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NMED Hazardous Waste Bureau

Los Alamos
NATIONAL LABORATORY
EST. 1943

Environmental Protection Division
Water Quality & RCRA Group (ENV-RCRA)
PO Box 1663, MS K490
Los Alamos, New Mexico 87545
(505) 667-0666

National Nuclear Security Administration
Los Alamos Field Office, A316
3747 West Jemez Road
Los Alamos, New Mexico, 87545
(505) 667-5794/FAX (505) 667-5948

Date: MAR 27 2013
Refer To: ENV-RCRA-13-0065
LAUR: 13-20922

Mr. William M. Oberle
Regulatory Division
Albuquerque District, Corps of Engineers
4101 Jefferson Plaza NE
Albuquerque, NM 87109-3435

Mr. Neal Schaeffer
Surface Water Quality Bureau
New Mexico Environment Department
P.O. Box 5469
Santa Fe, New Mexico 87502-5469

Dear Mr. Oberle and Mr. Schaeffer:

SUBJECT: ACTION NO. SPA-2012-00050-ABQ - REQUEST FOR AUTHORIZATION TO CONDUCT WORK IN SANDIA CANYON STREAM CHANNEL AND WETLAND

Pursuant to the requirements of the 2012 Nationwide Permits, the U.S. Department of Energy and Los Alamos National Security, LLC (DOE/LANS) request authorization from the U.S. Army Corps of Engineers (ACOE) to install three grade control structures in Sandia Canyon to arrest a headcut and physically stabilize the wetland. Stabilization of the stream channel and wetland will reduce the transport of sediments and minimize the migration of contaminants into lower sections of the canyon. This letter and enclosures are in support of the DOE/LANS application for authorization from the ACOE to conduct work in Sandia Canyon under Nationwide Permit No. 38, *Cleanup of Hazardous and Toxic Waste.* Enclosed is a completed Nationwide Permit Pre-Construction Notification Form (Enclosure 1).

An Order on Consent (Consent Order) between the New Mexico Environment Department (NMED) and DOE/LANS was signed on March 1, 2005. The Consent Order provides the time table and requirements for environmental cleanup of hazardous constituents at Los Alamos National Laboratory. Installation of the grade control structures in Sandia Canyon is a required activity based on the results of investigations conducted under the Consent Order. In January 2011 the NMED approved, with modifications, the *Phase II Investigation Work Plan for Sandia Canyon*. Enclosure 3 provides a copy of the approval letter from the NMED.

35795

The following documents are enclosed:

- Enclosure 1, Nationwide Permit Pre-Construction Notification (PCN) Form
- Enclosure 2, 100% Design Memorandum for Sandia Wetlands Stabilization Project
- Enclosure 3, NMED letter approving, with Modification, the Work Plan for Sandia Canyon
- Enclosure 4, 100% Review Design Drawings
- Enclosure 5, Dredge & Fill Quantities Worksheet
- Enclosure 6, Sandia Wetland Delineation Report, July 2010
- Enclosure 7, Site Map, Temporary Structures and Staging Area
- Enclosure 8, Storm Water Pollution Prevention Plan
- Enclosure 9, Vegetation Monitoring Plan for Sandia Canyon Wetland Grade Control Structure Project
- Enclosure 10, Photograph of the Sandia Canyon Stream Channel Headcut
- Enclosure 11, Biological Assessment Concurrence, U.S. Fish & Wildlife Service
- Enclosure 12, Biological and Cultural Resource Review

Additional information relevant to the project is provided below.

<u>Sandia Wetlands Stabilization Project</u>

- Name of Waterbody: Sandia Canyon
- Project Location: 35.873468° N, 106.310111° W
- Waterbody Classification: Reach S-2 of Sandia Canyon is an effluent dominated perennial stream and a tributary to the Rio Grande.
- Type of Material Discharged: Steel sheet pile driven into bedrock will be capped with concrete to create an impervious grade-control structure. Each structure will be backfilled with structural fill and compacted. Rock splash aprons will be installed at the downstream face of the upper two grade control structures to dissipate energy and prevent scour hole formation. The downstream (last) grade control structure will have a stone cascade and pool structure to transition into the native channel.
- Surface Area of Waters Filled: 0.033 acres
- Surface Area of Wetlands Filled: 0.073 acres

The overall project goals and objectives are to (1) arrest the headcut in lower portion of the wetland to avoid continued wetland impacts, and (2) to maintain hydrologic and geochemical conditions that will minimize contaminant migration. The headcut in the lower section of the wetland will be stabilized by constructing a series of three stepped grade control structures that will allow grade transition from the current elevation of the wetland to the stream bank near stream gage E123. A photograph of the headcut is included in Enclosure 10. The area behind the grade control structures will be backfilled, and wetland vegetation will be re-established behind the structures to further stabilize the area.

Because this activity involves the discharge of fill material into waters of the U.S., DOE/LANS are aware that measures must be taken to minimize impacts. These measures will include:

1. Work will be conducted during low flow periods.
2. The project is subject to the provisions of the NPDES Storm Water Construction General Permit and implementation of the Storm Water Pollution Prevention Plan (See Enclosure 8).
3. Flows will be temporarily diverted around the project construction site.
4. Temporary diversion structures will be made of non-erodible materials to minimize turbidity.
5. Temporary diversions will be monitored 24 hours/day, 7 days/week.
6. Construction equipment will be stored in a designated equipment staging area as indicated in the SWPPP.
7. Heavy equipment working in wetlands will be placed on mats, and/or other measures will be taken to minimize soil disturbance.

During construction, flows will be temporarily diverted around the work area. To accomplish this, a sump pit will be constructed upstream of wetlands and lined with a geotextile membrane to help minimize turbidity. A trench will be cut to any braided or secondary channels to divert all flows to the sump. The trenches will also be lined with non-erodible materials to minimize turbidity. Submersible pumps equipped with float switches will be used to draw the water from the sump and conveyed via a 6" PVC pipe around the construction area and back into the streambed. Controls will be placed at the re-entry point to ease water back into the channel. The temporary diversion is designed to continuously sustain the movement of water. The pumps will be powered from a diesel generator that will be manned and operated 24 hours a day, 7 days a week. A schematic with the location of the temporary diversion structures is included in Enclosure 7.

The Laboratory's Biological Resources Team completed a Biological Resources Project Review—for federally listed threatened and endangered species, wetlands, and floodplains—of proposed mitigations for the Sandia Canyon Wetland, including the Wetland Stabilization Project. Due to concerns about downstream changes in habitat and prey availability for federally-listed threatened or endangered species, a biological assessment was prepared for this project and submitted to the US Fish & Wildlife Service (USFWS) on June 30, 2010. Concurrence was received from the USFWS on July 23, 2010 for the Grade Control Structure; a copy has been provided in Enclosure 11.

The LANS Cultural Resources Team, in accordance with their standard operating procedure *Cultural Resources Project Review* (EAQ-412, R1, June 2007), completed a Cultural Resources Review of the proposed project. An explanation of the biological and cultural resources review process taken for the project is included in Enclosure 12.

Please contact Robert Gallegos by telephone at (505) 665-0450 or by email at rgallegos@lanl.gov if you have questions regarding this information.

Sincerely,

Anthony R. Grieggs
Group Leader
Water Quality & RCRA Group (ENV-RCRA)
Los Alamos National Security, LLC

Sincerely,

Gene E. Turner
Environmental Permitting Manager
Environmental Projects Office
Los Alamos Field Office
U.S. Department of Energy

ARG:GET:RMG/lm

Enclosures:

1. Nationwide Permit Pre-Construction Notification (PNC) Form
2. 100% Design Memorandum for Sandia Wetlands Stabilization Project
3. NMED letter approving, with modification, the Work Plan for Sandia Canyon
4. 100% Review Design Drawings
5. Dredge & Fill Quantities Worksheet
6. Sandia Wetland Delineation Report, July 2010
7. Site Map, Temporary Structures and Staging Area
8. Storm Water Pollution Prevention Plan
9. Vegetation Monitoring Plan for Sandia Canyon Wetland Grade Control Structure Project
10. Photograph of the Sandia Canyon Stream Channel Headcut
11. Biological Assessment Concurrence, US Fish & Wildlife Service
12. Biological and Cultural Resources Review

Cy: James Hogan, NMED/SWQB, Santa Fe, NM, w/enc.
John E. Kieling, NMED/HWB, Santa Fe, NM, w/enc.
Steven M. Yanicak, NMED/DOE/OB, w/enc., (E-File)
Romancita N. Massey, NA-OO-LA, w/enc., (E-File)
Gene E. Turner, NA-OO-LA, w/enc. (E-File)
Carl A. Beard, PADOPS, w/o enc., A102
Michael T. Brandt, ADESH, w/o enc., (E-File)
Jeffrey D. Mousseau, ADEP, w/o enc., (E-File)
Alison M. Dorries, ENV-DO, w/o enc., (E-File)
Victoria A. George, REG-DO, w/o enc., (E-File)
John P. McCann, PMFS-DO, w/enc., (E-File)
Deborah Apodaca Pesiri, ET-ER, w/enc., (E-File)
Amanda B. White, ET-EI, w/enc., (E-File)
Michael T. Saladen, ENV-RCRA, w/o enc., (E-File)
Robert M. Gallegos, ENV-RCRA, w/enc., (E-File)
LASOmailbox@nnsa.doe.gov, w/enc., (E-File)
locatesteam@lanl.gov, w/enc., (E-File)
ENV-RCRA Correspondence File, w/enc., K490

ENCLOSURE 1

Nationwide Permit Pre-Construction Notification (PCN) Form

ENV-RCRA-13-0065

LAUR-13-20922

Date: MAR 2 7 2013

U.S. Army Corps of Engineers

South Pacific Division

Nationwide Permit Pre-Construction Notification (PCN) Form

This form integrates requirements of the U.S. Army Corps of Engineers Nationwide Permit Program within the South Pacific Division (SPD), including General and Regional Conditions. You MUST fill out all boxes related to the work being done. Fillable boxes in this form expand if additional space is needed.

Box 1 Project Name Sandia Canyon Wetlands Stabilization Project			
Applicant Name John P. McCann		**Applicant Title** Project Manager	
Applicant Company, Agency, etc. Los Alamos National Security, LLC; U.S. Department of Energy		Applicant's internal tracking number (if any)	
Mailing Address P.O. Box 1663 Los Alamos, New Mexico 87545 Mail Stop M992			
Work Phone with area code 505.667.1091	Mobile Phone with area code 505.699.2204	Home Phone with area code	Fax # with area code 505.665.4747
E-mail Address jmccann@lanl.gov	Relationship of applicant to property: ☐ Owner ☐ Purchaser ☐ Lessee ■ Other:		
Application is hereby made for verification that subject regulated activities associated with subject project qualify for authorization under a U.S. Army Corps of Engineers Nationwide Permit or Permits as described herein. I certify that I am familiar with the information contained in this application and, that to the best of my knowledge and belief, such information is true, complete, and accurate. I further certify that I possess the authority to undertake the proposed activities. I hereby grant to the agency to which this application is made the right to enter the above-described location to inspect the proposed, in-progress or completed work. I agree to start work only after all necessary permits have been received and to comply with all terms and conditions of the authorization.			
Signature of applicant			Date (mm/dd/yyyy) 3-21-2013

If anyone other than the person named as the Applicant will be in contact with the U.S. Army Corps of Engineers representing the Applicant regarding this project during the permit process, Box 2 MUST be filled out.

Box 2 Authorized Agent/Operator Name Robert M. Gallegos		**Agent/Operator Title** Environmenal Professional	
Agent/Operator Company, Agency, etc. Los Alamos National Secuirty, LLC		E-mail Address rgallegos@lanl.gov	
Mailing Address 11 Torneo Road Santa Fe, NM 87508			
Work Phone with area code 505.665.0450	Mobile Phone with area code	Home Phone with area code	Fax # with area code
I hereby authorize the above named authorized agent to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application. I understand that I am bound by the actions of my agent and I understand that if a federal or state permit is issued, I, or my agent, must sign the permit.			
Signature of applicant			Date (mm/dd/yyyy) 3-21-2013
I certify that I am familiar with the information contained in this application, and that to the best of my knowledge and belief, such information is true, complete, and accurate.			
Signature of authorized agent Katy R. Miller			Date (mm/dd/yyyy) 3/21/13

Box 3 Name of Property Owner(s), if other than Applicant:		
Owner Title	**Owner Company, Agency, etc.**	
Mailing Address		
Work Phone with area code	Mobile Phone with area code	Home Phone with area code

Box 4 Name of Contractor(s) (if known):		
Contractor Title	**Contractor Company, Agency, etc.**	
Mailing Address		
Work Phone with area code	Mobile Phone with area code	Home Phone with area code

Box 5 Site Number __ of __. Project location(s), including street address, city, county, state, zip code where proposed activity will occur:	
Name of Waterbody(ies) (if known, otherwise enter "an unnamed tributary to"): Tributary to what named, downstream waterbody:	
Latitude & Longitude (D/M/S, DD, or UTM with Zone): °N 35.873468 ° W106.310111	Section, Township, Range: 16 19N 6E
County Assessor Parcel Number (Include County name):	USGS Quadrangle map name: Frijoles
Watershed (HUC and watershed name[1]): Sandia Canyon 13020101 [1]http://water.usgs.gov/GIS/regions.html	Size of permit area or project boundary: acres linear feet
Directions to the project location and other location descriptions, if known: From Albuquerque, I-25 N to US-285 N to NM 502 W towards Los Alamos. Merge onto NM-4 W via the ramp towards White Rock. Turn right on Jemez Rd. Turn left onto Diamond Drive. Turn left on Eniwetok Rd. Continue down Eniwetok Rd to access road at the far end of Sigma Mesa.	
Access limitations or restrictions (if any): Access limited. Must be escorted by approved Laboratory personnel.	

Box 6 Nature of Activity (Description of the project, include all features):

See Enclosure 2 - 100% Design Memorandum for Sandia Wetland Stabilization Project.

Project Purpose (Description of the reason or purpose of the project):

See Enclosure 3 - Letter from NMED Hazardous Water Bureau (January 14, 2011) to US Department of Energy and Los Alamos National Security, LLC approving with modification the work plan.

Reason(s) for Discharge into Waters of the United States (Description of why dredged and/or fill material needs to be placed in Waters of the United States):

See Enclosure 2, 100% Design Memorandum for Sandia Wetlands Stabilization Project. See Enclosure 4 100% Review Design Drawings.

Proposed discharge of dredge and/or fill material. Indicate total surface area in **acres** and **linear feet** (where appropriate) of the proposed impacts to Waters of the United States, indicate water body type (tidal wetland, non-tidal wetland, vernal pool, riparian wetland, ephemeral stream/river, intermittent stream/river, perennial stream/river, pond/lake, vegetated shallows, bay/harbor, lagoon, ocean, etc.), and identify the impact(s) as permanent and/or temporary for each requested Nationwide Permit[1]:

[1] Enter the intended permit number(s). See Nationwide Permit regulations for permit numbers and qualification information: http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits/NationwidePermits.aspx

Water Body Type	Requested NWP Number:				Requested NWP Number:				Requested NWP Number:			
	Permanent		Temporary		Permanent		Temporary		Permanent		Temporary	
	Area	Length	Area	Length	Area	Length	Area	Length	Area	Length	Area	Length
			See Enclosure 5 Dredge and Fill Quantities Worksheet									
Total:												

Total volume (in cubic yards) and type(s) of material proposed to be dredged from or discharged into Waters of the United States:

Material Type	Total Volume Dredged	Total Volume Discharged
Rock Slope Protection (RSP)		
Clean spawning gravel		
River rock		
Soil/Dirt/Silt/Sand/Mud	See Enclosure 5 Dredge and Fill Quantities Worksheet	
Concrete		
Structure		
Stumps/Root wads		
Other:		
Total:		

Activity requires a written waiver to exceed specified limits of the Nationwide Permit? ☐ Yes ■ No

If yes, provide Nationwide Permit number and name, limit to be exceeded, and rationale for each requested waiver:

Activity will result in the loss of greater than ½-acre of Waters of the United States? ■ Yes ☐ No
If yes, provide an electronic copy (compact disc) or multiple hard copies (7) of the complete PCN for appropriate Federal and State Pre-discharge Notification (See General Condition #31, Pre-construction Notification, Agency Coordination, Section 2 and 4):

Describe direct and indirect effects caused by the activity (see General Condition #31, Pre-construction Notification, District Engineer's Decision, Section 1): See Enclosure 2 -100% Design Memorandum for Sandia Wetlands

Potential cumulative impacts of proposed activity(if any): See Enclosure 2 100% Design Memorandum

Drawings and figures (see each U.S. Army Corps of Engineers District's Minimum Standards Guidance):
Vicinity map: ■ Attached (or mail copy separately if applying electronically)
To-scale Plan view drawing(s): ■ Attached (or mail copy separately if applying electronically)
To-scale elevation and/or Cross Section drawing(s): ■ Attached (or mail copy separately if applying electronically)
Numbered and dated pre-project color photographs: ■ Attached (or mail copy separately if applying electronically)
Sketch drawing(s) or map(s): ■ Attached (or mail copy separately if applying electronically)

Has a wetlands/waters of the U.S. delineation been completed?
■ Yes, Attached[2] (or mail copy separately if applying electronically) ☐ No
If a delineation has been completed, has it been verified in writing by the Corps?
☐ Yes, Date of preliminary or approved jurisdictional determination (mm/dd/yyyy): Corps file number: ■ No
[2]If available, provide ESRI shapefiles (NAD83) for delineated waters

For proposed discharges of dredged material resulting from navigation dredging into inland or near-shore waters of the U.S. (including beach nourishment), please attach[3] a proposed Sampling and Analysis Plan (SAP) prepared according to Inland Testing Manual (ITM) guidelines (including Tier I information, if available), or if disposed offshore, a proposed SAP prepared according to the Ocean Disposal Manual.
[3]Or mail copy separately if applying electronically

Is any portion of the work already complete? ☐ YES ■ NO
If yes, describe the work:

Box 7 Authority:
Is Section 10 of the Rivers and Harbors Act applicable?: ☐ YES ■ NO
Is Section 404 of the Clean Water Act applicable?: ■ YES ☐ NO

Is the project located on U.S. Army Corps of Engineers property or easement?: ☐ YES ■ NO
If yes, has Section 408 process been initiated?: ☐ YES ■ NO
Would the project affect a U.S. Army Corps of Engineers structure?: ☐ YES ■ NO
If yes, has Section 408 process been initiated?: ☐ YES ■ NO

Is the project located on other Federal Lands (USFS, BLM, etc.)?: ■ YES ☐ NO
Is the project located on Tribal Lands?: ☐ YES ■ NO

Box 8 Is the discharge of fill or dredged material for which Section 10/404 authorization is sought part of a larger plan of development?: ☐ YES ■ NO

If discharge of fill or dredged material is part of development, name and proposed schedule for that larger development (start-up, duration, and completion dates):

Location of larger development (if discharge of fill or dredged material is part of a plan of development, a map of suitable quality and detail of the entire project site should be included):

Box 9 Measures taken to avoid and minimize impacts to waters of the United States:

Conduct construction activities during low-flow period. Temporarily divert flows around work and minimized turbidity. Subject to provisions of Construction General Permit SWPPP.

Box 10 Proposed Compensatory Mitigation related to fill/excavation and dredge activities. Indicate in **acres** and **linear feet** (where appropriate) the total quantity of Waters of the United States proposed to be created, restored, enhanced and/or preserved for purposes of providing compensatory mitigation. Indicate water body type (tidal wetland, non-tidal wetland, vernal pool, riparian wetland, ephemeral stream/river, intermittent stream/river, perennial stream/river, pond/lake, vegetated shallows, bay/harbor, lagoon, ocean, etc.) or non-jurisdictional (uplands[1]). Indicate mitigation type (permittee-responsible on-site/off-site, mitigation bank, or in-lieu fee program). If the mitigation is purchase of credits from a mitigation bank, indicate the bank to be used, if known:

[1] For uplands, please indicate if designed as an upland buffer.

Site Number	Water Body Type	Created		Restored		Enhanced		Preserved		Mitigation Type
		Area	Length	Area	Length	Area	Length	Area	Length	
Total:										

If no mitigation is proposed, provide detailed explanation of why no mitigation would be necessary:

If permittee-responsible mitigation is proposed, provide justification for not utilizing a Corps-approved mitigation bank or in-lieu fee program:

Has a draft/conceptual mitigation plan been prepared in accordance with the April 10, 2008, Final Mitigation Rule[2] and District Guidelines[3,4,5]?

[2]http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits/mitig_info.aspx
[3]**Sacramento and San Francisco Districts**-http://www.spk.usace.army.mil/organizations/cespk-co/regulatory/pdf/Mitigation_Monitoring_Guidelines.pdf
[4]**Los Angeles District**-http://www.spl.usace.army.mil/regulatory/mmg_2004.pdf
[5]**Albuquerque District**-http://www.spa.usace.army.mil/reg/mitigation/SPA%20Final%20Mitigation%20Guidelines_OLD.pdf

☐ Yes, Attached (or mail copy separately if applying electronically) ☐ No

If no, a mitigation plan must be prepared and submitted, if applicable.

Mitigation site(s) Latitude & Longitude (D/M/S, DD, or UTM with Zone):	USGS Quadrangle map name(s):
Assessor Parcel Number(s):	Section(s), Township(s), Range(s):

Other location descriptions, if known:

Directions to the mitigation location(s):

Box 11 Threatened or Endangered Species and Essential Fish Habitat

Please list any federally-listed (or proposed) threatened or endangered species or critical habitat (or proposed critical habitat) within the project area (include scientific names (e.g., Genus species), if known):

a. b.
c. d.
e. f.

Have surveys, using U.S. Fish and Wildlife Service/NOAA Fisheries protocols, been conducted?
☒ Yes, Report attached (or mail copy separately if applying electronically) ☐ No

Has a biological assessment or evaluation been completed for the proposed project?
☒ Yes, Report attached (or mail copy separately if applying electronically) ☐ Not attached

Has Section 7 consultation been initiated by another federal agency?
☒ Yes, Initiation letter attached (or mail copy separately if applying electronically) ☐ No

Has Section 10 consultation been initiated for the proposed project?
☐ Yes, Initiation letter attached (or mail copy separately if applying electronically) ☒ No

Has the USFWS/NOAA Fisheries issued a Biological Opinion? See Enclosure 11 - July 23, 2010
☒ Yes, Attached (or mail copy separately if applying electronically) ☐ No
If yes, list date Opinion was issued (m/d/yyyy):

Is the project located within Essential Fish Habitat[1] (EFH)? ☐ Yes ☒ No
[1] http://swr.nmfs.noaa.gov/hcd/HCD_webContent/EFH/index_EFH.htm

Box 12 Historic Properties and Cultural Resources:

Are any cultural resources of any type known to exist on-site? ☐ Yes ☒ No

Please list any known historic properties listed, or eligible for listing, on the National Register of Historic Places:

a. b.
c. d.
e. f.

Has a cultural resource records search been conducted?
☒ Yes, Report attached (or mail copy separately if applying electronically) ☐ No

Has a cultural resource pedestrian survey been conducted for the site?
☐ Yes, Report attached (or mail copy separately if applying electronically) ☒ No

Has another federal agency been designated the lead federal agency for Section 106 consultation?
☐ Yes, Designation letter/email attached (or mail copy separately if applying electronically) ☒ No

Has Section 106 consultation been initiated by another federal agency?
☐ Yes, Initiation letter attached (or mail copy separately if applying electronically) ☒ No

Has a Section 106 MOA or PA been signed by another federal agency and the SHPO?
☐ Yes, Attached (or mail copy separately if applying electronically)
☒ No
If yes, list date MOA or PA was signed (m/d/yyyy):

Box 13 Section 401 Water Quality Certification (New Mexico):

I have read and will comply with applicable conditions of state or tribal water quality certifications. (ftp://ftp.nmenv.state.nm.us/www/swqb/WPS/401-404/NWPCertificationNotice04-13-2012.pdf)

■ Yes (If yes, list which conditions apply to your project): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16

I am applying for Tribal Certification ☐ Yes

* In New Mexico, notification is required to the NM Environment Departm :
and perennial waters and special aquatic sites.

Box 13 Section 401 Water Quality Certification (Texas):

I have included the appropriate completed TCEQ Tier I or Tier II application as an attachment of the PCN.

☐ Yes (If yes, list the conditions that apply to your project that determine Tier I or II):

☐ No (If no, the Corps cannot complete processing the application for permit without the WQC application)

Please visit http://www.tceq.texas.gov/permitting/401certification/401certification_definition.html

Box 14 List of other certifications or approvals/denials received from other federal, state, or local agencies for work described in this application:

Agency	Type of Approval[4]	Identification Number	Date Applied	Date Approved	Date Denied
NMED	Phase II Investigative Work Plan	EPA ID#NM0890010515	July 30, 2012	January 2, 2011	
NMED	Section 401 Water Quality Certification	2012 Nation-Wide Permit		April 13, 2012	
NMED	Construction General Permit State Certification	NMR120000		February 16, 2012	

[4] Would include but is not restricted to zoning, building, and flood plain permits

Box 15 Nationwide Permit Regional Conditions:

I have read the Nationwide Permit **Regional Conditions** for the state in which work is being completed.

☒ Yes (If yes, list which conditions apply to your project): a, e, g

☐ No (If no, please visit (http://www.spa.usace.army.mil/Missions/RegulatoryProgramandPermits.aspx)

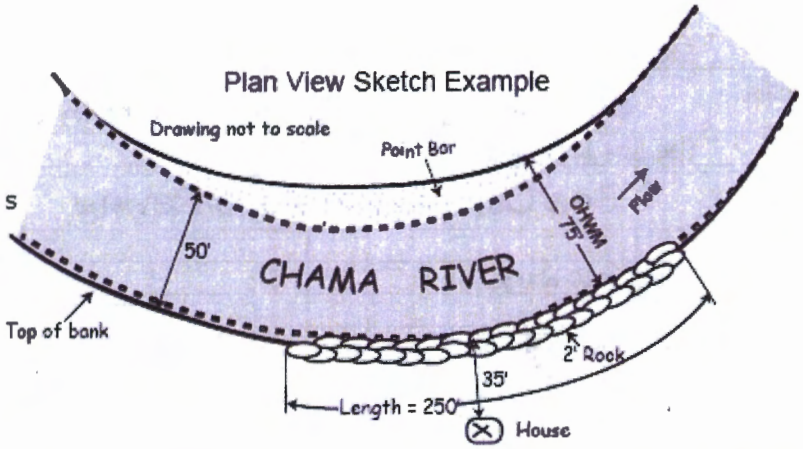
Nationwide Permit General Conditions (GC) checklist:

(http://www.gpo.gov/fdsys/pkg/FR-2012-02-21/pdf/2012-3687.pdf)

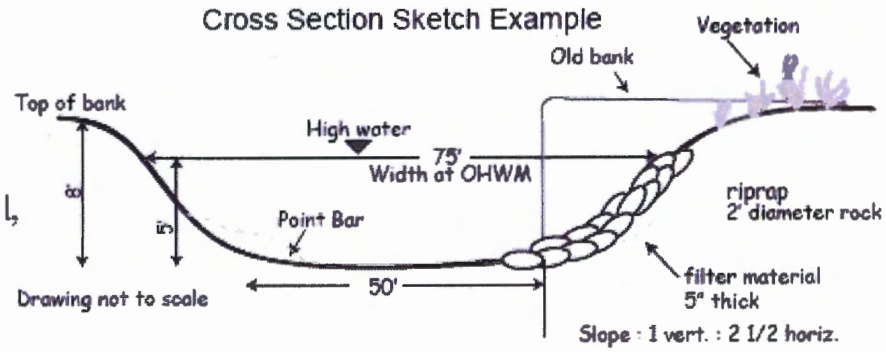
Check	General Condition	Rationale for compliance with General Condition
☐	1. Navigation	
☑	2. Aquatic Life Movements	Flows will be temporarily diverted and maintained to accommodate aquatic life movements
☐	3. Spawning Areas	
☑	4. Migratory Bird Breeding Areas	See Biological Resource Reveiw
☐	5. Shellfish Beds	
☑	6. Suitable Material	Plans include description of materials to be used
☐	7. Water Supply Intakes	
☐	8. Adverse Effects from Impoundments	
☑	9. Management of Water Flows	Flows will be temporarily diverted
☑	10. Fills Within 100-Year Floodplains	Will comply with FEMA-approved floodplain management requirements
☑	11. Equipment	Equipment will be used to minimize impacts to wetlands
☑	12. Soil Erosion and Sediment Controls	Control features will be put in place to minimize soil disturbance
☑	13. Removal of Temporary Fills	Top soil disturbances will be segregated
☑	14. Proper Maintenance	Monitoring and maintenance plan will be developed
☑	15. Single and Complete Project	
☐	16. Wild and Scenic Rivers	
☐	17. Tribal Rights	
☑	18. Endangered Species	See Box 11 above.
☑	19. Migratory Bird and Bald and Golden Eagle Permits	See Biological Resource Review
☐	20. Historic Properties	See Box 12 above.
☑	21. Discovery of Previously Unknown Remains and Artifacts	See Cultural Resource Review
☐	22. Designated Critical Resource Waters	
☐	23. Mitigation	See Box 10 above.
☐	24. Safety of Impoundment Structures	
☑	25. Water Quality	See Box 13 above.
☐	26. Coastal Zone Management	See Box 14 above.
☑	27. Regional and Case-by-Case Conditions	Read and understand 2012 Regional Conditions in New Mexico
☐	28. Use of Multiple Nationwide Permits	
☐	29. Transfer of Nationwide Permit Verifications	
☑	30. Compliance Certification	Signed certification will be provided upon completion of project
☑	31. Pre-Construction Notification	Pre-construction notification submitted

Map and Figures Examples:

Vicinity Map



Plan View Sketch "Bird's-eye view"; include all features, distances, length and width dimensions of features and waterbody/wetland, Ordinary High Water Mark (OHWM), wetland boundary, North arrow



Cross Section Sketch "Cut away view"; include heights, widths of structures, channel, wetland, bank slopes, OHWM, wetland boundary, etc.

ENCLOSURE 2

100% Design Memorandum for Sandia Wetlands Stabilization Project

ENV-RCRA-13-0065

LAUR-13-20922

Date: MAR 2 7 2013

CAP-SW-102698-REPORT-00517

March 2012

100% Design Memorandum For Sandia Wetlands Stabilization Project

Los Alamos
NATIONAL LABORATORY
EST. 1943

Prepared by the Environmental Programs Directorate

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Brown AND Caldwell

100% Design Memorandum

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Prepared for: Los Alamos National Security, LLC (LANS)

Project Title: Sandia Wetlands Stabilization Project

BC Project No: 140793-010-000

Technical Memorandum

Subject: **100% Design Memorandum for Sandia Wetlands Stabilization Project**

Date: March 8, 2012

To: Steve Veenis (LANS Project Manager)

Deborah Apodaca Pesiri (LANS Project Engineer)

From: Jim O'Neill, P.E.

Carl McDonald

Prepared by: James A. O'Neill II, P.E., Principal Engineer, NM #18656, Exp. 12/31/2012

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3/8/2012

Limitations:

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ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
cfs	Cubic feet per second
CMP	Corrugated Metal Pipe
the Consent Order	Compliance Order on Consent
DOE	United States Department of Energy
ET	Evapotranspiration
fps	feet per second
gpd	gallons per day
GPS	Global Positioning System
hr	hour
in	inch
IP	Individual Storm Water Permit
LANL, Laboratory	Los Alamos National Laboratory
m	meter
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
SWMU	Solid Waste Management Unit
yr	year

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Wetlands Design Memorandum_100%_.docx

1. INTRODUCTION

Los Alamos National Laboratory (LANL, Laboratory) has prepared this "Design Memorandum for Sandia Wetlands Stabilization Project" (memorandum), to provide design information and background for the work to be performed to stabilize the Sandia Wetland.

This memorandum provides general project background and documents the final design of the proposed measures intended to physically stabilize the Sandia Canyon wetland. The overall project goals and objectives are to arrest the headcut in the lower portion of wetland and to reduce the potential for erosion at the upper end of the wetland, where the 84-inch (in) open-top corrugated metal pipe (CMP) culvert discharges. These two measures will stabilize the wetland reducing sediment and associated contaminant transport into the lower sections of the canyon. These measures should also maintain chemically reducing conditions within the wetland sediments contributing to the goal of minimizing potential contaminant transport.

2. PROJECT BACKGROUND

2.1 Project Need

Hexavalent chromium from the power plant cooling tower was historically released from Technical Area 03 (TA-03) power plant (TA-03-22) at the head of Sandia Canyon from 1956–1972. Chemically reducing conditions within the wetland converted some of the hexavalent chromium to stable, relatively insoluble trivalent chromium. Although studies have shown that the trivalent form of chromium is unlikely to oxidize and be converted to hexavalent chromium, maintaining the chemically reducing conditions is a prudent measure to ensure stability of the chromium inventory. The wetland also contains constituents adsorbed to sediments such as polychlorinated biphenyls (PCBs) that can also be actively managed if the sediment within the wetland is stable.

2.1.1 Current Stream and Wetland Conditions

The wetland system is located in reach S-2 of Sandia Canyon and is shown in the design drawings. The largest drainage area contributing to the wetland is conveyed through what is called the Sandia land bridge by a 72-in CMP culvert and then to an 84-in open-top CMP culvert which empties a short distance upstream of the wetland. Stormwater flows have created a scour hole where the 84-in culvert discharges upstream of the wetland.

Between the outfall and the upstream extent of the wetland, the stream is establishing an inset, narrow bankfull floodplain as it erodes older sediment deposits. In some locations, this bankfull terrace is up to 4 meters (m) wide and wetland vegetation is beginning to re-establish on this terrace, creating a more stable inset floodplain with wetland vegetation. As the stream enters the larger wetland area, a defined stream channel is evident within the upper one-third of the wetland. Wetland vegetation is well established across the entire floodplain, and the stream and wetlands are stable. Towards the lower two-thirds of the wetland, surface water is generally present across the width of the wetland. A large headcut (up to 3 m high) is present and active at the terminus of the wetland. Willows have been planted in and around the headcut but have failed to stabilize its movement upstream. Downstream of the wetland, the stream system enters a narrow canyon reach and is stable, with bedrock exposed along much of the stream bed. Stream gage E123 is located a short distance below the wetland as shown on the design drawings.

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2.1.2 Stream Base and Stormwater Flows

Stream base flow from effluent released into Sandia Canyon through the culvert has averaged approximately 350,000 gallons per day (gpd) for 2011 and consists mainly of cooling water from the TA-03 Power Plant cooling tower. These base flows feed the groundwater within the reach, providing adequate hydrology and soil moisture conditions where the wetland vegetation can flourish. Stream gage E121 upgradient and stream gage E123 downgradient design drawings from the wetland have experienced peak flows approximately 140 cubic foot per second (cfs) and 88 cfs, respectively, during the period of record (1999 to 2010). Hydrologic calculations are shown in Appendix A.

2.2 Regulatory Considerations

This section briefly describes the regulatory basis for installation of the grade-control structure and stilling basin and other regulatory requirements applicable to, or potentially impacting, the project.

The grade-control structure and stilling basin are required based on the results of investigations performed under the Compliance Order on Consent (the Consent Order). Preparation of the design presented in this memo was directed by NMED's "Approval with Modification, Interim Measures Work Plan for Stabilization of the Sandia Canyon Wetland" (NMED 2011, 203806). The "Interim Measures Work Plan for Stabilization of the Sandia Canyon Wetland (LANL 2011, 203454) was prepared in response to NMED's "Approval with Modification, Phase II Investigation Work Plan for Sandia Canyon" (NMED 2011, 111518). The latter approval with modification required the Laboratory to submit a work plan to stabilize the eastern end of the wetland in Sandia Canyon to prevent further upstream migration of the headcut and to address erosion at the outfall of the CMP just upstream of the wetland. The work to stabilize the wetland was proposed by the Laboratory as an interim measure under section VII.B of the Consent Order. As described in section VII.B.1 of the Consent Order, interim measures are conducted to reduce or prevent migration of chemicals of concern which have or may result in an unacceptable human or environmental receptor exposure while long-term corrective action remedies are evaluated and implemented.

In addition to this interim measure, there are other Consent Order activities associated with Sandia Canyon. A Phase II investigation of Sandia Canyon is currently being performed and a Phase II investigation report is scheduled to be submitted to NMED in 2012. A Phase II investigation work plan for Solid Waste Management Units (SWMUs) and areas of concern (AOCs) in Upper Sandia Canyon Aggregate Area (LANL 2011, 206234) has been submitted by the Laboratory and approved by NMED (NMED 2011, 206390) and will be implemented by the Laboratory. Based on the results of these investigations, additional corrective actions could be required in the Sandia Canyon wetland.

Discharges of stormwater runoff from SWMUs and AOCs at the Laboratory are regulated under a National Pollutant Discharge Elimination System (NPDES) Individual Storm Water Permit (IP), effective November 2010 (NPDES No. NM0030759). Some of the SWMUs and AOCs regulated under the IP are located upstream of the Sandia Canyon wetlands and may contribute to the flow discharged to the wetland. Any corrective actions required under the IP will be coordinated with Consent Order activities being implemented in Sandia Canyon.

The effectiveness of the grade-control structure and stilling basin will be considered in evaluating the need for, and nature of, additional corrective actions required under either the Consent Order or the IP.

Consent Order remediation activities in Sandia Canyon were considered in United States Department of Energy's (DOE's) "Final Environmental Assessment for the Expansion of the Sanitary Effluent Reclamation Facility and Environmental Restoration of Reach S-2 of Sandia Canyon at Los Alamos National Laboratory" (DOE 2010, 206433). The grade-control structure and stilling basin are within the range of remediation activities considered in the environmental assessment, and no additional actions under the National Environmental Policy Act are required. Because the proposed construction activities would occur within a

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wetland, compliance with dredge and fill permitting requirements under Section 404 of the Clean Water Act is necessary.

2.3 Work Completed to Date

In the past, willows have been planted in and around the headcut in an effort to stabilize the headcut with vegetation but have failed to prevent its movement upstream. No other construction work has been done to date.

2.4 Project Goals and Objectives

The overall project goals and objectives are (1) to arrest the headcut in the lower portion of wetland and to reduce the potential for erosion at the culvert outfall near the entrance into the wetland, and (2) to maintain hydrologic and geochemical conditions that will minimize the migration of chemicals of concern. The headcut in the lower section of the wetland will be stabilized by constructing a stepped grade-control structure that will allow a grade transition from the current elevation of the wetland to the stream bank near stream gage E123. The area behind the grade-control structure will be backfilled, and wetland vegetation will be established behind the structure and further stabilize the area.

The source of the fill may include post-1942 alluival sediments downstream of the grade-control structure. Use of this source fill is contingent on characterization of the levels of contamination present in these sediments and the associated regulatory status of this material once excavated.

To reduce erosion at the culvert outlet, a hardened plunge pool stilling basin will be constructed to stabilize the area and minimize the potential for further erosion.

2.5 Performance Requirements/Criteria

The following are the performance criteria for the grade-control structure and the stilling basin:

- The grade-control structure will be backfilled to allow wetland expansion and further stabilization.
- The grade-control structure will be sufficiently impervious to prevent the draining of wetland soils behind the structure.
- The grade-control structure will reduce channelized flow.
- The stilling basin will dissipate the energy of the maximum flow of the culvert outfall near the entrance into the wetland.
- The stilling basin will be armored to reduce erosion.
- Each structure will be able to pass the 25-yr, 2-hr peak event without failing.
- The grade-control structure will reduce velocity and shear for the 10-yr, 25-yr, 50-yr, and 100-yr flow events.
- The grade-control structure and stilling basin will allow the wetland to be viable during reduced inflows into the wetland from the cooling tower.

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3. PROJECT DATA

3.1 Hydrology

The 25-yr, 2-hr storm event was used for all design calculations as required by the Laboratory design guidance. Hydrologic calculations are shown in Appendix A.

3.2 Wetland Evapotranspiration and Inflow

The wetland currently receives approximately 350,000 gpd of inflow from the cooling tower as described above. The Laboratory has a goal to reduce this flow as much as possible and still maintain a viable wetland area to actively manage the impacted sediments. Water saved will be recycled in other locations within the laboratory.

Modeling of the evapotranspiration (ET) of the wetland was performed using Penman-Monteith equations as described in Appendix B. Modeling indicates that the maximum 30-day ET is approximately 11 inches. Additional analysis of the modeling and desired flow reduction indicates that the average flow required to maintain a viable wetland during June is approximately 30,000 gpd or a greater than 90% reduction in flow during June. It is possible to reduce flows to zero during October through March and ramp up the flows at varying levels during April through September reducing the overall annual flows by significantly more than 90% as shown in Appendix B. This would require the Laboratory to actively manage the flows on a monthly basis.

3.3 Geotechnical/Geologic Information

Due to the quick turnaround time for the current design no geotechnical or geologic information was collected for the design. Conservative geotechnical or geologic properties were assumed and standard design constraints were used for the design.

3.4 Base Mapping and Survey

A site survey was conducted in the field using Global Positioning System (GPS) survey equipment at the end of July and early August. The survey data was used to create 3-dimensional models of each site (grade-control structure and stilling basin) and to create cross-sections for HEC-RAS modeling.

3.5 Site Access

Access roads needed for construction of the proposed structures will be designed by the Laboratory and require internal approval for environmental, engineering, safety, and security concerns. These issues are currently being addressed through normal Laboratory procedures. If unforeseen circumstances arise, the implementation schedule for this work plan may be impacted. This memorandum and design submittal does not include site access elements in the drawings or specifications.

4. GRADE CONTROL STRUCTURE

There are two improvements planned for the wetlands as discussed above, (1) a grade control structure and (2) hardening of the stilling basin near the head of the wetland. This section describes the proposed grade control structure.

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4.1 Design Development

The grade control structure, as shown in design drawings, is required to transition the grade of the existing wetland and mitigate headcutting. The structure will transition the grade approximately 11 vertical feet from the elevation of the current wetland just upgradient of the headcut to the natural stream bed just upstream of stream gage E123. In order to maintain grade and to reduce the overall fill and size of a single structure, a set of three steel sheet pile structures will be installed with smaller elevation drops. The final structure will also have a cascade structure made of boulders and rocks to transition to the final grade.

The grade control structure was designed using peak flows for the 10-yr, 25-yr, 50-yr, and 100-yr events. The primary goal of the work is to transition high flows (500 cfs 25-yr, 2-hr) through the area of the grade control structure without causing stream instability. Steam velocity and shear were determined using HEC-RAS modeling as shown in Appendix C.

Steel sheet piles are being used, with the following constraints:

- Steel sheet piles can corrode when exposed to the atmosphere. The sheet piles to be used will be limited to the area exposed to the atmosphere (no more than 3 ft).
- The sheet piles will be installed into a 2-foot deep trench into bedrock. The trench will be back-filled to the elevation of the bedrock with low permeability fill such as bentonite.
- Holes or notches will be cut at consistent elevations across the sheet pile to encourage smaller, braided channels through the restored sections of wetland during base and low flow events. High flow events will sheet flow over the cap elevation of the sheet pile.
- Stone or concrete splash pools will be used just downgradient of each sheet pile to prevent scour holes. The splash pools will slow the water.
- A stone cascade and pool structure will be installed at the bottom end of the grade-control structure to complete the final transition into the native channel just upgradient of gage station E-123.

Gabion structures have been used by the lab for past grade control structures. However, in this setting gabions will not be used for the following reasons:

- Continued exposure of gabion baskets to the low flows from the cooling towers can accelerate corrosion of the baskets, causing failure modes.
- If gabion baskets fail, high flows could create a large headcut that will move swiftly through the wetland.
- Gabions are not impervious and require the installation of separate design elements such as liners, sheet piles, concrete, etc. to create imperviousness.

Composite or vinyl sheet piles are not being used for this project due to the following:

- Composite and vinyl sheet piles require additional anchoring to maintain grade controls.
- Composite and vinyl sheet piles will melt and fail during fires.
- These sheet piles can become brittle after approximately 10 years and fail when impacted by items carried downstream.

4.2 Design Features

The grade-control structure will be seated in bedrock. The structure is designed to prevent groundwater from seeping through the structure as noted above. Maintaining the groundwater elevation is important to maintaining soil moisture conditions, wetland vegetation, and reducing conditions. If the groundwater is allowed to seep through the structure, the groundwater elevation will be lowered and the wetland vegetation

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behind the structure may become stressed and eventually die, thus reducing its stabilizing effect and role in reducing flow velocity The transition from the wetland above the grade-control structure to the stream channel below the grade-control structure is a gradual smooth transition in a stepped fashion to prevent erosive flows that could scour and destabilize the stream reach below the structure. In addition, the stepped nature of the design reduces the risk of catastrophic failure of the grade-control structure in the event of a localized failure. This will minimize the possibility of impacted sediments being transported downstream into other locations within Sandia Canyon.

Fill will be brought in and placed behind the grade-control structure to replace the area of the wetland that has been eroded. This area will be filled to match the elevation of the surrounding wetland areas to prevent the formation of a pool behind each grade-control structure. Native wetland vegetation will be re-established on the fill to stabilize it and expand the footprint of the wetland. The source of the fill may include post-1942 alluival sediments downstream of the grade-control structure. Use of this source fill is contingent on characterization of the levels of contamination present in these sediments and the associated regulatory status of this material once excavated.

5. STILLING BASIN

This section describes the proposed stilling basin.

5.1 Design Features

The stilling basin at the end of the outlet of the culvert, shown in design drawings, has been designed using the U.S. Department of Agriculture (USDA) plunge pool spreadsheet (USDA-NRCS Design Note No. 6 - Riprap Lined Plunge Pool for Cantilever Outlet). The pool will be excavated in the area of the current scour hole and armored with riprap. The area around the current scour hole has limited access and construction disturbances will be minimized.

The 25-yr, 2-hr peak flow event of 360 cfs was used for design purposes of the stilling basin. The peak flows described here are less than the grade-control structure because of its upstream position. The two gage stations just upstream of the culvert show that the combined peak events have not exceeded 355 cfs during the period of record (1999 to 2010). The stilling basin has been conservatively designed because the peak flow calculation did not take into account the impact on the culvert in attenuating peak flow. In addition, the maximum capacity of the culvert appears to be approximately 355 cfs, which is less than the peak flow used for design.

The outlet of the stilling basin releases base flows and flows resulting from smaller storm events directly into the stream at the elevation of the main stream channel. The structure is designed to release the peak flows from higher storm events over a wider area, reducing the concentrated high-velocity flows. This overflow is placed at the elevation of the new bankfull floodplain, allowing it to convey high flows and reduce erosion potential within the stream channel.

6. O&M REQUIREMENTS

The wetland's improvements have been designed to minimize or eliminate O&M requirements. The structures should be inspected after each storm event until wetland vegetation and seeding is established. Areas of erosion should be addressed as soon as practicable to prevent system failure during this time. After vegetation is established the improvements should be inspected semi-annually to determine if any areas of potential failure are beginning to form that need to be address.

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7. LIST OF DESIGN DRAWINGS

7.1 Grade Control Structure

G-0001 Title Sheet

C-0001 General Notes, Legend, Abbreviations, Symbols

C-1000 Survey

C-1001 Existing Conditions

C-1002 Overall Plan View

C-1003 Partial Plan – 1

C-1004 Partial Plan – 2

C-1005 Plan and Profile

C-1006 Section Location Plan

C-3000 Sections

C-5000 Details

C-5001 Details

C-7000 Planting and Stabilization Diagram

7.2 Stilling Basin

G-0001 Title Sheet

C-0001 General Notes, Legend, Abbreviations, Symbols

C-1000 Survey

C-1001 Existing Conditions

C-1002 Plan View

C-1003 Plan and Profile

C-1004 Section Location Plan

C-3000 Sections

C-5000 Detail

8. SPECIFICATIONS INDEX

Specifications are provided as a part of the construction documentation and are not included in this memorandum. The list below provides an index of the specifications provided as part of the design packages.

8.1 Grade Control Structure

01 4000	Quality Requirements
01 4200	References
01 7839	Project Record Documents
03 3001	Reinforced Concrete
31 0519	Geosynthetics
31 2000	Earth Moving
31 3700	Riprap/Streambed Stone
31 6223	Steel Sheet Pile
31 9219	Seeding

8.2 Stilling Basin

01 4000	Quality Requirements
01 4200	References
01 7839	Project Record Documents
31 0519	Geosynthetics
31 2000	Earth Moving
31 3700	Riprap
32 9219	Seeding

9. REFERENCES

DOE (U.S. Department of Energy), August 24, 2010. "Final Environmental Assessment for the Expansion of the Sanitary Effluent Reclamation Facility and Environmental Restoration of Reach S-2 of Sandia Canyon at Los Alamos National Laboratory, Los Alamos, New Mexico," U.S. Department of Energy document DOE/EA-1736, Los Alamos Site Office, Los Alamos, New Mexico. (DOE 2010, 206433)

LANL (Los Alamos National Laboratory), October 2009. "Investigation Report for Sandia Canyon," Los Alamos National Laboratory document LA-UR-09-6450, Los Alamos, New Mexico. (LANL 2009, 107453)

LANL (Los Alamos National Laboratory), May 2011. "Interim Measures Work Plan for Stabilization of the Sandia Canyon Wetland," Los Alamos National Laboratory document LA-UR-11-2186, Los Alamos, New Mexico. (LANL 2011, 203454)

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LANL (Los Alamos National Laboratory), August 2011. "2011 Interim Facility-Wide Groundwater Monitoring Plan," Los Alamos National Laboratory document LA-UR-11-2183, Los Alamos, New Mexico. (LANL 2011, 205231)

LANL (Los Alamos National Laboratory), September 2011. "Phase II Investigation Work Plan for Upper Sandia Canyon Aggregate Area, Revision 1," Los Alamos National Laboratory document LA-UR-11-4912, Los Alamos, New Mexico. (LANL 2011, 206234)

NMED (New Mexico Environment Department), January 4, 2011. "Approval with Modification, Phase II Investigation Work Plan for Sandia Canyon," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M.J. Graham (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2011, 111518)

NMED (New Mexico Environment Department), June 9, 2011. "Approval with Modification, Interim Measures Work Plan for Stabilization of the Sandia Canyon Wetland," 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, 203806)

NMED (New Mexico Environment Department), September 13, 2011. "Approval with Modifications, Phase II Investigation Work Plan, Upper Sandia Canyon Aggregate Area," 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, 206390)

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Appendix A: Hydrologic Calculations

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Calculations
Calculation Cover Sheet

Calc No.: Rev. No.:1 Page 1 of 13

Calc Title: Sandia Canyon Wetland Hydrology

Calculation Cover Sheet

1.0 INITIATION	
1.1 Calculation Status: ☐ Preliminary ☒ Final	
1.2 DP/DCP/DCF/ECN No.: NA	
1.3 Project ID No:	
1.4 Superseded Calc No.:	
1.5 Facility Name(s): NA	1.6 Organization: Brown and Caldwell
1.7 Structure/ System Name: Sandia Canyon Wetland Hydrology	1.8 Structure/ System Number: Sandia Canyon Wetland Hydrology
1.9 Management Level: ☐ ML-1 ☐ ML-2 ☒ ML-3 ☐ ML-4 ☐ SB Calculation ☐ N/A ; Explain:	1.10 Associated with Technical Baseline: ☐ Yes ☒ No
2.0 SECURITY CLASSIFICATION REVIEW	
2.1 Security Classification:	
2.2 DC/RO: *(Name, Z Number, Organization, Signature, Date)*	
3.0 CHECKING	
3.1 Checker (Note 1): *(Name, Z Number (if applicable), Organization, Signature, Date)*	
4.0 INDEPENDENT REVIEW	
4.1 Independent Review: ☐ Required ☐ Not Required	
4.2 Independent Reviewer: *(Name, Z Number (if applicable), Organization, Signature, Date)*	
5.0 DESIGN AUTHORITY REPRESENTATIVE REVIEW	
5.1 Design Authority Representative Review: ☒ Required ☐ Not Required	
5.2 Design Authority Representative: *(Name, Z Number, Organization, Signature, Date)*	

Note 1: Independent Reviewer can also be the calculation Checker if the scope of the independent review also includes the scope of calculation checking as described in Section 3.0 of the instructions.

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Conduct of Engineering
Calculations
Calculation Cover Sheet

Calc No.: CAL - XXXXXX

Calc Title: Sandia Canyon Wetland Hydrology

Calculation Cover Sheet

6.0 APPROVAL SIGNATURES

6.1 Preparer: *(Name, Z Number, Organization, Signature, Date)*

James A. O'Neill III, J. A. O'Neill III, 280079, Brown & Caldwell 3/8/2012

6.2 Subcontractor Approver: *(Name, Z Number (if applicable), Organization, Signature, Date)*

6.3 Responsible Manager: *(Name, Z Number, Organization, Signature, Date)*

7.0 REGISTERED PROFESSIONAL ENGINEER SEAL:

NEW MEXICO 18656 PROFESSIONAL ENGINEER
J. A. O'Neill III
3/8/2012

8.0 REVISION LOG

8.1 Rev.	8.2 Date	8.3 Description of Change(s)
0	Aug '11	Original Issue
1	Oct '11	90% Design Revision

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Conduct of Engineering
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Calculation Form

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1.0 Purpose

To calculate peak discharges and storage volumes associated with the design of the Sandia Canyon Wetland. Peak discharges were determined for the 25-year, 2-hour rainfall event.

2.0 Methodology

Software: The U.S. Army Corps of Engineers HEC-HMS software program was used to determine peak discharges for the Sandia Canyon Wetland. Peak discharges were determined at two design points within the drainage basin: one point located upgradient of the proposed stilling basin and the other located at the existing stream gage E-123. Input into the HEC-HMS model is attached to this form.

Loss Method: The loss method used in the model was the National Resource Conservation Service (NRCS) curve number (CN) method. The majority of the contributing drainage areas are urbanized areas with a high degree of imperviousness. Therefore, a high CN was chosen for the drainage areas.

Time of Concentration: The times of concentration were determined using the TR-55 method for determining sheet flow and shallow concentrated flow. Time of concentration calculations are attached to this form. Supporting equations and tables from TR-55 are also attached to this form.

Precipation Data:

The most widely used public source of rainfall data is published by the National Oceanic and Atmospheric Administration (NOAA). However, LANL has also collected approximately 20 years of rainfall data at various rain gages within the LANL property boundary. LANL rainfall data was used for this analysis rather than NOAA data for the following reasons:

- The U.S. Geological Survey (USGS) recommends a minimum of 10 years of rainfall data for statistical analysis. LANL gage data spans a time period of 1990 to present and includes years of both above and below average precipitation. Therefore, the data set meets the minimum requirements for statistical analysis of rainfall data.
- NOAA data is typically based on regional rainfall values. However, because LANL is located just east of the Jemez mountain range, precipitation values vary greatly within a short distance. In addition, the NOAA precipitation data does not accurately present spatial variations in precipitation data within a large region.
- Site-specific, local data is a better indicator of actual site conditions.

Rainfall depths:

Data was analyzed for the two rain gages closest in location to the Sandia Canyon Wetland, rain gage TA-6 and TA-53. Rainfall gage data were analyzed to estimate a 2-hour rainfall depth for the Sandia Canyon Wetland. Gage TA-6 and TA-53 were analyzed separately using the Gumbel Extreme Value Type 1 statistical distribution. The analysis was done using a spreadsheet with no additional software. The greatest rainfall depth between TA-6 and TA-53 was chosen as the design depth

Storm distributions:

The six largest storm events within the twenty year data record were evaluated for both rain gages, giving a total of twelve actual storm events for the 2-hour storm. From those twelve

events, the distribution that produced the greatest peak discharge (the storm event with the greatest intensity) was used as the design distribution.

All relevant back-up materials are attached to this calcualtion form.

3.0 Acceptance Criteria

Per the LANL Engineering Standards Manual (Chapter 3, Section G20), hydrologic analysis for design of drainage features with in the LANL boundaries should use the rational method to computer peak flows from small drainage areas (<5 acres). However, the rational method was not used in this hydrologic analysis because of two reasons: (1.) the drainage area for the Sandia Canyon Wetland is larger than 5 acres and (2.) the use of real LANL precipitation data to generate the hydrograph was deemed more accurate for the analyses.

4.0 Open Items

There are no open items for hydrology.

5.0 Assumptions

- The drainage areas and flow paths were estimated using LANL topographic contour data.
- Assumed the most conservative (highest runoff producing) storm event from LANL rain gage TA-53 as the storm distribution for the HEC-HMS model.
- Assumed the most conservative (highest runoff producing) storm event from LANL rain gage TA-6 as the precipitation amount for the HEC-HMS model.

6.0 Limitations

Due to the uncertain nature of hydrology, all hydrologic analyses are inherent to a certain amount of error. Therefore, the calculations performed as part of the Sandia Canyon Wetland anlysis leaned towards the conservative (highest runoff producing) side when at all possible.

7.0 Calculation Inputs

HEC-HMS inputs are attached to this form.

8.0 Computer Hardware and Software

U.S. Army Corps of Engineers HEC-HMS software, Version 3.3

9.0 Summary and Conclusions

Preliminary hydrologic output is attached to this form.

10.0 References

HEC website: http://www.hec.usace.army.mil/software/hec-hms/

United States Department of Agriculture, Technical Release 55 - Urban Hydrology for Small Watersheds, June 1998.

11.0 Calculation

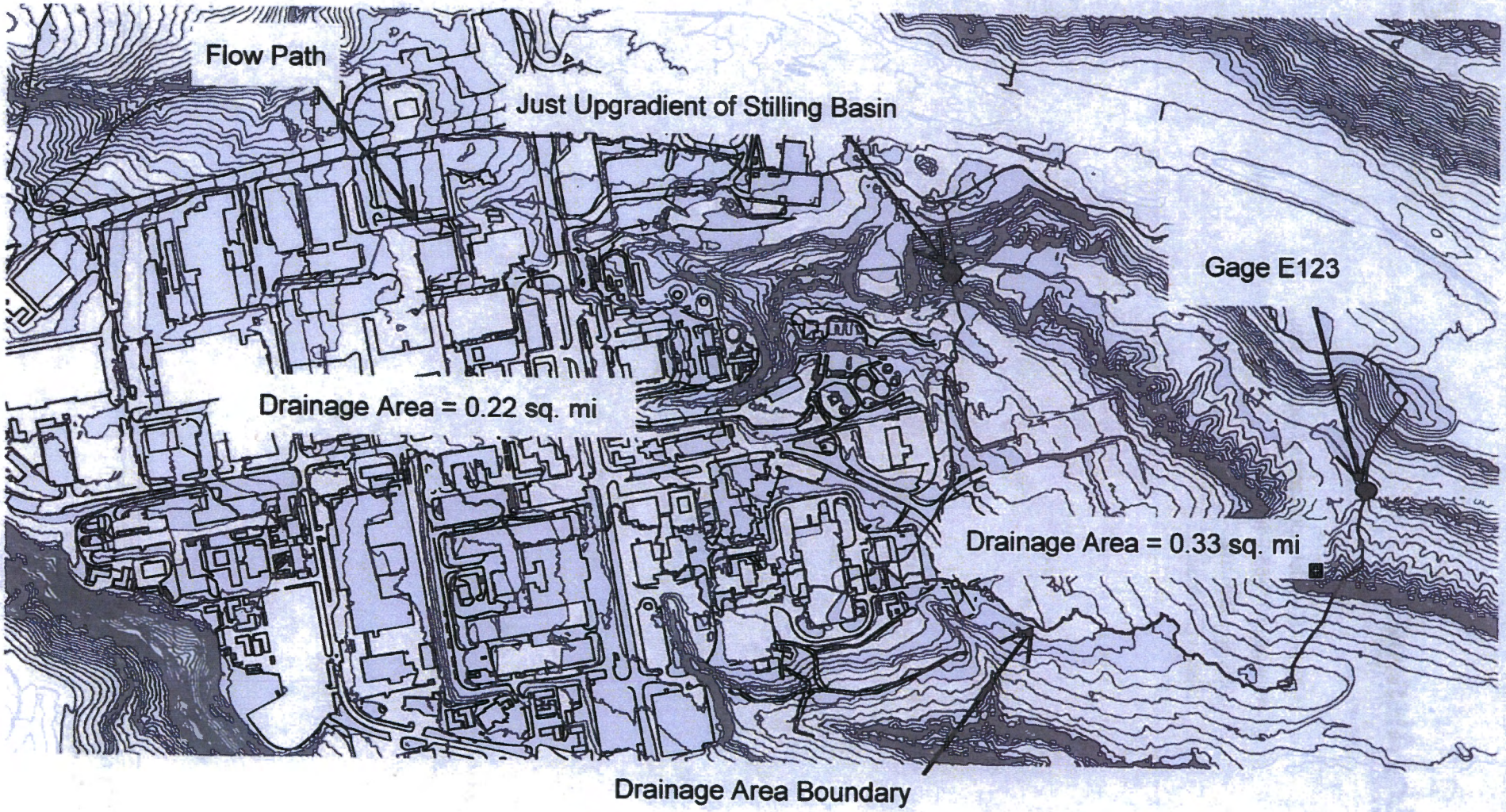
- Calculation 1: HEC-HMS model output (spreadsheet format)

Appendix – Supporting Information

- Drainage Area Map

- HEC-HMS model input (spreadsheet format)
- Applicable TR-55 Equations
- LANL Rainfall data
- Rainfall Distribution

Sandia Canyon Wetland Drainage Area Map 8/24/2011



Sandia Canyon Wetlands
Hydrologic Data
8/24/2011

HEC-HMS Input

	Soil Type	Descpt.	Soil Group	Cover	CN
DA1	NA	Impervious	NA	asphault/rock	98
DA2	162	Hackroy-Nyjack	D	grass cover	86
DA2	NA	Impervious	NA	asphault/rock	98

	Area (ft^2)	Area (mi^2)
DA1	6038460	0.2166
DA2	9313880	0.3341

	[5]Sheet Flow						[11]Storm Drain Flow			
	[6]n	[7]L (ft)	[8]P2 (in)	[9]S (ft/ft)	[10]Tt (hr)	Tt (min)	[12]L (ft)	[13]elev. (ft)	[14]S (ft/ft)	[15]v (ft/s)
DA1	0.011	300	1.39	0.050	0.051	3.07	3133	na	0.0125	2.5
DA2	0.011	300	1.39	0.050	0.051	3.07	3133	na	0.0125	2.5

Assumptions:

1.) CN generated based on land use and soil types within the drainage areas.
2.) S = (1000/CN) - 10
3.) Ia = 0.2 * S
4.) Drainage areas are mostly impervious (paved and/or gravel) landscape.
5.) Sheet flow travel time determined using TR-55 Sheet flow procedure
6.) Manning's n value for impervious area; n = 0.011 per TR-55, Table 3-1
7.) L = sheet flow travel length
8.) P2 = 2-year, 24-hour rainfall
9.) s = slope of hydraulic grade
10.) Tt = sheet flow travel time (TR-55 equation 3-3)
11.) Estimated Velocity of Storm Water in Storm Drain System
12.) L = shallow concentrated flow length
13.) elev = elevation drop along flow lenth

Sandia Canyon Wetlands
Hydrologic Data
8/24/2011

HEC-HMS Output

Storm	Basin	Peak (cfs)
100-yr, 2-hr	Stilling Basin	436.6
100-yr, 2-hr	Stabilization Structures	609.9
50-yr, 2-hr	Stilling Basin	398.02
50-yr, 2-hr	Stabilization Structures	555.7
25-yr, 2-hr	Stilling Basin	357.3
25-yr, 2-hr	Stabilization Structures	498.4
10-yr, 2-hr	Stilling Basin	303.7
10-yr, 2-hr	Stabilization Structures	422.9

Sandia Canyon Wetlands
Hydrologic Data
8/24/2011

LANL Rainfall Depths

TA-6 (2-hour)

EV1 Precipitation Statistics	
Recurrence	**Precipitation**
2.00	0.93
5.00	1.23
10.00	1.42
25.00	**1.67**
50.00	1.86
100.00	2.04

TA-6 (24-hour)

EV1 Precipitation Statistics	
Recurrence	**Precipitation**
2.00	1.39
5.00	1.84
10.00	2.13
25.00	2.50
50.00	2.78
100.00	**3.05**

TA-53 (2-hour)

EV1 Precipitation Statistics	
Recurrence	**Precipitation**
2.00	0.73
5.00	1.01
10.00	1.20
25.00	**1.43**
50.00	1.60
100.00	1.77

TA-53 (24-hour)

EV1 Precipitation Statistics	
Recurrence	**Precipitation**
2.00	1.20
5.00	1.56
10.00	1.80
25.00	2.10
50.00	2.32
100.00	**2.54**

2-hour Distribution

TA-53 Event #2, Aug. 2007

								100-year Storm	
Month	**Day**	**Year**	**Hour**	**Minute**	**Prcp 15 min (in)**	**Event Time**	**Distribution**	**Cum. Prcp (in)**	**Inc. Prcp (in)**
						0	0	0	0
9	20	2007	8	45	0.23	15	0.167883212	0.342481752	0.34248175
9	20	2007	9	0	0.3	30	0.386861314	0.78919708	0.44671533
9	20	2007	9	15	0.02	45	0.401459854	0.818978102	0.02978102
9	20	2007	9	30	0.82	60	1	2.04	1.2210219
9	20	2007	9	45	0	75	1	2.04	0
9	20	2007	10	0	0	90	1	2.04	0
9	20	2007	10	15	0	105	1	2.04	0
9	20	2007	10	30	0	120	1	2.04	0

Sheet flow

Sheet flow is flow over plane surfaces. It usually occurs in the headwater of streams. With sheet flow, the friction value (Manning's n) is an effective roughness coefficient that includes the effect of raindrop impact; drag over the plane surface; obstacles such as litter, crop ridges, and rocks; and erosion and transportation of sediment. These n values are for very shallow flow depths of about 0.1 foot or so. Table 3-1 gives Manning's n values for sheet flow for various surface conditions.

Table 3-1 Roughness coefficients (Manning's n) for sheet flow

Surface description	n [1]
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses [2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods:[3]	
Light underbrush	0.40
Dense underbrush	0.80

[1] The n values are a composite of information compiled by Engman (1986).
[2] Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
[3] When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

For sheet flow of less than 300 feet, use Manning's kinematic solution (Overtop and Meadows 1976) to compute T_t:

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}} \qquad \text{[eq. 3-3]}$$

where:

T_t = travel time (hr),
n = Manning's roughness coefficient (table 3-1)
L = flow length (ft)
P_2 = 2-year, 24-hour rainfall (in)
s = slope of hydraulic grade line (land slope, ft/ft)

This simplified form of the Manning's kinematic solution is based on the following: (1) shallow steady uniform flow, (2) constant intensity of rainfall excess (that part of a rain available for runoff), (3) rainfall duration of 24 hours, and (4) minor effect of infiltration on travel time. Rainfall depth can be obtained from appendix B.

Shallow concentrated flow

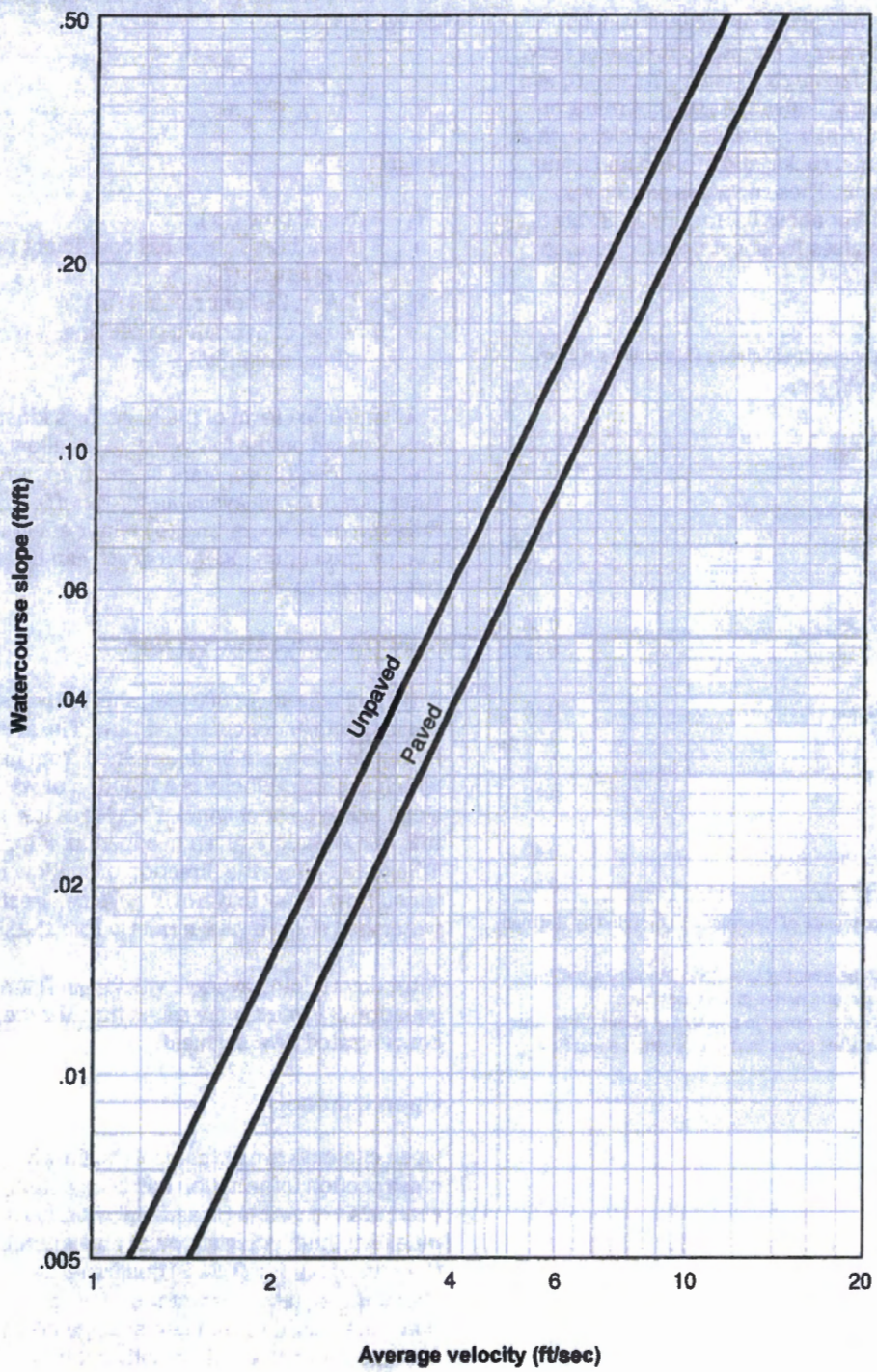
After a maximum of 300 feet, sheet flow usually becomes shallow concentrated flow. The average velocity for this flow can be determined from figure 3-1, in which average velocity is a function of watercourse slope and type of channel. For slopes less than 0.005 ft/ft, use equations given in appendix F for figure 3-1. Tillage can affect the direction of shallow concentrated flow. Flow may not always be directly down the watershed slope if tillage runs across the slope.

After determining average velocity in figure 3-1, use equation 3-1 to estimate travel time for the shallow concentrated flow segment.

Open channels

Open channels are assumed to begin where surveyed cross section information has been obtained, where channels are visible on aerial photographs, or where blue lines (indicating streams) appear on United States Geological Survey (USGS) quadrangle sheets. Manning's equation or water surface profile information can be used to estimate average flow velocity. Average flow velocity is usually determined for bankfull elevation.

Figure 3-1 Average velocities for estimating travel time for shallow concentrated flow



Appendix B: Evapotranspiration and Inflow Calculations

Los Alamos NATIONAL LABORATORY EST. 1943

Conduct of Engineering
Calculations
Calculation Cover Sheet

Calc No.: Rev. No.:0 Page 1 of 14

Calc Title: Sandia Canyon Wetland ET and Inflow Calcs

Calculation Cover Sheet

1.0 INITIATION	
1.1 Calculation Status: ☐ Preliminary ☒ Final	
1.2 DP/DCP/DCF/ECN No.: NA	
1.3 Project ID No: 102698	
1.4 Superseded Calc No.:	
1.5 Facility Name(s): NA	1.6 Organization: Brown and Caldwell
1.7 Structure/ System Name: Sandia Canyon Wetland	1.8 Structure/ System Number: Sandia Canyon Wetland
1.9 Management Level: ☐ ML-1 ☐ ML-2 ☒ ML-3 ☐ ML-4 ☐ SB Calculation ☐ N/A ; Explain:	1.10 Associated with Technical Baseline: ☐ Yes ☒ No
2.0 SECURITY CLASSIFICATION REVIEW	
2.1 Security Classification:	
2.2 DC/RO: *(Name, Z Number, Organization, Signature, Date)*	
3.0 CHECKING	
3.1 Checker (Note 1): *(Name, Z Number (if applicable), Organization, Signature, Date)*	
4.0 INDEPENDENT REVIEW	
4.1 Independent Review: ☐ Required ☒ Not Required	
4.2 Independent Reviewer: *(Name, Z Number (if applicable), Organization, Signature, Date)*	
5.0 DESIGN AUTHORITY REPRESENTATIVE REVIEW	
5.1 Design Authority Representative Review: ☒ Required ☐ Not Required	
5.2 Design Authority Representative: *(Name, Z Number, Organization, Signature, Date)*	

Note 1: Independent Reviewer can also be the calculation Checker if the scope of the independent review also includes the scope of calculation checking as described in Section 3.0 of the instructions.

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Conduct of Engineering
Calculations
Calculation Cover Sheet

Calc No.:

Calc Title: Sandia Canyon Wetland ET and Inflow Calcs

Calculation Cover Sheet

6.0 APPROVAL SIGNATURES
6.1 Preparer: *(Name, Z Number, Organization, Signature, Date)* James A. O'Neill II, 280079, Brown & Caldwell J. A. O'Neill II 3/8/2012
6.2 Subcontractor Approver: *(Name, Z Number (if applicable), Organization, Signature, Date)*
6.3 Responsible Manager: *(Name, Z Number, Organization, Signature, Date)*
7.0 REGISTERED PROFESSIONAL ENGINEER SEAL: JAMES A. O'NEILL II NEW MEXICO 18656 PROFESSIONAL ENGINEER J. A. O'Neill II 3/8/2012

8.0 REVISION LOG

8.1 Rev.	8.2 Date	8.3 Description of Change(s)
0	Oct 2011	Original Issue

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Conduct of Engineering
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Calculation Form

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1.0 Purpose

The purpose of these calculations is to determine the required SERF flow into the wetland to maintain a viable wetland during all periods of the year. The overall goal is to reduce SERF flow from the current 350K gpd to some much reduced flow.

2.0 Methodology

ET Calculation: The Penman-Monteith equation was used and a spreadsheet as developed based on a Food and Agriculture Organization of the United Nations (FAO) publication titled, *Crop Evapotranspiration – Guidelines for Computing Water Requirements.* The publication is freely available at the FAO website (URL: http://www.fao.org/docrep/X0490E/X0490E00.htm) which contains a complete explanation of the terms and values in the spreadsheet. A brief explanation of the model follows.

The Penman-Monteith equation was derived from site-specific, direct-measurement studies, and calibrated to calculate a reference evapotranspiration (ETo) for common vegetation types such as alfalfa or grass. The calculated ETo values can then be scaled to match the ET of various plants or crop types (ETc) using crop coefficients. Crop coefficients are available for most agricultural crops as well as non-agricultural vegetation, such as those found in wetland areas. In general, ET calculations relating to agricultural practices use the alfalfa ETo values, while ET calculations in non-agricultural settings use the grass ETo values. Grass ETo was used to calculate the wetland ET in this study.

The Penman-Montieth equation calculates ET on a daily basis and requires the following meteorological inputs in order to perform the ET calculations:

- Average, minimum, and maximum daily temperatures,
- Average daily vapor pressure,
- Daily net solar radiation, and
- Average daily wind speed.

Site details such as latitude, longitude, and elevation are also required inputs. Meteorological data was taken from the TA-06 weather station.

Required SERF Flow: The required SERF flow was calculated using precipitation data, ET modeling derived as noted above and an assumption of residual stormwater flow as follows:

- The current wetland area is approximately 3 acres. It was assumed for calculation purposes that the overall wetland area will eventually be increased to 4 acres.
- The ET model was run from 1996 through 2010 a total of 15 years to provide ET estimates of the drought years of 2000's.
- Once the area for calculations was determined the ET for each month from 2003 through 2010 was evaluated due to the drought during that seven year period (As noted by the TA-06 weather station) and the high monthly ET values observed in the modeling in June and July of those years (See Tables 1 and 2 attached).
- Precipitation from the TA-06 weather station was subtracted from the ET along with an addition 0.5 inches to make up for residual stormwater flow that drains to the wetland. This residual ET is depth of the required flow from SERF for the month.
- In months were the residual ET was less than zero it is assumed that no additional flow from SERF is required.
- The residual ET was then multiplied by the wetland area, converted to gallons, and divided by 30 days to give gallons per day (gpd).

All relevant back-up materials are attached to this calculation form.

3.0 Acceptance Criteria

There are no known acceptance criteria for the required reduction in SERF flow into the wetland. The goal was to reduce the flow as much as possible.

4.0 Open Items

There are no open items for the reductions of SERF flow into the wetland.

5.0 Assumptions

- The wetland area was estimated using GIS from the 2010 wetland delineation.
- Assumed that months with precipitation will have residual 0.5 inch depth of flow into the wetland through time unaccounted for by precipitation or ET. This flow will replenish soil moisture and be available for wetland vegetation, the remaining flow is assumed to pass through the wetland and be unavailable.
- Assumed the overall water balance does not include any leaching into deep groundwater due to impervious bedrock underlying the wetland.

6.0 Limitations

Due to the uncertain nature of hydrology and evapotranspiration, all analyses contain a certain amount of error. Therefore, the calculations performed as part of the Sandia Canyon Wetland analysis leaned towards the conservative side when at all possible.

7.0 Calculation Inputs

Inputs from the TA-06 rain gage are not shown. The front page of the spreadsheet model is shown below and contains the general inputs to the model.

8.0 Computer Hardware and Software

MS Window and Excel

9.0 Summary and Conclusions

The overall flow from SERF can be reduced from 350K gpd to approximately 30K for the driest months of the year (June/July). Additional savings in flow can be realized during the remaining months including the potential of reducing the flow to zero during the winter months (October through March).

10.0 References

Crop Evapotranspiration – Guidelines for Computing Crop Water Requirements. The publication is freely available at the FAO website (URL: http://www.fao.org/docrep/X0490E/X0490E00.htm)

11.0 Calculation

- Calculation 1: ET Model Explaination

Tables

- Table 1 – Monthly ET Calculations for years 1996 to 2010
- Table 2 – Maximum 30 day ET for years 1996 to 2010
- Table 3 – Drought conditions for Gage TA-06 for years 2003 through 2011
- Table 4 – Monthly Flow from SERF (gpd) April through September for years 2003 through 2011
- Model Input
- Hand Calculations of Flow rates

Wetland ET Model Explanation

Water consumption by wetland vegetation occurs through two mechanisms, evaporation from open water surfaces and transpiration through wetland vegetation. Both of these mechanisms occur simultaneously, but at varying rates. Therefore, it is difficult to isolate the losses attributed to each mechanism alone. As a result, losses from evaporation and transpiration are frequently expressed as a single combined term referred to as evapotranspiration (ET)

Evapotranspiration amounts can be determined using a number of approaches. There are several methods for measuring ET directly, but they all require the installation of specialized instrumentation. Alternatively, there are empirical equations that have been developed that rely only on meteorological input to calculate ET. Wetland ET calculations were performed for the Sandia Canyon wetland using the Penman-Monteith equation. The Penman-Monteith equation was derived from site-specific, direct-measurement studies, and calibrated to calculate a reference ET (ETo) for common vegetation types such as alfalfa or grass. The calculated ETo values can then be scaled to match the ET of various plants or crop types (ETc) using crop coefficients. Crop coefficients are available for most agricultural crops as well as non-agricultural vegetation, such as those found in wetland areas. In general, ET calculations relating to agricultural practices use the alfalfa ETo values, while ET calculations in non-agricultural settings use the grass ETo values. Grass ETo was used to calculate the wetland ET in this study.

The Penman-Montieth equation calculates ET on a daily basis and requires the following meteorological inputs in order to perform the ET calculations:

- Average, minimum, and maximum daily temperatures,
- Average daily vapor pressure,
- Daily net solar radiation, and
- Average daily wind speed.

Site details such as latitude, longitude, and elevation are also required inputs.

To calculate the wetland ET for this study, an MS Excel spreadsheet was programmed to run the daily Penman-Monteith equation. The spreadsheet was developed based on a Food and Agriculture Organization of the United Nations (FAO) publication titled, *Crop Evapotranspiration – Guidelines for Computing Crop Water Requirements.* The publication is freely available at the FAO website (URL: http://www.fao.org/docrep/X0490E/X0490E00.htm) and contains a complete explanation of the terms and values in the spreadsheet can be found in the FAO article.

To calculate the ET for the Sandia Wetlands site, meteorological data from was obtained from the TA6 weather station maintained by LANL. The spreadsheet was set up to calculate ET on a daily basis for 15 years (1996-2010). This period is representative of drought conditions, wetter than average conditions, and average conditions. A crop coefficient representative of wetlands consisting of cattails and bulrushes was chosen. This crop coefficient also accounts for annual period of frost or freezing.

Based on those inputs, the 15 year average ETc for the Sandia site was 31.9 inches (See Table 1). The highest ETc over a period of 30 consecutive days during the period was 11.3 inches (See Table 2). The maximum daily ETc was 0.5 inches. For months when maximum daily temperatures were consistently below 32 °F, there was little to no ETc calculated. The majority of the ETc occurred between May and September.

Table 1

Monthly ETc Values (in inches) for Sandia Wetland Site, Los Alamos National Laboratory, Los Alamos, NM

Years	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total
1996	0.00	0.00	0.00	0.07	4.68	8.66	7.43	7.17	1.82	0.00	0.00	0.00	29.84
1997	0.00	0.00	0.00	0.00	2.87	8.15	8.42	6.74	1.90	0.00	0.00	0.00	28.07
1998	0.00	0.00	0.00	0.00	4.19	10.51	7.44	6.94	2.58	0.00	0.00	0.00	31.66
1999	0.00	0.00	0.00	0.00	3.06	8.57	7.60	6.82	2.13	0.00	0.00	0.00	28.18
2000	0.00	0.00	0.00	0.03	2.27	9.70	8.66	8.07	2.91	0.00	0.00	0.00	31.63
2001	0.00	0.00	0.00	0.00	3.68	9.54	8.49	6.87	2.49	0.00	0.00	0.00	31.08
2002	0.00	0.00	0.00	0.00	4.06	10.42	8.41	9.13	2.01	0.00	0.00	0.00	34.04
2003	0.00	0.00	0.00	0.00	3.66	9.85	10.27	7.65	2.18	0.00	0.00	0.00	33.60
2004	0.00	0.00	0.00	0.04	4.51	9.84	9.19	7.79	2.31	0.00	0.00	0.00	33.67
2005	0.00	0.00	0.00	0.00	3.60	10.18	10.81	7.19	2.04	0.00	0.00	0.00	33.81
2006	0.00	0.00	0.00	0.00	4.28	10.03	8.60	6.20	1.76	0.00	0.00	0.00	30.88
2007	0.00	0.00	0.00	0.00	3.26	9.26	9.13	8.82	2.16	0.00	0.00	0.00	32.63
2008	0.00	0.00	0.00	0.11	3.87	10.87	8.67	7.69	2.26	0.00	0.00	0.00	33.47
2009	0.00	0.00	0.00	0.00	3.27	8.10	9.50	7.47	2.20	0.00	0.00	0.00	30.54
2010	0.00	0.00	0.00	0.00	4.19	10.92	8.96	8.18	2.96	0.00	0.00	0.00	35.21
Average	0.00	0.00	0.00	0.02	3.70	9.64	8.77	7.52	2.25	0.00	0.00	0.00	31.89

Table 2

Annual 30-Day Maxium ETc Values (inches)

Years	30-Day Max ETc (inches)	Start Date	End Date
1996	8.85	5/27/1996	6/26/1996
1997	9.48	6/18/1997	7/18/1997
1998	10.51	5/31/1998	6/30/1998
1999	8.77	6/3/1999	7/3/1999
2000	9.62	6/10/2000	7/10/2000
2001	9.74	6/8/2001	7/8/2001
2002	10.40	6/2/2002	7/2/2002
2003	10.96	6/22/2003	7/22/2003
2004	10.35	6/8/2004	7/8/2004
2005	11.32	6/20/2005	7/20/2005
2006	9.92	6/5/2006	7/5/2006
2007	9.97	6/17/2007	7/17/2007
2008	10.70	6/2/2008	7/2/2008
2009	8.96	6/16/2009	7/16/2009
2010	11.18	6/6/2010	7/6/2010
Average	10.05	6/9/2003	7/9/2003

Table 3
Estimate of Drought Conditions at Sandia Wetlands
J. Winters
9/28/2011

** Data from LANL Weather Machine TA-6 Tower: http://environweb.lanl.gov/weathermachine/default.asp*

	Avg 71-00	Avg 81-10	2003	2004	2005	2006	2007	2008	2009	2010	2011	# <	50% Avg.	# < 50%
Jan	0.96	0.95	0.00	0.41	2.63	0.15	1.06	1.39	0.26	1.32	0.01	5	0.48	5
Feb	0.75	0.86	0.88	2.22	2.11	0.02	0.54	1.11	0.02	1.23	0.04	4	0.43	3
March	1.28	1.20	0.63	0.85	1.91	0.63	1.23	0.46	1.18	1.00	0.16	7	0.60	2
Apr	1.05	1.06	0.49	3.08	1.45	0.51	0.62	0.13	1.31	1.43	0.47	5	0.53	4
May	1.43	1.39	1.35	0.02	0.92	0.22	1.70	1.66	2.14	1.10	0.18	1	0.70	3
June	1.44	1.51	0.71	0.75	0.26	1.78	1.28	0.04	2.67	0.59	0.00	7	0.76	6
July	2.97	2.82	0.26	3.13	1.63	2.26	1.93	2.59	4.01	4.10	0.77	6	1.41	2
Aug	3.33	3.61	2.78	1.83	5.76	5.85	2.93	6.01	1.66	3.43	4.98	5	1.81	1
Sept	2.08	2.01	0.84	1.63	3.44	1.36	4.18	0.33	1.95	1.32	?	6	1.01	2
Oct	1.54	1.55	0.90	2.50	1.11	1.73	0.32	1.43	1.87	2.09	?	4	0.78	1
Nov	1.19	0.98	0.78	1.47	0.07	0.47	1.61	0.60	0.26	0.03	?	6	0.49	4
Dec	0.92	1.01	0.31	0.89	1.19	1.62	2.74	1.63	1.27	1.18	?	2	0.51	1
Totals		18.95	9.93	18.78	22.48	16.6	20.14	17.38	18.6	18.82	6.61	58		34

* highlighed months are less than avg. rainfall
* red text months are less than 50% avg. rainfall

Total Mo.	116	Total Months Analyzed
Drt Mo	58	Total Months with rainfall < average
% Drt Mo.	50	% of Drought Months of Total Months Analyzed
Max Cons Mo.	11	Maximum Consecutive Months of Drought
Min Cons Mo.	1	Minimum Consecutive Months of Drought
% >1 Cons. Mo	79	% Drought Months that were followed by at least one additional month
50% Drt Mo	34	Total Months with rainfall < 50% of average
% 50% Drt Mo	29	% of Months w/ rainfall <50% of Average of Total Months Analyzed
Max Cons. Mo.	7	Maximum Consecutive Months w/ rainfall <50% of Average
Min Cons Mo.	1	Minimum Consecutive Months w/ rainfall <50% of Average
% >1 Cons. Mo	62	% Drought Months that were followed by at least one additional month

Table 4

Monthly Flow from SERF (GPD) for Sandia Wetland Site, Los Alamos National Laboratory, Los Alamos, NM

Wetland Size 4 acres

	April				May				June				July				August				September			
Years	**ET**	**P**	**Delta**	**Flow**	**ET**	**P**	**Delta**	**Flow**	**ET**	**P**	**Delta**	**Flow**	**ET**	**P**	**Delta**	**Flow**	**ET**	**P**	**Delta**	**Flow**	**ET**	**P**	**Delta**	**Flow**
2003	0.00	0.49	0.00	0.00	3.66	1.35	2.31	6,548.66	9.85	0.71	9.14	31,293.76	10.27	0.26	10.01	34,416.85	7.65	2.78	4.87	15,811.50	2.18	0.84	1.34	3,033.61
2004	0.04	3.08	0.00	0.00	4.51	0.02	4.49	14,454.13	9.84	0.75	9.09	31,085.63	9.19	3.13	6.06	20,118.45	7.79	1.83	5.96	19,754.49	2.31	1.63	0.68	666.09
2005	0.00	1.45	0.00	0.00	3.60	0.92	2.68	7,882.77	10.18	0.26	9.92	34,087.10	10.81	1.63	9.18	31,430.40	7.19	5.76	1.43	3,368.38	2.04	3.44	0.00	0.00
2006	0.00	0.51	0.00	0.00	4.28	0.22	4.06	12,895.29	10.03	1.78	8.25	28,057.10	8.60	2.26	6.34	21,149.77	6.20	5.85	0.35	0.00	1.76	1.36	0.40	0.00
2007	0.00	0.62	0.00	0.00	3.26	1.70	1.56	3,828.41	9.26	1.28	7.98	27,072.35	9.13	1.93	7.20	24,270.38	8.82	2.93	5.89	19,530.16	2.16	4.18	0.00	0.00
2008	0.11	0.13	0.00	0.00	3.87	1.66	2.21	6,175.72	10.87	0.04	10.83	37,409.59	8.67	2.59	6.08	20,218.28	7.69	6.01	1.68	4,265.52	2.26	0.33	1.93	5,161.96
2009	0.00	1.31	0.00	0.00	3.27	2.14	1.13	2,277.55	8.10	2.67	5.43	17,854.45	9.50	4.01	5.49	18,054.43	7.47	1.66	5.81	19,223.90	2.20	1.95	0.25	0.00
2010	0.00	1.43	0.00	0.00	4.19	1.10	3.09	9,388.25	10.92	0.59	10.33	35,571.74	8.96	4.10	4.86	15,776.88	8.18	3.43	4.75	15,397.25	2.96	1.32	1.64	4,138.23
Average	0.02		0.00	0.00	3.70		2.69	7,931.35	9.64		8.87	30,303.97	8.77		6.90	23,179.43	7.52		3.84	12,168.90	2.25		0.78	1,624.99

Flow= **Required flow in gallons per day from SERF to meet demands of ET-P-0.5 inches of additional stormwater runoff**

Model Input

Location Parameters			
Site Location	Latitude (Dec Deg)	Longitude (Dec Deg)	Elevation (m)
LANL - TA6	35.861417	-106.319	2263.4

Crop Parameters								
Crop:	Open Water, < 2m deep							
Crop Coefficients			FAO Growth Stage Length (days)				Start of Growth Period (Ordinal Day)	Average ETc (mm/year)
Kc1	Kc2	Kc3	Stage 1	Stage 2	Stage 3	Stage 4		
1.05	1.05	1.05	10	30	80	20	121	853.38

FAO Growing Season

Constants		
Stefan-Boltzman Const. σ (MJ/(m²*d*K⁴))	Atmospheric Pressure (kPa)	Psychrometric Constant γ (kPa/°C)
4.901E-09	77.25487878	0.051374495

Date	Month	Year	Ordinal Day	Net Radiation R_n (MJ/m²/d)	Net Short Wave Radiation R_{ns} (MJ/m²/d)	Net Long Wave Radiation R_{nl} (MJ/m²/d)	Cloudiness Function fcd	Clear-Sky Solar Radiation Rso (MJ/m²/d)	Inverse Relative Dist. Factor for Earth-Sun dr	Solar Declination sd (Radians)	Sunset Hour Angle ws	Extraterrestrial Radiation Ra (MJ/m²/d)	Soil heat flux density G (MJ/m²/d)	Slope of Saturation Vapor Pressure Δ (kPa/°C)	Saturation Vapour Pressure at Max Temp eO(Tmax) (kPa)	Saturation Vapour Pressure At Min Temp eO(Tmin) (kPa)	Mean Saturation Vapor Pressure es (kPa)	Actual Vapor Pressure of Air ea (kPa)	Wind Speed At The 2m u2 (m/s)	Mean Daily Air Temperature T (°C)	Penman-Monteith Grass Reference ET0 (mm/day)	Penman-Monteith Alfalfa Reference Etr (mm/day)	Kc	Etc (mm/day)
1/4/1996	1	1996	4	3.073168138	9.0552	5.982031862	0.854630295	13.17914722	1.032921929	-0.398325995	1.26349037	16.57185715	0	0.04007077	0.813261096	0.355803438	0.584532267	0.31082	1.9	-1.6	1.114005374	0.070095153	0	0
1/5/1996	1	1996	5	2.720008858	8.47	5.749981142	0.772194781	13.23299685	1.032878041	-0.394529772	1.265089536	16.63966971	0	0.04499256	0.89696939	0.41167714	0.654323265	0.23547	1.8	0.05	1.390443594	0.073181282	0	0
1/6/1996	1	1996	6	3.219013063	10.0562	6.837188937	0.976609933	13.29026684	1.032824427	-0.392616834	1.2667891	16.71168915	0	0.03363447	0.656709164	0.297244334	0.476976749	0.23209	1.4	-4.25	0.942391905	0.080183199	0	0
1/7/1996	1	1996	7	3.019579083	9.9099	6.880320917	0.951369002	13.35094041	1.032761102	-0.390587747	1.268587929	16.7879764	0	0.03865407	0.866240546	0.304361284	0.585300915	0.29014	1.5	-2.15	1.192173837	0.081755492	0	0
1/8/1996	1	1996	8	2.853494388	10.4489	7.595405612	1	13.41499961	1.032680086	-0.388443112	1.270484838	16.86852684	0	0.04488017	1.072760826	0.342267551	0.707518188	0.20653	1.7	0.15	1.559408159	0.081409122	0	0
1/9/1996	1	1996	9	2.465265272	10.4027	7.937434728	1	13.48242524	1.032605399	-0.386183562	1.272478587	16.95331038	0	0.05496643	1.269716891	0.46114662	0.865431756	0.20938	1.7	3.35	1.778139377	0.086903479	0	0
1/10/1996	1	1996	10	2.901885859	8.4084	5.506514141	0.737713853	13.55319680	1.032513066	-0.383809767	1.274567809	17.04230131	0	0.05065621	1.140327698	0.427616875	0.783972285	0.29078	2.2	2.05	1.725570897	0.074991558	0	0
1/11/1996	1	1996	11	3.180514323	10.1255	6.944985677	0.952716553	13.62729288	1.032411115	-0.381322428	1.27675141	17.13547241	0	0.04193837	0.928655184	0.342267551	0.635461368	0.25225	1.5	-0.9	1.272861201	0.092377271	0	0
1/12/1996	1	1996	12	2.993610582	10.395	7.401389418	0.979836693	13.70469028	1.032299576	-0.378722281	1.279027771	17.23279483	0	0.05540344	1.236215522	0.485983346	0.861099434	0.30893	1.8	3.5	1.69176463	0.099504302	0	0
1/13/1996	1	1996	13	3.086000668	10.5413	7.455299332	0.990660922	13.78536488	1.032178482	-0.378010096	1.281395554	17.33423812	0	0.05540344	1.269716891	0.471649743	0.870683317	0.31762	1.5	3.5	1.567611944	0.118339934	0	0
1/14/1996	1	1996	14	3.095266498	9.1322	6.036933502	0.804420929	13.86929117	1.032047868	-0.373188675	1.283853301	17.43977021	0	0.05277356	1.219758202	0.437441181	0.828599692	0.29981	1.4	2.7	1.483649864	0.119485577	0	0
1/15/1996	1	1996	15	3.044824499	8.7318	5.686975501	0.748912784	13.95644232	1.031907773	-0.370252853	1.28639952	17.54935735	0	0.05049641	1.102347112	0.440760123	0.771553617	0.24908	1.3	2	1.420247654	0.119671697	0	0
1/16/1996	1	1996	16	3.403447045	9.7328	6.329352955	0.864797102	14.04679016	1.031758239	-0.367209498	1.289032688	17.66296416	0	0.05394481	1.124999495	0.504442066	0.814720781	0.36064	2	3.05	1.6186461	0.099648699	0	0
1/17/1996	1	1996	17	3.744703706	8.9032	5.156496294	0.753853684	14.14030527	1.031599309	-0.364057511	1.291751249	17.78055356	0	0.04359836	0.779549661	0.454280186	0.616904923	0.39897	5.6	-0.3	1.418858933	0.035164151	0	0
1/18/1996	1	1996	18	4.132481042	11.0187	6.886218958	1	14.23685675	1.031431032	-0.360797823	1.294553624	17.90380678	0	0.02801498	0.485983346	0.268083735	0.37703354	0.18726	2	-6.95	0.990149935	0.063193776	0	0
1/19/1996	1	1996	19	3.563901597	7.0917	3.527798403	0.517249034	14.33671243	1.031253456	-0.3574314	1.297438208	18.02752334	0	0.03352217	0.747077546	0.255505095	0.50129132	0.28533	2.8	-4.3	1.141925281	0.048381641	0	0
1/20/1996	1	1996	20	4.093475304	11.3036	7.210124696	1	14.43953875	1.031066635	-0.353959237	1.300403378	18.15682103	0	0.03307619	0.633386994	0.297244334	0.465315664	0.17281	3.9	-4.5	1.649844184	0.041045684	0	0
1/21/1996	1	1996	21	3.728076743	9.1784	5.450323257	0.756329091	14.54540076	1.030870623	-0.350382561	1.303447489	18.28993592	0	0.03431512	0.768589883	0.261727197	0.51515854	0.19136	2.2	-3.95	1.40687078	0.064663369	0	0
1/22/1996	1	1996	22	4.075567892	11.396	7.320432108	1	14.85426213	1.030665478	-0.346701831	1.306560883	18.42682232	0	0.04193837	0.836443783	0.384308777	0.61037628	0.24132	3.6	-0.9	1.891855765	0.055870894	0	0
1/23/1996	1	1996	23	4.191384007	11.3498	7.158415993	0.997615145	14.76608516	1.030451262	-0.342918734	1.309765808	18.56743281	0	0.03187609	0.547252072	0.31905105	0.433151561	0.16548	5.4	-5.05	1.711550521	0.030092258	0	0
1/24/1996	1	1996	24	4.399235182	11.4653	7.126064818	1	14.88083073	1.030228037	-0.339034192	1.313036824	18.71171822	0	0.0321996	0.741783242	0.233801282	0.487792262	0.18725	2.5	-4.9	1.466377603	0.062886024	0	0
1/25/1996	1	1996	25	4.063010791	10.2949	6.231889209	0.853423685	14.99845833	1.02999587	-0.335049351	1.316380001	18.85962761	0	0.04234818	0.903229187	0.361349474	0.632289331	0.25202	4.3	-0.75	2.060634449	0.048208504	0	0
1/26/1996	1	1996	26	5.090051095	11.9966	6.906548905	1	15.11892807	1.029754829	-0.330865393	1.319793724	19.01110829	0	0.02258178	0.421176492	0.188888277	0.305032384	0.11077	3.2	-10.05	1.202959036	0.041226692	0	0
1/27/1996	1	1996	27	4.381776395	11.1265	6.744723605	0.929835717	15.24219065	1.029504985	-0.326783524	1.323278296	19.16610583	0	0.02744393	0.690634388	0.172327449	0.431480918	0.10782	1.9	-7.25	1.393300562	0.069343345	0	0
1/28/1996	1	1996	28	4.495081829	11.8811	7.386068171	1	15.36820738	1.029248413	-0.322504981	1.326826018	19.32456402	0	0.04531459	0.854211366	0.450851266	0.652531316	0.25662	4.4	0.3	2.177049105	0.055600585	0	0
1/29/1996	1	1996	29	3.855667844	8.932	5.076332156	0.660522717	15.4969302	1.028979189	-0.318131031	1.330441195	19.48642495	0	0.04739001	1.015700692	0.414822261	0.715261477	0.20435	1.7	1	1.721307976	0.114343647	0	0
1/30/1996	1	1996	30	4.373490764	10.7184	6.344909236	0.85243315	15.62831165	1.028703392	-0.313662968	1.334120133	19.65162894	0	0.05377613	1.195433435	0.468125395	0.831779415	0.32469	2.8	3	2.166835096	0.095706484	0	0
1/31/1996	1	1996	31	4.20073675	8.2467	4.04596325	0.567283475	15.76230292	1.028419103	-0.309102113	1.337861144	19.82011462	0	0.05479502	0.954709881	0.624265107	0.789487494	0.42302	5.6	3.3	2.143945658	0.050538475	0	0
2/1/1996	2	1996	32	3.872139193	5.8982	2.026060807	0.300424245	15.89885384	1.028126408	-0.304449815	1.341682548	19.9918189	0	0.0367919	0.884564423	0.263830083	0.574197703	0.35531	3	-2.9	1.213200895	0.053974287	0	0
2/2/1996	2	1996	33	4.503323266	7.8771	3.373776734	0.511115788	16.03791289	1.027825391	-0.299707451	1.345522675	20.16667701	0	0.02688299	0.628811428	0.18270887	0.405760149	0.25606	2.7	-7.55	0.955180168	0.050354292	0	0
2/3/1996	2	1996	34	5.315651609	12.2199	6.904248391	0.974181609	16.17942725	1.027516143	-0.294876424	1.349439865	20.3446225	0	0.02763315	0.508207422	0.247413804	0.377810613	0.13651	3.3	-7.15	1.452039966	0.051200154	0	0
2/4/1996	2	1996	35	5.603115769	12.9514	7.348284231	1	16.32334276	1.027198754	-0.289958162	1.353412488	20.5255873	0	0.03092235	0.752405183	0.208559871	0.480482527	0.12548	1.6	-5.5	1.531772562	0.114848671	0	0
2/5/1996	2	1996	36	5.213527346	12.0505	6.836972654	0.932817729	16.469604	1.02687332	-0.284954122	1.357438853	20.7095017	0	0.04830419	1.102347112	0.396286541	0.749306826	0.30646	1.5	1.3	1.705763325	0.172148916	0	0
2/6/1996	2	1996	37	5.321161453	12.8359	7.514738547	1	16.61815426	1.026539935	-0.279865783	1.361517399	20.89629441	0	0.06164073	1.348027971	0.567751891	0.957889931	0.37183	1.9	5.2	2.181146244	0.182444068	0	0
2/7/1996	2	1996	38	4.981190759	10.5875	5.606309241	0.756957555	16.76893564	1.026198689	-0.27469465	1.365646506	21.0858926	0	0.05652998	1.236215522	0.508207422	0.872211472	0.35966	1.7	3.8	1.892713393	0.172391776	0	0
2/8/1996	2	1996	39	5.339977527	12.1891	6.849122473	0.912890924	16.92188897	1.025849713	-0.269442254	1.369824588	21.2782219	0	0.06613019	1.537418793	0.580375263	1.058894528	0.4146	2	6.35	2.344279933	0.187877441	0	0
2/9/1996	2	1996	40	5.686911436	13.2671	7.580188564	1	17.07695396	1.025493079	-0.264110148	1.374050079	21.47320646	0	0.06613019	1.640576439	0.539237347	1.089906893	0.39381	1.7	6.35	2.373023536	0.228214065	0	0
2/10/1996	2	1996	41	5.311455001	12.1352	6.823744999	0.884531431	17.23406911	1.025128904	-0.258699909	1.378321433	21.67076899	0	0.07025873	1.716356408	0.59324626	1.154801334	0.38552	2.2	7.35	2.695088767	0.184281223	0	0
2/11/1996	2	1996	42	5.481534119	10.5798	5.098265881	0.716452982	17.39317187	1.024757294	-0.253213139	1.382637124	21.8708308	0	0.04619427	1.015700692	0.39024703	0.702973861	0.34636	2.1	0.8	1.712266635	0.130238171	0	0
2/12/1996	2	1996	43	5.494992202	11.858	6.363007798	0.834332052	17.55419856	1.024378361	-0.247651459	1.386995647	22.07331184	0	0.05958762	1.321465499	0.53526908	0.92836729	0.32325	1.9	4.65	2.254974852	0.182634831	0	0
2/13/1996	2	1996	44	6.035832138	12.8667	6.830867862	0.92326254	17.71708448	1.023992216	-0.242016517	1.391395518	22.27813075	0	0.06070011	1.430551404	0.511997642	0.971274523	0.40146	1.8	4.95	2.230420109	0.212280297	0	0
2/14/1996	2	1996	45	6.19880924	13.8908	7.69199076	1	17.88176595	1.023598973	-0.236309978	1.395835278	22.48520493	0	0.0675509	1.683511528	0.551298824	1.117405176	0.37233	2	6.7	2.711420285	0.22234006	0	0
2/15/1996	2	1996	46	6.41224241	14.1603	7.74805759	1	18.04817031	1.023198749	-0.230533531	1.400313487	22.69445057	0	0.06532989	1.629993941	0.527410004	1.078701973	0.33944	2.2	6.15	2.838216926	0.205961785	0	0

Brown AND Caldwell

Date Checked	Checked By	Job Number	By	Date	Calc. No.	Sheet No.
			Jim O	10/10/2011		1

Project	Subject
Sandia wetland	Water demand

References/Notes

wetland ⇒ ~3.0 Acres → from G.I.S

assume wetland will be expanded over time ⇒ 4.0 Acres

4 acres = 174,240 SF

Modeling using Penman-Monteith ET equations (1996-2010)

Max Annual ET = 35.21 inches
Average Annual ET = 31.24 inches
Max 30 day ET = 11.18 inches
Average Max 30 day ET = 10.05 inches

Current Cooling water flow = 350,000 gpd 2011 Average
what percentage can be cut to meet recycling requirement?

To meet max 30 day Et

$\frac{11.18''}{12} = 0.9317$ ft Et

Volume = wetland Area · Et depth

= 174,240 · 0.9317
= 162,333 CF per 30-day
= 1,214,255 gal per 30-days
= 40,475 gpd

To meet average Max 30 day Et

$\frac{10.05}{12} = 0.8375$ ET

Volume = wetland Area · Et depth

= 174,240 · 0.8375
= 145,926 CF per 30-day
= 1,091,526 gal per 30 day
= 36,384 gpd

Numbers above assume NO flow into wetland by stormwater and NO reduced need from precipitation.

#1580-1/8"sq.

Brown AND Caldwell

Date Checked	Checked By	Job Number	By	Date	Calc. No.	Sheet No.
						2

Project	Subject

References/Notes

Loss #'s also assume that no losses occur into deep groundwater based on bedrock impervious ness as demonstrated by previous lab studies.

Assuming average rainfall in June will provide stormwater flow and reduced Et equal to the average rainfall plus 0.5"

Max 30-day Et = 11.18 - 1.51 - 0.5 = 9.17"

flow = 33,198 gpd

Avg. Max 30-day Et = 10.05 - 1.51 - 0.5 = 8.04"

flow = 29,107 gpd

#1580-1/8"sq.

Appendix C: Hydraulic Calculations

Los Alamos NATIONAL LABORATORY EST. 1943

Conduct of Engineering
Calculations
Calculation Cover Sheet

Calc No.: Rev. No.:1 Page 1 of 11

Calc Title: Sandia Wetland Hydraulics

Calculation Cover Sheet

1.0 INITIATION	
1.1 Calculation Status: ☐ Preliminary ☒ Final	
1.2 DP/DCP/DCF/ECN No.:	
1.3 Project ID No: 102698	
1.4 Superseded Calc No.:	
1.5 Facility Name(s): NA	1.6 Organization: Brown and Caldwell
1.7 Structure/ System Name: Sandia Wetland	1.8 Structure/ System Number:
1.9 Management Level: ☐ ML-1 ☐ ML-2 ☒ ML-3 ☐ ML-4 ☐ SB Calculation ☐ N/A ; Explain:	1.10 Associated with Technical Baseline: ☐ Yes ☒ No
2.0 SECURITY CLASSIFICATION REVIEW	
2.1 Security Classification:	
2.2 DC/RO: *(Name, Z Number, Organization, Signature, Date)*	
3.0 CHECKING	
3.1 Checker (Note 1): *(Name, Z Number (if applicable), Organization, Signature, Date)*	
4.0 INDEPENDENT REVIEW	
4.1 Independent Review: ☒ Required ☐ Not Required	
4.2 Independent Reviewer: *(Name, Z Number (if applicable), Organization, Signature, Date)*	
5.0 DESIGN AUTHORITY REPRESENTATIVE REVIEW	
5.1 Design Authority Representative Review: ☒ Required ☐ Not Required	
5.2 Design Authority Representative: *(Name, Z Number, Organization, Signature, Date)*	

Note 1: Independent Reviewer can also be the calculation Checker if the scope of the independent review also includes the scope of calculation checking as described in Section 3.0 of the instructions.

Los Alamos NATIONAL LABORATORY EST. 1943

Conduct of Engineering
Calculations
Calculation Cover Sheet

Calc No.:

Calc Title: Sandia Wetland Hydraulics

Calculation Cover Sheet

6.0 APPROVAL SIGNATURES

6.1 Preparer: *(Name, Z Number, Organization, Signature, Date)*
James A. O'Neill II, 280079 Brown & Caldwell
J. G. O'Neill II 3/8/2012

6.2 Subcontractor Approver: *(Name, Z Number (if applicable), Organization, Signature, Date)*

6.3 Responsible Manager: *(Name, Z Number, Organization, Signature, Date)*

7.0 REGISTERED PROFESSIONAL ENGINEER SEAL:

JAMES A. O'NEILL II
NEW MEXICO
18656
PROFESSIONAL ENGINEER
J. G. O'Neill
3/8/2012

8.0 REVISION LOG

8.1 Rev.	8.2 Date	8.3 Description of Change(s)
0	Aug '11	Original Issue
1	Oct '11	90% Design Revision

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Conduct of Engineering
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Conduct of Engineering
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Calculation Form

1.0 Purpose

Calculate hydraulic profile and flow characteristics including velocity and shear for flow in the channel through the wetland area with proposed stilling basin and drop structures.

2.0 Methodology

The hydraulic profile is based on a step-backwater calculation analysis using the HEC-RAS software. The channel configuration and stream channel sections at hydraulic structures are as shown on the Drawings. Calculations include both pre- and post-construction runs to compare water surface elevations, flow velocities and channel shear.

3.0 Acceptance Criteria

The criteria used for evaluating the effectiveness of the design are outlined in Section 2.5 of the Design memorandum, and were developed by the Design Team and LANL staff to meet the goal of reducing sediment transport to the lower portion of Sandia Canyon from the wetland area.

4.0 Open Items

Final design development of the concepts presented in the Design Memorandum still need to be completed, with complete details and final hydraulic analysis to confirm the performance of the system under design flow conditions.

5.0 Assumptions

Tailwater water surface elevation is the primary variable that cannot be measured for design flow conditions, or is not empirically modeled. Tailwater is assumed based on nornal water surface elevation for the existing downstream channel section at design flow.

6.0 Limitations

The hydraulics analysis uses the 25-year design storm. Performance of the drop structures and plunge pool for higher flow rates (longer return periods) is not predicted.

The analysis is a steady state analysis based on the design configuration. The analysis is based on static flow conditions over a period of time, and includes conservative assumptions to minimize under-design. In the field, sediment transport and potentially unstable boundary layer conditions create flow patterns. These conditions may require a much more complex dynamic analysis to increase the accuracy of the model results, but may only result in a minor change in system performance.

7.0 Calculation Inputs

HEC-RAS (Hydraulic profile) - Hydraulic analysis inputs are the channel cross-section, channel slope, Manning's n-value, design discharge and starting water surface elevation at the downstream end where the improvements transition back into the existing channel. Flows are based on the results of the hydrologic analysis of the drainage basin. The design storm is the 25-year, 2-hour storm.

Design Note No. 6 (Plunge pool) – Inputs include the characteristics and configuration of the discharge pipe upstream of the plunge pool, flow discharge, information on the riprap and bedding used, and the side and end slopes of the pool. Again, the design storm is the 25-year, 2-hour storm.

8.0 Computer Hardware and Software

U.S. Army Corps of Engineers HEC-HMS software

Natural Resources Conservation Service, Engineering Division
"Riprap Lined Plunge Pool for Cantilever Outlet" - Design Note No. 6 (2nd Edition), Jan. 23, 1986
Spreadsheet developed by D. Hurtz, Midwest NTC, 1/90, modified by M. Dreischmeier, Eau Claire TC, Wis., 3/98 and 5/2005

9.0 Summary and Conclusions

The calculations show that the grade control structure and stilling basin will be stable and reduce energy and erosive forces locally.

10.0 References

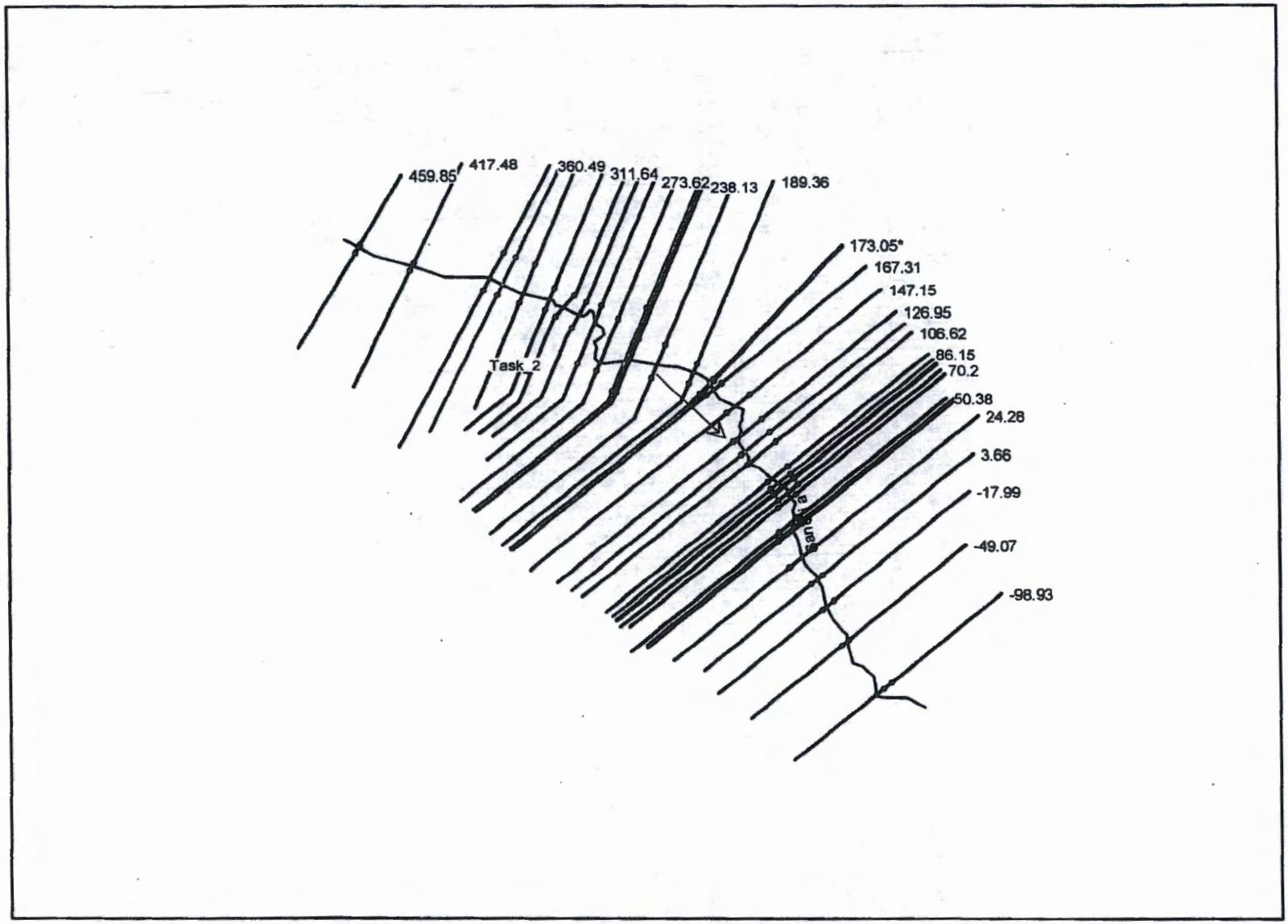
HEC website: http://www.hec.usace.army.mil/software/hec-ras.

11.0 Calculations

- Calculation 1 – Hydraulic profile for study channel reach (HEC-RAS)
- Calculation 2 – Plunge pool structure sizing – NRCS Design Note No. 6

Proposed Conditions							Existing								
River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Vel Chnl	Shear Chan	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Vel Chnl	Shear Chan	Change in	Change in
		(cfs)	(ft)	(ft)	(ft/s)	(lb/sq ft)			(cfs)	(ft)	(ft)	(ft/s)	(lb/sq ft)	Velocity	Shear
459.85	25-yr	498.4	7210.79	7214.55	6.16	1.77	459.85	25-yr	498.4	7210.79	7214.54	6.19	1.79	-0.03	-0.02
459.85	200cfs	200	7210.79	7213.57	5.08	1.34	459.85	200cfs	200	7210.79	7213.56	5.13	1.37	-0.05	-0.03
417.48	25-yr	498.4	7210.37	7213.52	9.19	4.48	417.48	25-yr	498.4	7210.37	7213.55	9.04	4.33	0.15	0.15
417.48	200cfs	200	7210.37	7212.88	6.37	2.37	417.48	200cfs	200	7210.37	7212.92	6.15	2.2	0.22	0.17
360.49	25-yr	498.4	7210.67	7212.9	4.48	1.15	360.49	25-yr	498.4	7210.67	7212.85	4.65	1.25	-0.17	-0.1
360.49	200cfs	200	7210.67	7212.19	3.39	0.78	360.49	200cfs	200	7210.67	7212.13	3.63	0.9	-0.24	-0.12
349.06*	25-yr	498.4	7210.82	7212.75	4.57	1.21	—	—	—	—	—	—	—		
349.06*	200cfs	200	7210.82	7212.02	3.52	0.85	—	—	—	—	—	—	—		
331.97	25-yr	498.4	7210.69	7212.56	4.26	1.06	331.97	25-yr	498.4	7210.08	7212.36	5.12	1.54	-0.86	-0.48
331.97	200cfs	200	7210.69	7211.85	2.83	0.55	331.97	200cfs	200	7210.08	7211.7	3.63	0.9	-0.8	-0.35
311.64	25-yr	498.4	7210.54	7212.31	5.04	1.48	311.64	25-yr	498.4	7209.12	7211.66	7.58	3.47	-2.54	-1.99
311.64	200cfs	200	7210.54	7211.64	3.42	0.8	311.64	200cfs	200	7209.12	7211.13	5.52	2.08	-2.1	-1.28
298.58	25-yr	498.4	7210.44	7212.18	4.65	1.27	298.58	25-yr	498.4	7204.87	7210.21	6.1	1.82	-1.45	-0.55
298.58	200cfs	200	7210.44	7211.52	3.22	0.72	298.58	200cfs	200	7204.87	7208.5	4.43	1.12	-1.21	-0.4
285.98	25-yr	498.4	7210.34	7212.04	4.49	1.19	285.98	25-yr	498.4	7204.52	7209.27	8.94	4.41	-4.45	-3.22
285.98	200cfs	200	7210.34	7211.39	3.09	0.66	285.98	200cfs	200	7204.52	7207.65	7.57	3.52	-4.48	-2.86
273.62	25-yr	498.4	7210.25	7211.91	3.98	0.95	273.62	25-yr	498.4	7204.32	7209.67	3.63	0.67	0.35	0.28
273.62	200cfs	200	7210.25	7211.27	2.73	0.52	273.62	200cfs	200	7204.32	7207.84	3.56	0.81	-0.83	-0.29
258.33	25-yr	498.4	7210.14	7211.76	4.06	0.99	258.33	25-yr	498.4	7203.13	7209.67	2.98	0.41	1.08	0.58
258.33	200cfs	200	7210.14	7211.14	2.78	0.55	258.33	200cfs	200	7203.13	7207.86	2.22	0.28	0.56	0.27
Crest of first drop structure															
241.5*	25-yr	498.4	7210.01	7211.18	5.65	2.14	—	—	—	—	—	—	—		
241.5*	200cfs	200	7210.01	7210.63	4.45	1.64	—	—	—	—	—	—	—		
240.5	25-yr	498.4	7209.01	7211.38	3.62	0.7	—	—	—	—	—	—	—		
240.5	200cfs	200	7209.01	7210.46	2.55	0.41	—	—	—	—	—	—	—		
238.13	25-yr	498.4	7208.99	7211.36	3.61	0.69	238.13	25-yr	498.4	7203.39	7209.65	2.74	0.34	0.87	0.35
238.13	200cfs	200	7208.99	7210.45	2.49	0.39	238.13	200cfs	200	7203.39	7207.83	2.02	0.23	0.47	0.16
217.54	25-yr	498.4	7208.84	7210.94	5.93	1.95	217.54	25-yr	498.4	7203.06	7209.45	4.16	0.8	1.77	1.15
217.54	200cfs	200	7208.84	7210.19	3.94	0.99	217.54	200cfs	200	7203.06	7207.71	2.94	0.47	1	0.52
189.36	25-yr	498.4	7208.62	7210.59	6.02	2.05	189.36	25-yr	498.4	7203.28	7208.1	9.3	4.34	-3.28	-2.29
189.36	200cfs	200	7208.62	7209.9	4.01	1.05	189.36	200cfs	200	7203.28	7207.2	5.33	1.59	-1.32	-0.54
Crest of second drop structure															
173.05*	25-yr	498.4	7208.5	7209.75	8.34	4.56	—	—	—	—	—	—	—		
173.05*	200cfs	200	7208.5	7209.19	6.25	3.12	—	—	—	—	—	—	—		
172.05	25-yr	498.4	7207.5	7209.82	5.39	1.55	—	—	—	—	—	—	—		
172.05	200cfs	200	7207.5	7208.94	3.82	0.91	—	—	—	—	—	—	—		
167.31	25-yr	498.4	7207.46	7209.79	5.16	1.42	167.31	25-yr	498.4	7202.84	7207.96	7.91	3.07	-2.75	-1.65
167.31	200cfs	200	7207.46	7208.9	3.7	0.86	167.31	200cfs	200	7202.84	7206.55	6.79	2.72	-3.09	-1.86
147.15	25-yr	498.4	7207.31	7209.45	5.56	1.7	147.15	25-yr	498.4	7202.62	7207.29	8.22	3.53	-2.66	-1.83
147.15	200cfs	200	7207.31	7208.64	3.83	0.94	147.15	200cfs	200	7202.62	7206.28	5.45	1.8	-1.62	-0.86

Proposed Conditions							Existing								
River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Vel Chnl	Shear Chan	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Vel Chnl	Shear Chan	Change in	Change in
		(cfs)	(ft)	(ft)	(ft/s)	(lb/sq ft)			(cfs)	(ft)	(ft)	(ft/s)	(lb/sq ft)	Velocity	Shear
126.95	25-yr	498.4	7207.16	7209.09	5.83	1.93	126.95	25-yr	498.4	7203.4	7207.35	5.92	1.76	-0.09	0.17
126.95	200cfs	200	7207.16	7208.35	4	1.07	126.95	200cfs	200	7203.4	7206.15	4.18	1.04	-0.18	0.03
Sill of drop															
115.38*	25-yr	498.4	7207.07	7208.5	7.69	3.72	—	—	—	—	—	—	—		
115.38*	200cfs	200	7207.07	7207.86	5.69	2.47	—	—	—	—	—	—	—		
106.62	25-yr	498.4	7206.19	7207.74	7.78	3.7	106.62	25-yr	498.4	7202.57	7207.24	5.39	1.48	2.39	2.22
106.62	200cfs	200	7206.19	7207.06	5.77	2.46	106.62	200cfs	200	7202.57	7205.94	4.16	1.06	1.61	1.4
86.15	25-yr	498.4	7204.15	7206.78	8.1	3.42	86.15	25-yr	498.4	7202.72	7206.79	6.82	2.29	1.28	1.13
86.15	200cfs	200	7204.15	7205.71	6.43	2.58	86.15	200cfs	200	7202.72	7205.59	4.95	1.4	1.48	1.18
Sill of pool															
80.3855*	25-yr	498.4	7203.57	7206.86	6.67	2.18	—	—	—	—	—	—	—		
80.3855*	200cfs	200	7203.57	7205.64	5.22	1.56	—	—	—	—	—	—	—		
76.38	25-yr	498.4	7203.57	7206.47	8.08	3.33	—	—	—	—	—	—	—		
76.38	200cfs	200	7203.57	7205.26	6.69	2.77	—	—	—	—	—	—	—		
75.88	25-yr	498.4	7202.07	7206.74	5.45	1.35	—	—	—	—	—	—	—		
75.88	200cfs	200	7202.07	7205.45	3.52	0.64	—	—	—	—	—	—	—		
70.2	25-yr	498.4	7199.01	7206.86	3.78	0.61	—	—	—	—	—	—	—		
70.2	200cfs	200	7199.01	7205.53	2.08	0.2	—	—	—	—	—	—	—		
65.53	25-yr	498.4	7199.01	7206.89	3.61	0.56	65.53	25-yr	498.4	7201.68	7206.77	5.65	1.53	-2.04	-0.97
65.53	200cfs	200	7199.01	7205.53	1.98	0.19	65.53	200cfs	200	7201.68	7205.43	4.53	1.14	-2.55	-0.95
50.38	25-yr	498.4	7199.01	7206.86	3.64	0.58	—	—	—	—	—	—	—		
50.38	200cfs	200	7199.01	7205.52	1.99	0.19	—	—	—	—	—	—	—		
46.38	25-yr	498.4	7201.01	7206.74	4.47	0.95	—	—	—	—	—	—	—		
46.38	200cfs	200	7201.01	7205.4	3.31	0.6	—	—	—	—	—	—	—		
44.91	25-yr	498.4	7201.02	7206.73	4.54	0.99	44.91	25-yr	498.4	7201.02	7206.73	4.54	0.99	0	0
44.91	200cfs	200	7201.02	7205.38	3.44	0.67	44.91	200cfs	200	7201.02	7205.38	3.44	0.67	0	0
24.28	25-yr	498.4	7200.68	7206.57	4.85	1.13	24.28	25-yr	498.4	7200.68	7206.57	4.85	1.13	0	0
24.28	200cfs	200	7200.68	7205.26	3.5	0.68	24.28	200cfs	200	7200.68	7205.26	3.5	0.68	0	0
3.66	25-yr	498.4	7200.73	7206.04	7.53	2.69	3.66	25-yr	498.4	7200.73	7206.04	7.53	2.69	0	0
3.66	200cfs	200	7200.73	7204.89	5.34	1.53	3.66	200cfs	200	7200.73	7204.89	5.34	1.53	0	0
-17.99	25-yr	498.4	7200.29	7205.7	7.78	3.01	-17.99	25-yr	498.4	7200.29	7205.7	7.78	3.01	0	0
-17.99	200cfs	200	7200.29	7204.41	6.39	2.34	-17.99	200cfs	200	7200.29	7204.41	6.39	2.34	0	0
-49.07	25-yr	498.4	7200.11	7204.88	9.36	4.27	-49.07	25-yr	498.4	7200.11	7204.88	9.36	4.27	0	0
-49.07	200cfs	200	7200.11	7203.85	6.62	2.34	-49.07	200cfs	200	7200.11	7203.85	6.62	2.34	0	0
-98.93	25-yr	498.4	7199.22	7204.17	7.98	3.01	-98.93	25-yr	498.4	7199.22	7204.17	7.98	3.01	0	0
-98.93	200cfs	200	7199.22	7202.77	7.39	2.91	-98.93	200cfs	200	7199.22	7202.77	7.39	2.91	0	0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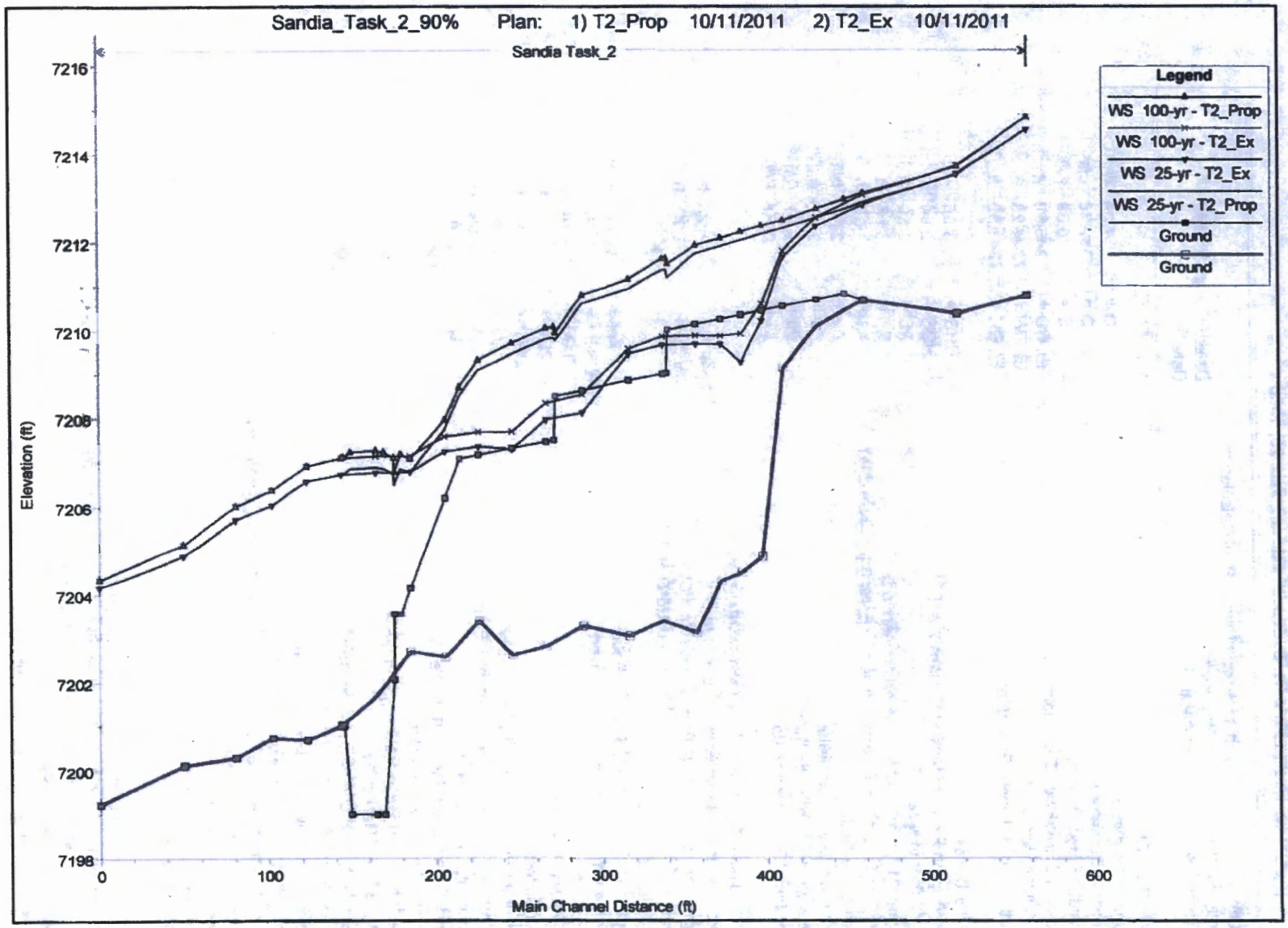
Task_2
Barranca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Sandia Task_2
Legend
WS 100-yr - T2_Prop
WS 100-yr - T2_Ex
WS 25-yr - T2_Ex
WS 25-yr - T2_Prop
Ground
Ground
Elevation (ft)
7216
7214
7212
7210
7208
7206
7204
7202
7200
7198
0
100
200
300
400
500
600
Main Channel Distance (ft)

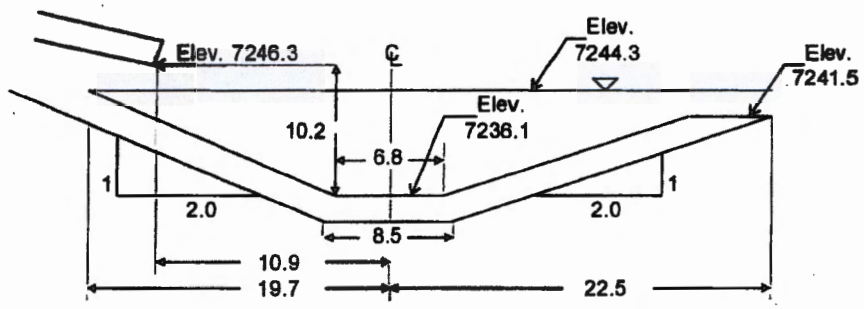
RIPRAP LINED PLUNGE POOL FOR CANTILEVER OUTLET (Version 5/2005)
(Reference Design Note No. 6 (Second Edition), Jan. 23, 1986

JOB:	Sandia Wetland Plunge Pool Calculation			
DESIGNER:	Carl McDonald	Date:	########	
CHECKER:	Jim O'Neill	Date:		

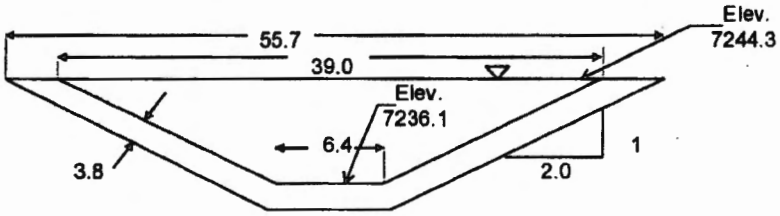
INPUT DATA:			
Conduit Diameter	D =	7.00	ft
Conduit Discharge:	Q =	357.30	cfs
Conduit Slope at Outlet:	S =	0.09	ft/ft
Conduit Outlet Invert Elevation:	El, CO =	7246.30	ft
Tailwater Elevation:	El, TW =	7244.28	ft
Outlet Channel Invert Elevation:	El, CH =	7241.50	ft
Water Density:	RHO =	1.00	
Bed/Riprap Particle Density: (Default 2.64)	RHOS =	2.64	
D, 50 Riprap Size:	RS =	1.50	ft
Riprap Thickness: (2.5*D, 50 recommended)	RT =	3.75	ft
Bedding Thickness: (6 inch min. rec.) (Enter 0 for geotextile)	BT =	1.00	ft
Side Slope Ratio:	Zw =	2.00	ft/ft
Upstream End Slope Ratio:	Zlu =	2.00	ft/ft
Downstream End Slope Ratio:	Zld =	2.00	ft/ft
Combined End Slope Ratio:	Z1 =	2.00	ft/ft
OUTPUT---POOL LOCATION AND DIMENSIONS:			
Vert. Dist. from Tailwater to Conduit Invert:	Zp =	2.02	ft
Submergence Check: (If Zp < 0 , Use Zp = 0)	Use Zp =	2.02	ft
Beaching Check: [Q/(gD^5)^0.5 <= (1.0+25*D,50/D)]		O.K.	
Beaching Controlled			
Distance from Conduit Exit to C/L Pool:	Xm =	10.87	ft
Pool depth at C/L Below Conduit Invert:	Zp+0.8Zm =	10.16	ft
Pool Bottom Elev:	El,PB =	7236.14	ft
Pool Bottom Length:	2Lr2 =	6.76	ft
Pool Bottom Width:	2Wr2 =	6.40	ft
Upstream Pool Length at Tailwater Elev.:	Lru =	19.66	ft
Downstream Pool Length at Tailwater Elev.:	Lrd =	19.66	ft
Pool Width at Tailwater Elev.:	2Wr =	38.95	ft
Check Side Slope Ratio: (Wr>=We)		O.K.	
Side Slope Ratio Zw O.K.			
Check Min. End Slope Ratio: (Lru & Lrd >= Le)		O.K.	
End Slope Ratios O.K.			
Check Upstream Length: (Lru >= Xm)		O.K.	
End Slope Ratio Zlu O.K.			
Pool Bottom Elev. at Bottom of Riprap:	El, BR =	7232.39	ft
Pool Bottom Elev. at Bottom of Bedding:	El, BB =	7231.39	ft
OUTPUT---VOLUMES BELOW WATER SURFACE ELEVATION:			
Volume of Excavation (measured from bottom surface of bedding):	V,pbs =	672.3	cu yd
Volume of Rock Riprap:	V,rs =	353.3	cu yd
Volume of Bedding:	V,bs =	134.9	cu yd

Spreadsheet developed by D. Hurtz, Midwest NTC, 1/90
Spreadsheet modified by M. Dreischmeier, Eau Claire TC, Wis., 3/98 and 5/2005
Design Note No. 6 (Second Edition), Jan. 23, 1986
"Riprap Lined Plunge Pool for Cantilever Outlet"
Natural Resources Conservation Service
Engineering Division

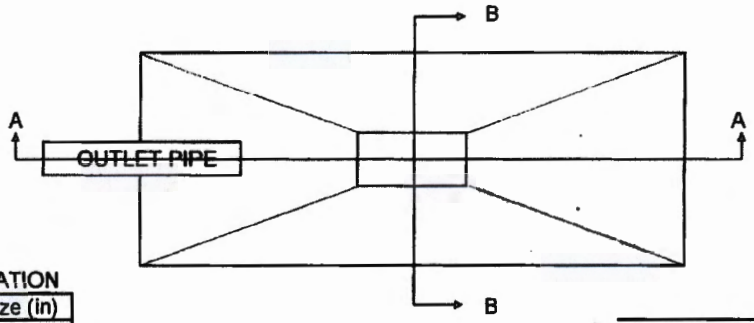
RIPRAP LINED PLUNGE POOL FOR CANTILEVER OUTLET
Reference Design Note No. 6 (Second Edition), Jan. 23, 1986



SECTION A-A



8.2 SECTION B-B



ROCK GRADATION

% Passing	Size (in)
100	36
60-85	27
25-50	18
5-20	9
0-5	3.6

Sandia Wetland Plunge Pool Calculation
LANDOWNER

DESIGNER: Carl McDonald
SHEET ___ OF ___

ENCLOSURE 3

NMED letter approving, with Modification, the Work Plan for Sandia Canyon

ENV-RCRA-13-0065

LAUR-13-20922

Date: MAR 27 2013

NEW MEXICO ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Phone (505) 476-6000 Fax (505) 476-6030
www.nmenv.state.nm.us

SUSANA MARTINEZ
Governor

JOHN A. SANCHEZ
Lieutenant Governor

RAJ SOLOMON, P.E.
Acting Secretary

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

5 JAN '11 PM12:49

January 4, 2011

George J. Rael
Manager, Environmental Projects Office
Los Alamos Site Office, DOE
3747 West Jemez Rd, MS A316
Los Alamos, NM 87544

Michael J. Graham
Associate Director, Environmental Programs
Los Alamos National Security, L.L.C.
P.O. Box 1663, MS M991
Los Alamos, NM 87545

RE: APPROVAL WITH MODIFICATION
PHASE II INVESTIGATION WORK PLAN FOR SANDIA CANYON
LOS ALAMOS NATIONAL LABORATORY
EPA ID#NM0890010515
HWB-LANL-10-061

Dear Messrs Rael and Graham:

The New Mexico Environment Department (NMED) is in receipt of the United States Department of Energy (DOE) and the Los Alamos National Security, L.L.C.'s (collectively, the Permittees) document entitled *Phase II Investigation Work Plan for Sandia Canyon* (Plan) dated July 30, 2010 and referenced by EP2010-0290.

NMED hereby issues this Approval with the following modifications.

1. **General Comment:**
   The Permittees must stabilize the eastern end of the wetland in reach S-2 in upper Sandia Canyon. Currently, the wetland is unstable as evidenced by active erosion (head-cutting) in that area. The Permittees must submit a work plan to stabilize the eastern end of the wetland and prevent further upstream migration of the headcut. The work plan must also include proposals for post-stabilization contaminant monitoring to determine the effectiveness of the stabilization and a

COR-EP-1.5.2011-312667

maintenance program for all structures installed as part of the stabilization. The work plan must be submitted to NMED no later than **March 25, 2011**.

2. **Section 3.0, CONCEPTUAL MODEL, pages 2 – 4:**
Based on NMED's review of available information and data concerning contamination in the regional aquifer beneath Sandia and Mortandad Canyons, the Permittees' Conceptual Model 3, which proposes two distinct sources of chromium contamination in the regional aquifer, appears to be the most accurate model of the three presented in the Plan. If data obtained under the Plan confirm or imply the existence of the second regional-aquifer chromium plume that originates from a source outside Sandia Canyon, the Permittees will be required to conduct an investigation to determine the nature and vertical and lateral extent of contamination within that plume. If additional groundwater monitoring wells are deemed necessary to properly characterize the plume, their number and location will be primarily based on data and information derived from the proposed regional wells R-61 and R-62, as well as other wells located in the investigation area.

3. **Section 4.1, DC-Resistivity Profiling in Upper Sandia Canyon, pages 4 – 5:**
The Permittees must add more profiles to the DC-resistivity survey in order to properly delineate the lateral contrast between zones of saturation beneath the wetland and the surrounding subsurface materials. The resistivity survey must also be configured to allow for determination of the role of the near-vertical features located beneath the wetland such as the Rendija Canyon fault and associated fault splays as potential infiltration pathways. The Permitees must submit the final scope of the resistivity survey to NMED no less than 20 days prior to its implementation. The Permittees must provide notice to NMED no less than 15 days prior to conducting the survey.

4. **Section 4.3, Collection of Additional Sediment Data in Sandia Canyon, page 7:**
The Permittees must add 10 more sediment samples to the scope of activities proposed in the Plan for characterization of reach S-5EC. The location and depth of the sediment samples must be based on results of mapping of the post-1942 geomorphic units, as described in the Plan. The Permittees must notify NMED a minimum of 15 days prior to sampling reach S-5EC.

5. **Appendix A, NMED Comment No. 3, page A-2:**
The Permittees' assertion that "[m]onitoring data from existing dual-screen wells, including R-50, provide good evidence that chromium migration occurs in the upper part of the aquifer and that the vertical extent of chromium is sufficiently constrained by the existing network of wells . . ." is not shared by NMED. Due to the absence of deep-screened wells within the main body of the chromium contaminant plume, significant uncertainty exists regarding the vertical extent of

chromium contamination in the regional aquifer. If the work performed under the Plan does not reduce this uncertainty to an acceptable level, the Permittees will be required to install a deep-screened, dual-screen well to define the vertical extent of chromium contamination in the regional aquifer.

The Phase II Investigation Report for Sandia Canyon must be submitted to NMED by **April 30, 2012**, as proposed in the Plan. Should you have any questions or comments, please contact Michael Dale at (505) 661-2673.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

JPB:md/jk

cc: J. Kieling, NMED HWB
D. Cobrain, NMED HWB
M. Dale, NMED HWB
J. Kulis, NMED HWB
N. Dhawan, NMED HWB
T. Skibitski, NMED DOE OB
S. Yanicak, NMED DOE OB, MS M894
B. Olson, NMED GWQB
L. King, EPA 6PD-N
D. Katzman, ENG-TECH, MS M992
G. Turner, DOE LASO-EO, MS A316
H. Shen, DOE LASO-EO, MS A316

ENCLOSURE 4

100% Review Design Drawings

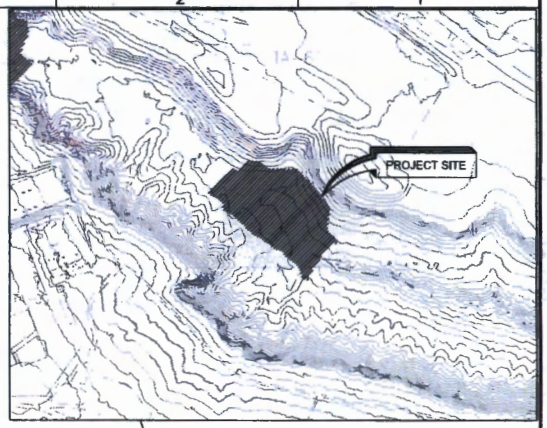
ENV-RCRA-13-0065

LAUR-13-20922

Date: MAR 2 7 2013

SANDIA CANYON STREAM GRADE CONTROL

BLDG N/A TA-00



LOCATION PLAN
NO SCALE TA-00

LIST OF DRAWINGS

REVISION NUMBER	SHEET NUMBER	DISCIPLINE SHEET NUMBER	DRAWING TITLE
	1	G-0001	TITLE SHEET
	2	C-0001	GENERAL NOTES, LEGEND, ABBREVIATIONS
	3	C-1000	SURVEY
	4	C-1001	EXISTING CONDITIONS
	5	C-1002	OVERALL PLAN VIEW
	6	C-1003	PARTIAL PLAN – 1
	7	C-1004	PARTIAL PLAN – 2
	8	C-1005	PLAN AND PROFILE
	9	C-1006	SECTION LOCATION PLAN
	10	C-1007	PLANTING AND STABILIZATION PLAN
	11	C-3000	SECTIONS
	12	C-5000	DETAILS
	13	C-5001	DETAILS

PROJECT DESIGN DATA

DESIGN STORM = 25-YEAR, 2-HOUR EVENT

PEAK FLOW (Qp) =500 CFS

LANL ENGINEERING DESIGN STANDARDS MANUAL (INCLUDED BUT NOT LIMITED TO LANL MASTER SPECIFICATIONS AND DRAFTING MANUAL)

PRODUCT OPTIONS/SUBSTITUTIONS

"OR APPROVED EQUAL" IS ALWAYS IMPLIED AFTER A BRAND NAME, PATENTED PROCESS OR CATALOG NUMBER. THE CONTRACTOR MAY SUBSTITUTE ANY BRAND OR PROCESS APPROVED AS AN EQUAL BY THE SPECIFYING ARCHITECT/ENGINEER. THE ONLY EXCEPTION IS WHERE "NO SUBSTITUTION" IS SPECIFIED. SEE GENERAL PROVISION "MATERIAL AND WORKMANSHIP".

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	VER	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON STREAM GRADE CONTROL

TITLE SHEET

DRAWN: A COX
DESIGN: C MCDONALD
CHECKED: J O'NEILL
DATE: 2012-07-30

BLDG. N/A TA-00

SUBMITTED: JAMES O'NEILL
APPROVED FOR RELEASE: JOHN P. MCCANN

Los Alamos NATIONAL LABORATORY PO Box 1663 Los Alamos, New Mexico 87545

SHEET G-0001
1 OF 13

CLASSIFICATION U REVIEWER R BOHN DATE 2012-07-30

PROJECT ID 102698 DRAWING NO C-55803 REV 0

GENERAL NOTES

1. IF SHEETS ARE NOT 36X24, THEN THEY ARE REDUCED SIZE PLOTS. USE GRAPHIC SCALE ACCORDINGLY.
2. ALL EXISTING PLANIMETRIC AND TOPOGRAPHIC INFORMATION PRESENTED ON THIS SHEET WAS OBTAINED OR DERIVED FROM INFORMATION PROVIDED BY OTHERS (SEE SHEET C-1000 FOR EXISTING SURVEY PROVIDED).
3. DATA FOR ALL ELEVATIONS AND NORTHING/EASTING POINTS STATED (EXISTING AND PROPOSED) ARE BASED ON PROVIDED EXISTING SURVEY INFORMATION (SEE NOTE 2 AND SHEET C-1000 FOR HORIZONTAL AND VERTICAL REFERENCE DATA).
4. THE SUBCONTRACTOR WILL BE RESPONSIBLE FOR WATER MANAGEMENT THROUGHOUT THE PROJECT. THE WETLAND RECEIVES CONTINUAL FLOW OF APPROXIMATELY 350,000 GALLONS PER DAY. THE SUBCONTRACTOR WILL ALSO BE RESPONSIBLE FOR STORMWATER FLOWS INTO THE WETLAND DURING PRECIPITATION EVENTS. ALL WATER FLOWS WILL NEED TO BE MANAGED AND TAKEN THROUGH THE WORK ZONE WITHOUT DELETERIOUS EFFECTS TO THE WORK.
5. CONTRACTOR WILL BE RESPONSIBLE FOR REMOVAL OF ALL WILLOWS AND OTHER WOODY VEGETATION PRIOR TO BEGINNING CONSTRUCTION.
6. CONSTRUCTION SUBCONTRACTOR SHALL FOLLOW THE SPECIFICATIONS INCLUDED WITH THE DESIGN PACKAGE. THESE INCLUDE:
   - 01 3545 WATER DISCHARGE REQUIREMENTS
   - 01 4000 QUALITY REQUIREMENTS
   - 01 4200 REFERENCES
   - 01 5705 TEMPORARY CONTROLS AND COMPLIANCE REQUIREMENTS
   - 01 7839 PROJECT RECORD DOCUMENTS
   - 03 3001 REINFORCED CONCRETE
   - 31 0519 GEOSYNTHETICS
   - 31 2000 EARTH MOVING
   - 31 3700 RIPRAP
   - 31 6223 STEEL SHEET PILING
   - 32 9219 SEEDING
   - 32 9300 PLANTING

LEGEND

- NORTH ORIENTATION SYMBOL
- GRAPHIC SCALE (10' 5' 0 5' 10', 1"=10'-0")
- DETAIL TAG (1 / C-0000)
- SECTION TAG (A / C-0001)
- SECTION END LINE (X)
- KEYED NOTE (2)
- LCN A0307 — SURVEY CONTROL POINT
- EXISTING TOPOGRAPHY/GRADE
- EXISTING STREAMBED (AS SURVEYED)
- EXISTING WETLANDS (AS SURVEYED)
- EXISTING ROCK/RIPRAP (AS SURVEYED)
- EXISTING TREES (AS SURVEYED)
- PROPOSED AGGREGATE
- PROPOSED TOPOGRAPHY/GRADE
- PROPOSED WETLAND RESTORATION
- PROPOSED STREAM/CHANNEL RESTORATION AREA
- PROPOSED BACKFILL TO MEET EXISTING GRADE
- PROPOSED CONCRETE

ABBREVIATIONS

Qp	– PEAK FLOW
CFS	– CUBIC FEET PER SECOND
NAD	– NORTH AMERICAN DATUM
NGVD	– NATIONAL GEODETIC VERTICAL DATUM
CMP	– CORRUGATED METAL PIPE
NMDOT	– NEW MEXICO DEPARTMENT OF TRANSPORTATION
OZ/SY	– OUNCE PER SQUARE YARD

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	VER	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL

GENERAL NOTES, LEGEND, ABBREVIATIONS

DRAWN: D VARJ.
DESIGN: C MCDONALD
CHECKED: J O'NEILL
DATE: 2012-07-30

BLDG. N/A TA-00

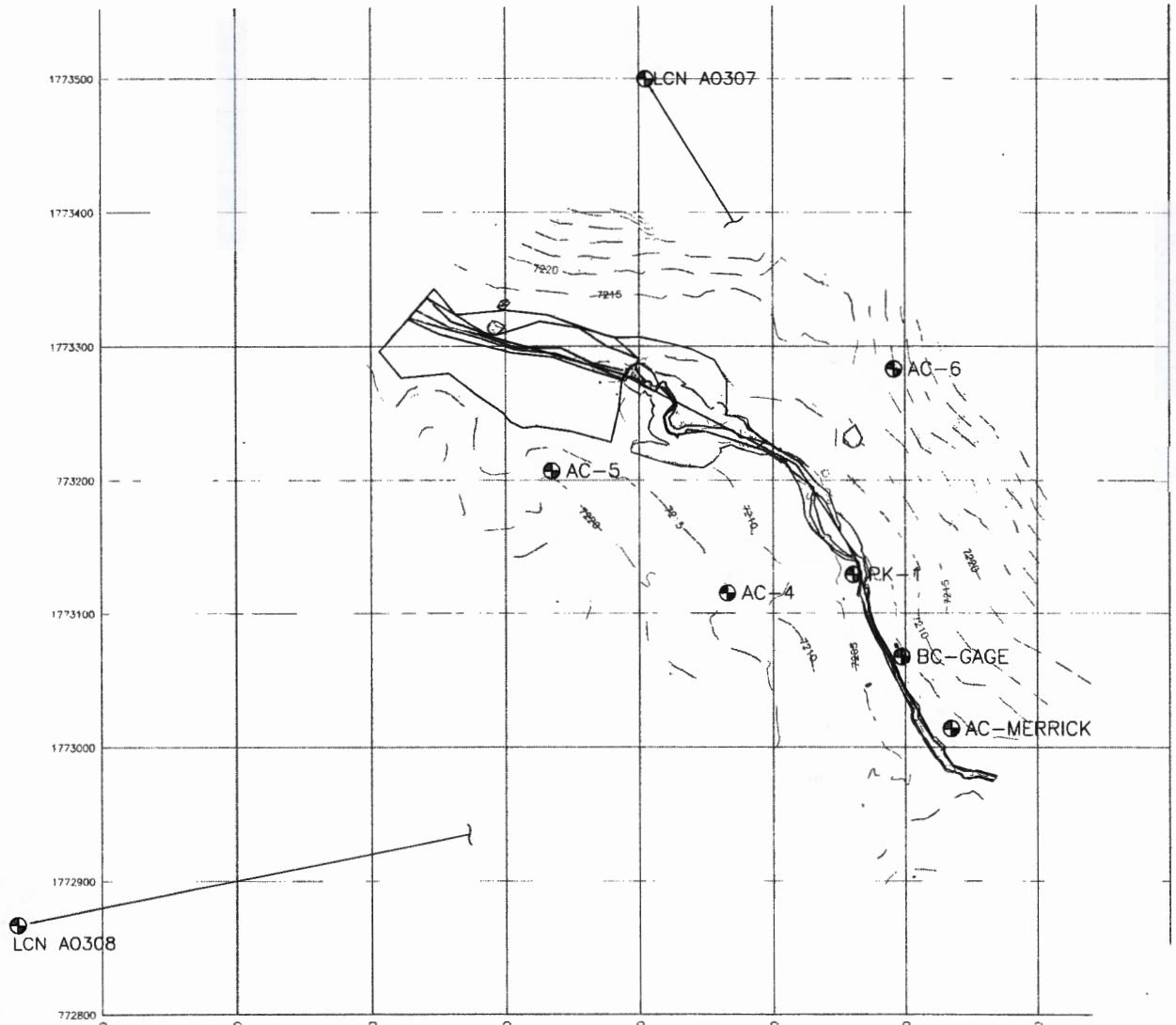
SUBMITTED: JAMES O'NEILL
APPROVED FOR RELEASE: JOHN P. MCCANN

Los Alamos NATIONAL LABORATORY PO Box 1663 Los Alamos, New Mexico 87545

SHEET C-0001 2 OF 13

CLASSIFICATION U REVIEWER R BOHN DATE 2012-07-30

PROJECT ID 102698 DRAWING NO C-55803 REV 0



SITE FEATURES AND CONTOUR MAPPING BY PORTAGE, INC.

GENERAL NOTES

1. SITE FEATURES AND CONTOUR MAPPING BY PORTAGE, INC. FIELD SURVEY PERFORMED JULY, 2011.

PERMANENT CONTROL MONUMENTS (1992/1993 LABORATORY CONTROL NETWORK)				
POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
A0307	1774602.90	1621878.68	7323.4	LANL CONTROL NETWORK
A0308	1772653.20	1620942.17	7368.0	LANL CONTROL NETWORK
LOCAL CONTROL POINTS				
AC MERRICK	1773013.83	1622725.60	7201.76	REBAR WITH ALUMINUM CAP
AC-4	1773115.23	1622585.45	7214.86	REBAR WITH ALUMINUM CAP
AC-5	1773206.94	1622434.58	7219.56	REBAR WITH ALUMINUM CAP
AC-6	1773283.08	1622691.52	7228.42	REBAR WITH ALUMINUM CAP
BC-GAGE	1773067.43	1622697.28	7204.31	BRASS CAP IN CONCRETE
PK-1	1773128.10	1622680.63	7204.51	PK NAIL

ALL COORDINATES ARE NEW MEXICO STATE PLANE COORDINATE SYSTEM, CENTRAL ZONE NAD 1983. ALL ELEVATIONS ARE NGVD 1929.

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	VER	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL

SURVEY

BLDG. N/A TA-00

DRAWN	OTHERS
DESIGN	N/A
CHECKED	OTHERS
DATE	2012-07-30

SUBMITTED: JAMES O'NEILL
APPROVED FOR RELEASE: JOHN P. MCCANN

Los Alamos NATIONAL LABORATORY PO Box 1663 Los Alamos, New Mexico 87545

SHEET C-1000
3 OF 13

CLASSIFICATION U REVIEWER R BOHN DATE 2012-07-30

PROJECT ID 102698 DRAWING NO C-55803 REV 0

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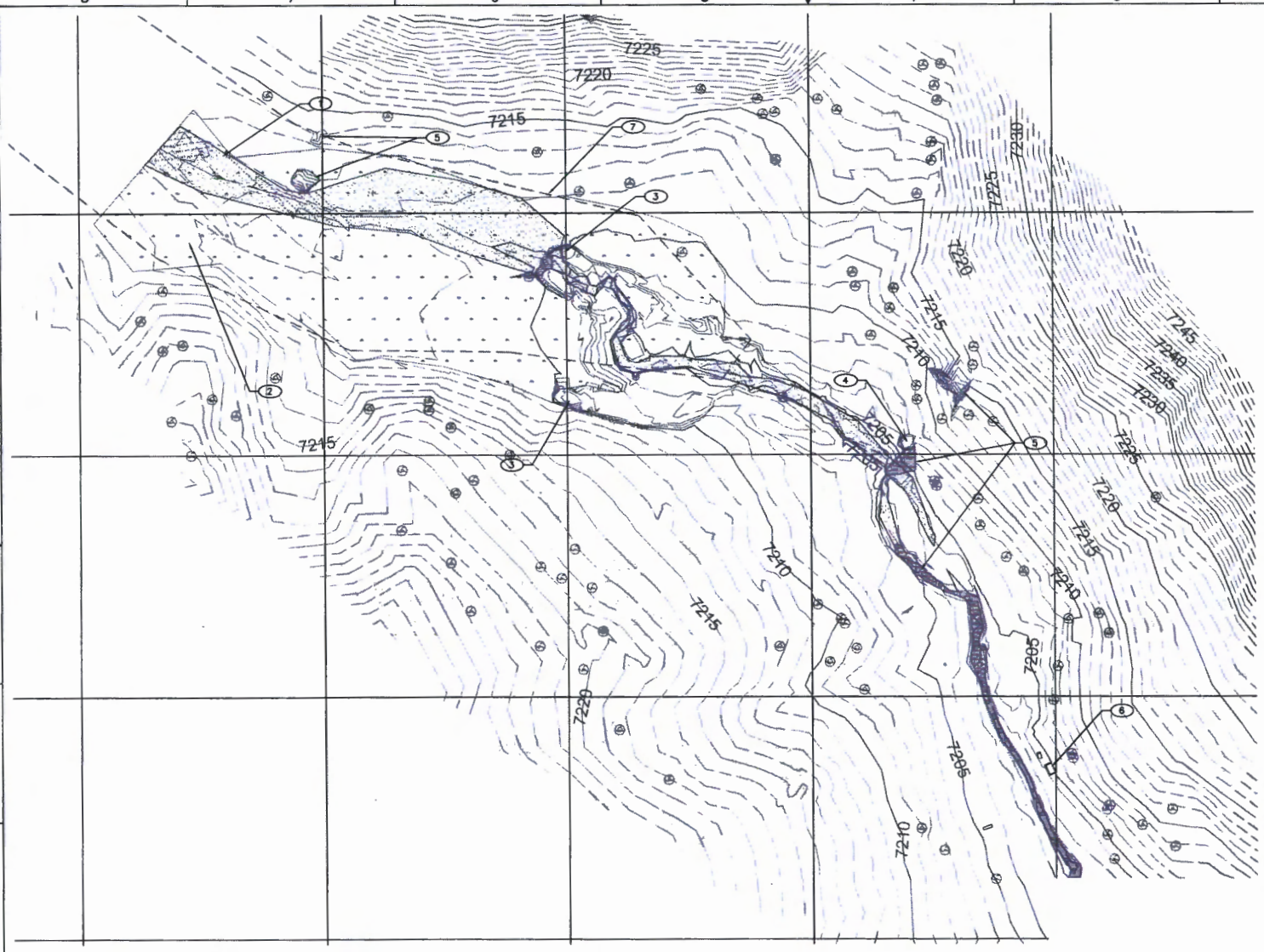

KEYED NOTES

1. SURVEYED STREAMBED LIMITS
2. SURVEYED WETLAND LIMITS
3. EXISTING HEADCUT LOCATIONS
4. SURVEYED BOULDER LOCATION
5. SURVEYED EXPOSED BEDROCK / BOULDERS
6. STREAM GAGE E-123
7. GIS DELINEATION OF WETLAND LIMITS (PROVIDED BY LANL)

PLAN VIEW
SCALE: 1" = 20'

20' 10' 0 10' 20'
1"=20'-0"

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	VER	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL

EXISTING CONDITIONS

DRAWN: D VARJ.
DESIGN: C MCDONALD
CHECKED: J O'NEILL
DATE: 2012-07-30

BLDG. N/A TA-00

SUBMITTED: JAMES O'NEILL
APPROVED FOR RELEASE: JOHN P. MCCANN

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET C-1001
4 OF 13

CLASSIFICATION U
REVIEWER R BOHN
DATE 2012-07-30

PROJECT ID 102698
DRAWING NO C-55803
REV 0

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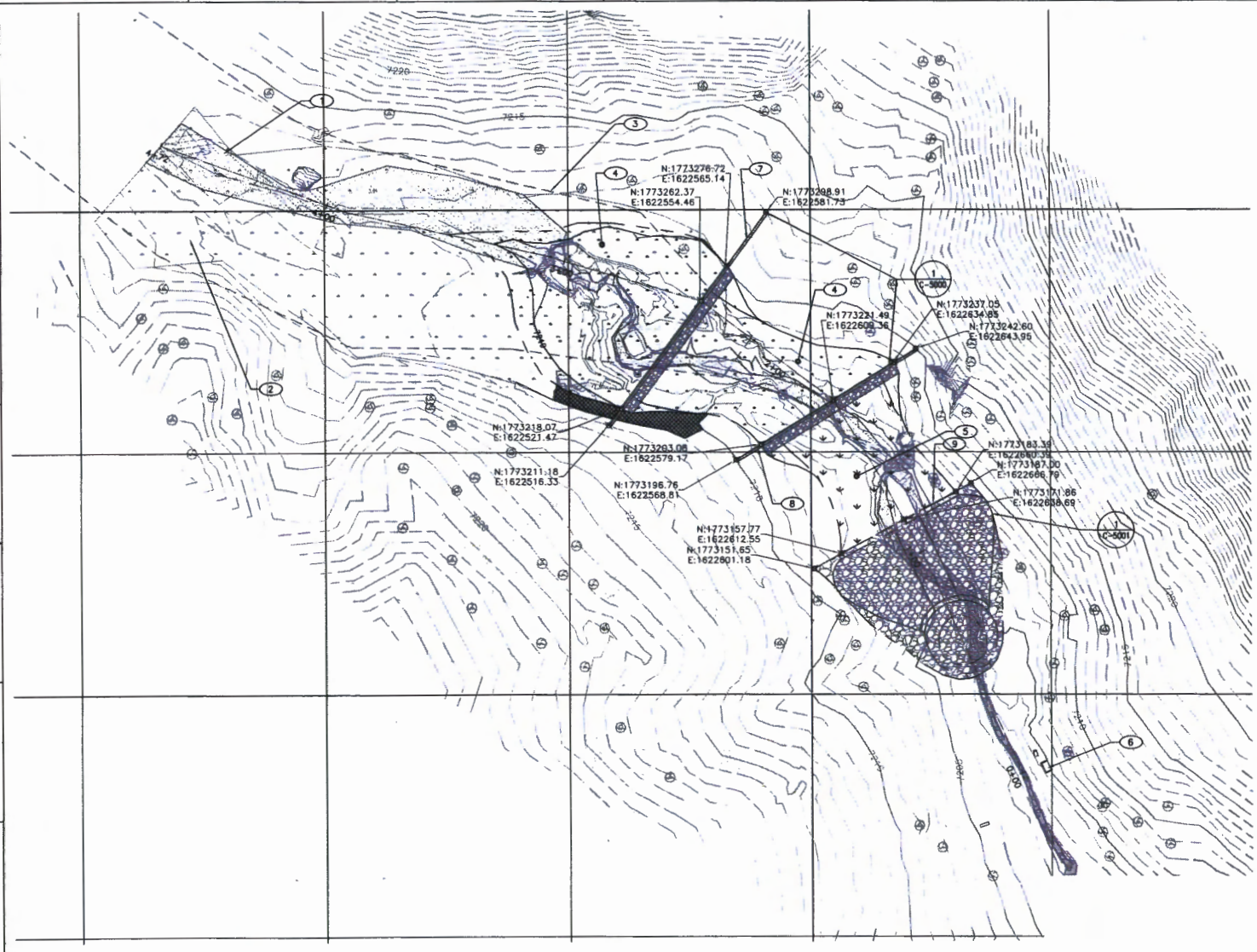

KEYED NOTES

1. SURVEYED STREAMBED LIMITS
2. SURVEYED WETLAND LIMITS
3. GIS DELINEATION OF WETLAND LIMITS (PROVIDED BY LANL)
4. WETLAND RESTORATION ZONE (SEE C-7000 FOR PLANTING DETAILS)
5. WETLAND/STREAM TRANSITION ZONE (SEE C-7000 FOR PLANTING DETAILS)
6. STREAM GAGE E-123
7. GRADE CONTROL STRUCTURE GC-1 (STA. 2+41.5)
8. GRADE CONTROL STRUCTURE GC-2 (STA. 1+73.1)
9. GRADE CONTROL STRUCTURE GC-3 (STA. 1+15.4)

PLAN VIEW
SCALE: 1" = 20'

20' 10' 0 10' 20'
1"=20'-0"

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	VER	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL

OVERALL PLAN VIEW

DRAWN: D VARJ.
DESIGN: C MCDONALD
CHECKED: J O'NEILL
DATE: 2012-07-30

BLDG. N/A TA-00

SUBMITTED: JAMES O'NEILL
APPROVED FOR RELEASE: JOHN P. MCCANN

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET C-1002
5 OF 13

CLASSIFICATION U
REVIEWER R BOHN
DATE 2012-07-30

PROJECT ID 102698
DRAWING NO C-55803
REV 0

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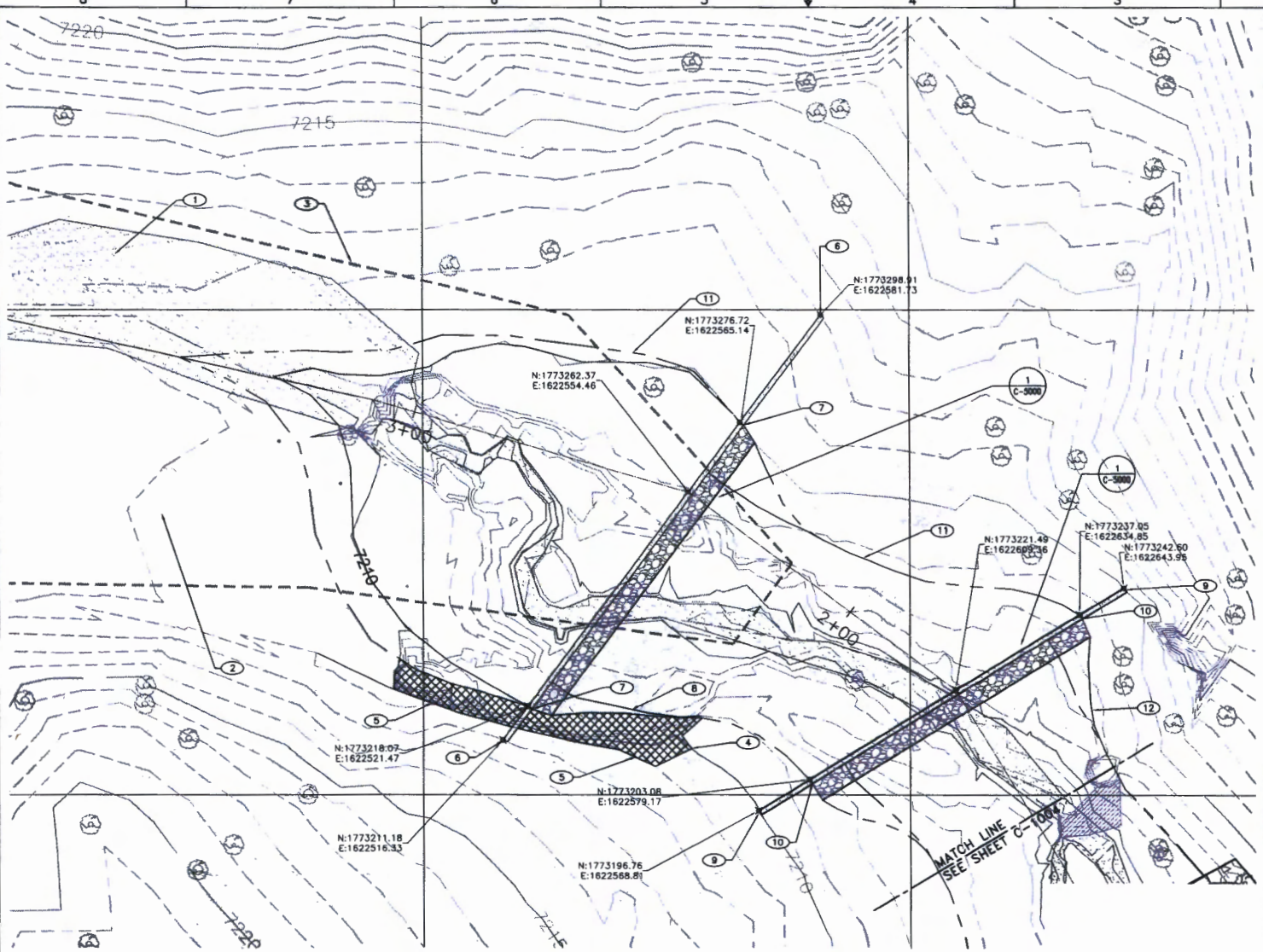
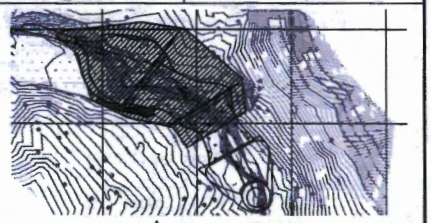


PARTIAL PLAN VIEW
SCALE: 1" = 10'

10' 5' 0 5' 10'
1"=10'-0"



KEY PLAN
SCALE: 1" = 60'

KEYED NOTES

1. SURVEYED STREAMBED LIMITS
2. SURVEYED WETLAND LIMITS
3. GIS DELINEATION OF WETLAND LIMITS (PROVIDED BY LANL)
4. FLOODPLAIN BACKFILL GRADE, ELEVATION 7210.0
5. FLOODPLAIN BACKFILL GRADE, ELEVATION 7211.0
6. GRADE CONTROL STRUCTURE GC-1 TIE ELEVATION = 7212.0
7. GRADE CONTROL STRUCTURE GC-1
   CREST OF WEIR ELEVATION = 7210.0
   DROP ELEVATION = 7209.0
8. FLOODPLAIN BACKFILL GRADE, ELEVATION 7209.0
9. GRADE CONTROL STRUCTURE GC-2 TIE ELEVATION = 7210.0
10. GRADE CONTROL STRUCTURE GC-2
    CREST OF WEIR ELEVATION = 7208.5
    DROP ELEVATION = 7207.5
11. LIMITS OF BACKFILL AND WETLAND RESTORATION
12. LIMITS OF BACKFILL AND STREAM TRANSITION ZONE

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	VER	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL

PARTIAL PLAN – 1

DRAWN	D VARJ.
DESIGN	C MCDONALD
CHECKED	J O'NEILL
DATE	2012-07-30

BLDG. N/A TA-00

SUBMITTED: JAMES O'NEILL
APPROVED FOR RELEASE: JOHN P. MCCANN

Los Alamos NATIONAL LABORATORY PO Box 1663 Los Alamos, New Mexico 87545

SHEET C-1003 6 OF 13

CLASSIFICATION U REVIEWER R BOHN DATE 2012-07-30

PROJECT ID 102698 DRAWING NO C-55803 REV 0

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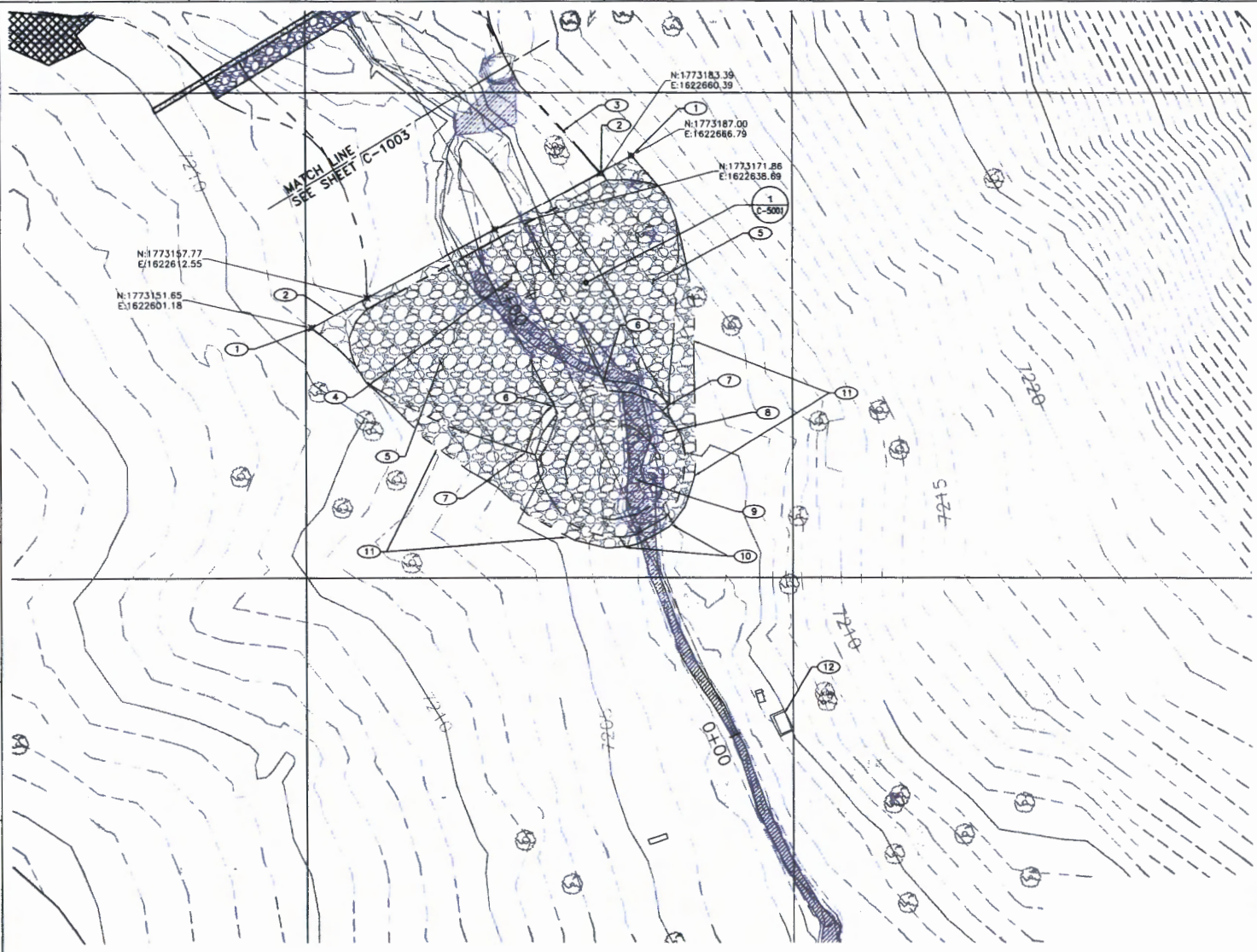
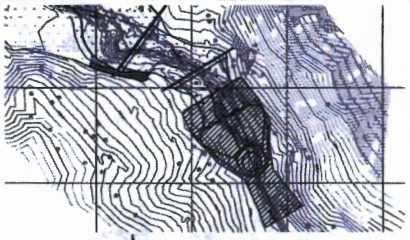


PARTIAL PLAN VIEW
SCALE: 1" = 10'

10' 5' 0 5' 10'
1"=10'-0"



KEY PLAN
SCALE: 1" = 60'

KEYED NOTES

1. GRADE CONTROL STRUCTURE GC-3 TIE ELEVATION = 7209.0
2. GRADE CONTROL STRUCTURE GC-3 CREST OF WEIR ELEV. = 7207.0.
3. LIMITS OF BACKFILL AND STREAM TRANSITION ZONE
4. CASCADE STRUCTURE CENTER CHANNEL, 10% SLOPE
5. CASCADE STRUCTURE SIDESLOPE CHANNELS
6. CASCADE STRUCTURE END-SILL, ELEVATION = 7203.6
7. CASCADE STRUCTURE END-SILL TIE-INS, ELEVATION 7205.6
8. 2:1 SLOPE INTO DROP POOL
9. DROP POOL ELEVATION = 7199.0
10. DROP POOL SILL, TIE TO EXISTING STREAM GRADE AT 7201.0
11. CASCADE LINED EDGES AT EXISTING GRADE
12. EXISTING STREAM GAGE E-123

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	VER	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL

PARTIAL PLAN - 2

DRAWN	D VARJ.
DESIGN	C MCDONALD
CHECKED	J O'NEILL
DATE	2012-07-30

BLDG. N/A TA-00

SUBMITTED: JAMES O'NEILL
APPROVED FOR RELEASE: JOHN P. MCCANN

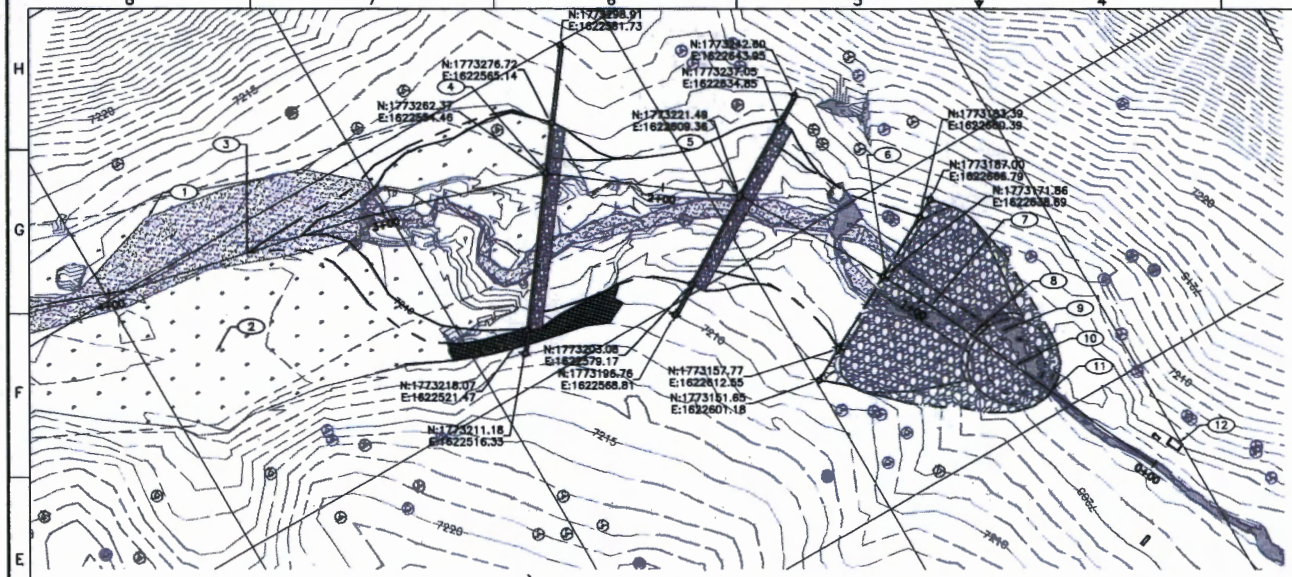
Los Alamos NATIONAL LABORATORY PO Box 1663 Los Alamos, New Mexico 87545

SHEET C-1004
7 OF 13

CLASSIFICATION U | REVIEWER R BOHN | DATE 2012-07-30

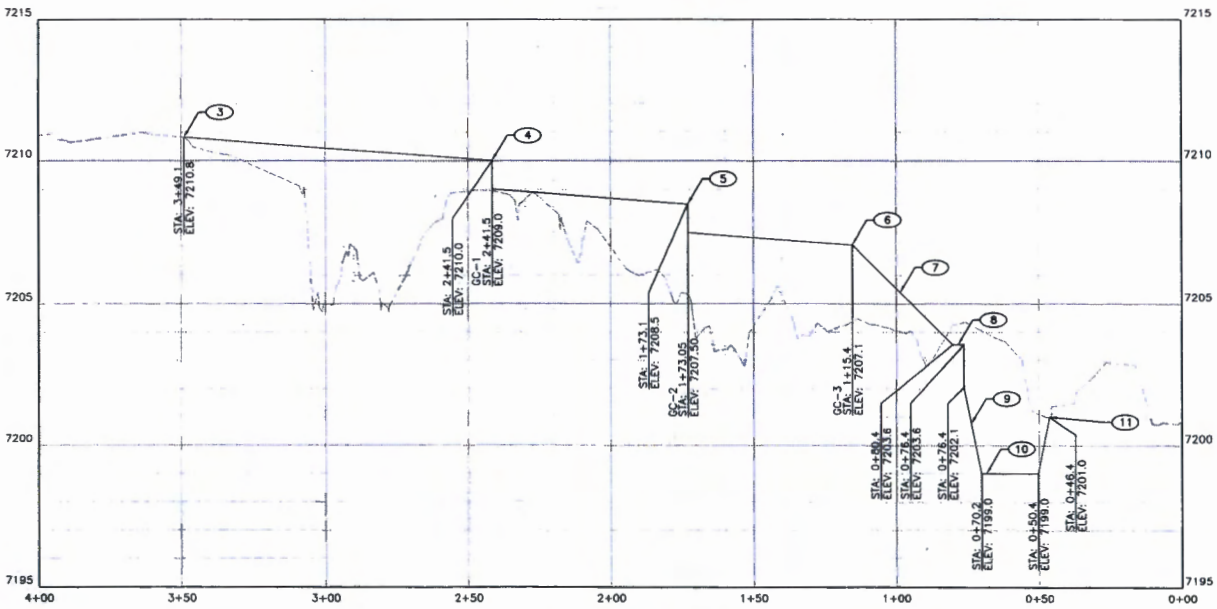
PROJECT ID 102698 | DRAWING NO C-55803 | REV 0

P:\Clients\CONFIDENTIAL-BCDENVER\Sandia_Canyon_CAD\3-Sheets\C-Civil\SET2_GRADE_CONTROL\102698-C-1004-R0.dwg Aug 01, 2012 - 1:43pm cmcdonald



PLAN VIEW
SCALE: 1" = 20'

1"=20'-0"



PROFILE VIEW
HORIZONTAL SCALE: 1" = 20'

1"=20'-0" 1"=2'-0"

KEYED NOTES

1. SURVEYED STREAMBED LIMITS
2. SURVEYED WETLAND LIMITS
3. TIE INTO EXISTING GRADE
4. GRADE CONTROL STRUCTURE GC-1 (STA. 2+41.5)
5. GRADE CONTROL STRUCTURE GC-2 (STA. 1+73.1)
6. GRADE CONTROL STRUCTURE GC-3 (STA. 1+15.4)
7. CASCADE CENTER DROP LOCATION
8. CASCADE END SILL
9. SLOPE INTO CASCADE POOL
10. CASCADE POOL LOCATION
11. SILL TO TIE INTO STREAM GRADE
12. STREAM GAGE E-123

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	VER	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL

PLAN AND PROFILE

DRAWN: D VARJ.
DESIGN: C MCDONALD
CHECKED: J O'NEILL
DATE: 2012-07-30

BLDG. N/A TA-00

SUBMITTED: JAMES O'NEILL
APPROVED FOR RELEASE: JOHN P. MCDANN

Los Alamos NATIONAL LABORATORY
PO Box 1663 Los Alamos, New Mexico 87545

SHEET C-1005
8 OF 13

CLASSIFICATION U
REVIEWER R BOHN
DATE 2012-07-30

PROJECT ID 102698
DRAWING NO C-55803
REV 0

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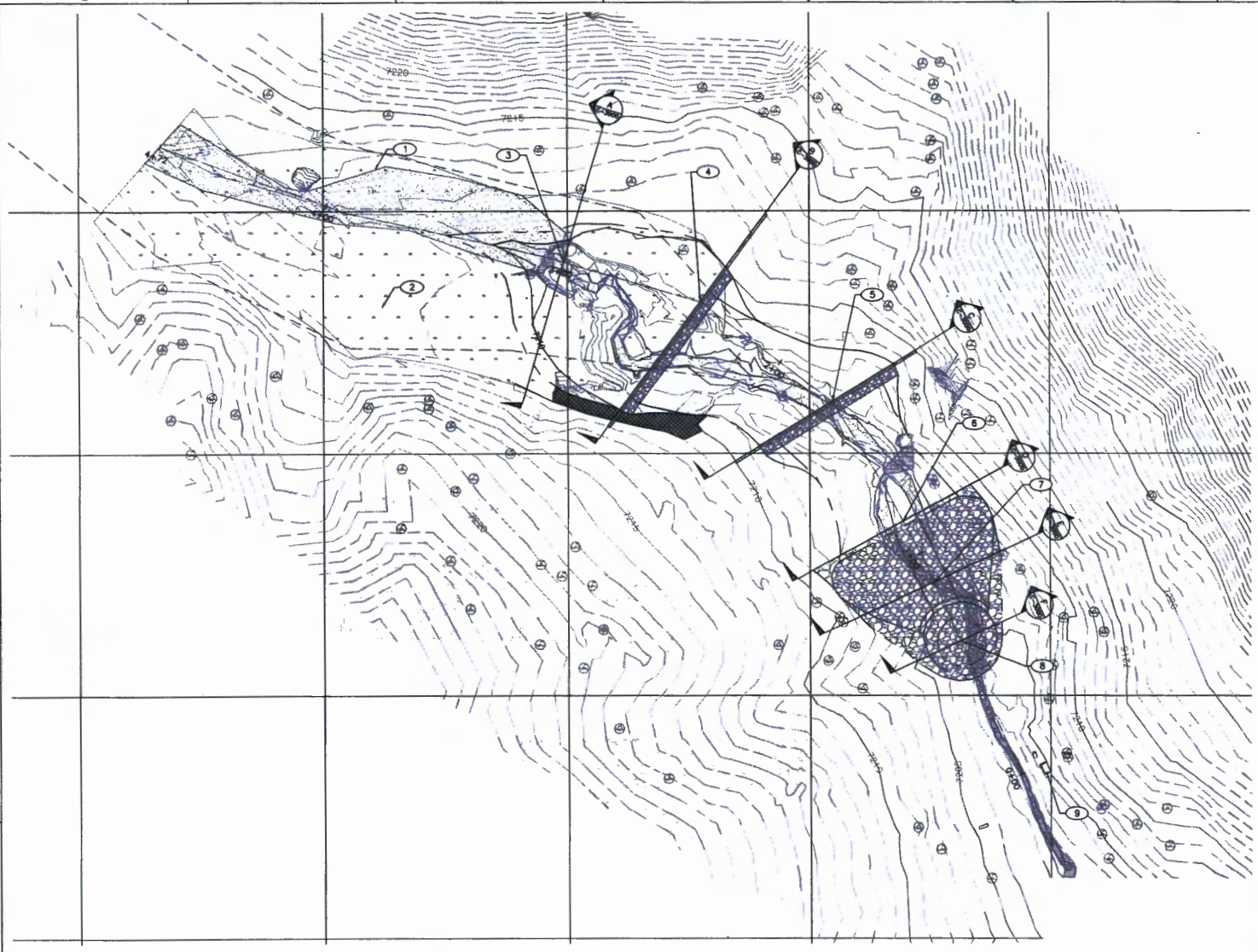
JAMES A. O'NEILL
NEW MEXICO
REGISTERED PROFESSIONAL ENGINEER
2012



KEYED NOTES

1. SURVEYED STREAMBED LIMITS
2. SURVEYED WETLAND LIMITS
3. EXISTING HEADCUT LOCATIONS
4. GRADE CONTROL STRUCTURE GC-1 (STA. 2+41.5)
5. GRADE CONTROL STRUCTURE GC-2 (STA. 1+73.1)
6. GRADE CONTROL STRUCTURE GC-3 (STA. 1+15.4)
7. CASCADE CENTER DROP LOCATION (STA. 0+88.2)
8. CASCADE POOL LOCATION (STA. 0+70.2)
9. EXISTING STREAM GAGE E-123

PLAN VIEW
SCALE: 1" = 20'

20' 10' 0 10' 20'
1"=20'-0"

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	VER	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL

SECTION LOCATION PLAN

DRAWN: D. VARJ.
DESIGN: C. MCDONALD
CHECKED: J. O'NEILL
DATE: 2012-07-30

BLDG. N/A TA-00

SUBMITTED: JAMES O'NEILL
APPROVED FOR RELEASE: JOHN P. MCCANN

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PO Box 1663
Los Alamos, New Mexico 87545

SHEET C-1006
9 OF 13

CLASSIFICATION U
REVIEWER R BOHN
DATE 2012-07-30

PROJECT ID 102698
DRAWING NO C-55803
REV 0

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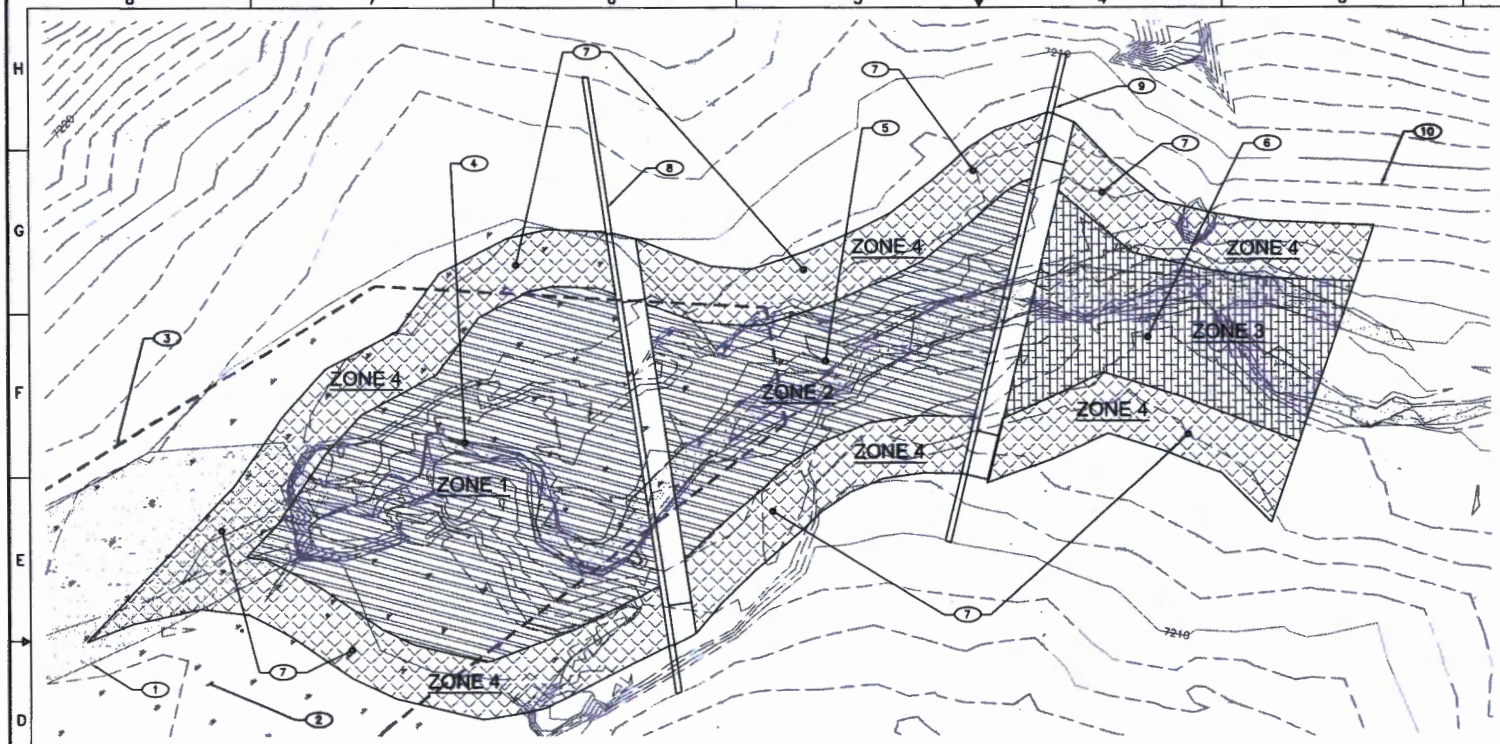


PLAN VIEW
1" = 10'-0"

GENERAL NOTES

1. AREA SHALL BE TEMPORARILY SEEDED IMMEDIATELY UPON COMPLETION OF ANY FINAL GRADES TO PREVENT EROSION.
2. EROSION CONTROL MATTING SHALL BE USED IN WET SHALL BE USED IN WETLAND AREA TO CONTROL EROSION UNTIL VEGETATION IS ESTABLISHED.
3. AREAS OUTSIDE OF WETLAND PLANTING AREA NOTED BELOW SHALL BE SEEDED WITH NATIVE GRASSES.

KEYED NOTES

1. SURVEYED STREAMBED LIMITS
2. SURVEYED WETLAND LIMITS
3. GIS DELINEATION OF WETLAND LIMITS (PROVIDED BY LANL)
4. WETLAND RESTORATION ZONE 1 (AREA = 4,916 SF). SEE PLANTING SCHEDULE FOR SPACING.
5. WETLAND RESTORATION ZONE 2 (AREA = 3,526 SF). SEE PLANTING SCHEDULE FOR SPACING.
6. WETLAND RESTORATION ZONE 3 (AREA = 2,706 SF). SEE PLANTING SCHEDULE FOR SPACING.
7. WETLAND RESTORATION ZONE 4 (AREA = 4,945 SF). SEE PLANTING SCHEDULE.
8. GRADE CONTROL STRUCTURE GC-1
9. GRADE CONTROL STRUCTURE GC-2
10. GRADE CONTROL STRUCTURE GC-3

QUANTITY	SCIENTIFIC NAME	COMMON NAME	TYPE	SPACING (O.C.)	ZONE
		HERBACEOUS			
2120	ELEOCHARIS PALUSTRIS	COMMON SPIKERUSH	PLUG/SEED	2'	1 AND 2
2120	GLYCERIA BOREALIS	NORTHERN MANNAGRASS	PLUG/SEED	2'	1 AND 2
2120	MIMULUS GUTTATUS	SEEP MONKEYFLOWER	PLUG/SEED	2'	1 AND 2
2120	SCIRPUS ACUTUS	HARDSTEM BULRUSH	PLUG/SEED	2'	1 AND 2
2120	SCIRPUS PUNGENS	THREESQUARE BULRUSH	PLUG/SEED	2'	1 AND 2
2120	SCIRPUS TABERNAEMONTANI	SOFTSTEM BULRUSH	PLUG/SEED	2'	1 AND 2
2120	TYPHA LATIFOLIA	BROADLEAF CATTAIL	PLUG/SEED	2'	1 AND 2
677	CAREX AQUATILIS	WATER SEDGE	PLUG/SEED	2'	3
677	CAREX LANUGINOSA	WOOLY SEDGE	PLUG/SEED	2'	3
677	CAREX MURICATA	POINTED SEDGE	PLUG/SEED	2'	3
677	CAREX ROSTRATA	BEAKED SEDGE	PLUG/SEED	2'	3
677	JUNCUS BALTICUS	BALTIC RUSH	PLUG/SEED	2'	3
677	JUNCUS LONGISTYLIS	LONGSTYLE RUSH	PLUG/SEED	2'	3
677	JUNCUS TORREYI	TORREY RUSH	PLUG/SEED	2'	3
677	SCIRPUS PUNGENS	THREESQUARE BULRUSH	PLUG/SEED	2'	3
		TREE/SHRUB			
320	ACER NEGUNDO	BOXELDER	TUBLING	4'	4
320	BACCHARIS SALICIFOLIA	SEEPWILLOW	TUBLING	4'	4
320	SALIX EXIGUA	COYOTE WILLOW	LIVE STAKE	4'	4
320	SALIX IRRORATA	BLUESTEM WILLOW	LIVE STAKE	4'	4

PLANTING SCHEDULE

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	VER	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL

PLANTING AND STABILIZATION PLAN

DRAWN: D VARJ.
DESIGN: B NASH
CHECKED: J O'NEILL
DATE: 2012-07-30

BLDG. N/A TA-00

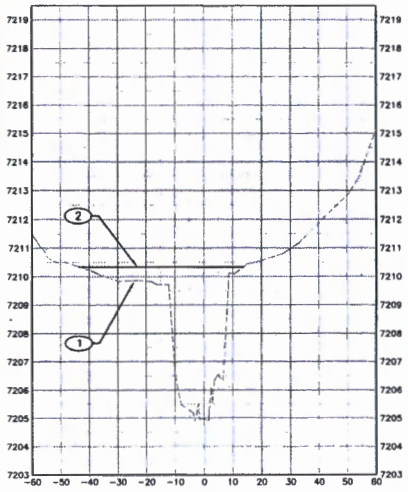
SUBMITTED: JAMES O'NEILL
APPROVED FOR RELEASE: JOHN P. MCCANN

Los Alamos NATIONAL LABORATORY
PO Box 1663 Los Alamos, New Mexico 87545

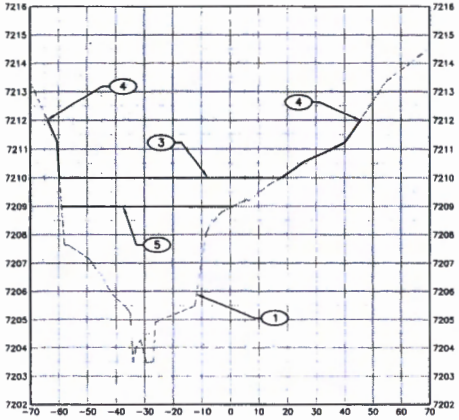
SHEET C-1007
10 OF 13

CLASSIFICATION U REVIEWER R BOHN DATE 2012-07-30

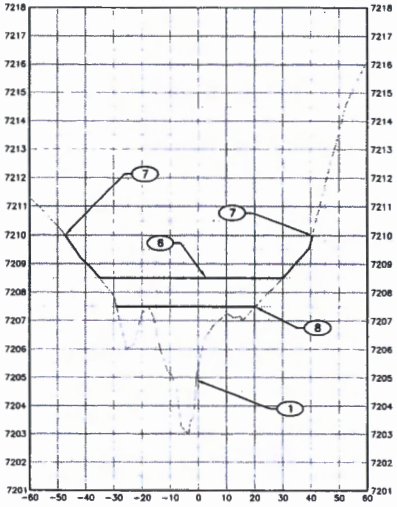
PROJECT ID 102698 DRAWING NO C-55803 REV 0



A C-1006 SECTION (STA. 3+00.0)
SCALE: Hz1"=20', Vt1"=2'



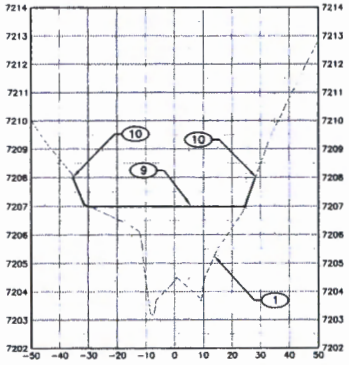
B C-1006 SECTION (STA. 2+41.5)
SCALE: Hz1"=20', Vt1"=2'



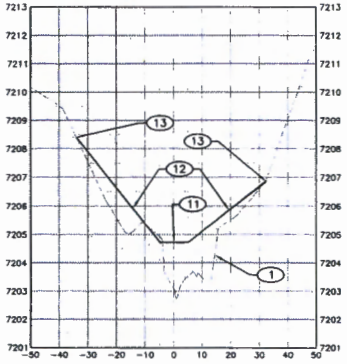
C C-1006 SECTION (STA. 1+73.1)
SCALE: Hz1"=20', Vt1"=2'

KEYED NOTES

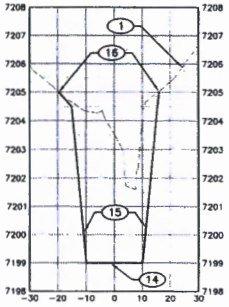
1. EXISTING GRADE
2. PROPOSED BACKFILL ELEVATION = 7210.3
3. GRADE CONTROL STRUCTURE GC-1 MAIN OVERFLOW ELEVATION = 7210.0
4. GRADE CONTROL STRUCTURE GC-1 TIE ELEVATION = 7212.0
5. GRADE CONTROL STRUCTURE GC-1 DROP ELEVATION = 7209.0
6. GRADE CONTROL STRUCTURE GC-2 MAIN OVERFLOW ELEVATION = 7208.5
7. GRADE CONTROL STRUCTURE GC-2 TIE ELEVATION = 7210.0
8. GRADE CONTROL STRUCTURE GC-2 DROP ELEVATION = 7207.5
9. GRADE CONTROL STRUCTURE GC-3 MAIN OVERFLOW ELEVATION = 7207.0
10. GRADE CONTROL STRUCTURE GC-3 TIE ELEVATION = 7208.0
11. CASCADE CENTER CHANNEL, ELEVATION 7204.4
12. CASCADE STRUCTURE SIDESLOPE CHANNELS
13. CASCADE STRUCTURE TIE-IN TO EXISTING ELEVATION
14. DROP POOL ELEVATION = 7199.0
15. 2:1 SLOPE INTO DROP POOL
16. CASCADE STRUCTURE TIE-IN TO EXISTING ELEVATION



D C-1006 SECTION (STA. 1+15.4)
SCALE: Hz1"=20', Vt1"=2'



E C-1006 SECTION (STA. 0+88.2)
SCALE: Hz1"=20', Vt1"=2'



F C-1006 SECTION (STA. 0+70.2)
SCALE: Hz1"=20', Vt1"=2'

20' 10' 0 10' 20'
1"=20'-0"

2' 1' 0 1' 2'
1"=2'-0"

JAMES A. O'NEILL NEW MEXICO REGISTERED PROFESSIONAL ENGINEER 2012

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	VER	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL

SECTIONS

DRAWN	L FORRISTER
DESIGN	C MCDONALD
CHECKED	J O'NEILL
DATE	2012-07-30

BLDG. N/A TA-00

SUBMITTED JAMES O'NEILL

APPROVED FOR RELEASE JOHN P. MCCANN

Los Alamos NATIONAL LABORATORY PO Box 1663 Los Alamos, New Mexico 87545

SHEET C-3000
11 OF 13

CLASSIFICATION U REVIEWER R BOHN DATE 2012-07-30

PROJECT ID 102698 DRAWING NO C-55803 REV 0

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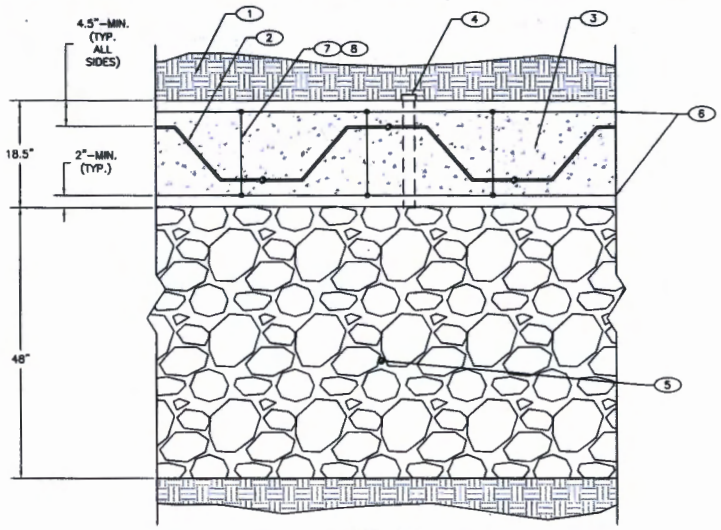
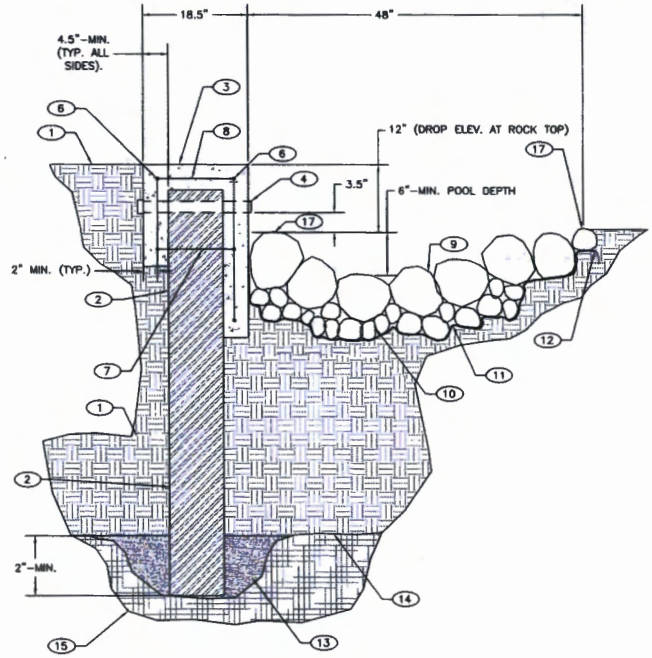
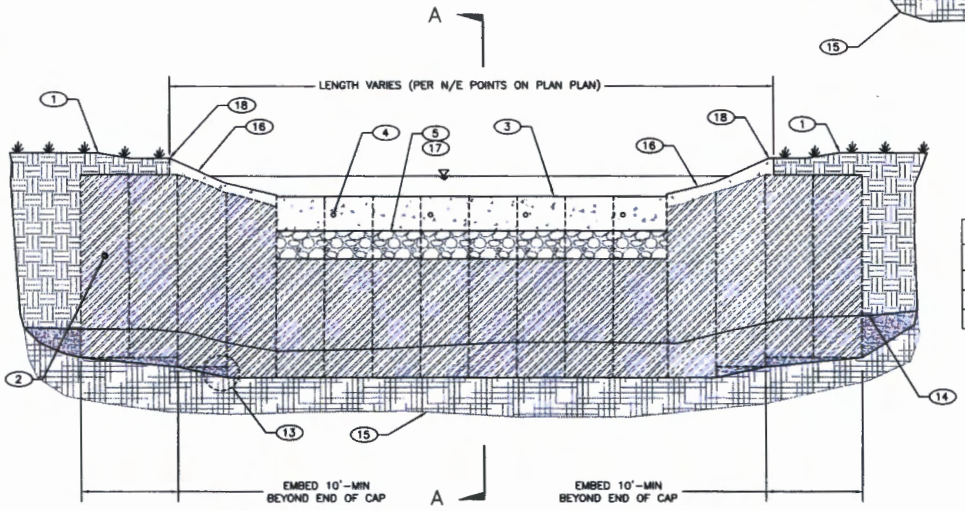


TOP VIEW



SECTION VIEW A-A



FRONT VIEW

1 C-1002 1 C-1003 DETAIL

KEYED NOTES

1. STRUCTURAL BACKFILL AS NEEDED AND COMPACTED TO 95% OF STANDARD PROCTOR DENSITY
2. STEEL SHEET PILE (TYPE PZ-22)
3. CREST OF WEIR ELEVATION, CONCRETE CAP – 4,000 PSI (SEE TABLE THIS SHEET)
4. PVC PIPE (2"-DIA.) WITH SCREENED CAP TO ALLOW DRAINAGE (DRILLED THROUGH PILE AND CAP AS SHOWN, 10-FEET O.C.)
5. ROCK SPLASH APRON ON GC-1 AND GC-2 ONLY (SEE SHEET C-5001 FOR DETAIL AT GC-3)
6. #4 LATERAL REBAR ON CORNERS OF CAP (2.5"-MIN. CLEARANCE TO CONCRETE ALL AROUND)
7. #4 REBAR DRILLED 18"-O.C. THROUGH PILE AND TIED TO BAR-(6) AND BAR-(8).
8. #4 REBAR SADDLE TIED TO BAR-(6) AND BAR-(7) @ 18"-O.C.
9. ONE-MAN STREAMBED BOULDERS FOR ENERGY DISSIPATION
10. COBBLES (12"-DIA. OR SMALLER) FOR BASE COURSE AND LEVELLING
11. 12-OZ PER SY NON-WOVEN GEOTEXTILE
12. ANCHOR GEOTEXTILE AT EDGES OF ROCK PAD
13. ALONG THE PROPOSED LENGTH OF EACH PILE, A TRENCH SHALL BE EXCAVATED TWO FEET INTO BEDROCK AND FILLED WITH BENTONITE (OR OTHER MATERIAL WITH LOWER HYDRAULIC CONDUCTIVITY PROPERTIES) TO CREATE A WATER-TIGHT SEAL. PRIOR TO PLACING WETLAND FILL ABOVE THE FINISHED TRENCH, THE CONTRACTOR SHALL LOCATE (HORIZONTALLY AND VERTICALLY) THE FINISHED TRENCH CENTERLINE AND TO ENSURE THAT THE PILE IS DRIVEN INTO THE TRENCH DURING CONSTRUCTION.
14. EXISTING GRADE
15. IN-SITU MATERIAL OR BEDROCK (UNCOMPACTED)
16. TIE-IN CONCRETE CAP (NOT REINFORCED)
17. DROP ELEVATION (SEE TABLE THIS SHEET)
18. TIE-IN ELEVATION (SEE TABLE THIS SHEET)

STRUCTURE ELEVATIONS

GRADE CONTROL STRUCTURE	CREST OF WEIR ELEVATION	DROP ELEVATION	TIE-IN ELEVATION
GC-1	7210.0	7209.0	7212.0
GC-2	7208.5	7207.5	7210.0
GC-3	7207.0	N/A *	7209.0

* SEE DETAIL C-5001 FOR DROP CONSTRUCTION ON GC-3

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	VER	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON STREAM GRADE CONTROL

DETAILS

DRAWN D VARU.
DESIGN C MCDONALD
CHECKED J O'NEILL
DATE 2012-07-30

BLDG. N/A TA-00

SUBMITTED JAMES O'NEILL
APPROVED FOR RELEASE JOHN P. MCCANN

Los Alamos NATIONAL LABORATORY PO Box 1663 Los Alamos, New Mexico 87545

SHEET C-5000
12 OF 13

CLASSIFICATION U REVIEWER R BOHN DATE 2012-07-30

PROJECT ID 102698 DRAWING NO C-55803 REV 0

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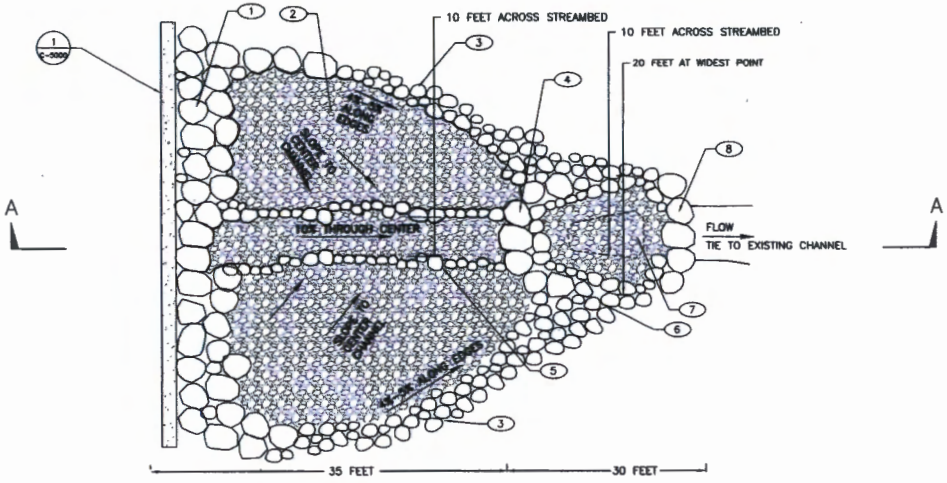
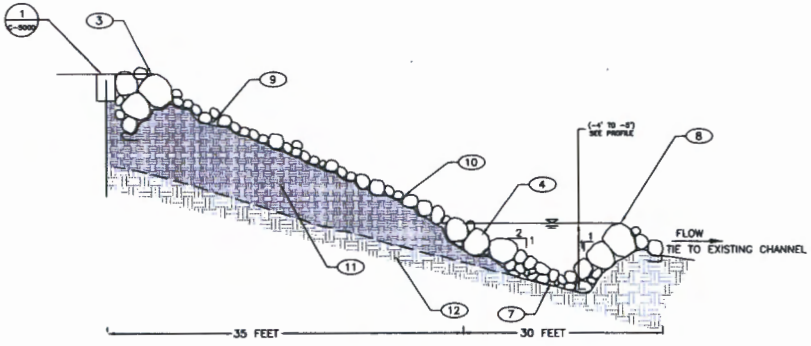


TOP VIEW



SECTION VIEW A–A

1 C-1002 / 1 C-1004 DETAIL

KEYED NOTES

1. TWO MAN STREAM BOULDERS AT CREST OF CASCADE
2. 12" STREAMBED COBBLES THROUGHOUT CASCADE INTERIOR
3. PLACE ONE MAN STREAMBED BOULDERS TO FORM CASCADE EDGE
4. TWO MAN STREAMBED BOULDERS AT END OF CASCADE
5. PLACE ONE MAN STREAMBED BOULDERS TO FORM CENTER CHANNEL
6. PLACE ONE MAN STREAMBED BOULDERS TO LINE EDGE OF POOL
7. 12" STREAMBED COBBLES THROUGHOUT CASCADE POOL (BOTTOM ELEV. = 7199.0')
8. TWO MAN BOULDERS AT CREST OF POOL SILL TO STREAM CHANNEL TIE–IN
9. GEOSYNTHETIC CLAY LINER (16–OZ/SY NON–WOVEN BOUND) TO LINE CASCADE
10. FILL VOID SPACES WITH SMALL COBBLES AND STREAMBED SEDIMENT
11. EXCAVATED MATERIAL BACKFILLED AS NEEDED AND COMPACTED TO 95% OF STANDARD PROCTOR DENSITY
12. EXISTING GRADE

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	VER	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL

DETAILS

DRAWN: D VARJ.
DESIGN: C MCDONALD
CHECKED: J O'NEILL
DATE: 2012-07-30

BLDG. N/A TA-00

SUBMITTED: JAMES O'NEILL
APPROVED FOR RELEASE: JOHN P. MCCANN

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SHEET C-5001 13 OF 13

CLASSIFICATION U REVIEWER R BOHN DATE 2012-07-30

PROJECT ID 102698 DRAWING NO C-55803 REV 0

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ENCLOSURE 5

Dredge & Fill Quantities Worksheet

ENV-RCRA-13-0065

LAUR-13-20922

Date: MAR 2 7 2013

ENCLOSURE 5
Dredge and Fill Quantities Worksheet
Action No. SPA-2012-00050-ABQ

Discharges to the Sandia Canyon Watercourse

Site #	Type	Location	Wetland?	Wetlands Width** (ft)	Channel OHWM (ft)	Fill Length (ft)	Fill Width (ft)	Fill depth (ft)	Fill Volume (cu.ft.)	Area (sq. ft.)	Cubic Yards (CY)	Acres	Fill Materials
1	Sheet piling	Grade Control Structure #1	Y	39	6	6	0.03	8.5	2	0	0.06	0.000	steel
1	Concrete	Grade Control Structure #1	Y	39	6	6	1.54	2.5	23	9	0.9	0.000	concrete
1	Rock	Grade Control Structure #1	Y	39	6	6	4	1.5	36	24	1.3	0.001	rock riprap
1	Backfill	Grade Control Structure #1	Y	39	6	6	1.5	6.5	59	9	2.2	0.000	clean backfill
1	Bentonite	Grade Control Structure #1	Y	39	6	6	3	2	36	18	1.33	0.000	bentonite
1	Headcut Fill	Upstream of Structure #1	Y	39	6	6	68	3.74	1,526	408	56.46	0.009	clean backfill
2	Sheet piling	Grade Control Structure #2	N	0	7	7	0.03	7.5	2	0	0.06	0.000	steel
2	Concrete	Grade Control Structure #2	N	0	7	7	1.5	3	32	11	1.17	0.000	concrete
2	Rock	Grade Control Structure #2	N	0	7	7	4	2	56	28	2.1	0.001	rock riprap
2	Backfill	Grade Control Structure #2	N	0	7	7	1.5	5.5	58	11	2.1	0.000	clean backfill
2	Bentonite	Grade Control Structure #2	N	0	7	7	2	2	28	14	1.0	0.000	bentonite
3	Sheet piling	Grade Control Structure #3	N	0	12	12	0.03	6	2	0	0.08	0.000	steel
3	Concrete	Grade Control Structure #3	N	0	12	12	1.54	3	55	18	2.1	0.000	concrete
3	Rock	Grade Control Structure #3	N	0	12	12	63.5	1.5	1,143	762	42	0.017	rock riprap
3	Backfill	Grade Control Structure #3	N	0	12	12	1.5	4	72	18	2.7	0.000	clean backfill
3	Bentonite	Grade Control Structure #3	N	0	12	12	3	2	72	36	2.7	0.001	bentonite
Total Discharges to Sandia Canyon Watercourse (all materials)									**3,200**	**1,366**	**118**	**0.031**	**all**

Discharges to the Sandia Canyon Wetlands

Site #		Location	Wetland?	Wetlands Width** (ft)	Channel OHWM (ft)	Fill Length** (ft)	Fill Width (ft)	Fill depth (ft)	Fill Volume (cu.ft.)	Area (sq. ft.)	Cubic Yards (CY)	Acres	Fill Materials
1	Sheet piling	Grade Control Structure #1	Y	39	6	39	0.03	8.5	10	1	0.4	0.000	steel
1	Concrete	Grade Control Structure #1	Y	39	6	39	1.54	2.5	150	60	6	0.001	concrete
1	Rock	Grade Control Structure #1	Y	39	6	39	4	1.5	234	156	9	0.004	rock riprap
1	Backfill	Grade Control Structure #1	Y	39	6	39	1.5	6.5	380	59	14	0.001	clean backfill
1	Bentonite	Grade Control Structure #1	Y	39	6	39	3	2	234	117	9	0.003	bentonite
1	Headcut Fill	Upstream of Structure #1	Y	39	6	39	68	3.74	9,918	2,652	367	0.061	clean backfill
2	Sheet piling	Grade Control Structure #2	N	0	7	0	0	0	0	0	0.0	0.000	steel
3	Sheet piling	Grade Control Structure #3	N	0	12	0	0	0	0	0	0.00	0.000	steel
Total Discharges to Sandia Canyon Wetland (all materials)									**10,927**	**3,045**	**404**	**0.070**	**all**

**Wetland width + channel width=45 ft Max fill depth for the headcut fill is 5.5 feet average of 3.74 feet.

ENCLOSURE 5
Dredge and Fill Quantities Worksheet
Action No. SPA-2012-00050-ABQ

Temporary Discharges to the Sandia Canyon Wetland													
Site #	Type	Location	Wetland?	Wetlands Width** (ft)	Channel OHWM (ft)	Fill Length (ft)	Fill Width (ft)	Fill depth (ft)	Fill Volume (cu.ft.)	Area (sq. ft.)	Cubic Yards (CY)	Acres	Fill Materials
1	Sump Pit	Above Grade Control #1	Y	39	6	10	15	8.5	1275	150	47.18	0.003	Erosion Blanket
Total Discharges to Sandia Canyon Watercourse (all materials)									1,275	150	47	0.003	all

Temporary Discharges to the Sandia Canyon Watercourse													
Site #	Type	Location	Wetland?	Wetlands Width** (ft)	Channel OHWM (ft)	Fill Length (ft)	Fill Width (ft)	Fill depth (ft)	Fill Volume (cu.ft.)	Area (sq. ft.)	Cubic Yards (CY)	Acres	Fill Materials
2	Gabions	Below Grade Control #1	N	0	6	6	2	1	12	12	0.44	0.000	Rock
3	Pipe Outfall Structure	Below Grade Control #1	N	0	6	6	10	1	60	60	2.22	0.001	Rock
Total Discharges to Sandia Canyon Watercourse (all materials)									72	72	3	0.002	all

ENCLOSURE 6

Sandia Wetland Delineation Report, July 2010

ENV-RCRA-13-0065

LAUR-13-20922

Date: MAR 27 2013

Los Alamos Technical Associates, Inc.

999 Central Ave., Suite 300 / Los Alamos, NM 87544 / Telephone (505) 662-9080 / FAX (505) 662-1757

July 14, 2010

Mr. Ray Cruz
DOE NNSA Service Center
PO Box 5400
Albuquerque, NM 87185
Via email: rcruz2@doeal.gov

SUBJECT: Environmental Assessment (EA) for the Expansion of the Sanitary Effluent Reclamation Facility and Environmental Restoration of Reach S-2 of Sandia Canyon at Los Alamos National Laboratory, Los Alamos

RE: Deliverables: Wetland Delineation Report, Revised

Dear Mr. Cruz:

Los Alamos Technical Associates, (LATA) is submitting a *revision* to the Wetland Delineation Report for this EA, prepared by our subcontractor HDR. The revised document addresses a comment from Ms. Elizabeth Withers.

Please do not hesitate to contact me at 505-662-1816 if you require any further clarification regarding our submittals.

Sincerely,

Felicia M. Aguilar

Felicia M. Aguilar
Los Alamos Operations Manager

cc: NEPA File
D. Goralczyk
R. Hull

Delineation and Preliminary Jurisdictional Determination of Waters of the U.S.

Sandia Canyon
Los Alamos National Laboratories
Los Alamos County, New Mexico

Prepared for:
U.S. Department of Energy
National Nuclear Security Administration
Los Alamos Site Office

Los Alamos County, New Mexico

Prepared by:

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1.0 INTRODUCTION

This report presents the results of a delineation and preliminary jurisdictional determination of waters of the United States (U.S.), including wetlands, performed on an approximately 27.5-acre study area in Sandia Canyon in Los Alamos County, New Mexico. The study area is located within Los Alamos National Laboratories (LANL). LANL occupies about 40 square miles of land in northwestern New Mexico and is located on the eastern portion of the Jemez Mountains along the Pajarito Plateau (**Appendix A, Figure 1**).

The preliminary jurisdictional determination for waters of the U.S., including wetlands was conducted by HDR Engineering, Inc. (HDR) for LANL in support of the requirements of Section 404 of the Clean Water Act (CWA). The following determination was conducted in accordance with the 1987 *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory, 1987) and the interim regional supplement for the Western Mountains, Valleys, and Coastal Region (U.S. Army Corps of Engineers, 2008a) through aerial photography and a site visit conducted in June 2010. HDR evaluated the potential for federal jurisdiction under Section 404 of the CWA over aquatic features in the study area based on U.S. Army Corps of Engineers (USACE) revised guidance published December 2, 2008 (USACE, 2008b). The guidance was issued pursuant to the U.S. Supreme Court findings in the Rapanos and Carabell cases and is referred to as the Rapanos Guidance. The results are followed by a discussion of potential permitting requirements and recommendations based on the findings. The determination within this report is subject to review and approval by the Albuquerque District of the USACE, and the final jurisdictional determination is within the regulatory authority of the USACE.

2.0 STUDY AREA DESCRIPTION

The study area is located within LANL, which as stated before occupies about 40 square miles of land in northwestern New Mexico (**Appendix A, Figure 1**). The predominant land uses in the vicinity of the study area are undeveloped, industrial, and commercial.

The study area includes a reach within Sandia Canyon which flows to the east from an outfall along the western side of the study area and out of the eastern side of the study area. Based on aerial photography and USGS topographical maps (USGS, 1984), Sandia Canyon appears to discharge into the Rio Grande River, a traditional navigable water (TNW). However, LANL investigations in Sandia Canyon indicate that the perennial surface water flow that is the primary source of water for the wetland being delineated terminates approximately 2.5 miles further downstream from the wetland, where it infiltrates shallow alluvium in the canyon floor (LANL 2009).

The study area appears to have been disturbed by past land uses and grading associated with the surrounding development, including the county landfill located just north of the study area. The vegetation in the study area contains species typical of canyons in the arid southwest and also areas that have been disturbed and regenerated (e.g., cattail, reed canarygrass, and coyote willow).

3.0 WATERS OF THE U.S. DELINEATION

3.1 Methods

A recent topographic map of the study area and one-meter resolution digital true color aerial photography (LANL, 2010) were used to identify potential locations for waters of the U.S. and areas prone to wetland development. On June 9, 2010, experienced HDR Environmental Scientist Tom Trimble conducted a reconnaissance site visit with LANL personnel David Keller and Kathy Bennett to assess the presence and condition of waters of the U.S. within the study area. Using six-inch resolution digital true color aerial photography (LANL, 2010) and data gathered during the site visit, the delineation was performed in accordance with the USACE 1987 Wetlands Delineation Manual (Environmental Laboratory, 1987) and the interim regional supplement for the Western Mountains, Valleys, and Coast Region (USACE, 2008a). The delineation was also performed to reflect guidance from the USACE in accordance with the U.S. Supreme Court rulings in the SWANCC and Rapanos cases.

Based on the review of topographic maps and high resolution true color aerial photography, areas potentially containing waters of the U.S. (e.g., stream corridors, impoundments, etc.) and wetlands (areas adjacent to streams or with little slope and depressional areas) were evaluated remotely and during the on-site reconnaissance survey. The on-site delineation was then performed and documented using true color aerial photography, and was mapped as a data layer using a Trimble GeoXT global positioning system (GPS) unit that is accurate to one meter. The data layer was then transferred into the computer system, ArcGIS 9.3, for analysis and mapping.

3.2 Results

3.2.1 Waters of the U.S.

Waters of the U.S. within the study area are described below. A delineation map for waters of the U.S. within the study area is provided in **Appendix A (Figure 2)**. Wetland determination data forms and a stream data sheet are provided in **Appendix B**.

Waters of the U.S. within the study area consist of one stream channel and one emergent wetland that is dominated by cattail (*Typha angustifolia*) (**Table 1**).

Table 1. Individual Waters of the U.S. within the Study Area

Resource ID	Description	OHWM* (feet)	Classification	Linear Feet Within Study Area	Acreage Within Study Area
S-1	Perennial Stream	8	RPW**	1,305	0.24
W-1	Emergent Wetland	---	PEM***	---	2.97
Total				**1,305**	**3.21**

* OHWM – ordinary high water mark
** RPW – relatively permanent water
*** PEM – palustrine emergent wetland

Perennial Stream S-1 (Sandia Canyon tributary) in the study area has an average ordinary high water mark (OHWM) width of approximately 8 feet. The channel bottom is composed of sand

and gravel with some in-channel vegetation. The banks of the stream are steeply sloped due to the incised nature of recent erosion along the stream channel. The banks of the channel are approximately 25 feet in width and 4 feet in height on average. The banks are largely covered with small shrubs and herbaceous vegetation typical of channels in the arid southwest region. The channel and banks contain some accumulations of sediment and moderate erosion due to the land and water uses upstream of the study area. This perennial stream appears to flow in response to releases from the power plant upstream of the study area. The channel flowed consistently during the site visit and flows throughout the year based on reports from LANL personnel.

The emergent wetland (W-1) located within the study area is approximately 2.97 acres in size. This emergent wetland directly abuts S-1 and the dominant vegetation consists of cattails and curly dock (*Rumex crispus*). The wetland also contains minor amounts of secondary species such as reed canarygrass (*Phalaris arundinacea*), brome (*Bromus tectorum*), Baltic rush (*Juncus balticus*), burhead (*Echinodorus* sp.), coyote willow (*Salix exigua*), and planted cottonwood trees (*Populus deltoides*). Approximately 80% of wetland W-1 was inundated and the soils were too wet to color accurately during the site visit; however, the soil pits in the drier portions of the wetland were found to have a low chroma and very few oxidized roots channels. These soils were 10YR3/2 and made up of gravelly sand, whereas the upland soils were 10YR6/3 and made up of a gravelly sand material. The wetland's primary water source is the perennial stream channel that receives nearly constant releases from the power plant upstream. Additional sources of hydrology for the wetland in the study area include runoff from precipitation events in the canyon.

3.2.2 Non-Jurisdictional Aquatic or Drainage Features

No non-jurisdictional aquatic or drainage features are present in the study area.

4.0 SUMMARY AND RECOMMENDATIONS

The study area contains one stream of 1,305 linear feet and 2.97 acres of emergent wetland that are considered to be a water of the U.S. based on this study.

4.1 Historical Changes in the Sandia Canyon Wetlands

This delineation and proposed jurisdictional determination of the study area is based on the best professional judgment of HDR's wetland delineator, with extensive experience with similar resources in the southwest region. Based on the findings of this evaluation, HDR identified the boundary of the wetland to be approximately 2.97 acres in size, compared to 2.96 acres in 2005, 3.55 acres in 2000, and 6.14 acres in 1996 (**Appendix D, Figures 3-6**). HDR also identified approximately 1,305 linear feet of perennial stream channel in the study area.

4.2 Regulatory and Permitting Discussion

This delineation and proposed jurisdictional determination does not constitute a final jurisdictional determination or significant nexus determination which can only be officially rendered by the USACE Regulatory Branch through the formal review process. Based on the findings of this evaluation, HDR recommends that this delineation and preliminary jurisdictional evaluation report be submitted to the USACE for verification.

Projects can be conducted in uplands and in non-jurisdictional waters (e.g., non-jurisdictional aquatic features) with no Section 404 permitting requirements. However, if the proposed project will cause fill within the feature identified as a water of the U.S. (i.e., W-1 or S-1) in this report and the findings of this report are verified by the USACE, impacts to this feature would require authorization under Section 404.

4.3 Other Permitting Requirements

Section 401 of the CWA requires that projects permitted under Section 404 meet conditions to ensure water quality protection during and following placement of fill (e.g., construction activities). The New Mexico Environmental Department (NMED) administers this program through it's Surface Water Quality Division. A comprehensive Stormwater Pollution Prevention Plan (SWPPP) developed in accordance with the National Pollution Discharge Elimination System (NPDES) Statewide General Permit for stormwater discharges from construction activities (General Permit NMR100000) will fulfill the requirements of the Section 401 Water Quality Certification. A review of the Best Management Practices (BMPs) in the site SWPPP should be conducted to verify consistency.

5.0 REFERENCES

Environmental Laboratory. 1987. *Corps of Engineers Wetlands Delineation Manual*. Technical Report Y-87-1, Department of the Army, Waterways Experiment Station.

LANL 2009. Los Alamos National Laboratory, Investigation Report for Sandia Canyon, LA-UR-09-6450, Los Alamos, NM. October 2009.

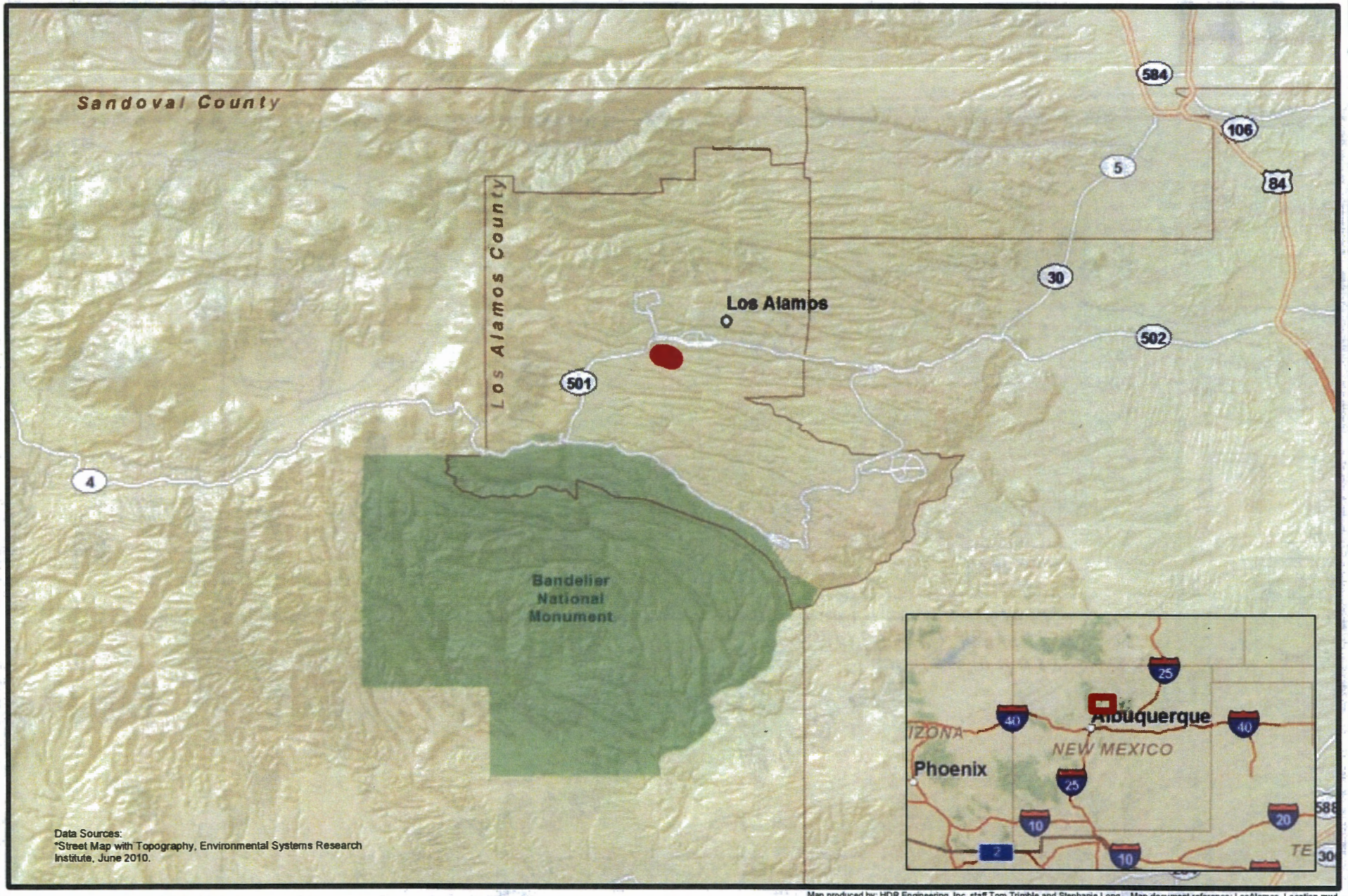
Los Alamos National Laboratories. 2010. Review of Internal Recent Aerial Photography with David Keller. Pers. Communication.

United States Army Corps of Engineers (USACE). 2008a. Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coastal Region, ed. J.S. Wakeley, R.W. Lichvar, and C.V. Noble. ERDC/EL TR 08-13. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

———. 2008b. Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States and Carabell v. United States. U.S. Army Corps of Engineers, Headquarters.

United States Geological Survey (USGS). 1984. Guaje Mountain and Frijoles Quads, Los Alamos County, New Mexico.

Appendix A:
Waters of the U.S. Delineation Map



Map produced by: HDR Engineering, Inc. staff Tom Trimble and Stephanie Long Map document reference: LosAlamos_Location.mxd

FIGURE 1

Legend

Project Location

0 2 4 6 8

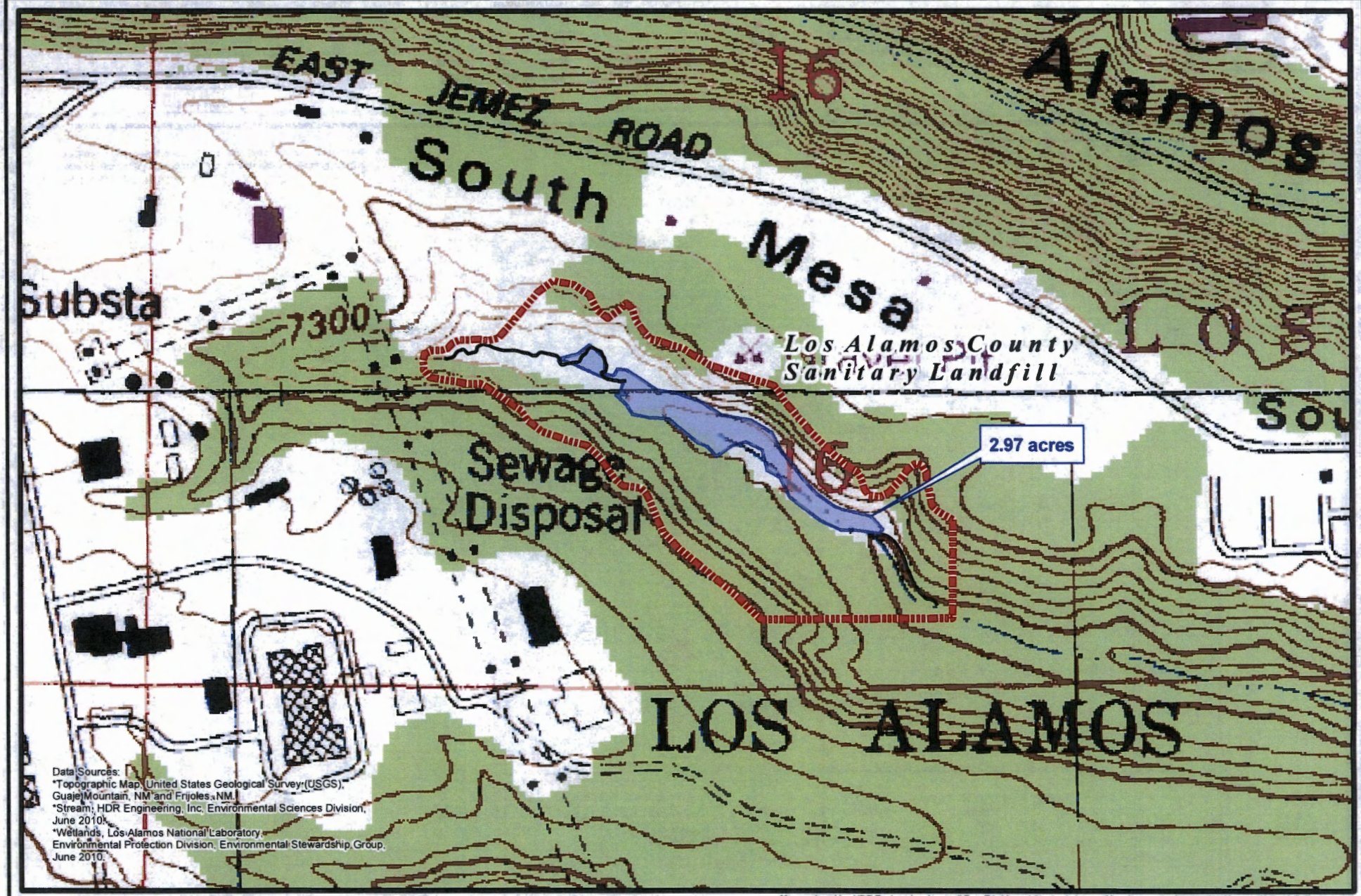
Miles

New Mexico State Plane Coordinate System, Units feet, North American Datum 1983.

N W E S

Disclaimer: This map was created for work processes associated with the 2010 Sandia Wetland Delineation at Los Alamos National Laboratory. All other uses for this map should be confirmed with LANL ENV-ES Biology staff.

HDR



Map produced by: HDR Engineering, Inc. staff Tom Trimble and Stephanie Long Map document reference: LosAlamos_Wetland_Delineate.mxd

FIGURE 2

Legend

Study Area — Stream 06/10/2010

0 500 1,000

Feet

New Mexico State Plane Coordinate System, Units feet, North American Datum 1983.

N W E S

Disclaimer: This map was created for work processes associated with the 2010 Sandia Wetland Delineation at Los Alamos National Laboratory. All other uses for this map should be confirmed with LANL ENV-ES Biology staff.

HDR

Appendix B:
Representative Site Photos

Sandia Canyon Wetland Delineation
Representative Site Photography
June 9, 2010

Photo 1. Outfall structure on the far western edge of the study area. This flow, due to releases from the power plant, supplies the hydrology for the stream (S-1) and wetland (W-1).

Photo 2. Stream S-1 on the western portion of the study area. Note the severe erosion and incised channel. Also note the vegetation within the OHWM of the channel.

Photo 3. Photo taken of the western portion of wetland W-1. Note the cottonwood (*Populus deltoides*) was planted in the previous years. This portion of the wetland was drier than the eastern portion which was completely inundated. This portion was saturated to the surface.

Photo 4. Soils within the drier portions of W-1. Note the color of the soil is 10YR3/2. Also note the water in the bottom of the open pit. Depth to water was approximately 10 inches.

Photo 5. The eastern portion of W-1. Note the homogenous stand of cattails (*Typha angustifolia*) in the wetland.

Photo 6. Photo of the head cutting on the easternmost side of W-1.

Photo 7. Stream S-1 on the eastern side of the study area. Photo taken from the easternmost edge of W-1 looking east out of the study area.

Photo 8. Upland habitat in Sandia Canyon.

Photo 9. Photo looking down on W-1 from the top of the canyon walls.

Photo 10. Photo looking down on W-1 from the top of the canyon walls.

Appendix C:
Data Sheets

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: SANDIA CANYON City/County: LOS ALAMOS / LOS ALAMOS Sampling Date: 6-9-2010
Applicant/Owner: LANL State: NM Sampling Point: W-1
Investigator(s): T. TRIMBLE Section, Township, Range: _____
Landform (hillslope, terrace, etc.): CANYON Local relief (concave, convex, none): NONE Slope (%): _____
Subregion (LRR): ROCKY MTN FOREST + RANGE Lat: _____ Long: _____ Datum: _____
Soil Map Unit Name: ROCK OUTCROPS – ESCARPEMENTS NWI classification: PEM
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	Is the Sampled Area within a Wetland? Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: 10m x 10m)			
1. SALIX EXIGUA	5	Y	OBL
2.			
3.			
4.			
5.			
	5 = Total Cover		
Herb Stratum (Plot size: 5m x 5m)			
1. TYPHA ANGUSTIFOLIA	75	Y	OBL
2. RUMEX CRISPUS	10	N	FACW
3. PHALARIS ARUNDINACEA	5	N	OBL
4. JUNCUS BALTICUS	5	N	OBL
5. BROMUS TECTORUM	<2	N	NL
6. ECHINODORUS SP.	<2	N	OBL
7.			
8.			
9.			
10.			
11.			
	99 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum 1

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:
___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks:

SOIL

Sampling Point: W-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR3/2		—	—	—	—	SAND	WITH ~25% GRAVEL

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (except MLRA 1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- X Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): —

Hydric Soil Present? Yes X No ___

Remarks:
- SOILS HAVE REDUCED CHROMA COMPARED TO UPLAND SOILS
- CONSIDERED TO BE HYDRIC BASED ON SITE CONDITIONS

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- X Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- (FEW) X Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (LRR A)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- X Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- X Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (LRR A)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes X No ___ Depth (inches): 0-12

Water Table Present? Yes X No ___ Depth (inches): 0-10

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 0

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: SANDIA CANYON City/County: LOS ALAMOS / LOS ALAMOS Sampling Date: 6-9-2010

Applicant/Owner: LANL State: NM Sampling Point: U-1

Investigator(s): T. TRIMBLE Section, Township, Range: _____

Landform (hillslope, terrace, etc.): CANYON Local relief (concave, convex, none): NONE Slope (%): _____

Subregion (LRR): ROCKY MTN FOREST + RANGE Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: ROCK OUTCROPS – ESCARPEMENTS NWI classification: UPLAND

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	Is the Sampled Area within a Wetland? Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10M x 10M)	Absolute % Cover	Dominant Species?	Indicator Status
1. QUERCUS GAMBELLI	50	Y	NL
2. PINUS PONDEROSA	20	Y	FACU
3.			
4.			
	70	= Total Cover	
Sapling/Shrub Stratum (Plot size: 10M x 10M)			
1. ATRIPLEX CANESCENS	10	N	UPL
2.			
3.			
4.			
5.			
	10	= Total Cover	
Herb Stratum (Plot size: 5M x 5M)			
1. ROSA ARKANSANA	10	N	NI
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	10	= Total Cover	
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
		= Total Cover	

% Bare Ground in Herb Stratum 15

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	—	x 1 =	—
FACW species	—	x 2 =	—
FAC species	—	x 3 =	—
FACU species	20	x 4 =	80
UPL species	10	x 5 =	50
Column Totals:	30 (A)		130 (B)

Prevalence Index = B/A = 4.33

Hydrophytic Vegetation Indicators:

__ Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Wetland Non-Vascular Plants[1]

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:

SOIL

Sampling Point: U-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 6/3		—	—	—	—	SAND	WITH ~35% GRAVEL

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (except MLRA 1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Rock

Depth (inches): 12

Hydric Soil Present? Yes ___ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (LRR A)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (LRR A)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

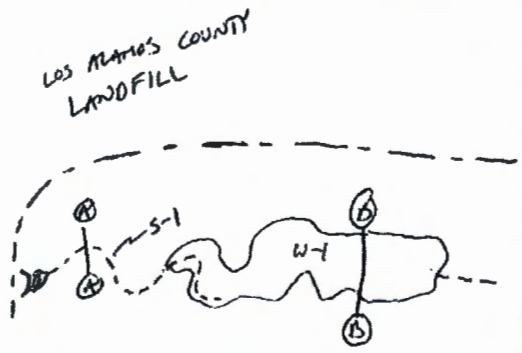
STREAM DATA SHEET

Stream #: 5-1	Date: 6-9-2010

Project Name: SANDIA CANYON DELINEATION	Project No.:
County/State: LOS ALAMOS, NM	Surveyors: T. TRIMBLE
Stream Name: SANDIA CANYON TRIBUTARY	GPS Unit #: 2

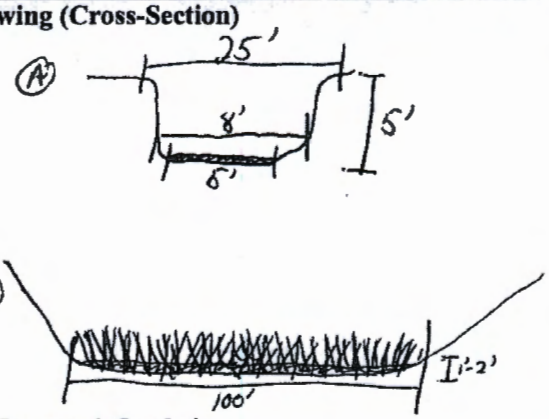
Stream Characteristics			
Stream Width:		*Stream Height/Depth:*	
Bank to Bank = 25'		Avg. Banks = 5'	
Waters Edge = 5'		Avg. Water = 1'-2'	
OHWM = 8'		OHWM = 2'	
Stream Flow:	☒ Perennial	☐ Intermittent	☐ Ephemeral
Erosion:	☒ Heavy →	☒ Moderate	☐ Slight
Flow Regime:	☒ Upstream Development	☐ Dense Regrowth	☒ Heavy Downcutting

Drawing (Plan View)



Please Include Directional Arrow

Drawing (Cross-Section)



Facing Downstream for Cross-Section

Substrate Description

☐ Bedrock	☐ Boulder	☐ Cobble	☒ Gravel	☒ Sand	☐ Silt/Clay	☐ Organic	☐ Concrete

☐ Other (Describe)

Aquatic Habitat (Instream) Description

☐ Undercut Banks	☐ Logs/Brush	☒ Aquatic Veg.	☒ Sand Bar	☐ Mud Bar
☐ Overhanging Veg.	☒ Gravel Riffles	☐ Deep Pools	☐ Oxbows	☐ Shallows

Species (Description) CATTAIL, COYOTE WILLOW, SPIKE RUSH

Riparian Zone Description

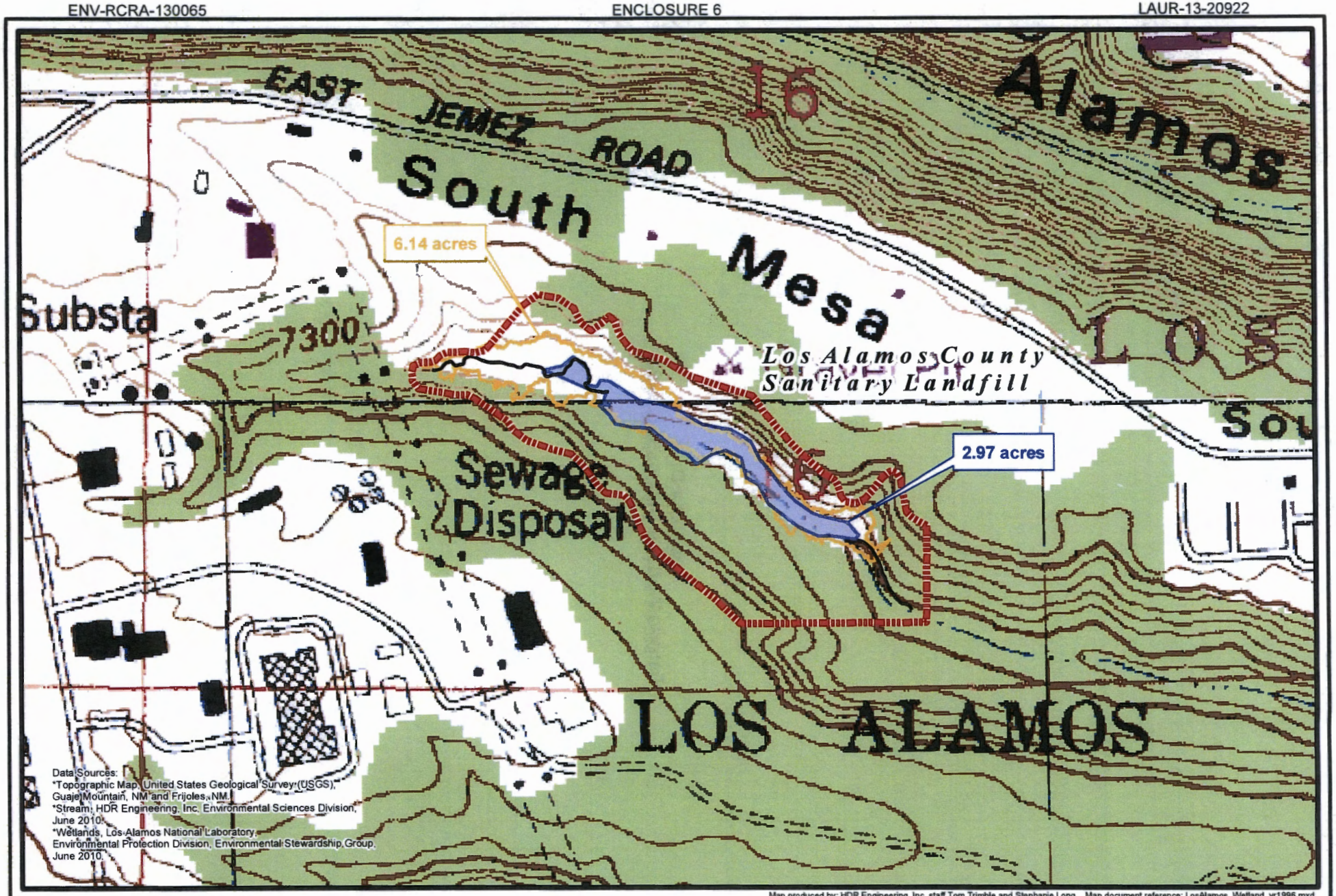
☐ Forest	☒ Scrub/Shrub	☐ Old-Field/ROW	☒ Pasture	☐ Row Crop
☐ Wetland	☐ Paved	☐ Residential	☐ Park	☐ Other

Species (Description) RUSSIAN OLIVE, SALTBUSH, GAMBEL OAK, PINE

Width: 50+	Age Class: <50	Existing Species Composition Sufficient for Maintenance and Recovery:	☐ Y	☐ N

Notes

Appendix D:
Historic Wetland Delineation Maps



Map produced by: HDR Engineering, Inc. staff Tom Trimble and Stephanie Long Map document reference: LosAlamos_Wetland_yr1996.mxd

FIGURE 3

Legend

- Study Area
- Stream
- 06/10/2010
- 6/15/1996

0 500 1,000

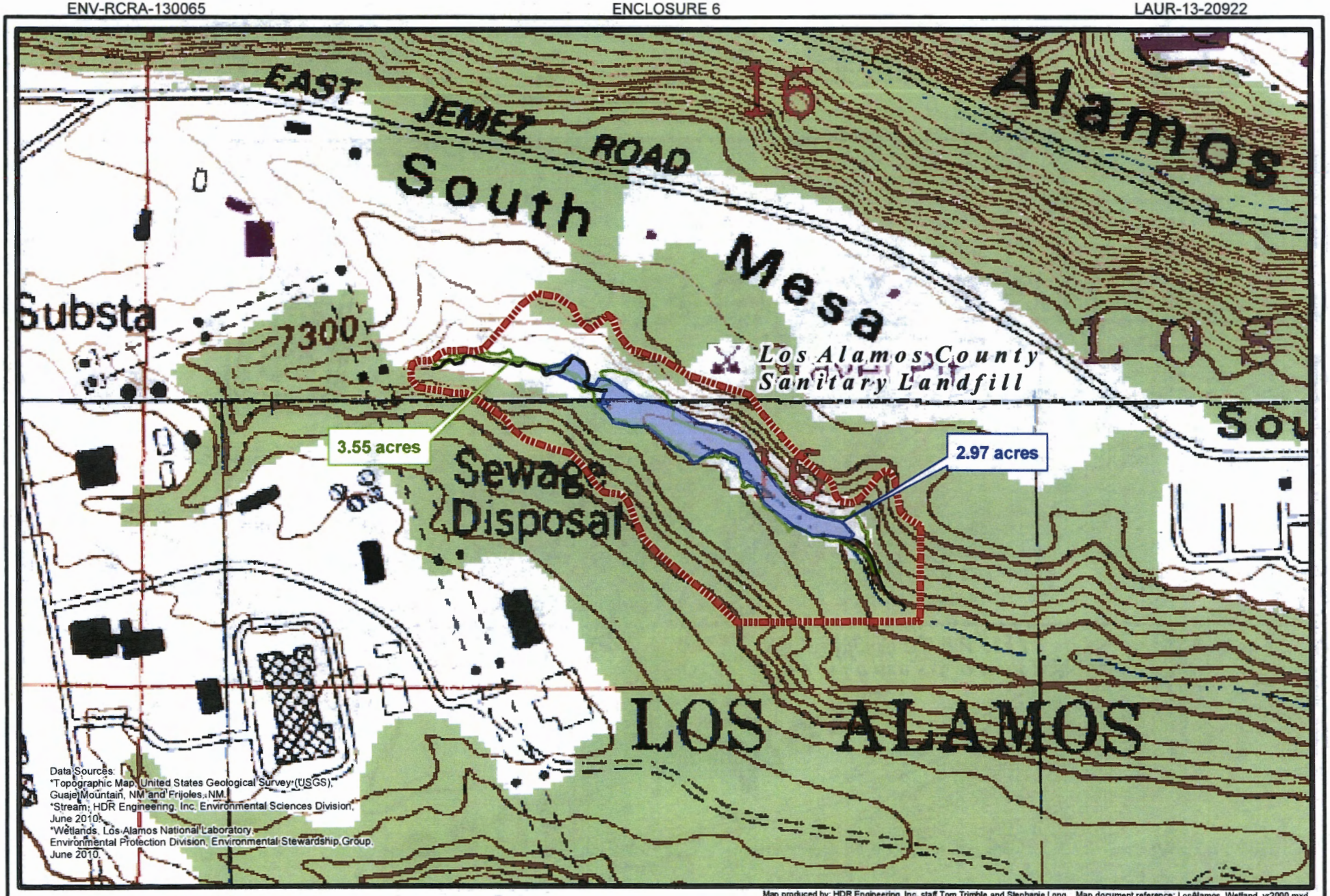
Feet

New Mexico State Plane Coordinate System, Units feet, North American Datum 1983.

N W E S

Disclaimer: This map was created for work processes associated with the 2010 Sandia Wetland Delineation at Los Alamos National Laboratory. All other uses for this map should be confirmed with LANL ENV-ES Biology staff.

HDR



Map produced by: HDR Engineering, Inc. staff Tom Trimble and Stephanie Long Map document reference: LosAlamos_Wetland_yr2000.mxd

FIGURE 4

Legend

- Study Area
- Stream
- 06/10/2010
- 6/30/2000

0 500 1,000
Feet

New Mexico State Plane Coordinate System, Units feet, North American Datum 1983.

N W E S

Disclaimer: This map was created for work processes associated with the 2010 Sandia Wetland Delineation at Los Alamos National Laboratory. All other uses for this map should be confirmed with LANL ENV-ES Biology staff.

HDR

Map produced by: HDR Engineering, Inc. staff Tom Trimble and Stephanie Long Map document reference: LosAlamos_Wetland_yr2006.mxd

FIGURE 5

Legend

- Study Area
- Stream
- 06/10/2010
- 5/24/2005

0 500 1,000

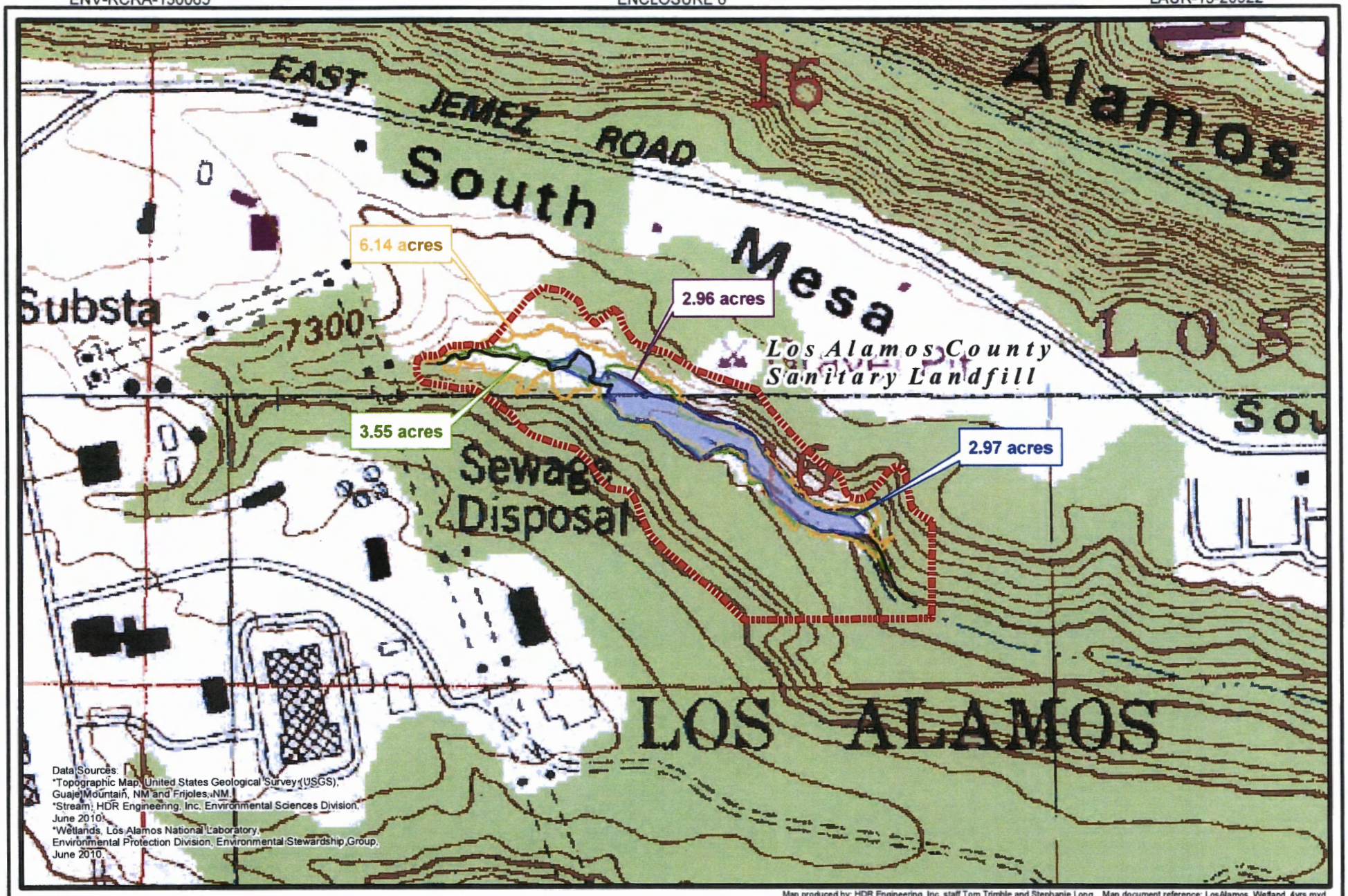
Feet

New Mexico State Plane Coordinate System, Units feet, North American Datum 1983.

N W E S

Disclaimer: This map was created for work processes associated with the 2010 Sandia Wetland Delineation at Los Alamos National Laboratory. All other uses for this map should be confirmed with LANL ENV-ES Biology staff.

HDR



Map produced by: HDR Engineering, Inc. staff Tom Trimble and Stephanie Long Map document reference: LosAlamos_Wetland_4yrs.mxd

FIGURE 6

Legend

- Study Area
- Stream
- 06/10/2010
- 5/24/2005
- 6/15/1996
- 6/30/2000

0 500 1,000
Feet

New Mexico State Plane Coordinate System, Units feet, North American Datum 1983.

N W E S

Disclaimer: This map was created for work processes associated with the 2010 Sandia Wetland Delineation at Los Alamos National Laboratory. All other uses for this map should be confirmed with LANL ENV-ES Biology staff.

HDR

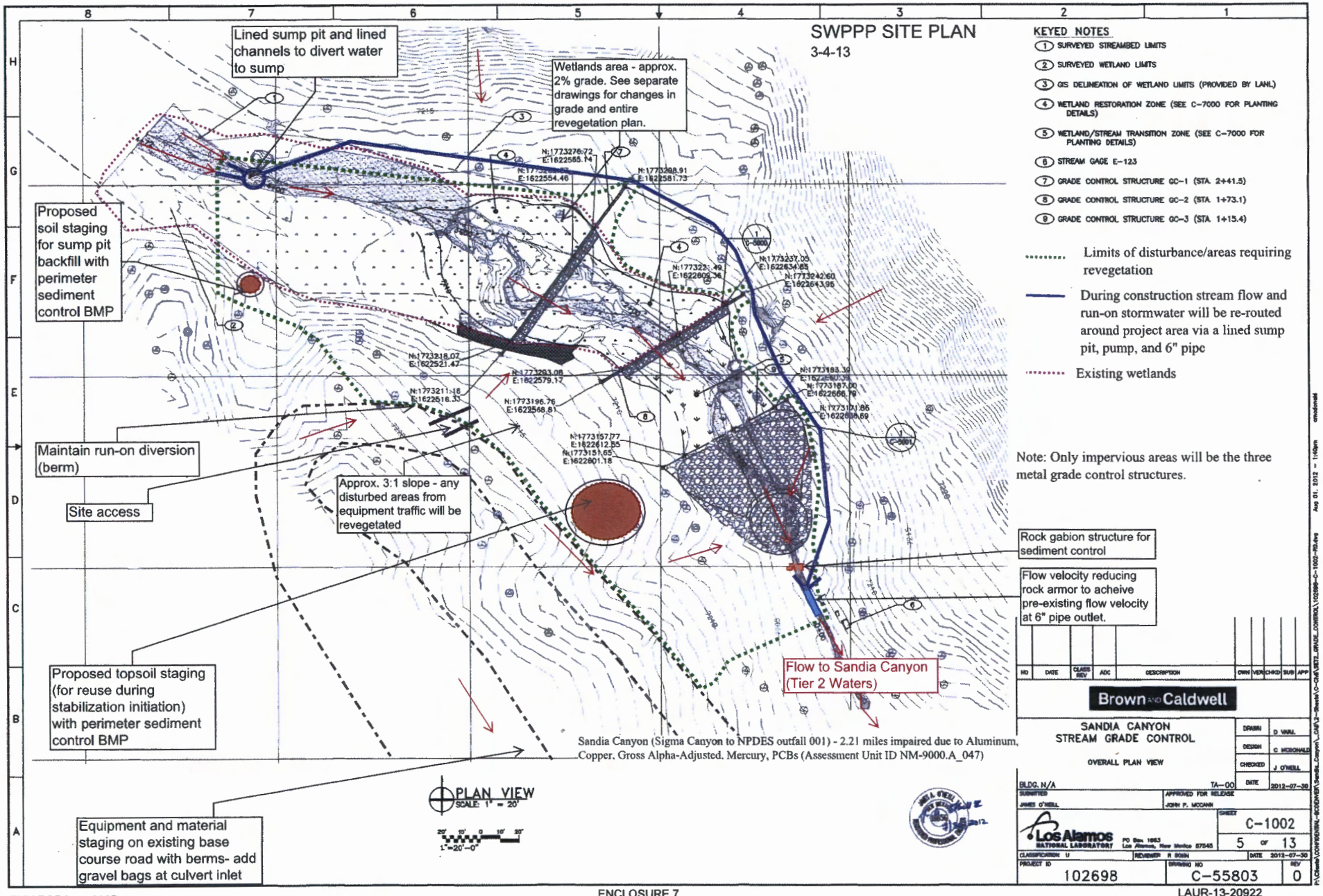
ENCLOSURE 7

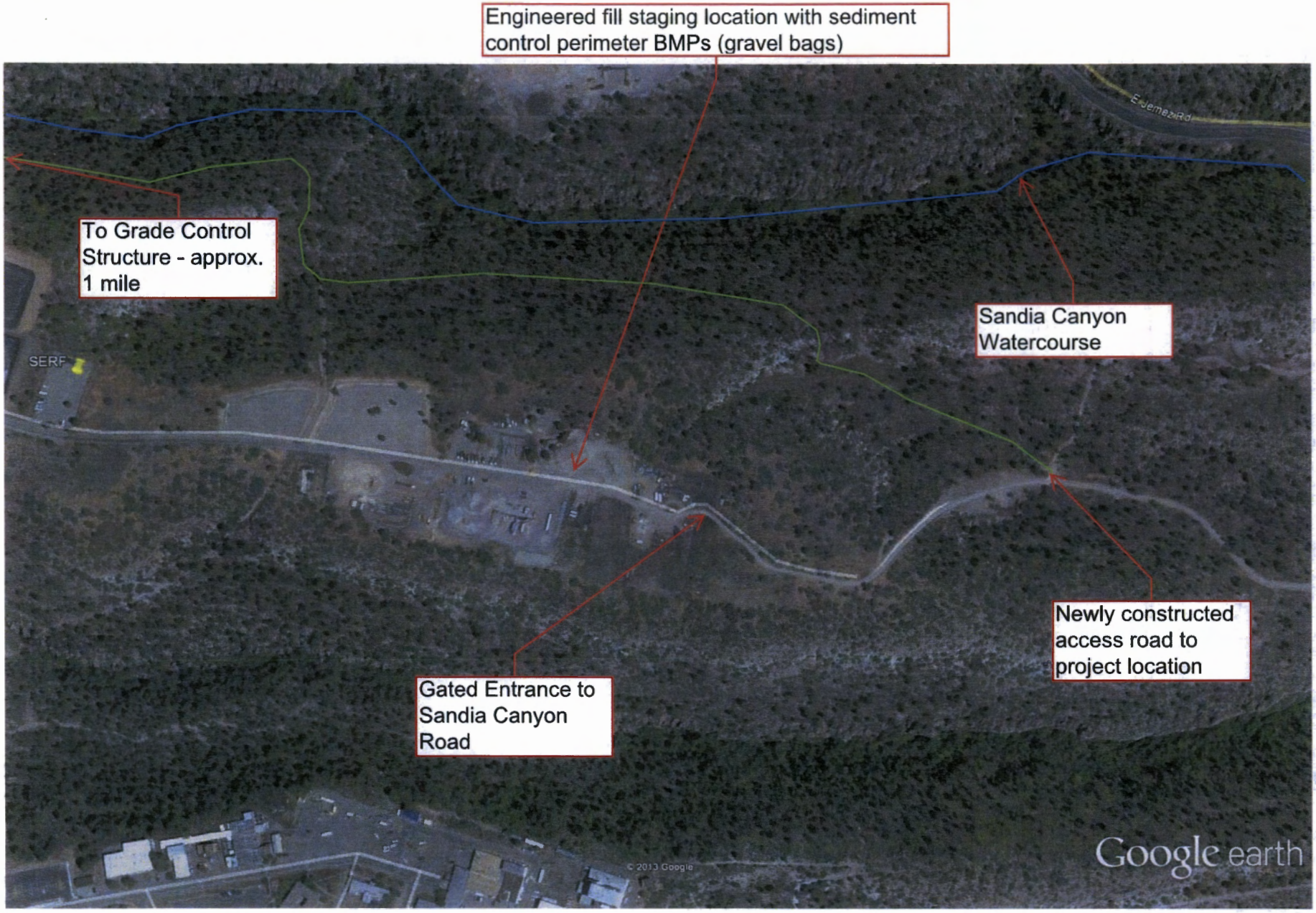
Site Map, Temporary Structures and Staging Area

ENV-RCRA-13-0065

LAUR-13-20922

Date: MAR 2 7 2013


SWPPP SITE PLAN
3-4-13
KEYED NOTES
1 SURVEYED STREAMBED LIMITS
2 SURVEYED WETLAND LIMITS
3 GIS DELINEATION OF WETLAND LIMITS (PROVIDED BY LANL)
4 WETLAND RESTORATION ZONE (SEE C-7000 FOR PLANTING DETAILS)
5 WETLAND/STREAM TRANSITION ZONE (SEE C-7000 FOR PLANTING DETAILS)
6 STREAM GAGE E-123
7 GRADE CONTROL STRUCTURE GC-1 (STA. 2+41.5)
8 GRADE CONTROL STRUCTURE GC-2 (STA. 1+73.1)
9 GRADE CONTROL STRUCTURE GC-3 (STA. 1+15.4)
Limits of disturbance/areas requiring revegetation
During construction stream flow and run-on stormwater will be re-routed around project area via a lined sump pit, pump, and 6" pipe
Existing wetlands
Lined sump pit and lined channels to divert water to sump
Wetlands area - approx. 2% grade. See separate drawings for changes in grade and entire revegetation plan.
Proposed soil staging for sump pit backfill with perimeter sediment control BMP
Maintain run-on diversion (berm)
Site access
Approx. 3:1 slope - any disturbed areas from equipment traffic will be revegetated
Proposed topsoil staging (for reuse during stabilization initiation) with perimeter sediment control BMP
Equipment and material staging on existing base course road with berms- add gravel bags at culvert inlet
Rock gabion structure for sediment control
Flow velocity reducing rock armor to acheive pre-existing flow velocity at 6" pipe outlet.
Flow to Sandia Canyon (Tier 2 Waters)
Note: Only impervious areas will be the three metal grade control structures.
Sandia Canyon (Sigma Canyon to NPDES outfall 001) - 2.21 miles impaired due to Aluminum, Copper, Gross Alpha-Adjusted, Mercury, PCBs (Assessment Unit ID NM-9000.A_047)
PLAN VIEW
SCALE: 1" = 20'
1"=20'-0"
Brown AND Caldwell
SANDIA CANYON
STREAM GRADE CONTROL
OVERALL PLAN VIEW
DRAWN D. VAIL
DESIGN C. MCDONALD
CHECKED J. O'NEILL
DATE 2012-07-30
BLDG. N/A
TA-00
SUBMITTED JAMES O'NEILL
APPROVED FOR RELEASE JOHN P. MCCANN
Los Alamos NATIONAL LABORATORY
PO Box 1663 Los Alamos, New Mexico 87545
SHEET C-1002
5 OF 13
CLASSIFICATION U
REVIEWER R SOHN
DATE 2012-07-30
PROJECT ID 102698
DRAWING NO C-55803
REV 0



Google earth

feet 2000

meters 800

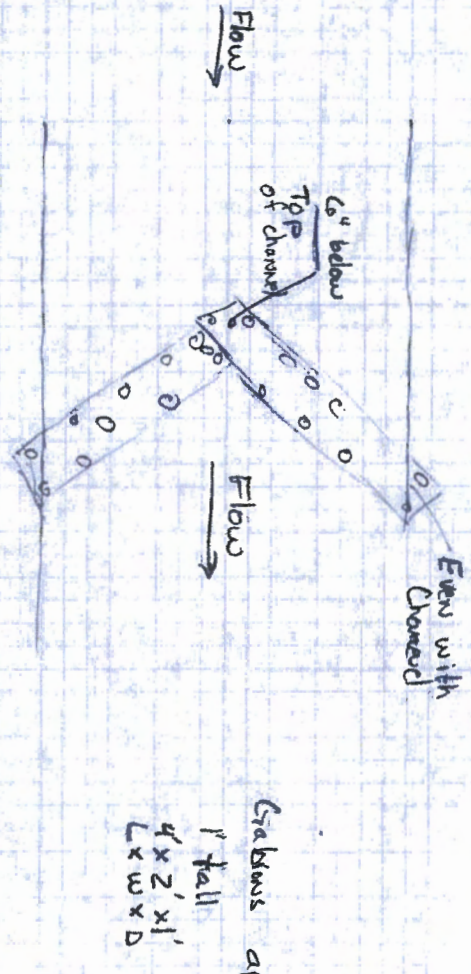
Brown AND Caldwell

Date Checked	Checked By	Job Number	By	Date	Calc. No.	Sheet No.

Project	Subject

References/Notes

Gabions

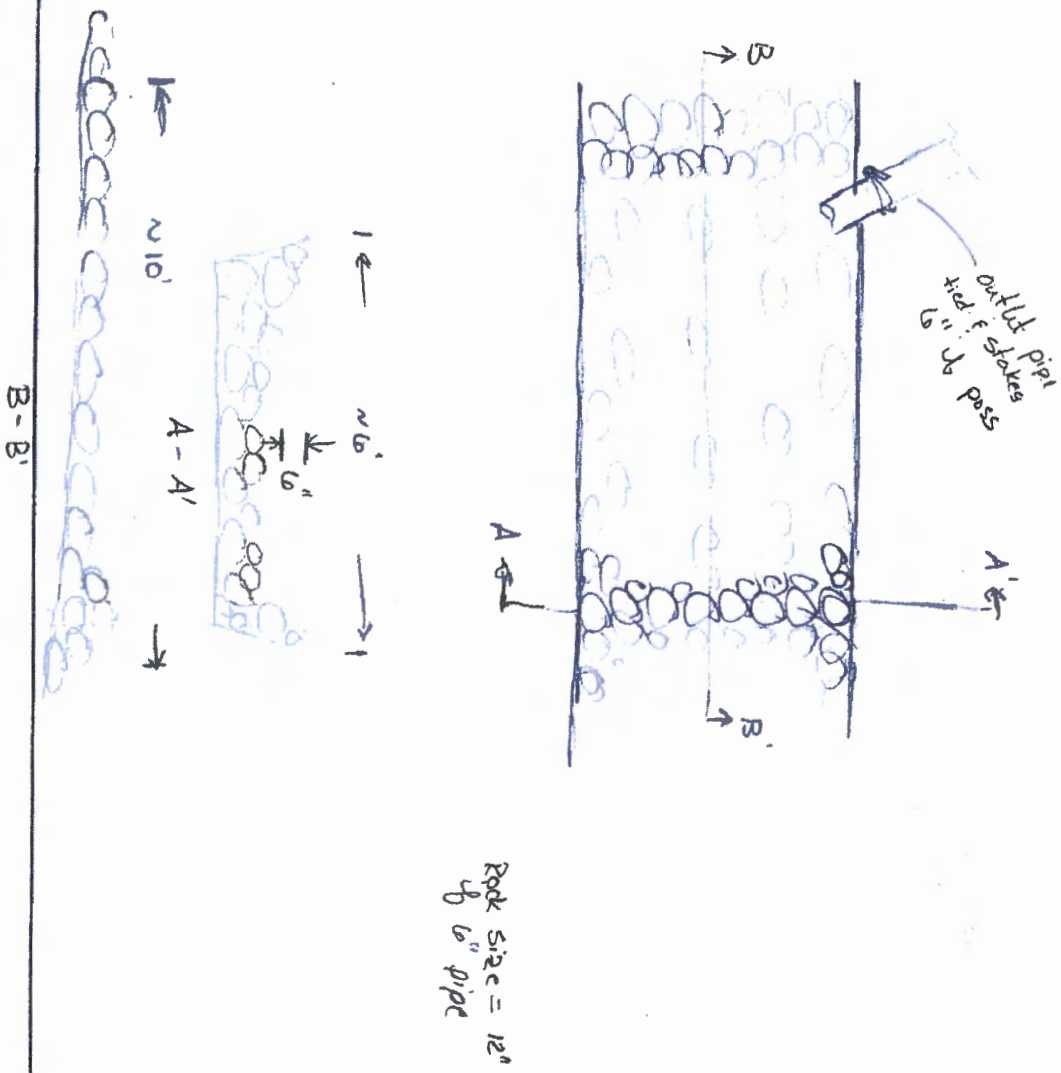


#1580-1/8"sq.

Brown AND Caldwell

Date Checked	Checked By	Job Number	By	Date	Calc. No.	Sheet No.

Project	Subject



References/Notes

Pipe Outfall

#1580-1/8"sq.

ENCLOSURE 8 (CD)

Storm Water Pollution Prevention Plan

ENV-RCRA-13-0065

LAUR-13-20922

Date: MAR 2 7 2013

ENCLOSURE 9

Vegetation Monitoring Plan for Sandia Canyon
Wetland Grade Control Structure Project

ENV-RCRA-13-0065

LAUR-13-20922

Date: MAR 2 7 2013

EXAMPLE
VEGETATION MONITORING PLAN
FOR SANDIA CANYON WETLAND GRADE CONTROL STRUCTURES

This example vegetation monitoring plan has been prepared by Los Alamos National Laboratory (LANL) for submission to the U.S. Army Corps of Engineers in support of LANL's 404 Dredge and Fill Permit. Reports based on this plan will be prepared annually for 5 yr or until LANL is notified by the U.S. Army Corps of Engineers that reporting is no longer required.

1.0 PROJECT OVERVIEW

The following information will be provided in each annual report.

1.1 U.S. Army Corps of Engineers Permit Number

LANL will provide the U.S. Army Corps of Engineers permit number.

1.2 Name and Contact Information of Permittee and Consultant

LANL will provide the name and contact information of the permittee and consultant.

1.3 Name of Party Responsible for Conducting the Monitoring and the Date(s) the Inspection Was Conducted

LANL will provide the name of the party responsible for conducting the monitoring and the date(s) the inspection was conducted.

1.4 Purpose and Description of Project

The Sandia Canyon wetland is an existing 2.97-acre emergent wetland with primarily cattail vegetation that is experiencing headcutting erosion at its downstream (eastern) terminus. The wetland is substantially supported by effluent discharges from a National Pollutant Discharge Elimination System–permitted outfall in Sandia Canyon. Wetland sediments currently contain trivalent chromium and polychlorinated biphenyls sourced from historic LANL operations. The purpose of installing the grade control structure for the wetlands is to mitigate headcutting, stabilize the sediments, and maintain hydrologic and geochemical conditions that will minimize the migration of chemicals of concern.

A set of three steel sheet pile structures will be installed at and beyond the eastern terminus of the wetland with a total elevation drop of 11 vertical feet. The grade control structure will be seated in bedrock and designed to prevent groundwater from seeping through the structure. The project design predicts disturbance of approximately 0.13 acres of delineated wetland for installation of the grade control structure and backfilling of the headcut area. The disturbed area within the delineated wetland and below the wetland boundary between the three steel sheet piles will be revegetated with wetland obligate and facultative plants.

1.5 Location of the Sandia Canyon Wetland Grade Control Structure

The location of the Sandia Canyon Wetland Grade Control Structure is in Technical Area 60/61 at Los Alamos National Laboratory, Los Alamos, NM. Center point Universal Transverse Mercator coordinates are N1773221 and E1622609.

1.6 Dates Compensatory Mitigation Project Commenced and/or Was Completed

LANL will provide the dates the compensatory mitigation project commenced and/or was completed.

1.7 Statement on whether the Performance Standards Are Being Met

LANL will provide a short statement on whether the performance standards are being met.

1.8 Dates of Any Recent Corrective or Maintenance Activities Conducted since the Previous Report Submission

LANL will provide the dates of any recent corrective or maintenance activities conducted since the previous report submission.

1.9 Specific Recommendations for any Additional Corrective or Remedial Actions

LANL will provide specific recommendations for any additional corrective or remedial actions.

2.0 REQUIREMENTS

2.1 Inspection and Maintenance Plan

The grade control structures will be inspected consistent with other storm water structure inspections and at a minimum of once a year. The inspection form will be similar to the one found in Attachment 1 of this document and maintenance will follow as needed.

2.2 Performance Standards

LANL will adhere to the following performance standards.

1. Vegetation in wetland disturbed area recovers to ≥60% native species absolute cover
2. Extent of wetland facultative and obligate vegetation west of grade control structure does not decrease below current wetland size (2.97 acre)
3. Percent relative cover of wetland facultative and obligate vegetation within delineated wetland boundaries does not decline more than 15% from baseline in years following installation of grade control structure

2.3 Monitoring Requirements

LANL will adhere to the following monitoring requirements.

Photo Documentation	Photos will be taken of the grade control structure and disturbed area from two photo points (S and T on map) annually during the active growing season. Photos of the undisturbed portion of the wetland will be taken from an additional three photo points (M/N/O, R, and U on the map in section 4) annually during the active growing season. One of those photo points (M/N/O) is a historical photo point with photos dating back to 1990.

Vegetative species and cover quantification	Four line-point intercept transects (Herrick et al. 2005) will be established to estimate percent vegetative cover by species and percent bare soil. One transect will be established through the wetland area disturbed by construction of the grade control structure, perpendicular to the stream channel. The other three transects will be spaced at approximately 450-ft intervals, travelling west from the grade control structure, each also perpendicular to the stream channel. Transects will be run once per year during the active growing season. Transects run before the grade control structure is installed will be used as baseline vegetation measurements.
Extent of wetland vegetation	The perimeter of the wetland vegetation west of the grade control structure in Sandia Canyon will be surveyed using a global positioning system once per year during the active growing season to measure the extent (location and acreage).
Water level monitoring	Following completion of the grade control structure, 12 piezometers will be installed to monitor the effects of the grade control structure and variations in effluent flow into Sandia Canyon on the local water table.
Reporting	An annual report of the monitoring results will be prepared using the U.S. Army Corps of Engineers Albuquerque District format and will be delivered by November 30 of each year. Reporting will continue for 5 yr or until LANL is notified by the U.S. Army Corps of Engineers that reporting is no longer required.

2.4 Adaptive Management Plan

The grade control structure will be inspected by LANL personnel or subcontractors as discussed previously. In addition, the piezometer data will provide indications of adverse effects on the local water table from either grade control structure issues or water quantity input issues. LANL has the ability to vary the amount of water released from the effluent outfall if conditions warrant. Strategies for dealing with other factors preventing attainment of the performance standards will be identified as needed.

3.0 SUMMARY DATA

The following pre-project photos have been obtained from photo point M/N/O to monitor vegetation regrowth. (Hathcock et al. 2010).

1990 November 2000 June 2010

Photo Series M: Looking north across the middle section of the wetland

1990 November 2000 June 2010

Photo Series N: Looking west across the middle section of the wetland

1990 November 2000 June 2010

Photo Series O: Looking northwest

4.0 MAP

The following map identifies the potential locations where vegetation monitoring will take place.

Orthophoto map of Sandia Wetland. Blue line is 2010 wetland delineation boundary. Black lines are approximate locations of proposed line-point intercept transects.

5.0 REFERENCES

Hathcock, Charles D., David C. Keller, and Kathryn D. Bennett. 2010. Comparative Photos of the Sandia Wetlands at TA-60 and TA-61 – 1990, 2000, & 2010. Los Alamos National Laboratory report LA-UR-10-04676, Los Alamos, New Mexico.

Herrick, Jeffrey E., Justin W. Van Zee, Kris M. Havstad, Laura M. Burkett and Walter G. Whitford. 2005. Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems, Volume I: Quick Start. USDA-ARS Jornada Experimental Range, P.O. Box 30003, MSC 3JER, NMSU, Las Cruces, New Mexico 88003-8003. http://usda-ars.nmsu.edu.

Herrick, Jeffrey E., Justin W. Van Zee, Kris M. Havstad, Laura M. Burkett and Walter G. Whitford. 2005. Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems, Volume II: Design, Supplementary Methods and Interpretation. USDA-ARS Jornada Experimental Range, P.O. Box 30003, MSC 3JER, NMSU, Las Cruces, New Mexico 88003-8003. http://usda-ars.nmsu.edu.

Attachment 1 Sample Grade Control Structure Inspection Form

GRADE-CONTROL STRUCTURE INSPECTION CHECKLIST				Date:		
				Time:		
Inspection Type (Circle one): Monthly, Flow Event, Integrity			Weather & Site Conditions:			
Inspector (Z#):			Others:			
CHECK AREA AS INSPECTED	**CHECK/CIRCLE CONDITION NOTED**		OBSERVATIONS	**ACTION**		
				REPAIR	**MONITOR**	**INVESTIGATE**
			EMBANKMENTS			
☐U/S SLOPE		Vegetation/erosion				
		Beaching/slides/cracks				
		Undermining/erosion				
☐ABUTMENT		Vegetation/erosion				
		Sloughs/slides/cracks				
		Seepage/wetness				
☐D/S SLOPE		Vegetation/riprap				
		Rodent burrows*				
		Sloughs/slides/cracks				
		Seepage/wetness				
			OVERFLOW WEIR STRUCTURE AND STANDPIPE			
☐U/S FACE		Deteriorated joints*				
		Cracking/spalling*				
☐CREST		Deteriorated joints				
		Cracking/spalling*				
		Poor alignment				
☐D/S FACE		Deteriorated joints				
		Cracking/spalling				
		Seepage/piping*				

Note: *May require immediate corrective action.

PAGE 1 OF 2

GRADE-CONTROL STRUCTURE INSPECTION CHECKLIST	Date:
	Time:
Inspection Type (Circle one): Monthly, Flow Event, Integrity	Weather & Site Conditions:
Inspector (Z#):	Others:

CHECK AREA AS INSPECTED		CHECK/CIRCLE CONDITION NOTED	OBSERVATIONS	ACTION: REPAIR	ACTION: MONITOR	ACTION: INVESTIGATE
			OVERFLOW WEIR STRUCTURE AND STANDPIPE			
☐STANDPIPE		Corrosion				
		Amount of sediment present				
		Height of inlet				
		Trash/debris				
			SPILLWAY/OUTLET			
☐FLOW - WAY		Improper alignment				
		Deterioration				
		Trash/debris				
☐OUTLET		Seepage/piping*				
		Undercutting*				
		Erosion*				
		Debris				
		Amount of sediment present				

GENERAL COMMENTS, SKETCHES, & FIELD MEASUREMENTS

Inspector's Signature: Z#:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who managed the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment for knowing violations."

Certified By: Z#:

Note: *May require immediate corrective action

PAGE 2 OF 2

ENCLOSURE 10

Photograph of the Sandia Canyon Stream Channel Headcut

ENV-RCRA-13-0065

LAUR-13-20922

Date: MAR 27 2013

Photograph of a headcut in the Sandia Canyon Wetland

ENCLOSURE 11

Biological Assessment Concurrence, US Fish & Wildlife Service

ENV-RCRA-13-0065

LAUR-13-20922

Date: MAR 27 2013

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New Mexico Ecological Services Field Office
2105 Osuna NE
Albuquerque, New Mexico 87113
Phone: (505) 346-2525 Fax: (505) 346-2542

'10 JUL 28 AM7:58

July 23, 2010

Cons. # 22420-2010-I-0097

Vicki D. Loucks
Biological Resource Program Manager
National Nuclear Security Administration
Los Alamos Site Office
Los Alamos, New Mexico 87544

Dear Ms. Loucks:

This responds to your June 30, 2010, cover letter and biological assessment (BA) requesting informal consultation for the effects from the Elimination of Effluent Outfalls and Cleanup of Wetland Soil Contamination in Sandy Canyon at Los Alamos National Laboratory, New Mexico received on July 6, 2010. As documented in your BA, which is hereby incorporated by reference, we find that your proposed action will have insignificant and discountable effects to the Mexican spotted owl (*Strix occidentalis lucida*). Therefore, the Service concurs with your determination of "may affect, not likely to adversely affect".

This concludes section 7 consultation regarding the proposed action. If monitoring or other information results in modification or the inability to complete all aspects of the proposed action, consultation should be reinitiated. Please contact the Service if: 1) future surveys detect listed, proposed or candidate species in habitats where they have not been previously observed; 2) the proposed action changes or new information reveals effects of the proposal to listed species that have not been considered in this analysis; or 3) a new species is listed or critical habitat designated that may be affected by the action.

Thank you for your concern for endangered species and New Mexico's wildlife habitats. If you have any questions, please contact Lynn Gemlo of my staff at the letterhead address or at (505) 761-4726.

Sincerely,

Wally Murphy
Field Supervisor

cc:
Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico
Director, New Mexico Energy, Minerals, and Natural Resources Department, Forestry Division, Santa Fe, New Mexico

COR-NSM-7.28.2010-270832

ENCLOSURE 12

Biological and Cultural Resources Review

ENV-RCRA-13-0065

LAUR-13-20922

Date: MAR 2 7 2013

Biological and Cultural Resources Review

The Endangered Species Act compliance for the construction of the Sandia Wetland grade control structure was completed in July of 2010 when Los Alamos National Laboratory received the letter of concurrence on the Biological Assessment "Biological Assessment of the Effects of Elimination of Effluent Outfalls and Cleanup of Wetland Soil Contamination in Sandia Canyon at Los Alamos National Laboratory" (see Enclosure 11). The NEPA compliance for the construction of the grade control structure was covered by the Environmental Assessment "Expansion of the Sanitary Effluent Reclamation Facility and Environmental Restoration of Reach S-2 of Sandia Canyon at LANL (SERF EA), August 2010" (http://energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/EA-1736-FEA-2010.pdf) , and its Finding of No Significant Impact (http://energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/EA-1736-FONSI-2010.pdf) , and Mitigation Action Plan (http://energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/EA-1736-MAP-2010.pdf).

The construction access road into Sandia Canyon as it was installed was not identified as necessary until after these documents were completed. Therefore, a separate Biological Assessment and separate NEPA coverage were developed for the road project. These were approved and the road was constructed in fall 2012. Since the road did not impact Sandia Wetland nor did it require a 404 Permit Application, these are not included as part of this application.

ENCLOSURE 8 (CD)

Storm Water Pollution Prevention Plan

ENV-RCRA-13-0065

LAUR-13-20922

Date: MAR 2 7 2013

STORM WATER POLLUTION PREVENTION PLAN

Sandia Canyon
Grade Control Structure Project
Los Alamos National Laboratory

a requirement of the
NPDES GENERAL PERMIT
for Storm Water Discharges From Construction Activities

Prepared By:
Navarro Research & Engineering, Inc.
190 Central Park Square
Los Alamos, NM 87544
Phone 505-661-4887

In Conjunction with:
Los Alamos National Laboratory
Environmental Protection Division, Water Quality & RCRA Group
ENV-RCRA

Revision 0: March 4, 2013

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STORM WATER POLLUTION PREVENTION PLAN
Sandia Canyon Grade Control Structure Project
LOS ALAMOS NATIONAL LABORATORY

PREFACE

The United States Environmental Protection Agency (EPA) has issued a final 2012 Construction General Permit (CGP) that covers discharges of stormwater from construction sites.

The 2012 National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges from Construction Activity (Appendix E) includes the following requirements:

- conduct a critical habitat and threatened/endangered species study;
- develop and implement a Storm Water Pollution Prevention Plan (SWPPP) in accordance with good engineering practices;
- submit a Notice of Intent (NOI);
- install and maintain erosion and stormwater controls, Best Management Practices (BMPs);
- perform and document storm water inspections during construction and site stabilization;
- amend the SWPPP as necessary;
- submit a Notice of Termination (NOT) following project completion and final stabilization of disturbed areas.

Authorization to discharge storm water is required under this Permit for both large and small construction projects disturbing more than one (1) acre or part of a larger common plan of development that collectively disturbs more than one (1) acre.

All parties that meet the definition of Operator must be permitted. Each permittee is not required to develop and implement a separate SWPP Plan. It is required that there be at least one SWPP Plan for a site that incorporates the required elements for all Operators.

The 2012 CGP number for New Mexico (Region 6) is NMR120000. This Plan, which has been developed for LANL and its subcontractor(s), describes the nature and sequencing of construction activities, potential sources of pollution, and identifies the Best Management Practices (BMPs) to minimize the potential for erosion and storm water pollution. The Plan was developed in accordance with the provisions of the Clean Water Act (33 U.S.C. § §1251 et seq., as amended by the Water Quality Act of 1987, P.L. 100-4), and the regulations established by the U.S. Environmental Protection Agency (EPA) for National Pollutant Discharge Elimination System (NPDES) General Permits for Storm Water Discharges From Construction Activities.

Sandia Canyon Grade Control Structure Project
STORM WATER POLLUTION PREVENTION PLAN

CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information contained therein. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information contained is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Delegation of Authority Letter, NOI in Appendix E.

Organization:	**Los Alamos National Security, LLC (Los Alamos National Laboratory)**
Contact:	**Michael Alexander**
Title:	**Operations Manager**

(Signature) March 4, 2013 (Date)

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Delegation of Authority Letter, NOI in Appendix E.

Organization: **Portage, Inc.**
Contact: **Ken Kisiel**
Title: **Program Manager**

(Signature) 3/5/12 (Date)

1. PROJECT INFORMATION

Per Requirements set forth by the NMED Hazardous Waste Bureau, LANL is working on a project to further stabilize the Sandia Canyon Wetland. The overall project goals and objectives are (1) to arrest the head cut in the lower portion of wetland and to reduce the potential for erosion at the entrance into the wetland from an 84-in open-top CMP culvert which empties a short distance upstream of the wetland, and (2) to maintain hydrologic and geochemical conditions that will minimize contaminant migration. Hexavalent chromium from the power plant cooling tower was historically released from TA-3 power plant at the head of Sandia Canyon. Currently there is an approximate average flow of 350,000 gpd of clean effluent through the wetland, mainly from cooling water used at the power plant cooling tower. The head cut in the lower section of the wetland will be stabilized by constructing a series of stepped grade-control structures that will allow a grade transition from the current elevation of the wetland to the stream bank near stream gage E123. The area behind the grade-control structures will be backfilled with engineered fill, and wetland vegetation will be allowed to expand into the area behind the grade-control structure and further stabilize the area. A drop pool constructed with rock at the downstream end of the grade control structures will serve as a final energy dissipater for the water flow.

This SWPP Plan only covers the Sandia Canyon Grade Control Structure to be constructed. An access road to Sandia is complete and revegetation efforts along roadside slopes and berms are covered under a separate SWPPP.

Los Alamos National Security, LLC shall retain a single NPDES permit for all aspects of the Project.

There are no other discharges covered by other permits located at the site or any other items excluded from this Plan. If waste disposal, sanitary sewer or septic systems are within the permitted area, the SWPP Plan shall be consistent with applicable state, tribal and local regulations.

1.1. Operators

The “operator” of a storm water discharge associated with construction activity is the individual or party responsible for applying to the EPA for NPDES Permit coverage. The EPA defines an “operator” to be anyone who meets either of the following two criteria:

1) Has operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications, or
2) Has day-to-day operational control of project activities.

The permittee with day-to-day operational control over the construction plans and specifications including the ability to make modifications to those plans and specifications and with control of project activities and control over implementation of this Plan is:

Los Alamos National Security, LLC (LANS)
Los Alamos National Laboratory (LANL)
Los Alamos, NM 87545
Contact: Michael Fichtel

The permittee with day-to-day operational control of project activities is:

Portage, Inc.
335 Central Park Square
Los Alamos, NM 87544
Contact: David Weatherbie

The Operators must implement and maintain BMPs in the manner specified in the SWPPP. Operators shall ensure that project plans and specifications meet the minimum requirements of this SWPP Plan. Operators shall comply with the terms and conditions of the permit. Operators will implement the SWPPP until final stabilization is complete or the notice of termination (NOT) has been submitted along with another operator’s NOI submission in accordance with Appendix I Section I.11.3 of the CGP addressing changes to authorization.

1.2. Stormwater Team

A Stormwater Team comprised of members consists of personnel from each operator who are responsible for overseeing the development of this SWPPP, any modifications to the SWPPP and for compliance with the requirements of the 2012 CGP.) Each member of the stormwater team must have ready access to either an electronic or paper copy of applicable portions of the 2012 CGP and this SWPPP. SWPPP Preparer qualifications are included in Appendix J.

Operator	Name	Title	Contact	Responsible for:
LANL ENV-RCRA	See Inspector List App J	Inspector	667-0666	Inspections, SWPPP Modifications, identifying corrective actions
LANL	Mike Alexander	Operations Manager	665-4752	Certifying SWPPP for LANL, implementing SWPPP and Corrective Actions, and signing inspections
LANL	John McCann	Construction Project Mgr. (PM)	665-1091	Implementing SWPPP and Corrective Actions, and signing inspections
LANL	Michael Fichtel	Subcontractor Technical Rep (STR)	665-4864	Implementing SWPPP and Corrective Actions, and signing inspections
LANL	Deborah Apodaca Pesiri	Engineer	665-9823	Implementing SWPPP
General Contractor-Portage, Inc.	Ken Kisiel	Program Manager	662-7600	Certifying NOI/NOT and SWPPP, Signing inspections, Implementing SWPPP and corrective actions
General Contractor – Portage, Inc.	Melvin Pahe	CISEC		Implementing SWPPP and Corrective Actions

SWPPP Preparer:

Name	Title	Company	Contact
Tim Zimmerly	CISEC, CPESC	LANS	664-0105
Jacob Knight	CISEC	Navarro Research and Engineering Inc.	665-5880

1.3. Site Description

The wetland system is located in reach S-2 of Sandia Canyon. The largest drainage area contributing to the wetland is conveyed through a culvert a short distance upstream of the wetland. Storm water flows have created a scour hole where the culvert discharges upstream of the wetland.

Between the NPDES permitted outfall and the upstream extent of the wetland the stream is establishing an inset, narrow bank-full floodplain as it erodes older sediment deposits. In some locations, this bank-full terrace is up to 4 m wide and wetland vegetation is beginning to re-establish on this terrace, creating a more stable inset floodplain with wetland vegetation. As the stream enters the larger wetland area, a defined stream channel is evident within the upper one-third of the wetland. Wetland vegetation is well established across the entire floodplain, and the stream and wetlands are very stable. Towards the lower two-thirds of the wetland, surface water is generally present across much of the width of the wetland. A large headcut (up to 9 feet high) is present and active at the terminus of the wetland. Willows have been planted in and around the headcut but have failed to stabilize the headcut movement upstream. Downstream of the wetland, the stream system enters a narrow canyon reach and is stable, with bedrock exposed along much of the stream bed. Stream gage E123 is located a short distance below the wetland.

The area to be disturbed for the wetlands stabilization will be kept to the minimum extent possible, and is estimated to be approximately 0.75 acre. The maximum area estimated to be disturbed at once is the 0.75 acre.

Staging Areas:

Due to lack of space for staging at the project area staging of engineered fill will be conducted at the east end of Eniwetok road above the entrance to Sandia Canyon. This area is currently covered under the MSGP and is used as staging for the LANL Batch Plant and Roads & Grounds. Staging of preserved topsoil from clearing and grubbing activities will be within the limits of disturbance north of the new access road and south of the stream channel. Staging of office trailer, equipment, materials and portable toilet will be on the new gravel access road north and up gradient from the project. There was a turnaround area constructed and widened for staging use. Concrete washout will be staged and conducted near the location for engineered fill staging near the asphalt batch plant or at the turnaround area. A small watertight container will be utilized. The site map will be updated to reflect the location of concrete washout.

1.4. Buffers

This project qualifies for one of the exceptions in Part 2.1.2.1.e as the buffer disturbances are authorized under a CWA Section 404 permit. An ACOE nationwide permit 38 – **Cleanup of Hazardous and Toxic Waste -** Specific activities required to effect the containment, stabilization, or removal of hazardous or toxic waste materials that are performed, ordered, or sponsored by a government agency with established legal or regulatory authority.

1.5. Impaired Waters

Names of Receiving Waters

Name(s) of the first surface water that receives stormwater directly from your site and/or from the MS4 (note: multiple rows provided where your site has more than one point of discharge that flows to different surface waters)
1. Sandia Canyon

Impaired Waters / TMDLs (Answer the following for each surface water listed in Table above)

	Is this surface water listed as "impaired"?	If you answered yes, then answer the following:				
		What pollutant(s) are causing the impairment?	Tier 2 Waters?	Has a TMDL been completed?	Title of the TMDL document	Pollutant(s) for which there is a TMDL
1.	☒ YES ☐ NO	Aluminum, copper, gross alpha – adjusted, mercury and PCBs	☒YES ☐ NO	☐ YES ☒ NO	NA	NA

1.6. Compliance with Other Federal Requirements

This section contains summary information on documentation related to total maximum daily loads (TMDL) and documentation of permit eligibility related to threatened & endangered (T&E) species and critical habitat. Several tributaries to the Rio Grande are listed on the NM 303(d) list for assessed river/stream reaches requiring TMDLs; however TMDLs pertaining to sediment have yet to be established for these waters.

A biological assessment was prepared for this project. The project is approved to move ahead with concurrence from the USFWS. Requirements will be communicated to the project personnel. The biological assessment is included in Appendix H.

Appendix H includes a Historical Properties, Wetland, Threatened and Endangered (T&E) Species, and Critical Habitat Evaluation for Construction Projects with detailed information.

LANL NPDES Storm Water Individual Permit:

Based on a review to identify possible impacts and concerns for ENV-RCRA storm-water quality per the requirements listed in the LANL 2010 Storm Water Individual Permit (IP) (IP No. NM0030759), this project does not directly impact a Site Monitoring Area (SMA), sampler, or contaminant Potential Release Sites (PRSs) listed on the Individual Permit. There are several IP SMAs located in the project vicinity that should not be disturbed.

404/401 permit requirements:

This project will be covered under US Army Corps of Engineers Nationwide 401/404 Permit No. 38 Cleanup of Hazardous and Toxic Waste. Permit documentation will be included in Appendix H.

- Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction.
- All exposed soil and other fills, as well as any work below the ordinary high water mark must be permanently stabilized at the earliest practicable date.
- Heavy equipment working in wetlands or mudflats must be placed on mats, or other measures must be taken to minimize soil disturbance.
- The water in the streambed is being temporarily rerouted as a requirement in the 401 Certification from the New Mexico Environment Department.

2. CONSTRUCTION ACTIVITIES AND CONTROLS

This section includes a description of the Best Management Practices (BMPs) that will be implemented as part of the construction activity to control pollutants in storm water discharges. BMPs include structural controls, schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants to waters of the United States. BMPs are used to prevent the contamination of storm water runoff by retaining sediment on-site; minimizing contact with spoils, other disturbed soils, and equipment; and by diverting storm water from the locations in which erosion or sediment transport regularly take place. Details of controls are included in Appendix E and locations of controls will be shown on the site map included with this SWPP Plan.

BMPs that will be implemented at the construction site must be adequate and sufficient to meet water quality standards. Discharges that will cause or contribute to non-attainment of water quality standards, including failure to protect and maintain existing designated uses of receiving waters, are not allowed. Before soil-disturbing activities begin, the Operator with day-to-day control of Project activities will implement structural controls as needed to protect the disturbed areas and maintain them as required until final stabilization is achieved.

2.1. Sequence of Events/Soil Disturbing Activities

As major grading activities occur, as construction activities temporarily or permanently cease on a portion of the site and as stabilization measures are initiated, dates will be added to the Soil Disturbance Sequencing Table listed in Appendix A. Estimated dates are provided below and actual dates will be provided in Appendix A.

- Mobilization – 4/1/13 – 4/3/13
- Install sediment control gabion and energy dissipation structure to receive water routed around project through a pipe, prior to any earth disturbing activities – 4/4/13
- Excavate and install holding basin for pumping and rerouting water around site, place controls around stockpile to control discharges - 4/4/13 – 4/10/13
- Installation of stream diversion utilizing pump system – 4/10/13/ - 4/13/13
- Clear and grub site and stockpile topsoil, place controls around stockpile to control discharges.(cleared vegetation may be used as sediment control BMPs but associated soil will be stockpiled) 4-15-13 – 4-18-13
- Stage engineered fill above access to Sandia Canyon, place controls around stockpile to control discharges. – 4-15-13 – 4-18-3
- Backfill and compact wetlands area – 4-18-13 – 4-26-13
- Excavation for and installation of sheet pile grade control structures and associated rock drop structures– 4-23-13 – 5-13-13
- Excavate and install Cascade Structure – 5-14-13 – 5-15-13
- Planting wetland vegetation and seeding/hydromulching – 5-15-13 – 5-20-13
- Demobilization - 5-21-13 – 6-10-13
- Final stabilization - 10-15-13 dependent on sufficient growth to meet definition of final stabilization in seeded and planted areas

2.2. Potential Pollutants

Potential pollutants that could have an effect on the quality of storm water discharges from this project may include but are not limited to:

- Sediment from exposed areas, excavations and material or spoils stockpiles
- Construction Materials (i.e. metal, concrete, rock, revegetation materials including, pipe cutting debris, etc.)
- Vehicle fluids and fluids from construction equipment leaks (i.e. hydraulic fluid, motor oil, gasoline, and diesel fuel, and lubricants)
- Portable lavatories

- Construction trash
- Concrete washouts

Equipment and materials defined staging areas. All equipment and materials used during the project will be stored upslope of the site's structural controls. Additional appropriate controls including, but not limited to: secondary containment, drip pans, berming and covering; will be established based on site conditions and the type of equipment/materials used. If additional construction and waste materials are stored on site, these sections will be updated to reflect these materials, including a description of controls and storage practices, designed to minimize exposure of the materials to storm water, and spill prevention and response practices.

2.3. Design Requirements

The stream diversion during construction will be sized to handle the existing base stream flow and the rock structure at the pipe outlet will reduce flow velocity. The final rock cascade pool structure is designed to dissipate energy of water released through wetlands. See Appendix G for design details.

2.4. Control Measures

All erosion and sediment control measures, stabilization and structural controls, and other protective measures identified in this Plan will be maintained in effective operating condition by the subcontractor. Installation, maintenance, and inspection criteria for the BMPs to be used on-site are described along with details and specifications in Appendix F. If inspections indicate that existing BMPs require modification, or additional BMPs are necessary, implementation shall be completed by no later than 7 days after the time of discovery. If it is not feasible to complete the installation or repair within 7 days you must document why it is infeasible within this timeframe and document your schedule for installation or repair as soon as practicable after the 7-day timeframe. In all circumstances you must immediately (on the same day or by no later than the following day) take all reasonable steps to minimize or prevent the discharge of pollutants until a permanent solution is installed and made operational, including cleaning up any contaminated surfaces so that the material will not discharge in subsequent storm events.

All BMPs and controls are existing prior to subcontractor remobilization. General controls and management practices that will be implemented in association with activities at the Project site include:

<u>Site Planning and Management Controls</u>

- Vegetation removal and soil disturbance will be minimized to the extent possible. BMPs will be installed prior to soil disturbance and as needed to reduce flow velocities and control sediment. SWPPP will be modified to reflect any additional controls necessary during construction.
- Topsoil will be preserved and reused during final stabilization unless proven infeasible. Staged topsoil will have perimeter controls to limit sediment discharge.
- Stabilization measures will be initiated immediately in portions of the site where construction activities have temporarily or permanently ceased. Within 7 days after the construction activity in that portion of the site has temporarily or permanently ceased stabilization measures will have to be completed (except as provided in 2.2.1.3 of the CGP).
- The only part of the construction site that has steep slopes is on the west side of the site at the edge of the gravel access road. The existing slopes off the gravel road are approximately 3:1. A ramp will be constructed for access to the site from the road to reduce the steep slope.
- The main areas of erosion will be backfilled with engineered fill and the grade control structures will be completed. In order for the eroded area to be successfully completed it will need to be compacted. Therefor e the minimization of soil compaction will only be practical at the small locations where no backfill is placed.
- There are no storm drain inlets in the vicinity.

Sediment and Erosion Controls

- Run-on will be diverted around the site to a stabilized outlet below disturbed areas of the site during construction activities.
    - A sump pit, approximately 15’ x 10’ x 5’ deep, will be constructed and lined. Channels will route water to the sump. Any disturbed areas of the channels will be lined as well to prevent erosion and sedimentation in the sump.
    - Approximately 20 CY of soil will be excavated for the sump. This material will be staged in a designated staging area to the south. The soil will have perimeter controls such as gravel bags to prevent sediment migration.
    - Water will be pumped from the sump to the stabilized outlet via a 6” pipe approximately 400’ feet long.
    - The stabilized outlet will consist of a rock armored outfall constructed with 12 inch rock with approximate dimensions of 6’ x 10’. Filter fabric will be installed beneath the rock. Flow velocity will be reduced to pre existing flow conditions. Additional design detail is provided in Appendix G. Flow will be returned to a natural pattern once the grade control structures have been installed and the wetlands revegetated.
    - Polymers, flocculants or other treatment chemicals are not anticipated to be used on this project. Should they be needed, this SWPPP will need to be modified to address the requirements in Part 2.1.3.3.
- A rock gabion structure will be installed across the lower edge of disturbance above the diverted stream flow with approximate dimensions of 4’ x 2’ x 1’. See Appendix G for additional details.
- The existing brush barrier along the access road and existing berms at the staging pad will be maintained. Gravel bags will be placed at the culvert inlet at the east end of the staging area.
- A berm will be maintained at the entrance to the project area from the gravel road to divert stormwater run-on.
- A brush barrier will be installed down gradient of grubbing activities where practicable.
- All Spoil piles, including piles of imported engineered fill, will be protected with perimeter sediment control BMPs such as gravel bags, silt fence or wattles to minimize the potential for sediment transport.
- This site will be accessed by a gravel stabilized road; therefore an additional stabilized construction entrance is not necessary. Equipment working at the site will be pulled onto the access road at the end of each day since equipment should not be left in the watercourse overnight. If large amounts of sediment are tracked onto the road soil will be removed from the base coarse. Sweeping the site will not be practicable since the access road is made of gravel.

Rationale for BMP selection is as follows:

- Minimization of vegetation removal and soil disturbance is an economical and effective method of minimizing erosion.
- Material and waste management practices are an effective way to control the spread of potential pollutants and prevent discharge.
- Use of water is a low cost and effective way to manage fugitive dust.
- Diverting stream flow around the site will allow work to occur without affecting the stream quality while the channel is being disturbed.
- The berms will prevent run-on from entering the site.

- A Gabion basket at the down gradient end of limits of disturbance will be able to withstand concentrated flow and minimize discharges of sediment.
- Gravel bags, silt fence, or wattles around spoils staging piles will minimize sediment discharges.

2.5. Stabilization

Disturbed areas of the site will be stabilized after construction with native vegetation and rock armoring as per the design and this SWPPP. See appendix G for Planting and Stabilization Plan. Areas disturbed not included in the plan will be revegetated in accordance with the project seeding specification 32 9219-1 Rev. 3, February 22, 2012. The seeding specification is provided in Appendix F.

Final stabilization is defined as: all soil disturbing activities at the site have been completed and a uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover with a density of 70% of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed. **Such determination will be made by ENV-RCRA personnel.**

Dates for stabilization of areas will be added to the Sequence of Soil Disturbing Events Table (Appendix A). **Stabilization shall be initiated immediately and completed no more than 7 days after construction activities have permanently or temporarily ceased in an area** (except for exceptions provided in part 2.2.1.3 of the CGP). The Operator with day-to-day control of Project activities is responsible for implementation and maintenance of stabilization methods until final stabilization is achieved.

3. POLLUTION PREVENTION

3.1. Non-Storm Water Discharges and controls

Non-storm water discharges are defined as significant discharges of water not associated with the natural runoff from a storm event. Non-storm water discharge control is the responsibility of the Operator with day-to-day operational control of the project area. The Operator will not cause, contribute to, or have reasonable potential to cause or contribute to a violation of a water quality standard. If additional controls are required they will be implemented and added to the Plan. The following possible non-storm water discharges are included under this Permit and are listed below:

Type of Allowable Non-Stormwater Discharge	Likely to be Present at Your Site?
Discharges from emergency fire-fighting activities	☐ YES ☒ NO
Fire hydrant flushings	☐ YES ☒ NO
Landscape irrigation	☒ YES ☐ NO
Waters used to wash vehicles and equipment	☐ YES ☒ NO
Water used to control dust	☒ YES ☐ NO
Potable water including uncontaminated water line flushings	☐ YES ☒ NO
Routine external building wash down	☐ YES ☒ NO
Pavement wash waters	☐ YES ☒ NO
Uncontaminated air conditioning or compressor condensate	☐ YES ☒ NO
Uncontaminated, non-turbid discharges of ground water or spring water	☒ YES ☐ NO
Foundation or footing drains	☐ YES ☒ NO
Construction dewatering water	☒ YES ☐ NO

The subcontractor will ensure that any activities listed above will not result in runoff. If runoff from such an application does occur, appropriate controls such as rock check structures and gravel bags downstream of the discharge, will be established prior to the next anticipated discharge and the SWPP Plan will be amended to reflect such a change.

It is unknown if ground water will be encountered during excavation activities for this project but is possible. The discharge of pollutants from dewatering trenches and excavations will be minimized. Discharges are prohibited unless managed by appropriate controls. If groundwater is encountered the SWPPP will be modified to reflect the following dewatering practices:

- Controls such as a sediment basin, sediment trap, dewatering tank, weir tank, or filtration system designed to remove sediment will be utilized.
- At points where dewatering water is discharged velocity dissipation requirements per Part 2.1.3.1 of the CGP will be implemented to prevent erosion.

3.2. Spill Prevention, Response & Reporting

Spill Prevention for this project includes inspecting equipment regularly for safety, cleanliness and leaks and implementation of appropriate controls at staging areas. Equipment found to be leaking will be removed from service and repaired. A spill kit will be located next to any materials or equipment that may leak. All treatment chemicals will be stored in leak-proof containers that are kept under storm-resistant cover and surrounded by secondary containment structures (e.g., spill berms, decks, spill containment pallets), or provide equivalent measures, designed and maintained to minimize the potential discharge of treatment chemicals in stormwater or by any other means (e.g., storing chemicals in covered area or having a spill kit available on site).

The discharge of hazardous substances or oil resulting from an on-site spill is not authorized under this Permit coverage. Spills or releases shall be reported in accordance with LANL requirements. If fire or explosion is present, or if the potential for such exists, the situation will be reported by dialing 911.

Emergency Management & Response (EM&R) has been appointed by the Laboratory Director as the organization responsible for emergency management at the Laboratory. All uncontrollable spills or releases must be reported to the EM&R Office by calling 667-6211 or, after hours, at 667-7080. In the event of a spill, the EM&R Office will determine appropriate cleanup procedures and will notify the individuals or organization. If fire or explosion hazards are present, or if the potential for such exists, the situation must be reported by dialing 911 from a non-cellular phone or by activating a fire pull box. In accordance with LANL requirements, internal spill reporting will be completed in the event of any release. Spill reports will be completed by the LANL organization responsible for overseeing site operations, and copies of the reports will be maintained by both the responsible organization and ENV-RCRA. Federal and state reporting is the responsibility of ENV-RCRA, and the determination for such notification will be made by ENV-RCRA and the EM&R Office in accordance with Laboratory and DOE policies and federal and state regulatory reporting requirements.

In the event of a release equal to or in excess of a reportable quantity, the SWPP Plan will be amended. All spills over 1 quart will be documented in the Spill Tracking Table (Appendix D.) As per LANL Procedures and EPA Regulations, any facility with a total aboveground fuel and oil storage capacity greater than 1,320 gallons including a de minimis container size of 55 gallons must have a Spill Prevention Control and Countermeasures Plan. This Plan will be submitted to ENV-RCRA for approval.

3.3. Construction and Waste Materials

Material and Waste Management

- Material and soil stockpiles will be protected from contact with stormwater (including run-on) using a temporary perimeter sediment barrier such as berms, dikes, fiber rolls, silt fences, gravel bags or will be placed on the upslope side of open trenches and away from any nearby watercourses. Provide cover or other appropriate temporary or permanent stabilization to avoid direct contact with precipitation or to prevent sediment discharge. Storage areas will be located at least 50’ from the watercourse where feasible.
- To maximize the native topsoil’s continued function, when stockpiling native topsoil, mound the soil and cover, if possible, to prevent soil erosion and weed growth.
- Litter, material cuttings, concrete or asphalt waste, and any other waste will be picked up or managed under good housekeeping practices at the end of each workday and prior to an anticipated precipitation event. Waste may be placed in bins to limit contact with storm water.
- Direct all concrete (and other construction materials such as paint, stucco, etc.) washwater into a leak-proof container or leak-proof pit in a specially designated area away from storm drain inlets and drainage areas. The container or pit must be designed so that no overflows can occur due to inadequate sizing or precipitation.
- Fluids (including fuels) and chemicals will be placed within covered storage, or a lined berm or other appropriate secondary containment. Drums containing liquids or hazardous materials will be stored on secondary containment pallets, which minimize storm water accumulation. Good housekeeping practices will be maintained and exposure to storm water will be minimized to the extent practicable.
- If used, portable lavatories will be used and maintained and secured in accordance with manufacturer recommendations to prevent from tipping over in windy conditions or being knocked over; lavatory waste will be treated off-site. Lavatories will be placed on a level area at least 50’ from the watercourse.
- Material shall be transported in appropriate containers or vehicles so that facility locations outside the project boundaries and public roadways will not be adversely impacted through sediment tracking or waste spillage.

- All vehicles and equipment will be observed for leaks and, if found, drip pans will be used until fixed. Leaks will be fixed as soon as practicable and leaking vehicles and equipment will be removed from service and repaired. Any leaks discovered shall be recorded in Appendix F. Spills of all products will be cleaned up and managed per applicable state and federal regulations.
- Vehicle and equipment washing is not done on LANL construction sites, therefore Part 2.3.3.2 is not applicable.
- Refueling of equipment shall be conducted at least 100 ft from any drainage, including dry arroyos. Fueling operations will be completed such that head space is provided within fuel tanks to allow for fuel expansion. Clearly flag off and designate areas to be used for fueling and maintenance activities and conduct such activities only in these areas. You must provide secondary containment structures or other similarly effective means of preventing the discharge of spilled or leaked chemicals from the area designated for this activity. If not practical, identify specifically the situations where this requirement may not be practical and describe alternative methods of preventing the discharge.
- If sediment escapes the construction site, off-site accumulations of sediment will be removed at a frequency sufficient to minimize offsite impacts.
- Where necessary, dust generation on-site shall be minimized with the application of water and/or an approved soil stabilizer. Water used to suppress dust generation will be applied at a rate to avoid discharge of water from the site. If additives are used, they will be applied per an approved NMED NOI.
- Fertilizer will not be used at this location, therefore Part 2.3.5 Fertilizer Discharge Restrictions will not apply.

4. PROCEDURES

4.1. Inspections

Disturbed areas, structural control measures, staging areas, and areas that have been stabilized shall be inspected at least once every **seven (7) calendar days**, and within 24 hours or the next working day of the end of a storm event equal to or greater than ¼ inch of precipitation. If the entire site has been temporarily stabilized, runoff is unlikely due to winter conditions (e.g., site is covered with snow, ice, or frozen ground exists), or during seasonal arid periods, inspections shall be conducted at least once every month.

Inspections to be performed by qualified personnel shall include the following:

- All areas that have been cleared, graded, or excavated where stabilization has not yet been implemented.
- All stormwater controls (including pollution prevention measures) installed at the site to comply with this permit.
- Material, waste, borrow, or equipment storage and maintenance areas that are covered by this permit.
- All areas where stormwater typically flows within the site, including drainageways designed to divert, convey, and/or treat stormwater.
- All points of discharge from the site.
- All locations where stabilization measures have been implemented.

Inspections shall be documented on the inspection form provided in Appendix J and will be retained in the SWPPP under Appendix K. Operators shall certify each inspection report in accordance with Appendix I, Part I.11 of the CGP. Inspections shall be continued by LANL (ENV-RCRA) until final stabilization of an area is achieved and/or the NOT is submitted. Inspector qualifications are included in Appendix J.

Precipitation Event:

- The rain events in the high desert mountain environments such as northern New Mexico can vary from short intense storms to a longer duration and less intense storm. The CGP requires that permittees complete inspections within 24 hours of a ¼ inch or greater storm event. Inspections will only be conducted during the project's normal working hours as permitted by the CGP. Rain data will be taken from the LANL TA-6 Met Tower. . Rain gage TA-50-9001 will be used as a backup.

4.2. Maintenance

Erosion and sediment controls must remain in effective operation condition during permit coverage and must be protected from activities that would reduce their effectiveness. Erosion and sediment controls will be inspected as required and noted in section 4.1 of this SWPPP and deficiencies will be documented on inspection forms and corrective action forms as discovered. Repairs or modifications must be made according to the following schedule:

- Initiate work to fix the problem immediately after discovering the problem, and complete such work by the close of the next work day, if the problem does not require significant repair or replacement, or if the problem can be corrected through routine maintenance.
- When installation of a new erosion or sediment control or significant repair is needed, you must install the new or modified control and make it operational, or complete the repair, within 7 calendar days from the time of discovery where feasible. If it is infeasible, you must document the reason it is infeasible and document your schedule for installing the control measures or making it operational as soon as practicable after the 7-day timeframe. Where these actions result in changes to any of the stormwater controls or procedures documented in this SWPPP, the SWPPP will be modified accordingly within 7 calendar days of completing the work.

4.3. Corrective Actions and Reporting

A corrective action report shall be completed for corrective actions taken in accordance with Part 5.4 of the CGP. These reports must be maintained in the permittees records but do not need to be provided to EPA except upon request. A blank corrective action report will be kept in Appendix J. Completed corrective action reports will be kept in Appendix J behind each applicable inspection. A corrective action constitutes any action taken by the permittee in compliance with Part 5 of the CGP to:

- Repair, modify, or replace any stormwater control used at the site;
- Clean up and properly dispose of spills, releases, or other deposits; and
- Remedy a permit violation.

Within 24 hours of one of the triggering conditions listed below occurring at a permittee's site, the permittee is required to complete a report of the following:

- Which condition was identified at the site
- The nature of the condition identified
- The date and time of the condition identified and how it was identified

Triggering conditions requiring the above reporting to be completed:

- A required stormwater control was never installed, was installed incorrectly, ornot in accordance with the requirements in Parts 2 and/or 3; or
- You become aware that the stormwater controls you have installed and are maintaining are not effective enough for the discharge to meet applicable water quality standards or applicable requirements in Part 3.1 of the CGP (Effluent Limitations). In this case, you must notify your EPA Regional Office by the end of the next work day. You are required to submit your notification through EPA's electronic NOI system, or "eNOI", at www.epa.gov/npdes/cgpenoi; or
- One of the prohibited discharges in Part 2.3.1 of the CGP is occurring or has occurred.

Within 7 days of discovering any of the triggering conditions requiring a corrective action report, a follow up report must be attached to the corrective action report noting any immediate follow up actions taken and a summary of stormwater control modifications taken or to be taken, including schedules and dates.

Operators shall also certify each corrective action and follow up report in accordance with Appendix I, Part I.11 of the CGP and maintain such reports in Appendix K of this Plan.

4.4. SWPPP Modifications

This SWPP Plan, including site maps, will be modified within 7 calendar days under the following conditions:

- New operators become active in construction activities on your site or changes are made to the construction plans, stormwater control measures, pollution prevention measures, or other activities at the site that are no longer accurately reflected in the SWPPP. This includes changes made due to required corrective actions.
- Areas on the site map where operational control has been transferred (and the date of transfer) since permit coverage was initiated.
- Inspections or investigations by site staff, or by local, state, tribal, or federal officials determine that SWPPP modifications are necessary for compliance with the CGP.
- EPA determines it is necessary to impose additional requirements on your discharge. The following must be included in the SWPPP:
  - A copy of any correspondence describing such requirements.
  - A description of the stormwater control measures that will be used to meet such requirements.
- To reflect any revisions to applicable federal, state, tribal, or local requirements that affect the stormwater control measures implemented at the site.

- If applicable, if a change in chemical treatment systems or chemically-enhanced stormwater control is made, including including use of a different treatment chemical, different dosage rate, or different area of application.

A record of SWPPP modifications including a summary of the changes, authorization, dates and notifications to other operators will be maintained using the SWPPP Modification Tracking Log provided in Appendix B.

4.5. Training

All onsite employees and subcontractors must be trained, as necessary, to be made aware of the applicable control measures implemented at the site so they follow applicable procedures. The following personnel at a minimum must receive training:

- Personnel who are responsible for the design, installation, maintenance, and/or repair of stormwater controls (including pollution prevention measures)
- Personnel responsible for the application and storage of treatment chemicals (if applicable)
- Personnel who are responsible for conducting inspections as required in Part 4.1.1 of the CGP
- Personnel who are responsible for taking corrective actions as required in Part 5 of the CGP.

Required personnel must be trained to understand the following if related to the scope of their job duties:

- The location of all stormwater controls on the site required by this permit, and how they are to be maintained
- The proper procedures to follow with respect to the permit's pollution prevention requirements
- When and how to conduct inspections, record applicable findings and take corrective actions.

Records of training will be maintained in Appendix J.

4.6. Site Maps

The site maps (Appendix C) provide boundaries of the property and the locations where construction activities will occur, including the following:

- Locations where earth-disturbing activities will occur, noting any phasing of construction activities.
- Approximate slopes before and after major grading activities. Areas of steep slopes as definite in Appendix A of the CGP.
- Locations where sediment, soil or other construction materials will be stockpiled.
- Locations of any crossings of surface waters
- Designated points on the site where vehicles will exist onto paved roads
- Locations of structures and other impervious surfaces upon completion of construction.
- Locations of construction support activity areas covered by this permit as listed in 1.3c (i.e. concrete or asphalt batch plants, equipment staging yards, material storage areas, excavated material disposal areas, borrow areas).
- Locations of all surface waters, including wetlands,that exist on or near your site. Indicate which waterbodies are listed as impaired, and which are identified as Tier 2, Tier 2.5, or Tier 3 waters.
- The boundary lines of any natural buffer areas.
- Areas of federally-listed critical habitat for endangered or threatened species.
- Topography of the site, existing vegetative cover (e.g., forest, pasture, pavement, structures), and drainage pattern(s) of stormwater and allowable non-stormwater flow onto, over, and from the site properly before and after major grading activities.
- Stormwater and allowable non-stormwater discharge locations, including:

  - Locations of any storm drain inlets(not applicable to this site) on the site and in the immediate vicinity of the site
  - Locations where stormwater or allowable non-stormwater will be discharged to surface waters (including wetlands)
- Locations of all potential pollutant-generating activities.
- Locations of all stormwater control measures
- Locations where polymers, flocculants, or other treatment chemicals will be used and stored(not applicable to this site).

4.7. Record Keeping

A copy of the SWPP Plan will be maintained onsite for the use of all operators and those identified in the SWPP Plan as having on-site responsibilities, the EPA, ENV-RCRA representatives, State or Tribal agencies, and local government officials until the permit is terminated. The Plan will contain required signatures, a copy of permit language, all reports required by permit coverage, a copy of the complete NOI (once posted on EPA's website), and any other applicable documentation. Items that will be maintained and attached to the SWPP include:

- Soil Disturbance Sequencing Event Table containing: dates when major soil disturbing activities occur, dates when construction activities temporarily or permanently cease on a portion of the site, and dates when stabilization measures are initiated (Appendix A)
- SWPPP Modification Records (Appendix B)
- Site Maps (Appendix C)
- Spill Tracking Form (Appendix D)
- SWPPP training (Appendix I)
- Inspection Reports (Appendix J)
- Corrective Action Reports (Appendix K)

Copies of SWPP Plans, inspection records, spill reports, all reports required by NPDES permit coverage, and data used to complete the NOI shall be retained by the permittees for a period of at least three (3) years from the date of final stabilization. LANL will also retain records in accordance with DOE policy.

4.8. Posting Requirements

Operators will post conspicuously near the main entrance of the site the following information:

- Copy of NOI
- Updated information if location of SWPPP or name and telephone number of contact have changed since NOI submittal

APPENDIX A:

Sequence of Events for Soil Disturbance Tracking Table

APPENDIX A: Sequence of Events for Soil Disturbance

Activity description	Actual dates of disturbance	Activity status
Mobilization		
Install sediment control gabion and energy dissipation structure to receive water routed around project through a pipe, prior to any earth disturbing activities		
Excavate and install holding basin for pumping and rerouting water around site, place controls around stockpile to control discharges		
Installation of stream diversion utilizing pump system		
Clear and grub site and stockpile topsoil, place controls around stockpile to control discharges		
Stage engineered fill above access to Sandia Canyon, place controls around stockpile to control discharges		
Backfill and compact wetlands area		
Excavation for and installation of sheet pile grade control structures and associated rock drop structures		
Excavate and install Cascade Structure		
Planting wetland vegetation and seeding/hydromulching		

Demobilization		
Final stabilization		

APPENDIX B: SWPPP Modification Records - Tracking Table

No.	Description of the Amendment (show date condition identified)	Date of Amendment	Amendment Prepared and Authorized by [Name(s) and Title]	Other Operators Notified Name & date notified

No.	Description of the Amendment (show date condition identified)	Date of Amendment	Amendment Prepared and Authorized by [Name(s) and Title]	Other Operators Notified Name & date notified

APPENDIX C:

Site Maps

SWPPP SITE PLAN

3-4-13

Lined sump pit and lined channels to divert water to sump

Wetlands area - approx. 2% grade. See separate drawings for changes in grade and entire revegetation plan.

Proposed soil staging for sump pit backfill with perimeter sediment control BMP

Maintain run-on diversion (berm)

Site access

Approx. 3:1 slope - any disturbed areas from equipment traffic will be revegetated

Proposed topsoil staging (for reuse during stabilization initiation) with perimeter sediment control BMP

Equipment and material staging on existing base course road with berms- add gravel bags at culvert inlet

Rock gabion structure for sediment control

Flow velocity reducing rock armor to acheive pre-existing flow velocity at 6" pipe outlet.

Flow to Sandia Canyon (Tier 2 Waters)

Sandia Canyon (Sigma Canyon to NPDES outfall 001) - 2.21 miles impaired due to Aluminum, Copper, Gross Alpha-Adjusted, Mercury, PCBs (Assessment Unit ID NM-9000.A_047)

PLAN VIEW
SCALE: 1" = 20'

1"=20'-0"

KEYED NOTES

1. SURVEYED STREAMBED LIMITS
2. SURVEYED WETLAND LIMITS
3. GIS DELINEATION OF WETLAND LIMITS (PROVIDED BY LANL)
4. WETLAND RESTORATION ZONE (SEE C-7000 FOR PLANTING DETAILS)
5. WETLAND/STREAM TRANSITION ZONE (SEE C-7000 FOR PLANTING DETAILS)
6. STREAM GAGE E-123
7. GRADE CONTROL STRUCTURE GC-1 (STA. 2+41.5)
8. GRADE CONTROL STRUCTURE GC-2 (STA. 1+73.1)
9. GRADE CONTROL STRUCTURE GC-3 (STA. 1+15.4)

Limits of disturbance/areas requiring revegetation

During construction stream flow and run-on stormwater will be re-routed around project area via a lined sump pit, pump, and 6" pipe

Existing wetlands

Note: Only impervious areas will be the three metal grade control structures.

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	VER	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL

OVERALL PLAN VIEW

DRAWN	D VARJ.
DESIGN	C MCDONALD
CHECKED	J O'NEILL
DATE	2012-07-30

BLDG. N/A TA-00

SUBMITTED JAMES O'NEILL

APPROVED FOR RELEASE JOHN P. MCCANN

Los Alamos NATIONAL LABORATORY PO Box 1663 Los Alamos, New Mexico 87545

SHEET C-1002

5 OF 13

CLASSIFICATION U REVIEWER R BOHN DATE 2012-07-30

PROJECT ID 102698 DRAWING NO C-55803 REV 0

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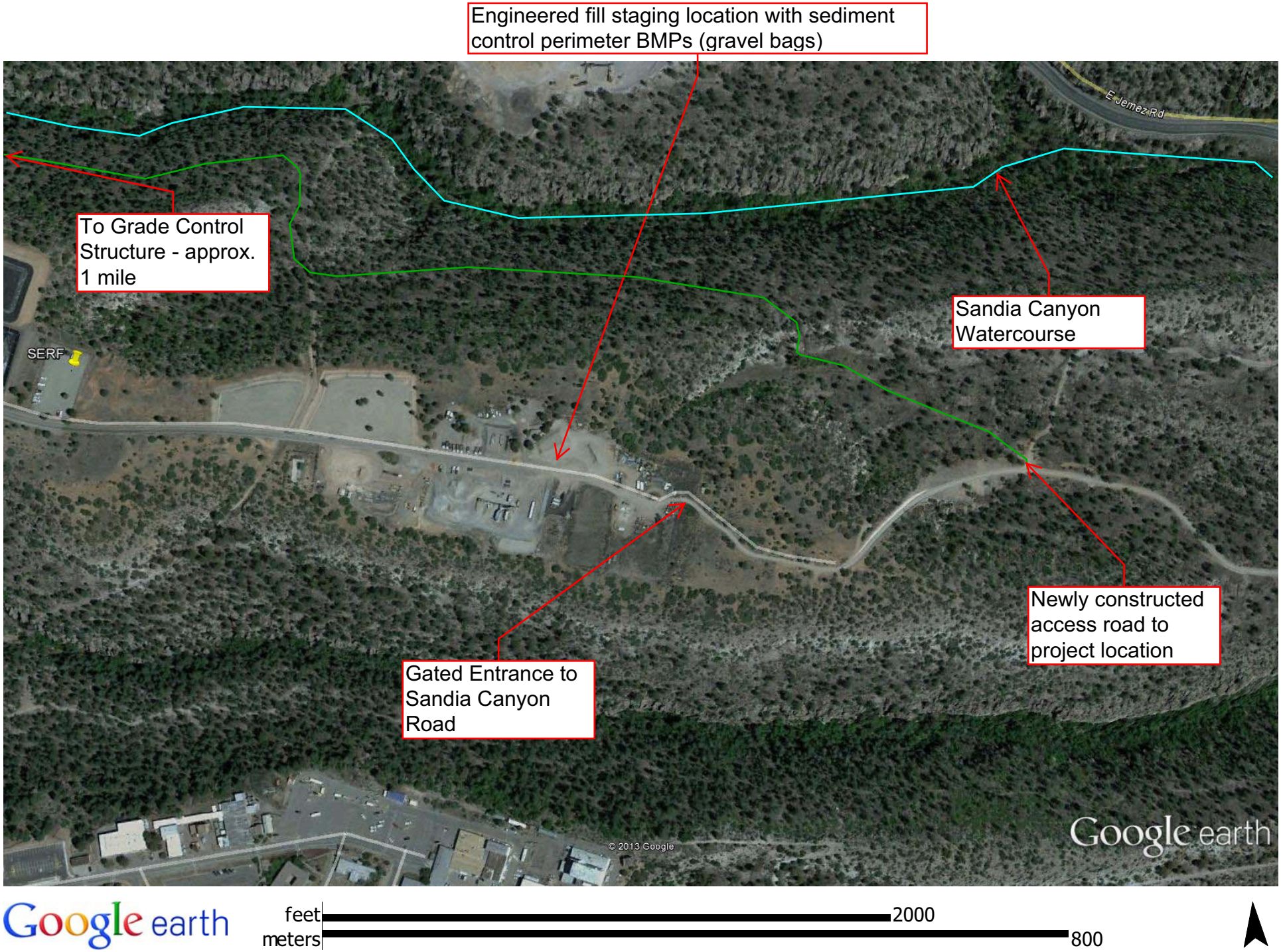
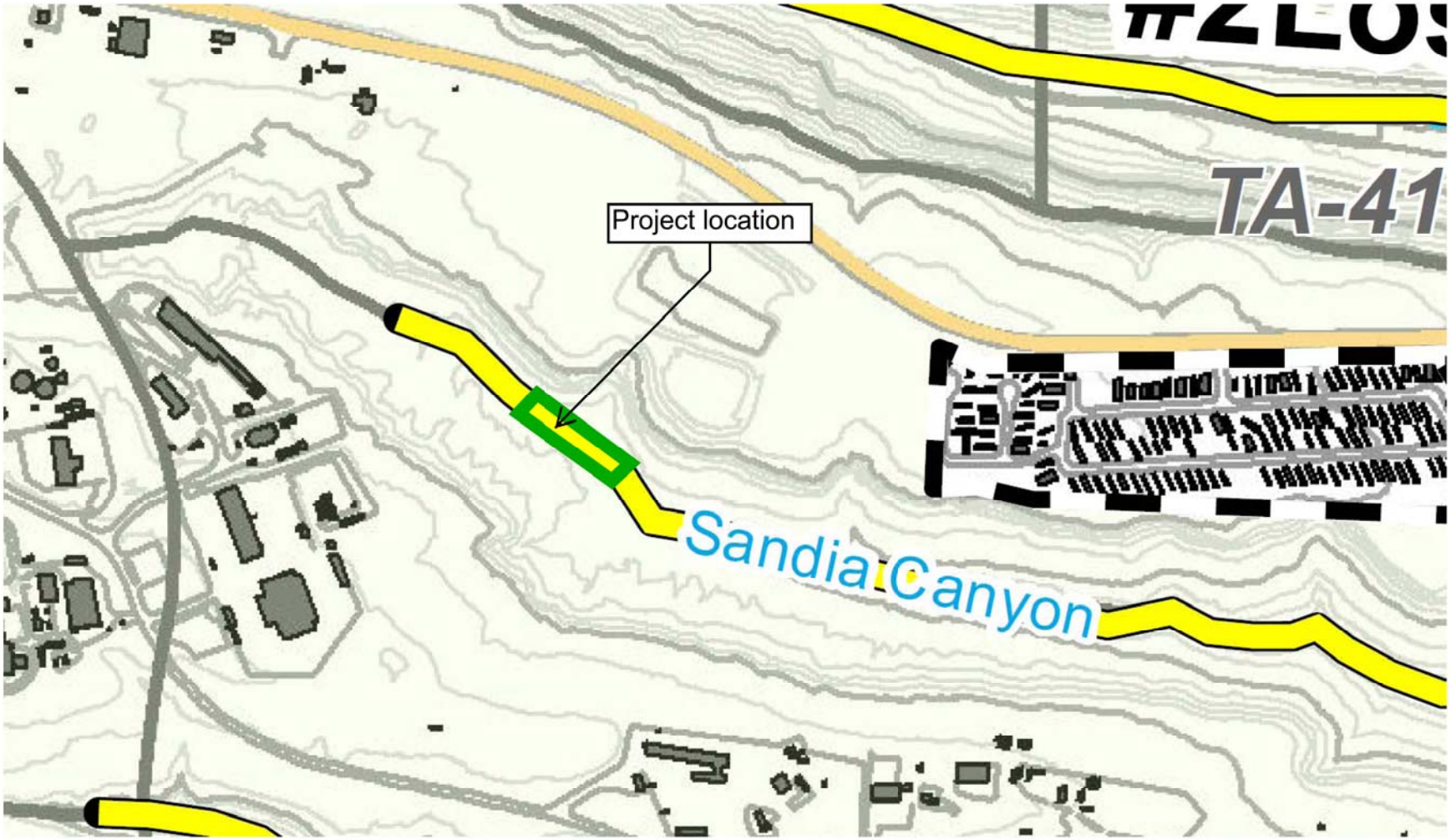
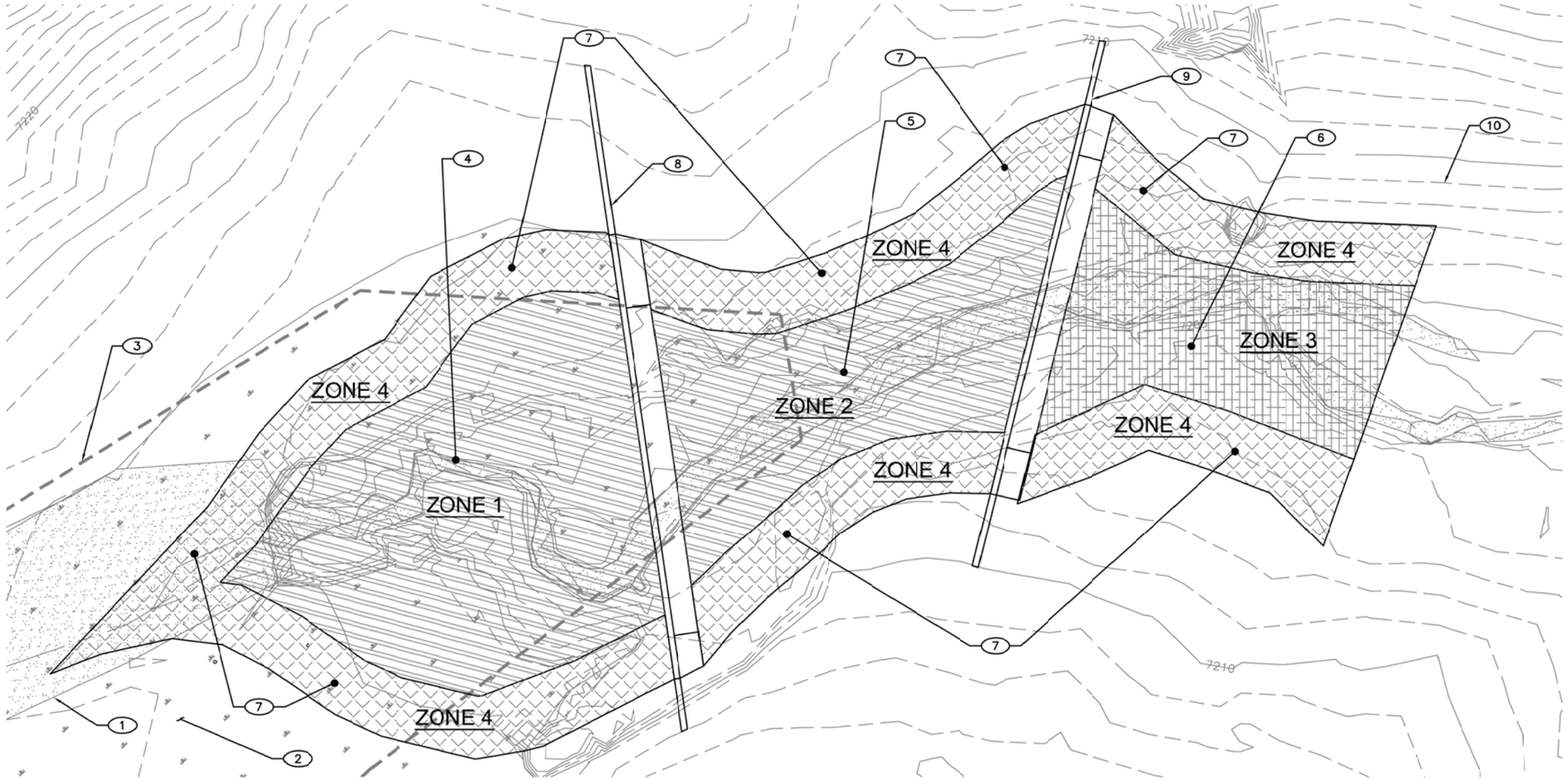

Engineered fill staging location with sediment control perimeter BMPs (gravel bags)
To Grade Control Structure - approx. 1 mile
Sandia Canyon Watercourse
Newly constructed access road to project location
Gated Entrance to Sandia Canyon Road
SERF
E Jemez Rd
© 2013 Google
Google earth
Google earth
feet
meters
2000
800



Sandia Canyon (Sigma Canyon to NPDES outfall 001) - 2.21 miles impaired due to Aluminum, Copper, Gross Alpha-Adjusted, Mercury, PCBs (Assessment Unit ID NM-9000.A_047)

Yellow indicates impaired waters



PLAN VIEW

10' 5' 0 5' 10'
1"=10'-0"

GENERAL NOTES

1. AREA SHALL BE TEMPORARILY SEEDED IMMEDIATELY UPON COMPLETION OF ANY FINAL GRADES TO PREVENT EROSION.
2. EROSION CONTROL MATTING SHALL BE USED IN WET SHALL BE USED IN WETLAND AREA TO CONTROL EROSION UNTIL VEGETATION IS ESTABLISHED.
3. AREAS OUTSIDE OF WETLAND PLANTING AREA NOTED BELOW SHALL BE SEEDED WITH NATIVE GRASSES.

KEYED NOTES

1. SURVEYED STREAMBED LIMITS
2. SURVEYED WETLAND LIMITS
3. GIS DELINEATION OF WETLAND LIMITS (PROVIDED BY LANL)
4. WETLAND RESTORATION ZONE 1 (AREA = 4,916 SF). SEE PLANTING SCHEDULE FOR SPACING.
5. WETLAND RESTORATION ZONE 2 (AREA = 3,526 SF). SEE PLANTING SCHEDULE FOR SPACING.
6. WETLAND RESTORATION ZONE 3 (AREA = 2,706 SF). SEE PLANTING SCHEDULE FOR SPACING.
7. WETLAND RESTORATION ZONE 4 (AREA = 4,945 SF). SEE PLANTING SCHEDULE.
8. GRADE CONTROL STRUCTURE GC-1
9. GRADE CONTROL STRUCTURE GC-2
10. GRADE CONTROL STRUCTURE GC-3

QUANTITY	SCIENTIFIC NAME	COMMON NAME	TYPE	SPACING (O.C.)	ZONE
		HERBACEOUS			
2120	ELEOCHARIS PALUSTRIS	COMMON SPIKERUSH	PLUG/SEED	2'	1 AND 2
2120	GLYCERIA BOREALIS	NORTHERN MANNAGRASS	PLUG/SEED	2'	1 AND 2
2120	MIMULUS GUTTATUS	SEEP MONKEYFLOWER	PLUG/SEED	2'	1 AND 2
2120	SCIRPUS ACUTUS	HARDSTEM BULRUSH	PLUG/SEED	2'	1 AND 2
2120	SCIRPUS PUNGENS	THREESQUARE BULRUSH	PLUG/SEED	2'	1 AND 2
2120	SCIRPUS TABERNAEMONTANI	SOFTSTEM BULRUSH	PLUG/SEED	2'	1 AND 2
2120	TYPHA LATIFOLIA	BROADLEAF CATTAIL	PLUG/SEED	2'	1 AND 2
677	CAREX AQUATILIS	WATER SEDGE	PLUG/SEED	2'	3
677	CAREX LANUGINOSA	WOOLY SEDGE	PLUG/SEED	2'	3
677	CAREX MURICATA	POINTED SEDGE	PLUG/SEED	2'	3
677	CAREX ROSTRATA	BEAKED SEDGE	PLUG/SEED	2'	3
677	JUNCUS BALTICUS	BALTIC RUSH	PLUG/SEED	2'	3
677	JUNCUS LONGISTYLIS	LONGSTYLE RUSH	PLUG/SEED	2'	3
677	JUNCUS TORREYI	TORREY RUSH	PLUG/SEED	2'	3
677	SCIRPUS PUNGENS	THREESQUARE BULRUSH	PLUG/SEED	2'	3
		TREE/SHRUB			
320	ACER NEGUNDO	BOXELDER	TUBLING	4'	4
320	BACCHARIS SALICIFOLIA	SEEPWILLOW	TUBLING	4'	4
320	SALIX EXIGUA	COYOTE WILLOW	LIVE STAKE	4'	4
320	SALIX IRRORATA	BLUESTEM WILLOW	LIVE STAKE	4'	4

PLANTING SCHEDULE

JAMES A. O'NEILL NEW MEXICO 18656 REGISTERED PROFESSIONAL ENGINEER 7/30/2012

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	VER	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL

PLANTING AND STABILIZATION PLAN

DRAWN: D VARJ.
DESIGN: B NASH
CHECKED: J O'NEILL
DATE: 2012-07-30

BLDG. N/A TA-00

SUBMITTED: JAMES O'NEILL
APPROVED FOR RELEASE: JOHN P. MCCANN

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET C-1007
10 OF 13

CLASSIFICATION U
REVIEWER R BOHN
DATE 2012-07-30

PROJECT ID 102698
DRAWING NO C-55803
REV 0

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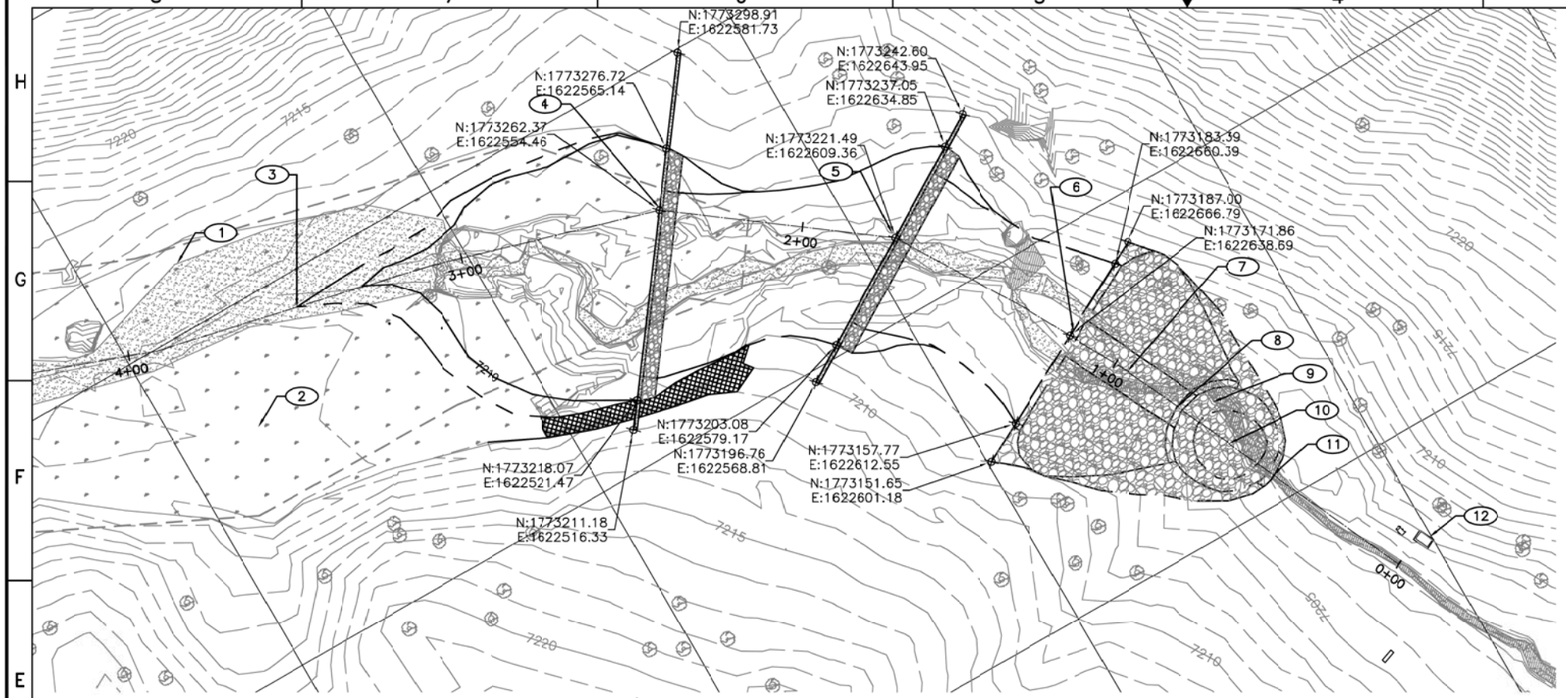


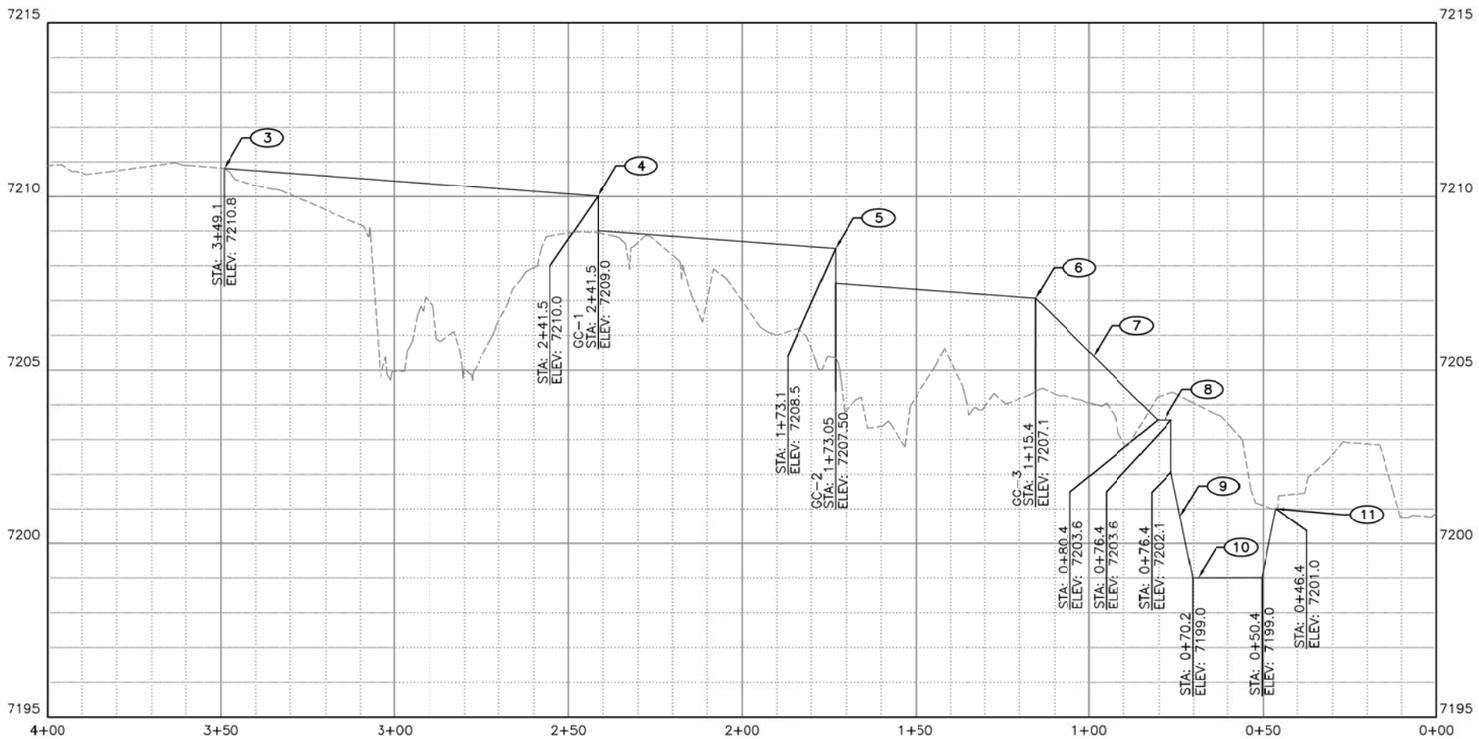
PLAN VIEW

SCALE: 1" = 20'

1"=20'-0"

KEYED NOTES

1. SURVEYED STREAMBED LIMITS
2. SURVEYED WETLAND LIMITS
3. TIE INTO EXISTING GRADE
4. GRADE CONTROL STRUCTURE GC-1 (STA. 2+41.5)
5. GRADE CONTROL STRUCTURE GC-2 (STA. 1+73.1)
6. GRADE CONTROL STRUCTURE GC-3 (STA. 1+15.4)
7. CASCADE CENTER DROP LOCATION
8. CASCADE END SILL
9. SLOPE INTO CASCADE POOL
10. CASCADE POOL LOCATION
11. SILL TO TIE INTO STREAM GRADE
12. STREAM GAGE E-123



PROFILE VIEW

HORIZONTAL SCALE: 1" = 20'

1"=20'-0"

1"=2'-0"

JAMES A. O'NEILL
NEW MEXICO
18656
REGISTERED PROFESSIONAL ENGINEER
7-30-2012

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	VER	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL

PLAN AND PROFILE

DRAWN	D VARJ.
DESIGN	C MCDONALD
CHECKED	J O'NEILL
DATE	2012-07-30

BLDG. N/A TA-00

SUBMITTED: JAMES O'NEILL

APPROVED FOR RELEASE: JOHN P. MCCANN

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET C-1005
8 OF 13

CLASSIFICATION U | REVIEWER R BOHN | DATE 2012-07-30

PROJECT ID 102698 | DRAWING NO C-55803 | REV 0

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APPENDIX D:

SPILL TRACKING FORM

Date	Spill Location	Material(s) Spilled	Quantity Spilled	Corrective Action Taken	Plans to Prevent Recurrence

APPENDIX E:

Permit Regulations, NOI, Delegation of Authority Letter,

EPA Acknowledgement

http://www.epa.gov/npdes/pubs/cgp2012_finalpermit.pdf

Los Alamos
NATIONAL LABORATORY
EST. 1943

Associate Directorate for ESH&Q
P.O. Box 1663, Mail Stop K491
Los Alamos, New Mexico 87545
(505) 667-4218/Fax: (505) 665-3811

Date: March 2, 2009
Refer To: ESH&Q-09-009

Mr. Lawrence E. Starfield, Regional Administrator
U.S. Environmental Protection Agency, Region 6
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Dear Mr. Starfield:

SUBJECT: DELEGATION OF "AUTHORIZED REPRESENTATIVE" FOR THE CLEAN WATER ACT (CWA) AND NPDES STORM WATER PERMITS AND INDUSTRIAL OUTFALL PERMIT BY LOS ALAMOS NATIONAL SECURITY, LLC (LANS)

The purpose of this letter is to inform the Environmental Protection Agency (EPA) Region 6 of a change in signatory authority for operator of Los Alamos National Laboratory (LANL). Los Alamos National Security, LLC (LANS) has been the Laboratory's management and operation contractor since June 1, 2006. This letter delegates authority as the LANS "authorized representative" for certifying and signing permits and documents required under the Clean Water Act and associated National Pollutant Discharge Elimination System (NPDES) storm water permits (Construction General Permit, Multi-Sector General Permit, LANL Individual Permit), and the NPDES Industrial Outfall Permit. This letter replaces the two LANS' delegation of "authorized representative" letters dated June 1, 2006 (ESH&Q: 06-001) and June 19, 2006 (ESH&Q: 06-002).

As the designated LANS signatory official for Clean Water Act and associated NPDES Permit Programs (please see Enclosure 1), I wish to further identify the position of Division Leader of the Laboratory's Environmental Protection Division (ENV-DO) as certifying official for NPDES standard permit requirements with the authority to certify, review, approve and/or sign as certifying official of all permit applications (e.g. Notice of Intent (NOIs) and Notice of Termination (NOTs)), permit modifications, registrations, certifications, reports and other information as required by EPA. The following is a detailed breakdown of this delegation of signatory authorities.

The following positions are hereby designated as authorized representatives to sign reports, plans, certifications, notices of changed conditions, discharge monitoring reports, and other information as required by the EPA:

NPDES Storm Water Construction General Permit

- Group Leader or Deputy Group Leader of the Laboratory's Water Quality & RCRA Group.
- Cognizant Project Manager, Project Leader, or Subcontractor Technical Representative for the regulated construction activity.
- Responsible Facility Operations Director (FOD), Deputy FOD, or Operations Manager responsible for the overall operation of the regulated facility or activity.

Multi-Sector General Permit & LANL Individual Permit

- Group Leader or Deputy Group Leader of the Laboratory's Water Quality & RCRA Group.
- Director, Deputy Director, or Group Leader of the Laboratory Division responsible for the overall operation of the regulated facility or activity.
- Responsible FOD, Deputy FOD or Operations Manager responsible for the overall operation of the regulated facility or activity.
- Program Director, Program Manager or Project Leader responsible for the overall operation of the regulated facility or activity.

NPDES Outfall Permit No. NM0028355

- Group Leader or Deputy Group Leader of the Laboratory's Water Quality & RCRA Group.
- Director or Deputy Director of the Laboratory Division responsible for the overall operation of the regulated facility or activity.

Please contact Tori George, Division Leader for Environmental Protection, at (505) 667-2211, if you have questions.

Sincerely,

J. Chris Cantwell
Associate Director
Environment, Safety, Health and Quality

Enclosures: a/s

Cy: M. Flores, U.S. EPA, Region 6, Dallas, TX, w/enc.
C. Hosch, U.S. EPA, Region 6, Dallas, TX, w/enc.
W. Lane, U.S. EPA, Region 6, Dallas, TX, w/enc.
I. Chen, U.S. EPA, Region 6, Dallas, TX, w/enc.
B. Larsen, U.S. EPA, Region 6, Dallas, TX, w/enc.
G. Saums, NMED/SWQB, Santa Fe, NM, w/enc.
R. Powell, NMED/SWQB, Santa Fe, NM, w/enc.
D. Winchell, NNSA-LASO, w/enc., MS A316
G. Rael, NNSA-LASO, w/enc., MS A906
G. Turner, NNSA-LASO, w/enc., MS A316
D. Sosinski, LC-DO, MS A183
D. Woitte, LC-LESH, MS A187
P. Wardwell, LC-LESH, w/enc., MS A187
T. George, ENV-DO, w/enc., MS J978
T. Grieggs, ENV-RCRA, w/enc., MS K490
M. Saladen, ENV-RCRA, w/enc., MS K490
T. Lemke, ENV-RCRA, w/enc., MS K490
ESH&Q File, w/enc., MS K491
ENV-DO, File, w/enc., MS J978
ENV-RCRA, File, (09-024), w/enc., MS K490
IRM-RMMSO, w/enc., MS A150

(ENCLOSURE 1)

Los Alamos
NATIONAL LABORATORY
EST. 1943

Office of the Director

March 4, 2009

J. Chris Cantwell
Associate Director
Environment, Safety, Health and Quality
Los Alamos National Security

Dear Mr. Cantwell: Chris

SUBJECT: **CONTRACT NUMBER: DE-AC52-06NA25396, DELEGATION OF AUTHORITY FOR PERMITS, AUTHORIZATIONS AND OTHER DOCUMENTS AS AN OPERATOR OR CO-OPERATOR UNDER ENVIRONMENTAL PERMITS FOR THE LOS ALAMOS NATIONAL LABORATORY**

I, Michael R. Anastasio, Director of Los Alamos National Laboratory and President of Los Alamos National Security, LLC (LANS), the "Company," hereby delegate authority to you, J. Chris Cantwell, Associate Director, Environmental, Safety and Health and Quality (ADESH&Q), to execute on behalf of the Company permits, authorizations, or other documents necessary for the Company to become an operator or co-operator under the environmental permits for the Los Alamos National Laboratory, which permits are currently in the name of the Los Alamos National Security.

This delegation shall remain in effect while you are in the position of Associate Director, ADESH&Q or until revoked by me.

Sincerely,

Michael R. Anastasio
Director

Cy: I. E. Richardson III, DIR, A100
M. Mallory, PADOPS, A102
M. Graham, ADEP, M991
T. George, ENV-DO, J978
D. Sosinski, LC-DO, A183
D. Woitte, LC-LESH, A187
R. Madison, LANS, T009
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APPENDIX F:

BMP Guidance, Details, and Specifications

1. Berms
2. Permanent seeding
3. Fiber Rolls/Gravel bags
4. Check dams
5. Silt fence
6. Riprap
7. Good Housekeeping
8. LANL seeding spec 32 9219

BERMS AND CHANNELS

Options and Alternatives

- Swale/berm combination
- Rock berms
- Log berms
- Triangular Silt Dike®

BMP Objectives

- Runoff Control
- Run-on Diversion

Description

Berms and channels are most often used to prevent run-on from eroding an exposed or disturbed area, and to divert sediment-laden runoff to a sediment trap, sediment basin or other suitable, stabilized discharge outlet. When used as a temporary control, berms are most often constructed from compacted soil or loose gravel, stone, or crushed rock. Berms may serve as a permanent structural control when constructed from asphalt, concrete, or other similar material. Channels can be incorporated into a berm design or function as a stand-alone BMP, and are typically constructed from compacted soil or lined with a suitable material.

Applications

Effective in diverting run-on away from unprotected areas and reducing flow velocities; effective to retain small amounts of runoff and sediment onsite.

Limitations

- A berm with a height of over 2 feet or located in an area where failure of the berm would result in damage to facilities, the environment or other safety issues requires an engineered design.
- Increased potential for failure if the upslope gradient is too great, resulting in high velocity flows.
- Earth berms may require vegetative stabilization to prevent erosion of the berm itself.
- Excessive sediment accumulation on upslope side of berm needs frequent clean-out.
- Channels may require engineering calculations to ensure the channel material is adequate to withstand flow velocity and shear stress.

Performance and Longevity

Performance	Poor or N/A	Good	Excellent
Erosion Prevention		x	
Sediment Control		x	
Runoff Control			x
Good Housekeeping	x		

Longevity	Temporary (must be removed)	Long term (may need maintenance)	Permanent	Re-useable
Earth and base course	x	x		
Asphalt and concrete			x	
Prefabricated channels and culverts	x	x	x	x
Prefabricated barriers	x			x

Design and Construction Guidance

- Berms should be constructed during initial land-disturbing activities and must be operational prior to upslope land disturbance.
- A shallow trench or swale to contain the diverted run-on/runoff can be incorporated into the berm design.
- Where applicable, on-site material should be used for berm construction.
- Berm material needs to meet requirements for gravelly clay or sandy clay. Do not use gravelly sand or gravelly loam to construct berms.
- When used as a perimeter or down slope control, berms should divert runoff to a sediment trapping control such as a sediment trap or basin.

- Berms should be located so as to minimize damage by construction operations and traffic.
- Triangular Silt Dike® berms can be used in locations subject to minor traffic flow.
- Earth berms must be adequately compacted to prevent failure.
- Logs must be delimbed, trenched in and backfilled. If necessary, secure with wooden stakes on either side of the log.
- Rock berms must be constructed of large angular rock. Height and depth of the berm is dependent on the expected storm water flow. Ends of berm should be brought forward to help contain the flow.
- Channel material must be adequate to withstand flow velocity and shear stress.
- Ensure channels are designed and constructed with a defined flow line adequate to convey flows.
- Spillways on berms should be at least 6 inches in depth and should be protected against scour. Use rock or TRM for stabilization of the spillway.

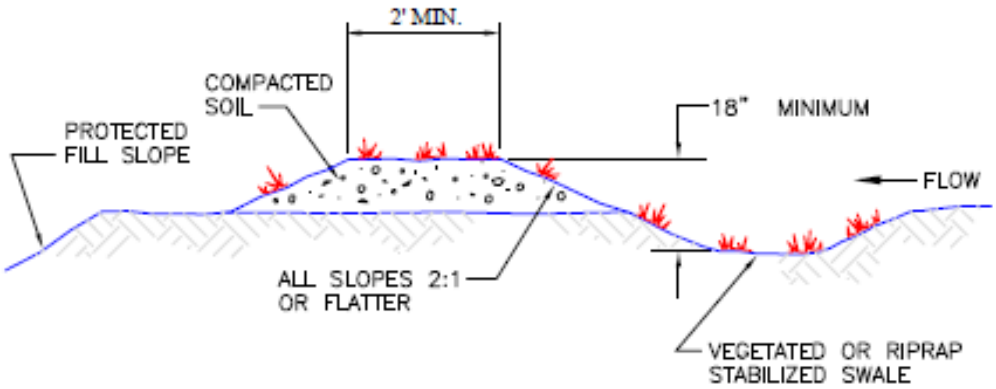
Inspection and Maintenance

- Seeded areas which fail to establish a vegetative cover shall be reseeded as necessary.
- Damage from vehicle or construction traffic shall be repaired prior to the end of each working day or prior to the next storm event, whichever is sooner.
- Conduct required repairs immediately.
- Temporary berms may be removed when the site has been finally stabilized or when drainage patterns changed so that the berms are no longer functional.
- Berms that are designed to trap sediment should be cleaned out as necessary or after each storm event.
- Inspect for erosion or other damage, and repair.

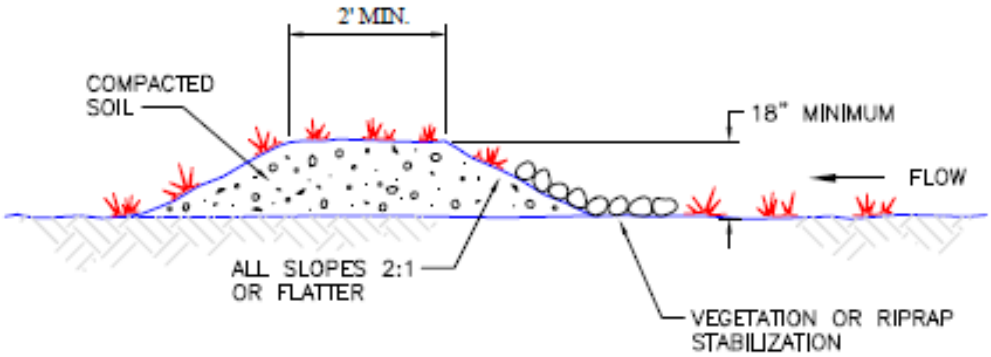
What not to do…

Berm was not well stabilized and could not stand up to run-on flows. Berms and swales should be designed and constructed to handle site specific run-on or run-off flows.

EARTH BERM



TYPICAL FILL DIVERSION

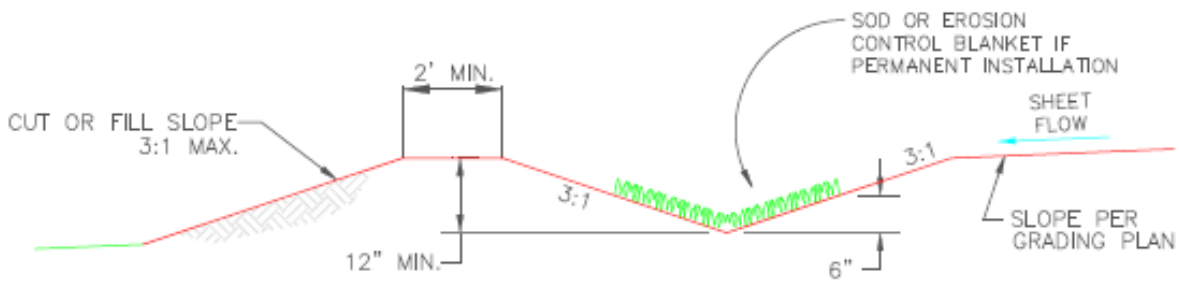


TYPICAL TEMPORARY DIVERSION DIKE

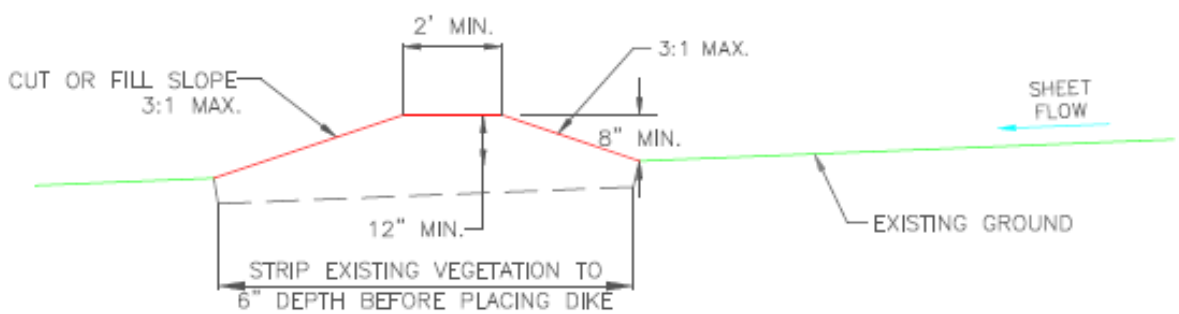
NOTES:

1. THE CHANNEL BEHIND THE BERM SHALL HAVE A POSITIVE GRADE TO A STABILIZED OUTLET.
2. THE BERM SHALL BE ADEQUATELY COMPACTED TO PREVENT FAILURE.
3. THE BERM SHALL BE STABILIZED WITH TEMPORARY OR PERMANENT SEEDING, MATTING, OR OTHER APPLICABLE MEASURES.
4. THE TOP OF THE BERM SHALL HAVE A MINIMUM WIDTH OF 2 FEET AND ALL SIDE SLOPES SHALL BE 2:1 OR FLATTER.

EARTH BERMS & SWALES



SWALE

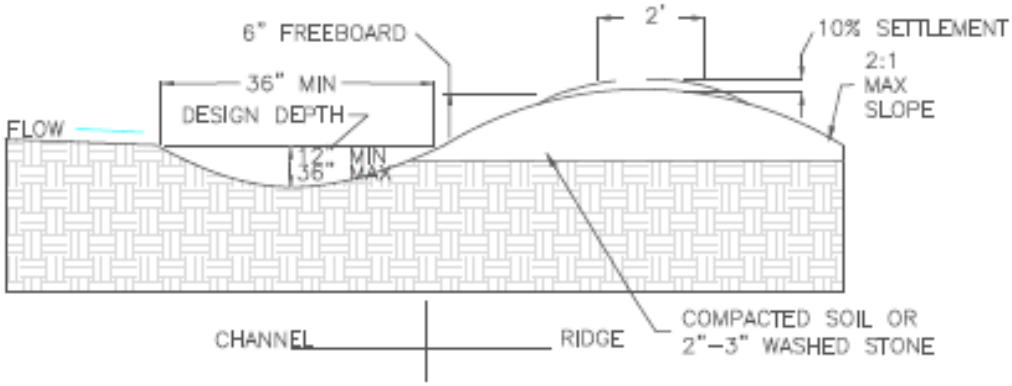


DIKE

NOTES:

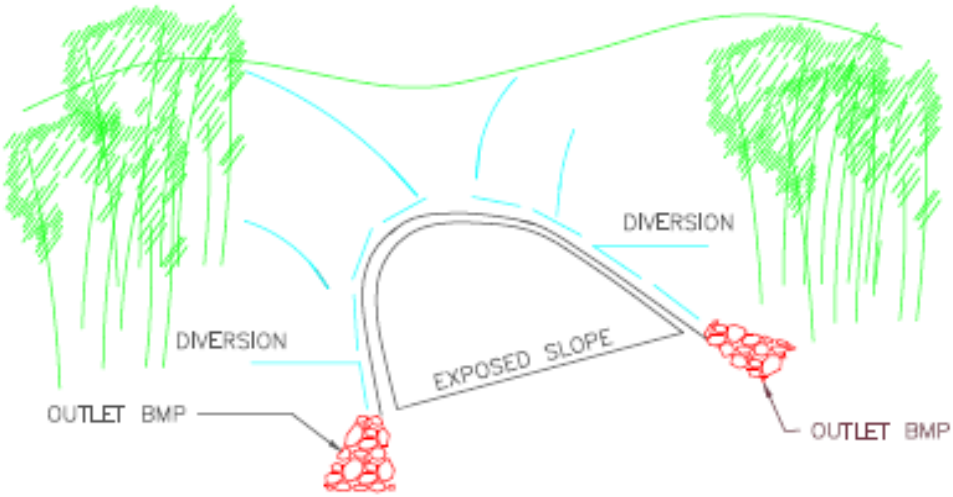
1. DIKE SHALL BE COMPACTED TO DENSITY EQUAL TO THAT SPECIFIED FOR ADJOINING AREA (90% STANDARD PROCTOR DENSITY, MINIMUM).
2. MINIMUM 1% GRADE MUST BE PROVIDED FOR SWALE OR ALONG UPSLOPE SIDE OF DIKE FOR PROPER DRAINAGE.

EARTH BERMS & SWALES

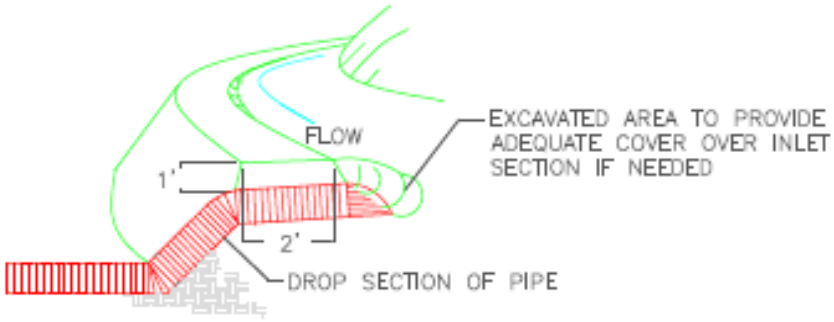


CROSS SECTION

ALL SURFACE STABILIZED WITH MULCH, SEED OR GRAVEL



TYPICAL PERIMETER PROTECTION



TYPICAL TOP OF SLOPE INSTALLATION

Revegetation

Options

- Seed in conjunction with hydromulch
- Seed in conjunction with erosion control blanket installation
- Seed in conjunction with other types of mulch products

Alternatives

- Use Turf Reinforcement Mat
- Preservation of existing vegetation

BMP Objectives

- Temporary or permanent soil stabilization
- Increase infiltration and reduce erosion and sediment transport

Description

Revegetation is the establishment of short-term or long-term vegetative cover, through seeding, on disturbed surfaces or other areas that pose a high risk of erosion. Seeding can provide temporary or permanent stabilization with reduced erosion, runoff, and sediment transport. Temporary seeding can be used on any temporary earthen structure, construction sites, topsoil stockpiles, etc. Typical areas appropriate for permanent seeding include denuded areas where long-term vegetative cover is desired, buffer areas, steep slopes, stream banks, and areas where soils are unstable.

Applications

- Temporary or permanent stabilization at construction sites, topsoil stockpiles, etc.
- Denuded areas where long-term vegetative cover is desired, buffer areas, steep slopes, stream banks, and areas where soils are unstable.

Limitations

- Establishment of vegetation can take one or more growing seasons and is dependent upon growing conditions (temperature, rainfall, soils, etc.).
- May require ongoing irrigation and maintenance to establish vegetation.
- Incorrect revegetation methods may inhibit growth and may not be fully evident until after the growing season.
- Effectiveness can be greatly reduced if rills or gullies are allowed to form underneath blankets, or if hydromulch is subject to concentrated flows.
- Soil may require agronomic evaluation and/or amendment before revegetation can be successfully implemented or established.

Performance and Longevity

Performance	Poor	Good	Excellent
Erosion Prevention			x
Sediment Control		x	
Runoff Control	x		
Good Housekeeping	x		

Longevity	Temporary (must be removed)	Long term (may need maintenance)	Permanent	Re-useable
Revegetation		x		

Design Criteria and Construction Specifications

Design Criteria: Use LANL Master Specification 32 9219 for detailed guidance on seedbed preparation, applicable seed mixes, seeding operations, application rates, and mulch cover products. (http://engstandards.lanl.gov/specs/32_9219R3.doc)

- Seeding should be initiated as soon as practicable following completion of soil disturbing activities.
- Permanent seeding should be applied prior to seasonal rains or freezing weather.
- If soil is compacted, loosen soil with disking, raking or harrowing. Remove large clods and stones, or other foreign material that would interfere with seeding equipment and installation of erosion control blankets (ECB).
- If seeding requires harrowing, tracking, or furrowing, these activities shall be conducted horizontally across the face of the slope.
- Native species appropriate to site conditions should be used wherever possible.
- Seed shall be applied uniformly using calibrated broadcast spreaders, mechanical drills, or hydroseeders.
- Do not seed during windy weather, or when topsoil is dry, saturated or frozen.
- ~~Apply slow-release organic fertilizers in accordance with manufacturer recommended rates.~~
- The application of mulch shall immediately follow seeding.
- Apply hydromulch and soil amendments in accordance with manufacturer's specifications.
- Select appropriate mulch material or erosion control blanket based on slope, required longevity, irrigation or non-irrigation, and site and soil conditions.
- If hydraulically applying mulch as part of the broadcast seeding process, use a 2-step process. Apply seed with a tracer. Once seed is applied, apply full complement of mulch. This will allow seed to be in good contact with soil surface and not suspended in the mulch matrix.
- Mix hydromulch slurry in a tank with an agitation system and spray, under pressure, uniformly over soil surface.
- Lay ECBs loosely and maintain direct contact with the soil. Do not place over protruding objects; rocks, bushes, etc.
- Install storm water diversion and conveyance controls as needed to divert concentrated flows away from seeded areas.

Fertilizer will not be used on this project within the wetlands vicinity. JK 3-1-13

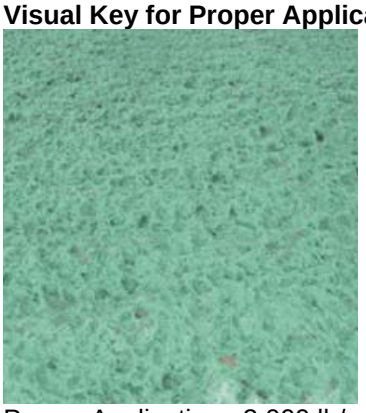
Inspection and Maintenance

ECB and Hydromulch Usage Table

	slopes steeper than 1:1	slopes flatter than 1:1	slopes flatter than 2:1	slopes flatter than 3:1	channels
Permanent blankets (TRM)	x	x	x	x	x
BFM, FGM hydromulch	x	x	x	x	
Wood fiber hydromulch, compost mulch			x	x	
Straw/coir ECBs			X	x	
Coir ECBs		x	X	X	

- Ensure seed and mulch is applied at the specified rate.
- Inspect seeded area for uniform application of seed and mulch.
- For hydromulch applications on slopes, inspect the mulch application from multiple directions (i.e., looking both up and down the slope) to ensure uniform application and no “shadowing” (absence of mulch on the back side of a furrow caused by spraying hydromulch from only one direction).
- Ensure ECBs are properly trenched, overlapped, and anchored. Check that rocks, sticks, or vegetation are not interfering with the blanket’s contact with the ground.
- Ensure that ECBs have been placed such that they maintain contact with the ground surface.
- Inspect seeded area for evidence of erosion (rills, gullies).
- Check for erosion and undermining. Backfill and compact any rills. Install storm water diversion and conveyance controls as needed to divert concentrated flows away from seeded areas.
- Repair torn or windblown blankets.
- Inspect reseeded areas for uniform growth of vegetation. Check for areas for damage by vehicles or other equipment.
- Install storm water diversion and conveyance controls as needed to divert concentrated flows away from seeded areas.

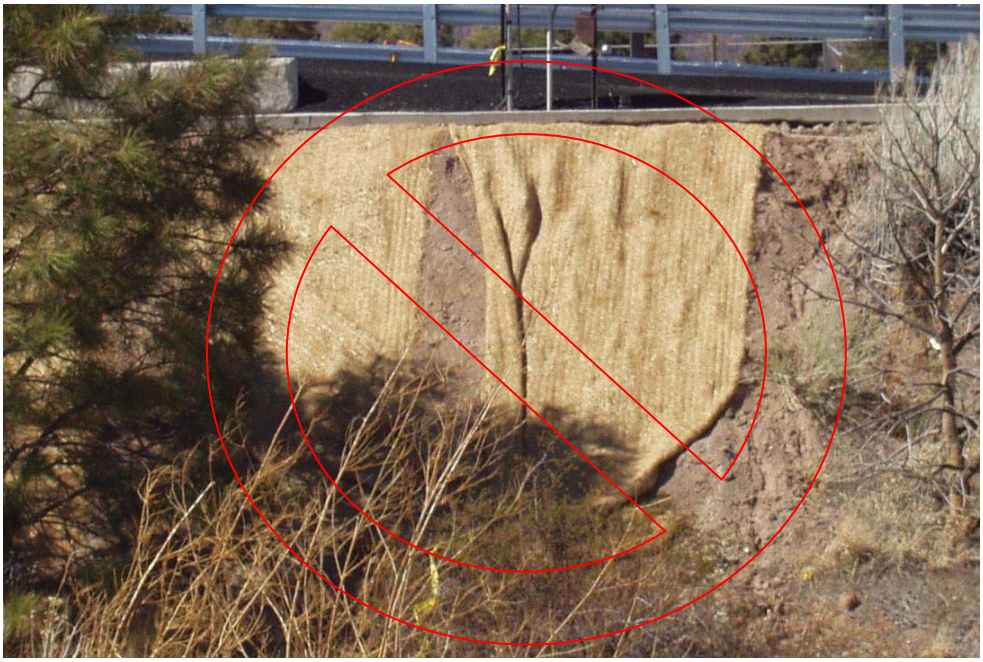
Visual Key for Proper Application (Flexterra-FGM shown)



Proper Application: 3,000 lb/acre - 4.1 mm thick

Improper Application (thin)

What not to do…



Properly prepare seed bed and ensure mulch or blanketing is installed correctly in order to promote vegetation growth and control erosion.

Fiber Rolls/Gravel Bags

BMP Objectives
- Sediment Control
- Reduce Runoff Velocity
- Inlet Protection

Options
- Fiber Rolls,
- Straw Fiber rolls™,
- Terra-Tubes®
- Coir Logs,
- Compost Socks,
- Gravel Bags

Alternatives
- Silt fence
- TSD

Description

Fiber rolls are tube-shaped erosion-control devices filled with straw, flax, rice, coconut fiber material, fabrics, or composted material. Common types of this BMP include: straw fiber rolls, coir logs, compost socks, gravel bags, and Terra-Tubes®. Straw fiber rolls are wrapped with UV-degradable polypropylene netting for longevity or with 100% biodegradable materials like burlap, jute, or coir. Coir logs are very similar to straw fiber rolls but are comprised of long lasting coconut fiber. They are also resistant to being consumed by wildlife. Compost socks and gravel bags are three dimensional tubular devices comprised of woven mesh fabric or other similar material and filled with gravel, rock or compost material. Terra-Tubes® are similar to fiber rolls except they are treated with special polymers that react (flocculate) with suspended soil particles, increasing their ability to settle.

These devices can be used to break up a slope length, reducing the effects of runoff on long or steep slopes. They also help reduce sediment loads to receiving waters by filtering runoff or capturing sediments. Fiber roll BMPs can be used as check structures to reduce runoff velocity and can be placed around storm drain inlets for velocity and sediment control.

Applications

- Along the toe, top, face, and at-grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow
- Along the perimeter of exposed soil areas
- As check dams in unlined ditches
- Around temporary stockpiles (on dirt)
- Around storm drain inlets (see Section 2.6)

Limitations

- They have a limited sediment capture zone
- Some may have problems with ice buildup
- Must be trenched in to function properly

Performance and Longevity

Performance	Poor or N/A	Good	Excellent
Erosion Prevention	x		
Sediment Control			x
Runoff Control		x	
Good Housekeeping	x		

Longevity	Temporary (must be removed)	Long term (may need maintenance)	Permanent	Re-useable
Straw, Coir logs	x	x		
compost socks	x			x
gravel bags/snakes	x			x

Design Criteria and Construction Specifications

Materials

- Most will come prefabricated. Some may require filling onsite, such as gravel bags and compost socks.
- Straw fiber rolls must be at least 8” diameter. To be effective, fiber rolls at the toe of slopes must be at least 20 inches in diameter. An equivalent installation, such as stacked smaller-diameter fiber rolls, can be used to achieve a similar level of protection.
- Compost socks: the compost shall be free of any refuse, contaminants or other materials toxic to plant growth. Non-composted products will not be accepted. Filter socks used for erosion control are usually 12 inches in diameter.
- Gravel bags: filled with clean 3/4” crushed or 1/4” pea gravel. If subject to impact from equipment or vehicles, fill bags only ½ to ¾ full with non-angular rock.
- Terra-Tubes® can be used where additional reductions in turbidity are required
- Stakes installed per manufacture recommendations.

Installation.

- On projects with slopes, install fiber rolls along the contour with a slight downward angle at the end of each row to prevent ponding at the midsection. Turn the ends of each fiber roll upslope to prevent runoff from flowing around the

roll.

- Install fiber rolls in shallow trenches dug 3 to 5 inches deep for soft, loamy soils and 2 to 3 inches deep for hard, rocky soils.
- Determine the vertical spacing for slope installations on the basis of the slope gradient and soil type. A good rule of thumb is:
    - 1:1 slopes = 10 feet apart
    - 2:1 slopes = 20 feet apart
    - 3:1 slopes = 30 feet apart
    - 4:1 slopes = 40 feet apart

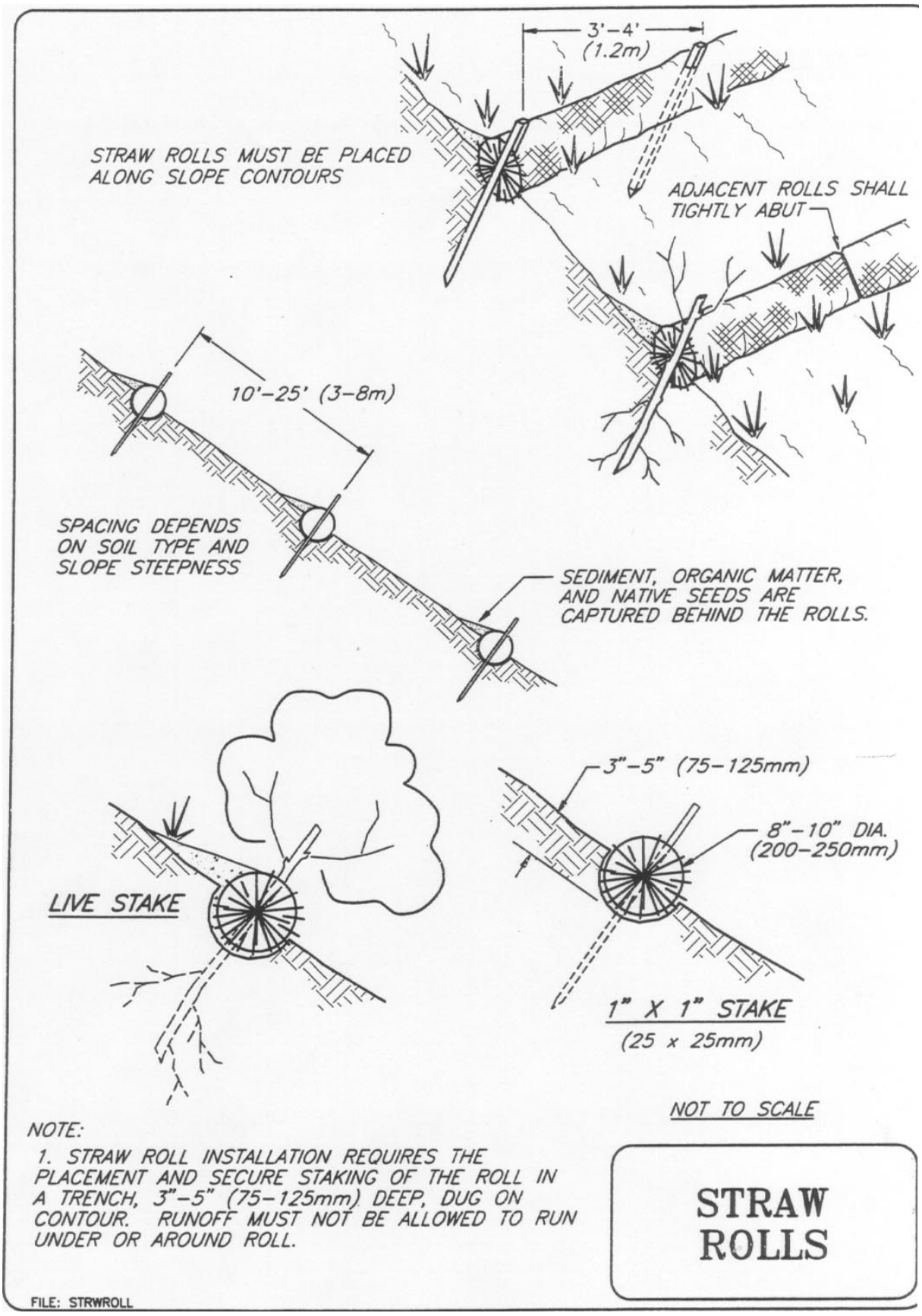
- Fiber rolls can be anchored in the following ways:
    1. Drive the stakes through the middle of the fiber roll and deep enough into the ground to anchor the roll in place. About 3 inches of the stake should stick out above the roll, and the stakes should be spaced 3 to 4 feet apart.
    2. Stakes may be placed on each side of the roll tying across with a natural fiber twine or staking in a crossing manner ensuring direct soil contact at all times.
- Gravel bags do not require staking
- Terminal ends of fiber rolls may be dog legged up slope to ensure containment and prevent channeling of sedimentation.
- Backfill the length of the fiber roll with the excavated soil and compact

Inspection and Maintenance

- Ensure that the rolls remain firmly anchored in place and are not crushed or damaged by equipment traffic.
- Check that fiber rolls are trenched in and no gaps exist under the rolls.
- Check that fiber rolls are adequately aligned with the next roll. Either overlapped uphill of the next or doglegged.
- Check that fiber rolls are securely anchored.
- Repair or replace split, torn, unraveled, or slumping fiber rolls.
- Rills or gullies upslope of the rolls and any undercutting is to be repaired.
- Sediment deposits shall be removed when the sediment reaches one-third of the fiber rolls functional freeboard height. Removed sediment shall be deposit within the project in such a way that the sediment is not subject to erosion by wind or water.
- Do not disturb or remove sediment from BMPs in PRS/SWMU areas
- Additional fiber rolls can be placed on top of existing ones to increase sediment capacity.

What not to do…

Notice that erosion is occurring under the fiber roll where a rill is forming. The fiber roll should be properly entrenched into the soil so that water velocity is decreased and water is forced to pool behind to promote sedimentation and flow over the fiber roll.



NOTE:

1. STRAW ROLL INSTALLATION REQUIRES THE PLACEMENT AND SECURE STAKING OF THE ROLL IN A TRENCH, 3"-5" (75-125mm) DEEP, DUG ON CONTOUR. RUNOFF MUST NOT BE ALLOWED TO RUN UNDER OR AROUND ROLL.

STRAW ROLLS

FILE: STRWROLL

CHECK DAMS

Alternatives

- Stabilize channel with TRM, asphalt or concrete.

Options

- Gravel bags
- Rock
- Logs
- Prefabricated Juniper Bales
- Triangular Silt Dike®
- Other prefabricated products

BMP Objectives

- Sediment Retention
- Reduction in runoff velocity
- Erosion Control

Description

A check dam is a small dam constructed across a channel, drainage ditch or other area of concentrated flow. Check dams reduce erosion and promote sedimentation by reducing runoff flow velocity and encouraging sediment to settle out. Check dams are usually constructed of rock, gravel bags, sandbags or other proprietary products and may either be a temporary or permanent structural control.

Applications

- Use to minimize down cutting in channels, retain sediment, and reduce velocity.
- Useful in temporary ditches that will be removed after construction.

Limitations

- A check dam with a height of over 2 feet or located in an area where failure of the check dam would result in damage to facilities, the environment or other safety issues requires an engineered design.
- Significant sediment accumulations behind the check structure may destroy vegetation lining the channel.
- Requires regular maintenance and sediment removal.
- May not be used in a drainage that is a perennial stream.
- May cause increased erosion if not installed correctly.

Performance and Longevity

Performance	Poor or N/A	Good	Excellent
Erosion Prevention		x	
Sediment Control			x
Runoff Control			x
Good Housekeeping	x		

Longevity	Temporary (must be removed)	Long term (may need maintenance)	Permanent	Re-useable
Rock, logs, juniper bales		x	x	
Gravel bags, Triangular Silt Dike	x			x

Design and Construction Guidance

- Check dam must be located in a defined channel to reduce runoff velocity or retain sediment.
- If high flows are expected, ensure scour protection has been installed on the downstream of the check dam.
- Check dams should be spaced at a distance to allow the elevation of the ponded water from the downstream check dam to match the elevation of the toe of the upstream dam.
- Flows must be directed over the check dam.
- When using rock, ensure the material diameter is appropriate to create ponding.
- Straw bales and wattles should not be used as check dams.
- The center of a check dam must always be lower than its outside edges and the channel bank height to allow proper flow over the check structure.

<u>Installation:</u>

- Should be installed as soon as possible while construction activities are occurring.
- The center of the dam should be at least six-inches lower than its edges.
- Check dam material should be entrenched into the sides and bottom of the channel to ensure flow does not go around or under the check dam.
- Rock should be placed individually by hand or by mechanical methods (no dumping of rock).

Inspection and Maintenance

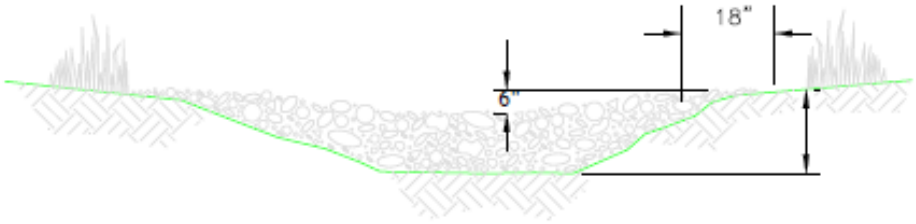
- Check for damage and erosion caused by flows around or under the dam structure. Repair erosion around a check dam and lower the center if required.
- Remove any debris that would impede flow over the check dam.
- When the sediment has reached a height of approximately one-half the original height of the dam (measured at the center), remove accumulated sediment from the upstream side of the dam.
- Remove check dams made from temporary materials when the adjacent site is stabilized.
- Before removing a check dam, remove all accumulated sediment from the channel. If sediment is placed on adjacent slopes, stabilize it with native vegetation.

What not to do…

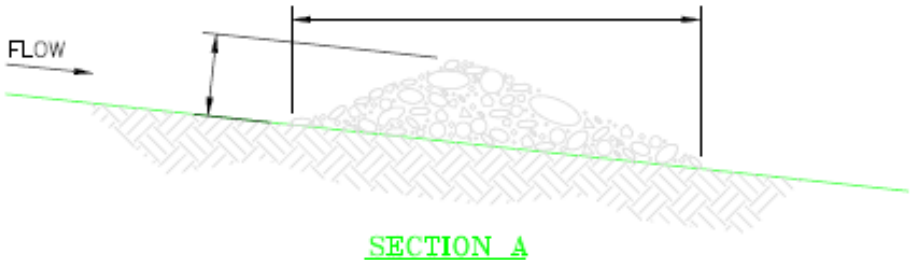
Silt fence cannot be used as a check structure and is not designed for concentrated flow.

Notice how runoff bypassed the check structures. Channel banks must be sufficient to withstand flows and the dam center must be lower to allow flow over the check dam.

ROCK CHECK DAM

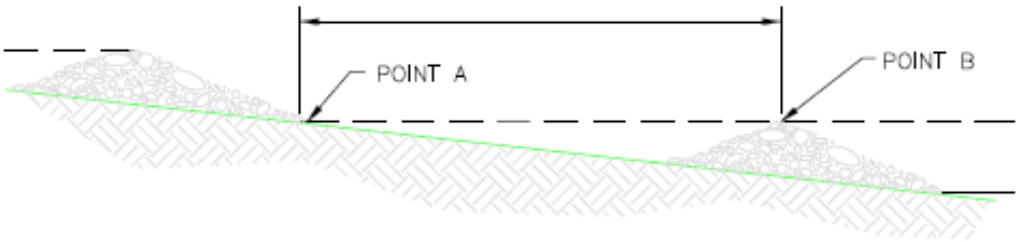


VIEW LOOKING UPSTREAM



SECTION A

X = THE DISTANCE SUCH THAT POINT A AND B ARE OF EQUAL ELEVATION.



SPACING BETWEEN CHECK DAMS

NOTES:

1. ROCK CHECK DAMS SHALL BE CONSTRUCTED WITH 2–15 INCH MAXIMUM SIZE AGGREGATE ROCK.
2. WHERE APPLICABLE, KEY STONE INTO CHANNEL BANKS AND EXTEND IT BEYOND THE ABUTMENTS A MINIMUM OF 18" TO PREVENT FLOW AROUND DAM.
3. PROVIDE AN ENERGY DISSIPATOR ON THE DOWNSTREAM SIDE OF THE DAM TO REDUCE DOWNSTREAM EROSION.

SILT FENCE AND S-FENCE™

Product Types

- Silt fence
- S-Fence™

Alternatives

- Depending on surface and site conditions; gravel bags, wattles, or Triangular Silt Dike may be used.

BMP Objectives

- Sediment Control
- Sheet Flow Runoff Control
- Wind Erosion Control

Description

Silt fences are typically used as temporary perimeter controls around sites where construction activities will disturb the soil. They can also be used within the interior of a site. A silt fence consists of a length of woven, permeable geotextile, stretched between anchoring posts spaced at regular intervals along the site at low/downslope areas. The filter fabric should be entrenched in the ground between the support posts. When installed correctly, silt fences create ponding of runoff from the site, allowing transported sediment to settle out. Silt fences can be an effective barrier to sediment leaving the site.

The S-Fence is made from HDPE material and is much stiffer than the silt fence material. It is buried 3 inches in the ground and can be secured to an existing chain link fence or can be installed by itself and fastened to wood stakes. Each section is 7 feet long and comes in two heights: 10 inch and 14 inch. S-Fence is designed to allow water to flow through it and significantly reduces erosive energy and provides particle

filtering.

Applications

Silt fences apply to construction sites with relatively small drainage areas. They are appropriate in areas where runoff will occur as sheet flow. The drainage area for silt fences should not exceed 0.25 acre per 100-foot fence length. Silt fence should not be used for runoff velocity control or placed in areas of concentrated runoff such as drainage channels and storm drain inlets and outlets. Silt fence should be installed along the contour to minimize channeling of runoff. They may also be placed perpendicular to prevailing winds at staggered intervals to address wind erosion. The same applications apply to S-Fence.

Limitations

- Do not install silt fences along areas where rocks or other hard surfaces will prevent uniformly anchoring the fence posts and entrenching the filter fabric. Improper installation prevents proper function.
- Silt fences are not suitable for areas where large amounts of concentrated runoff are likely. Do not install silt fences across streams, ditches, or waterways.
- High winds can make the filter fabric deteriorate faster, so installing fences in open, windy areas should be avoided.
- When the pores of the fence fabric become clogged with sediment, pools of water are likely to form on the uphill side of the fence. Siting and design of the silt fence should account for this. Take care to avoid unnecessarily diverting storm water from these pools, causing further erosion damage.
- UV exposure degrades silt fence filter fabric, causing separation of the fabric strands which leads to greater potential for holes and wind damage.

Performance and Longevity

Studies have approximated the following effectiveness ranges for silt fences constructed of filter fabric that are properly installed and well maintained:

- Average total suspended solids removal of 70 percent
- Sand removal of 80 to 90 percent
- Silt-loam removal of 50 to 80 percent
- Silt-clay-loam removal of 0 to 20 percent.

Removal rates are highly dependent on local conditions and installation.

Silt fence in the LANL area will typically experience the onset of degradation due to UV exposure over a period of 6 to 12 months and will need to be maintained or repaired due to damage from wind and runoff.

S-Fence can also be used as a perimeter control but is made from an HDPE material and has a functional life greater than 4 years. It can also be reused. The product will stand up to winds and UV exposure and can be recycled at the end of its life.

Performance	Poor or N/A	Good	Excellent
Erosion Prevention	x		
Sediment Control			x
Runoff Control		x	
Good Housekeeping	x		

Longevity	Temporary (must be removed)	Long term (may need maintenance)	Permanent	Re-useable
Silt Fence	x			
S-fence	x			x

Design and Construction Guidance

Materials

Silt Fence

- The material for silt fences should be a pervious sheet of synthetic fabric such as polypropylene, nylon, polyester, or polyethylene yarn.
- Choose the material based on the minimum synthetic fabric requirements shown in Table 1.

Table 1. Minimum requirements for silt fence fabric

Physical property	Requirements
Filtering efficiency	75%-85% (minimum): highly dependent on local conditions
Tensile strength at 20% (maximum) Elongation	Standard strength: 30 lb/linear inch (minimum) Extra strength: 50 lb/linear inch (minimum)
Ultraviolet radiation	90% (minimum)
Slurry flow rate	0.3 gal/ft^2/min (minimum)

S- Fence Product Characteristics

- Unit weight, 10" / 14" (Lbs/ft) (max) 0.35 / 0.48
- Reusable YES
- Functional life (minimum)(years) 4+
- Filter capability – AOS (ASTM D4751) (microns) 250
- Dimension – length per module (ft) 7
- Percentage Open Area (COE 22125-86) (min %) 20%
- Dimension (freeboard height in inches) 10.0 / 14.0
- Tensile Yield ASTM D-638 (lb/in2) 1800 - 2800
- Installed freeboard height (inches) 7.0 / 11.0
- Ultimate Tensile Strength: ASTM D-638 (lb/in2) 2000 - 2800
- Recyclable Post consumer #2 YES

  Service temperature (deg F) -30 to 160

Installation

- Standard-strength fabric can be reinforced with wire mesh behind the filter fabric to increase the effective life of the fence.
- Attach the filter fabric to wood or metal stakes at least 4 feet long. Stakes should have a minimum diameter of 2 inches if a hardwood like oak is used or at least 4 inches in diameter if soft woods such as pine are used. When using metal posts in place of wooden stakes, they should weigh at least 1.00 to 1.33 lb/linear foot. If metal posts are used, attachment points are needed for fastening the filter fabric with wire ties.
- Erect silt fence in a continuous fashion from a single roll of fabric to eliminate gaps in the fence. If a continuous roll of fabric is not available, overlap the fabric from both directions only at stakes or posts. Overlap at least 6 inches in a shingle pattern in the direction of runoff flow.
- Excavate a trench to anchor the bottom of the fabric fence at least 6 inches

below the ground surface. The trench should be backfilled and the soil compacted over the toe of the filter fabric. Alternatively use a slicing machine to install the filter fabric.

- Install posts along the length of the fence at a height of 18 to 36 inches above the original ground surface. Posts should be driven into the ground a minimum of 12 inches. If standard-strength fabric is used with wire mesh, space the posts no more than 10 feet apart. If extra-strength fabric is used without wire mesh reinforcement, space the posts no more than 6 feet apart. Attach the filter fabric to the posts.
- The ends of the silt fence should be turned uphill to prevent flow from running around the ends of the fence.
- Install silt fence at least 6 feet from the toe of a slope.
- Once installed, silt fence should remain in place until all areas upslope have been permanently stabilized by vegetation or other means.

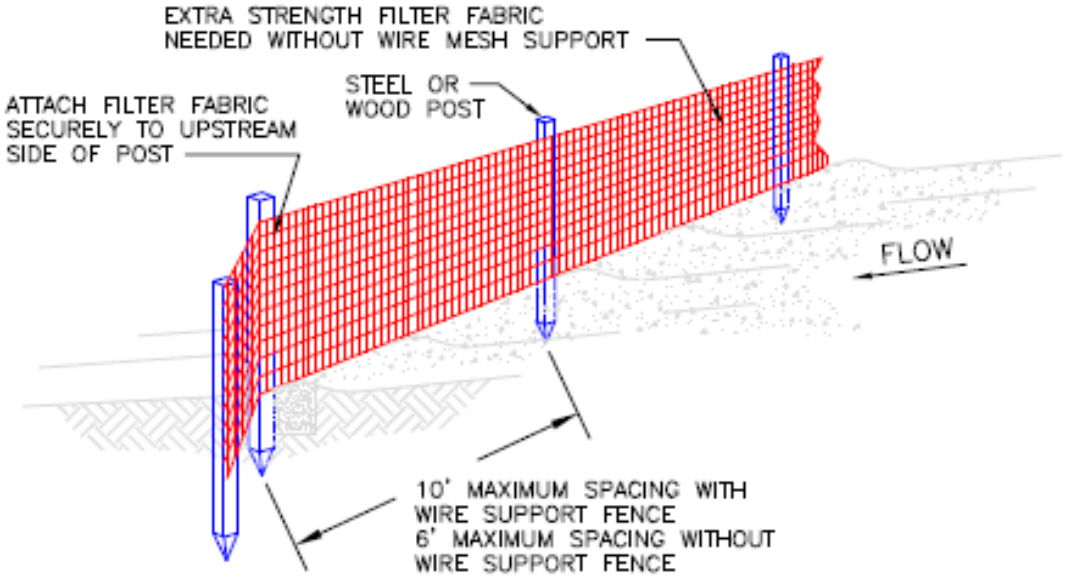
Inspection and Maintenance

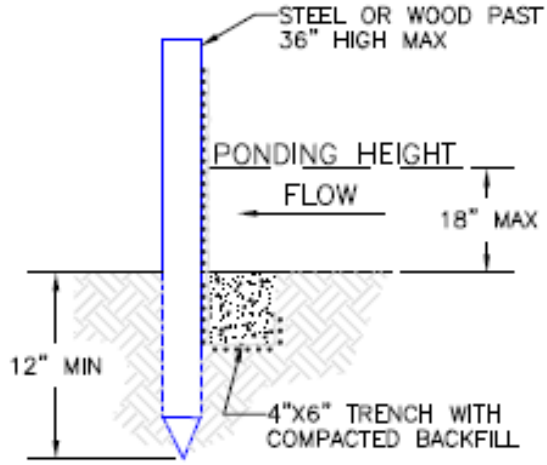
- Inspect fences to make sure that they are intact and that there are no gaps where the fence meets the ground or tears along the length of the fence.
- If gaps or tears are found, repair or replace the fabric immediately.
- Remove accumulated sediments from the fence base when the sediment reaches one-third to one-half the fence height.
- Remove sediment more frequently if accumulated sediment is creating noticeable strain on the fabric and the fence might fail from a sudden storm event.
- When removing the fence, remove the accumulated sediment as well.

What not to do…

Silt fence should be properly entrenched for proper operation.

SILT FENCE



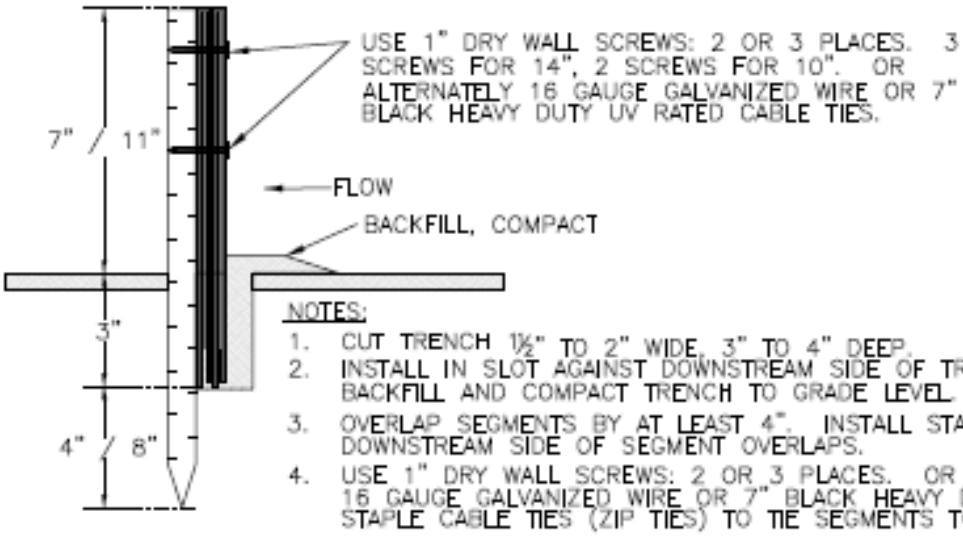


TRENCH DETAIL

NOTES:

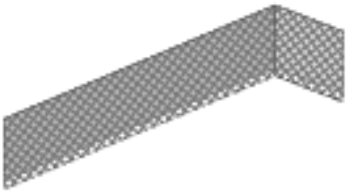
1. SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.
2. WHEN USING WIRE MESH SUPPORT, EXTEND WIRE INTO TRENCH A MINIMUM OF 2 INCHES AND NO MORE THAN 36 INCHES ABOVE THE ORIGINAL GROUND SURFACE.
3. THE ENDS OF THE SILT FENCE SHALL BE TURNED UPHILL.
4. PLACE SILT FENCE AT LEAST 6 FEET FROM THE TOE OF A SLOPE.
5. PONDING HEIGHT SHALL BE A MAXIMUM OF 18 INCHES WITH TRENCH INSTALLATION AND 9" WITHOUT TRENCHING.

ERTEC"S-FENCE ™



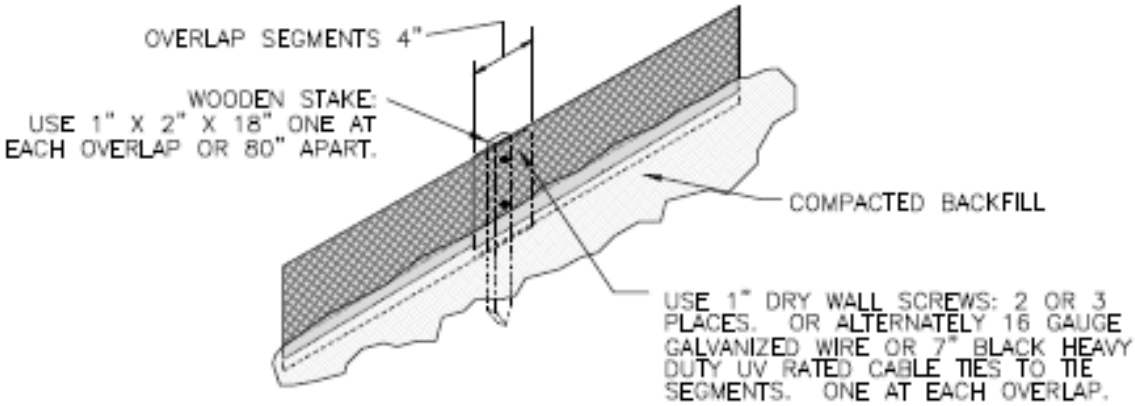
NOTES:

1. CUT TRENCH 1½" TO 2" WIDE, 3" TO 4" DEEP.
2. INSTALL IN SLOT AGAINST DOWNSTREAM SIDE OF TRENCH WALL, BACKFILL AND COMPACT TRENCH TO GRADE LEVEL.
3. OVERLAP SEGMENTS BY AT LEAST 4". INSTALL STAKES ON DOWNSTREAM SIDE OF SEGMENT OVERLAPS.
4. USE 1" DRY WALL SCREWS: 2 OR 3 PLACES. OR ALTERNATELY 16 GAUGE GALVANIZED WIRE OR 7" BLACK HEAVY DUTY UV STAPLE CABLE TIES (ZIP TIES) TO TIE SEGMENTS TOGETHER.



NOTES:

1. DOG-LEG AT END-OF-RUNS TO CONTAIN SEDIMENT.
2. INSTALL ON SAME CONTOUR TO LIMIT SCOUR AND FLOW CONCENTRATION. DOG-LEG PERIODICALLY IF ON DOWN-HILL RUN TO MINIMIZE VELOCITY SCOUR.



RIPRAP

Options
- Can be wire enclosed or loose

Alternatives
- Use TRM for channel install (see Section 4.3)
- Vegetation and terracing on slopes

BMP Objectives
- Erosion Control

Description

Riprap is a permanent, erosion-resistant layer made of stones. It is intended to protect soil from erosion in areas of concentrated runoff. Riprap generally consists of crushed rock and for added effectiveness may be placed on filter fabric on a prepared surface. The individual stones are typically angular in shape and well graded to promote interlocking.

Applications

- Riprap is effective in protecting culvert inlets and outlets and preventing scouring and undercutting.
- Useful in the stabilization of stream or channel banks and drainage channels.
- Can be used to stabilize cut and fill slopes, storm drains and slope drains.
- Should be considered where perennial flows or frequent ponding would drown a vegetated lining.

Limitations

- Should not be placed on slopes greater than 2:1.
- Cost may be a prohibitive factor in large scale applications.
- Proper design and stone selection for expected flow velocity is essential.
- Difficult to remove sediment accumulations.

Performance and Longevity

Performance	Poor or N/A	Good	Excellent
Erosion Prevention			x
Sediment Control			x
Runoff Control	x		
Good Housekeeping	x		

Longevity	Temporary (must be removed)	Long term (may need maintenance)	Permanent	Re-useable
Riprap	x			

Design Criteria and Construction Specifications

- Riprap installations should be designed and specified by an engineer.
- Use stones angular in shape and well graded to promote interlocking.
- Filter fabric must be used underneath.
- Brush, trees, stumps, and other objects that would interfere with riprap placement should be removed.
- Use filter fabric and connect joints with a minimum overlap of 1 foot and space anchor pins approximately every 3 feet along the overlap. The ends of the fabric shall be buried to a minimum depth of 12 inches.
- Place riprap stones forming a continuous blanket to minimum thickness of 12 inches.
- Place the riprap in a trench excavated to 24 inches below the toe of the slope of the embankment or side of channel.

Inspection and Maintenance

- Check that filter fabric was used under the riprap.
- Check that riprap installed in a channel has a low point in the center to prevent flows from going around the rock.
- For riprap aprons, inspect for erosion around the riprap and dislodgment of stones.
- Check for slumping on hillsides.
- Check for scour or undermining – replace or reposition riprap as necessary.

What not to do…

Properly installed riprap at culvert outlet will control erosion.

GOOD HOUSEKEEPING

Options and Alternatives

- WASTE AND MATERIAL STORAGE AND TRA
- VEHICLE AND EQUIPMENT BMPS
- STREET SWEEPING
- WASHOUT AREAS

Objectives

- REDUCE OR ELIMINATE RUNOFF POLLUTA

Description

Good housekeeping includes controls that are practices (as opposed to structural controls) that are used to reduce or prevent pollutants.

Applications

Low cost alternative to structural BMPs.

Limitations

Only prevents the initial migration of pollutants from the source.

Performance and Longevity

In general, use of practices to prevent pollutants from contact with storm water is extremely effective.

Good housekeeping practices are implemented before project activities begin and throughout project activities. These practices are temporary in nature and are only meant to last through the construction activity process.

Performance	Poor or N/A	Good	Excellent
Erosion Prevention	x		
Sediment Control	x		
Runoff Control	x		
Good Housekeeping			x

Longevity	Temporary (must be removed)	Long term (may need maintenance)	Permanent	Re-useable
Good housekeeping	x			

Design and Construction Guidance

Material storage

- Designate material storage areas away from the nearest watercourse and in locations that do not receive a substantial amount of upslope run-on.
- Store soils uphill of BMPs or the excavation.
- Hazardous materials, fluids, and chemicals should be placed within covered storage, or a lined berm or other appropriate secondary containment.
- Drums containing liquids or hazardous materials should be stored on secondary containment pallets that minimize storm water accumulation.

Wastes

- Designate a waste collection site that does not drain to a watercourse and that does not receive a substantial amount of upslope run-on.
- Refuse containers should have lids that will remain closed to prevent rain exposure. Bins should be leak proof.
- Waste collection should be scheduled to prevent overflow of refuse.
- Trash, material cuttings, and any other waste should be managed or disposed of at the end of each workday and prior to an anticipated storm event.
- Portable lavatories should be used and maintained in accordance with manufacturer's recommendations; staked to the ground to prevent being knocked over by wind; and lavatory waste must be treated off-site.

Material Transport or Movement

- Material should be transported in appropriate containers or vehicles so that facility locations outside the project boundaries and public roadways will not be adversely impacted through sediment tracking or waste spillage.
- Spill control equipment should be present during any transfer operations.
- Movement of liquid filled containers or transfers of oil or chemicals will not occur during precipitation events
- Containers must be upright and secured to the vehicle/hand truck it is being transported on
- Drums are not to be rolled or tipped, even while empty, to prevent damage to containers
- Containers will be inspected before and after they are transported for leaks or damage.
- Storm drain covers will be used at adjacent storm drains if necessary to prevent a potential spill from entering the storm drain before it would be controlled.
- Transfers from portable containers to equipment occur away from storm drains. Spigots or pumps should be used, do not pour directly from drums. Consider placing absorbent mats before a transfer occurs.

Vehicle and Equipment Refueling & Maintenance

Vehicle and equipment control techniques include:

- Properly covering and providing secondary containment for fuel drums and other similar materials.
- Refueling of equipment shall be conducted at least 100 feet from any storm drain, drainage, or wetland, including dry arroyos.
- Refueling operations will be completed such that head space is provided within fuel tanks to allow for fuel expansion.
- Develop and implement spill prevention and cleanup plan.
- Maintain a spill kit on site.
- Use a covered, paved area dedicated to vehicle maintenance.
- Wash vehicles and equipment only at facilities approved for washing activity.
- All vehicles and equipment will be observed for leaks and if found drip pans will be used until fixed.
- Leaks will be fixed as soon as practicable and leaking vehicles and equipment will be removed from service and repaired.
- Spills of all products will be cleaned up and managed per applicable state and federal regulations.

Potholing

- Spoils must be properly disposed of.
- Discharge spoils only in approved designated areas.
- Do not discharge to the environment any glycol treated water.

Concrete Washouts

Concrete washouts should be used to contain concrete and liquids when rinsing equipment used for mixing or delivering concrete, or for excess concrete. They consolidate solids for easier disposal and prevent contaminated water from mixing with runoff.

- Washouts should be located a minimum of 100' from a watercourse or storm drain and in a location that allows convenient access for concrete trucks and equipment.
- Containment areas will not be constructed in areas designated as Solid Waste Management Units (SWMUs), Areas of Concern (AOCs), or Treatment Storage and Disposal Facilities (TSDFs).
- Washouts are typically built below grade to prevent breaches and reduce runoff.
- Washouts should be sized to manage both concrete washout and storm water accumulation from precipitation events.
- Use appropriate control measures that act as a continuous line barrier to prevent the runoff of discharges and the co-mingling of discharges with storm water.
- Prefabricated washout containers must protect against spills and leaks, be watertight, and should be used in accordance with manufacturer specifications.
- Inspect washout area for damage and repair as necessary to ensure structure integrity.
- Once a washout facility has reached 75% capacity the materials should be removed and properly disposed of.

Street Sweeping

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways.

- Vacuuming is essential because sweeping alone may cause dust pollution and off-site sediment transport.
- Points of site egress are especially vulnerable to off-site sediment tracking.
- A proper construction entrance/exit may be needed if street sweeping efforts are not sufficient to prevent sediment from leaving the site.
- Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).
- Sweeping should be performed at a frequency necessary to minimize visible sediment tracking from the site.

Inspection and Maintenance

- Check that materials are properly stored.
- Check that washout areas are being used.
- Check for vehicle leaks and proper maintenance.
- Check for tracking of sediment from site.

What not to do…

Sweeping without vacuuming causes severe dust migration leading to sediment transport offsite.

Improper waste disposal and storage of waste products. Containerize and separate waste items for proper disposal.

SECTION 32 9219

SEEDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Preparation of seedbed.

B. Seeding.

C. Mulching and erosion control blankets.

D. Watering and maintenance.

1.2 RELATED SECTIONS

A. Section 01 5705, Temporary Controls and Compliance Requirements

B. Section 31 2000, Earth Moving

1.3 SUBMITTALS

A. Submit the following in accordance with project submittal procedures:

1. Catalog data, including sources of supply for amendments, mulch, tackifier, ~~fertilizer~~ and erosion control blankets.

2. Certification substantiating that material complies with specified requirements. Submit certified seed bag tags and copies of seed invoices identified by project name.

3. Installation instructions, including proposed seeding schedule. Coordinate with specified maintenance periods to provide maintenance from date of final acceptance. Once schedule is accepted, revise dates only with LANL approval after documentation of delays.

1.4 QUALITY ASSURANCE

A. Subcontractor Qualifications:

1. Perform work by a single firm experienced with the type and scale of work required and having equipment and personnel adequate to perform the work satisfactorily.

B. Material Quality Control:

1. Provide seed mixture in containers sealed and labeled by seed dealer. Container label shall show origin of seed and pure live seed (PLS) content, species and percentages in seed mix; lot number; test information including, purity, germination, percentage seed crop, percentage inert, percentage noxious/restricted weeds; net weight; test date; date of packaging; and location of packaging. The seed dealer may premix the seed, documentation shall be provided the same as if the seeds were sold or bagged separately. Seed analysis shall be no older than five months for seed shipped interstate, and no older than nine months for seed shipped intrastate.

2. Furnish seed labeled in accordance with the requirements of federal seed laws and New Mexico Department of Agriculture seed labeling laws. Such resulting requirements include but are not necessarily limited to: Federal

Seed Act and Amendments, rules and regulations established by the United States Department of Agriculture; the New Mexico Seed Law; and all resulting regulations or restrictions established by New Mexico State University or other authorized entity.

3. In addition, ensure seed mix and its application comply with the requirements of all other federal and New Mexico statutes and regulations governing seeds, plants, and weeds. These requirements include but are not necessarily limited to: the Noxious Weed Control Act and all rules, regulations, or control measures by a noxious weed control district embracing Los Alamos County, New Mexico; and the Harmful Plant Act.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver packaged materials in original sealed and labeled containers from seed dealer. Protect materials from deterioration during delivery and while stored at site. Opened or wet seed shall be rejected and returned to the responsible party.

B. Temperature of the seed in storage shall not exceed the supplier's recommended maximum temperature.

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Comply with Section 01 2500, Substitution Procedures.

2.2 SEED

A. Obtain native grass seed from sources whose origin would ensure site adaptability at LANL. Plant sources from New Mexico or surrounding states are preferred.

B. Cover crops (e.g., annual barley, oats, winter rye, etc.) may be used only as a temporary stabilization measure and shall not be used in conjunction with a perennial seed mix or for final stabilization.

C. Only sterile, non-invasive annual species such as Quickguard sterile triticale hybrid or Regreen shall be used with a perennial seed mix. A minimum 7 lbs per acre to a maximum 10 lbs per acre shall be applied with the perennial mix. This shall be done when a quick growth establishment is necessary.

E. Develop seed mixture from the following guidelines. Choose a minimum of 5 grass species from the list. ~~All seeding operations must include fertilizer~~. The seed dealer may premix the seed.

1. Pre-mixed Sources:
   a. Plants of the Southwest, "Dryland Blend"
   b. Granite Seed, "CGRP Mix"
   c. Curtis & Curtis Inc, "Homesteaders Choice Mix" or "Santa Fe Trail Mix"

NATIVE PERENNIAL MIX

Common Name	*Scientific Name*	*% of Mix*
Grasses		
Blue grama*	*Bouteloua gracilis*	5 – 10%
Galleta grass*	*Hilaria jamesii*	5- 10%
Mutton grass	*Poa fendleriana*	10-15%
Sideoats grama*	*Bouteloua curtipendula*	10-15%
Arizona fescue†	*Festuca arizonica*	10 – 15%
Prairie junegrass†	*Koeleria macrantha*	5 – 10%
Bottlebrush squirreltail*	*Elymus elymoides*	15 – 20%
Little bluestem†	*Schizachyrium scoparium*	10 – 15%
Indian ricegrass*	*Oryzopsis hymenoides*	10 – 15%
Mountain brome†	*Bormus marginatus*	10 – 15%
Sand dropseed*	*Sporobolus cryptandrus*	1 - 8%
Thickspike wheatgrass	*Agropyron dasystachyum*	20 – 25%
Needle and Thread grass*	*Stipa comata*	5 – 10%
New Mexico needlegrass*	*Stipa neomexicana*	10 - 15%
Sheep fescue	*Festuca ovina*	10 – 15%
Smooth Brome	*Bromus inermis*	15 – 20%
Stream Bank Wheatgrass	*Elymus lanceolatus ssp. psammophilus*	20 – 25%

*Species particularly suited for especially dry sites
†Species particularly suited for higher elevations (above 7000 ft.)

2.3 HYDRAULIC MULCH/TACKIFIER

A. Provide mulch material consisting of 100 percent virgin wood fibers manufactured expressly from whole wood chips, such as Eco-Fibre, Conwed, etc. Process chips in such a manner as to contain no growth or germination inhibiting factors. Do not produce fiber from recycled material such as sawdust, paper, cardboard, or residue from pulp and paper plants. Provide materials free from contaminants such as lead paint, varnish or other metal contaminants. Hydraulic mulch shall contain non-toxic dye to assist in visually determining even distribution. Mulch material shall meet the following specifications:

Parameter	Value
pH at 3% consistency	4.5 +/- 0.5
Ash content	0.8% +/- 0.2%
Moisture holding capacity	1250 (grams water/100 grams oven dry fiber)
Moisture content	12% +/- 3% (Wet weight basis)

B. Combine mulch with an organic plantago based tackifier, such as M-binder, etc., that has no growth or germination inhibiting factors and is nontoxic. Apply the uniform mixture to the seeded area.

C. Bagged mulch/tackifier mix that is homogenous within the unit package may also be used. Tackifier shall adhere to the fibers during manufacturing to prevent separation during shipment and to avoid chemical agglomeration during mixing in the hydraulic mulching equipment.

2.4 BONDED FIBER MATRIX

A. Provide Bonded Fiber Matrix (BFM) composed of natural color, long strand wood fiber, produced by therm-mechanical defribration of wood chips and joined together by a high strength non-toxic adhesive, such as Eco-Ageis, etc. The product shall be composed of 90 percent wood fiber, 9 percent blended hydrocolloid-based binder, and 1 percent mineral activators, all by total weight. The BFM shall be 100 percent biodegradable and non-toxic to fish and wildlife, and it shall not contain any synthetic fibers.

2.5 FLEXIBLE GROWTH AND FLEXIBLE CONTROL MEDIUMS

A. Provide Flexible Growth Medium (FGM) such as Flexterra™/CocoFlex ET™ or a Flexible Control Medium (FCM) such as EcoFlex™ composed of longstrand, thermally processed wood fibers, crimped, interlocking fibers and performance enhancing additives. The FGM or FCM requires no curing period and upon application forms an intimate bond with the soil surface to create a continuous, porous, absorbent and flexible erosion resistant blanket that allows for rapid germination and accelerated plant growth.

B. The FGM or FCM™ shall be hydraulically applied to the soil as a viscous mixture, creating a continuous three-dimensional blanket that adheres to the soil surface. Upon drying, the matrix shall form a high-strength, porous and erosion-resistant mat that shall not inhibit the germination and growth of plants in and beneath the layer. The matrix shall retain its form despite re-wetting. The FCM™ shall be 100% biodegradable over time, non-toxic to fish and wildlife, and it shall not contain any non-photo-degradable synthetic fibers.

2.6 ROLLED EROSION CONTROL PRODUCTS

A. For all non-channel applications provide the following:

1. Slopes less than 2:1:

Straw/ coir blend blankets	A machine produced straw /coir fiber erosion control blanket using 70 percent straw /30 percent coir fibers sewn into a heavy weight photo degradable top net and a medium weight photo degradable bottom net. Minimum weight of blanket 0.7 lbs/square yard, such as Greenfix America CFS072R, etc.

2. Slopes 2:1 and greater:

Permanent turf reinforcement mat	A machine-produced mat of 100% UV stable polypropylene fiber. The matting shall be of consistent thickness with synthetic fibers evenly distributed over the entire area of the mat. The matting shall be covered on the top with black heavyweight UV stabilized polypropylene netting having ultraviolet additives to prevent breakdown and an approximate 0.50 x 0.50 inch (1.27 x 1.27 cm) mesh size. The bottom net shall also be UV stabilized polypropylene, with a 0.625 x 0.625 inch (1.57 x 1.57 cm) mesh size. The matting shall be sewn together on 1.50 inch (3.81 cm) centers with UV stabilized polypropylene thread, such as North American Green P300 or Greenfix America CFG 2000

B. For all channel applications provide the following:

1. For channels subject to flow producing an unvegetated shear stress of 3 lbs/ft^2 or less and a vegetated shear stress of 8 lbs/ft^2 or less:

Permanent composite turf reinforcement mat (C-TRM)	A machine-produced composite turf reinforcement mat comprised of a 100% UV stabilized polypropylene fiber matrix incorporated into permanent three-dimensional turf reinforcement matting. The matting shall be of consistent thickness with synthetic fibers evenly distributed over the entire area of the mat. The matting shall be covered on the top with black heavyweight UV stabilized polypropylene netting having ultraviolet additives to prevent breakdown and an approximate 0.50 x 0.50 inch (1.27 x 1.27 cm) mesh size The bottom net shall also be UV stabilized polypropylene, with a 0.625 x 0.625 inch (1.57 x 1.57 cm) mesh size. The matting shall be sewn together on 1.50 inch (3.81 cm) centers with UV stabilized polypropylene thread to form permanent three-dimensional turf reinforcement matting, such as North American Green P300.

2. For channels subject to flow producing an unvegetated shear stress of 4 lbs/ft^2 or greater and a vegetated shear stress of 12 lbs/ft^2 or less:

Permanent composite turf reinforcement mat (C-TRM)	A machine-produced composite turf reinforcement mat comprised of a 100% coconut fiber matrix or a 100% polypropylene fiber matrix incorporated into permanent three-dimensional turf reinforcement matting. The matrix shall be evenly distributed across the entire width of the matting and stitch bonded between a super heavy duty UV stabilized bottom net with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings, an ultra-heavy duty UV stabilized, dramatically corrugated (crimped) intermediate netting with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings, and covered by a super heavy duty UV stabilized top net with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings. The corrugated netting shall form prominent closely spaced ridges across the entire width of the mat. The three nettings shall be stitched together on 1.50 inch (3.81 cm) centers with UV stabilized polypropylene thread to form permanent three dimensional turf reinforcement matting, such as North American Green C350 or P550.

C. Staples: U-shaped, 11 gauge or heavier steel wire, minimum leg length of 6 inches after bending, with a throat approximately 2 inches wide.

2.7 AMENDMENTS / SOIL ADDITIONS

A. ~~Fertilizer: Apply slow-release organic fertilizers such as Biosol Mix, Biosol, Gro-Power, Osmocote, or approved equal to minimize deficiencies of the topsoil. Micronizing fertilizer is acceptable for use in the spring and summer months. All seeding operations must include fertilizer.~~

B. Water: Clean, fresh, and free of substances or matter that could inhibit vigorous growth.

C. Sand: Clean, washed, and free of toxic materials.

PART 3 EXECUTION

3.1 PREPARATION

A. Preparation of the Seedbed:

1. Prepare seedbed to a maximum depth of 4 inches by tilling with a disc, harrow or chiseling tool. Uproot all competitive vegetation during seedbed preparation and work soil uniformly, leaving surface rough to reduce surface erosion and to retain water runoff. Remove large clods and stones, or other foreign material that would interfere with seeding equipment and erosion control blankets.

2. Perform tillage across slope and along the contour adequately break up soil. Do not till up and down slopes, as this will create excessive surface erosion problems.

3. Do not do work when moisture content of soil is unfavorable or ground is otherwise in a non-tillable condition.
4. To minimize dust problems for adjoining areas, when wind speeds are over 10 mph, dust control measures shall be implemented.
5. The extent of seedbed preparation shall not exceed the area on which the entire seeding operation can be accomplished within a one week period.

B. ~~Soil Amendments/Additions: Uniformly apply slow release organic fertilizer to prepared seedbed in accordance with manufacturer recommended rates.~~

C. Prepare seedbed again if prior to seeding rain or some other factor has affected the prepared surfaces and will prevent seeding to the proper depth.

D. If cover crop has been established in area to be seeded, mow cover crop early in growing season before cover crop is ready to drop seeds.

3.2 APPLICATION OF SEED

A. General:

1. Avoid seeding between October 1 and April 15. Provide for temporary soil stabilization measures between these dates. Do not seed during windy weather, or when topsoil is dry, saturated or frozen.
2. Equip seed boxes used for drill and broadcast seeding with an agitator.
3. To prevent stratification of seed mix, do not run seed box agitators while seeding is not being performed.
4. If seed mix is transported to site in a seed box or other equipment that subjects mix to shaking or similar movement that has the potential to cause stratification, remix seed prior to application.
5. Seeding equipment shall be calibrated as appropriate to distribute seed at the specified rates.
6. Unless otherwise shown on Drawings, seed areas disturbed by or denuded by construction operations or erosion.
7. Use markers to ensure that no gaps will exist between passes of seeding equipment.
8. If cover crop has been established, mow the crop and drill seed perennial seed mix into the crop stubble.

B. Drill Seeding:

When drill seeding, plant seed mix at a rate of 30 - 35 PLS lbs/acre. Uniformly apply prescribed mix over area to be seeded as follows:

1. Accomplish seeding operations, where practical, by drilling in a direction across slope and along the contour.
2. Plant seeds approximately 1/4 inch deep.
3. Do not exceed 4 inches distance between drilled furrows. If furrow openers on drill exceed 4 inches, drill area twice to obtain a 4-inch distance between furrows.
4. Seed with grass wheels, rate control attachments, seed boxes with agitators, and separate boxes for small seed.

5. Once seed is applied, apply full complement of mulch. This shall allow seed to be in good contact with soil surface and not suspended in mulch matrix.
6. Prohibit vehicles from traveling over the seeded areas.

C. Broadcast Seeding:

When broadcast seeding, plant seed mix at a rate of 32 - 37 PLS lbs/acre.

1. Where it is not practical to accomplish seeding by drilling, mechanically broadcast seed by use of a hydraulic mulch slurry blower, rotary spreader, or a seeder box with a gear feed mechanism. If seeding is done with a slurry blower, use highest pressure and smallest nozzle opening that will accommodate the seed.
2. Immediately following seeding operation, thoroughly rake seedbed to provide approximately 1/4 inch of soil cover over of the seed.
3. If hydraulically applying mulch as part of the broadcast seeding process, use a 2-step process. Apply seed with a tracer. Once seed is applied, apply full complement of mulch. This shall allow seed to be in good contact with soil surface and not suspended in mulch matrix.
4. Prohibit vehicles from traveling over the seeded areas.

3.3 HYDRAULIC MULCHING/TACKIFIER: Slopes Flatter than 2:1

A. Mix slurry in a tank with an agitation system and spray, under pressure, uniformly over soil surface. Apply mulch evenly across landscape at a rate of 2000 lbs/ acre.

B. Use both horizontal and vertical movements in applicator to achieve an even application of slurry material. Keep all materials in uniform suspension throughout mixing and suspension cycle when using hydraulic mulching equipment.

C. When using plantago based tackifier as mulch, apply tackifier at a rate of 150 lbs/acre.

D. Prohibit foot/vehicle traffic from hydraulically mulched areas.

3.4 BONDED FIBER MATRIX (BFM): Slopes 2:1 and Steeper, Irrigated and Non-Irrigated Projects

A. Hydraulically apply BFM over seeded area (or apply seed with a tracer amount, 200-300 lbs/ acre) in accordance with manufacturer's specified procedures. Hydraulically apply BFM as a viscous mixture to form a continuous, porous and erosion resistant mat. Upon drying, matrix shall not inhibit germination and growth of plants in and beneath the layer. Matrix shall retain its form despite re-wetting.

B. Apply matrix uniformly across area and apply in multiple directions to ensure a 100 percent soil surface coverage.

C. Apply at a rate of approximately 3,500-lbs/ acre in a manner that achieves uniform coverage of all exposed soils.

D. Prohibit vehicle traffic on hydraulic BFM applications.

3.5 FLEXIBLE GROWTH MEDIUM (FGM) AND FLEXIBLE CONTROL MEDIUM (FCM): SLOPES 3:1 AND STEEPER

A. For maximum performance, apply FGM or FCM in a two-step process:

1. Step One: Mix and apply seed and soil amendments with small amount of FGM for visual metering.
2. Step Two: Mix and apply FGM at a rate of 50 lb per 125 gallons (23 kg/475 liters) of water over freshly seeded surfaces. Confirm loading rates with equipment manufacturer. Do not leave seeded surfaces unprotected, especially if precipitation is imminent.

B. Mixing:

A mechanically agitated hydraulic-application machine is recommended:

1. Fill tank to middle of agitator shaft or tank about 1/3 full of water. Turn on pump to wet or purge lines. Begin agitating. Keep adding water slowly while adding the FGM at a steady rate.
2. Consult application and loading charts to determine number of bags to be added. Mix at a rate of 50 lbs of FGM per 125 gallons (23kg/475 liters). Contact equipment manufacturer to confirm optimum FGM mixing rates.
3. All FGM should be loaded when the tank is approximately 3/4 full.
4. ~~Fertilizer should be added once the tank is nearly full.~~
5. Before applying, mix the slurry for at least 10 minutes after adding the last amount of FGM. This is very important to fully activate the bonding additives and to attain proper viscosity.
6. Turn off re-circulation valve to minimize potential for air entrainment within the slurry.

C. Application:

Use a fan-type nozzle (50-degree tip) whenever possible for best soil surface coverage. Apply FGM from opposing directions to soil surface, reducing the "shadow effect" and assuring a minimum of 95% of soil surface coverage. Slope interruption devices or water diversion techniques are recommended when slope lengths exceed 100 feet (30 m). Install materials at the following minimum application rates:

CONDITION	ENGLISH	SI
≤ 3H to 1V	3000 lb/ac	3400 kg/ha
>3H to 1V and ≤ 2H to 1V	3500 lb/ac	3900 kg/ha
>2H to 1V and ≤ 1H to 1V	4000 lb/ac	4500 kg/ha
>1H to 1V	4500 lb/ac	5100 kg/ha
Below ECB or TRM	1500 lb/ac	1700 kg/ha
As infill for TRM	3500 lb/ac	3900 kg/ha

Material should not be applied in channels, swales or other areas where concentrated flows are anticipated, unless installed in conjunction with a temporary erosion control blanket or non-degradable turf reinforcement mat. After application, thoroughly flush the tank, pumps and hoses to remove all FGM material. Wash all material from the exterior of the machine and remove any slurry spills. FGM will be more difficult to remove once it dries.

3.6 EROSION CONTROL BLANKET: SLOPES 2:1 AND FLATTER

A. Place blankets over native grass seeding immediately following the raking/chaining operation.

B. When using single netted products for 3:1 or flatter slopes, place blanket with netting on top and the wood/ straw fibers in contact with soil over entire seeded area.

C. For slope installations, the following guidelines shall be used:

Upslope Anchor – utilize one of the methods detailed below for initial anchoring of Rolled Erosion Control Products (RECP):

1. Staples: Install the RECP 3 ft. (900 mm) beyond the shoulder of the slope onto flat final grade. Secure roll end with a single row of stakes/staples on 1 ft. (300-mm) centers.
2. Anchor trench: Excavate a 6 in. by 6 in. (150 mm by 150 mm) anchor trench. Extend the upslope terminal end of the RECP 3 ft. (900 mm) past the anchor trench. Use stakes or staples to fasten the product into the bottom of the anchor trench on 1 ft. (300 mm) centers. Backfill the trench and compact the soil into the anchor trench.
3. Unroll blanket downslope in direction of water flow.
4. Overlap edges of adjacent parallel rolls 2 to 4 inches and staple every 3 feet.
5. When blankets are spliced, place blankets end over end (shingle style) with 6-inch overlap. Staple through overlapped area, approximately 12 inches apart.
6. Lay blankets loosely and maintain direct contact with soil. Do not place over protruding objects; rocks, grass, etc.
7. Wire staple blankets sufficiently to anchor blanket and maintain blanket contact with soil per manufacturer's instructions.

Seams – utilize one of the methods detailed below for seaming of RECP:

1. Adjacent seams: Overlap edges of adjacent RECP by 2 to 4 in. (50 to 100 mm) or by abutting products as defined by manufacturer. Use a sufficient number of stakes or staples to prevent seam or abutted rolls from separating.
2. Consecutive rolls: Shingle and overlap consecutive rolls 2 to 6 in. (50 to 150 mm) in the direction of flow. Secure staples through seam at 1 ft. (300 mm) intervals.
3. Check seam. Construct a stake/staple check seam along the top edge of RECP for slope application and at specified intervals in a channel by installing two staggered rows of stakes/staples 4 in. (100 mm) apart on 4 in. (100 mm) centers.
4. Slope interruption check slot: Excavate a trench measuring 6 in. wide by 6 in. deep (150 x 150 mm). Secure product to the bottom of the trench. Fold product over upslope material and fill and compact the trench on the downslope side of check slot and seed fill. Continue rolling material downslope over trench.

Terminal Ends – utilize one of the methods detailed below for all terminal ends of RECPs:

1. Staples: Install the RECP 3 ft. (900 mm) beyond the end of the channel and secure end with a single row of stakes/staples on 1 ft. (300-mm) centers. Stakes/staples for securing RECP to the soil is typically 6 in. (150 mm) long.

2. Anchor trench: Excavate a 6 in. by 6 in. (150 mm by 150 mm) anchor trench.
   Extend the terminal end of the RECP 3 ft. (900 mm) past the anchor trench. Use stakes or staples to fasten the product into the bottom of the anchor trench on 1 ft. (300 mm) centers. Backfill the trench and compact the soil into the anchor trench. Apply seed and any necessary soil amendments to the compacted soil and cover with remaining 1 ft. (300 mm) terminal end of the RECP. Secure terminal end of RECP with a single row of stakes or staples on 1 ft. (300 mm) centers.

D. Check slot: Construct a stake/staple check slot along the terminal end of the RECP by installing two rows of staggered stakes/staples 4 in. (100 mm) apart on 4 in. (100 mm) centers.

E. Do not use blankets on undisturbed, natural tuff slopes. Use hydraulic mulching on tuff slopes.

3.7 WATERING

A. Where temporary watering is required for seeded areas, provide temporary water system which may be a sprinkler system, or a water truck with a spray boom or any other method satisfactory to distribute a uniform coverage of clean water (free of oil, acid, salt or other substances harmful to plants) to previously seeded and mulched areas.

B. If a temporary sprinkler system is used, keep all pipe connections tight to avoid leakage and loss of water, and to prevent washing or erosion of growing areas. Maintain sprinklers in proper working order during watering.

C. Do not drive trucks with spray systems on seeded areas and ensure water force does not cause movement of mulch or seed on the ground.

3.8 MAINTENANCE

A. Begin maintenance immediately after planting. Keep re-vegetated areas free of noxious weeds.

B. Maintain seeded areas for not less than 60 days after final acceptance of work and longer as required to achieve final stabilization as described in Section 3.11 ACCEPTANCE.

C. Reseed void areas greater than 6 square feet or repetitive voids greater than 2 square feet amounting to more than 10 percent of any area that appears the growing season following installation.

3.9 CLEANUP AND PROTECTION

A. After completion of work, clear site of excess soil, waste material, debris and objects that may hinder maintenance and detract from neat appearance of site.

B. Protect seeded areas, work and materials from damage due to vehicles, pedestrians, and operations by other subcontractors. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged work as directed.

C. Upon completion of all seeding operations, clean the portion of the project site used for storing materials and equipment of all debris. Remove all superfluous materials and equipment from the project site. Sweep walks and pavement clean upon completion of work in this section.

3.10 ACCEPTANCE

A. Seeded areas will be reviewed for acceptance by LANL when final stabilization has been achieved. Final stabilization is defined as "All soil disturbing activities at the site have been completed and a uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover with a density of 70 percent of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed." Stabilization shall be in conformance with the Storm Water Pollution Prevention Plan (SWPPP), as applicable.

B. In the event that all other work required by the Subcontract is completed before final stabilization is achieved or because seasonal limitations prevent seeding, partial acceptance of the work shall be made with final acceptance delayed until satisfactory vegetative growth has been established.

END OF SECTION

SECTION 32 9300

PLANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Preparation of planting mix

B. New trees, plants, and ground cover

C. Mulch ~~and fertilizer~~ Fertilizer will not be used on this project within the wetlands vicinity. JK 3-1-13

D. Maintenance

E. Tree pruning

1.2 RELATED SECTIONS

A. Section 32 8400, Planting Irrigation

1.3 SUBMITTALS

A. Submit the following in accordance with Project submittal procedures:

1. Installation Instructions, including planting schedule dates and type of work to be performed. Correlate to provide specified maintenance periods. Once schedule is accepted, document reasons for delays or changes and revise dates only as approved by the LANL Subcontract Technical Representative (STR).

2. Materials list of trees, ground cover, and shrubs. Indicate source name, address, telephone number, quantity, genus, variety, size, and species of trees to be ordered.

3. Catalog data, including sources of supply for amendments, mulch, trees, ground cover, and shrubs.

1.3 QUALITY ASSURANCE

A. Subcontractor Qualifications

1. Perform work with a licensed subcontractor experienced in landscaping with the type and scale of work required and having equipment and personnel adequate to perform the work satisfactorily.

B. Material Quality Controls:

1. Ship landscape materials with certificates of inspection required by industry and/or government regulations. Package standard products with manufacturer's certified analysis. Comply with regulations applicable to landscape materials.

2. Label each tree, shrub and ground cover with securely attached waterproof tag bearing legible designation of botanical and common name.

3. LANL STR shall inspect or tag trees, shrubs and ground covers either at place of growth or at site before planting, for compliance with requirements for genus, species, variety, size and quality, injuries and defects. Unsatisfactory or defective material may be rejected at any time during progress of work.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery/Storage of Materials:

1. Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

2. Do not prune trees and shrubs prior to delivery. Do not bend or bind-tie trees or shrubs in such manner as to damage bark, break branches or destroy natural shape. Provide protective covering for deciduous tress or shrubs during transport to site. Do not remove boxed, balled/burlaped, or container-grown stock from containers until planting time.

3. Delivery trees and shrubs after preparations for planting have been completed and can be planted immediately. If planting is delayed set trees and shrubs in shade, protect from weather and mechanical damage and keep roots moist.

B. Handling During Planting:

1. Lift trees only by methods that will not damage bark or loosen trunk from rootball or otherwise damage the appearance, health or growth of the tree.

2. Handle shrubs and ground covers by containers, do not carry by foliage or branches. Do not drop or damage material during moving.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not install plant life when ambient temperatures may drop below 35 degrees F or rise above 90 degrees F.

B. Proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required. Assess if site is ready for work to begin.

2.3 PLANT MATERIALS

A. Provide sound, healthy symmetrical specimens typical of their species, with well-formed tops and good healthy root systems. Provide materials free from pests, diseases, broken branches and plant sizes at least equal to the minimum size indicated.

B. Nomenclature: Conform to Standardized Plant Names and accepted botanical nomenclature in the nursery trade.

C. Strictly adhere to the American Standards for Nursery stock unless specific approval is given for particular plant material that does not meet those specifications.

D. To ensure whole sound condition of the rootball, fully wrap the balled and burlapped material with no deterioration of the wrapping fabric. Properly root prune balled and burlapped stock when dug and during cultivation.

2.4 TREES AND SHRUBS

A. Provide trees and shrubs, deciduous and evergreen, well shaped, symmetrical, full, sound, healthy specimens, with well-formed tops and healthy root systems. Provide trees and shrubs that are free from injurious pests, diseases, broken branches, etc.

B. Provide nursery grown evergreen trees that have been fully transplanted at least twice during cultivation.

C. The rootball of balled and burlapped material shall be fully burlap wrapped with little deterioration of the fabric and the rootball shall be in whole sound condition. Rootballs wrapped with plastic burlap or plastic twine will be rejected. Use rootball supporting devices, such as wire baskets to hold the ball in firm rigid condition. Do not use trees that have had the main leader pruned and no replacement leader trained. Trees which have trunk abrasions or scars comprising one-third or more of the diameter of the trunk or which diminish the aesthetic quality of the tree may be rejected.

2.5 LANDSCAPE MATERIALS

A. Anti-Desiccant: Emulsion type, film-forming agent designed to permit transpiration but retard excessive loss of moisture from plants. Deliver in manufacturer's fully identified containers and mix in accordance with manufacturer's instructions.

B. Landscape Fabric: Non-woven, spun bonded, water permeable polypropylene or polyester material with UV inhibitors in accordance with the following:

Tensile strength per ASTM D4632: minimum 135 lbs. min. Elongation percent per ASTM D4632: >60%. Equivalent opening size (US Sieve NO.): 60/70. Weight in pounds per square yard: 3.0 oz/sq. yd. min. Puncture strength (lbs) 35. Do not expose fabric material to sunlight in storage

C. Staking Materials

1. Stakes: Use green steel T-bar fence posts for tree support.

2. Cable, Wire, Eye Bolts and Turnbuckles: Non-corrosive, of sufficient strength to withstand wind pressure and resulting movement of plant life.

3. Fabric Pins: Steel pin minimum 11 gauge, 6”x1”x6”, per fabric manufacturer’s standard.

4. Plant protectors: Rubber sleeves over cable to protect plant stems, trunks, and branches.

5. Large Gravel Cover: 3/4 inch, coarse washed, natural color gravel, standard color shall be Santa Fe Brown.

PART 3 EXECUTION

3.1 PREPARATION

A. Layout individual trees and shrubs and areas for multiple plantings. Stake locations and outline areas and secure LANL acceptance before excavation for planting work.

B. Preparation of Planting Soil/Backfill Mixture:

1. Before mixing, clean topsoil of roots, plants, clods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.

2. Mix specified soil amendments ~~and fertilizers~~ with topsoil at rates specified. ~~Delay mixing of fertilizer if planting will not follow within 2 days.~~

3.2 PLANTING

A. Trees

1. Excavate tree pits to a diameter 12 inches greater than the spread of the rootball, and 12 inches deeper than the depth of the rootball.

2. Loosen a minimum depth of 3 inches of subsoil in bottom of pit and mix planting soil/backfill mixture into the loosened subsoil. Place and compact soil/backfill mixture in pit to proper depth so that top of rootball will be 4 inches below surrounding finish grades. On slopes, maintain 4 inches below surrounding grade on the downhill side.

3. Set rootball on compacted soil/backfill mixture, plumb tree in center of pit with top of ball 4 inches lower than surrounding grade. Soil/backfill mixture in carefully tamped layers to two-thirds the depth of the rootball and flood with water. After water is absorbed continue backfilling and tamping to grade, leaving no voids or air pockets. Water again after placing final layer of soil/backfill mixture.

4. Around trees not in planter beds or lawns, form a 4 foot diameter depression 4 inches below surrounding grade with sides neatly sloped inward to top of

rootball. On slopes, maintain 4 inches below surrounding grade on the downhill side. Fill depressions with landscape fabric and gravel cover.

5. If specified on Drawings, guy or stake tree.

B. Shrub Areas:

1. Final grading shall be accomplished and shrub locations will be approved by LANL prior to shrub pit excavation.

2. Clear shrub areas of rocks, stones larger than 1 inch across and other debris.

3. Place individual shrubs in pits a minimum of 6 inches deeper and 12 inches wider in diameter than the container or ball size. Place plants on compacted soil/backfill layer. When shrub pit is two-thirds backfilled. Place soil/backfill mixture to finish grade level and thoroughly soak.

4. Set top of soil/backfill mixture in shrub areas to allow for large rock cover

5. Install landscape fabric and large rock cover around shrub as required on Drawings.

6. When not in planting beds, install individual shrubs or small shrub groups with a watering depression a minimum of 3 inches deeper than adjacent grades on downhill side of depression and 18 inches wider than the rootball of the shrub or the combined area of the shrub group. Coordinate shrub placement with the location of bubbler or drip emitter.

C. Ground Cover and Multiple Plant Areas:

1. Loosen subgrade of planting bed areas to a minimum depth of 6 inches. Remove stones larger than 1 inch in any dimension, sticks, stones, rubbish and other extraneous matter.

2. Place approximately 1/2 of total amount of planting soil required. Work into top of loosened subgrade to create a transition layer, then place remainder of the planting soil. Ensure top of planting soil mixture is smooth, level and consistent. Install planting soil mixture to minimum depth required to meet lines, grades and elevations required, after light rolling, natural settlement and depth of mulch.

3. After soil preparation, set out ground cover materials at on center rates specified. Align plants in uniform rectangular pattern or triangular pattern. Excavate pits large enough to set each plant. Backfill with excavated planting soil mix.

4. Water area thoroughly after planting. Fill depressions and level high spots.

D. Planters With Covered Bottom: Exterior Planters

1. Place a minimum 4 inch layer of 3/4 inch gravel in bottom of planters. Install landscape fabric to cover gravel, lap edges by 6 inches at joints and up side of planter. Fill with soil mixture consisting of 1 part topsoil, 1 part course

sand, and 1 part peat humus. Place soil in lightly compacted layers to an elevation of 1-1/2 inch below top of planter, allowing for natural settlement and 2 inch depth of mulch.

2. Provide for irrigation to the planters with the installation of a bubbler or drip emitter system.

E. Mulch: Provide not less than the following thicknesses of mulch and finish level with adjacent finish grades.

1. Install landscape fabric per manufacturer's instructions; to include overlapping edges and pinning. Neatly trim edges and areas of abutment without having ragged edges. Fabric shall be laid onto abutments; sidewalks, walls, landscape edging. Do not leave gapes at abutment areas.

2. Provide a minimum of 3 inch thickness of mulch (stone) at indicated hard scaped areas, unless otherwise noted on Drawings.

3. Provide a minimum 2 inch thickness of mulch at ground cover and shrub planting bed, unless otherwise noted on Drawings.

4. Provide a minimum 3 inch thickness of mulch at tree pits, unless otherwise noted on Drawings.

5. Install mulch adjacent to walks and curbs abutting the walk or curb edge with top of mulch one inch below top of walk or curb.

F. Prune, thin out and shape trees and shrubs for structure, appearance, and health. Prune trees to retain required height and spread. Do not cut tree leaders, and remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character and accomplish their function in the landscape design.

1. Remove and replace excessively pruned or malformed stock resulting from improper pruning.

3.3 MAINTENANCE

A. Begin maintenance immediately after planting.

B. Maintain trees, shrubs and other plants until final acceptance.

3.4 CLEANUP AND PROTECTION

A. During landscape work, keep pavements clean and work area in an orderly condition.

B. Protect landscape work and materials from damage due to landscape operations, operations by other subcontractors, trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged landscape.

C. Upon completion of all planting operations, clean the portion of the project site used for storing materials and equipment of all debris. Remove all superfluous

materials and equipment from the project site. Sweep or wash walks and pavement clean upon completion of work in this section.

3.5 INSPECTION AND ACCEPTANCE

A. Upon request when landscaping work is completed including maintenance, LANL will inspect to determine acceptability of work.

B. Where inspected landscape work does not comply with requirements, replace rejected work and continue specified maintenance until reinspected by LANL and found to be acceptable. Remove rejected plants and materials promptly from project site.

END OF SECTION

APPENDIX G:

BMP Design Requirements

NMED SWQB Requirements – Supporting Calculations

SCOPE / PURPOSE
The operator(s) must demonstrate, that implementation of the site-specific practices will assure that the applicable standards are met, and will result in sediment yields and flow velocities that, to the maximum extent practicable, will not be greater than the sediment yield levels and flow velocities from pre-construction, pre-development conditions.

ASSUMPTIONS
RUSLE2 is used to calculate sediment yield and the rational method is a technique used for analysis of the peak discharge rate produced within small watersheds.

Under actual field conditions, the effectiveness of barriers varies widely. The calculations assume that the barriers are properly designed, installed, and maintained.

SEDIMENT YIELD

Rusle Program Version: 1.38.60 Feb 8 2010
Rusle Science Version: 1/27/10
Data Base: LANL 3-3-10

RUSLE2 Profile Erosion Calculation Record – Pre-development

Info:

File: profiles\TA-3 D&D Predevelopment

Inputs:
Location: New Mexico\LosAlamos County\NM_Los_Alamos_18-20
Soil: sandy clay loam\sandy clay loam (h OM, s-m perm)
Slope length (horiz): 225 ft
Avg. slope steepness: 3.0 %

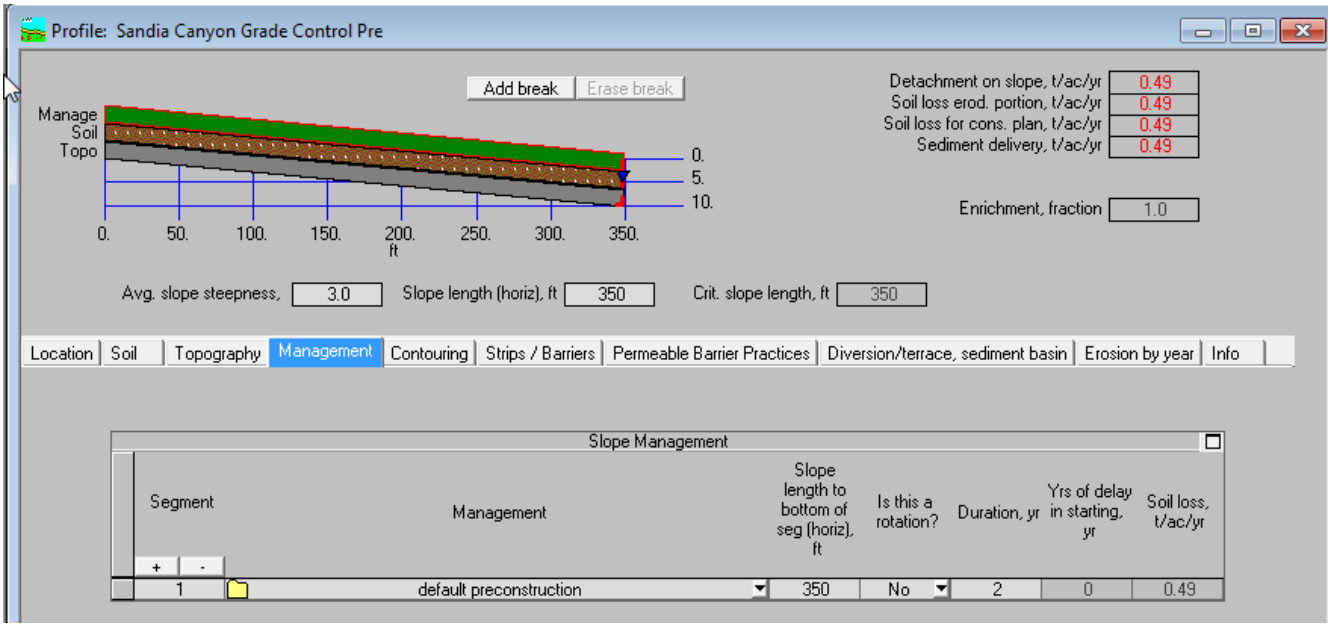
Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
default preconstruction	Permanent cover not harvested\Grass, warm season, permanent, establishment period, poor condition	tons	0.50
default preconstruction	Permanent cover not harvested\Grass, warm season, permanent, establishment period, poor condition	tons	0.50
default preconstruction	Permanent cover not harvested\Grass, warm season, permanent, establishment period, poor condition	tons	0.50

Contouring: a. perfect contouring no row grade
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 3.0 t/ac/yr
Soil loss erod. portion: 0.45 t/ac/yr
Detachment on slope: 0.45 t/ac/yr
Soil loss for cons. plan: 0.45 t/ac/yr
Sediment delivery: 0.45 t/ac/yr

Crit. slope length: 225 ft
Surf. cover after planting: -- %

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
7/1/0	Plant new vegetation\Begin growth	Permanent cover not harvested\Grass, warm season, permanent, establishment period, poor condition	0
7/1/1	Plant new vegetation\Begin growth	Permanent cover not harvested\Grass, warm season, permanent, establishment period, poor condition	19



RUSLE2 Profile Erosion Calculation Record – During Construction

Info:

Info:

File: profiles\Sandia Canyon Grade Control During

Inputs:
Location: New Mexico\LosAlamos County\NM_Los_Alamos_18-20
Soil: sandy clay loam\sandy clay loam (h OM, s-m perm)
Slope length (horiz): 300 ft
Avg. slope steepness: 3.0 %

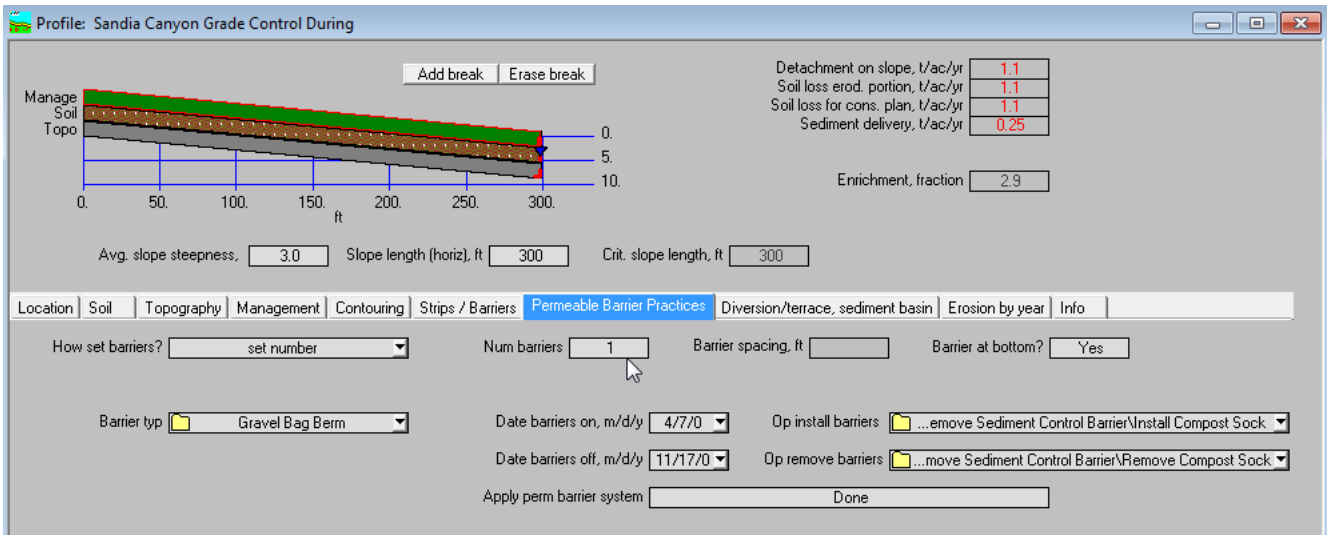
Management	*Vegetation*	*Yield units*	*# yield units, #/ac*

Contouring: a. perfect contouring no row grade
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 3.0 t/ac/yr
Soil loss erod. portion: 1.1 t/ac/yr
Detachment on slope: 1.1 t/ac/yr
Soil loss for cons. plan: 1.1 t/ac/yr
Sediment delivery: 0.25 t/ac/yr

Crit. slope length: 300 ft
Surf. cover after planting: -- %

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
4/10/0	Grading/Excavation\Bulldozer, filling/leveling		0
4/7/0	Install - Remove Sediment Control Barrier\Install Compost Sock		0
11/17/0	Install - Remove Sediment Control Barrier\Remove Compost Sock		0



RUSLE2 Profile Erosion Calculation Record – Post Construction

Info:

Info:

File: profiles\Sandia Canyon Grade Control post

Inputs:
Location: New Mexico\LosAlamos County\NM_Los_Alamos_18-20
Soil: sandy clay loam\sandy clay loam (h OM, s-m perm)
Slope length (horiz): 300 ft
Avg. slope steepness: 2.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*

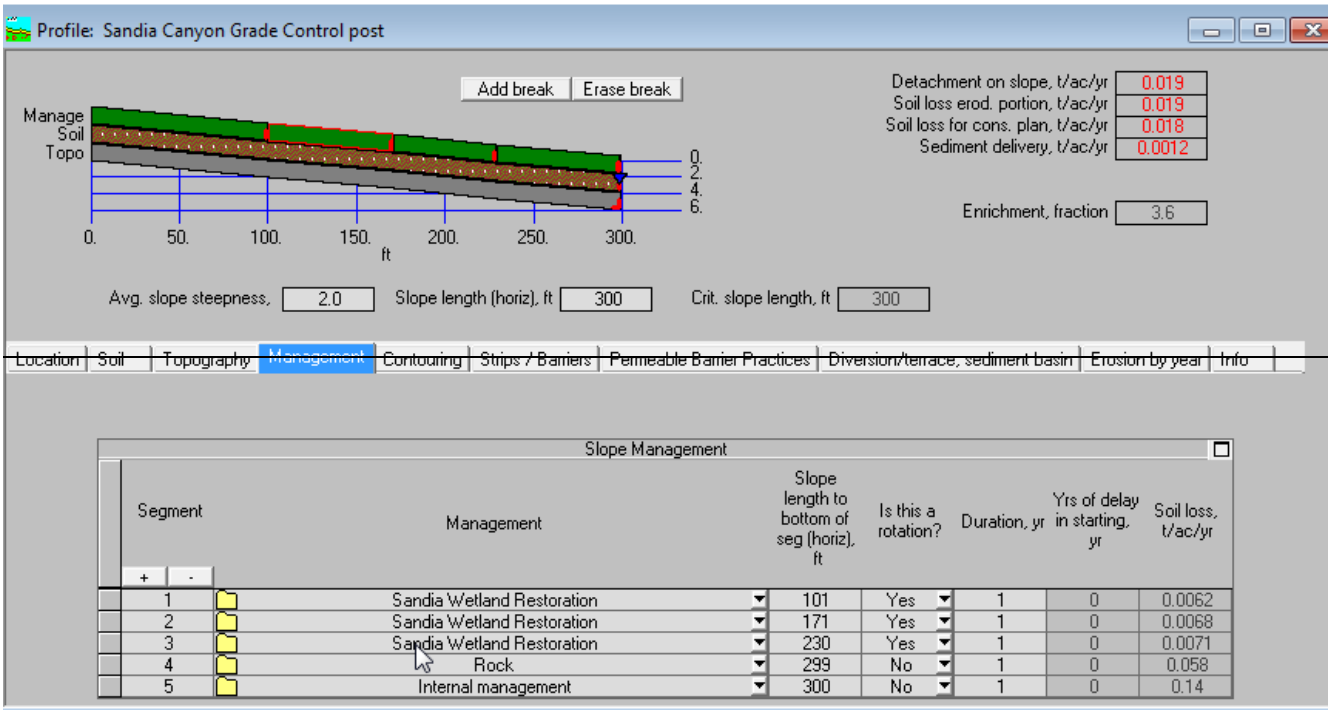
	Sandia Wetland Restoration	Permanent cover not harvested\Vegetative Barrier permanent, not harvested, good condition	tons			

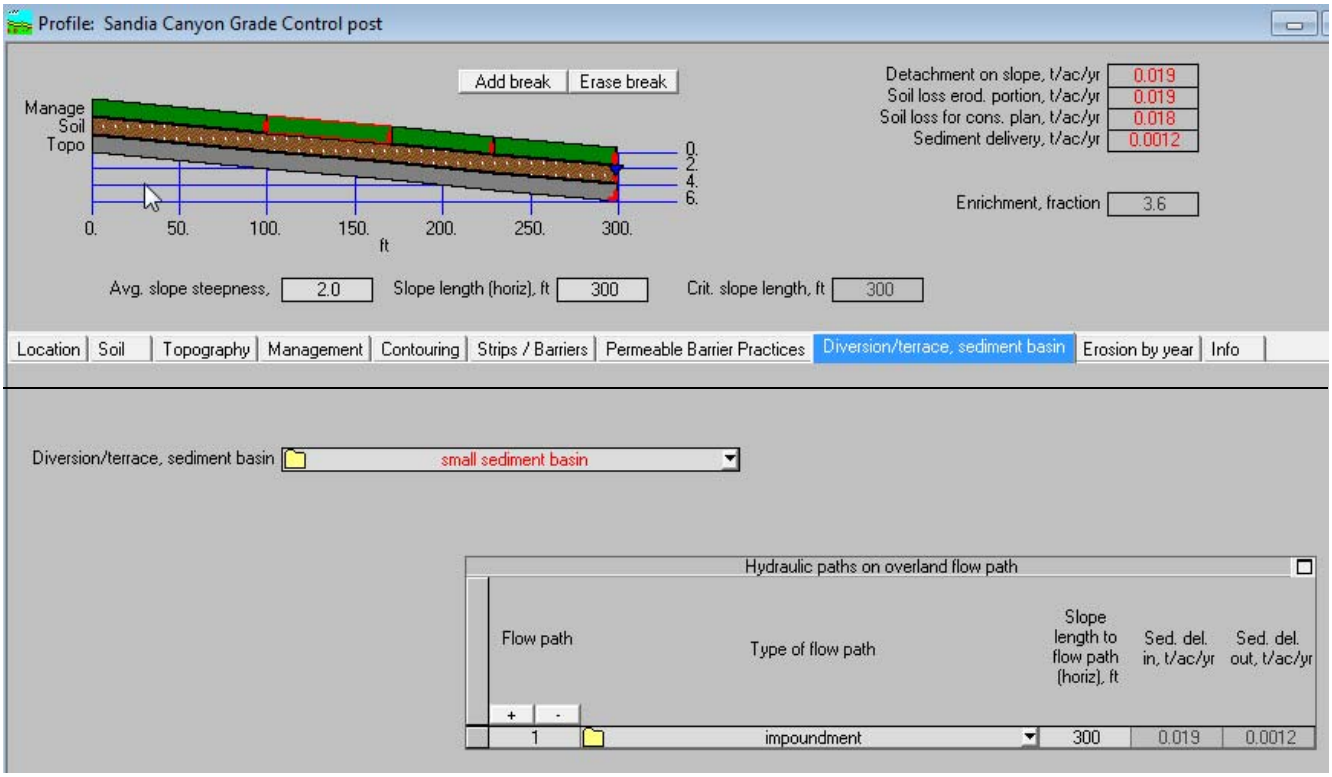
10
Contouring: a. perfect contouring no row grade
Strips/barriers: man. strips set in profile
Diversion/terrace, sediment basin: small sediment basin
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 3.0 t/ac/yr
Soil loss erod. portion: 0.023 t/ac/yr
Detachment on slope: 0.023 t/ac/yr
Soil loss for cons. plan: 0.022 t/ac/yr
Sediment delivery: 0.0014 t/ac/yr

Crit. slope length: 300 ft
Surf. cover after planting: -- %

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
5/15/0	Plant new vegetation\Planting, manual	Permanent cover not harvested\Vegetative Barrier permanent, not harvested, good condition	0
5/15/0	Plant new vegetation\Planting, manual	Permanent cover not harvested\Vegetative Barrier permanent, not harvested, good condition	0
5/15/0	Plant new vegetation\Planting, manual	Permanent cover not harvested\Vegetative Barrier permanent, not harvested, good condition	0
6/15/0	Highly disturbed land\add mulch		95




Profile: Sandia Canyon Grade Control post
Add break
Erase break
Manage
Soil
Topo
0.
2.
4.
6.
0.
50.
100.
150.
200.
250.
300.
ft
Detachment on slope, t/ac/yr 0.019
Soil loss erod. portion, t/ac/yr 0.019
Soil loss for cons. plan, t/ac/yr 0.018
Sediment delivery, t/ac/yr 0.0012
Enrichment, fraction 3.6
Avg. slope steepness, 2.0
Slope length (horiz), ft 300
Crit. slope length, ft 300
Location
Soil
Topography
Management
Contouring
Strips / Barriers
Permeable Barrier Practices
Diversion/terrace, sediment basin
Erosion by year
Info
Diversion/terrace, sediment basin
small sediment basin
Hydraulic paths on overland flow path
Flow path
Type of flow path
Slope length to flow path (horiz), ft
Sed. del. in, t/ac/yr
Sed. del. out, t/ac/yr
+
-
1
impoundment
300
0.019
0.0012

FLOW VELOCITIES DURING CONSTRUCTION

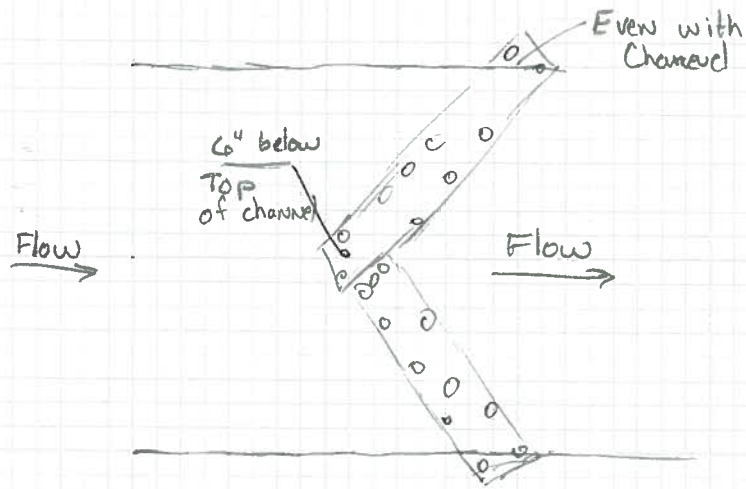
Date Checked	Checked By	Job Number	By	Date	Calc. No.	Sheet No.

Project

Subject

References/Notes

Gabions



Gabions approx
1' tall
4' x 2' x 1'
L x W x D

Brown AND Caldwell

#1580-1/8"sq.

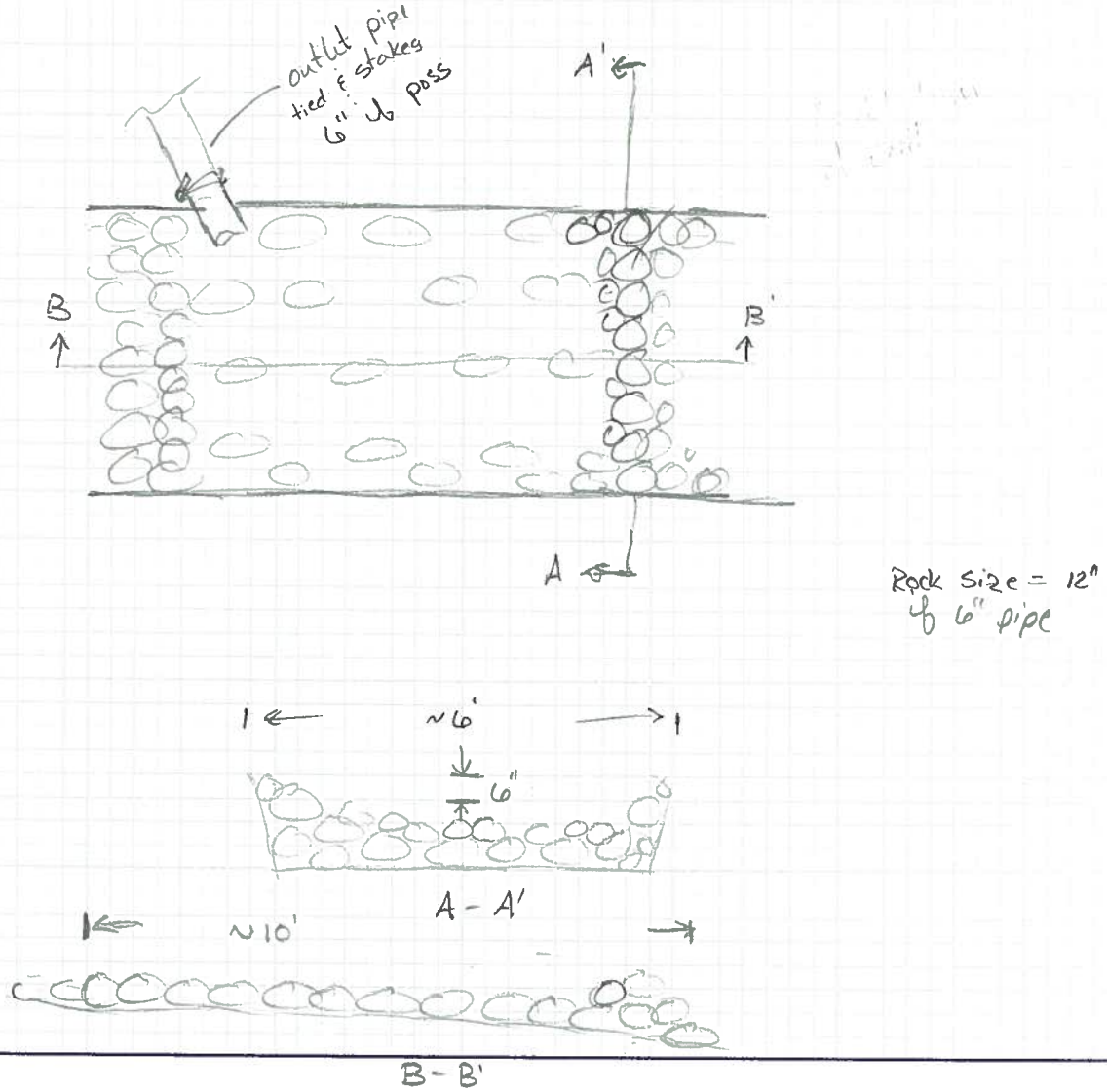
Date Checked	Checked By	Job Number	By	Date	Calc. No.	Sheet No.

Project

Subject

References/Notes

Pipe Outfall



Brown AND Caldwell

#1580-1/8"sq.

Knight, Jacob L

From: Fichtel, Michael D
Sent: Tuesday, February 26, 2013 1:21 PM
To: Zimmerly, Timothy; Knight, Jacob L; Gallegos, Robert M
Cc: Apodaca Pesiri, Deborah Apodaca; McCann, John P; O'Neill, Jim; Macgregor, Alan S
Subject: FW: Sandia SWPPP
Attachments: Sandia GCS - SWPPP Sketches.pdf

All,

See the below email from Portage. They've agreed to provide a 6" pipe and install the BMP's per the sketches.

Thanks,
Mike

From: David Weatherbie [mailto:dweatherbie@portageinc.com]
Sent: Tuesday, February 26, 2013 1:11 PM
To: Fichtel, Michael D
Cc: McCann, John P; 'Jake Shiver'
Subject: RE: Sandia SWPPP

Mike,

I think this is fine. Do you need anything else in order to secure the permits? Let me know when you are ready to submit the NOI.

Thanks,
David

From: Fichtel, Michael D [mailto:mfichtel@lanl.gov]
Sent: Tuesday, February 26, 2013 10:07 AM
To: David Weatherbie
Cc: McCann, John P
Subject: Sandia SWPPP
Importance: High

David,

Both the SWPPP and the 401/404 permits require additional details concerning temporary structures, specifically the rock gabion and the energy dissipation structure. As a result of our meeting this morning, we've sketched both of these structure and I've attached them herein for your review and concurrence.

One related item of consideration, we strongly recommend that you use a 6" diameter pipe in lieu of a 4" pipe. The reason is primarily because the velocity within a 4" pipe could be upwards of 15 fps however the 6" pipe would be only 6 fps. At 15 fps, 6" cobbles would wash downstream and therefore large boulders within a wire basket would be required to dissipate that much energy. If we use a 6" pipe, we would still need larger than 6" cobbles (12" is needed) however the structure itself is not nearly as intensive and the wire basket is not needed. The attached sketch is designed for 12" cobbles.

Anyways, please call me when you have a minute.

Thanks,
Mike

Michael D. Fichtel II
Los Alamos National Laboratory
EP-CAP / 606-0788

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Knight, Jacob L

From: Apodaca Pesiri, Deborah Apodaca
Sent: Monday, March 04, 2013 1:13 PM
To: Zimmerly, Timothy; Knight, Jacob L
Subject: FW: Rock Sizing for Wetlands
Attachments: image001.gif

We are covered on the pipe size and rock size. 6-inch pipe and 12-inch D50…. I know I talked to you about this Friday Jacob. I just wanted to make sure and find this e-mail for our records.

Debbie

From: O'Neill, Jim [mailto:joneill@BrwnCald.com]
Sent: Tuesday, February 26, 2013 7:34 PM
To: Apodaca Pesiri, Deborah Apodaca; debpesiri@yahoo.com; Fichtel, Michael D
Subject: Rock Sizing for Wetlands

Debbie and Mike,

For rock sizing:

If they get the velocity down to 7 fps by going to 6" pipe a 12-inch D50 will work.
If they don't and the velocity stays at 15 fps with a 4" pipe a minimum of 24 to 30 inch D50.

Sorry this took all day,
Jim

From the desk of:

James A. O'Neill II, P.E.*
Principal Engineer | Associate
Brown and Caldwell
joneill@brwncald.com
T 303.239.5486 | **C** 970.402.7117
Professional Registration in Specific States

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March 2012

100% Design Memorandum For Sandia Wetlands Stabilization Project

Prepared by the Environmental Programs Directorate

Los Alamos National Laboratory, operated by Los Alamos National Security, LLC, for the U.S. Department of Energy under Contract No. DE-AC52-06NA25396, has prepared this document pursuant to the Compliance Order on Consent, signed March 1, 2005. The Compliance Order on Consent contains requirements for the investigation and cleanup, including corrective action, of contamination at Los Alamos National Laboratory. The U.S. government has rights to use, reproduce, and distribute this document. The public may copy and use this document without charge, provided that this notice and any statement of authorship are reproduced on all copies.

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APPENDICES

Appendix A: Hydrology Calculations
Appendix B: Evapotranspiration and Inflow Calculations
Appendix C: Hydraulic Calculations

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Brown AND Caldwell

100% Design Memorandum

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Prepared for: Los Alamos National Security, LLC (LANS)

Project Title: Sandia Wetlands Stabilization Project

BC Project No: 140793-010-000

Technical Memorandum

Subject: **100% Design Memorandum for Sandia Wetlands Stabilization Project**

Date: March 8, 2012

To: Steve Veenis (LANS Project Manager)

Deborah Apodaca Pesiri (LANS Project Engineer)

From: Jim O'Neill, P.E.

Carl McDonald

Prepared by: James A. O'Neill II, P.E., Principal Engineer, NM #18656, Exp. 12/31/2012

Name and Title, License No., Expiration

JAMES A. O'NEILL II
NEW MEXICO
18656
PROFESSIONAL ENGINEER
J. A. O'Neill II
3/8/2012

Limitations:

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ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
cfs	Cubic feet per second
CMP	Corrugated Metal Pipe
the Consent Order	Compliance Order on Consent
DOE	United States Department of Energy
ET	Evapotranspiration
fps	feet per second
gpd	gallons per day
GPS	Global Positioning System
hr	hour
in	inch
IP	Individual Storm Water Permit
LANL, Laboratory	Los Alamos National Laboratory
m	meter
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
SWMU	Solid Waste Management Unit
yr	year

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1. INTRODUCTION

Los Alamos National Laboratory (LANL, Laboratory) has prepared this "Design Memorandum for Sandia Wetlands Stabilization Project" (memorandum), to provide design information and background for the work to be performed to stabilize the Sandia Wetland.

This memorandum provides general project background and documents the final design of the proposed measures intended to physically stabilize the Sandia Canyon wetland. The overall project goals and objectives are to arrest the headcut in the lower portion of wetland and to reduce the potential for erosion at the upper end of the wetland, where the 84-inch (in) open-top corrugated metal pipe (CMP) culvert discharges. These two measures will stabilize the wetland reducing sediment and associated contaminant transport into the lower sections of the canyon. These measures should also maintain chemically reducing conditions within the wetland sediments contributing to the goal of minimizing potential contaminant transport.

2. PROJECT BACKGROUND

2.1 Project Need

Hexavalent chromium from the power plant cooling tower was historically released from Technical Area 03 (TA-03) power plant (TA-03-22) at the head of Sandia Canyon from 1956–1972. Chemically reducing conditions within the wetland converted some of the hexavalent chromium to stable, relatively insoluble trivalent chromium. Although studies have shown that the trivalent form of chromium is unlikely to oxidize and be converted to hexavalent chromium, maintaining the chemically reducing conditions is a prudent measure to ensure stability of the chromium inventory. The wetland also contains constituents adsorbed to sediments such as polychlorinated biphenyls (PCBs) that can also be actively managed if the sediment within the wetland is stable.

2.1.1 Current Stream and Wetland Conditions

The wetland system is located in reach S-2 of Sandia Canyon and is shown in the design drawings. The largest drainage area contributing to the wetland is conveyed through what is called the Sandia land bridge by a 72-in CMP culvert and then to an 84-in open-top CMP culvert which empties a short distance upstream of the wetland. Stormwater flows have created a scour hole where the 84-in culvert discharges upstream of the wetland.

Between the outfall and the upstream extent of the wetland, the stream is establishing an inset, narrow bankfull floodplain as it erodes older sediment deposits. In some locations, this bankfull terrace is up to 4 meters (m) wide and wetland vegetation is beginning to re-establish on this terrace, creating a more stable inset floodplain with wetland vegetation. As the stream enters the larger wetland area, a defined stream channel is evident within the upper one-third of the wetland. Wetland vegetation is well established across the entire floodplain, and the stream and wetlands are stable. Towards the lower two-thirds of the wetland, surface water is generally present across the width of the wetland. A large headcut (up to 3 m high) is present and active at the terminus of the wetland. Willows have been planted in and around the headcut but have failed to stabilize its movement upstream. Downstream of the wetland, the stream system enters a narrow canyon reach and is stable, with bedrock exposed along much of the stream bed. Stream gage E123 is located a short distance below the wetland as shown on the design drawings.

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2.1.2 Stream Base and Stormwater Flows

Stream base flow from effluent released into Sandia Canyon through the culvert has averaged approximately 350,000 gallons per day (gpd) for 2011 and consists mainly of cooling water from the TA-03 Power Plant cooling tower. These base flows feed the groundwater within the reach, providing adequate hydrology and soil moisture conditions where the wetland vegetation can flourish. Stream gage E121 upgradient and stream gage E123 downgradient design drawings from the wetland have experienced peak flows approximately 140 cubic foot per second (cfs) and 88 cfs, respectively, during the period of record (1999 to 2010). Hydrologic calculations are shown in Appendix A.

2.2 Regulatory Considerations

This section briefly describes the regulatory basis for installation of the grade-control structure and stilling basin and other regulatory requirements applicable to, or potentially impacting, the project.

The grade-control structure and stilling basin are required based on the results of investigations performed under the Compliance Order on Consent (the Consent Order). Preparation of the design presented in this memo was directed by NMED's "Approval with Modification, Interim Measures Work Plan for Stabilization of the Sandia Canyon Wetland" (NMED 2011, 203806). The "Interim Measures Work Plan for Stabilization of the Sandia Canyon Wetland (LANL 2011, 203454) was prepared in response to NMED's "Approval with Modification, Phase II Investigation Work Plan for Sandia Canyon" (NMED 2011, 111518). The latter approval with modification required the Laboratory to submit a work plan to stabilize the eastern end of the wetland in Sandia Canyon to prevent further upstream migration of the headcut and to address erosion at the outfall of the CMP just upstream of the wetland. The work to stabilize the wetland was proposed by the Laboratory as an interim measure under section VII.B of the Consent Order. As described in section VII.B.1 of the Consent Order, interim measures are conducted to reduce or prevent migration of chemicals of concern which have or may result in an unacceptable human or environmental receptor exposure while long-term corrective action remedies are evaluated and implemented.

In addition to this interim measure, there are other Consent Order activities associated with Sandia Canyon. A Phase II investigation of Sandia Canyon is currently being performed and a Phase II investigation report is scheduled to be submitted to NMED in 2012. A Phase II investigation work plan for Solid Waste Management Units (SWMUs) and areas of concern (AOCs) in Upper Sandia Canyon Aggregate Area (LANL 2011, 206234) has been submitted by the Laboratory and approved by NMED (NMED 2011, 206390) and will be implemented by the Laboratory. Based on the results of these investigations, additional corrective actions could be required in the Sandia Canyon wetland.

Discharges of stormwater runoff from SWMUs and AOCs at the Laboratory are regulated under a National Pollutant Discharge Elimination System (NPDES) Individual Storm Water Permit (IP), effective November 2010 (NPDES No. NM0030759). Some of the SWMUs and AOCs regulated under the IP are located upstream of the Sandia Canyon wetlands and may contribute to the flow discharged to the wetland. Any corrective actions required under the IP will be coordinated with Consent Order activities being implemented in Sandia Canyon.

The effectiveness of the grade-control structure and stilling basin will be considered in evaluating the need for, and nature of, additional corrective actions required under either the Consent Order or the IP.

Consent Order remediation activities in Sandia Canyon were considered in United States Department of Energy's (DOE's) "Final Environmental Assessment for the Expansion of the Sanitary Effluent Reclamation Facility and Environmental Restoration of Reach S-2 of Sandia Canyon at Los Alamos National Laboratory" (DOE 2010, 206433). The grade-control structure and stilling basin are within the range of remediation activities considered in the environmental assessment, and no additional actions under the National Environmental Policy Act are required. Because the proposed construction activities would occur within a

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wetland, compliance with dredge and fill permitting requirements under Section 404 of the Clean Water Act is necessary.

2.3 Work Completed to Date

In the past, willows have been planted in and around the headcut in an effort to stabilize the headcut with vegetation but have failed to prevent its movement upstream. No other construction work has been done to date.

2.4 Project Goals and Objectives

The overall project goals and objectives are (1) to arrest the headcut in the lower portion of wetland and to reduce the potential for erosion at the culvert outfall near the entrance into the wetland, and (2) to maintain hydrologic and geochemical conditions that will minimize the migration of chemicals of concern. The headcut in the lower section of the wetland will be stabilized by constructing a stepped grade-control structure that will allow a grade transition from the current elevation of the wetland to the stream bank near stream gage E123. The area behind the grade-control structure will be backfilled, and wetland vegetation will be established behind the structure and further stabilize the area.

The source of the fill may include post-1942 alluival sediments downstream of the grade-control structure. Use of this source fill is contingent on characterization of the levels of contamination present in these sediments and the associated regulatory status of this material once excavated.

To reduce erosion at the culvert outlet, a hardened plunge pool stilling basin will be constructed to stabilize the area and minimize the potential for further erosion.

2.5 Performance Requirements/Criteria

The following are the performance criteria for the grade-control structure and the stilling basin:

- The grade-control structure will be backfilled to allow wetland expansion and further stabilization.
- The grade-control structure will be sufficiently impervious to prevent the draining of wetland soils behind the structure.
- The grade-control structure will reduce channelized flow.
- The stilling basin will dissipate the energy of the maximum flow of the culvert outfall near the entrance into the wetland.
- The stilling basin will be armored to reduce erosion.
- Each structure will be able to pass the 25-yr, 2-hr peak event without failing.
- The grade-control structure will reduce velocity and shear for the 10-yr, 25-yr, 50-yr, and 100-yr flow events.
- The grade-control structure and stilling basin will allow the wetland to be viable during reduced inflows into the wetland from the cooling tower.

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3. PROJECT DATA

3.1 Hydrology

The 25-yr, 2-hr storm event was used for all design calculations as required by the Laboratory design guidance. Hydrologic calculations are shown in Appendix A.

3.2 Wetland Evapotranspiration and Inflow

The wetland currently receives approximately 350,000 gpd of inflow from the cooling tower as described above. The Laboratory has a goal to reduce this flow as much as possible and still maintain a viable wetland area to actively manage the impacted sediments. Water saved will be recycled in other locations within the laboratory.

Modeling of the evapotranspiration (ET) of the wetland was performed using Penman-Monteith equations as described in Appendix B. Modeling indicates that the maximum 30-day ET is approximately 11 inches. Additional analysis of the modeling and desired flow reduction indicates that the average flow required to maintain a viable wetland during June is approximately 30,000 gpd or a greater than 90% reduction in flow during June. It is possible to reduce flows to zero during October through March and ramp up the flows at varying levels during April through September reducing the overall annual flows by significantly more than 90% as shown in Appendix B. This would require the Laboratory to actively manage the flows on a monthly basis.

3.3 Geotechnical/Geologic Information

Due to the quick turnaround time for the current design no geotechnical or geologic information was collected for the design. Conservative geotechnical or geologic properties were assumed and standard design constraints were used for the design.

3.4 Base Mapping and Survey

A site survey was conducted in the field using Global Positioning System (GPS) survey equipment at the end of July and early August. The survey data was used to create 3-dimensional models of each site (grade-control structure and stilling basin) and to create cross-sections for HEC-RAS modeling.

3.5 Site Access

Access roads needed for construction of the proposed structures will be designed by the Laboratory and require internal approval for environmental, engineering, safety, and security concerns. These issues are currently being addressed through normal Laboratory procedures. If unforeseen circumstances arise, the implementation schedule for this work plan may be impacted. This memorandum and design submittal does not include site access elements in the drawings or specifications.

4. GRADE CONTROL STRUCTURE

There are two improvements planned for the wetlands as discussed above, (1) a grade control structure and (2) hardening of the stilling basin near the head of the wetland. This section describes the proposed grade control structure.

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4.1 Design Development

The grade control structure, as shown in design drawings, is required to transition the grade of the existing wetland and mitigate headcutting. The structure will transition the grade approximately 11 vertical feet from the elevation of the current wetland just upgradient of the headcut to the natural stream bed just upstream of stream gage E123. In order to maintain grade and to reduce the overall fill and size of a single structure, a set of three steel sheet pile structures will be installed with smaller elevation drops. The final structure will also have a cascade structure made of boulders and rocks to transition to the final grade.

The grade control structure was designed using peak flows for the 10-yr, 25-yr, 50-yr, and 100-yr events. The primary goal of the work is to transition high flows (500 cfs 25-yr, 2-hr) through the area of the grade control structure without causing stream instability. Steam velocity and shear were determined using HEC-RAS modeling as shown in Appendix C.

Steel sheet piles are being used, with the following constraints:

- Steel sheet piles can corrode when exposed to the atmosphere. The sheet piles to be used will be limited to the area exposed to the atmosphere (no more than 3 ft).
- The sheet piles will be installed into a 2-foot deep trench into bedrock. The trench will be back-filled to the elevation of the bedrock with low permeability fill such as bentonite.
- Holes or notches will be cut at consistent elevations across the sheet pile to encourage smaller, braided channels through the restored sections of wetland during base and low flow events. High flow events will sheet flow over the cap elevation of the sheet pile.
- Stone or concrete splash pools will be used just downgradient of each sheet pile to prevent scour holes. The splash pools will slow the water.
- A stone cascade and pool structure will be installed at the bottom end of the grade-control structure to complete the final transition into the native channel just upgradient of gage station E-123.

Gabion structures have been used by the lab for past grade control structures. However, in this setting gabions will not be used for the following reasons:

- Continued exposure of gabion baskets to the low flows from the cooling towers can accelerate corrosion of the baskets, causing failure modes.
- If gabion baskets fail, high flows could create a large headcut that will move swiftly through the wetland.
- Gabions are not impervious and require the installation of separate design elements such as liners, sheet piles, concrete, etc. to create imperviousness.

Composite or vinyl sheet piles are not being used for this project due to the following:

- Composite and vinyl sheet piles require additional anchoring to maintain grade controls.
- Composite and vinyl sheet piles will melt and fail during fires.
- These sheet piles can become brittle after approximately 10 years and fail when impacted by items carried downstream.

4.2 Design Features

The grade-control structure will be seated in bedrock. The structure is designed to prevent groundwater from seeping through the structure as noted above. Maintaining the groundwater elevation is important to maintaining soil moisture conditions, wetland vegetation, and reducing conditions. If the groundwater is allowed to seep through the structure, the groundwater elevation will be lowered and the wetland vegetation

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behind the structure may become stressed and eventually die, thus reducing its stabilizing effect and role in reducing flow velocity The transition from the wetland above the grade-control structure to the stream channel below the grade-control structure is a gradual smooth transition in a stepped fashion to prevent erosive flows that could scour and destabilize the stream reach below the structure. In addition, the stepped nature of the design reduces the risk of catastrophic failure of the grade-control structure in the event of a localized failure. This will minimize the possibility of impacted sediments being transported downstream into other locations within Sandia Canyon.

Fill will be brought in and placed behind the grade-control structure to replace the area of the wetland that has been eroded. This area will be filled to match the elevation of the surrounding wetland areas to prevent the formation of a pool behind each grade-control structure. Native wetland vegetation will be re-established on the fill to stabilize it and expand the footprint of the wetland. The source of the fill may include post-1942 alluival sediments downstream of the grade-control structure. Use of this source fill is contingent on characterization of the levels of contamination present in these sediments and the associated regulatory status of this material once excavated.

5. STILLING BASIN

This section describes the proposed stilling basin.

5.1 Design Features

The stilling basin at the end of the outlet of the culvert, shown in design drawings, has been designed using the U.S. Department of Agriculture (USDA) plunge pool spreadsheet (USDA-NRCS Design Note No. 6 - Riprap Lined Plunge Pool for Cantilever Outlet). The pool will be excavated in the area of the current scour hole and armored with riprap. The area around the current scour hole has limited access and construction disturbances will be minimized.

The 25-yr, 2-hr peak flow event of 360 cfs was used for design purposes of the stilling basin. The peak flows described here are less than the grade-control structure because of its upstream position. The two gage stations just upstream of the culvert show that the combined peak events have not exceeded 355 cfs during the period of record (1999 to 2010). The stilling basin has been conservatively designed because the peak flow calculation did not take into account the impact on the culvert in attenuating peak flow. In addition, the maximum capacity of the culvert appears to be approximately 355 cfs, which is less than the peak flow used for design.

The outlet of the stilling basin releases base flows and flows resulting from smaller storm events directly into the stream at the elevation of the main stream channel. The structure is designed to release the peak flows from higher storm events over a wider area, reducing the concentrated high-velocity flows. This overflow is placed at the elevation of the new bankfull floodplain, allowing it to convey high flows and reduce erosion potential within the stream channel.

6. O&M REQUIREMENTS

The wetland's improvements have been designed to minimize or eliminate O&M requirements. The structures should be inspected after each storm event until wetland vegetation and seeding is established. Areas of erosion should be addressed as soon as practicable to prevent system failure during this time. After vegetation is established the improvements should be inspected semi-annually to determine if any areas of potential failure are beginning to form that need to be address.

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7. LIST OF DESIGN DRAWINGS

7.1 Grade Control Structure

G-0001 Title Sheet

C-0001 General Notes, Legend, Abbreviations, Symbols

C-1000 Survey

C-1001 Existing Conditions

C-1002 Overall Plan View

C-1003 Partial Plan – 1

C-1004 Partial Plan – 2

C-1005 Plan and Profile

C-1006 Section Location Plan

C-3000 Sections

C-5000 Details

C-5001 Details

C-7000 Planting and Stabilization Diagram

7.2 Stilling Basin

G-0001 Title Sheet

C-0001 General Notes, Legend, Abbreviations, Symbols

C-1000 Survey

C-1001 Existing Conditions

C-1002 Plan View

C-1003 Plan and Profile

C-1004 Section Location Plan

C-3000 Sections

C-5000 Detail

Use of contents on this sheet is subject to the limitations specified at the beginning of this document.

8. SPECIFICATIONS INDEX

Specifications are provided as a part of the construction documentation and are not included in this memorandum. The list below provides an index of the specifications provided as part of the design packages.

8.1 Grade Control Structure

01 4000	Quality Requirements
01 4200	References
01 7839	Project Record Documents
03 3001	Reinforced Concrete
31 0519	Geosynthetics
31 2000	Earth Moving
31 3700	Riprap/Streambed Stone
31 6223	Steel Sheet Pile
31 9219	Seeding

8.2 Stilling Basin

01 4000	Quality Requirements
01 4200	References
01 7839	Project Record Documents
31 0519	Geosynthetics
31 2000	Earth Moving
31 3700	Riprap
32 9219	Seeding

9. REFERENCES

DOE (U.S. Department of Energy), August 24, 2010. "Final Environmental Assessment for the Expansion of the Sanitary Effluent Reclamation Facility and Environmental Restoration of Reach S-2 of Sandia Canyon at Los Alamos National Laboratory, Los Alamos, New Mexico," U.S. Department of Energy document DOE/EA-1736, Los Alamos Site Office, Los Alamos, New Mexico. (DOE 2010, 206433)

LANL (Los Alamos National Laboratory), October 2009. "Investigation Report for Sandia Canyon," Los Alamos National Laboratory document LA-UR-09-6450, Los Alamos, New Mexico. (LANL 2009, 107453)

LANL (Los Alamos National Laboratory), May 2011. "Interim Measures Work Plan for Stabilization of the Sandia Canyon Wetland," Los Alamos National Laboratory document LA-UR-11-2186, Los Alamos, New Mexico. (LANL 2011, 203454)

Use of contents on this sheet is subject to the limitations specified at the beginning of this document.
Wetlands Design Memorandum_100%_.docx

LANL (Los Alamos National Laboratory), August 2011. "2011 Interim Facility-Wide Groundwater Monitoring Plan," Los Alamos National Laboratory document LA-UR-11-2183, Los Alamos, New Mexico. (LANL 2011, 205231)

LANL (Los Alamos National Laboratory), September 2011. "Phase II Investigation Work Plan for Upper Sandia Canyon Aggregate Area, Revision 1," Los Alamos National Laboratory document LA-UR-11-4912, Los Alamos, New Mexico. (LANL 2011, 206234)

NMED (New Mexico Environment Department), January 4, 2011. "Approval with Modification, Phase II Investigation Work Plan for Sandia Canyon," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M.J. Graham (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2011, 111518)

NMED (New Mexico Environment Department), June 9, 2011. "Approval with Modification, Interim Measures Work Plan for Stabilization of the Sandia Canyon Wetland," 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, 203806)

NMED (New Mexico Environment Department), September 13, 2011. "Approval with Modifications, Phase II Investigation Work Plan, Upper Sandia Canyon Aggregate Area," 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, 206390)

Use of contents on this sheet is subject to the limitations specified at the beginning of this document.
Wetlands Design Memorandum_100%_.docx

Appendix A: Hydrologic Calculations

Calc No.: Rev. No.:1 Page 1 of 13

Calc Title: Sandia Canyon Wetland Hydrology

Calculation Cover Sheet

1.0 INITIATION	
1.1 Calculation Status: ☐ Preliminary ☒ Final	
1.2 DP/DCP/DCF/ECN No.: NA	
1.3 Project ID No:	
1.4 Superseded Calc No.:	
1.5 Facility Name(s): NA	1.6 Organization: Brown and Caldwell
1.7 Structure/ System Name: Sandia Canyon Wetland Hydrology	1.8 Structure/ System Number: Sandia Canyon Wetland Hydrology
1.9 Management Level: ☐ ML-1 ☐ ML-2 ☒ ML-3 ☐ ML-4 ☐ SB Calculation ☐ N/A ; Explain:	1.10 Associated with Technical Baseline: ☐ Yes ☒ No
2.0 SECURITY CLASSIFICATION REVIEW	
2.1 Security Classification:	
2.2 DC/RO: *(Name, Z Number, Organization, Signature, Date)*	
3.0 CHECKING	
3.1 Checker (Note 1): *(Name, Z Number (if applicable), Organization, Signature, Date)*	
4.0 INDEPENDENT REVIEW	
4.1 Independent Review: ☐ Required ☐ Not Required	
4.2 Independent Reviewer: *(Name, Z Number (if applicable), Organization, Signature, Date)*	
5.0 DESIGN AUTHORITY REPRESENTATIVE REVIEW	
5.1 Design Authority Representative Review: ☒ Required ☐ Not Required	
5.2 Design Authority Representative: *(Name, Z Number, Organization, Signature, Date)*	

Note 1: Independent Reviewer can also be the calculation Checker if the scope of the independent review also includes the scope of calculation checking as described in Section 3.0 of the instructions.

Calc No.: CAL - XXXXXX

Calc Title: Sandia Canyon Wetland Hydrology

Calculation Cover Sheet

6.0 APPROVAL SIGNATURES

6.1 Preparer: *(Name, Z Number, Organization, Signature, Date)*

James A. O'Neill II, J. A. O'Neill II, 280079, Brown & Caldwell 3/8/2012

6.2 Subcontractor Approver: *(Name, Z Number (if applicable), Organization, Signature, Date)*

6.3 Responsible Manager: *(Name, Z Number, Organization, Signature, Date)*

7.0 REGISTERED PROFESSIONAL ENGINEER SEAL:

NEW MEXICO 18656 PROFESSIONAL ENGINEER
J. A. O'Neill II
3/8/2012

8.0 REVISION LOG

8.1 Rev.	8.2 Date	8.3 Description of Change(s)
0	Aug '11	Original Issue
1	Oct '11	90% Design Revision

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7.0	Calculation Inputs	3
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1.0 Purpose

To calculate peak discharges and storage volumes associated with the design of the Sandia Canyon Wetland. Peak discharges were determined for the 25-year, 2-hour rainfall event.

2.0 Methodology

Software: The U.S. Army Corps of Engineers HEC-HMS software program was used to determine peak discharges for the Sandia Canyon Wetland. Peak discharges were determined at two design points within the drainage basin: one point located upgradient of the proposed stilling basin and the other located at the existing stream gage E-123. Input into the HEC-HMS model is attached to this form.

Loss Method: The loss method used in the model was the National Resource Conservation Service (NRCS) curve number (CN) method. The majority of the contributing drainage areas are urbanized areas with a high degree of imperviousness. Therefore, a high CN was chosen for the drainage areas.

Time of Concentration: The times of concentration were determined using the TR-55 method for determining sheet flow and shallow concentrated flow. Time of concentration calculations are attached to this form. Supporting equations and tables from TR-55 are also attached to this form.

Precipation Data:

The most widely used public source of rainfall data is published by the National Oceanic and Atmospheric Administration (NOAA). However, LANL has also collected approximately 20 years of rainfall data at various rain gages within the LANL property boundary. LANL rainfall data was used for this analysis rather than NOAA data for the following reasons:

- The U.S. Geological Survey (USGS) recommends a minimum of 10 years of rainfall data for statistical analysis. LANL gage data spans a time period of 1990 to present and includes years of both above and below average precipitation. Therefore, the data set meets the minimum requirements for statistical analysis of rainfall data.
- NOAA data is typically based on regional rainfall values. However, because LANL is located just east of the Jemez mountain range, precipitation values vary greatly within a short distance. In addition, the NOAA precipitation data does not accurately present spatial variations in precipitation data within a large region.
- Site-specific, local data is a better indicator of actual site conditions.

Rainfall depths:

Data was analyzed for the two rain gages closest in location to the Sandia Canyon Wetland, rain gage TA-6 and TA-53. Rainfall gage data were analyzed to estimate a 2-hour rainfall depth for the Sandia Canyon Wetland. Gage TA-6 and TA-53 were analyzed separately using the Gumbel Extreme Value Type 1 statistical distribution. The analysis was done using a spreadsheet with no additional software. The greatest rainfall depth between TA-6 and TA-53 was chosen as the design depth

Storm distributions:

The six largest storm events within the twenty year data record were evaluated for both rain gages, giving a total of twelve actual storm events for the 2-hour storm. From those twelve

events, the distribution that produced the greatest peak discharge (the storm event with the greatest intensity) was used as the design distribution.

All relevant back-up materials are attached to this calcualtion form.

3.0 Acceptance Criteria

Per the LANL Engineering Standards Manual (Chapter 3, Section G20), hydrologic analysis for design of drainage features with in the LANL boundaries should use the rational method to computer peak flows from small drainage areas (<5 acres). However, the rational method was not used in this hydrologic analysis because of two reasons: (1.) the drainage area for the Sandia Canyon Wetland is larger than 5 acres and (2.) the use of real LANL precipitation data to generate the hydrograph was deemed more accurate for the analyses.

4.0 Open Items

There are no open items for hydrology.

5.0 Assumptions

- The drainage areas and flow paths were estimated using LANL topographic contour data.
- Assumed the most conservative (highest runoff producing) storm event from LANL rain gage TA-53 as the storm distribution for the HEC-HMS model.
- Assumed the most conservative (highest runoff producing) storm event from LANL rain gage TA-6 as the precipitation amount for the HEC-HMS model.

6.0 Limitations

Due to the uncertain nature of hydrology, all hydrologic analyses are inherent to a certain amount of error. Therefore, the calculations performed as part of the Sandia Canyon Wetland anlysis leaned towards the conservative (highest runoff producing) side when at all possible.

7.0 Calculation Inputs

HEC-HMS inputs are attached to this form.

8.0 Computer Hardware and Software

U.S. Army Corps of Engineers HEC-HMS software, Version 3.3

9.0 Summary and Conclusions

Preliminary hydrologic output is attached to this form.

10.0 References

HEC website: http://www.hec.usace.army.mil/software/hec-hms/

United States Department of Agriculture, Technical Release 55 - Urban Hydrology for Small Watersheds, June 1998.

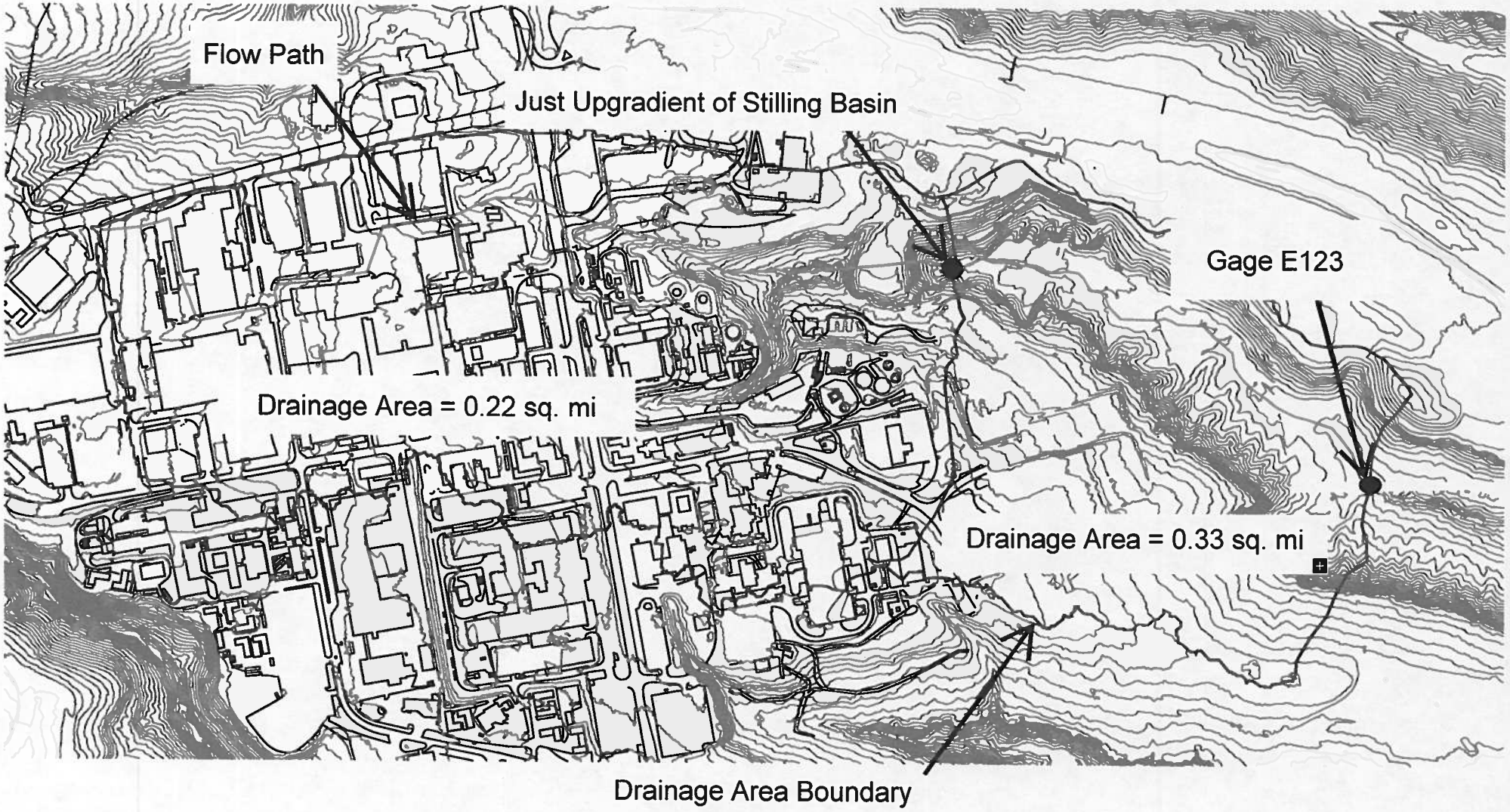
11.0 Calculation

- Calculation 1: HEC-HMS model output (spreadsheet format)

- Appendix – Supporting Information
  - Drainage Area Map

- HEC-HMS model input (spreadsheet format)
- Applicable TR-55 Equations
- LANL Rainfall data
- Rainfall Distribution

Sandia Canyon Wetland
Drainage Area Map
8/24/2011



Sandia Canyon Wetlands
Hydrologic Data
8/24/2011

HEC-HMS Input

	Soil Type	Descpt.	Soil Group	Cover	CN
DA1	NA	Impervious	NA	asphault/rock	98
DA2	162	Hackroy-Nyjack	D	grass cover	86
DA2	NA	Impervious	NA	asphault/rock	98

	Area (ft^2)	Area (mi^2)
DA1	6038460	0.2166
DA2	9313880	0.3341

	[5]Sheet Flow						[11]Storm Drain Flow			
	[6]n	[7]L (ft)	[8]P2 (in)	[9]S (ft/ft)	[10]Tt (hr)	Tt (min)	[12]L (ft)	[13]elev. (ft)	[14]S (ft/ft)	[15]v (ft/s)
DA1	0.011	300	1.39	0.050	0.051	3.07	3133	na	0.0125	2.5
DA2	0.011	300	1.39	0.050	0.051	3.07	3133	na	0.0125	2.5

Assumptions:

1.) CN generated based on land use and soil types within the drainage areas.
2.) S = (1000/CN) - 10
3.) Ia = 0.2 * S
4.) Drainage areas are mostly impervious (paved and/or gravel) landscape.
5.) Sheet flow travel time determined using TR-55 Sheet flow procedure
6.) Manning's n value for impervious area; n = 0.011 per TR-55, Table 3-1
7.) L = sheet flow travel length
8.) P2 = 2-year, 24-hour rainfall
9.) s = slope of hydraulic grade
10.) Tt = sheet flow travel time (TR-55 equation 3-3)
11.) Estimated Velocity of Storm Water in Storm Drain System
12.) L = shallow concentrated flow length
13.) elev = elevation drop along flow lenth

Sandia Canyon Wetlands
Hydrologic Data
8/24/2011

HEC-HMS Output

Storm	Basin	Peak (cfs)
100-yr, 2-hr	Stilling Basin	436.6
100-yr, 2-hr	Stabilization Structures	609.9
50-yr, 2-hr	Stilling Basin	398.02
50-yr, 2-hr	Stabilization Structures	555.7
25-yr, 2-hr	Stilling Basin	357.3
25-yr, 2-hr	Stabilization Structures	498.4
10-yr, 2-hr	Stilling Basin	303.7
10-yr, 2-hr	Stabilization Structures	422.9

Sandia Canyon Wetlands
Hydrologic Data
8/24/2011

LANL Rainfall Depths

TA-6 (2-hour)

EV1 Precipitation Statistics	
Recurrence	Precipitation
2.00	0.93
5.00	1.23
10.00	1.42
25.00	**1.67**
50.00	1.86
100.00	2.04

TA-6 (24-hour)

EV1 Precipitation Statistics	
Recurrence	Precipitation
2.00	1.39
5.00	1.84
10.00	2.13
25.00	2.50
50.00	2.78
100.00	**3.05**

TA-53 (2-hour)

EV1 Precipitation Statistics	
Recurrence	Precipitation
2.00	0.73
5.00	1.01
10.00	1.20
25.00	**1.43**
50.00	1.60
100.00	1.77

TA-53 (24-hour)

EV1 Precipitation Statistics	
Recurrence	Precipitation
2.00	1.20
5.00	1.56
10.00	1.80
25.00	2.10
50.00	2.32
100.00	**2.54**

2-hour Distribution

TA-53 Event #2, Aug. 2007

								100-year Storm	
Month	Day	Year	Hour	Minute	Prcp 15 min (in)	Event Time	Distribution	Cum. Prcp (in)	Inc. Prcp (in)
						0	0	0	0
9	20	2007	8	45	0.23	15	0.167883212	0.342481752	0.34248175
9	20	2007	9	0	0.3	30	0.386861314	0.78919708	0.44671533
9	20	2007	9	15	0.02	45	0.401459854	0.818978102	0.02978102
9	20	2007	9	30	0.82	60	1	2.04	1.2210219
9	20	2007	9	45	0	75	1	2.04	0
9	20	2007	10	0	0	90	1	2.04	0
9	20	2007	10	15	0	105	1	2.04	0
9	20	2007	10	30	0	120	1	2.04	0

Sheet flow

Sheet flow is flow over plane surfaces. It usually occurs in the headwater of streams. With sheet flow, the friction value (Manning's n) is an effective roughness coefficient that includes the effect of raindrop impact; drag over the plane surface; obstacles such as litter, crop ridges, and rocks; and erosion and transportation of sediment. These n values are for very shallow flow depths of about 0.1 foot or so. Table 3-1 gives Manning's n values for sheet flow for various surface conditions.

Table 3-1 Roughness coefficients (Manning's n) for sheet flow

Surface description	n [1]
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses [2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods:[3]	
Light underbrush	0.40
Dense underbrush	0.80

[1] The n values are a composite of information compiled by Engman (1986).
[2] Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
[3] When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

For sheet flow of less than 300 feet, use Manning's kinematic solution (Overtop and Meadows 1976) to compute T_t:

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}} \qquad \text{[eq. 3-3]}$$

where:

T_t = travel time (hr),
n = Manning's roughness coefficient (table 3-1)
L = flow length (ft)
P_2 = 2-year, 24-hour rainfall (in)
s = slope of hydraulic grade line (land slope, ft/ft)

This simplified form of the Manning's kinematic solution is based on the following: (1) shallow steady uniform flow, (2) constant intensity of rainfall excess (that part of a rain available for runoff), (3) rainfall duration of 24 hours, and (4) minor effect of infiltration on travel time. Rainfall depth can be obtained from appendix B.

Shallow concentrated flow

After a maximum of 300 feet, sheet flow usually becomes shallow concentrated flow. The average velocity for this flow can be determined from figure 3-1, in which average velocity is a function of watercourse slope and type of channel. For slopes less than 0.005 ft/ft, use equations given in appendix F for figure 3-1. Tillage can affect the direction of shallow concentrated flow. Flow may not always be directly down the watershed slope if tillage runs across the slope.

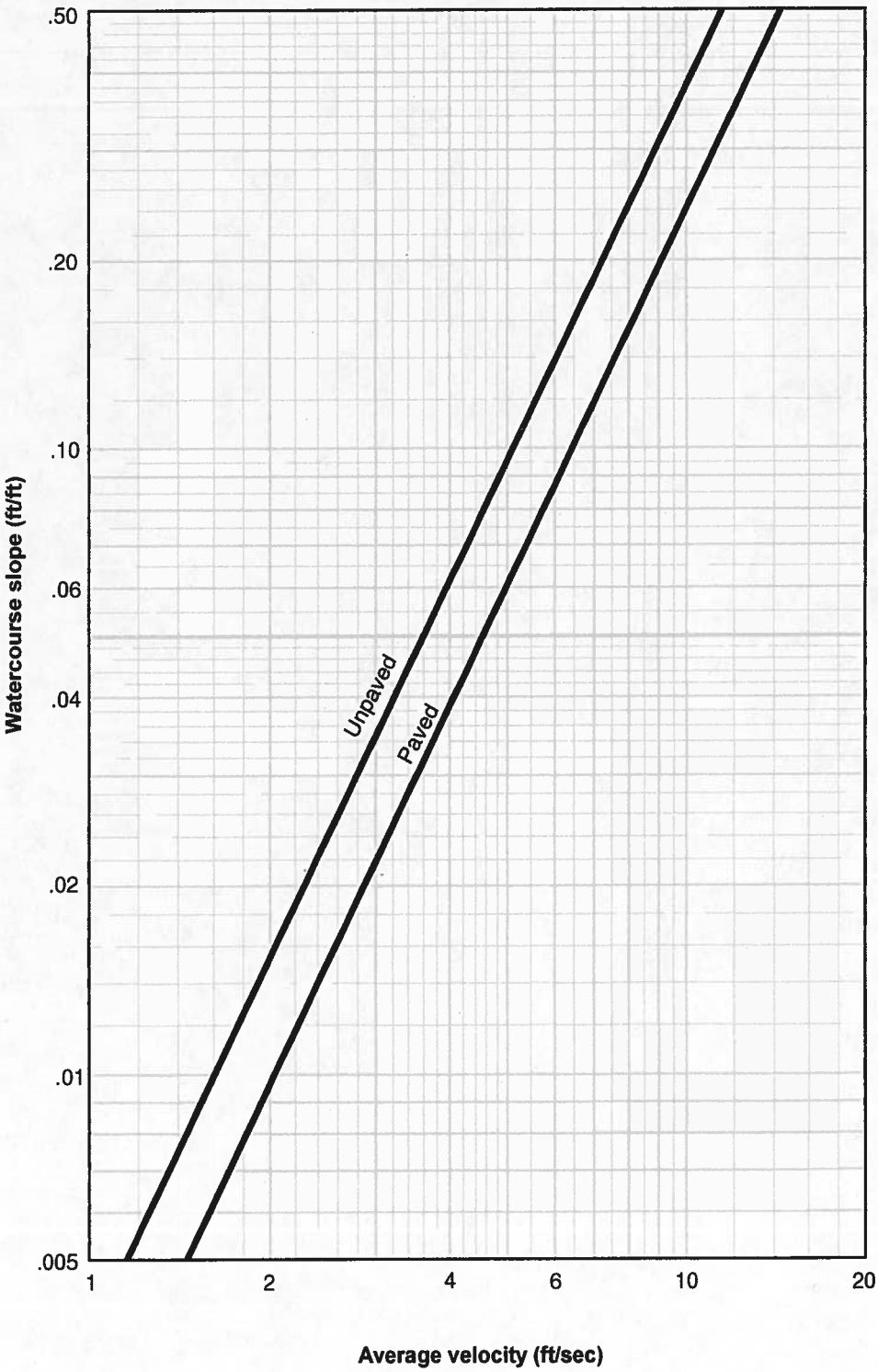
After determining average velocity in figure 3-1, use equation 3-1 to estimate travel time for the shallow concentrated flow segment.

Open channels

Open channels are assumed to begin where surveyed cross section information has been obtained, where channels are visible on aerial photographs, or where blue lines (indicating streams) appear on United States Geological Survey (USGS) quadrangle sheets. Manning's equation or water surface profile information can be used to estimate average flow velocity. Average flow velocity is usually determined for bankfull elevation.

ENV-RCRA-13-0065 ENCLOSURE 8 LAUR-13-20922

Figure 3-1 Average velocities for estimating travel time for shallow concentrated flow



Appendix B: Evapotranspiration and Inflow Calculations

Calc No.: Rev. No.:0 Page 1 of 14

Calc Title: Sandia Canyon Wetland ET and Inflow Calcs

Calculation Cover Sheet

1.0 INITIATION	
1.1 Calculation Status: ☐ Preliminary ☒ Final	
1.2 DP/DCP/DCF/ECN No.: NA	
1.3 Project ID No: 102698	
1.4 Superseded Calc No.:	
1.5 Facility Name(s): NA	1.6 Organization: Brown and Caldwell
1.7 Structure/ System Name: Sandia Canyon Wetland	1.8 Structure/ System Number: Sandia Canyon Wetland
1.9 Management Level: ☐ ML-1 ☐ ML-2 ☒ ML-3 ☐ ML-4 ☐ SB Calculation ☐ N/A ; Explain:	1.10 Associated with Technical Baseline: ☐ Yes ☒ No
2.0 SECURITY CLASSIFICATION REVIEW	
2.1 Security Classification:	
2.2 DC/RO: *(Name, Z Number, Organization, Signature, Date)*	
3.0 CHECKING	
3.1 Checker (Note 1): *(Name, Z Number (if applicable), Organization, Signature, Date)*	
4.0 INDEPENDENT REVIEW	
4.1 Independent Review: ☐ Required ☒ Not Required	
4.2 Independent Reviewer: *(Name, Z Number (if applicable), Organization, Signature, Date)*	
5.0 DESIGN AUTHORITY REPRESENTATIVE REVIEW	
5.1 Design Authority Representative Review: ☒ Required ☐ Not Required	
5.2 Design Authority Representative: *(Name, Z Number, Organization, Signature, Date)*	

Note 1: Independent Reviewer can also be the calculation Checker if the scope of the independent review also includes the scope of calculation checking as described in Section 3.0 of the instructions.

Calc No.:

Calc Title: Sandia Canyon Wetland ET and Inflow Calcs

Calculation Cover Sheet

6.0 APPROVAL SIGNATURES

6.1 Preparer: *(Name, Z Number, Organization, Signature, Date)*
James A. O'Neill II, 280079, Brown & Caldwell
J. A. O'Neill II 3/8/2012

6.2 Subcontractor Approver: *(Name, Z Number (if applicable), Organization, Signature, Date)*

6.3 Responsible Manager: *(Name, Z Number, Organization, Signature, Date)*

7.0 REGISTERED PROFESSIONAL ENGINEER SEAL:

JAMES A. O'NEILL II
NEW MEXICO
18656
PROFESSIONAL ENGINEER
J. A. O'Neill II
3/8/2012

8.0 REVISION LOG

8.1 Rev.	8.2 Date	8.3 Description of Change(s)
0	Oct 2011	Original Issue

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11.0	Calculation	4

1.0 Purpose

The purpose of these calculations is to determine the required SERF flow into the wetland to maintain a viable wetland during all periods of the year. The overall goal is to reduce SERF flow from the current 350K gpd to some much reduced flow.

2.0 Methodology

ET Calculation: The Penman-Monteith equation was used and a spreadsheet as developed based on a Food and Agriculture Organization of the United Nations (FAO) publication titled, *Crop Evapotranspiration – Guidelines for Computing Water Requirements.* The publication is freely available at the FAO website (URL: http://www.fao.org/docrep/X0490E/X0490E00.htm) which contains a complete explanation of the terms and values in the spreadsheet. A brief explanation of the model follows.

The Penman-Monteith equation was derived from site-specific, direct-measurement studies, and calibrated to calculate a reference evapotranspiration (ETo) for common vegetation types such as alfalfa or grass. The calculated ETo values can then be scaled to match the ET of various plants or crop types (ETc) using crop coefficients. Crop coefficients are available for most agricultural crops as well as non-agricultural vegetation, such as those found in wetland areas. In general, ET calculations relating to agricultural practices use the alfalfa ETo values, while ET calculations in non-agricultural settings use the grass ETo values. Grass ETo was used to calculate the wetland ET in this study.

The Penman-Montieth equation calculates ET on a daily basis and requires the following meteorological inputs in order to perform the ET calculations:

- Average, minimum, and maximum daily temperatures,
- Average daily vapor pressure,
- Daily net solar radiation, and
- Average daily wind speed.

Site details such as latitude, longitude, and elevation are also required inputs. Meteorological data was taken from the TA-06 weather station.

Required SERF Flow: The required SERF flow was calculated using precipitation data, ET modeling derived as noted above and an assumption of residual stormwater flow as follows:

- The current wetland area is approximately 3 acres. It was assumed for calculation purposes that the overall wetland area will eventually be increased to 4 acres.
- The ET model was run from 1996 through 2010 a total of 15 years to provide ET estimates of the drought years of 2000's.
- Once the area for calculations was determined the ET for each month from 2003 through 2010 was evaluated due to the drought during that seven year period (As noted by the TA-06 weather station) and the high monthly ET values observed in the modeling in June and July of those years (See Tables 1 and 2 attached).
- Precipitation from the TA-06 weather station was subtracted from the ET along with an addition 0.5 inches to make up for residual stormwater flow that drains to the wetland. This residual ET is depth of the required flow from SERF for the month.
- In months were the residual ET was less than zero it is assumed that no additional flow from SERF is required.
- The residual ET was then multiplied by the wetland area, converted to gallons, and divided by 30 days to give gallons per day (gpd).

All relevant back-up materials are attached to this calculation form.

3.0 Acceptance Criteria

There are no known acceptance criteria for the required reduction in SERF flow into the wetland. The goal was to reduce the flow as much as possible.

4.0 Open Items

There are no open items for the reductions of SERF flow into the wetland.

5.0 Assumptions

- The wetland area was estimated using GIS from the 2010 wetland delineation.
- Assumed that months with precipitation will have residual 0.5 inch depth of flow into the wetland through time unaccounted for by precipitation or ET. This flow will replenish soil moisture and be available for wetland vegetation, the remaining flow is assumed to pass through the wetland and be unavailable.
- Assumed the overall water balance does not include any leaching into deep groundwater due to impervious bedrock underlying the wetland.

6.0 Limitations

Due to the uncertain nature of hydrology and evapotranspiration, all analyses contain a certain amount of error. Therefore, the calculations performed as part of the Sandia Canyon Wetland analysis leaned towards the conservative side when at all possible.

7.0 Calculation Inputs

Inputs from the TA-06 rain gage are not shown. The front page of the spreadsheet model is shown below and contains the general inputs to the model.

8.0 Computer Hardware and Software

MS Window and Excel

9.0 Summary and Conclusions

The overall flow from SERF can be reduced from 350K gpd to approximately 30K for the driest months of the year (June/July). Additional savings in flow can be realized during the remaining months including the potential of reducing the flow to zero during the winter months (October through March).

10.0 References

Crop Evapotranspiration – Guidelines for Computing Crop Water Requirements. The publication is freely available at the FAO website (URL: http://www.fao.org/docrep/X0490E/X0490E00.htm)

11.0 Calculation

- Calculation 1: ET Model Explaination

- Tables
  - Table 1 – Monthly ET Calculations for years 1996 to 2010
  - Table 2 – Maximum 30 day ET for years 1996 to 2010
  - Table 3 – Drought conditions for Gage TA-06 for years 2003 through 2011
  - Table 4 – Monthly Flow from SERF (gpd) April through September for years 2003 through 2011
  - Model Input
  - Hand Calculations of Flow rates

Wetland ET Model Explanation

Water consumption by wetland vegetation occurs through two mechanisms, evaporation from open water surfaces and transpiration through wetland vegetation. Both of these mechanisms occur simultaneously, but at varying rates. Therefore, it is difficult to isolate the losses attributed to each mechanism alone. As a result, losses from evaporation and transpiration are frequently expressed as a single combined term referred to as evapotranspiration (ET)

Evapotranspiration amounts can be determined using a number of approaches. There are several methods for measuring ET directly, but they all require the installation of specialized instrumentation. Alternatively, there are empirical equations that have been developed that rely only on meteorological input to calculate ET. Wetland ET calculations were performed for the Sandia Canyon wetland using the Penman-Monteith equation. The Penman-Monteith equation was derived from site-specific, direct-measurement studies, and calibrated to calculate a reference ET (ETo) for common vegetation types such as alfalfa or grass. The calculated ETo values can then be scaled to match the ET of various plants or crop types (ETc) using crop coefficients. Crop coefficients are available for most agricultural crops as well as non-agricultural vegetation, such as those found in wetland areas. In general, ET calculations relating to agricultural practices use the alfalfa ETo values, while ET calculations in non-agricultural settings use the grass ETo values. Grass ETo was used to calculate the wetland ET in this study.

The Penman-Montieth equation calculates ET on a daily basis and requires the following meteorological inputs in order to perform the ET calculations:

- Average, minimum, and maximum daily temperatures,
- Average daily vapor pressure,
- Daily net solar radiation, and
- Average daily wind speed.

Site details such as latitude, longitude, and elevation are also required inputs.

To calculate the wetland ET for this study, an MS Excel spreadsheet was programmed to run the daily Penman-Monteith equation. The spreadsheet was developed based on a Food and Agriculture Organization of the United Nations (FAO) publication titled, *Crop Evapotranspiration – Guidelines for Computing Crop Water Requirements.* The publication is freely available at the FAO website (URL: http://www.fao.org/docrep/X0490E/X0490E00.htm) and contains a complete explanation of the terms and values in the spreadsheet can be found in the FAO article.

To calculate the ET for the Sandia Wetlands site, meteorological data from was obtained from the TA6 weather station maintained by LANL. The spreadsheet was set up to calculate ET on a daily basis for 15 years (1996-2010). This period is representative of drought conditions, wetter than average conditions, and average conditions. A crop coefficient representative of wetlands consisting of cattails and bulrushes was chosen. This crop coefficient also accounts for annual period of frost or freezing.

Based on those inputs, the 15 year average ETc for the Sandia site was 31.9 inches (See Table 1). The highest ETc over a period of 30 consecutive days during the period was 11.3 inches (See Table 2). The maximum daily ETc was 0.5 inches. For months when maximum daily temperatures were consistently below 32 °F, there was little to no ETc calculated. The majority of the ETc occurred between May and September.

Table 1

Monthly ETc Values (in inches) for Sandia Wetland Site, Los Alamos National Laboratory, Los Alamos, NM

Years	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total
1996	0.00	0.00	0.00	0.07	4.68	8.66	7.43	7.17	1.82	0.00	0.00	0.00	29.84
1997	0.00	0.00	0.00	0.00	2.87	8.15	8.42	6.74	1.90	0.00	0.00	0.00	28.07
1998	0.00	0.00	0.00	0.00	4.19	10.51	7.44	6.94	2.58	0.00	0.00	0.00	31.66
1999	0.00	0.00	0.00	0.00	3.06	8.57	7.60	6.82	2.13	0.00	0.00	0.00	28.18
2000	0.00	0.00	0.00	0.03	2.27	9.70	8.66	8.07	2.91	0.00	0.00	0.00	31.63
2001	0.00	0.00	0.00	0.00	3.68	9.54	8.49	6.87	2.49	0.00	0.00	0.00	31.08
2002	0.00	0.00	0.00	0.00	4.06	10.42	8.41	9.13	2.01	0.00	0.00	0.00	34.04
2003	0.00	0.00	0.00	0.00	3.66	9.85	10.27	7.65	2.18	0.00	0.00	0.00	33.60
2004	0.00	0.00	0.00	0.04	4.51	9.84	9.19	7.79	2.31	0.00	0.00	0.00	33.67
2005	0.00	0.00	0.00	0.00	3.60	10.18	10.81	7.19	2.04	0.00	0.00	0.00	33.81
2006	0.00	0.00	0.00	0.00	4.28	10.03	8.60	6.20	1.76	0.00	0.00	0.00	30.88
2007	0.00	0.00	0.00	0.00	3.26	9.26	9.13	8.82	2.16	0.00	0.00	0.00	32.63
2008	0.00	0.00	0.00	0.11	3.87	10.87	8.67	7.69	2.26	0.00	0.00	0.00	33.47
2009	0.00	0.00	0.00	0.00	3.27	8.10	9.50	7.47	2.20	0.00	0.00	0.00	30.54
2010	0.00	0.00	0.00	0.00	4.19	10.92	8.96	8.18	2.96	0.00	0.00	0.00	35.21
Average	0.00	0.00	0.00	0.02	3.70	9.64	8.77	7.52	2.25	0.00	0.00	0.00	31.89

Table 2

Annual 30-Day Maxium ETc Values (inches)

Years	30-Day Max ETc (inches)	Start Date	End Date
1996	8.85	5/27/1996	6/26/1996
1997	9.48	6/18/1997	7/18/1997
1998	10.51	5/31/1998	6/30/1998
1999	8.77	6/3/1999	7/3/1999
2000	9.62	6/10/2000	7/10/2000
2001	9.74	6/8/2001	7/8/2001
2002	10.40	6/2/2002	7/2/2002
2003	10.96	6/22/2003	7/22/2003
2004	10.35	6/8/2004	7/8/2004
2005	11.32	6/20/2005	7/20/2005
2006	9.92	6/5/2006	7/5/2006
2007	9.97	6/17/2007	7/17/2007
2008	10.70	6/2/2008	7/2/2008
2009	8.96	6/16/2009	7/16/2009
2010	11.18	6/6/2010	7/6/2010
Average	10.05	6/9/2003	7/9/2003

Table 3
Estimate of Drought Conditions at Sandia Wetlands
J. Winters
9/28/2011

** Data from LANL Weather Machine TA-6 Tower: http://environweb.lanl.gov/weathermachine/default.asp*

	Avg 71-00	Avg 81-10	2003	2004	2005	2006	2007	2008	2009	2010	2011	# <	50% Avg.	# < 50%
Jan	0.96	0.95	0.00	0.41	2.63	0.15	1.06	1.39	0.26	1.32	0.01	5	0.48	5
Feb	0.75	0.86	0.88	2.22	2.11	0.02	0.54	1.11	0.02	1.23	0.04	4	0.43	3
March	1.28	1.20	0.63	0.85	1.91	0.63	1.23	0.46	1.18	1.00	0.16	7	0.60	2
Apr	1.05	1.06	0.49	3.08	1.45	0.51	0.62	0.13	1.31	1.43	0.47	5	0.53	4
May	1.43	1.39	1.35	0.02	0.92	0.22	1.70	1.66	2.14	1.10	0.18	1	0.70	3
June	1.44	1.51	0.71	0.75	0.26	1.78	1.28	0.04	2.67	0.59	0.00	7	0.76	6
July	2.97	2.82	0.26	3.13	1.63	2.26	1.93	2.59	4.01	4.10	0.77	6	1.41	2
Aug	3.33	3.61	2.78	1.83	5.76	5.85	2.93	6.01	1.66	3.43	4.98	5	1.81	1
Sept	2.08	2.01	0.84	1.63	3.44	1.36	4.18	0.33	1.95	1.32	?	6	1.01	2
Oct	1.54	1.55	0.90	2.50	1.11	1.73	0.32	1.43	1.87	2.09	?	4	0.78	1
Nov	1.19	0.98	0.78	1.47	0.07	0.47	1.61	0.60	0.26	0.03	?	6	0.49	4
Dec	0.92	1.01	0.31	0.89	1.19	1.62	2.74	1.63	1.27	1.18	?	2	0.51	1
Totals		18.95	9.93	18.78	22.48	16.6	20.14	17.38	18.6	18.82	6.61	58		34

* highlighed months are less than avg. rainfall
* red text months are less than 50% avg. rainfall

Total Mo.	116	Total Months Analyzed
Drt Mo	58	Total Months with rainfall < average
% Drt Mo.	50	% of Drought Months of Total Months Analyzed
Max Cons Mo.	11	Maximum Consecutive Months of Drought
Min Cons Mo.	1	Minimum Consecutive Months of Drought
% >1 Cons. Mo	79	% Drought Months that were followed by at least one additional month
50% Drt Mo	34	Total Months with rainfall < 50% of average
% 50% Drt Mo	29	% of Months w/ rainfall <50% of Average of Total Months Analyzed
Max Cons. Mo.	7	Maximum Consecutive Months w/ rainfall <50% of Average
Min Cons Mo.	1	Minimum Consecutive Months w/ rainfall <50% of Average
% >1 Cons. Mo	62	% Drought Months that were followed by at least one additional month

Table 4

Monthly Flow from SERF (GPD) for Sandia Wetland Site, Los Alamos National Laboratory, Los Alamos, NM

Wetland Size 4 acres

	April				May				June				July				August				September			
Years	ET	P	Delta	Flow	ET	P	Delta	Flow	ET	P	Delta	Flow	ET	P	Delta	Flow	ET	P	Delta	Flow	ET	P	Delta	Flow
2003	0.00	0.49	0.00	0.00	3.66	1.35	2.31	6,548.66	9.85	0.71	9.14	31,293.76	10.27	0.26	10.01	34,416.85	7.65	2.78	4.87	15,811.50	2.18	0.84	1.34	3,033.61
2004	0.04	3.08	0.00	0.00	4.51	0.02	4.49	14,454.13	9.84	0.75	9.09	31,085.63	9.19	3.13	6.06	20,118.45	7.79	1.83	5.96	19,754.49	2.31	1.63	0.68	666.09
2005	0.00	1.45	0.00	0.00	3.60	0.92	2.68	7,882.77	10.18	0.26	9.92	34,087.10	10.81	1.63	9.18	31,430.40	7.19	5.76	1.43	3,368.38	2.04	3.44	0.00	0.00
2006	0.00	0.51	0.00	0.00	4.28	0.22	4.06	12,895.29	10.03	1.78	8.25	28,057.10	8.60	2.26	6.34	21,149.77	6.20	5.85	0.35	0.00	1.76	1.36	0.40	0.00
2007	0.00	0.62	0.00	0.00	3.26	1.70	1.56	3,828.41	9.26	1.28	7.98	27,072.35	9.13	1.93	7.20	24,270.38	8.82	2.93	5.89	19,530.16	2.16	4.18	0.00	0.00
2008	0.11	0.13	0.00	0.00	3.87	1.66	2.21	6,175.72	10.87	0.04	10.83	37,409.59	8.67	2.59	6.08	20,218.28	7.69	6.01	1.68	4,265.52	2.26	0.33	1.93	5,161.96
2009	0.00	1.31	0.00	0.00	3.27	2.14	1.13	2,277.55	8.10	2.67	5.43	17,854.45	9.50	4.01	5.49	18,054.43	7.47	1.66	5.81	19,223.90	2.20	1.95	0.25	0.00
2010	0.00	1.43	0.00	0.00	4.19	1.10	3.09	9,388.25	10.92	0.59	10.33	35,571.74	8.96	4.10	4.86	15,776.88	8.18	3.43	4.75	15,397.25	2.96	1.32	1.64	4,138.23
Average	0.02		0.00	0.00	3.70		2.69	7,931.35	9.64		8.87	30,303.97	8.77		6.90	23,179.43	7.52		3.84	12,168.90	2.25		0.78	1,624.99

Flow= Required flow in gallons per day from SERF to meet demands of ET-P-0.5 inches of additional stormwater runoff

Model Input

Location Parameters			
Site Location	Latitude (Dec Deg)	Longitude (Dec Deg)	Elevation (m)
LANL - TA6	35.861417	-106.319	2263.4

Crop Parameters								
Crop:	Open Water, < 2m deep							
Crop Coefficients			FAO Growth Stage Length (days)				Start of Growth Period (Ordinal Day)	Average ETc (mm /year)
Kc1	Kc2	Kc3	Stage 1	Stage 2	Stage 3	Stage 4		
1.05	1.05	1.05	10	30	80	20	121	853.38
FAO Growing Season								

Constants		
Stefan-Boltzman Const. σ (MJ/(m²*d*K⁴))	Atmospheric Pressure (kPa)	Psychrometric Constant γ (kPa/°C)
4.901E-09	77.25487678	0.051374493

Date	Month	Year	Ordinal Day	Net Radiation R_n (MJ/m²/d)	Net Short Wave Radiation R_{ns} (MJ/m²/d)	Net Long Wave Radiation R_{nl} (MJ/m²/d)	Cloudiness Function fcd	Clear-Sky Solar Radiation Rso (MJ/m²/d)	Inverse Reletive Dist. Factor for Earth-Sun dr	Solar Declination sd (Radians)	Sunset Hour Angle ws	Extraterrestial Radiation Ra (MJ/m²/d)	Soil heat flux density G (MJ/m²/d)	Slope of Saturation Vapor Pressure Δ (kPa/°C)	Saturation Vapour Pressure at Max Temp e0(Tmax) (kPa)	Saturation Vapour Pressure At Min Temp e0(Tmin) (kPa)	Mean Saturation Vapor Pressure es (kPa)	Actual Vapor Pressure of Air ea (kPa)	Wind Speed At The 2m u2 (m/s)	Mean Daily Air Temperature T (°C)	Penman-Monteith Grass Reference ETO (mm/day)	Penman-Monteith Alfalfa Reference Etr (mm/day)	Kc	Etc (mm/day)
1/4/1996	1	1996	4	3.073168138	9.0552	5.982031862	0.854630295	13.17914722	1.032921929	-0.396325995	1.26349037	16.57195715	0	0.04007077	0.813261096	0.355803438	0.584532267	0.31082	1.9	-1.6	1.114005374	0.070095153	0	0
1/5/1996	1	1996	5	2.720008858	8.47	5.749991142	0.772194781	13.23299685	1.032878041	-0.394529772	1.265089536	16.63966971	0	0.04459256	0.89696939	0.41167714	0.654323265	0.23547	1.8	0.05	1.390443594	0.073181282	0	0
1/6/1996	1	1996	6	3.219013063	10.0562	6.837186937	0.976609933	13.29026684	1.032824427	-0.392616834	1.2667891	16.71168315	0	0.03363447	0.656709164	0.297244334	0.476976749	0.23209	1.4	-4.25	0.942391905	0.080183199	0	0
1/7/1996	1	1996	7	3.019579083	9.9099	6.890320917	0.951369002	13.35094041	1.032761102	-0.390587747	1.268587929	16.7879764	0	0.03865407	0.866240546	0.304361284	0.585300915	0.23014	1.5	-2.15	1.192173837	0.081755492	0	0
1/8/1996	1	1996	8	2.853494388	10.4489	7.595405612	1	13.41499961	1.032688086	-0.388443112	1.270484838	16.86852684	0	0.04488017	1.072768826	0.342267551	0.707518188	0.20653	1.7	0.15	1.559488159	0.081409122	0	0
1/9/1996	1	1996	9	2.465265272	10.4027	7.937434728	1	13.48242524	1.032605399	-0.386183562	1.272478587	16.95331038	0	0.05496643	1.269716891	0.46114662	0.865431756	0.20938	1.7	3.35	1.778139377	0.086903479	0	0
1/10/1996	1	1996	10	2.901885859	8.4084	5.506514141	0.737713853	13.55319688	1.032513066	-0.383809767	1.274567889	17.04230131	0	0.05065621	1.140327698	0.427616873	0.783972285	0.29078	2.2	2.05	1.725570897	0.074991558	0	0
1/11/1996	1	1996	11	3.180614323	10.1255	6.944885677	0.952716553	13.62729288	1.032411115	-0.381322428	1.27675141	17.13547241	0	0.04193837	0.928655184	0.342267551	0.635461368	0.25225	1.5	-0.9	1.272661201	0.092977271	0	0
1/12/1996	1	1996	12	2.993610582	10.395	7.401389418	0.979836693	13.70469028	1.032299576	-0.378722281	1.279027771	17.23279483	0	0.05548344	1.236215522	0.485983346	0.861099434	0.30893	1.8	3.5	1.69176463	0.099504302	0	0
1/13/1996	1	1996	13	3.086000668	10.5413	7.455299332	0.990660922	13.78536488	1.032178482	-0.376010096	1.281395554	17.33423812	0	0.05548344	1.269716891	0.471649743	0.870683317	0.31762	1.5	3.5	1.567611944	0.118339934	0	0
1/14/1996	1	1996	14	3.095266498	9.1322	6.036933502	0.804420929	13.86929117	1.032047868	-0.373186675	1.283853301	17.43977021	0	0.05277356	1.219758202	0.437441181	0.828599692	0.29981	1.4	2.7	1.483649864	0.119485577	0	0
1/15/1996	1	1996	15	3.044924499	8.7318	5.686875501	0.746912784	13.95644232	1.031907773	-0.370252853	1.28639952	17.54935735	0	0.05049641	1.102347112	0.440760123	0.771553617	0.24908	1.3	2	1.420247654	0.119671697	0	0
1/16/1996	1	1996	16	3.403447045	9.7328	6.329352955	0.864797102	14.04679018	1.031758239	-0.367209498	1.289032688	17.66296416	0	0.05394481	1.124999495	0.504442066	0.814720781	0.36064	2	3.05	1.6186461	0.099648699	0	0
1/17/1996	1	1996	17	3.744703706	8.9012	5.156496294	0.753653684	14.14030527	1.031599309	-0.364057511	1.291751249	17.78055356	0	0.04359836	0.779549661	0.454260186	0.616904923	0.39897	5.6	-0.3	1.418858933	0.035164151	0	0
1/18/1996	1	1996	18	4.132481042	11.0187	6.886218958	1	14.23695675	1.031431032	-0.360797823	1.294553624	17.90208678	0	0.02801498	0.485983346	0.268083735	0.37703354	0.18726	2	-6.95	0.990149935	0.063193776	0	0
1/19/1996	1	1996	19	3.563901597	7.0917	3.527798403	0.517249034	14.33671243	1.031253456	-0.3574314	1.297438208	18.02752334	0	0.03352217	0.747077546	0.255505095	0.50129132	0.28533	2.8	-4.3	1.141925281	0.048381641	0	0
1/20/1996	1	1996	20	4.093475304	11.3036	7.210124696	1	14.43953875	1.031066635	-0.353959237	1.300403378	18.15682103	0	0.03307619	0.633386994	0.297244334	0.465315664	0.17281	3.9	-4.5	1.649644184	0.041045684	0	0
1/21/1996	1	1996	21	3.728076743	9.1784	5.450323257	0.756329091	14.54540076	1.030870623	-0.350382361	1.303447489	18.28993592	0	0.03431512	0.768589883	0.261727197	0.51515854	0.19136	2.2	-3.95	1.40687078	0.064663369	0	0
1/22/1996	1	1996	22	4.075567892	11.396	7.320432108	1	14.65426213	1.030665478	-0.346701831	1.306568883	18.42682232	0	0.04193837	0.836443783	0.384308777	0.61037628	0.24132	3.6	-0.9	1.891855765	0.055870894	0	0
1/23/1996	1	1996	23	4.191384007	11.3498	7.158415993	0.997615145	14.76608516	1.030451262	-0.342918734	1.309765888	18.56743281	0	0.03187609	0.547252072	0.31905105	0.433151561	0.16548	5.4	-5.05	1.711550521	0.030092258	0	0
1/24/1996	1	1996	24	4.339235182	11.4653	7.126064818	1	14.88083073	1.030228037	-0.339034192	1.313036824	18.71171822	0	0.0321996	0.741783242	0.233801282	0.487792262	0.18725	2.5	-4.9	1.466377603	0.062886024	0	0
1/25/1996	1	1996	25	4.063010791	10.2949	6.231889209	0.853423685	14.99845833	1.02999587	-0.335049351	1.316380001	18.85962761	0	0.04234818	0.903229187	0.361349474	0.632289331	0.25202	4.3	-0.75	2.060634449	0.048208504	0	0
1/26/1996	1	1996	26	5.090051095	11.9966	6.906548905	1	15.11892607	1.029754829	-0.330965393	1.319793724	19.01110829	0	0.02258178	0.421176492	0.188888277	0.305032384	0.11077	3.2	-10.05	1.202959036	0.041226692	0	0
1/27/1996	1	1996	27	4.381776395	11.1265	6.744723605	0.929835717	15.24219065	1.029504985	-0.326783524	1.323276296	19.16610583	0	0.02744393	0.690634388	0.172327449	0.431480918	0.10782	1.9	-7.25	1.393300562	0.069343345	0	0
1/28/1996	1	1996	28	4.495031829	11.8811	7.386068171	1	15.36820738	1.029246413	-0.322504981	1.326826018	19.32456402	0	0.04531459	0.854211366	0.450851266	0.652531316	0.25662	4.4	0.3	2.177049105	0.055600585	0	0
1/29/1996	1	1996	29	3.855667844	8.932	5.076332156	0.660522717	15.4969302	1.028979189	-0.318131031	1.330441195	19.48642495	0	0.04739001	1.015700692	0.414822261	0.715261477	0.20435	1.7	1	1.721307976	0.114343647	0	0
1/30/1996	1	1996	30	4.373490764	10.7184	6.344909236	0.85243315	15.62831165	1.028703392	-0.313662968	1.334120133	19.65162894	0	0.05377613	1.195433435	0.468125395	0.831779415	0.32469	2.8	3	2.166835096	0.095706484	0	0
1/31/1996	1	1996	31	4.20073675	8.2467	4.04596325	0.567283475	15.76230292	1.028419103	-0.309102113	1.337861144	19.82011462	0	0.05479502	0.954709881	0.624265107	0.789487494	0.42302	5.6	3.3	2.143945658	0.050538475	0	0
2/1/1996	2	1996	32	3.872139193	5.8982	2.026060807	0.300424245	15.89885384	1.028126408	-0.304449815	1.341662548	19.9918189	0	0.0367919	0.884564423	0.263830983	0.574197703	0.35531	3	-2.9	1.213200895	0.053974287	0	0
2/2/1996	2	1996	33	4.503323266	7.8771	3.373776734	0.511115788	16.03791289	1.027825391	-0.299707451	1.345522675	20.16667701	0	0.02688299	0.628811428	0.18270887	0.405760149	0.25606	2.7	-7.55	0.955188168	0.050354292	0	0
2/3/1996	2	1996	34	5.315651609	12.2199	6.904248391	0.974181609	16.17942725	1.027516143	-0.294876424	1.349439865	20.3446225	0	0.02763315	0.508207422	0.247413804	0.377810613	0.13651	3.3	-7.15	1.452039966	0.051200154	0	0
2/4/1996	2	1996	35	5.603115769	12.9514	7.348284231	1	16.32334276	1.027198754	-0.289958162	1.353412468	20.5255873	0	0.03092235	0.752405183	0.208559871	0.480482527	0.12548	1.6	-5.5	1.531772562	0.114848671	0	0
2/5/1996	2	1996	36	5.213527346	12.0505	6.836972654	0.932817729	16.469604	1.02687332	-0.284954122	1.357438853	20.7095017	0	0.04830419	1.102347112	0.396266541	0.749306826	0.30646	1.5	1.3	1.705763325	0.172148916	0	0
2/6/1996	2	1996	37	5.321161453	12.8359	7.514738547	1	16.61815426	1.026539935	-0.279865783	1.361517399	20.89629441	0	0.06164073	1.348027971	0.567751891	0.957889931	0.37183	1.9	5.2	2.181146244	0.182444868	0	0
2/7/1996	2	1996	38	4.981190759	10.5875	5.606309241	0.756957555	16.76893564	1.026198699	-0.27469465	1.365646506	21.0858926	0	0.05652998	1.236215522	0.508207422	0.872211472	0.35966	1.7	3.8	1.892713393	0.172391776	0	0
2/8/1996	2	1996	39	5.339977527	12.1891	6.849122473	0.912890924	16.92188897	1.025849713	-0.269442254	1.369824588	21.2782219	0	0.06613019	1.537413793	0.580375263	1.058894528	0.4146	2	6.35	2.344279933	0.187877441	0	0
2/9/1996	2	1996	40	5.686911436	13.2671	7.580188564	1	17.07695396	1.025493079	-0.264110148	1.374050079	21.47320646	0	0.06613019	1.640576439	0.539237347	1.089906893	0.39381	1.7	6.35	2.373023536	0.228214065	0	0
2/10/1996	2	1996	41	5.311455001	12.1352	6.823744999	0.884531431	17.23406911	1.025128904	-0.258699909	1.378321433	21.67076899	0	0.07025873	1.716356408	0.59324626	1.154801334	0.38552	2.2	7.35	2.695088767	0.184281223	0	0
2/11/1996	2	1996	42	5.481534119	10.5798	5.098265881	0.716452982	17.39317187	1.024757294	-0.253213139	1.382637124	21.8708308	0	0.04619427	1.015700692	0.39024703	0.702973861	0.34636	2.1	0.6	1.712266635	0.130238171	0	0
2/12/1996	2	1996	43	5.494992202	11.858	6.363007798	0.834332052	17.55419856	1.024378361	-0.247651459	1.386995647	22.07331184	0	0.05958762	1.321465499	0.53526908	0.92836729	0.32325	1.9	4.65	2.254974852	0.182634831	0	0
2/13/1996	2	1996	44	6.035832138	12.8667	6.830867862	0.92326254	17.71708448	1.023992216	-0.242016517	1.391395518	22.27813075	0	0.06070011	1.430551404	0.511997642	0.971274523	0.40146	1.8	4.95	2.230420109	0.212280297	0	0
2/14/1996	2	1996	45	6.19880924	13.8908	7.69199076	1	17.88176395	1.023598973	-0.236309978	1.395835278	22.48520493	0	0.0675509	1.683511528	0.551298824	1.117405176	0.37233	2	6.7	2.711420285	0.22234006	0	0
2/15/1996	2	1996	46	6.41224241	14.1603	7.74805759	1	18.04817031	1.023198749	-0.230533531	1.400313487	22.69445057	0	0.06532989	1.629993941	0.527410004	1.078701973	0.33944	2.2	6.15	2.838216926	0.205961785	0	0

Brown AND Caldwell

Date Checked	Checked By	Job Number	By	Date	Calc. No.	Sheet No.
			Jim O	10/10/2011		1

Project	Subject
Sandia wetland	Water demand

References/Notes

wetland ⇒ ~3.0 Acres → from G.I.S

assume wetland will be expanded over time ⇒ 4.0 Acres

4 acres = 174,240 SF

Modeling using Penman-Montcith ET equations: (1996-2010)

Max Annual ET = 35.21 inches
Average Annual ET = 31.24 inches
Max 30 day ET = 11.18 inches
Average Max 30 day ET = 10.05 inches

Current Cooling water flow = 350,000 gpd 2011 Average
what percentage can be cut to meet recycling requirement?

To meet max 30 day Et:

$\frac{11.18''}{12} = 0.9317$ ft Et

Volume = wetland Area · Et depth

= 174,240 · 0.9317
= 162,333 CF per 30-day
= 1,214,255 gal per 30-days
= 40,475 gpd

To meet average max 30 day Et

$\frac{10.05}{12} = 0.8375'$ ET

Volume = wetland Area · Et depth

= 174240 · 0.8375
= 145,926 CF per 30-day
= 1,091,526 gal per 30-day
= 36,384 gpd

Numbers above assume NO flow into wetland by stormwater and NO reduced need from precipitation.

#1580-1/8"sq.

Brown AND Caldwell

Date Checked	Checked By	Job Number	By	Date	Calc. No.	Sheet No.
						2

Project	Subject

References/Notes

Loss #'s also assume that no losses occur into deep groundwater based on bedrock imperviousness as demonstrated by previous lab studies.

Assuming average rainfall in June will provide stormwater flow and reduced Et equal to the average rainfall plus 0.5"

Max 30-day Et = 11.18 - 1.51 - 0.5 = 9.17"

flow = 33,198 gpd

Avg_Max 30-day Et = 10.05 - 1.51 - 0.5 = 8.04"

flow = 29,107 gpd

21580-1/8"sq.

Appendix C: Hydraulic Calculations

Calc No.: Rev. No.:1 Page 1 of 11

Calc Title: Sandia Wetland Hydraulics

Calculation Cover Sheet

1.0 INITIATION	
1.1 Calculation Status: ☐ Preliminary ☒ Final	
1.2 DP/DCP/DCF/ECN No.:	
1.3 Project ID No: 102698	
1.4 Superseded Calc No.:	
1.5 Facility Name(s): NA	1.6 Organization: Brown and Caldwell
1.7 Structure/ System Name: Sandia Wetland	1.8 Structure/ System Number:
1.9 Management Level: ☐ ML-1 ☐ ML-2 ☒ ML-3 ☐ ML-4 ☐ SB Calculation ☐ N/A ; Explain:	1.10 Associated with Technical Baseline: ☐ Yes ☒ No
2.0 SECURITY CLASSIFICATION REVIEW	
2.1 Security Classification:	
2.2 DC/RO: *(Name, Z Number, Organization, Signature, Date)*	
3.0 CHECKING	
3.1 Checker (Note 1): *(Name, Z Number (if applicable), Organization, Signature, Date)*	
4.0 INDEPENDENT REVIEW	
4.1 Independent Review: ☒ Required ☐ Not Required	
4.2 Independent Reviewer: *(Name, Z Number (if applicable), Organization, Signature, Date)*	
5.0 DESIGN AUTHORITY REPRESENTATIVE REVIEW	
5.1 Design Authority Representative Review: ☒ Required ☐ Not Required	
5.2 Design Authority Representative: *(Name, Z Number, Organization, Signature, Date)*	

Note 1: Independent Reviewer can also be the calculation Checker if the scope of the independent review also includes the scope of calculation checking as described in Section 3.0 of the instructions.

Calc No.:

Calc Title: Sandia Wetland Hydraulics

Calculation Cover Sheet

6.0 APPROVAL SIGNATURES

6.1 Preparer: *(Name, Z Number, Organization, Signature, Date)*
James A. O'Neill II, 280079 Brown & Caldwell
J. A. O'Neill II 3/8/2012

6.2 Subcontractor Approver: *(Name, Z Number (if applicable), Organization, Signature, Date)*

6.3 Responsible Manager: *(Name, Z Number, Organization, Signature, Date)*

7.0 REGISTERED PROFESSIONAL ENGINEER SEAL:

JAMES A. O'NEILL II
NEW MEXICO
18656
PROFESSIONAL ENGINEER
J. A. O'Neill II
3/8/2012

8.0 REVISION LOG

8.1 Rev.	8.2 Date	8.3 Description of Change(s)
0	Aug '11	Original Issue
1	Oct '11	90% Design Revision

TABLE OF CONTENTS

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1.0 Purpose

Calculate hydraulic profile and flow characteristics including velocity and shear for flow in the channel through the wetland area with proposed stilling basin and drop structures.

2.0 Methodology

The hydraulic profile is based on a step-backwater calculation analysis using the HEC-RAS software. The channel configuration and stream channel sections at hydraulic structures are as shown on the Drawings. Calculations include both pre- and post-construction runs to compare water surface elevations, flow velocities and channel shear.

3.0 Acceptance Criteria

The criteria used for evaluating the effectiveness of the design are outlined in Section 2.5 of the Design memorandum, and were developed by the Design Team and LANL staff to meet the goal of reducing sediment transport to the lower portion of Sandia Canyon from the wetland area.

4.0 Open Items

Final design development of the concepts presented in the Design Memorandum still need to be completed, with complete details and final hydraulic analysis to confirm the performance of the system under design flow conditions.

5.0 Assumptions

Tailwater water surface elevation is the primary variable that cannot be measured for design flow conditions, or is not empirically modeled. Tailwater is assumed based on nornal water surface elevation for the existing downstream channel section at design flow.

6.0 Limitations

The hydraulics analysis uses the 25-year design storm. Performance of the drop structures and plunge pool for higher flow rates (longer return periods) is not predicted.

The analysis is a steady state analysis based on the design configuration. The analysis is based on static flow conditions over a period of time, and includes conservative assumptions to minimize under-design. In the field, sediment transport and potentially unstable boundary layer conditions create flow patterns. These conditions may require a much more complex dynamic analysis to increase the accuracy of the model results, but may only result in a minor change in system performance.

7.0 Calculation Inputs

HEC-RAS (Hydraulic profile) - Hydraulic analysis inputs are the channel cross-section, channel slope, Manning's n-value, design discharge and starting water surface elevation at the downstream end where the improvements transition back into the existing channel. Flows are based on the results of the hydrologic analysis of the drainage basin. The design storm is the 25-year, 2-hour storm.

Design Note No. 6 (Plunge pool) – Inputs include the characteristics and configuration of the discharge pipe upstream of the plunge pool, flow discharge, information on the riprap and bedding used, and the side and end slopes of the pool. Again, the design storm is the 25-year, 2-hour storm.

8.0 Computer Hardware and Software

U.S. Army Corps of Engineers HEC-HMS software

Natural Resources Conservation Service, Engineering Division
"Riprap Lined Plunge Pool for Cantilever Outlet" - Design Note No. 6 (2nd Edition), Jan. 23, 1986
Spreadsheet developed by D. Hurtz, Midwest NTC, 1/90, modified by M. Dreischmeier, Eau Claire TC, Wis., 3/98 and 5/2005

9.0 Summary and Conclusions

The calculations show that the grade control structure and stilling basin will be stable and reduce energy and erosive forces locally.

10.0 References

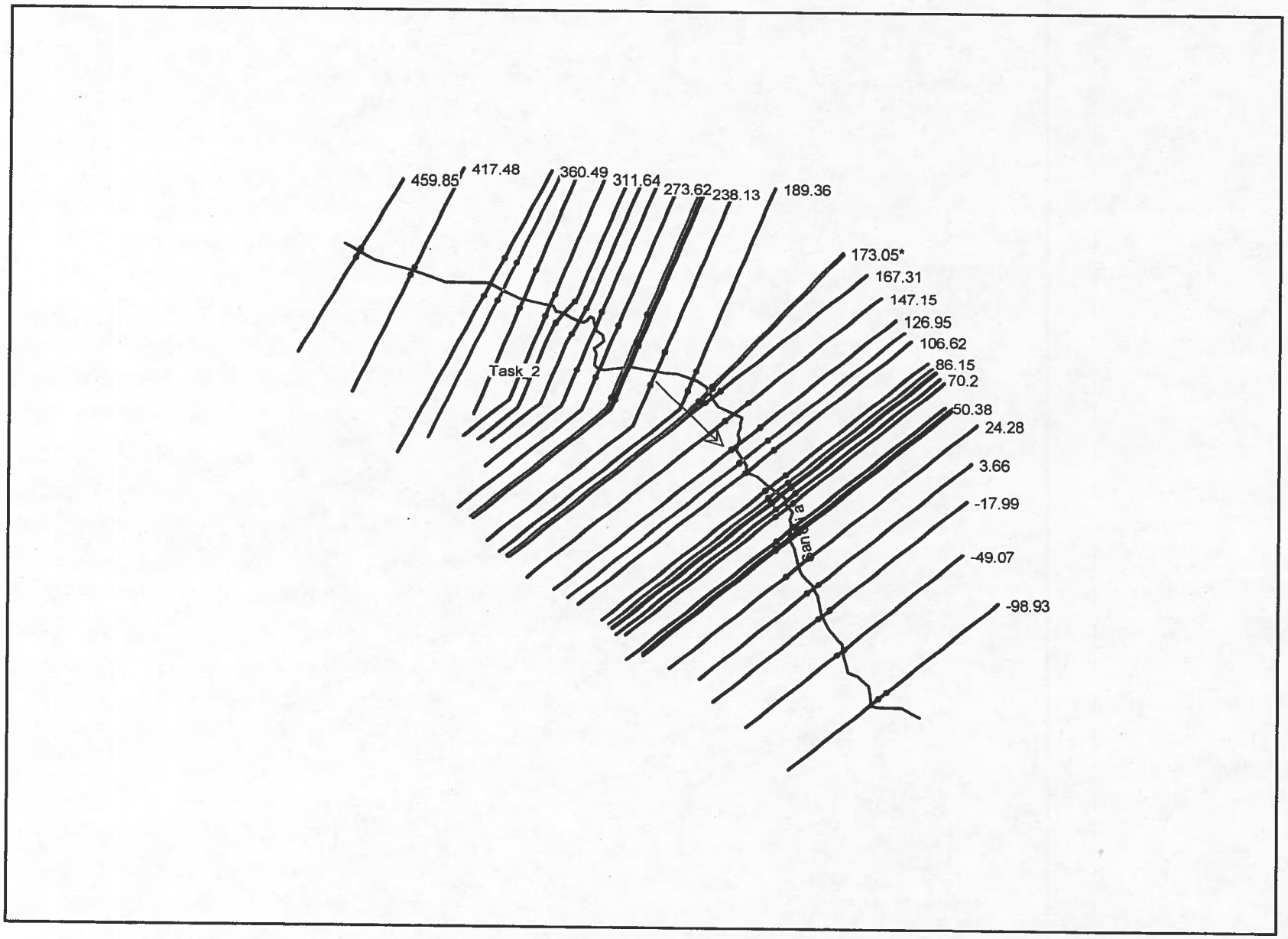
HEC website: http://www.hec.usace.army.mil/software/hec-ras.

11.0 Calculations

- Calculation 1 – Hydraulic profile for study channel reach (HEC-RAS)
- Calculation 2 – Plunge pool structure sizing – NRCS Design Note No. 6

Proposed Conditions							Existing								
River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Vel Chnl	Shear Chan	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Vel Chnl	Shear Chan	Change in	Change in
		(cfs)	(ft)	(ft)	(ft/s)	(lb/sq ft)			(cfs)	(ft)	(ft)	(ft/s)	(lb/sq ft)	Velocity	Shear
459.85	25-yr	498.4	7210.79	7214.55	6.16	1.77	459.85	25-yr	498.4	7210.79	7214.54	6.19	1.79	-0.03	-0.02
459.85	200cfs	200	7210.79	7213.57	5.08	1.34	459.85	200cfs	200	7210.79	7213.56	5.13	1.37	-0.05	-0.03
417.48	25-yr	498.4	7210.37	7213.52	9.19	4.48	417.48	25-yr	498.4	7210.37	7213.55	9.04	4.33	0.15	0.15
417.48	200cfs	200	7210.37	7212.88	6.37	2.37	417.48	200cfs	200	7210.37	7212.92	6.15	2.2	0.22	0.17
360.49	25-yr	498.4	7210.67	7212.9	4.48	1.15	360.49	25-yr	498.4	7210.67	7212.85	4.65	1.25	-0.17	-0.1
360.49	200cfs	200	7210.67	7212.19	3.39	0.78	360.49	200cfs	200	7210.67	7212.13	3.63	0.9	-0.24	-0.12
349.06*	25-yr	498.4	7210.82	7212.75	4.57	1.21	---	---	---	---	---	---	---		
349.06*	200cfs	200	7210.82	7212.02	3.52	0.85	---	---	---	---	---	---	---		
331.97	25-yr	498.4	7210.69	7212.56	4.26	1.06	331.97	25-yr	498.4	7210.08	7212.36	5.12	1.54	-0.86	-0.48
331.97	200cfs	200	7210.69	7211.85	2.83	0.55	331.97	200cfs	200	7210.08	7211.7	3.63	0.9	-0.8	-0.35
311.64	25-yr	498.4	7210.54	7212.31	5.04	1.48	311.64	25-yr	498.4	7209.12	7211.66	7.58	3.47	-2.54	-1.99
311.64	200cfs	200	7210.54	7211.64	3.42	0.8	311.64	200cfs	200	7209.12	7211.13	5.52	2.08	-2.1	-1.28
298.58	25-yr	498.4	7210.44	7212.18	4.65	1.27	298.58	25-yr	498.4	7204.87	7210.21	6.1	1.82	-1.45	-0.55
298.58	200cfs	200	7210.44	7211.52	3.22	0.72	298.58	200cfs	200	7204.87	7208.5	4.43	1.12	-1.21	-0.4
285.98	25-yr	498.4	7210.34	7212.04	4.49	1.19	285.98	25-yr	498.4	7204.52	7209.27	8.94	4.41	-4.45	-3.22
285.98	200cfs	200	7210.34	7211.39	3.09	0.66	285.98	200cfs	200	7204.52	7207.65	7.57	3.52	-4.48	-2.86
273.62	25-yr	498.4	7210.25	7211.91	3.98	0.95	273.62	25-yr	498.4	7204.32	7209.67	3.63	0.67	0.35	0.28
273.62	200cfs	200	7210.25	7211.27	2.73	0.52	273.62	200cfs	200	7204.32	7207.84	3.56	0.81	-0.83	-0.29
258.33	25-yr	498.4	7210.14	7211.76	4.06	0.99	258.33	25-yr	498.4	7203.13	7209.67	2.98	0.41	1.08	0.58
258.33	200cfs	200	7210.14	7211.14	2.78	0.55	258.33	200cfs	200	7203.13	7207.86	2.22	0.28	0.56	0.27
Crest of first drop structure															
241.5*	25-yr	498.4	7210.01	7211.18	5.65	2.14	---	---	---	---	---	---	---		
241.5*	200cfs	200	7210.01	7210.63	4.45	1.64	---	---	---	---	---	---	---		
240.5	25-yr	498.4	7209.01	7211.38	3.62	0.7	---	---	---	---	---	---	---		
240.5	200cfs	200	7209.01	7210.46	2.55	0.41	---	---	---	---	---	---	---		
238.13	25-yr	498.4	7208.99	7211.36	3.61	0.69	238.13	25-yr	498.4	7203.39	7209.65	2.74	0.34	0.87	0.35
238.13	200cfs	200	7208.99	7210.45	2.49	0.39	238.13	200cfs	200	7203.39	7207.83	2.02	0.23	0.47	0.16
217.54	25-yr	498.4	7208.84	7210.94	5.93	1.95	217.54	25-yr	498.4	7203.06	7209.45	4.16	0.8	1.77	1.15
217.54	200cfs	200	7208.84	7210.19	3.94	0.99	217.54	200cfs	200	7203.06	7207.71	2.94	0.47	1	0.52
189.36	25-yr	498.4	7208.62	7210.59	6.02	2.05	189.36	25-yr	498.4	7203.28	7208.1	9.3	4.34	-3.28	-2.29
189.36	200cfs	200	7208.62	7209.9	4.01	1.05	189.36	200cfs	200	7203.28	7207.2	5.33	1.59	-1.32	-0.54
Crest of second drop structure															
173.05*	25-yr	498.4	7208.5	7209.75	8.34	4.56	---	---	---	---	---	---	---		
173.05*	200cfs	200	7208.5	7209.19	6.25	3.12	---	---	---	---	---	---	---		
172.05	25-yr	498.4	7207.5	7209.82	5.39	1.55	---	---	---	---	---	---	---		
172.05	200cfs	200	7207.5	7208.94	3.82	0.91	---	---	---	---	---	---	---		
167.31	25-yr	498.4	7207.46	7209.79	5.16	1.42	167.31	25-yr	498.4	7202.84	7207.96	7.91	3.07	-2.75	-1.65
167.31	200cfs	200	7207.46	7208.9	3.7	0.86	167.31	200cfs	200	7202.84	7206.55	6.79	2.72	-3.09	-1.86
147.15	25-yr	498.4	7207.31	7209.45	5.56	1.7	147.15	25-yr	498.4	7202.62	7207.29	8.22	3.53	-2.66	-1.83
147.15	200cfs	200	7207.31	7208.64	3.83	0.94	147.15	200cfs	200	7202.62	7206.28	5.45	1.8	-1.62	-0.86

Proposed Conditions							Existing								
River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Vel Chnl	Shear Chan	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Vel Chnl	Shear Chan	Change in	Change in
		(cfs)	(ft)	(ft)	(ft/s)	(lb/sq ft)			(cfs)	(ft)	(ft)	(ft/s)	(lb/sq ft)	Velocity	Shear
126.95	25-yr	498.4	7207.16	7209.09	5.83	1.93	126.95	25-yr	498.4	7203.4	7207.35	5.92	1.76	-0.09	0.17
126.95	200cfs	200	7207.16	7208.35	4	1.07	126.95	200cfs	200	7203.4	7206.15	4.18	1.04	-0.18	0.03
Sill of drop															
115.38*	25-yr	498.4	7207.07	7208.5	7.69	3.72	---	---	---	---	---	---	---		
115.38*	200cfs	200	7207.07	7207.86	5.69	2.47	---	---	---	---	---	---	---		
106.62	25-yr	498.4	7206.19	7207.74	7.78	3.7	106.62	25-yr	498.4	7202.57	7207.24	5.39	1.48	2.39	2.22
106.62	200cfs	200	7206.19	7207.06	5.77	2.46	106.62	200cfs	200	7202.57	7205.94	4.16	1.06	1.61	1.4
86.15	25-yr	498.4	7204.15	7206.78	8.1	3.42	86.15	25-yr	498.4	7202.72	7206.79	6.82	2.29	1.28	1.13
86.15	200cfs	200	7204.15	7205.71	6.43	2.58	86.15	200cfs	200	7202.72	7205.59	4.95	1.4	1.48	1.18
Sill of pool															
80.3855*	25-yr	498.4	7203.57	7206.86	6.67	2.18	---	---	---	---	---	---	---		
80.3855*	200cfs	200	7203.57	7205.64	5.22	1.56	---	---	---	---	---	---	---		
76.38	25-yr	498.4	7203.57	7206.47	8.08	3.33	---	---	---	---	---	---	---		
76.38	200cfs	200	7203.57	7205.26	6.69	2.77	---	---	---	---	---	---	---		
75.88	25-yr	498.4	7202.07	7206.74	5.45	1.35	---	---	---	---	---	---	---		
75.88	200cfs	200	7202.07	7205.45	3.52	0.64	---	---	---	---	---	---	---		
70.2	25-yr	498.4	7199.01	7206.86	3.78	0.61	---	---	---	---	---	---	---		
70.2	200cfs	200	7199.01	7205.53	2.08	0.2	---	---	---	---	---	---	---		
65.53	25-yr	498.4	7199.01	7206.89	3.61	0.56	65.53	25-yr	498.4	7201.68	7206.77	5.65	1.53	-2.04	-0.97
65.53	200cfs	200	7199.01	7205.53	1.98	0.19	65.53	200cfs	200	7201.68	7205.43	4.53	1.14	-2.55	-0.95
50.38	25-yr	498.4	7199.01	7206.86	3.64	0.58	---	---	---	---	---	---	---		
50.38	200cfs	200	7199.01	7205.52	1.99	0.19	---	---	---	---	---	---	---		
46.38	25-yr	498.4	7201.01	7206.74	4.47	0.95	---	---	---	---	---	---	---		
46.38	200cfs	200	7201.01	7205.4	3.31	0.6	---	---	---	---	---	---	---		
44.91	25-yr	498.4	7201.02	7206.73	4.54	0.99	44.91	25-yr	498.4	7201.02	7206.73	4.54	0.99	0	0
44.91	200cfs	200	7201.02	7205.38	3.44	0.67	44.91	200cfs	200	7201.02	7205.38	3.44	0.67	0	0
24.28	25-yr	498.4	7200.68	7206.57	4.85	1.13	24.28	25-yr	498.4	7200.68	7206.57	4.85	1.13	0	0
24.28	200cfs	200	7200.68	7205.26	3.5	0.68	24.28	200cfs	200	7200.68	7205.26	3.5	0.68	0	0
3.66	25-yr	498.4	7200.73	7206.04	7.53	2.69	3.66	25-yr	498.4	7200.73	7206.04	7.53	2.69	0	0
3.66	200cfs	200	7200.73	7204.89	5.34	1.53	3.66	200cfs	200	7200.73	7204.89	5.34	1.53	0	0
-17.99	25-yr	498.4	7200.29	7205.7	7.78	3.01	-17.99	25-yr	498.4	7200.29	7205.7	7.78	3.01	0	0
-17.99	200cfs	200	7200.29	7204.41	6.39	2.34	-17.99	200cfs	200	7200.29	7204.41	6.39	2.34	0	0
-49.07	25-yr	498.4	7200.11	7204.88	9.36	4.27	-49.07	25-yr	498.4	7200.11	7204.88	9.36	4.27	0	0
-49.07	200cfs	200	7200.11	7203.85	6.62	2.34	-49.07	200cfs	200	7200.11	7203.85	6.62	2.34	0	0
-98.93	25-yr	498.4	7199.22	7204.17	7.98	3.01	-98.93	25-yr	498.4	7199.22	7204.17	7.98	3.01	0	0
-98.93	200cfs	200	7199.22	7202.77	7.39	2.91	-98.93	200cfs	200	7199.22	7202.77	7.39	2.91	0	0


459.85
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360.49
311.64
273.62
238.13
189.36
173.05*
167.31
147.15
126.95
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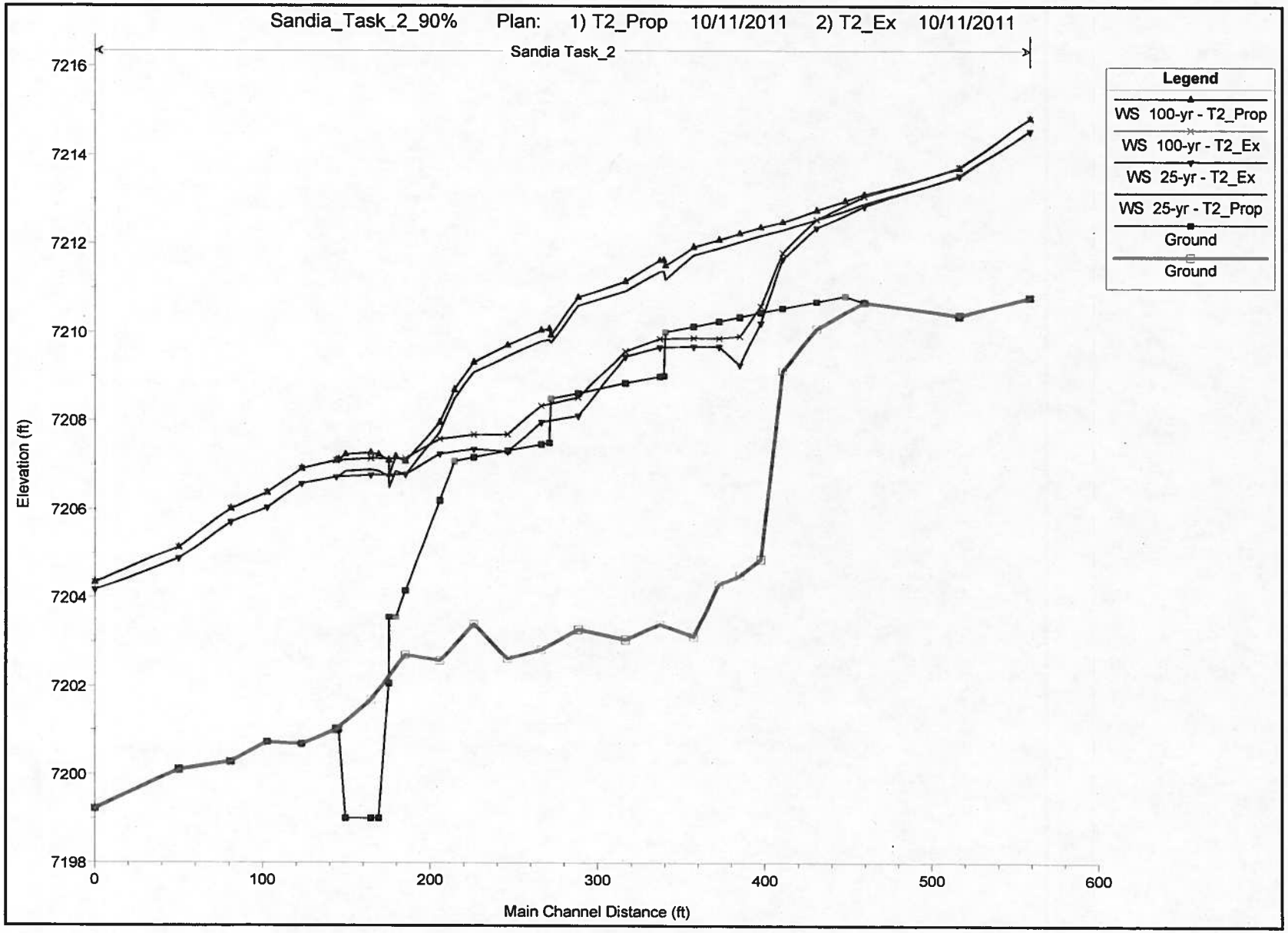
70.2
50.38
24.28
3.66
-17.99
-49.07
-98.93
Task_2
Pueblo


Sandia_Task_2_90% Plan: 1) T2_Prop 10/11/2011 2) T2_Ex 10/11/2011
Sandia Task_2
Legend
WS 100-yr - T2_Prop
WS 100-yr - T2_Ex
WS 25-yr - T2_Ex
WS 25-yr - T2_Prop
Ground
Ground
Elevation (ft)
7216
7214
7212
7210
7208
7206
7204
7202
7200
7198
0
100
200
300
400
500
600
Main Channel Distance (ft)

RIPRAP LINED PLUNGE POOL FOR CANTILEVER OUTLET (Version 5/2005)
(Reference Design Note No. 6 (Second Edition), Jan. 23, 1986

JOB:	Sandia Wetland Plunge Pool Calculation		
DESIGNER:	Carl McDonald	Date:	########
CHECKER:	Jim O'Neill	Date:	

INPUT DATA:

Conduit Diameter	D =	7.00	ft
Conduit Discharge:	Q =	357.30	cfs
Conduit Slope at Outlet:	S =	0.09	ft/ft
Conduit Outlet Invert Elevation:	El, CO =	7246.30	ft
Tailwater Elevation:	El, TW =	7244.28	ft
Outlet Channel Invert Elevation:	El, CH =	7241.50	ft
Water Density:	RHO =	1.00	
Bed/Riprap Particle Density: (Default 2.64)	RHOS =	2.64	
D, 50 Riprap Size:	RS =	1.50	ft
Riprap Thickness: (2.5*D, 50 recommended)	RT =	3.75	ft
Bedding Thickness: (6 inch min. rec.) (Enter 0 for geotextile)	BT =	1.00	ft
Side Slope Ratio:	Zw =	2.00	ft/ft
Upstream End Slope Ratio:	Zlu =	2.00	ft/ft
Downstream End Slope Ratio:	Zld =	2.00	ft/ft
Combined End Slope Ratio:	Z1 =	2.00	ft/ft

OUTPUT---POOL LOCATION AND DIMENSIONS:

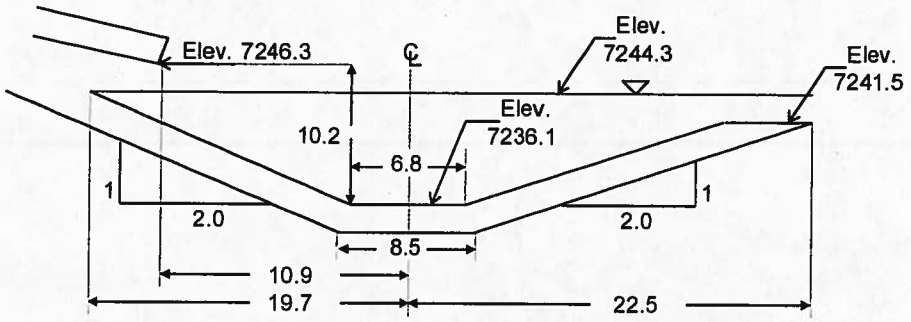
Vert. Dist. from Tailwater to Conduit Invert:	Zp =	2.02	ft
Submergence Check: (If Zp < 0 , Use Zp = 0)	Use Zp =	2.02	ft
Beaching Check: [Q/(gD^5)^0.5 <= (1.0+25*D,50/D)]		O.K.	
Beaching Controlled			
Distance from Conduit Exit to C/L Pool:	Xm =	10.87	ft
Pool depth at C/L Below Conduit Invert:	Zp+0.8Zm =	10.16	ft
Pool Bottom Elev:	El,PB =	7236.14	ft
Pool Bottom Length:	2Lr2 =	6.76	ft
Pool Bottom Width:	2Wr2 =	6.40	ft
Upstream Pool Length at Tailwater Elev.:	Lru =	19.66	ft
Downstream Pool Length at Tailwater Elev.:	Lrd =	19.66	ft
Pool Width at Tailwater Elev.:	2Wr =	38.95	ft
Check Side Slope Ratio: (Wr>=We)		O.K.	
Side Slope Ratio Zw O.K.			
Check Min. End Slope Ratio: (Lru & Lrd >= Le)		O.K.	
End Slope Ratios O.K.			
Check Upstream Length: (Lru >= Xm)		O.K.	
End Slope Ratio Zlu O.K.			
Pool Bottom Elev. at Bottom of Riprap:	El, BR =	7232.39	ft
Pool Bottom Elev. at Bottom of Bedding:	El, BB =	7231.39	ft

OUTPUT---VOLUMES BELOW WATER SURFACE ELEVATION:

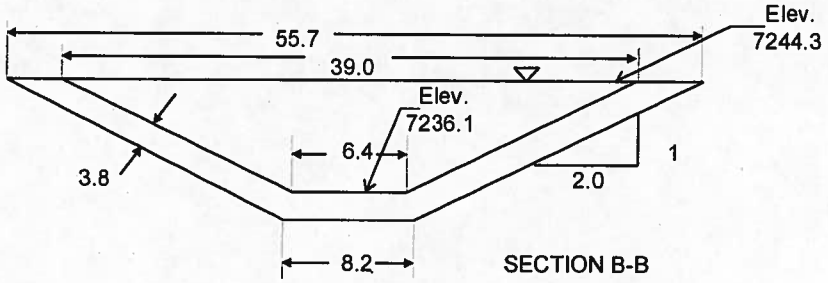
Volume of Excavation (measured from bottom surface of bedding):	V,pbs =	672.3	cu yd
Volume of Rock Riprap:	V,rs =	353.3	cu yd
Volume of Bedding:	V,bs =	134.9	cu yd

Spreadsheet developed by D. Hurtz, Midwest NTC, 1/90
Spreadsheet modified by M. Dreischmeier, Eau Claire TC, Wis., 3/98 and 5/2005
Design Note No. 6 (Second Edition), Jan. 23, 1986
"Riprap Lined Plunge Pool for Cantilever Outlet"
Natural Resources Conservation Service
Engineering Division

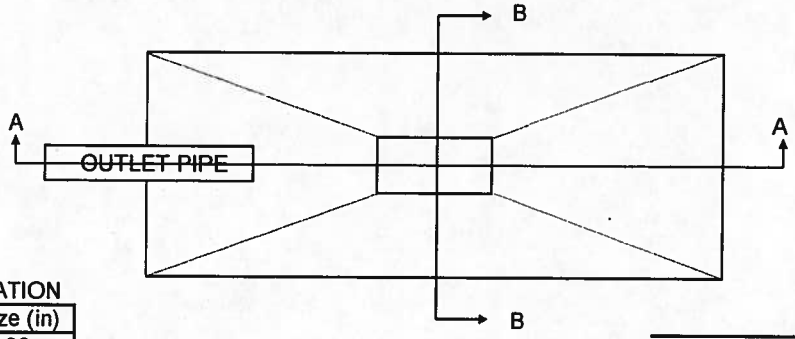
RIPRAP LINED PLUNGE POOL FOR CANTILEVER OUTLET
Reference Design Note No. 6 (Second Edition), Jan. 23, 1986



SECTION A-A



SECTION B-B



ROCK GRADATION

% Passing	Size (in)
100	36
60-85	27
25-50	18
5-20	9
0-5	3.6

Sandia Wetland Plunge Pool Calculation
LANDOWNER

DESIGNER: Carl McDonald
SHEET ___ OF ___

FLOW VELOCITIES POST CONSTRUCTION

FLOW VELOCITIES
DESIGN INPUT
I: = 4.9 From LANL Engineering Standards Manual ISD 341-2, Figure G20GEN-1 Rainfall Intensity-Duration-Relationship Curve

C:

Period	% site	category	C
Pre- development	100	hilly, med c-l, woods	0.45
During project	100	Flat, med c-l, barren	0.7
Final Stabilization	100	Flat, med c-l, woods	0.65

From LANL Facility Engineering Manual, Chapter 3-Civil, Section 200-Engineering Requirements/Guides, Table 202-1

A: Disturbed Project Area = .78 acres

Rational Method Calculation
Q:

Period	C	I	A	=Q	Discharge Rate increase or decrease (cubic feet/sec)
Pre-development	0.45	4.9	0.78	1.71	
During Project	0.7	4.9	0.78	2.67	0.96
Final Stabilization	0.65	4.9	0.78	2.48	0.77*

CONCLUSION
The soil loss at the sites will be below pre-development values during construction activities and after final stabilization has been achieved due to use of BMPs such as wattles, gravel bags and temporary gabion check dam during construction and a change in grade with engineered fill, grade control structures and cascade pool with boulders and stabilization for post construction.

*Though the above table shows an increase in the discharge rate from pre-development to final stabilization, a separate calculation on the cascade pool shows the decrease in flow rate as the water is discharged over the weir. (See calc on next page showing the cascade pool size and weir dimensions. The cascade pool will reduce the flow velocity to pre-development rates where the water discharges downstream.

Sandia Canyon Stream Post-Const. Cascade Pool Sizing verification 3/1/2013

Variables:

Basin Size:	0.78 ac
Runoff Coefficient (pre):	0.45
Runoff Coefficient (post):	0.65
Design Frequency:	25 yr
Peak Inflow:	2.48 cfs
Peak Outflow:	1.72
Outflow Rate Factor, k:	0.82

Assumptions:

1. A Runoff Coefficient of 0.65 for post construction conditions was used since the surface will consist of engineered fill and pl
The cascade pool calc takes into consideration the drainage from the disturbed area only.
The pond will be used as a post construction BMP to reduce velocity

2. A Predevelopment Runoff Coefficient of 0.45 was used to calculate the runoff flowrate with a calaulated time of concentration (tc) of 10 minutes for pre-development conditions based on a 25 yr storm.

Required peak storage volume of pond

Storm Duration, min T	Storm Duration, sec.	Rainfall Intensity, in/h I	Runoff Vol., ft^3 CIAT	Outflow Vol., ft^3 kQoT	Storage Vol., ft^3	Storage Vol., ac-ft
0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	300.00	6.25	950.63	423.12	527.51	0.01
10.00	600.00	4.80	1460.16	846.24	613.92	0.01
20.00	1200.00	3.55	2159.82	1692.48	467.34	0.01
30.00	1800.00	2.75	2509.65	2538.72	-29.07	0.00
40.00	2400.00	2.25	2737.80	3384.96	-647.16	-0.01
50.00	3000.00	1.90	2889.90	4231.20	-1341.30	-0.03
60.00	3600.00	1.65	3011.58	5077.44	-2065.86	-0.05
70.00	4200.00	1.45	3087.63	5923.68	-2836.05	-0.07
80.00	4800.00	1.30	3163.68	6769.92	-3606.24	-0.08
90.00	5400.00	1.15	3148.47	7616.16	-4467.69	-0.10
100.00	6000.00	1.05	3194.10	8462.40	-5268.30	-0.12
110.00	6600.00	0.95	3178.89	9308.64	-6129.75	-0.14
120.00	7200.00	0.90	3285.36	10154.88	-6869.52	-0.16

These dimensions includes the width and length from top of berm to top of berm

Pond	D (ft)	L (ft)	W (ft)	P (ft)	A1 (cubic ft)	A2 (cubic ft)	Tot Avail (cubic ft)	Req Vol (cubic ft)
Pond	5	16	10	4.5	3100	2502	598	613

Variables:
A1= Entire interior area of pond, from top of berm to pond bottom and from interior side slope to interior side slope(cubic ft). L & W are dimensions at bottom of pond (interior slopes are 2:1)
A2= Entire volume of area (impoundment) below weir that stays in pond(cubic ft)
D=Depth of pond from top of berm to pond bottom(ft)
L=Length of pond, from top of berm to top of berm(ft)
W=Width of pond from top of berm to top of berm(ft)
P=distance from the bottom of the weir to the bottom of the pond(ft)
H=Head above the crest, which is equal to D-P(ft)
L'=The effective crest length(ft), this is the width of the flow thru the weir
C=Discharge coefficient, equation 5a, page 249 of Applications In Hydraulic Engineering, Jeppson, 1995.
Q=Design discharge from pond using rect. contracted weir eqn.5a, pg 249 from Appl. In Hydraulic Eng.

*Rect. Contracted Weir Dimensions**

Pond	L' (ft)	C	H (ft)	P (ft)	Q (cfs)	Q predevel (cfs)
Pond	0.6	0.619333	0.5	4.5	0.585738	1.71

APPENDIX H:

Endangered Species Act and Historical Property Documentation

STORM WATER POLLUTION PREVENTION PLAN (SWPPP)
HISTORICAL PROPERTIES, WETLAND,
THREATENED AND ENDANGERED SPECIES,
AND CRITICAL HABITAT EVALUATION
FOR CONSTRUCTION PROJECTS

PROJECT NAME: **SANDIA GRADE CONTROL STRUCTURE**

DATE: **1/30/2013**

EVALUATORS: **DAVID KELLER**
BIOLOGICAL REVIEW

KARI GARCIA
CULTURAL REVIEW

Information Requested for Inclusion in SWPP and Sediment Control Plans:

Excavation permit: PR-ID:

Please attach copies of site maps used: include project area boundaries and show areas of concern regarding wetlands, historical property, and threatened or endangered species.

Wetlands:

Are any wetlands located within the project area or in proximity to the construction activity?

Yes ☒ No ☐

Check where wetlands are located:

- ☒ Areas to be disturbed and the immediate vicinity (including utility trenching),
- ☒ Areas (and the immediate vicinity) where storm water discharges flow from the construction site to the point of discharge into receiving waters, and
- ☒ Areas in the immediate vicinity of discharges into receiving waters.

If so, please describe the precise location of the wetlands and summarize the actions/ requirements associated with working in the wetlands.
There are wetlands immediately downstream from the project area and along the drainages of Pajarito and Two-mile Canyons. No wetland vegetation should be removed during this action.

What is the approximate acreage of the wetlands? Approximately 26 acres

Can measures be implemented to avoid adverse effects on wetlands identified above?

Yes ☒ No ☐ N/A ☐

If so, what measures are recommended?

- ☒ The water release must be distributed and mitigated so that the flow rate from the discharge is comparable to normal water flows in the affected canyons.
- ☒ The rate and volume of release should not cause erosion or remove vegetation.
- ☒ Storm water or Fast runoff reaching the canyon should be slowed to limit sedimentation and erosion to prevent damage to downstream resources.

- ☒ Other **Limit the removal of native ground vegetation as much as possible. Follow the requirements in the Wetland and flood plain assessments. The vegetation must be removed prior to 1 June or after 31 July to avoid disturbance of nesting birds. If construction has to be during the restricted time, a survey of the vegetation must be completed by ENV-ES personnel to protect nest locations.**

Historical Properties:

1. **Are you installing any stormwater controls that require subsurface earth disturbance?** Examples include: Dikes, Berms, Catch Basins, Ponds, Ditches, Trenches, Culverts, Channels, Perimeter Drains and Swales.

   Yes ☒ No ☐

   If yes, proceed to step 2.
   If no, this will be indicated in the NOI and no further screening is necessary.

2. **Have prior professional cultural resource surveys or other evaluations determined that historic properties do not exist, or have prior disturbances precluded the existence of historic properties?**

   Yes ☐ No ☒ N/A ☐

   If yes, this will be indicated in the NOI and no further screening is necessary.
   If no, proceed to step 3.

3. **If you are installing any stormwater controls that require subsurface earth disturbance, will these activities have an effect on historic properties?:**

   Yes ☐ No ☐ N/A ☐

   If your answer to the questions in Steps 1 and 2 is "no", then you must assess whether your earth-disturbing activities related to the installation of stormwater controls will have an effect on historic properties. This assessment may be based on historical sources, knowledge of the area, an assessment of the types of earth-disturbing activities you are engaging in, considerations of any controls and/or management practices you will adopt to ensure that your stormwater control-related earth-disturbing activities will not have an effect on historic properties, and any other relevant factors. If you determine based on this assessment that earth disturbances related to the installation of your stormwater controls will not cause effects to historic properties, you may indicate this on your NOI, and document the basis for your determination in your SWPPP and no further screening steps are necessary. In this case you must also attach a copy of your site map to your NOI. After submitting your NOI, and during the 14-day waiting period, the SHPO, THPO, or other tribal representative may request that EPA hold up authorization based on concerns about potential adverse impacts to historic properties. EPA will evaluate any such request and notify you if any additional measures to address adverse impacts to historic properties are necessary.

4. **If you are installing any stormwater controls that require subsurface earth disturbance and you have not satisfied the conditions in Steps 1-3, have you contacted and consulted with the appropriate historic preservation authorities? Refer to Appendix E of the CGP.**

   Yes ☐ No ☐ N/A ☒

<u>Additional Supplemental Information(if applicable)</u>:

Threatened and Endangered Species and Critical Habitat Evaluation:

Project area consists of:

- Areas on construction sites where storm water discharges originate and flow toward the point of discharge into the receiving waters (including areas where excavation, site development, or other ground disturbance activities occur), and the immediate vicinity.
- Areas where storm water discharges flow from the construction site to the point of discharge into receiving waters.
- Areas where storm water from construction activities discharge into receiving waters and the areas in the vicinity of the point of discharge.
- Areas where storm water BMPs will be constructed and operated, including any areas where storm water flows to and from BMPs.
- The areas upstream and/or downstream from construction activities that discharges into a stream segment that may be affected by the said discharges.

1. Determine if Your Discharges and Discharge-Related Activities Were Already Addressed in Another Operator's Valid Certification that Included Your Action Area

Yes ☒ No ☐ If yes, select Criterion B on the NOI form.

Provide eligibility criterion (A, C, D, E, or F) that was certified to by the previous operator, and provide the Tracking Number:

Work covered by the biological assessment for the road to the flood control structure (LA-CP 11-01686) and the general habitat management plan biological assessment (LA-CP 11-02582).

If discharges and discharge-related activities from your site were not addressed in another operator's valid certification that included your action area, you must follow the applicable procedures in Steps 2 through 5 below.

2. Determine if Listed Threatened or Endangered Species or their Designated Critical Habitat(s) are Likely to Occur in your Site's Action Area.

☒ Yes ☐ No

If there are no listed species in your county or township and no critical habitat areas in your action area, check eligibility criterion A on your NOI form. Provide a description of the basis for the criterion selected on your NOI form and provide documentation supporting the criterion selected in your SWPPP.

If there are listed species and/or critical habitat in your county or township and If your local FWS, NMFS, or State or Tribal Heritage Center indicates that these species and/or critical habitat could exist in your action area, do one or more of the following:

- Conduct visual inspections. This method may be particularly suitable for construction sites that are smaller in size or located in non-natural settings such as highly urbanized areas or industrial parks where there is little or no natural habitat, or for construction activities that discharge directly into municipal stormwater collection systems.
- Conduct a formal biological survey. In some cases, particularly for larger construction sites with extensive stormwater discharges, biological surveys may be an appropriate way to assess whether species are located in the action area and whether there are likely to be adverse effects to such species. Biological surveys are frequently performed by environmental

consulting firms. A biological survey may in some cases be useful to conduct in conjunction with Steps Two, Three, or Four of these instructions.

- for specific reasons, such as federal funding or other federal involvement in the project. Note: Coverage under the CGP does not trigger such a review for individual projects/sites. EPA has complied with NEPA in the issuance of the CGP.

and

- Follow the instructions in Steps 3 – 5 below, as applicable. Note that many but not all measures imposed to protect listed species under these steps will also protect critical habitat. Thus, meeting the eligibility requirements of this CGP may require measures to protect critical habitat that are separate from those to protect listed species.

3. Determine if the Construction Activity's Discharges or Discharge-Related Activities Are Likely to Adversely Affect Listed Threatened or Endangered Species or Designated Critical Habitat.

Potential adverse effects from storm water discharges and storm water discharge-related activities at the project area include:

☒ **Hydrological.** Storm water discharges may cause siltation, sedimentation, or induce other changes in receiving waters such as temperature, salinity, or pH. These effects will vary with the amount of storm water discharged, and the volume and condition of the receiving water. Where storm water discharge constitutes a minute portion of the total volume of the receiving water, adverse hydrological effects are less likely. Construction activity may alter drainage patterns on a site where construction occurs which can impact listed species or critical habitat.

☒ **Habitat.** Excavation, site development, grading, and other surface disturbance activities from construction activities, including the installation or placement of storm water BMPs, may adversely affect listed species or their habitat. Storm water may drain or flood listed species habitat.

☒ **Toxicity.** Pollutants in storm water may have toxic effects on listed species.

Please specify which potential adverse effects are of the greatest concern:

The removal of vegetation during sensitive times of the year and the uncontrolled release of storm water is of the greatest concern. All requirements in the Biological Assessments / Wetland Assessment / Floodplain Assessment must be followed.

The scope of effects to consider will vary with each site. If you are having difficulty determining whether your project is likely to adversely affect listed species or critical habitat, or one of the Services has already raised concerns to you, you should contact the appropriate office of the FWS, NMFS or Natural Heritage Center for assistance.

- **If adverse effects to listed threatened or endangered species or their critical habitat are not likely**, then you may select eligibility criterion C on the NOI form. You must provide the following specific information on your NOI form: 1) what federally listed species and/or designated habitat are located in your "action area"?

and 2) what is the distance between your site and the listed species or designated critical habitat (in miles)?

Approximately 0.75 miles to the east.

You must also provide a copy of your site map with your NOI.

- **If adverse effects to listed threatened or endangered species or their critical habitat are likely**, you must follow Step 4 below.

Work covered by the biological assessment for the road to the flood control structure (LA-CP 11-01686) and the general habitat management plan biological assessment (LA-CP 11-02582). And the requirements in those documents must be followed.

4. Determine if Measures Can Be Implemented to Avoid Adverse Effects

If you make a preliminary determination in Step 3 that adverse effects from your construction activity's discharges or discharge-related activities are likely to occur, you can still receive coverage under eligibility criterion C of the CGP if appropriate measures are undertaken to avoid or eliminate the likelihood of adverse effects prior to applying for CGP coverage.

These measures may involve relatively simple changes to construction activities such as re-routing a stormwater discharge to bypass an area where species are located, relocating stormwater controls, or by modifying the "footprint" of the construction activity. If you are unable to ascertain which measures to implement to avoid the likelihood of adverse effects, you must coordinate or enter into consultation with the FWS and/or NMFS, in which case you would not be eligible for coverage under eligibility criterion C, but may instead be eligible for coverage under eligibility criterion D, E, or F (described in more detail in Step 5).

- **If you are able to install and implement appropriate measures to avoid the likelihood of adverse effects, then you may check eligibility criterion C on the NOI form**. The measures you adopt to avoid or eliminate adverse affects must be implemented for the duration of the construction project and your coverage under the CGP. You must also provide a description of the basis for the criterion selected , and the following specific information on your NOI form: 1) what federally listed species and/or designated habitat are located in your "action area"?:

  and 2) what is the distance between your site and the listed species or designated critical habitat (in miles)?:

- **If you cannot ascertain which measures to implement to avoid the likelihood of adverse effects**, you must follow the procedures in Step 5.

5. Determine if the Eligibility Requirements of Criterion D, E, or F Can Be Met

If you have met the requirements of criterion D, E, or F, you may select the appropriate Criterion on the NOI form. You must provide a description of the basis for the criterion

selected on your NOI form and must include copies of the correspondence between you and the applicable Service in your SWPPP.

(Further detail and explanation provided in Part D.2.5 of Appendix D in the 2012 Construction General Permit)

Notice of Intent Evaluation:

Under which criterion of the permit have the ESA eligibility obligations been satisfied?

☐ **(A)** No federally-listed threatened or endangered species or their designated critical habitat(s) are likely to occur in your site's "action area" as defined in Appendix A of this permit.

☐ **(B)** The construction site's discharges and discharge-related activities were already addressed in another operator's valid certification of eligibility for your action area under eligibility Criterion A, C, D, E, or F and there is no reason to believe that federally-listed species or federally-designated critical habitat not considered in the prior certification may be present or located in the "action area". To certify your eligibility under this Criterion, there must be no lapse of NPDES permit coverage in the other operator's certification. By certifying eligibility under this Criterion, you agree to comply with any effluent limitations or conditions upon which the other operator's certification was based. You must include in your NOI the tracking number from the other operator's notification of authorization under this permit. If your certification is based on another operator's certification under Criterion C, you must provide EPA with the relevant supporting information required of existing dischargers in Criterion C in your NOI form.

☐ **(C)** Federally-listed threatened or endangered species or their designated critical habitat(s) are likely to occur in or near your site's "action area," and your site's discharges and discharge-related activities are not likely to adversely affect listed threatened or endangered species or critical habitat. This determination may include consideration of any stormwater controls and/or management practices you will adopt to ensure that your discharges and discharge-related activities are not likely to adversely affect listed species and critical habitat. To make this certification, you must include the following in your NOI: 1) any federally listed species and/or designated habitat located in your "action area"; and 2) the distance between your site and the listed species or designated critical habitat (in miles). You must also include a copy of your site map with your NOI.

☐ **(D)** Coordination between you and the Services has been concluded. The coordination must have addressed the effects of your site's discharges and discharge-related activities on federally-listed threatened or endangered species and federally-designated critical habitat, and must have resulted in a written concurrence from the relevant Service(s) that your site's discharges and discharge-related activities are not likely to adversely affect listed species or critical habitat. You must include copies of the correspondence between yourself and the Services in your SWPPP and your NOI.

☒ **(E)** Consultation between a Federal Agency and the U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service under section 7 of the ESA has been concluded. The consultation must have addressed the effects of the construction site's discharges and discharge-related activities on federally-listed threatened or endangered species and federally-designated critical habitat. The result of this consultation must be either:

i. a biological opinion that concludes that the action in question (taking into account the effects of your site's discharges and discharge-related activities) is not likely to jeopardize the continued existence of listed species, nor the destruction or adverse modification of critical habitat; or
ii. written concurrence from the applicable Service(s) with a finding that the site's discharges and discharge-related activities are not likely to adversely affect federally-listed species or federally-designated habitat.

You must include copies of the correspondence between yourself and the Services in your SWPPP and your NOI.

☐ **(F)** Your construction activities are authorized through the issuance of a permit under section 10 of the ESA, and this authorization addresses the effects of the site's discharges and discharge-related activities on federally-listed species and federally-designated critical habitat. You must include copies of the correspondence between yourself and the Services in your SWPPP and your NOI.

Biological Assessment Requirements:

- The new road will follow a path of lower density and smaller trees when possible.
- The new road will have a gate installed at the east end of the asphalt batch plant footprint and access will be controlled year-round to official business only.
- A 3-strand smooth-wire fence will be installed to protect cultural and natural resources on the mesa. The fence will run south from the gate for 250 ft to the canyon edge. The fence will also run north by northwest 350 ft from the gate to the boundary of a cultural site.
- Appropriate LANL-approved erosion and runoff controls will be employed and periodically inspected throughout the life of the project. All exposed soils must be re-vegetated as soon as feasible to minimize erosion.
- Any temporary or permanent lighting will comply with the New Mexico Night Sky Protection Act.
- Landscape vegetation planted in association with the construction of these projects must be native species appropriate for this elevation and forest type.
- Ensure that project activities will not cut down trees and shrubs between 1 June and 31 July of any year (the peak bird-nesting season), or have qualified personnel survey trees and shrubs immediately prior to removal to ensure no nestlings or eggs are destroyed.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New Mexico Ecological Services Field Office
2105 Osuna NE
Albuquerque, New Mexico 87113
Phone: (505) 346-2525 Fax: (505) 346-2542

July 25, 2012

Cons. # 02ENNM00-2012-I-0090

Kevin W. Smith, Manager
Department of Energy
National Nuclear Security Administration
Los Alamos Site Office
Los Alamos, New Mexico 87544

Dear Mr. Smith:

This responds to your cover letter and biological assessment (BA) requesting informal consultation for the effects of the construction and use of the Upper Sandia Canyon access road on federally listed threatened and endangered species at Los Alamos National Laboratory, received on January 23, 2012. As documented in your BA, which is hereby incorporated by reference, we find that your proposed action will have insignificant and discountable effects to the Mexican spotted owl (*Strix occidentalis lucida*) (MSO). Therefore, the Service concurs with your determination of "may affect, is not likely to adversely affect" the MSO.

This concludes section 7 consultation regarding the proposed action. If monitoring or other information results in modification or the inability to complete all aspects of the proposed action, consultation should be reinitiated. Please contact the Service if: 1) future surveys detect listed, proposed or candidate species in habitats where they have not been previously observed; 2) the proposed action changes or new information reveals effects of the proposal to listed species that have not been considered in this analysis; or 3) a new species is listed or critical habitat designated that may be affected by the action.

Thank you for your concern for endangered species and New Mexico's wildlife habitats. If you have any questions, please contact Eric Hein of my staff at the letterhead address or at (505) 761-4735.

Sincerely,

for Wally Murphy
Field Supervisor

cc:
Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico
Director, New Mexico Energy, Minerals, and Natural Resources Department, Forestry Division, Santa Fe, New Mexico

LA-CP-11-01686

Los Alamos Controlled Publication;
distribution is limited.

Title:	**Biological Assessment of the Effects of the Construction and Use of the Upper Sandia Canyon Access Road on Federally Listed Threatened and Endangered Species at Los Alamos National Laboratory**
Prepared by:	David C Keller and Charles D Hathcock Environmental Protection Division
Prepared for:	U.S. Department of Energy, National Nuclear Security Administration, Los Alamos Site Office

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Cover photo: Shelf in Sandia Canyon where the access road will be constructed.

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Date:	December 2011

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LIST OF ACRONYMS

AEI	Area of Environmental Interest
DOE	U.S. Department of Energy
GSA	General Services Administration
HMP	Habitat Management Plan
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security, LLC
NMED	New Mexico Environmental Department
NNSA	National Nuclear Security Administration
SCS	Sediment Control Structure
SERF	Sanitary Effluent Recycling Facility
SFNF	Santa Fe National Forest
TA	Technical Area
USFWS	U.S. Fish and Wildlife Service

Biological Assessment of the Effects of the Construction and Use of the Upper Sandia Canyon Access Road on Federally Listed Threatened and Endangered Species at Los Alamos National Laboratory

EXECUTIVE SUMMARY

This biological assessment accounts for the direct, indirect, and cumulative effects of the construction and use of a proposed new access road into upper Sandia Canyon at Los Alamos National Laboratory (LANL) on federally listed threatened and endangered species. The road is necessary to build a Sediment Control Structure to limit the movement of sediments out of the Sandia wetlands. A LANL Habitat Management Plan screening evaluation revealed there was no habitat at LANL for the black-footed ferret (*Mustela nigripes*); therefore, this project should have no effect on this species. There is habitat for the Southwestern Willow Flycatcher (*Empidonax trailii extimus*) at LANL. No habitat for this species will be removed or disturbed during the project activities which led to the assessment decision that these actions should have no effect on the Southwestern Willow Flycatcher. There is habitat for the Mexican Spotted Owl (*Strix occidentalis lucida*) at LANL. The proposed project areas are in core and buffer habitat for the Mexican Spotted Owl. The actions will remove approximately 2.66 ha (6.56 ac) of Mexican Spotted Owl core habitat in Sandia Canyon and approximately 1.86 ha (4.61 ac) of buffer habitat from the Sandia and Los Alamos Canyons Areas of Environmental Interest. A detailed analysis of the potential magnitude of the effects within led to the assessment decision that, after applying reasonable and prudent measures, these actions may affect, but are not likely to adversely affect, the Mexican Spotted Owl.

1.0 PROJECT DESCRIPTION

The U.S. Department of Energy, National Nuclear Security Administration, Los Alamos Site Office is proposing to construct an access road into upper Sandia Canyon for the purpose of constructing a Sediment Control Structure (SCS) and monitoring wells into the downstream termination of the Sandia Canyon Wetlands. Remediation of these wetlands up to and including complete removal of the wetlands was analyzed in Consultation # 22420-2010-I-0097; however, this access road was not part of that analysis. The previous road proposal was outside of core and buffer habitat, but it was determined not to be economically or structurally feasible. This new road will be following a shelf of the canyon (Figure 1) and will be approximately 3.0 km (1.85

mi) long and 15 m (50 ft) wide or less. The road is located in undeveloped buffer and core habitat for the Mexican Spotted Owl (Photograph 1). The trees on the shelf are of a higher density of smaller trees. The deeper part of the canyon where the mixed conifer is located is to the right in Photograph 1 and the mesa top is above the slope on the left side of Photograph 1. This road will be constructed using heavy equipment by clearing the initial route of the road and then it will be compacted and built up to heavy equipment all season standards using gravel base course. The road will be restricted to official business only.

Photograph 1. The shelf along Sandia Canyon where the road will be constructed.

To limit road access to official business only traffic, the newly constructed road will be gated. In addition to the gate, fencing will be installed north and south from the gate to prevent traffic from bypassing the gate and to prevent future encroachment of work activities into undeveloped land on the mesa top. The proposed access control fence will be approximately 182 m (600 ft) in length and smooth wired to promote wildlife safety (Photographs 2 & 3).

Photograph 2. On the mesa top, from the gate location facing southeast

Photograph 3. On the mesa top, from gate location facing northwest

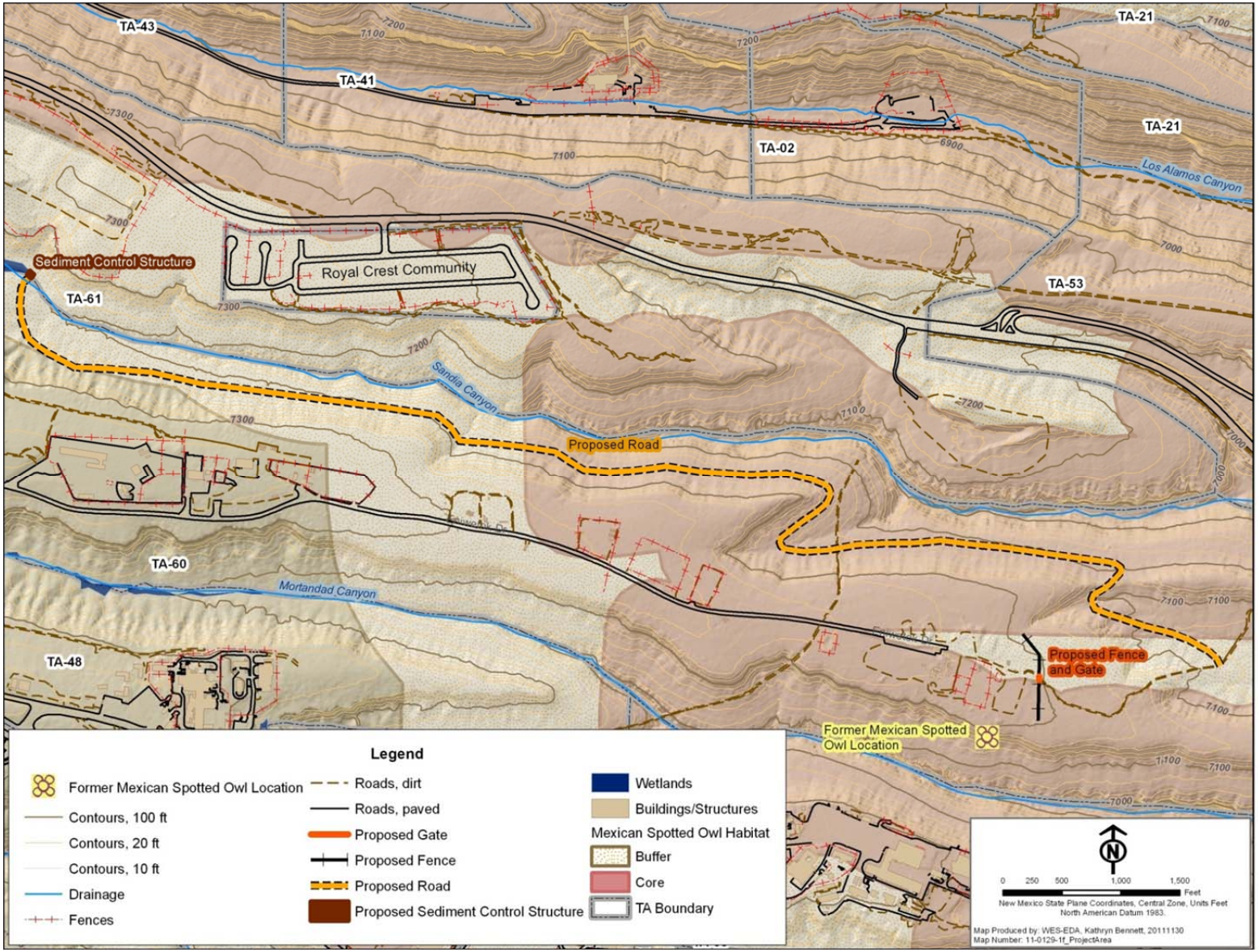

Figure 1. Location of the new road and SCS in Sandia Canyon.

2.0 REGIONAL DESCRIPTION

2.1 Location within the State

LANL and the associated residential areas of Los Alamos and White Rock are located in Los Alamos County, north-central New Mexico, approximately 100 km (60 mi) north-northeast of Albuquerque and 40 km (25 mi) northwest of Santa Fe (Figure 2). The 10,240-ha (25,600-ac) LANL site is situated on the Pajarito Plateau. This plateau is a series of fingerlike mesas separated by deep east-to-west-oriented canyons cut by intermittent streams. Mesa tops range in elevation from approximately 2,400 m (7,800 ft) on the flanks of the Jemez Mountains to about 1,900 m (6,200 ft) at their eastern termination above the Rio Grande.

Most LANL and community developments are confined to mesa tops. The surrounding land is largely undeveloped. Large tracts of land north, west, and south of the LANL site are held by the SFNF, Bureau of Land Management, Bandelier National Monument, General Services Administration, and Los Alamos County. The Pueblo of San Ildefonso borders LANL to the east.

2.2 Geologic Setting, Surface Water, and Ground Water

Most of the fingerlike mesas in the Los Alamos area are composed of Bandelier Tuff, which consists of ash fall, ash fall pumice, and rhyolite tuff. Tuff was deposited after major eruptions in the Jemez Mountains Volcanic Field about 1.2 to 1.6 million years ago (Self and Sykes 1996). LANL is bordered on the east by the Rio Grande, within the Rio Grande rift.

LANL and its surrounding environs encompass a wide range of environmental conditions. This is due to the prominent elevation gradient in the east-west direction and the complex local topography that is found throughout much of the region. At the lowest point along the Rio Grande, the elevation is approximately 1,631 m (5,350 ft) above mean sea level. At the opposite extreme to the west is the Sierra de los Valles which rises to 3,199 m (10,496 ft).

Surface water in the Los Alamos area occurs primarily as short-lived or intermittent reaches of streams. Perennial springs on the flanks of the Jemez Mountains supply base flow into the upper reaches of some canyons, but the volume is insufficient to maintain surface flows across the LANL site before they are depleted by evaporation, transpiration, and infiltration (DOE 2008). Runoff from heavy thunderstorms or heavy snowmelt reaches the Rio Grande several times a

year in some drainages. Effluents from sanitary sewage, industrial waste treatment plants, and cooling-tower blowdown enter some canyons at rates sufficient to maintain surface flows for varying distances.

Groundwater in the Los Alamos area occurs in three forms: (1) water in shallow alluvium in canyons, (2) perched water (a body of groundwater above a less permeable layer that is separated from the underlying main body of groundwater by an unsaturated zone), and (3) the main aquifer of the Los Alamos area. Water in the main aquifer is under artesian conditions under the eastern part of the Pajarito Plateau near the Rio Grande (Purtymun and Johnson 1974). This aquifer discharges into the Rio Grande through springs in White Rock Canyon.

2.3 Weather and Climate

Los Alamos has a temperate, semiarid mountain climate (Bowen 1990 and 1992). However, its climate is strongly influenced by elevation, and large temperature and precipitation differences are locally observed in the area because of the topography. Winter temperatures range from 30°F to 50°F (-1°C to 10°C) during the daytime to 15°F to 25°F (-9°C to -4°C) during the nighttime. The record low temperature recorded in Los Alamos is -18°F (-28°C). Winter is usually not particularly windy, so extreme wind chills are uncommon at Los Alamos. Summer temperatures range from 70°F to 88°F (21°C to 31°C) during the daytime to 50°F to 59°F (10°C to 15°C) during the nighttime. Temperatures occasionally will break 90°F (32°C). The highest temperature ever recorded in Los Alamos is 95°F (35°C). The average annual precipitation in Los Alamos is 48.08 cm (18.93 in.). The average snowfall for a year is 149.6 cm (58.9 in.) (LANL 2009).

2.4 Plant Communities

The Pajarito Plateau, including the Los Alamos area, is biologically diverse. Several wetlands and riparian areas enrich the diversity of plants and animals found on LANL lands. This diversity of ecosystems is due partly to the dramatic 1,500-m (5,000-ft) elevation gradient from the Rio Grande on the east to the Jemez Mountains 20 km (12 mi) to the west, and partly to the many steep canyons that dissect the area. Five major vegetative cover types are found in Los Alamos County: juniper (*Juniperus monosperma* [Englem.] Sarg.)-savanna, piñon (*Pinus edulis* Engelm.)-juniper, ponderosa pine (*Pinus ponderosa* C. Lawson), mixed conifer, and spruce

(*Picea* spp)-fir (*Abies* spp). All of the communities and their distribution are described in Balice (1998).

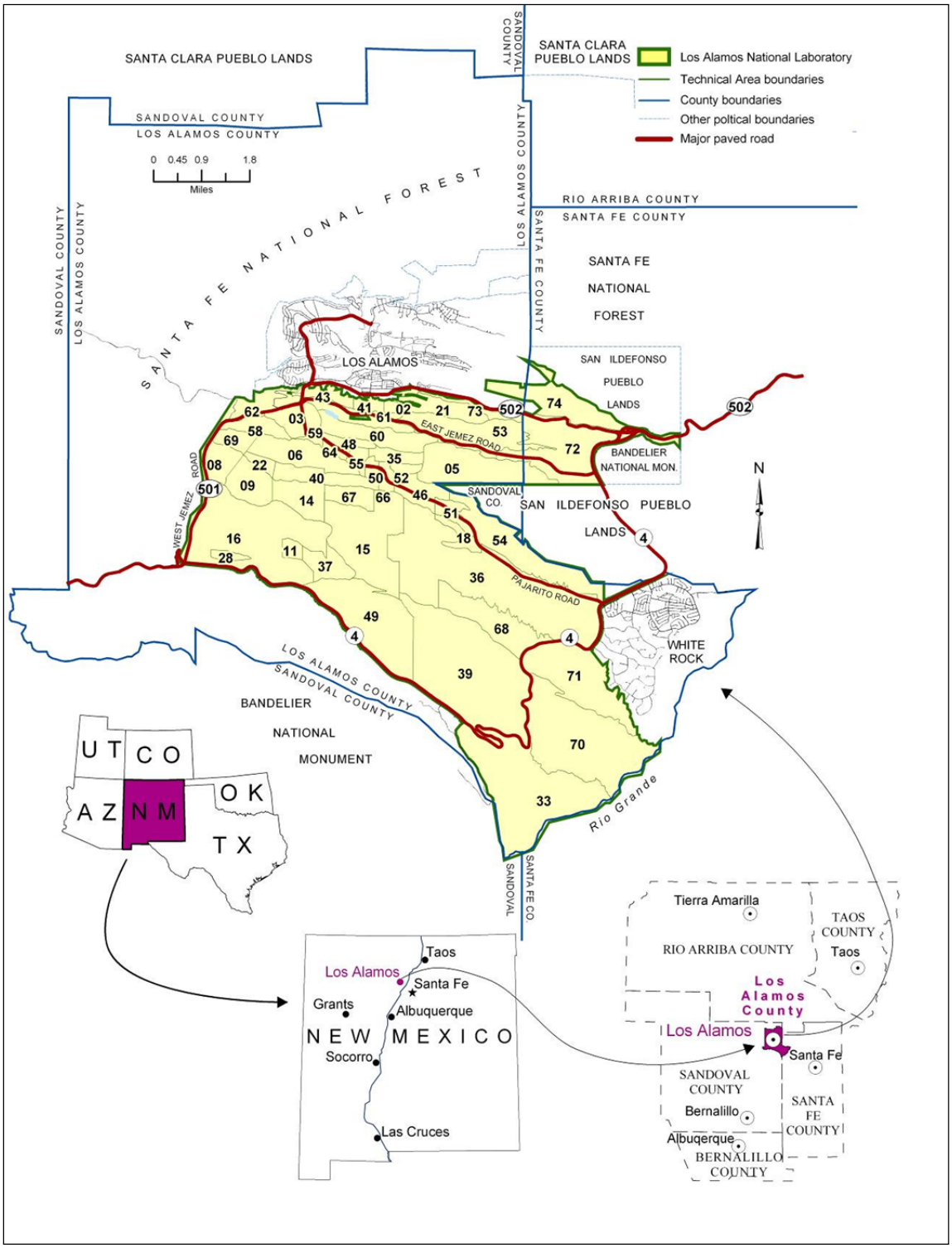

Figure 2. Location of LANL within New Mexico.

3.0 CURRENT ENVIRONMENTAL CONDITIONS AT THE PROJECT LOCATION

3.1 Land Cover, Use, and Traffic Volumes

The primary landcover types in the project area are piñon-juniper forest and ponderosa pine-mixed conifer woodlands based on the land cover categories derived from the LANL land cover map (McKown et al. 2003). In addition to the mapped habitat types, two areas of riparian habitat have been identified along the perennial stream channel (Hansen 2008), and one area of riparian habitat has been identified along an intermittent portion of the stream channel in Sandia Canyon (Hansen 2011). The westernmost area is 0.096 km (0.06 mi) long and 7.3 m (24 ft) wide and consists of narrowleaf cottonwood (*Populus angustifolia* James)/ponderosa pine/*Poa* spp. woodland community type. The central area is 2.09 km (1.3 mi) long and approximately 7.3 ft (24 ft) wide and consists of mixed conifer spp./Gambel's oak (*Quercus gambelii* Nutt.) forest community type. The easternmost area is 0.225 (0.14 mi) long and 9.14 m (30 ft) wide and consists of ponderosa pine/box elder (*Acer negundo* L.)/brome spp. woodland community type. The Sandia Canyon wetland is a primarily cattail (*Typha latifolia* L.) wetland. Small mammal trapping was conducted using Sherman traps in the Mexican Spotted Owl core habitat (and central riparian area) of Sandia Canyon in May 2010. Species captured included *Peromyscus boylii*, *Peromyscus maniculatus*, and *Peromyscus truei*. The small mammal mean percent daily capture rate (number of total captures per 100 trap nights) was 9.25 in the area (Hansen and Hathcock 2010).

East Jemez Road traverses the lower portions of Sandia Canyon and it is a major commuter and transportation route within LANL. The road down Sigma Mesa services the Roads and Grounds facilities, several laydown yards, the older existing SERF evaporation ponds, the newer SERF evaporation ponds currently under construction (Hansen and Hathcock 2010; Consultation # 22420-2010-1-0097), and the asphalt batch plant (Hansen 2005; Consultation # 2-22-05-I-392). The road terminates at the asphalt batch plant and continues as a base-course fire road to the end of the mesa. There is large truck traffic to and from the asphalt batch plant daily.

Just to the west of the project area, a new area of habitat is expected to be removed on the mesa top in a pending biological assessment for the Sigma Mesa clean fill storage yard. This project is expected to remove an additional 5-6 acres of mesa-top habitat.

3.2 Surface Water, Wetlands, and Floodplains

There is a twenty five acre wetland at the head of Sandia Canyon (Figure 1). The SCS will be constructed in the floodplain; however, the new road is not in the floodplain. Surface water flow in Sandia Canyon, from the wetland down through the Mexican Spotted Owl habitat, is perennial.

3.3 Noise

The average daytime background noise level for the Sandia-Mortandad Canyon complex Mexican spotted owl Area of Environmental Interest (AEI) was 52.74 A-weighted decibels [dB(A)], measured at different points along the AEI core boundary (Vrooman *et al.* 2000). The average background noise levels for all of the AEIs are explained in Table 1.

Table 1. Background Noise Levels by AEI

AEI Name	Background Noise Level dB(A)
Pajarito Canyon	49.63
Los Alamos Canyon	59.46
Sandia – Mortandad Complex	52.74
Three-mile Canyon	37.62
Cañon de Valle	51.87

3.4 Light

There are permanent lighting sources currently operating at facilities located on the mesa tops around the project areas.

4.0 POTENTIAL EFFECTS OF THE ACCESS ROAD CONSTRUCTION

4.1 Land Cover, Use, and Traffic Volumes

The proposed road and SCS will remove up to approximately 2.66 ha (6.56 ac) of Mexican Spotted Owl core habitat in Sandia Canyon and approximately 1.86 ha (4.61 ac) of buffer habitat in the Sandia and Los Alamos Canyon AEIs. The affected habitat in Sandia Canyon is detailed in Table 2. The majority of the habitat being removed is piñon-juniper forest with smaller amounts of ponderosa pine forest and mixed conifer. The traffic volumes on Sigma Mesa road and the new road will increase temporarily during the construction of the road and SCS. Once

construction is complete, increased traffic and access is expected to be at relatively infrequent intervals throughout the year, primarily for maintenance or monitoring purposes.

Table 2. Area in Acres of Each Land Cover Type for This Project

Land Cover Type	Hectares	Acres
Piñon-Juniper Forest	1.169	2.889
Ponderosa pine-Mixed conifer Woodland	1.091	2.695
Ponderosa pine Forest	0.921	2.277
Mixed conifer-Spruce-Fir Forest	0.522	1.289
Cerro Grande Fire high burn severity	0.330	0.815
Piñon-Juniper Woodland	0.260	0.643
Shrubland	0.260	0.642
Urban	0.022	0.055
Grassland	0.002	0.005
Total	**4.577**	**11.309**

4.2 Surface Water, Wetlands, and Floodplains

The new road will not have any impacts to surface water, wetlands, or floodplains.

4.3 Noise

The average healthy human ear can barely perceive noise level changes of 3 dB(A) (CalTrans 1998). In general, increases in noise levels of 4 dB(A) or less over background conditions are considered to be “masked” by the ambient noise levels with the primary contribution to that noise level coming from background sources (Lee and Fleming 1996). Increases of 10 dB(A) are perceived by humans as an approximate 100 percent increase (or doubling of) the noise levels (CalTrans 1998), and the ambient noise contribution when a project produces a 10 dB(A) or more increase above background is negligible (Lee and Fleming 1996).

Construction activity associated with the road will temporarily raise noise levels. Only the road construction activity is likely to raise noise levels in core habitat for federally listed species more than 6 dB(A) above background levels. Business use only access to the road will be year-round but noise levels will likely not exceed background levels.

4.4 Light

There may be temporary lighting associated with construction activities. If lighting is needed at the SCS it will be oriented to not light the core area to the east and will be used only during construction. No new permanent lighting will be installed.

5.0 THREATENED AND ENDANGERED SPECIES

The LANL Threatened and Endangered Species Habitat Management Plan (HMP) is a document prepared by LANL personnel to provide for the protection of federally listed threatened and endangered species and their habitats on LANL. The HMP is designed to be a comprehensive landscape-scale management plan that balances the current operations and future development needs of LANL with the habitat requirements of threatened and endangered species. It also facilitates DOE compliance with the Endangered Species Act and related federal regulations (LANL 2011).

The HMP defines site plans and monitoring plans for threatened and endangered species that occur or may occur on LANL. Currently, there are site plans for each of the following threatened and endangered species occurring or potentially occurring at LANL: Southwestern Willow Flycatcher and Mexican Spotted Owl.

The purpose of site plans is to provide guidelines to ensure LANL operations do not adversely affect these species or their habitats. Suitable habitats for these species, along with a protective buffer area surrounding the habitats, have been designated as AEIs. Site plans provide information on the location of AEIs and guidelines for their management. In general, an AEI consists of a core area that contains important breeding or wintering habitat for a specific species and a buffer area around the core area. The buffer protects the core area from disturbances that would degrade the value of the core area to the species.

5.1 Regional Lists

Table 3 presents the list of federally threatened and endangered species potentially occurring on the Pajarito Plateau.

5.2 Status of Species

Population trends of the threatened and endangered species potentially occurring at LANL are outlined below. Two of the species, the Southwestern Willow Flycatcher and Mexican Spotted Owl, either occur on LANL or have potentially suitable nesting or foraging habitat and require an assessment relative to the potential effects of the project. The remaining species, the black-

footed ferret, was determined not to have suitable habitat on LANL property and will not require detailed evaluation. Habitat requirements and survey methods for all species will be discussed in the following sections.

Table 3. Threatened and Endangered Species Potentially Occurring at LANL

Scientific Name	Common Name	Status[1]	Habitat	Potential to Occur[2]
Mustela nigripes	Black-footed ferret	FE	Prairie dog towns greater than 32 ha (80 ac).	Low
Empidonax trailii extimus	Southwestern Willow Flycatcher	FE	Riparian areas with stands of willow (*Salix* spp), buttonbush (*Cephalanthus* spp), or tamarisk (*Tamarix* spp).	Moderate
Strix occidentalis lucida	Mexican Spotted Owl	FT	Forested mountains and canyons. Generally uneven-aged, multistoried forest with closed canopy.	High

[1]Codes for Legal Status: FE = Federally Endangered, FT = Federally Threatened

[2]Potential to Occur: High = Species is known to occur in the area; Moderate = the area has some species habitat components; Low = the area does not have species habitat components

5.2.1 Black-footed Ferret

Status: Federally Endangered

Regional Trends: In 1992, the black-footed ferret was listed as the rarest mammal in North America. In 1981, a remnant population in northwest Wyoming was removed for captive breeding and reintroduction. Reintroduction has begun in Wyoming, Montana, and South Dakota (Finch 1992).

State Trends: Last reported in New Mexico in 1934 (Frey and Yates 1996). If any animals survive, the northwestern part of the state is the most likely area (Findley *et al.* 1975).

Local Trends: No reported sightings of black-footed ferrets in Los Alamos County for at least the last 50 years. In addition, no large prairie dog towns have been observed on LANL lands.

5.2.2 Southwestern Willow Flycatcher

Status: Federally Endangered

Local Trends: Willow Flycatcher surveys have been conducted at LANL beginning in 1995. Willow Flycatchers, not necessarily of the southwestern subspecies, have been detected during both the spring and fall migration period; however, no breeding Willow Flycatchers have been documented at LANL.

5.2.3 Mexican Spotted Owl

Status: Federally Threatened

Local Trends: Surveys for Mexican Spotted Owls have been conducted on LANL property since 1994. In 1995 a pair of Mexican Spotted Owls and their nest was located in Cañon de Valle. Each year since, the nesting territory has been occupied, and young have fledged in multiple years. In 2004, 2005, and 2006, a second territory in Mortandad Canyon was occupied by at least one Mexican Spotted Owl. In 2007 LANS biologists located a pair of Mexican Spotted Owls and their nest in Three-mile Canyon. This site has been occupied each year since and young have fledged in multiple years.

5.3 Surveys for Species Included in the HMP

The Southwestern Willow Flycatcher and Mexican Spotted Owl have potential suitable habitat on or near LANL. These species require an impact assessment decision.

5.3.1 Southwestern Willow Flycatcher

5.3.1.1 Habitat Description

The Southwestern Willow Flycatcher breeds in riparian habitats from southern California to Arizona and New Mexico and as far north as southern Utah and Nevada. In winter it is found in southern Mexico, Central America, and northern South America. Southwestern Willow Flycatchers are present in New Mexico from early May through mid-September, and breed from late May through late July. The flycatcher's nesting cycle is approximately 28 days. Southwestern Willow Flycatchers typically raise one brood per year.

The Southwestern Willow Flycatcher only nests along rivers, streams, and other wetlands. It is found in close association with dense stands of willows (*Salix* L.), arrowweed (*Pluchea* spp.),

buttonbush (*Cephalanthus occidentalis* L.), tamarisk (*Tamarix* L.), Russian olive (*Elaeagnus angustifolia* L.), and other riparian vegetation, often with a scattered overstory of cottonwood (*Populus* spp; Finch 1992, USFWS 1995b). The size of vegetation patches or habitat mosaics used by Southwestern Willow Flycatchers varies considerably and ranges from as small as 0.8 ha (2 ac) to several hundred hectares. The Southwestern Willow Flycatcher nests in thickets of trees and shrubs approximately 2 to 15 m (6.5 to 50 ft) tall, with a high percentage of canopy cover and dense foliage from 0 to 4 m (0 to 13 ft) above ground. Regardless of the plant species composition or height, occupied sites always have dense vegetation in the patch interior (Sogge *et al.* 1997).

Under the HMP, Southwestern Willow Flycatcher habitat was modeled at LANL based on macro-level vegetation classifications. The only area currently recognized as possible suitable Southwestern Willow Flycatcher nesting habitat at LANL is the large wetlands complex along the north side of Pajarito road in TA-36.

5.3.1.2 Survey Methods

Surveys are conducted in the core areas of the Southwestern Willow Flycatcher AEI. A minimum of one survey is conducted during each of the following survey periods: May 15 to May 31, June 1 to June 21, and June 22 to July 17. Surveys must be at least five days apart. The surveys start at first light and continue until the entire AEI has been surveyed (USFWS 2000). This protocol is a broadcast survey. At each site, surveyors broadcast recorded vocalizations of Southwestern Willow Flycatchers using a Fox Pro Game Caller. Sogge *et al.* (1997) describe the survey methods in detail. If a flycatcher is found, its behavior is observed and recorded to determine if the individual is nesting in the area.

5.3.1.3 Results

Southwestern Willow Flycatcher surveys have been conducted at LANL since 1995. Willow Flycatchers, not necessarily of the southwestern subspecies, have been detected during both the spring and fall migration period; however, no breeding Willow Flycatchers have been documented at LANL.

5.3.2 Mexican Spotted Owl

5.3.2.1 Habitat Description

The Mexican Spotted Owl is found in northern Arizona, southeastern Utah, and southwestern Colorado south through New Mexico, west Texas, and into Mexico. It is the only subspecies of Spotted Owl recognized in New Mexico (USFWS 1995a). The Mexican Spotted Owl generally inhabits mixed conifer and ponderosa pine-gambel oak forests in mountains and canyons. High canopy closure, high stand diversity, multilayered canopy resulting from an uneven-aged stand, large mature trees, downed logs, snags, and stand decadence, as indicated by the presence of mistletoe (*Phoradendron* Nutt.), are characteristic of Mexican Spotted Owl habitat. Some Spotted Owls have been found in second-growth forests, i.e., younger forests that have been logged; however, these areas were found to contain characteristics typical of old-growth forests. No Spotted Owls were found in forests less than 36 years of age (USFWS 1995a). Mexican Spotted Owls in the Jemez Mountains seem to prefer cliff faces in canyons for their nest sites (Johnson and Johnson 1985). The recovery plan for the Mexican Spotted Owl recommends that mixed conifer and pine-oak woodland types on slopes greater than 40 percent be protected for the conservation of this owl (USFWS 1995a). Although seasonal movements vary among owls, adults commonly remain within their summer home ranges throughout the year.

Under the HMP, Mexican Spotted Owl habitat was modeled at LANL based on a combination of topographical features and macro-level vegetation classifications. Areas defined as suitable Mexican Spotted Owl habitat were delineated into AEIs during the development of the HMP in 1998. However, personnel at LANL developed a Mexican Spotted Owl habitat model that incorporates a finer scale of vegetation characteristics into the current model (Hathcock and Haarmann 2008). A version of this model was used to redelineate the AEIs at LANL and the proposed changed received concurrence from the USFWS in 2005 (Hathcock and Keller 2005). The current Mexican Spotted Owl AEI inventory consists of five AEIs spanning seven canyons at LANL.

5.3.2.2 Survey Methods

There are three primary calling techniques that can be used to survey for the Mexican Spotted Owl. The choice of calling technique should be based on the best way to cover all suitable

habitats. The three calling techniques are point, continuous, and leapfrog. At LANL, the survey technique used is the point method.

In the point method, an electronic recording of an owl call is played using a Fox Pro Game Caller at a fixed point. The observer will spend at least 15 minutes at a point and alternate between playing the recording of the owl and listening for a response. In canyon habitat, it is recommended that surveyors spend a minimum of 20 minutes at each station. The primary four-note location call of the Mexican Spotted Owl should be the major call played during surveys. Points are approximately 0.8 km (0.5 mi) apart and cover all suitable habitats.

Surveys are conducted annually in the Mexican Spotted Owl AEI core areas on LANL property. Up to four surveys (depending on results) are conducted between April 1 and August 31 of any given year. No more than one survey can be conducted in March of any given year. A minimum of two surveys must be completed before July 1 of any given year. Surveys must be at least five days apart. The preferred time to perform surveys is before sunrise and the two hours after sunset. Field surveys are not conducted during existing or predicted wind (>15 mph) or during stormy weather. Surveys are not conducted when there are access problems due to snow or poor road conditions.

5.3.2.3 Results

A pair of Mexican Spotted Owls has been documented in the Cañon de Valle Mexican spotted owl AEI each year since 1995. At this nest site, young have been fledged in multiple years. Since 2007, a second pair of owls has been recorded nesting in the Three-mile Canyon AEI. At this nest site, young have been fledged in multiple years as well. Both Cañon de Valle and Three-mile Canyon were occupied in 2011. All other habitat locations were vacant during 2011 annual surveys.

A single Mexican Spotted Owl was recorded in the Sandia-Mortandad Canyon AEI during the breeding season in 2004, 2005, and 2006. No breeding activity or second owl in the Sandia-Mortandad Canyon AEI was documented during follow-up surveys in those years. No Mexican Spotted Owls have been detected during annual surveys in the Sandia-Mortandad Canyon AEI since 2006.

A history of the Mexican Spotted Owl survey results since surveys began in 1994 is detailed in Table 4.

Table 4. Mexican Spotted Owl Survey Results at LANL

	Cañon de Valle	Water Canyon	Three-mile Canyon	Pajarito Canyon	Mortandad Canyon	Sandia Canyon	Los Alamos Canyon
1993	--	--	--	N	--	--	--
1994	--	--	--	--	--	--	N
1995	P+	N	N	N	--	--	N
1996	P+	N	N	N	--	--	N
1997	P	N	--	--	--	--	N
1998	P+	N	--	--	N	N	N
1999	P+	N	N	N	N	N	N
2000	P	N	N	N	N	N	N
2001	P	N	N	N	N	N	N
2002	P	N	N	N	N	N	N
2003	P	N	N	N	N	N	N
2004	P	N	N	N	P*	N	N
2005	P+	N	N	N	P*	N	N
2006	P	N	N	N	P*	N	N
2007	P	N	P+	N	N	N	N
2008	P	N	P	N	N	N	N
2009	P+	N	P+	N	N	N	N
2010	P	N	P	N	N	N	N
2011	P	N	P	N	N	N	N

-- No data; P = Positive survey; N = Negative survey; * = Only a single owl; + = Breeding confirmed

6.0 THREATENED AND ENDANGERED SPECIES ASSESSMENTS

6.1 Assessments for Species Not Included in the HMP

6.1.1 Black-footed Ferret

The black-footed ferret is listed by the USFWS as endangered in New Mexico but has no potential suitable habitat on or near LANL. This species has not been included in the HMP site plans and did not receive a detailed assessment. There are no prairie dog colonies of the

appropriate size in Los Alamos County, and there are no prairie dog colonies near the proposed project area. The proposed action should have no effect on the black-footed ferret.

6.2 Assessments for Species Included in the HMP

6.2.1 Southwestern Willow Flycatcher

6.2.1.1 Project Impacts

The Southwestern Willow Flycatcher AEI at LANL is 3.9 km (2.4 mi) from the nearest proposed project activity, and is located in a different canyon watershed. The proposed actions should not have direct or indirect effects on this species.

6.2.1.2 Reasonable and Prudent Alternatives

None are required.

6.2.1.3 Assessment Decision

There will be no habitat loss or disturbance associated with these proposed actions and as a result the proposed actions should have no effect on this species.

6.2.2 Mexican Spotted Owl

6.2.2.1 Project Impacts

The road following the canyon shelf will be approximately 3.0 km (1.85 mi) and 15 m (50 ft) wide. The actions will remove approximately 2.66 ha (6.56 ac) of Mexican Spotted Owl core habitat in Sandia Canyon and approximately 1.86 ha (4.61 ac) of buffer habitat in the Sandia and Los Alamos Canyon AEIs. Sensitive habitat in the canyon, including some mixed-conifer and ponderosa pine forest, will be removed. The road will meander to miss as many trees larger than 20 cm (9 in) in diameter as possible. The disturbance represents less than one percent of the available core habitat in the AEI.

The general location on Sigma Mesa is highly disturbed (Figure 3). The cumulative impacts in the area include year-round activities such as aggregate and equipment storage at the asphalt batch plant. This batch plant operation was consulted in 2005 (Hansen 2005; Consultation # 2-22-05-I-392). Immediately west of the asphalt batch plant on the north side of the road will be a new clean fill yard. This action has a biological assessment that is in draft and will be consulted

with the USFWS in January 2012. Immediately west of the proposed clean fill yard are the existing Sanitary Effluent Recycling Facility (SERF) ponds, the General Services Administration (GSA) new vehicle staging lot, and a well storage yard. These projects were all completed in past years under existing HMP restrictions. The SERF ponds are being expanded this year as well and that project was consulted in 2010 (Hansen and Hathcock 2010; Consultation # 22420-2010-I-0097).

Mexican Spotted Owl surveys have been conducted for Sandia Canyon every year from 1995 to the present. Sandia Canyon has never been documented as occupied by Mexican Spotted Owls, and the Sandia wetlands have never been documented as being used for foraging by Mexican Spotted Owls. All of this habitat will still be fully available for use by any Mexican Spotted Owls. The location of the single Mexican Spotted Owl that stayed in Mortandad Canyon in 2004, 2005, and 2006 is approximately 245 m (800 ft) south-southeast from the asphalt batch plant (Figure 1). Breeding was never confirmed in this location and it is our opinion that his was a single male attempting to establish a new territory.

This habitat is suitable to support the Mexican Spotted Owl and with the proper controls to limit disturbance, this area will remain suitable. The road is on the shelf and out of the deeper canyon habitat sections that contains the bulk of the mixed conifer. In this assessment we are requiring access controls to be in place so that this road is only used for official business only. We are also requiring the installation of fencing on the mesa top around the gate to limit disturbance and further habitat degradation.

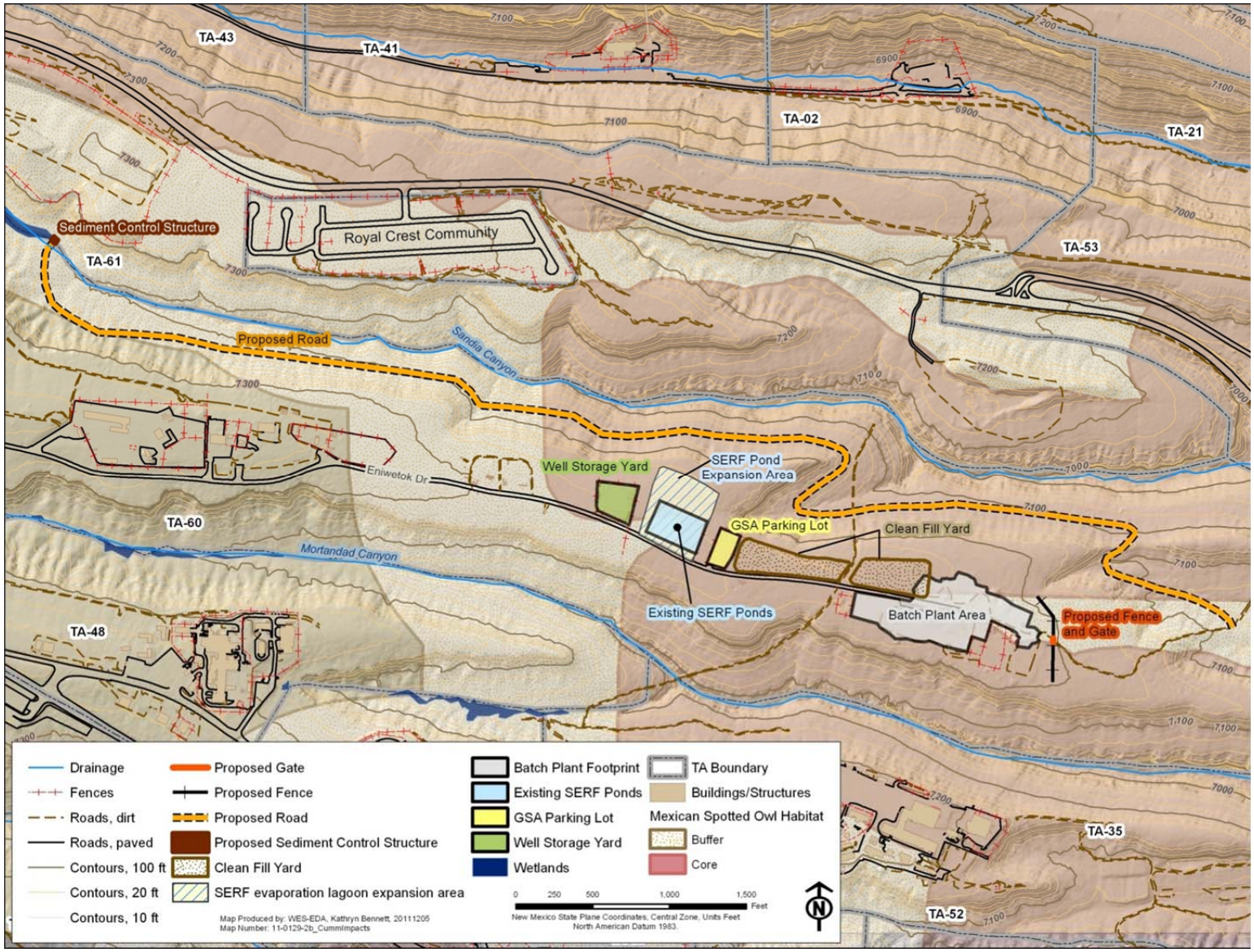

Figure 3. Cumulative Impacts Around the Project Area.

6.2.2.2 Reasonable and Prudent Alternatives

- The new road will follow a path of lower density and smaller trees when possible.
- The new road will have a gate installed at the east end of the asphalt batch plant footprint and access will be controlled year-round to official business only.
- A 3-strand smooth-wire fence will be installed to protect cultural and natural resources on the mesa. The fence will run south from the gate for 250 ft to the canyon edge. The fence will also run north by northwest 350 ft from the gate to the boundary of a cultural site.
- Appropriate LANL-approved erosion and runoff controls will be employed and periodically inspected throughout the life of the project. All exposed soils must be re-vegetated as soon as feasible to minimize erosion.
- Any temporary or permanent lighting will comply with the New Mexico Night Sky Protection Act.
- Landscape vegetation planted in association with the construction of these projects must be native species appropriate for this elevation and forest type.

6.2.2.3 Assessment Decision

Applying the reasonable and prudent alternatives described above, these project activities may affect, but are not likely to adversely affect, the Mexican Spotted Owl.

ACKNOWLEDGMENTS

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APPENDIX I:

SWPPP Training Records

SWPPP Training

All onsite employees and subcontractors must be trained as necessary to be made aware of the applicable control measures implemented at the site so they follow applicable procedures.

Name	Title

APPENDIX J:

Inspector/SWPPP Preparer Qualifications and Inspection Templates

Inspector/SWPPP Preparer Qualifications

NPDES General Permit for Storm Water Discharges from Construction Activities

Terrill Lemke, P.E., CPESC, CISEC, ENV Division
Qualifications: LANL Team Leader responsible for storm water permitting and compliance at LANL. Involved in the development, implementation, and regulatory review of construction SWPP Plans. Assisted in the development of LANL guidance documents for storm water BMPs. Attended and instructed courses in NPDES storm water permit compliance and sediment and erosion control. Civil engineer with previous experience in construction. Certified Professional in Erosion and Sediment Control (CPESC) and Certified Inspector of Sediment and Erosion Control (CISEC).

Tim Zimmerly CPESC, CISEC, ENV Division
Qualifications: Bachelor of Science in Civil Engineering with over 20 years experience in design engineering/construction/project management/remediation and emergency and spill response. Assisted in the development of LANL guidance documents for storm water BMPs and the development of construction SWPP Plans. SME in field inspections, implementation of BMPs and other controls. Certified Professional in Erosion and Sediment Control (CPESC) and Certified Inspector of Sediment and Erosion Control (CISEC), and familiar with erosion control and storm water requirements for this project.

Jacob Knight, CISEC, ENV Division
Qualifications: Bachelor of Science degree in Biology. Involved in the development and revision of SWPP Plans and site maps. Has demonstrated ability in performing and documenting storm water inspections and is familiar with placement, and maintenance of BMPs. Certified Inspector of Sediment and Erosion Control (CISEC).

Samuel R. Loftin, BS, MS, PhD, CISEC, ENV Division
Qualificatins: I received my BS degree in Biology from Western Oregon State University in 1983, my MS in Botany from Arizona State University in 1987 and my Ph.D. in Biology from the University of New Mexico in 1994. I worked on a postdoc research appointment with the USFS Rocky Mountain Research Station in Albuquerque for five years and then started at LANL in 1998. I have over 20 years of professional experience in terrestrial plant ecology, restoration ecology, and vegetation management. I have been working on NPDES permit management at LANL since 2006. I received CISEC certification in June 2010.

Phillip Noll, BS, MS, PhD, CISEC, ENV Division
Qualifications: BS, MS, and PhD degrees in Geology. Has demonstrated ability in performing and documenting storm water inspections and is familiar with placement, and maintenance of BMPs. Certified Inspector of Sediment and Erosion Control (CISEC). Experience with the LANL NPDES Permits (Individual Permit, Multi-Sector General Permit, and the Construction General Permit). Management experience in Environmental Restoration. NEPA Specialist.

Marwin Shendo, CISEC, ENV Division
Qualifications: Received my Bachelor of Science degree in Wildlife Science in 2004 and my Master of Water Resources degree in 2011. I have a year and half experience in performing inspections of NPDES CGP, MSGP, and IP regulated sites; is knowledgeable about implementation and maintenance of BMPs. Certified Inspector of Sediment and Erosion Control (CISEC).

NPDES Construction General Permit Stormwater Site Inspection Report

Project Name:		
Inspector's Name(s) and Title: See SWPPP Appendix for Inspector's Qualifications and Titles **Others Present:**	**Date of Inspection:** **Time:**	**Are there any discharges of stormwater, sediment, or other potential pollutants at the time of inspection?** ❑Yes ❑No **If yes, complete CGP SWPPP Inspection Visual Assessment Form.**
Type of Inspection: ❑7-Day ❑ 14-Day ❑ Monthly ❑ Precipitation Event (attach weather information)	**SWPPP inspections signed?** ❑ Yes ❑ No	**Describe present phase of construction:**

Site Areas Inspected:	❑ All disturbed areas	❑ All installed stormwater controls	❑ Material, waste, borrow, or equipment storage and maintenance areas	❑ All areas where stormwater typically flows	❑All points of discharge	❑ All locations where stabilization has been implemented

	Site findings/Erosion and Sediment controls and Pollution Prevention		**Description of observations (corrective actions required are documented on Corrective Action Report):**
1	Are erosion, sediment and pollution prevention controls installed, operational, and effective?	❑Yes ❑No ❑N/A	
2	Do any controls need to be replaced, repaired, or maintained?	❑Yes ❑No ❑N/A	
3	Are there any locations where new controls are necessary to comply with Parts 2 and/or 3 of the CGP?	❑Yes ❑No ❑N/A	
4	Are there any signs of erosion on-site or sedimentation at stormwater controls since the last inspection?	❑Yes ❑No ❑N/A	
5	Are conditions present that could lead to spills, leaks or other accumulations of pollutants onsite?	❑Yes ❑No ❑N/A	
6	Other:		

Comments:

The Site has been found to be: ❑ In Compliance ❑ Non-Compliant **Inspector Signature :** _____ **Date:** _____

CORRECTIVE ACTIONS REPORT REQUIRED: ❑Yes ❑No (If yes, see page 2 for C/A Report)

CERTIFICATION STATEMENT:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information contained therein. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information contained is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

LANL:

Print name and title: _____ **Signature :** _____ **Date:**_____

Sub-Contractor:

Print name and title: _____ **Signature :** _____ **Date:**_____

Corrective Action (CA) Report

Project Name:	Date:	Time:

CA #	Condition Identified	Nature of condition requiring corrective action	Date Due *
1			
2			
3			
4			
5			
6			
7			

* If corrective action is infeasible to complete by the date due document why it is infeasible and document schedule for ensuring completion of corrective action(s) as soon as practicable

SWPPP updates required ❑Yes ❑No

CAs identified by ❑SWPPP inspector ❑Site representative ❑Other:	**Print name and title:**	**Signature of person identifying corrective actions:**

A FOLLOW UP REPORT IS REQUIRED WITHIN 7 DAYS OF THIS CA REPORT AND IS PROVIDED ON PAGE 2.

CERTIFICATION STATEMENT:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information contained therein. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information contained is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

LANL:

Print name and title: _____ **Signature :** _____ **Date:**_____

Contractor:

Print name and title: _____ **Signature :** _____ **Date:**_____

7-Day Corrective Action Follow Up Report

To be completed within 7 days of identification of corrective actions

Project Name:

CA #	Immediate follow up actions taken to review the design, installation, and maintenance of stormwater controls	Date	Stormwater control modifications taken or to be taken including schedule of activities necessary to implement changes, include the date the modifications are completed or expected to be completed	Date completed *
1				
2				
3				
4				
5				
6				
7				

*** Or date modifications are expected to be completed once scheduled**

Follow up report completed by - Print name and title: **Signature :** **Date:**

CERTIFICATION STATEMENT:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information contained therein. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information contained is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

LANL:

Print name and title: _____ **Signature :** _____ **Date:**_____

Contractor:

Print name and title: _____ **Signature :** _____ **Date:**_____

APPENDIX K:

Inspection and Corrective Actions Reports