	SSC; particle size	SSC, particle size
2	Max+11	PCB[b] (UF)	PCB (UF)	PCB (UF)
3	Max+12	PCB (UF)	PCB (UF)	PCB (UF)
4	Max+13	Isotopic plutonium (UF)	Gamma spectroscopy(UF)	Gamma spectroscopy(UF)
5	Max+14	Dioxins and furans(UF)	Americium-241; isotopic plutonium; isotopic uranium (UF)	isotopic uranium, isotopic plutonium (UF)
6	Max+15	Dioxins and furans (UF)	Americium-241; isotopic plutonium; isotopic uranium (UF)	isotopic uranium, isotopic plutonium (UF)
7	Max+16	TAL[c] metals (F[d]/UF)	Strontium-90 (UF)	Strontium-90 (UF)
8	Max+17	SSC	Dioxins and furans (UF)	Dioxins and furans (UF)
9	Max+18	Extra bottle	Dioxins and furans (UF)	Dioxins and furans (UF)
10	Max+19	Extra bottle	TAL metals (F/UF)	TAL metals (F/UF)
11	Max+20	Extra bottle	Cyanide (UF)	SSC
12	Max+21	Extra bottle	SSC	Extra bottle

[a] UF = Unfiltered.
[b] PCB = Polychlorinated biphenyl.
[c] TAL = Target analyte list.
[d] F = Filtered.

Table 3.2-4
Sampling Sequence for Collection of Stormwater Samples at E026, E038, and E039.1

Sample Bottle (1 Liter)	Start Time (min) 12-Bottle ISCO	E026	E038 and E039.1	E026, E038, and E039.1	
		Analytical Suites	Analytical Suites	Start Time (min) 24-Bottle ISCO	Analytical Suites 24-Bottle ISCO 1-L Poly Wedge[a]
1	Max+10	PCB[b] (UF[c])	PCB (UF)	Trigger	SSC
2	Max+11	PCB (UF)	PCB (UF)	Trigger+2	SSC
3	Max+12	Gamma spectroscopy(UF)	Gamma spectroscopy (UF)	Trigger+4	SSC
4	Max+13	Americium-241; isotopic plutonium; isotopic uranium (UF)	Isotopic uranium; isotopic plutonium (UF)	Trigger+6	SSC
5	Max+14	Americium-241; isotopic plutonium; isotopic uranium (UF)	Isotopic uranium; isotopic plutonium (UF)	Trigger+8	SSC
6	Max+15	Strontium-90 (UF)	Strontium-90 (UF)	Trigger+10	SSC
7	Max+16	Dioxins and furans (UF)	Dioxins and furans (UF)	Trigger+12	SSC
8	Max+17	Dioxins and furans (UF)	Dioxins and furans (UF)	Trigger+14	SSC
9	Max+18	TAL[d] metals (F[e]/UF)	TAL metals (F/UF)	Trigger+16	SSC
10	Max+19	Cyanide (UF)	Extra bottle	Trigger+18	SSC; particle size
11	Max+20	Extra bottle	Extra bottle	Trigger+20	SSC
12	Max+21	Extra bottle	Extra bottle	Trigger+22	SSC
13	n/a[f]	n/a	n/a	Trigger+24	SSC
14	n/a	n/a	n/a	Trigger+26	SSC
15	n/a	n/a	n/a	Trigger+28	SSC
16	n/a	n/a	n/a	Trigger+30	SSC
17	n/a	n/a	n/a	Trigger+50	SSC
18	n/a	n/a	n/a	Trigger+70	SSC
19	n/a	n/a	n/a	Trigger+90	SSC
20	n/a	n/a	n/a	Trigger+110	SSC
21	n/a	n/a	n/a	Trigger+130	SSC
22	n/a	n/a	n/a	Trigger+150	SSC
23	n/a	n/a	n/a	Trigger+170	SSC
24	n/a	n/a	n/a	Trigger+190	SSC

[a] Two SSC analysis collected before the peak of discharge at E026 will be replaced by gamma spectroscopy and isotopic plutonium analyses.

[b] PCB = Polychlorinated biphenyl.

[c] UF = Unfiltered.

[d] TAL = Target analyte list.

[e] F = Filtered.

[f] n/a = Not applicable.

Table 3.2-5
Sampling Sequence for Collection of Stormwater Samples at E042.1 and E059

Sample Bottle (1 Liter)	Start Time (min) 12-Bottle ISCO	E042.1	E059	E042.1 and E059	
		Analytical Suites 12-Bottle ISCO	Analytical Suites 12-Bottle ISCO	Start Time (min) 24-Bottle ISCO	Analytical Suites 24-Bottle ISCO 1-L Poly Wedge[a]
1	Max+10	PCB[b] (UF[c])	PCB (UF)	Trigger	SSC
2	Max+11	Gamma spectroscopy (UF)	Gamma spectroscopy (UF)	Trigger+2	SSC
3	Max+12	Isotopic plutonium, americium-241, and isotopic uranium (UF)	Isotopic plutonium, americium-241, and isotopic uranium (UF)	Trigger+4	SSC
4	Max+13	Isotopic plutonium, americium-241, and isotopic uranium (UF)	Isotopic plutonium, americium-241, and isotopic uranium (UF)	Trigger+6	SSC
5	Max+14	Strontium-90 (UF)	Strontium-90 (UF)	Trigger+8	SSC
6	Max+15	Dioxins and furans (UF)	Dioxins and furans (UF)	Trigger+10	SSC
7	Max+16	TAL[d] metals (F[e]/UF)	TAL metals (F/UF)	Trigger+12	SSC
8	Max+17	Cyanide (UF)	Extra bottle	Trigger+14	SSC
9	Max+60	PCB (UF)	PCB (UF)	Trigger+16	SSC
10	Max+61	Isotopic plutonium (UF)	Isotopic plutonium (UF)	Trigger+18	SSC; particle size
11	Max+105	PCB (UF)	PCB (UF)	Trigger+20	SSC
12	Max+106	Isotopic plutonium (UF)	Isotopic plutonium (UF)	Trigger+22	SSC
13	n/a[f]	n/a	n/a	Trigger+24	SSC
14	n/a	n/a	n/a	Trigger+26	SSC
15	n/a	n/a	n/a	Trigger+28	SSC
16	n/a	n/a	n/a	Trigger+30	SSC
17	n/a	n/a	n/a	Trigger+50	SSC
18	n/a	n/a	n/a	Trigger+70	SSC; particle size
19	n/a	n/a	n/a	Trigger+90	SSC
20	n/a	n/a	n/a	Trigger+110	SSC; particle size
21	n/a	n/a	n/a	Trigger+130	SSC
22	n/a	n/a	n/a	Trigger+150	SSC
23	n/a	n/a	n/a	Trigger+170	SSC
24	n/a	n/a	n/a	Trigger+190	SSC

[a] Two SSC analysis collected before the peak of discharge will be replaced by gamma spectroscopy and isotopic plutonium analyses.

[b] PCB = Polychlorinated biphenyl.

[c] UF = Unfiltered.

[d] TAL = Target analyte list.

[e] F = Filtered.

[f] n/a = Not applicable.

Table 3.2-6
Sampling Sequence for Collection of Stormwater Samples at E050.1 and E060.1

Sample Bottle (1 Liter)	Start Time (min) 12-Bottle ISCO	E050.1	E060.1	E050.1 and E060.1	
		Analytical Suites 12-Bottle ISCO	Analytical Suites 12-Bottle ISCO	Start Time (min) 24-Bottle ISCO	Analytical Suites 24-Bottle ISCO 1-L Poly Wedge[a]
1	Max+10	PCB[b] (UF[c])	PCB (UF)	Trigger	SSC
2	Max+11	Gamma spectroscopy (UF)	Gamma spectroscopy (UF)	Trigger+2	SSC
3	Max+12	Isotopic plutonium, americium-241, and isotopic uranium (UF)	Isotopic plutonium, americium-241, and isotopic uranium (UF)	Trigger+4	SSC
4	Max+13	Isotopic plutonium, americium-241, and isotopic uranium (UF)	Isotopic plutonium, americium-241, and isotopic uranium (UF)	Trigger+6	SSC
5	Max+14	Strontium-90 (UF)	Strontium-90 (UF)	Trigger+8	Radium-226 (UF)
6	Max+15	Dioxins and furans (UF)	Dioxins and furans (UF)	Trigger+10	SSC
7	Max+16	TAL[d] metals (F[e]/UF)	TAL metals (F/UF)	trigger+12	Radium-228 (UF)
8	Max+17	Gross alpha/beta (UF) cyanide (UF)	Gross alpha/beta (UF)	Trigger+14	SSC
9	Max+60	PCB (UF)	PCB (UF)	Trigger+16	SSC
10	Max+61	Isotopic plutonium (UF)	Isotopic plutonium (UF)	Trigger+18	SSC; particle size
11	Max+105	PCB (UF)	PCB (UF)	Trigger+20	SSC
12	Max+106	Isotopic plutonium (UF)	Isotopic plutonium (UF)	Trigger+22	SSC
13	n/a[f]	n/a	n/a	Trigger+24	SSC
14	n/a	n/a	n/a	Trigger+26	SSC
15	n/a	n/a	n/a	Trigger+28	SSC
16	n/a	n/a	n/a	Trigger+30	SSC
17	n/a	n/a	n/a	Trigger+50	SSC
18	n/a	n/a	n/a	Trigger+70	SSC; particle size
19	n/a	n/a	n/a	Trigger+90	SSC
20	n/a	n/a	n/a	Trigger+110	SSC; particle size
21	n/a	n/a	n/a	Trigger+130	SSC
22	n/a	n/a	n/a	Trigger+150	SSC
23	n/a	n/a	n/a	Trigger+170	SSC
24	n/a	n/a	n/a	Trigger+190	SSC

[a] Two SSC analysis collected before the peak of discharge will be replaced by gamma spectroscopy and isotopic plutonium analyses.

[b] PCB = Polychlorinated biphenyl.

[c] UF = Unfiltered.

[d] TAL = Target analyte list.

[e] F = Filtered.

[f] n/a = Not applicable.

Table 3.2-7
Sampling Sequence for Collection of Stormwater Samples at E109.9

Sample Bottle (1 Liter)	E109.9			
	Start Time (min) 12-Bottle ISCO	Analytical Suites 12-Bottle ISCO	Start Time (min) 24-Bottle ISCO	Analytical Suites 24-Bottle ISCO 1-L Poly Wedge[a]
1	Max+10	PCB[b] (UF[c])	Trigger	SSC
2	Max+11	Gamma spectroscopy (UF)	Trigger+2	SSC
3	Max+12	Isotopic plutonium, americium-241, and isotopic uranium (UF)	Trigger+2	SSC
4	Max+13	Isotopic plutonium, americium-241, and isotopic uranium (UF)	Trigger+2	SSC
5	Max+14	Strontium-90 (UF)	Trigger+8	SSC
6	Max+15	Dioxins and furans (UF)	Trigger+10	Gamma spectroscopy; isotopic plutonium, americium-241, and isotopic uranium (F)
7	Max+16	TAL[d] metals (F[e]/UF)	Trigger+12	SSC; particle size
8	Max+17	Gross alpha/beta (UF) cyanide (UF)	Trigger+14	Strontium-90 (F)
9	Max+60	PCB (UF)	Trigger+16	SSC
10	Max+61	Isotopic plutonium (UF)	Trigger+18	Radium-226 (UF)
11	Max+105	PCB (UF)	Trigger+20	SSC
12	Max+106	Isotopic plutonium (UF)	Trigger+22	Radium-228 (UF)
13	n/a[f]	n/a	Trigger+24	SSC
14	n/a	n/a	Trigger+26	Radium-226 (F)
15	n/a	n/a	Trigger+28	SSC
16	n/a	n/a	Trigger+30	Radium-228 (F)
17	n/a	n/a	Trigger+50	SSC
18	n/a	n/a	Trigger+70	SSC; particle size
19	n/a	n/a	Trigger+90	SSC
20	n/a	n/a	Trigger+110	SSC; particle size
21	n/a	n/a	Trigger+130	SSC
22	n/a	n/a	Trigger+150	SSC
23	n/a	n/a	Trigger+170	SSC
24	n/a	n/a	Trigger+190	SSC

[a] Two SSC analysis collected before the peak of discharge will be replaced by gamma spectroscopy and isotopic plutonium analyses.

[b] PCB = Polychlorinated biphenyl.

[c] UF = Unfiltered.

[d] TAL = Target analyte list.

[e] F = Filtered.

[f] n/a = Not applicable.

LA-UR-12-~~1080~~21486
Ma~~rch~~y 2012
EP2012-~~0044~~0121

2012 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project, Revision 1

Prepared by the Environmental Programs Directorate

EP2012-~~0044~~0121

2012 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project, Revision 1

Ma~~rch~~y 2012

Responsible project manager:

Printed Name	Signature	Title	Organization	Date
Steve Veenis		Project Manager	Environmental Programs	

Responsible LANS representative:

Printed Name	Signature	Title	Organization	Date
Michael J. Graham		Associate Director	Environmental Programs	

Responsible DOE representative:

Printed Name	Signature	Title	Organization	Date
~~George J. Rael~~Peter Maggiore		Assistant Manager	DOE-LASO	

2012 Monitoring Plan for Los Alamos and Pueblo Canyons, Revision 1

CONTENTS

1.0 INTRODUCTION 1

2.0 MONITORING GEOMORPHIC CHANGES 1
- 2.1 Pueblo Canyon 2
- 2.2 Los Alamos Canyon 3

3.0 MONITORING STORMWATER RUNOFF 3
- 3.1 Discharge Gaging 4
- 3.2 Sampling and Analysis 4

4.0 REPORTING 6

5.0 REFERENCES 6

Figures

Figure 2.0-1 Los Alamos and Pueblo canyons showing monitoring locations and sediment transport mitigation sites .... 11~~9~~

Figure 3.0-1 Detention basins and sampling locations below the SWMU 01-001(f) drainage .... 13~~10~~

Tables

Table 3.0-1 Locations and Analytical Suites for Stormwater Samples .... 14~~11~~

Table 3.2-1 Analytical Requirements for Stormwater Samples .... 15~~12~~

Table 3.2-2 Sampling Sequence for Collection of Stormwater Samples at the Detention Basins and Wetland below the SWMU 01-001(f) Drainage and in Graduation Canyon below SWMU 00-019 .... 16~~13~~

Table 3.2-3 Sampling Sequence for Collection of Stormwater Samples at E030, E040, E055, E055.5, and E056 .... 17~~14~~

Table 3.2-4 Sampling Sequence for Collection of Stormwater Samples at E026, E038, and E039.1 .... 18~~15~~

Table 3.2-5 Sampling Sequence for Collection of Stormwater Samples at E042.1 and E059 .... 20~~16~~

Table 3.2-6 Sampling Sequence for Collection of Stormwater Samples at E050.1 and E060.1 .... 21~~17~~

Table 3.2-7 Sampling Sequence for Collection of Stormwater Samples at E109.9 .... 22~~18~~

1.0 INTRODUCTION

This monitoring plan is submitted pursuant to the New Mexico Environment Department's (NMED's) approval with modification letter, dated June 3, 2011 (NMED 2011, 203705), of the "2011 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project" (LANL 2011, 201578). The objective of this monitoring plan is to evaluate the effect of mitigation measures that were undertaken in the Los Alamos and Pueblo Canyons (LA/Pueblo) watershed under the NMED-approved "Interim Measure Work Plan to Mitigate Contaminated Sediment Transport in Los Alamos and Pueblo Canyons" (LANL 2008, 101714) and the "Supplemental Interim Measures Work Plan to Mitigate Contaminated Sediment Transport in Los Alamos and Pueblo Canyons" (LANL 2008, 105716). In accordance with these work plans, several activities have been undertaken to reduce flood energy and associated sediment transport. These activities include willow planting, construction of cross-vane structures (CVSs), a wing ditch, grade-control structures (GCSs), sediment detention basins, and modification of basins above a low-head weir. Because contaminants migrate with sediment entrained in runoff, reduced sediment transport will thereby reduce contaminant transport, which is the primary objective of these activities.

Two types of monitoring that began in 2010 continued in 2011 and will continue in the foreseeable future to meet the objectives of (1) monitoring geomorphic changes in the canyon bottom that are measures of performance of various mitigations and (2) collecting and analyzing stormwater runoff samples at gage and monitoring stations located throughout the watershed. Monitoring conducted during 2010 in the LA/Pueblo watershed was performed per the "Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project" (LANL 2009, 107457) and the "Approval with Modifications, Los Alamos and Pueblo Canyons Sediment Transport Monitoring Plan" (NMED 2010, 108444). Monitoring conducted during 2011 in the LA/Pueblo watershed was performed per the "2011 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project" (LANL 2011, 201578) and the "Approval with Modifications [for the] 2011 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project" (NMED 2011, 203705). This monitoring plan builds upon these previous documents.

Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to NMED in accordance with U.S. Department of Energy (DOE) policy. Water quality results from stormwater events are systematically uploaded to the publically accessible environmental monitoring database, RACERIntellus New Mexico.

2.0 MONITORING GEOMORPHIC CHANGES

Monitoring of geomorphic changes (e.g., sediment deposition or erosion) associated with the mitigation measures has been conducted using three methods: (1) repeat cross-section surveys, (2) channel thalweg surveys, and (3) general area surveys. These surveys have been conducted at the locations described below. Surveys have been conducted annually in late fall, winter, or early spring to document geomorphic changes that may have occurred during the previous summer monsoon season. The optimal time is selected based on the weather, the presence or absence of ponded water in constructed basins, and the ability to work in wetlands after dense vegetation has senesced. Figure 2.0-1 shows the areas where surveys have been conducted, and where repeat surveys are planned after the 2012 monsoon season, as described below.

Evaluation of survey data from previous years (e.g., LANL 2011, 203661) indicates the channel thalweg surveys are not the best method for evaluating changes in channel elevation in the survey areas. Specifically, because of changes in thalweg sinuosity and year-to-year variability in survey point spacing that affect the total cumulative length of the survey, thalweg profiles from 1 yr cannot be reliably overlain on profiles from a previous year to evaluate changes in channel elevation. Instead, potential channel elevation changes (aggradation or incision) can be more effectively monitored by directly comparing thalweg elevation at each surveyed cross-section in successive years. Therefore, the Laboratory proposes to discontinue annual thalweg surveys and instead will evaluate channel elevation changes directly at the cross-sections.

2.1 Pueblo Canyon

Reaches P-3FE and P-4W—A total of 23 cross-sections were originally surveyed in September and October 2009 at 100-ft intervals, for a total of 1100 ft above and below a transition area separating a broad upcanyon wetland (reach P--3FE) from a narrower downcanyon wetland within incised geomorphic surfaces (reach P-4W) (LANL 2011, 203661)Figure 2.0-1. A longitudinal survey of the thalweg elevation through this area was also conducted that encompasses an area where willows were planted in spring 2009. Annual resurveys in these reaches are intended to monitor geomorphic changes in this portion of Pueblo Canyon, particularly those related to potential changes in the transition area.

Upper willow-planting area—A total of 18 cross-sections were originally surveyed in October 2009 in the area where willows were planted in spring 2008 and 2009 between the new County of Los Alamos wastewater treatment plant (WWTP) outfall and the wing ditch (Figure 2.0-1). These cross-sections were divided between the upper, middle, and lower thirds of this area. A total of six cross-sections were surveyed in each of these three areas at 100-ft intervals. A longitudinal channel thalweg profile was also surveyed in each of these areas. Annual resurveys at the upper willow-planting area are intended to document anticipated aggradation of floodplain surfaces where willows will slow flood water and trap sediment as well as monitor any changes to thalweg elevation in this area.

Pueblo Canyon GCS—A total of 15 cross-sections were originally surveyed in April 2010 at 100-ft intervals for a distance of 1500 ft above the Pueblo Canyon GCS (Figure 2.0-1). Three cross-sections were also surveyed below the GCS at 100-ft intervals to document any changes to the channel downcanyon of the structure. A longitudinal channel thalweg profile was also surveyed in this area. Annual resurveys in this area are intended to document expected sediment accumulation above the GCS and monitor potential changes in the upcanyon wetland.

CVSs—Two cross-sections were originally surveyed in April and May 2010 in the vicinity of each of the three CVSs (Figure 2.0-1): one 50-ft upcanyon and one 50-ft downcanyon of the apex rock of each structure. A longitudinal thalweg profile was also surveyed over these 100-ft intervals. Although the CVSs were damaged during floods in 2010 (LANL 2010, 111125) and have been abandoned, annual resurveys in this area serve to monitor potential geomorphic changes in Pueblo Canyon upstream from the WWTP outfall.

Wing ditch—Five cross-sections were originally surveyed in November 2009 downcanyon from the wing ditch (Figure 2.0-1) at 100-ft intervals, and a longitudinal channel thalweg profile was also surveyed over this distance. The wing ditch was designed to divert water from the main channel through the upper part of the lower Pueblo Canyon wetland into an abandoned channel to the south. However, the wing ditch is no longer needed for this purpose because new culverts installed during road reconstruction completed by the County of Los Alamos in 2011 immediately upstream from the wing ditch effectively divert water into this formerly abandoned channel. Although no longer needed to perform monitoring, annual resurveys in this area serve to monitor potential geomorphic changes in this part of the wetland.

2.2 Los Alamos Canyon

DP Canyon GCS—A total of 11 cross-sections were originally surveyed in April and May 2010 above the DP Canyon GCS (Figure 2.0-1) at 100-ft intervals upcanyon of the structure. Two cross-sections were also surveyed below the GCS at 100-ft intervals to document any changes to the channel downcanyon of the structure. A longitudinal channel thalweg profile was also surveyed over this area. Annual resurveys in this area are intended to document expected sediment accumulation above the GCS.

Los Alamos Canyon low-head weir—After modifications were made in 2009 to the sediment detention basin above the Los Alamos Canyon low-head weir, including development of three separate basins, an initial topographic survey of this area was conducted in July 2009 (Figure 2.0-1). The basins were reexcavated in June 2011 in preparation for expected floods following the Las Conchas fire, and a new baseline survey was conducted in July 2011. Irregular topography associated with basalt mounds and constructed modifications above the weir warrants a more detailed survey than can be conducted with repeat cross-sections, and instead the topography of the area is surveyed in detail. Annual resurveys of this area enable annual measurements of sediment accumulation within the basins.

Upper Los Alamos Canyon detention basins—A general topographic survey was originally conducted in March 2010 of sediment detention basins constructed below Solid Waste Management Unit (SWMU) 01-001(f). The basins were reexcavated in June 2011 in preparation for expected floods following the Las Conchas fire, and a new baseline survey was conducted in July 2011. Annual resurveys of this area enable annual measurements of sediment accumulation within the basins.

3.0 MONITORING STORMWATER RUNOFF

Stormwater monitoring will be conducted at locations shown in Figure 2.0-1 and listed in Table 3.0-1. These locations are collectively situated to compartmentalize monitoring data for effective performance evaluation of the sediment transport mitigation sites within the watershed. Data will also be available to document baseline conditions upcanyon of these sites and evaluate contaminant sources. The goals of the sampling are (1) to collect data that represent variations in contaminant concentrations and suspended sediment concentrations (SSC) within runoff events at each location and (2) to evaluate short-term and long-term trends in SSC, suspended sediment yield, and contaminant concentrations associated with the mitigation sites. The monitoring strategy described below is developed to achieve these goals. After implementation of this plan, data collected during 2010, 2011, and 2012 will be reviewed and recommendations will be made, if appropriate, regarding potential changes to analytical suites and/or sampling.

Large parts of the upper watersheds of Los Alamos Canyon and a major tributary, Guaje Canyon, were affected by the Las Conchas fire in 2011. As documented after the Cerro Grande fire (Gallaher and Koch 2004, 088747), stormwater chemistry can be strongly affected by incorporation of ash from burn areas. To help evaluate the influence of the Las Conchas fire on stormwater quality in 2011, americium-241 and cyanide were added to the analytical suites at E026 and E030, and cyanide was added to the analytical suites at the other Los Alamos Canyon gages (E042.1, E050.1, and E109.9). Additionally, repeat SSC measurements across the hydrograph were made at the upper boundary station at E026 to better characterize sediment flux from the burn area upstream from Laboratory sites. These modifications to the monitoring plan will continue in 2012.

Additionally, samples will be collected using automated pump samplers at the detention basins below SWMU 01-001(f) at the locations CO111041 and CO101038 shown in Figure 3.0-1 and listed in Table 3.0-1. These samples will allow the performance of the sediment detention basins and associated wetland below the basins to be evaluated. Planned monitoring at the detention basins will be unchanged from 2011.

As directed in the approval with modifications for the 2011 monitoring plan (NMED 2011, 203705), sampling was conducted in Graduation Canyon during 2011 (location CO115002 on Figure 2.0-1). The results of these analyses were reported in the March 2012 “Stormwater Performance Monitoring in the Los Alamos/Pueblo Watershed during 2011” (LANL 2012, 211396).Continued monitoring at this location is not proposed. Monitoring for PCBs and SSC will continue at this location during 2012.

3.1 Discharge Gaging

Each of the stream gages listed in Table 3.1-1 will be monitored continuously throughout the year for stage. Each gage, except for E099 in lower Guaje Canyon (Figure 2.0-1), has an established rating curve that will be reviewed annually or after large channel-altering floods to enable conversion of stage to discharge. Additionally, a rating curve will be developed for E099 during 2012, if possible.

3.2 Sampling and Analysis

Stormwater runoff sampling for SSC analyses at each of the monitoring locations, except E038, E050.1, E060.1, E109.9, at Graduation Canyon below 00-019 and at the detention basins below SWMU 01-001(f), will be triggered by discharges of approximately 10 cubic feet per second (cfs). Sampling at E038 will be triggered by discharges of approximately 40 cfs. Sampling for SSC analyses at E050.1, E060.1, and E109.9 will be triggered by 5-cfs discharges to ensure sampling at small discharges that may extend to the Rio Grande. Sampling at the detention basins below SWMU 01-001(f) and at Graduation Canyon below SWMU 00-019 will be triggered by an actuator detecting the presence of water above the sampler intake. Stormwater runoff sampling for chemical and radiochemical analyses will be triggered 10-min following the maximum discharge exceeding the triggering discharge. Analytical requirements for stormwater samples are listed in Table 3.2-1. Samples at gages will be collected using automated stormwater samplers that contain a carousel of 24 1-L bottles and/or 12 1-L bottles as specified in Tables Tables 3.2-2, 3.2-3, 3.2-4, 3.2-5, and 3.2-6, and 3.2-7. Sample collection inlets will be placed a minimum of 4 in0.33 ft. above the bottom of natural stream channels and a minimum of 0.172 ft above the bottom of supercritical flumes. The sampling approach is intended to allow characterization of suspended sediment flux from the four portions of a typical hydrograph consisting of a rapidly rising limb, a short-duration peak, a rapidly receding limb following the peak, and a longer-duration recessional limb, and contaminant concentrations from the portions of each hydrograph following the peak.

The restriction of samples for chemical and radionuclide analyses to parts of the hydrograph following the peak meets a requirement by NMED to not collect such samples before the peak (NMED 2011, 203705). However, evaluation of monitoring data from 2011 suggests this approach is not optimum for estimating chemical and radionuclide transport contaminant flux because the early parts of the hydrograph, where discharge and SSC are highest, are not sampled directly for contaminant concentrations, resulting in large uncertainties in chemical and radiochemical transport contaminant flux estimates through a hydrograph. Therefore, if since a goal of the monitoring is to estimate contaminant fluxchemical and radionuclide transport at specific stations, the Laboratory recommends that the sampling approach be modified to include sampling for targeted radionuclides earlier in each hydrograph.

The Laboratory proposes to add analyses of radionuclides before the peak of discharge to help improve estimates of- radionuclide transportcontaminant flux. One sample collected on the rising limb of the hydrograph near the peak of discharge will be selected for analyses of gamma spectroscopy radionuclides and isotopic plutonium, instead of SSC. The sample for additional radionuclide analyses will be selected based on a visual inspection of the hydrograph following sample collection and prior to shipment to the analytical laboratory.

To characterize water quality entering and leaving the detention basins below the SWMU 01-001(f) drainage, automated pump samplers will collect stormwater from locations above and below the basins up to four times annually when stormwater discharge is occurring (Figure 3.0-1). To assess PCBs in stormwater runoff in Graduation Canyon, an automated pump sampler will collect stormwater below SWMU 00-019 up to four times annually when stormwater discharge is occurring (CO115002 in Figure 23.0.1).

Analytical suites vary according to monitoring groups and are based on key indicator contaminants for a given portion of the watershed. Table 3.0-1 shows the monitoring groups and the analytical suite for each. SSC analyses, which are common to all groups, will allow determination of correlations between contaminant concentrations and SSC. The SSC analyses will also allow calculations of the total mass transported during stormwater runoff events at the gages. Particle-size analyses conducted in conjunction with selected SSC analyses will support characterization of chemical and radionuclide transport.

Evaluation of stormwater data from the LA/Pueblo watershed and other parts of the Pajarito Plateau (e.g., LANL 2011, 207316) indicate that gross alpha, gross beta, radium-226, and radium-228 results are dominated by background conditions and are not useful for monitoring potential Laboratory impacts on stormwater quality. Therefore, the Laboratory, with NMED approval, proposes to discontinued these analyses in 2012 for the evaluation of sediment transport mitigation for samples collected from all but gage stations E050.1, E060.1, and E109.9. Additionally, although analyses of filtered radionuclides at E109.9 are not particularly useful for monitoring potential Laboratory impacts on stormwater quality, analyses will be continued at E109.9. However, DOE and the Buckman Direct Diversion Board have agreed thatare in discussion to remove analyses of gross alpha, gross beta, radium-226, and radium-228 will be conductedfrom future analyses at E050.1, E060.1, and E109.9 and that to remove analyses of filtered radionuclides will be analyzed at E109.9 as long asfrom the May 2010 memorandum of understanding between DOE and the board of the Buckman Direct Diversion (DOE and BDD Board 2010, 206259) requires their continued analyses. Implementation of any change depends upon the outcome of the discussion.

Samples collected will be analyzed for the analytical suites described in Table 3.0-1. Samples will be submitted for chemical and radionuclide analyses at gage stations E059 and E042.1 if samples were collected during the event at their paired downstream gages (E060.1 and E050.1, respectively). The list of analyses for each monitoring group is prioritized to guide which analyses will be conducted if the collected water volume for a sample composite is insufficient to fulfill all planned suites. The priority is consistent with the order of the constituents listed in Table 3.0-1. The analytical method, expected method detection limit (MDL), and minimal detectable activity (MDA) (for radionuclides) are presented in Table 3.2-1. The sampling sequence for CO115002, CO101038, and CO111041 is presented in Table 3.2-2. The sampling sequence for E030, E040, E055, E055.5, and E056 is presented in Table 3.2-3. Table 3.2-4 provides the sampling sequence at E026, E038, and E039.1. Table 3.2-5 provides the sampling sequence at E042.1 and E059. Table 3.2-6 provides the sampling sequence at E050.1 and E060.1. Table 3.2-7 provides the sampling sequence at E109.9.

Total suspended sediment transport during a runoff event at a station is determined most accurately when discharge is sampled periodically for SSC analysis through a hydrograph. During 2010, SSC was measured at 2- or 3-min intervals for the first 30 min then at 20-min intervals throughout each runoff event only at lower watershed gages. During 2011, SSC measurements were added at 3-min intervals for the first 30 min then at 20-min intervals throughout runoff events using a second automated sampler containing a carousel of 24 1-L bottles above and below the DP Canyon GCS at E038 and E039.1 to better characterize performance of the GCS and upcanyon floodplains and in upper Los Alamos Canyon below the ice rink at E026 to help characterize Las Conchas fire effects. The second sampler was dedicated to collecting stormwater for SSC analyses with the goal of representing most or all of the duration of runoff. This focus will be maintained during monitoring in 2012; however, all SSC samples will be collected at 2-min intervals during the first 30 min to better characterize the early part of the hydrograph and to provide bottles for the proposed additional radionuclide analyses.

If four runoff events have been sampled at a gaging station, subsequent events with discharge less than the largest discharge will be analyzed for SSC only. At upper watershed gages where a single sampler containing a carousel of 12 1-L bottles is installed, the first and last sample collected from these subsequent storms will be analyzed for SSC. At locations where a sampler containing a carousel of 24 1-L bottles is installed and dedicated to collection of samples throughout the entire hydrograph (i.e., upstream and downstream of watershed mitigations), all samples collected from this 24-bottle carousel from these subsequent storms will be analyzed for SSC. In this way, SSC analyses are obtained at many different times during the hydrograph, and suspended sediment transport for the entire runoff event can be characterized.

4.0 REPORTING

The repeat cross-section and general area surveys will be conducted in late fall to early spring, as described above. The survey data, plotted cross-sections, and discussion will be provided in an annual report submitted on May 30 of each year. Analytical and discharge data for each water year (October through September) will be reported annually on February 28. The report will include discharge data from each gage, analytical results, and discussion. An update to the monitoring plan will be prepared annually and submitted by March 10 of every year.

~~Previous plans proposed reporting analytical and discharge data for each water year (October to September) and accompanying discussion, annually on February 28. Beginning in 2011, the Laboratory also included runoff events in October in the annual report because fall storms can be important in the total sediment transport in some years, and providing a complete set of calendar-year events seemed more appropriate than waiting to report on October events until the following year's report. Because the monitoring period has been extended by 1 mo, the Laboratory proposes to extend the reporting date by 1 mo as well, to March 31 of each year, to allow a more complete evaluation of data. This report delivery schedule will allow time to combine analytical data from off-site laboratories with finalized discharge data from the gage stations, the latter of which typically requires 3 mo for data processing (e.g., January 31 for discharge data obtained in October of the previous calendar year) and sufficient time for data evaluation.~~

~~Because of the proposed changes to the annual report date to March 31, the Laboratory proposes also to change the date for the annual update of the monitoring plan to April 10. This later date to submit the plan will allow insights gained from evaluation of the previous year's data to be better incorporated into the plan.~~

The objective of both reports is to review the data in the context of the mitigation measures implemented under the work plans as described in section 1.0 and evaluate overall watershed performance. Additionally, evaluations of geomorphic change will include considerations of the need for adaptive management at any of the mitigation sites in the watershed.

5.0 REFERENCES

The following list includes all documents cited in this plan. Parenthetical information following each reference provides the author(s), publication date, and ER ID number. This information is also included in text citations. ER ID numbers are assigned by the Environmental Programs Directorate's Records

Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

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

DOE and BDD Board (U.S. Department of Energy and Buckman Direct Diversion Board), May 12, 2010. "Memorandum of Understanding between the U.S. Department of Energy and the Buckman Direct Diversion Board Regarding Water Quality Monitoring," Santa Fe, New Mexico. (DOE and BDD Board 2010, 206259)

Gallaher, B.M., and R.J. Koch, September 2004. "Cerro Grande Fire Impacts to Water Quality and Stream Flow near Los Alamos National Laboratory: Results of Four Years of Monitoring," Los Alamos National Laboratory report LA-14177, Los Alamos, New Mexico. (Gallaher and Koch 2004, 088747)

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

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

LANL (Los Alamos National Laboratory), October 2009. "Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project," Los Alamos National Laboratory document LA-UR-09-6563, Los Alamos, New Mexico. (LANL 2009, 107457)

LANL (Los Alamos National Laboratory), October 2010. "Interim Assessment to Report Storm Damage to Sediment Control Structures and Monitoring Stations in Los Alamos and Pueblo Canyons," Los Alamos National Laboratory document LA-UR-10-7281, Los Alamos, New Mexico. (LANL 2010, 111125)

LANL (Los Alamos National Laboratory), March 2011. "2011 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project," Los Alamos National Laboratory document LA-UR-11-0943, Los Alamos, New Mexico. (LANL 2011, 201578)

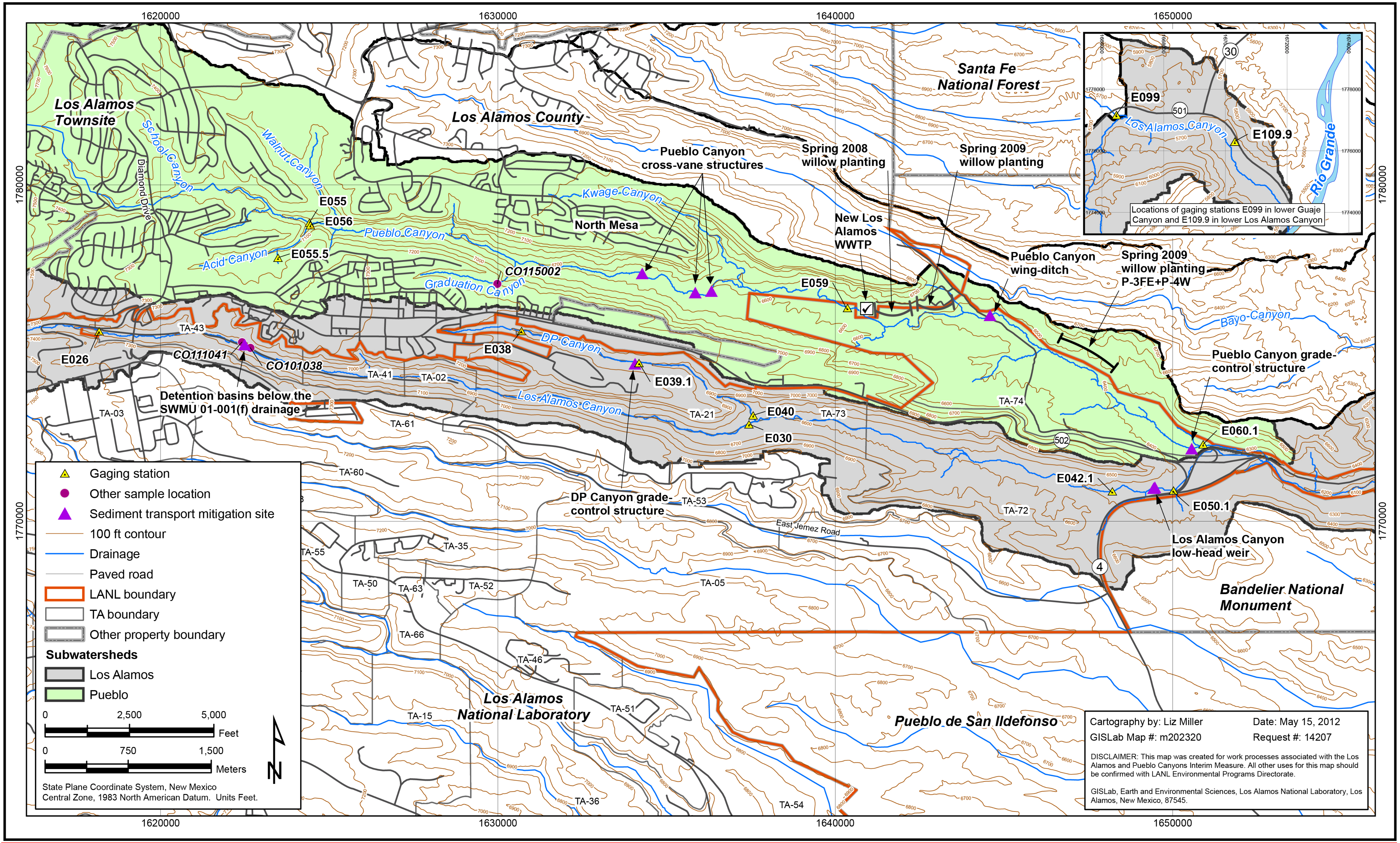
LANL (Los Alamos National Laboratory), May 2011. "2010 Geomorphic Changes at Sediment Transport Mitigation Sites in the Los Alamos and Pueblo Canyon Watersheds," Los Alamos National Laboratory document LA-UR-11-2970, Los Alamos, New Mexico. (LANL 2011, 203661)

LANL (Los Alamos National Laboratory), September 2011. "Los Alamos National Laboratory Environmental Report 2010," Los Alamos National Laboratory report LA-14445-ENV, Los Alamos, New Mexico. (LANL 2011, 207316)

LANL (Los Alamos National Laboratory), February 2012. "Stormwater Performance Monitoring in the Los Alamos/Pueblo Watershed during 2011," Los Alamos National Laboratory document LA-UR-12-0029, Los Alamos, New Mexico. (LANL 2012, 211396)

NMED (New Mexico Environment Department), January 11, 2010. "Approval with Modifications, Los Alamos and Pueblo Canyons Sediment Transport Monitoring Plan," 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, 108444)

NMED (New Mexico Environment Department), June 3, 2011. "Approval with Modifications, 2011 Monitoring Plan for Los Alamos and Pueblo Canyons Sediment Transport Mitigation Project," 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, 203705)


1620000
1630000
1640000
1650000
1780000
1770000
Los Alamos Townsite
Los Alamos County
Santa Fe National Forest
School Canyon
Diamond Drive
Walnut Canyon
Kwage Canyon
North Mesa
Pueblo Canyon
Acid Canyon
Graduation Canyon
DP Canyon
Los Alamos Canyon
Bayo Canyon
E055
E056
E055.5
CO115002
Pueblo Canyon cross-vane structures
Spring 2008 willow planting
Spring 2009 willow planting
New Los Alamos WWTP
E059
Pueblo Canyon wing-ditch
Spring 2009 willow planting P-3FE+P-4W
Pueblo Canyon grade-control structure
E060.1
TA-43
E026
CO111041
CO101038
Detention basins below the SWMU 01-001(f) drainage
E038
E039.1
TA-41
TA-02
TA-03
TA-61
TA-21
TA-73
TA-74
E040
E030
502
E042.1
E050.1
Los Alamos Canyon low-head weir
TA-72
TA-60
DP Canyon grade-control structure
TA-53
East Jemez Road
TA-55
TA-35
TA-50
TA-63
TA-52
TA-05
TA-66
TA-46
TA-15
TA-51
TA-36
TA-54
4
Los Alamos National Laboratory
Pueblo de San Ildefonso
Bandelier National Monument
30
501
E099
Los Alamos Canyon
E109.9
Rio Grande
Locations of gaging stations E099 in lower Guaje Canyon and E109.9 in lower Los Alamos Canyon
Gaging station
Other sample location
Sediment transport mitigation site
100 ft contour
Drainage
Paved road
LANL boundary
TA boundary
Other property boundary
Subwatersheds
Los Alamos
Pueblo
0
2,500
5,000
Feet
0
750
1,500
Meters
N
State Plane Coordinate System, New Mexico Central Zone, 1983 North American Datum. Units Feet.
Cartography by: Liz Miller
Date: May 15, 2012
GISLab Map #: m202320
Request #: 14207
DISCLAIMER: This map was created for work processes associated with the Los Alamos and Pueblo Canyons Interim Measure. All other uses for this map should be confirmed with LANL Environmental Programs Directorate.
GISLab, Earth and Environmental Sciences, Los Alamos National Laboratory, Los Alamos, New Mexico, 87545.

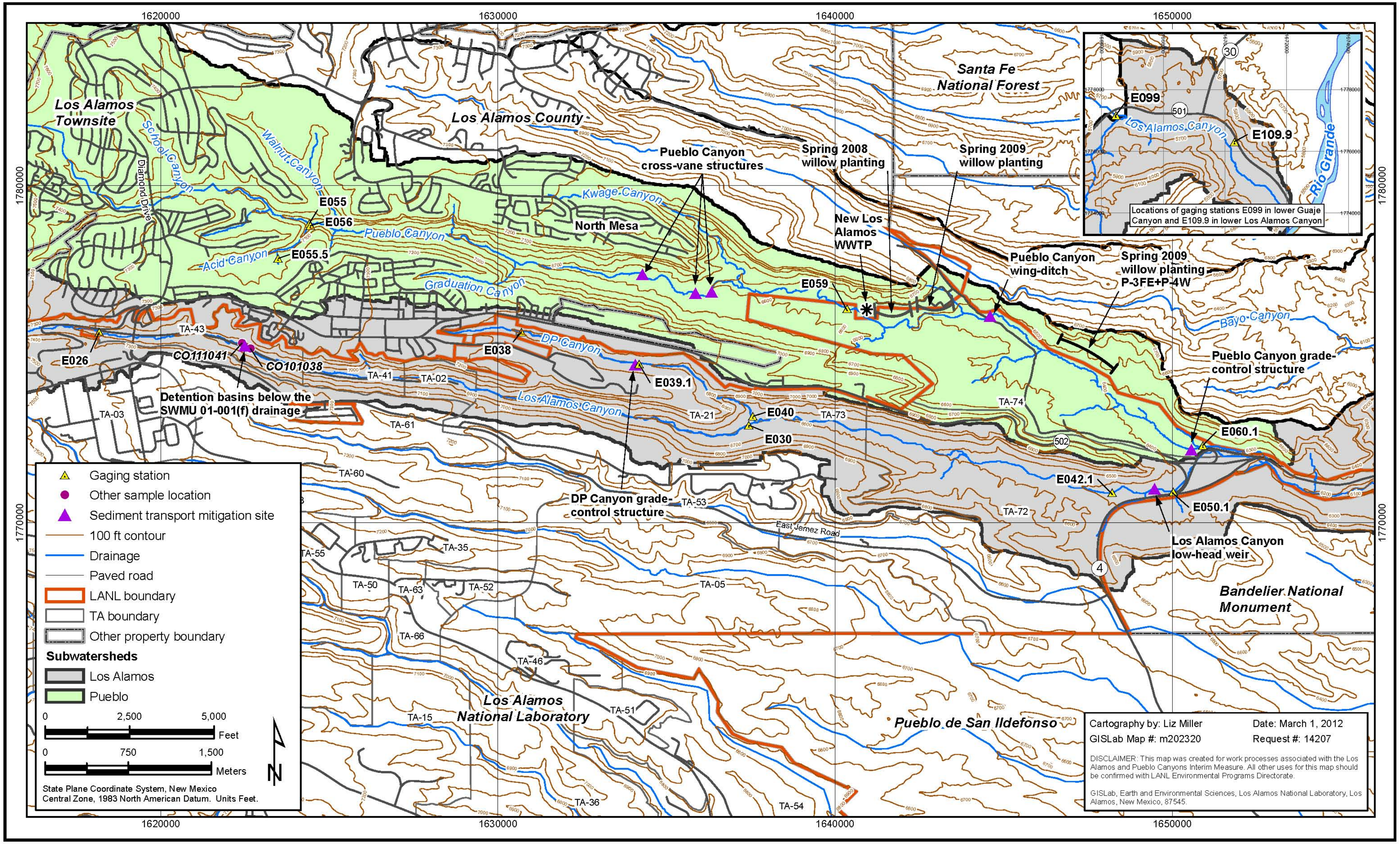
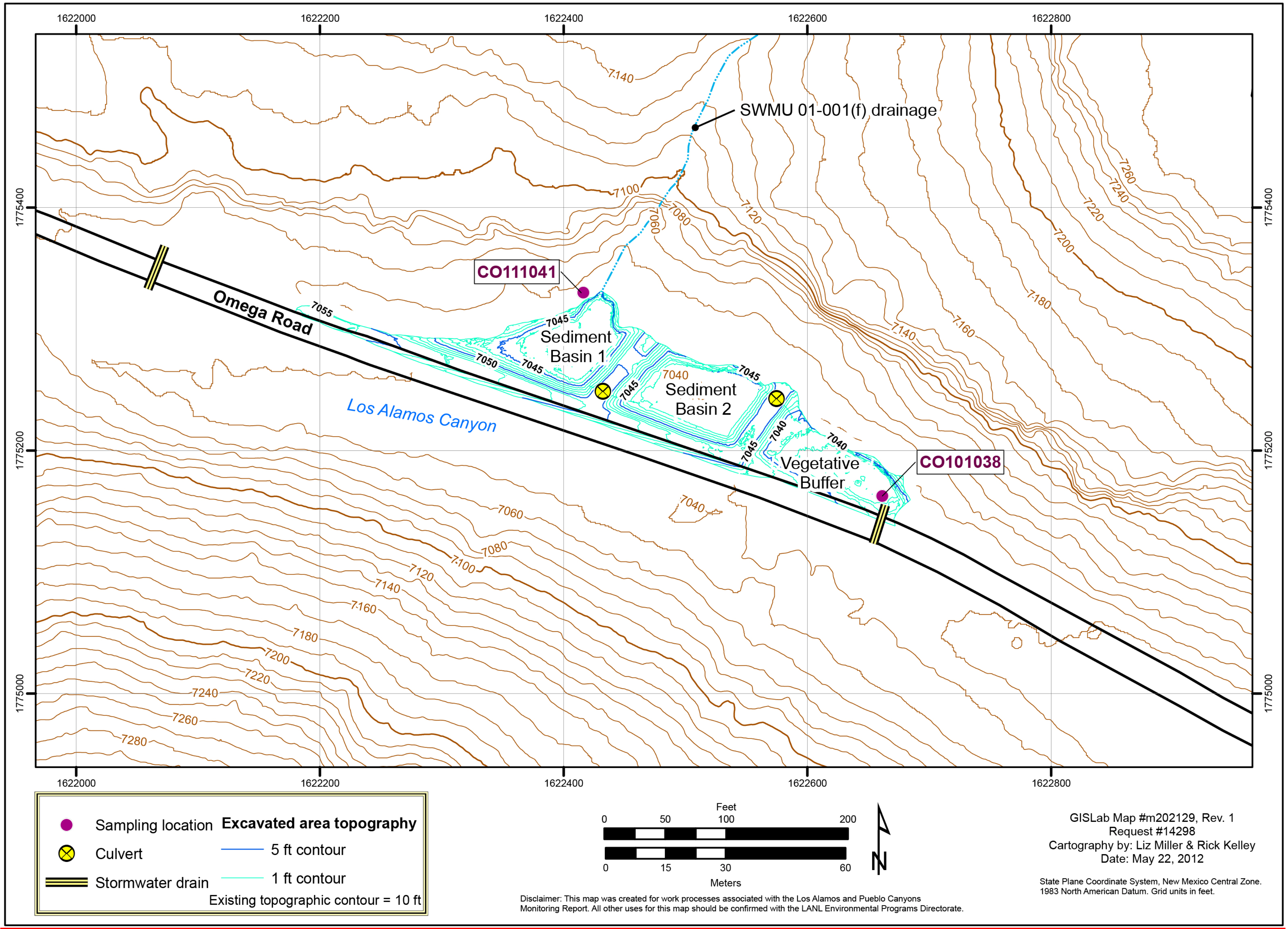


Figure 2.0-1 Los Alamos and Pueblo canyons showing monitoring locations and sediment transport mitigation sites


SWMU 01-001(f) drainage
CO111041
CO101038
Omega Road
Sediment Basin 1
Sediment Basin 2
Vegetative Buffer
Los Alamos Canyon
Sampling location
Culvert
Stormwater drain
Excavated area topography
5 ft contour
1 ft contour
Existing topographic contour = 10 ft
Feet
Meters
GISLab Map #m202129, Rev. 1
Request #14298
Cartography by: Liz Miller & Rick Kelley
Date: May 22, 2012
State Plane Coordinate System, New Mexico Central Zone. 1983 North American Datum. Grid units in feet.
Disclaimer: This map was created for work processes associated with the Los Alamos and Pueblo Canyons Monitoring Report. All other uses for this map should be confirmed with the LANL Environmental Programs Directorate.

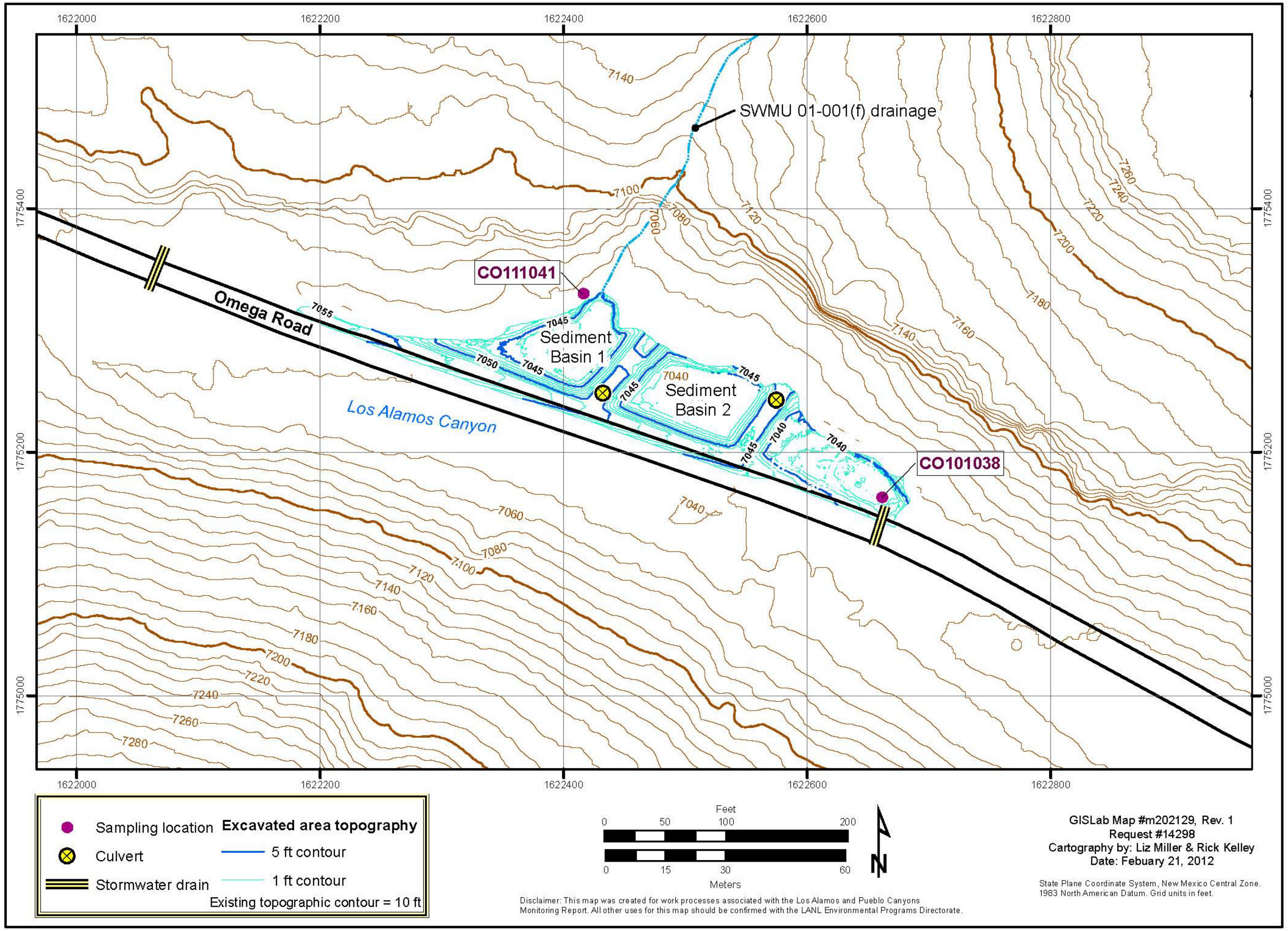


Figure 3.0-1 Detention basins and sampling locations below the SWMU 01-001(f) drainage

Table 3.0-1
Locations and Analytical Suites for Stormwater Samples

Monitoring Group	Locations	Analytical Suites[a,b]
Upper Los Alamos Canyon	E026, E030	PCBs[c] (by Method 1668A), gamma spectroscopy radionuclides, isotopic plutonium, isotopic uranium, americium-241 (by alpha spectroscopy), strontium-90, dioxins and furans, TAL[d] metals, hardness, cyanide, SSC, particle size
DP Canyon gages	E038, E039.1, E040	PCBs (by Method 1668A), gamma spectroscopy radionuclides, isotopic plutonium, isotopic uranium, strontium-90, dioxins and furans, TAL[d] metals, hardness, SSC, particle size
Upper Pueblo Canyon and Acid Canyon gages	E055, E055.5, E056	PCBs (by Method 1668A), isotopic plutonium, dioxins and furans, TAL Metals, hardness, SSC, particle size
Fire-affected lower watershed gages	E042.1, E050.1, E109.9	PCBs (by Method 1668A), isotopic plutonium, gamma spectroscopy radionuclides, isotopic uranium, americium-241 (by alpha spectroscopy), strontium-90, dioxins and furans, TAL metals, hardness, cyanide, SSC, particle size
Lower Pueblo Canyon gages	E059, E060.1	PCBs (by Method 1668A), isotopic plutonium, gamma spectroscopy radionuclides, isotopic uranium, americium-241 (by alpha spectroscopy), strontium-90, dioxins and furans, TAL metals, hardness, SSC, particle size
Detention basins and wetland below the SWMU 01-001(f) drainage	CO101038, CO111041	PCBs (by Method 1668A), TAL metals, hardness, isotopic uranium, total organic carbon, SSC
BDD[e]–Required Monitoring	E050.1, E060.1, E109.9	PCBs (by Method 1668A), gamma spectroscopy radionuclides, isotopic plutonium, isotopic uranium, americium-241 (by alpha spectroscopy), strontium-90, dioxins and furans, Ggross alpha, gross beta, radium-226/radium-228, TAL metals, Mercury, hardness, SSC
Graduation Canyon below SWMU 00-019	CO115002	PCBs (by Method 1668A), SSC

[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] Radionuclides will be analyzed in filtered and unfiltered samples at E109.9.

[c] PCBs = Polychlorinated biphenyls.

[d] TAL = Target analyte list.

[e] BDD = Buckman Direct Diversion.

Table 3.2-1
Analytical Requirements for Stormwater Samples

Analytical Suite	Method	Detection Limit[a]	Upper Los Alamos Canyon	DP Canyon	Upper Pueblo Canyon and Acid Canyon	Fire Affected Lower Watershed	Lower Pueblo Canyon	BDD[b] Required Monitoring	Detention Basins below the SWMU 01-001(f) Drainage	Graduation Canyon below SWMU 00-019
PCBs[c]	EPA:1668A	25 pg/L	√[d]	√	√	√	√	—[e]	√	√
Isotopic plutonium	HASL-300	0.5 pCi/L	√	√	√	√	√	—	—	—
Gamma spectroscopy	EPA:901.1	10 pCi/L (cesium-~~1~~137)	√	√	—	√	√	—	√	—
Isotopic uranium	HASL-300	0.5 pCi/L	√	√	—	√	√	—	√	—
Americium-241	HASL-300	0.5 pCi/L	√	—	—	√	√	—	√	—
Strontium-90	EPA:905.0	0.5 pCi/L	√	√	—	√	√	—	—	—
TAL[f] metals	EPA:200.7/200.8/245.2	Variable	√	√	√	√	√	—	√	—
Cyanide	EPA:335.4	1.5 µg/L	√	—	—	√	—	—	—	—
Dioxins and furans	EPA:1613B	50 pg/L	√	√	√	√	√	—	—	—
Gross alpha	EPA:900	10 pCi/L	—	—	—	—	—	√	—	—
Gross beta	EPA:900	10 pCi/L	—	—	—	—	—	√	—	—
Radium-226/radium-228	EPA:903.1/EPA:904	0.5/0.5 pCi/L	—	—	—	—	—	√	—	—
SSC	EPA:160.2	10 mg/L	√	√	√	√	√	—	√	√
Total organic carbon	SW-846:9060	0.5 mg/L	—	—	—	—	—	—	√	—
Particle size	ASTM:C1070	0.01%	√	√	√	√	√	—	—	—

[a] MDL or MDA for radionuclides.

[b] BDD = Buckman Direct Diversion.

[c] PCBs = Polychlorinated biphenyls.

[d] √ = Monitoring planned.

[e] — = Monitoring not planned.

[f] TAL = Target analyte list.

Table 3.2-2
Sampling Sequence for Collection of Stormwater Samples at the Detention Basins and Wetland below the SWMU 01-001(f) Drainage and in Graduation Canyon below SWMU 00-019

Sample Bottle (1 L)	CO115002		CO101038, CO111041	
	Start Time (min) 12-Bottle ISCO	Analytical Suite	Start Time (min) 12-Bottle ISCO	Analytical Suite
1	Trigger	SSC	Trigger	PCB (UF[a]SSC
2	Trigger +1	PCB (UF[a])	Trigger +1	PCB (UF)
3	Trigger +2	PCB (UF)	Trigger +2	PCB (UF)TALb metals (Fc/UF)
4	Trigger +3	Extra bottle	Trigger +3	TAL[b] metals (F[c]/UF)Isotopic uranium (UF)
5	Trigger +4	Extra bottle	Trigger +4	Isotopic uranium (UF)TOC[d] (UF)
6	Trigger +5	Extra bottle	Trigger +5	TOC[d] (UF)SSC
7	Trigger +6	Extra bottle	Trigger +6	Extra bottle
8	Trigger +7	Extra bottle	Trigger +7	Extra bottle
9	Trigger +8	Extra bottle	Trigger +8	Extra bottle
10	Trigger +9	Extra bottle	Trigger +9	Extra bottle
11	Trigger +10	Extra bottle	Trigger +10	Extra bottle
12	Trigger +11	Extra bottle	Trigger +11	Extra bottle

[a] UF = Unfiltered.

[b] TAL = Target analyte list.

[c] F = Filtered.

[d] TOC = Total organic carbons.

Table 3.2-3
Sampling Sequence for Collection of Stormwater Samples at E030, E040, E055, E055.5, and E056

Sample Bottle (1 Liter)	Start Time (min) 12-Bottle ISCO	E055, E055.5, and E056	E030	E040
		Analytical Suites	Analytical Suites	Analytical Suites
1	Max+10	SSC (UF[a]); particle size	SSC; particle size	SSC, particle size
2	Max+11	PCB[b] (UF)	PCB (UF)	PCB (UF)
3	Max+12	PCB (UF)	PCB (UF)	PCB (UF)
4	Max+13	Isotopic plutonium (UF)	Gamma spectroscopy; isotopic plutonium; americium-241 and isotopic uranium (UF)	Gamma spectroscopy; isotopic plutonium and isotopic uranium (UF)
5	Max+14	Dioxins and furans(UF)	Americium-241; isotopic plutonium; isotopic uranium (UF)Strontium-90 (UF)	isotopic uranium, isotopic plutonium (UF)Strontium-90 (UF)
6	Max+15	Dioxins and furans (UF)	Americium-241; isotopic plutonium; isotopic uranium (UF)Dioxins and furans (UF)	Dioxins and furans (UF) isotopic uranium, isotopic plutonium (UF)
7	Max+16	TAL[c] metals (F[d]/UF)	Strontium-90 (UF)Dioxins and furans (UF)	Strontium-90 (UF)Dioxins and furans (UF)
8	Max+17	SSC	Dioxins and furans (UF)TAL metals (F/UF)	Dioxins and furans (UF)TAL metals (F/UF)
9	Max+18	Extra bottle	Dioxins and furans (UF)Cyanide (UF)	Dioxins and furans (UF)SSC
10	Max+19	Extra bottle	TAL metals (F/UF)SSC	TAL metals (F/UF)Extra bottle
11	Max+20	Extra bottle	Cyanide (UF)Extra bottle	SSCExtra bottle
12	Max+21	Extra bottle	SSCExtra bottle	Extra bottle

[a] UF = Unfiltered.

[b] PCB = Polychlorinated biphenyl.

[c] TAL = Target analyte list.

[d] F = Filtered.

Table 3.2-4
Sampling Sequence for Collection of Stormwater Samples at E026, E038, and E039.1

Sample Bottle (1 Liter)	Start Time (min) 12-Bottle ISCO	E026	E038 and E039.1	E026, E038, and E039.1	
		Analytical Suites	Analytical Suites	Start Time (min) 24-Bottle ISCO	Analytical Suites 24-Bottle ISCO 1-L Poly Wedge[a]
1	Max+10	PCB[b] (UF[c])	PCB (UF)	Trigger	SSC
2	Max+11	PCB (UF)	PCB (UF)	Trigger+2	SSC
3	Max+12	Gamma spectroscopy; isotopic plutonium, americium-241 and isotopic uranium (UF)	Gamma spectroscopy; isotopic plutonium and isotopic uranium (UF)	Trigger+4	SSC
4	Max+13	Americium-241; isotopic plutonium; isotopic uranium (UF)Strontium-90 (UF)	Isotopic uranium; isotopic plutonium (UF)Strontium-90 (UF)	Trigger+6	SSC
5	Max+14	Americium-241; isotopic plutonium; isotopic uranium (UF)Dioxins and furans (UF)	Isotopic uranium; isotopic plutonium (UF)Dioxins and furans (UF)	Trigger+8	SSC
6	Max+15	Strontium-90 (UF)Dioxins and furans (UF)	Strontium-90 (UF)Dioxins and furans (UF)	Trigger+10	SSC
7	Max+16	Dioxins and furans (UF)TAL[d] metals (F[e]/UF)	Dioxins and furans (UF)TAL metals (F/UF)	Trigger+12	SSC
8	Max+17	Dioxins and furans (UF)Cyanide (UF)	Dioxins and furans (UF)Extra bottle	Trigger+14	SSC
9	Max+18	TAL[d] metals (F[e]/UF)Extra bottle	TAL metals (F/UF)Extra bottle	Trigger+16	SSC
10	Max+19	Cyanide (UF)Extra bottle	Extra bottle	Trigger+18	SSC; particle size
11	Max+20	Extra bottle	Extra bottle	Trigger+20	SSC
12	Max+21	Extra bottle	Extra bottle	Trigger+22	SSC
13	n/a[f]	n/a	n/a	Trigger+24	SSC
14	n/a	n/a	n/a	Trigger+26	SSC
15	n/a	n/a	n/a	Trigger+28	SSC
16	n/a	n/a	n/a	Trigger+30	SSC
17	n/a	n/a	n/a	Trigger+50	SSC
18	n/a	n/a	n/a	Trigger+70	SSC
19	n/a	n/a	n/a	Trigger+90	SSC
20	n/a	n/a	n/a	Trigger+110	SSC
21	n/a	n/a	n/a	Trigger+130	SSC
22	n/a	n/a	n/a	Trigger+150	SSC
23	n/a	n/a	n/a	Trigger+170	SSC
24	n/a	n/a	n/a	Trigger+190	SSC

[a] One Two SSC analysis collected before the peak of discharge at E026 will be replaced by gamma spectroscopy and isotopic plutonium analyses.

2012 Monitoring Plan for Los Alamos and Pueblo Canyons, Revision 1

[b] PCB = Polychlorinated biphenyl.

[c] UF = Unfiltered.

[d] TAL = Target analyte list.

[e] F = Filtered.

[f] n/a = Not applicable.

Table 3.2-5
Sampling Sequence for Collection of Stormwater Samples at E042.1 and E059

Sample Bottle (1 Liter)	Start Time (min) 12-Bottle ISCO	E042.1	E059	E042.1 and E059	
		Analytical Suites 12-Bottle ISCO	Analytical Suites 12-Bottle ISCO	Start Time (min) 24-Bottle ISCO	Analytical Suites 24-Bottle ISCO 1-L Poly Wedge[a]
1	Max+10	PCB[b] (UF[c])	PCB (UF)	Trigger	SSC
2	Max+11	Gamma spectroscopy~~; isotopic plutonium, americium-241, and isotopic uranium~~ (UF)	Gamma spectroscopy~~; isotopic plutonium, americium-241, and isotopic uranium~~ (UF)	Trigger+2	SSC
3	Max+12	Isotopic plutonium, americium-241, and isotopic uranium (UF)~~Strontium-90 (UF)~~	Isotopic plutonium, americium-241, and isotopic uranium (UF)~~Strontium-90 (UF)~~	Trigger+4	SSC
4	Max+13	Isotopic plutonium, americium-241, and isotopic uranium (UF)~~Dioxins and furans (UF)~~	Isotopic plutonium, americium-241, and isotopic uranium (UF)~~Dioxins and furans (UF)~~	Trigger+6	SSC
5	Max+14	Strontium-90 (UF)~~TAL[d] metals (F[e]/UF)~~	Strontium-90 (UF)~~TAL metals (F/UF)~~	Trigger+8	SSC
6	Max+15	Dioxins and furans (UF)~~Cyanide (UF)~~	Dioxins and furans (UF)~~Extra bottle~~	Trigger+10	SSC
7	Max+16~~Max+60~~	TAL[d] metals (F[e]/UF)~~PCB (UF)~~	TAL metals (F/UF)~~PCB (UF)~~	Trigger+12	SSC
8	Max+17~~Max+61~~	Cyanide (UF)~~Gamma spectroscopy; isotopic plutonium (UF)~~	Extra bottle~~Gamma spectroscopy; isotopic plutonium (UF)~~	Trigger+14	SSC
9	Max+60~~Max+105~~	PCB (UF)~~PCB (UF)~~	PCB (UF)~~PCB (UF)~~	Trigger+16	SSC
10	Max+61~~Max+106~~	Isotopic plutonium (UF)~~Gamma spectroscopy; isotopic plutonium (UF)~~	Isotopic plutonium (UF)~~Gamma spectroscopy; isotopic plutonium (UF)~~	Trigger+18	SSC; particle size
11	Max+105 ~~Max+150~~	PCB (UF)~~PCB (UF)~~	PCB (UF)~~PCB (UF)~~	Trigger+20	SSC
12	Max+106 ~~Max+151~~	Isotopic plutonium (UF)~~Gamma spectroscopy; isotopic plutonium (UF)~~	Isotopic plutonium (UF)~~Gamma spectroscopy; isotopic plutonium (UF)~~	Trigger+22	SSC
13	n/a[f]	n/a	n/a	Trigger+24	SSC
14	n/a	n/a	n/a	Trigger+26	SSC
15	n/a	n/a	n/a	Trigger+28	SSC
16	n/a	n/a	n/a	Trigger+30	SSC
17	n/a	n/a	n/a	Trigger+50	SSC
18	n/a	n/a	n/a	Trigger+70	SSC; particle size
19	n/a	n/a	n/a	Trigger+90	SSC

20	n/a	n/a	n/a	Trigger+110	SSC; particle size
21	n/a	n/a	n/a	Trigger+130	SSC
22	n/a	n/a	n/a	Trigger+150	SSC
23	n/a	n/a	n/a	Trigger+170	SSC
24	n/a	n/a	n/a	Trigger+190	SSC

[a] One Two SSC analysis collected before the peak of discharge will be replaced by gamma spectroscopy and isotopic plutonium analyses.

[b] PCB = Polychlorinated biphenyl.

[c] UF = Unfiltered.

[d] TAL = Target analyte list.

[e] F = Filtered.

[f] n/a = Not applicable.

Table 3.2-6
Sampling Sequence for Collection of Stormwater Samples at E050.1 and E060.1

Sample Bottle (1 Liter)	Start Time (min) 12-Bottle ISCO	E050.1 Analytical Suites 12-Bottle ISCO	E060.1 Analytical Suites 12-Bottle ISCO	E050.1 and E060.1 Start Time (min) 24-Bottle ISCO	E050.1 and E060.1 Analytical Suites 24-Bottle ISCO 1-L Poly Wedge[a]
1	Max+10	PCB[b] (UF[c])	PCB (UF)	Trigger	SSC
2	Max+11	Gamma spectroscopy; isotopic plutonium, americium-241, and isotopic uranium (UF)	Gamma spectroscopy; isotopic plutonium, americium-241, and isotopic uranium (UF)	Trigger+2	SSC
3	Max+12 Max+12	Isotopic plutonium, americium-241, and isotopic uranium (UF)Strontium-90 (UF)	Isotopic plutonium, americium-241, and isotopic uranium (UF)Strontium-90 (UF)	Trigger+4	SSC
4	Max+13 Max+13	Isotopic plutonium, americium-241, and isotopic uranium (UF)Dioxins and furans (UF)	Isotopic plutonium, americium-241, and isotopic uranium (UF)Dioxins and furans (UF)	Trigger+6	SSC
5	Max+14Max+14	Strontium-90 (UF)TAL[d] metals (F[e]/UF)	Strontium-90 (UF)TAL metals (F/UF)	Trigger+8	Radium-226 (UF)
6	Max+15Max+15	Dioxins and furans (UF)Gross alpha/beta (UF) cyanide (UF)	Dioxins and furans (UF)Gross alpha/beta (UF)	Trigger+10	SSC
7	Max+16Max+60	TAL[d] metals (F[e]/UF)PCB (UF)	TAL metals (F/UF)PCB (UF)	trigger+12	Radium-228 (UF)
8	Max+17Max+61	Gross alpha/beta (UF) cyanide (UF)Gamma spectroscopy; isotopic plutonium (UF)	Gross alpha/beta (UF)Gamma spectroscopy; isotopic plutonium (UF)	Trigger+14	SSC
9	Max+60Max+105	PCB (UF)PCB (UF)	PCB (UF)PCB (UF)	Trigger+16	SSC

10	Max+61Max+106	Isotopic plutonium (UF)Gamma spectroscopy; isotopic plutonium (UF)	Isotopic plutonium (UF)Gamma spectroscopy; isotopic plutonium (UF)	Trigger+18	SSC; particle size
11	Max+105Max+150	PCB (UF)PCB (UF)	PCB (UF)PCB (UF)	Trigger+20	SSC
12	Max+106Max+151	Isotopic plutonium (UF)Gamma spectroscopy; isotopic plutonium (UF)	Isotopic plutonium (UF)Gamma spectroscopy; isotopic plutonium (UF)	Trigger+22	SSC
13	n/a[f]	n/a	n/a	Trigger+24	SSC
14	n/a	n/a	n/a	Trigger+26	SSC
15	n/a	n/a	n/a	Trigger+28	SSC
16	n/a	n/a	n/a	Trigger+30	SSC
17	n/a	n/a	n/a	Trigger+50	SSC
18	n/a	n/a	n/a	Trigger+70	SSC; particle size
19	n/a	n/a	n/a	Trigger+90	SSC
20	n/a	n/a	n/a	Trigger+110	SSC; particle size
21	n/a	n/a	n/a	Trigger+130	SSC
22	n/a	n/a	n/a	Trigger+150	SSC
23	n/a	n/a	n/a	Trigger+170	SSC
24	n/a	n/a	n/a	Trigger+190	SSC

[a] One Two SSC analysis collected before the peak of discharge will be replaced by gamma spectroscopy and isotopic plutonium analyses.

[b] PCB = Polychlorinated biphenyl.

[c] UF = Unfiltered.

[d] TAL = Target analyte list.

[e] F = Filtered.

[f] n/a = Not applicable.

Table 3.2-7
Sampling Sequence for Collection of Stormwater Samples at E109.9

Sample Bottle (1 Liter)	E109.9			
	Start Time (min) 12-Bottle ISCO	**Analytical Suites 12-Bottle ISCO**	**Start Time (min) 24-Bottle ISCO**	**Analytical Suites 24-Bottle ISCO 1-L Poly Wedge[a]**
1	Max+10	PCB[b] (UF[c])	Trigger	SSC
2	Max+11	Gamma spectroscopy; isotopic plutonium, americium-241, and isotopic uranium (UF)	Trigger+2	SSC
3	Max+12	Isotopic plutonium, americium-241, and isotopic uranium (UF)Strontium-90 (UF)	Trigger+2Trigger+4	SSC
4	Max+13	Isotopic plutonium, americium-241, and isotopic uranium (UF)Dioxins and furans (UF)	Trigger+2Trigger+6	SSC

5	Max+14	Strontium-90 (UF)TAL[d] metals (F[e]/UF)	Trigger+8	SSC
6	Max+15	Dioxins and furans (UF)Gross alpha/beta (uf) cyanide (UF)	Trigger+10	Gamma spectroscopy; isotopic plutonium, americium-241, and isotopic uranium (F)
7	Max+60 Max+16	TAL[d] metals (F[e]/UF)PCB (UF)	Trigger+12	SSC; particle size
8	Max+61 Max+17	Gross alpha/beta (ufUF) cyanide (UF)Gamma spectroscopy; Isotopic plutonium, americium-241, and isotopic uranium (UF)	Trigger+14	Strontium-90 (F)
9	Max+60Max+105	PCB (UF)PCB (UF)	Trigger+16	SSC
10	Max+61Max+106	Isotopic plutonium (UF)Gamma spectroscopy; Isotopic plutonium, americium-241, and Isotopic uranium (UF)	Trigger+18	Radium-226 (UF)
11	Max+105 Max+150	PCB (UF)PCB (UF)	Trigger+20	SSC
12	Max+106 Max+151	Isotopic plutonium (UF)Gamma spectroscopy; Isotopic plutonium, americium-241, and isotopic uranium (UF)	Trigger+22	Radium-228 (UF)
13	n/a[f]	n/a	Trigger+24	SSC
14	n/a	n/a	Trigger+26	Radium-226 (F)
15	n/a	n/a	Trigger+28	SSC
16	n/a	n/a	Trigger+30	Radium-228 (F)
17	n/a	n/a	Trigger+50	SSC
18	n/a	n/a	Trigger+70	SSC; particle size
19	n/a	n/a	Trigger+90	SSC
20	n/a	n/a	Trigger+110	SSC; particle size
21	n/a	n/a	Trigger+130	SSC
22	n/a	n/a	Trigger+150	SSC
23	n/a	n/a	Trigger+170	SSC
24	n/a	n/a	Trigger+190	SSC

[a] One Two SSC analysis collected before the peak of discharge will be replaced by gamma spectroscopy and isotopic plutonium analyses.

[b] PCB = Polychlorinated biphenyl.

[c] UF = Unfiltered.

[d] TAL = Target analyte list.

[e] F = Filtered.

[f] n/a = Not applicable.