NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

Restoring and Protecting Wetlands in Cebolla Canyon Closed Basin
CD# 966857-01-0C
Quality Assurance Project Plan

Submitted to:
U.S. Environmental Protection Agency
Region 6

Submitted by:
New Mexico Environment Department
Surface Water Quality Bureau
1190 Saint Francis Drive
Santa Fe, NM 87502

June 2009

GROUP A PROJECT MANAGEMENT

A1.0 TITLE AND APPROVAL SHEET

A1.1 Project Title: *Restoring and Protecting Wetlands in Cebolla Canyon Closed Basin*
Section 104(b)(3) Wetlands Development Grant 2008, CD# 966857-01-0C

A1.2 Approvals:

New Mexico Environment Department Surface Water Quality Bureau

Abe Franklin, Program Manager, Watershed Protection Section — Date: 7/7/09

Maryann McGraw, Wetlands Program Coordinator, Wetlands and D.O.T. Team, Watershed Protection Section — Date: 6/30/09

Matt Schultz, Project Officer, Watershed Protection Section — Date: 6/8/09

Tim Michael, Interim Quality Assurance Officer, Standards, Planning and Reporting Team — Date: 6/30/2009

United States Environmental Protection Agency Region VI

Donna Miller, Chief, State and Tribal Programs Section — Date: 7-22-09

Arlene Gaines, Project Officer, Water Quality Protection Division — Date: 7/24/09

Rio Puerco Alliance

Charles Wohlenberg, Vice Chairman of the Board of Directors — Date: 8 June 2009

Bureau of Land Management

Dave Mattern, Hydrologist, Rio Puerco Field Office — Date: 6-8-09

A2.0 TABLE OF CONTENTS

A2.1 List of Tables

A2.2 List of Figures

A2.3 Abbreviations

AWF	Albuquerque Wildlife Federation
BLM	Bureau of Land Management
BMP	Best Management Practice
DOQQ	Digital Orthoimagery Quarter Quadrangle
EMNCA	El Malpais National Conservation Area
NMED	New Mexico Environment Department
QA	Quality Assurance
QC	Quality Control
QAPP	Quality Assurance Project Plan
RPA	Rio Puerco Alliance
SOP	Standard Operating Procedures
SWQB	New Mexico Environment Department Surface Water Quality Bureau
U.S. EPA	United States Environmental Protection Agency
WPS	Watershed Protection Section
ZEC	Zeedyk Ecological Consulting

A3.0 DISTRIBUTION LIST

The Project Officer will distribute copies of this approved Quality Assurance Project Plan (QAPP) and any subsequent revisions to the project personnel listed below. Upon receipt of the QAPP, those on the distribution list will sign the receiving form (see E1.0) and return to the Project Officer. All receiving forms will be kept on file at NMED SWQB.

New Mexico Environment Department Surface Water Quality Bureau

Project Officer: Matt Schultz, 3082 32nd St., Suite D Silver City NM, 88061, (575) 956-1550
matthew.schultz@state.nm.us
Interim QA Officer: Tim Michael, (505) 476-3799
File Manager: Bessie Muzumdar, (505) 827-0584

Bureau of Land Management

BLM Liaison: Dave Mattern, Hydrologist (505) 761-8776

Rio Puerco Alliance

Project Manager: Barbara Johnson, (505) 474-6689

U.S. Environmental Protection Agency Region 6

Assistance Programs Branch Chief: Donna Miller, Wetlands Program, (214) 665-8093
Project Officer: Arlene Gaines, Water Quality Protection Division, (214) 665-7163

Additional copies of the QAPP will be distributed to consultants listed below who have been contracted to perform monitoring and design tasks. The consultants will sign the receiving form indicating that they are familiar with the requirements of the QAPP.

Private Consultants

Designer:	Bill Zeedyk, Zeedyk Ecological Consulting, LLC (505) 281-9066
Geomorphology Team Leader:	Steve Vrooman, Steve Vrooman Restoration Ecology 505-490-0594
Vegetation Monitoring Leader:	Steve Vrooman, Steve Vrooman Restoration Ecology 505-490-0

A4.0 PROJECT/TASK ORGANIZATION

This section lists the roles and responsibilities of persons who will collect and/or use the information gathered for the restoration project. A project organizational chart on page 10 displays hierarchy of the project.

Table A4.1 Project Roles and Responsibilities

Name	Organization	Role	Responsibilities	Contact Information
Matt Schultz	SWQB	Project Officer/decision maker/information producer	Manage progress of project, supervise work, process invoices, assist in data collection activities including photopoints, compile interim monitoring reports, prepare final project report etc.	Office: (575) 956-1550 Mobile: (575) 654-0182 matthew.schultz@state.nm.us
Maryann McGraw	SWQB	Wetlands Program Coordinator/Principal investigator/decision maker	Oversee technical completion of work.	(505) 827-0581 maryann.mcgraw@state.nm.us
Dave Menzie	SWQB	Geologist/Information producer	Collect and interpret soil data.	(575) 956-1548 david.menzie@state.nm.us
Abe Franklin	SWQB	Program Manager/decision maker		(505) 827-2793 abe.franklin@state.nm.us
Glenn Saums	SWQB	Bureau Chief/decision maker		(505) 827-2827 glenn.saums@state.nm.us
Tim Michael	SWQB	QA Officer	Review QAPP	(505) 476-3799 tim.michael@state.nm.us
Bessie Muzumdar	SWQB	File Manager	Maintains project files	(505) 827-0584 bessie.muzumdar@state.nm.us
Dave Mattern	BLM	BLM Liaison/ decision maker on BLM land		(505) 761-8776 David_Mattern@nm.blm.gov
Barbara Johnson	RPA	Executive Director and	Help manage progress of	(505) 474-6689 lunah3@comcast.net

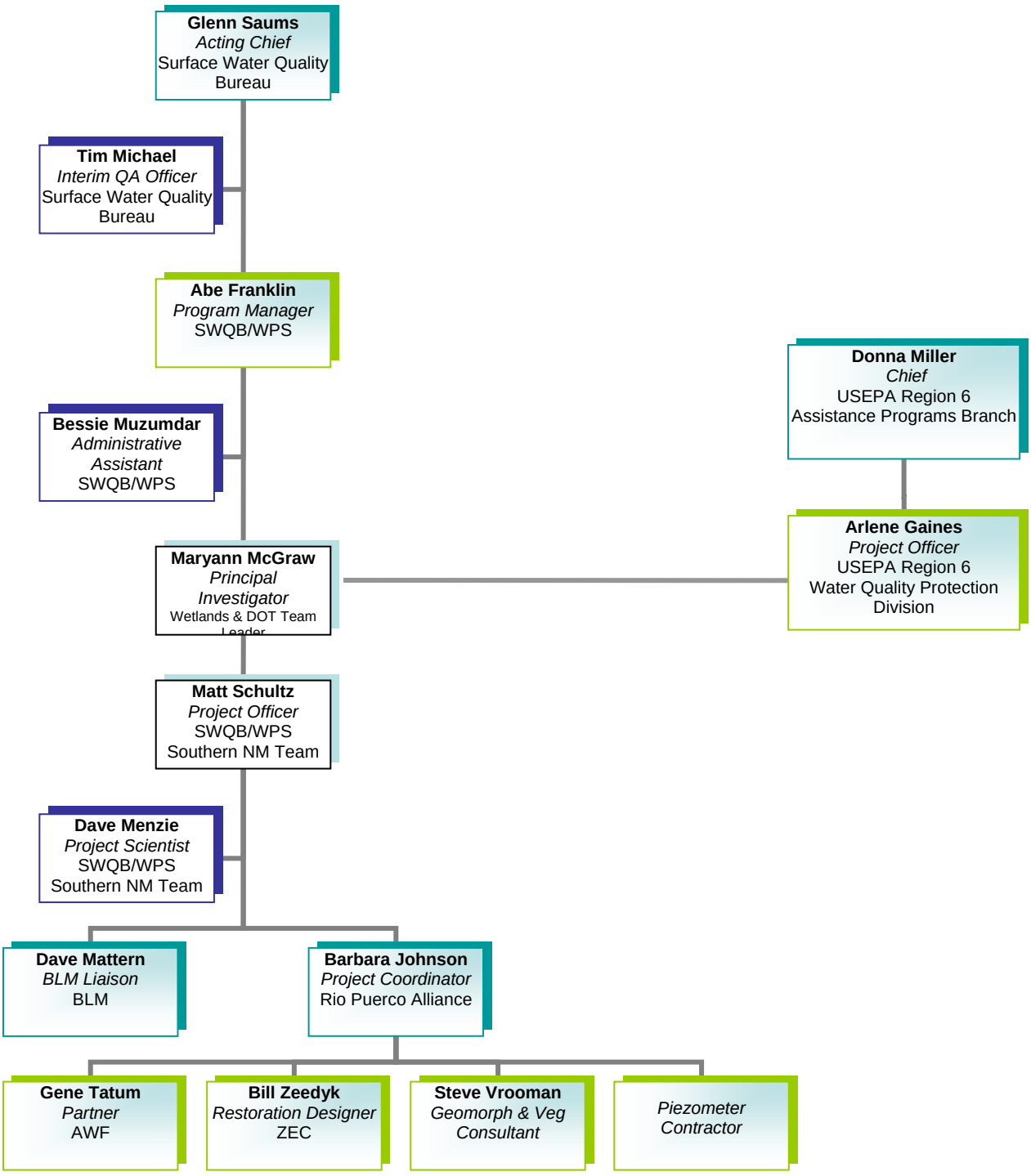
		Project Manager	project, process invoices, assist in data collection activities, prepare final project report etc.	
Steve Vrooman		Geomorphology and vegetation monitoring producer	Collect and analyze geomorphology and vegetation data. Prepare monitoring reports.	505-490-0594 stevevrooman@starband.net
Bill Zeedyk	ZEC	Restoration Designer	Prepare restoration design. Oversee implementation.	(505) 281-9066 bzcreekz@att.net
To be determined		Piezometer installer and groundwater information producer	Collect and analyze groundwater level data.	
Gene Tatum	AWF	Partner	Assist with monitoring.	gtatum3@msn.com
Arlene Gaines	U.S. EPA	Decision maker/regulator/ principal data user		(214) 665-7163 gaines.arlene@epa.gov
Donna Miller	U.S. EPA	Decision maker/regulator		(214) 665-8093 miller.donna@epa.gov

Volunteers will be trained and under the supervision of RPA, the monitoring contractors, and SWQB will assist the collection of some data including photo-point and vegetation transect data

A4.1 Line of Authority Description

The organizational structure for this project is presented in Figure A4.1.

Figure A4.1 Project Organization Chart



A5.0 PROBLEM DEFINITION/BACKGROUND

The SWQB Wetlands Program protects and restores New Mexico's remaining wetlands and riparian areas with the goal of increasing wetland acreage in New Mexico. The Program identifies impaired wetlands and implements restoration projects funded by U.S. Environmental Protection Agency Wetland Program Development Grants issued under the Clean Water Act Section 104(b)(3). The restoration project covered by this QAPP is titled *Restoring and Protecting Wetlands in Cebolla Canyon Closed Basin*.

Historic irrigation diversions have dried out the wetlands along Cebolla Creek and caused headcutting and incision in the main channel. Our project will restore water to the wetlands and begin to stabilize the stream banks through implementation of select best management practices (BMPs).

Cebolla Canyon is primarily within and protected by a congressionally designated Wilderness Area (Cebolla Wilderness) within the congressionally designated El Malpais National Conservation Area (EMNCA) near Grants, New Mexico (Map 1). The project area has multiple designations including Wilderness Area, and National Conservation area. However, all of the project area is Bureau of Land Management (BLM) Public Lands. Within the project area, Cebolla Spring and Cebollita Spring emerge from the ground and provide habitat and/or water to a variety of wildlife species including Bald Eagle (*Haliaeetus leucocephalus*), Mule Deer (*Odocoileus hemionus*), Elk (*Cervus canadensis)*, Mountain lion (*Felis concolor*), Bobcat (*Lynx rufus*), Abert's Squirrel (*Sciurus aberti*), two species of Wild Turkey (*Meleagris gallopavo intermedia, Meleagris gallopavo Merriami)* and reptiles such as the side-blotched lizard (*Uta stansburiana*). The next nearest constant water source for wildlife is the Rio San Jose, approximately 40 miles away. In addition, several ephemeral playas hold seasonal water but the nearest playa is about seven miles away.

The valley was homesteaded in the early 1900s. Today only ruins of the stone houses and hydrological modifications established by early settlers remain. The historic wetland of Cebolla Creek has been drained and earthen dams constructed to retain water for agricultural use. These changes to the area's hydrology coupled with cattle grazing have reduced the historic wetland to a fraction of its original size and inadvertently created a massive down-cut, incising the stream in some areas as deep as 50 feet.

Previously, water from the springs was impounded and used for irrigation almost exclusively. Former wetlands were drained and dams, irrigation ditches, and impoundments were constructed along Cebolla Creek to support agriculture. The irrigation systems and impoundments are no longer functional, but Cebolla Creek is displaced from its natural drainage, headcutting is occurring in the valley bottom, and the wetlands have not recovered. In one area, an abandoned diversion channel led from Cebolla Spring to a storage reservoir. Blocking that channel to re-connect groundwater flow from the spring to the former wetland is one of the practices proposed in this project. In other areas, grade control structures need to be built to raise the bed of the channel from the spring where it was deliberately ditched and drained.

Due to the draining of the valley, the plant community composition has deteriorated to a monoculture of blue grama grass (*Bouteloua gracilis*) with rabbit brush (*Chrysothamnus nauseosus)* increasing in the valley bottom. This coupled with increasing encroachment of Piñon (*Pinus edulis*) and Juniper (*Juniperus scopulorum*) from the uplands has converted the vegetative composition of the valley to that of a warm season upland plant community instead of a wetland. Revegetation with wetland species is needed to jump start recovery in the areas we treat under this project.

In 1994, a seven-acre exclosure was constructed by BLM to reduce livestock use of the Cebolla Spring. In one growing season, the spring turned from a mud bog to standing water. The water promoted vegetative growth, which increased ground cover and shade, reducing loss of water to evaporation. As a result, a permanent saturated zone developed, providing the conditions for a nascent wetland. Since the fall of 2000 the Albuquerque Wildlife Federation (AWF) has been organizing volunteer groups to help with restoration efforts in Cebolla Canyon. The groups have worked to construct restoration best management practice structures to spread water over the valley. These structures are re-wetting the meadow, widening the stream banks, and building up the channel bottom to return this portion of the wilderness area to its natural condition of a perennial stream and a properly functioning wetland. The result has been two-fold: the creek gradient is flattened and water infiltration into the banks has increased, promoting an increase in emergent wetland plant species, which add to bank stability. The saturated zone associated with the spring has expanded downstream along the first terrace adjacent to the creek. The saturated zone currently is over 40 acres. The wetlands area associated with the spring has the potential to double in size to over 80 acres. A long-term landscape-based approach to improving the ecological health of Cebolla Canyon and its associated wetlands is needed.

This project is based on the previous work done in the area. It will demonstrate and monitor innovative techniques to return land altered for agricultural use to its natural condition. This could provide the basis for other projects using similar techniques to return many acres of land hydrologically modified for agricultural use to their original condition in New Mexico, which would have enormous benefits to the watersheds. This would provide habitat for diverse plant and animal species which are currently finding fewer hospitable locations; it would increase the amount of recharge into aquifers; reduce currently excessive erosion rates; and improve water quality in area streams. Ultimately, this project and others like it would be sustainable, because they would return the land to its natural condition and would require no further modifications.

A6.0 PROJECT/TASK DESCRIPTION

The New Mexico Environment Department Surface Water Quality Bureau (SWQB) proposes to complete a demonstration project for the restoration of historical wetlands degraded by former agricultural practices in Cebolla Canyon closed basin in Cibola County, New Mexico. SWQB will partner with the Bureau of Land Management, Rio Puerco Alliance, Rio Puerco Management Committee, Albuquerque Wildlife Federation, New Mexico Wilderness Alliance and other partners to restore historic wetlands by more than 80 acres and to develop a Wetlands Action Plan that develops measures for protection and restoration of wetlands in Cebolla Canyon watershed within the North Plains closed basin. Workshops will be conducted on the restoration field methods. Project partners will also organize a Watershed/Wetlands Academy for high school students and teachers in the Grants area with special emphasis on local and tribal schools.

We will collect vegetation, hydrology, fluvial geomorphology, soils, and photomonitoring data to establish a baseline for the project area. In order to track progress of this project, SWQB will conduct pre and post monitoring of changes in these parameters. Vegetation monitoring will employ the line-point intercept and greenline methods. Greenline monitoring and line-point intercept methods will be used at BMP implementation sites and at restored spring sites. Stream geomorphology will track changes in the pattern, profile, and dimension of the stream after restoration. Repeat photography will also occur to anecdotally track changes of the restoration project. Peizometers will be installed to detect changes in ground water storage. Groundwater levels will be metered and metered data will be collected semi-annually during the life of the project. If resources are available, surface water quality will be monitored with the intention of creating a water quality station for future regional water quality monitoring needs.

A6.1 Project Purpose

This project will demonstrate and monitor innovative techniques to return land altered for agricultural use to its natural condition. This could provide the basis for other projects using similar techniques to return many acres of land hydrologically modified for agricultural use to their original natural condition in New Mexico, which would have enormous benefits to the watersheds. This would provide habitat for diverse plant and animal species which are currently finding fewer hospitable locations; it would increase the amount of recharge into aquifers; it would stop erosion and improve water quality in area streams. Ultimately, this project and others like it would be sustainable, because they would return the land to its natural condition and would require no further modifications.

Table A6.1 Results of Activities (Deliverables) and Anticipated Environmental Improvement (Outcomes)

Activity	Timeline	Deliverables	Milestones	Outcome	Track Progress
Task 1: Project Administration.	April 2009 to June 2012	Contracts, agreements, amendments, reimbursements, etc. Maintaining the project Steering Committee	Contracts in place, amendments completed, reimbursements paid, etc. 12 Steering Committee meetings convened. Participation Tracked.	Project managed and administered. Steering Committee oversees the timely and successful completion of the project. Support toward achieving wetland project goals.	Drawdown on contract amounts, project progress towards end date tracked, technical aspects assisted. Number and nature of decisions show coordination and progress.
Task 2: Restoration Reconnaissance.	April 2009 to May 2009	Geomorphological inventory for Reaches 1 through 7 and map.	Inventory report and map completed.	Inventory and map locations for structures available for design phase	Proper placement of restoration structures to achieve wetland functions and ecosystem restoration.
Task 4: Cebolla Canyon Wetlands Action Plan.	April 2009 to October 2011	Wetlands planning document for Cebolla Canyon included in Rio Puerco WRAS to facilitate further restoration in the area.	WAP meetings, wetlands info. collected, projects developed, chapters completed, stakeholder input included.	Increased understanding of Cebolla Canyon wetlands. Increased knowledge to restore Cebolla Canyon wetlands.	Stakeholder input and involvement in process. Spin-offs from WAP.
Task 5: Restoration Design.	April 2009 to May 2010	Completed design for the structures, plans and specifications for restoration work.	Design completed.	Improved wetland restoration project	Design development and implementation.
Task 6: Fencing.	May 2010 to October 2010	Installation of fence along saturated area with volunteers.	Fencing installed.	Relief from grazing pressure will speed wetland recovery.	Fencing milestone completed. Wetlands recovered.
Task 7: Reach 1 Restoration.	May 2010 to October 2010	Fill 50 ft. length of gully to divert flow.	Work completed.	Runoff diverted to rewet the natural channel.	Natural channel restored.

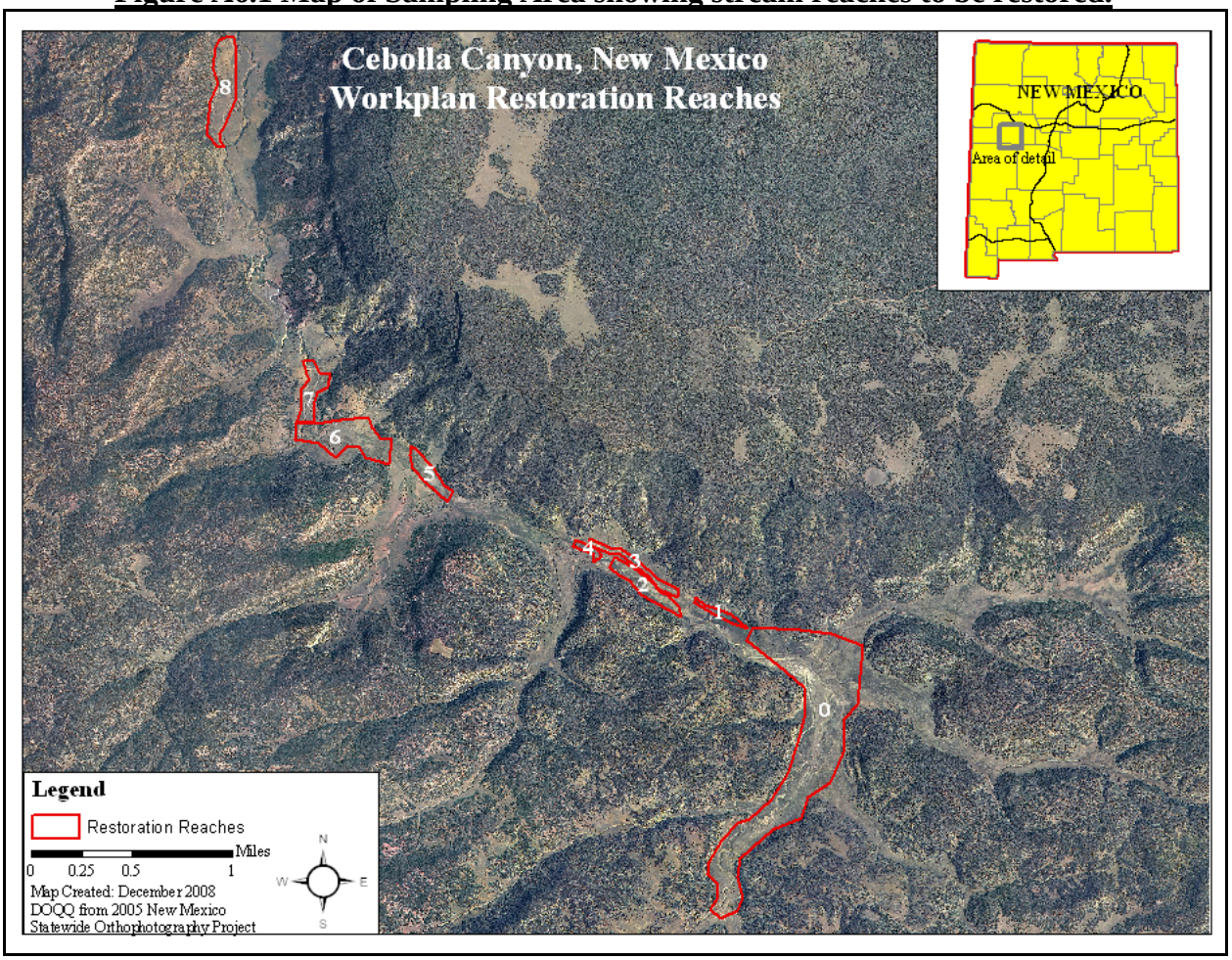
Activity	Timeline	Deliverables	Milestones	Outcome	Track Progress
Task 8: Reach 3 Restoration.	May 2010 to September 2011	Volunteers build permeable fill structures and install plantings.	Work completed.	More water held in drainage ways. Increased erosion prevented.	Documentation of structures built and functioning.
Task 9: Reach 4 Restoration.	June 2010 To June 20	Volunteers build 12 wicker weirs in the old channel or 12 short berms to plug rills. Construct grade control structure.	Work completed.	Floodwater rewets floodplain and wetland terrace. Restored floodplain and wetland terrace.	Documentation of structures built and functioning.
Task 10: Reach 6 Restoration.	May 2010 to June 2012	Widen and reshape worm ditch, and create new side berm. Construct grade control structures/gully rehabilitation.	Work completed.	Reduced runoff into head cut. Increased capacity of worm ditch. Restored stream reach.	Documentation of structures built and functioning.
Task 11: Reach 7 Restoration.	May 2010 to June 2012	Volunteers build induced meandering structures, road redesigned, crossing raised, and water bars installed.	Work completed.	Reduced sediment entering stream, stream grade raised, slope flattened and meanders increased. Hydrology restored.	Documentation of structures built and functioning.
Task 12: Outreach and Education.	April 2009 to June 2012	Workshop, field trips, and newsletter articles, Watershed/Wetlands Academy	Participation documented, materials created, reports.	Technology transfer.	Individuals informed about and trained in wetland restoration techniques
Task 13: Project monitoring and QAPP.	April 2009 to June 2012	Baseline assessment, 3 years progress monitored.	QAPP, monitoring data collected and stored in database.	Increased understanding of WQ and wetland changes and improvements.	Monitoring report of analysis and results.

Project Outputs: See Project Tasks section and Schedule and Milestones Table for more information. Progress will be tracked through monitoring, semi-annual reports, and a final report.

Project Outcomes: The overall project outcome in this project is to restore wetland acreage by at least 80 acres in New Mexico and to develop a Wetlands Action Plan that develops measures for protection and restoration of wetlands in Cebolla Canyon watershed within the North Plains closed basin.

Progress will be tracked through interim summary monitoring reports and final monitoring report, semi-annual reports, and a final report. Success will be monitored with favorable trends toward attaining stable stream channel types; an increase in aerial extent and species composition, cover, and condition of wetland vegetation; favorable trends in groundwater; an increase in desirable species of riparian vegetation in composition and cover.

Figure A6.1 Map of Sampling Area showing stream reaches to be restored.



A7.0 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

Measurement data quality will be monitored using the quantitative and qualitative data quality indicators described in Section 1.5 of the SWQB QAPP (SWQB, 2009).

A8.0 SPECIAL TRAINING/CERTIFICATION

Personnel involved in this monitoring are bound to the same training requirements that are indicated in the SWQB QAPP (SWQB, 2009).

The contractor for vegetation monitoring will be required to have a bachelor's degree related to biology, botany, or conservation. The contractors and subcontractors must have experience collecting vegetation data using the techniques listed in this QAPP.

The contractor approved for geomorphologic monitoring needs to have demonstrated survey skills and a background in fluvial geomorphology, which .could include university coursework, experience/training in riparian/wetland/stream ecology, familiarity with channel evolution concepts and models, or a successful project design and implementation track record in which determining the natural potential of a site was documented with professionally accepted methodologies.

Contractor qualifications will be documented through resume and professional references. The qualification will be reviewed by the SWQB Project Officer for this project. The documentation of this information will be kept in the SWQB project files managed by the File Manager.

A9.0 DOCUMENTS AND RECORDS

Copies of this QAPP and any subsequent revisions will be provided to all individuals included on the distribution list by the SWQB Project Officer. The SWQB Project Officer will also distribute all applicable protocol documents and subsequent revisions used throughout the project to the appropriate contractors. The QAPP, protocol documents and interim summary and final monitoring reports will be maintained in the project file of the project officer and backed up at NMED. The documents and CDs will also be maintained in the project file at NMED SWQB.

Table A9.1 Reporting Format and Storage

Monitoring Technique	Reporting Format	Storage Location And Time
Vegetation Monitoring: Line-Point Intercept transects Greenline Composition	Data recorded on project specific field sheets and spreadsheets. Reported in monitoring report attached to final report.	Paper copies in project file, electronic copies on CD and hard drive.
Fluvial geomorphology measurements	Data recorded in any professionally accepted field noteform and transferred to The Reference Reach Spreadsheet Version 4.1L (Mecklenburg, et al., 2004).	Paper copies in project file, electronic copies on CD and hard drive.
Hydrological Properties including depth to shallow groundwater.	Data recorded on project specific field sheets and spreadsheets. Reported in monitoring report attached to final report	Paper copies in project file, electronic copies on CD and hard drive.
Soils-character of the soils including hydric soil indicators.	Data recorded on project specific field sheets and spreadsheets. Reported in monitoring report attached to final report	Paper copies in project file, electronic copies on CD and hard drive.
Repeat Photography (all aspects of project)	Paired photopoints included in final report.	Paper copies in project file, electronic copies on CD and hard drive.

DATA GENERATION AND ACQUISITION

B1.0 SAMPLING PROCESS DESIGN

The overall goal of this plan is to develop a monitoring program that is capable of tracking change within the project site from pre-restoration condition to post-restoration condition and evaluate the effectiveness of the project's principal goal of restoring 80 acres of degraded wetlands. The monitoring program should also be straightforward and simple enough to track project success without overwhelming data analyses or complicated procedures prone to error. Monitoring protocols described in this plan are designed to be conducted for the duration of the grant (short-term). However, the methodologies lend themselves to long-term monitoring as well and can be utilized if other additional resources are available.

The monitoring components to be employed are: 1) vegetation monitoring 2) hydrology monitoring, 3) fluvial geomorphologic monitoring, 4) soils monitoring, and 5) photographic documentation. The rationale, methods, data to be collected, and equipment are described for each component.

B2.0 SAMPLING METHODS

The monitoring components of the project, including vegetation monitoring, geomorphology and repeat photography will be conducted and will employ the use of specific data collection methods. All methods used for this project are described below.

1. Vegetation Monitoring
Vegetation monitoring will be conducted on a portion of the restored areas to track progress and determine success

Greenline Composition Monitoring – Greenline Composition Monitoring will be performed in a portion of the restoration reaches as part of this project. A subset of the reaches will be sampled using a systematic sampling design applied spatially. Systematic sampling consists of collecting data at locations in a specified pattern, specifically multiple transects within each sampling group (U.S. EPA, 2002). This type of monitoring will be conducted both pre and post project implementation. The Greenline Composition Monitoring method will be performed at select sites using the protocol established in *Monitoring the Vegetation Resources in Riparian Areas* (Winward, 2000).

Line-Point Intercept Monitoring – Line Point Intercept monitoring will be conducted at select sites along Cebolla Spring and tributary areas. Line-Point intercept will be collected using measuring tapes laid on ground between points fixed by rebar (some of which will be the same as the geomorphology cross section markers, and marked using the same protocol). Observers will walk from the zero end of the transect and take measurements at every 2.5 feet interval. The pin flag gets dropped at each designated point and all plants, litter, rocks, and soil (clay, sand, etc.) touching the pin flag get identified to the functional group level starting with the top most level. This type of monitoring will be conducted both pre and post project implementation. The *Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems*, developed by the

Jornada Experimental Range in cooperation with the US EPA, NRCS, and BLM, establishes the protocols for this vegetation data gathering.

2. Hydrology monitoring

Wetland restoration efforts are often designed to support the expansion of remnant wetlands into the larger area they historically occupied. Monitoring groundwater elevations in the zone surrounding the initial remnant area will provide a baseline for the restoration of hydrology that will support natural self-sustaining wetland conditions. It will also provide early clues about the "micro-areas" where plantings of desired species are most likely to thrive. Likewise, work aimed at re-connecting fragmented riparian stream corridors will benefit from monitoring floodplain groundwater levels downstream of active channel or floodplain restoration work by revealing elevated groundwater levels through a greater spatial extent—with obvious implications for adaptive management.

Measuring groundwater levels will be done in accordance with the protocol in **Monitoring Surface and Groundwater Interactions to Assess Riparian and Wetland Restoration Efforts** by Ellen S. Soles. Further information on groundwater levels in order to accurately delineate the wetlands in Cebolla Canyon will be done in accordance with the Wetlands Regulatory Assistance Program's Technical Notes ERDC TN-WRAP-00-02 **Installing Monitoring Wells/Piezometers in Wetlands** and ERDC TN-WRAP-05-2 **Technical Standard for Water-Table Monitoring of Potential Wetland Sites.** The purpose of this note is to help wetland scientists obtain quantitative information about shallow ground-water regimes near wetland boundaries and in adjacent uplands. Monitoring wells and piezometers are some of the easiest means of determining depth and movement of water tables within and immediately below the soil profile.

3. Fluvial Geomorphology monitoring

Morphology includes the physical dimension, pattern, and profile of the stream channel and associated floodplains and terraces. These physical features create the foundation for the determining the range of variability and other characteristics of a "naturally functioning" system. Geomorphology measurements will be collected before and after implementation of the stream restoration to evaluate if the stream responded to the structures and to determine if the pattern, profile, and dimension improved. The geomorphologic surveying conducted for this project will be using the Rosgen Level II surveying and recording techniques (Rosgen, 1996) and the USDA Forest Service Stream Channel Reference Sites techniques (Harrelson, et. al., 1994; http://www.stream.fs.fed.us/publications/PDFs/RM245E.PDF).

Cross-sections and slope will be surveyed at a minimum of three locations at the project site to assess channel/floodplain dimension and profile. Distribution of bed and bank material will be characterized using the Wolman Pebble Count. Cross-section, slope, and bed-bank material data will be entered into specially created MS Excel worksheets for analysis. A number of morphologic parameters described in Rosgen (1996) will be identified. These include bankfull width, mean depth, maximum depth, floodprone width, width-depth ratio, entrenchment ratio, average channel slope, and channel bed and bank material distribution (d_{15}, d_{50}, d_{85}, d_{100}).

The following procedures are used to survey cross-sections: The endpoints (2) for each cross section will be marked/monumented with rebar; using a 3-4' x 1/2" (or 5/8") rebar driven flush with native ground surface (or up to ½" above native ground surface). The rebar should be driven into each bank at an elevation equal to or greater than three times maximum bankfull stage on each side of a riffle/crossover section. The pins are placed perpendicular to stream flow. GPS waypoints/coordinates will be recorded for every endpoint rebar, plotted on a Digital Orthoimagery Quarter Quadrangle DOQQ, and visually verified for correctness. Use top of the left-side rebar as the benchmark. Beginning at the left pin (looking downstream) a tape is stretched between the pins as tight as possible. Sag in the tape can distort measurements significantly. Working from left to right (facing downstream) the distance on the tape (station) and the ground elevation is measured and recorded using a surveying device. A pre-survey accuracy check for the leveling instrument will be documented (Harrelson, p.20, or according to manufacturer's recommendations). Measurements are taken at each change in slope. Submit originals and one copy of the reduced survey field notes for each cross section. Fieldnote format should be according to recognized professional surveying standards (Harrelson, p.28, figure 35, left half). Any sketches such as on right side of figure 35 are welcome, but not required. Make field notes to show:

-date, weather, survey party, Instrument make, model, and serial number.
-left-side endpoint rebar as station 0.0 feet;
-distances measured along the cross section line in feet and tenths.
-left-side top-of-rebar elevation as 100.00 feet.
-rod readings to one-hundredth of a foot.
-brief remarks for each shot sufficient to describe the upland/channel morphology and vegetation.
-an ending 'check benchmark' shot after measuring each cross section, whether or not more than one instrument setup was used because of turning points.

Submit a single Mecklenburg Excel spreadsheet with X-Y pairs (distance-elevation) for each cross-section.

A longitudinal profile of the channel will be taken at each cross section 300 feet both upstream and downstream of the cross section to determine slope.

Photograph each cross section from both upstream and downstream, and from each side of the river standing somewhere on the cross section line itself, sufficient to show the channel bed, banks, and floodplains at the time of survey. If possible, take photographs with the measuring tape lying on the ground along the cross section line.

Wolman Pebble Count - The pebble count (Wolman, 1954) may be performed separately or as part of a larger stream inventory and assessment study (Rosgen, 1996). The intermediate axis of 100 particles should be measured and tallied using standard Wentworth size classes. The particles will be collected from the riffle/crossover at the cross-section. Pebble counts may be recorded, tallied and represented using commonly available forms. From the raw data (d35, d50, and d85) percent composition values for six class types of channel materials ranging from fines (sand, silt and clay) through bedrock may be calculated. The pebble count procedure will be conducted as a modified Wolman pebble count as follows: Select the riffle/crossover, begin at

the edge of the channel, take one step, reach down without looking to the front of the foot, pick up the first sediment particle touched, measure the intermediate axis of the sediment particle, record the measured size on the pebble count form (any particle smaller than 2 millimeters is simply counted as fine sediment), discard the sediment particle where it won't be picked again, proceed across the channel one step at a time repeating the prior procedure, at the other side of the channel turn and proceed across the channel again at an slight angle so the prior path won't be repeated, repeat the picking and measuring procedure across the channel, keep repeating the method until one hundred sediment particles have been measured.

Data: Station and elevation in feet will be collected to characterize channel cross-section and slope. Consistent and random measurements of bed and bank materials in millimeters will be collected to characterize the channel substrate. Data will be stored on Mecklenburg spreadsheets.

Equipment: A leveling/survey device, survey rods, and tapes will be used to collect cross-section and slope data. Bed and bank material measurements will be collected using rulers in millimeters.

4. Soils

Certain soils are characteristic of wetlands and are an important component of monitoring for wetland restoration. A hydric soil is generally saturated, flooded, or ponded long enough in the growing season to develop anaerobic conditions and favor the establishment of wetland vegetation.

Methods for the description of soils published by NRCS and USACE (USACE 1987, NRCS 2006 and Schoeneburger et al, 2002) will serve as the guide for collection of soils data. The monitoring effort will describe relevant soil characteristics including location of sampled material, geomorphic information, drainage class, indicators of inundation, and reduction/oxidation indicators present in the soils. All soil characterization borehole data will be recorded on field sheets and a photograph of the material retrieved from the boreholes will be taken. Borehole locations will be determined with a GPS unit, plotted on a scaled map, and verified for accuracy.

Data: Data collected will include a basic description of the soil and any soil horizons, the presence or absence of standing water in the soil borehole, depth to standing water if present, and the type of hydric soil indicators if present. Specially designed data sheets will be used to collect and analyze data.

Equipment: Hand auger, shovels, Munsel soil color charts, camera, GPS unit,

5. Repeat Photography

Under many circumstances, evaluating change over time by using repeat photography can give great insight into the relative success of restoration efforts. Repeat photography can also document how well an entire project site is doing with a couple of overview photo sites. Project objectives include increasing the health and function of the degraded wetlands within the project area. Thus photo monitoring goals will include demonstrating an increase in native wetland

vegetation, floodplain grasses, woody riparian trees, and an overall increase in native plant establishment on the floodplain.

Methods: Photo points will be set up at several sites within the project area to capture changes over time in the stream channel, floodplain, and re-vegetation areas. Photo point markers will be carefully located and monumented with rebar pins. Locations will be recorded with a GPS unit, plotted on scaled maps, and verified for accuracy.. These photos will provide a broad view of the site. The SWQB photo-documentation protocol will be used for this procedure. See NMED/SWQB's 2007 Standard Operating Procedures for Data Collection.

Data: Annual photographs to show vigor of native re-vegetation efforts, increases in overbanking during flood events, and general site characteristics. Photos selectively placed at representative treated areas throughout the reach will track restoration efforts and vegetation establishment. The overall reach photos will show the response of the riparian corridor to the enhancement treatments. Photos of soils will document any project-related development of hydric soil indicators.

Equipment: Digital camera, tripod, GPS unit, photo board, rebar pins

B3.0 SAMPLING HANDLING AND CUSTODY

No physical samples will be obtained as part of the implementation of this project and therefore, no handling requirements are needed. All data collected are maintained in paper or electronic copies that are provided to the SWQB Project Officer and maintained in project file.

B4.0 ANALYTICAL METHODS

Sample analysis will not be conducted as part of the implementation of this project and therefore no analytical methods are needed.

B5.0 QUALITY CONTROL

Quality control (QC) activities are technical activities performed on a routine basis to quantify the variability that is inherent to any environmental data measurement activity. The purpose for conducting QC activities is to understand and incorporate the effects the variability may have in the decision making process. Additionally, the results obtained from the QC analysis, or data quality assessment, may identify areas where the variability can be reduced or eliminated in future data collection efforts, thereby improving the overall quality of the project being implemented.

The data collection methods used for this project are primarily qualitative and quantitative estimations. The quantitative estimations collected as part of the Line-Point Intercept and Greenline Composition monitoring will have a precision requirement of within +/- 20% of the actual feature measured. The quality of both the direct and indirect measurements will be assessed by the repeated measurements of the feature to assure values fall within the accepted level of precision. Considering that there are primarily only two sampling events, pre and post implementation, QC sampling would serve a very limited purpose and therefore repeat measurements will be collected as time and resources allow. Analyzing replicate data and checking measurement precision will be the responsibility of the SWQB Project Officer.

B6.0 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

The scientific instruments used to collect physical measurements include a survey device (e.g. laser level, autolevel, theodolite, or total station depending on the contractor), global positioning system unit (GPS), camera, dataloggers, and sondes. All field equipment will be inspected prior to each sampling trip. All instruments and equipment will be tested, inspected and maintained in accordance with the manufacturer's specifications as included in the associated instrument/equipment manual.

Maintenance logs are maintained for all SWQB instruments and equipment. Consultants will use their own equipment. Results of equipment inspections will be noted in the maintenance log and/or project file. Any deficiencies in equipment will be noted and reported immediately. If condition of equipment is in doubt, it will not be used. In the event of instrument failure the SWQB Project Officer will correct the problem, rejecting the resultant data or accepting the data with notations.

B7.0 INSTRUMENT CALIBRATION AND FREQUENCY

Instrument calibration and frequency will be done in accordance with manufacturer's specifications and documented on the field sheets that will be included in the interim and final monitoring reports.

B8.0 DATA MANAGEMENT

Data obtained for this project are maintained in paper and electronic files. All data are to be delivered to SWQB Project Officer as soon as practical following the data collection event. These data are maintained in the project file and on CD and hard drive and backup of SWQB Project Officer.

Contractors will provide summary reports to the SWQB Project Officer. All data and summary reports will be compiled into the final project report and provided to U.S. EPA.

ASSESSMENT/OVERSIGHT

C1.0 ASSESSMENT AND RESPONSE ACTIONS

The SWQB Project Officer provides project oversight by periodically assisting with and/or reviewing data collection efforts. A review of the restoration project occurs on a semi-annual basis. This semi-annual report describes the progress of each task to the restoration project and justifies task tardiness if applicable. Any problems encounters during the course of this project will be immediately reported to the SWQB Project Officer who will consult with appropriate individual to determine appropriate action. All problems will be documented for inclusion in the project file and final report.

C2.0 REPORTS TO MANAGEMENT

Semi-annual reports are submitted to U.S. EPA and include progress of project implementation and any available data. Printouts, status reports, or special reports for SWQB or U.S. EPA will be prepared on request. Separate annual monitoring reports detailing the findings will be provided and will be also be included in the final project report. The SWQB Project Officer will be responsible for the final restoration project report. The geomorphology, vegetation, and groundwater monitoring consultants will prepare the monitoring reports for approval by the SWQB Project Officer. The final report will be prepared in accordance with the guidance set forth in *Informal Draft Final Report Guidance* (Attachment E 2.0).

DATA VALIDATION AND USABILITY

D1.0 DATA REVIEW, VALIDATION, AND VERIFICATION

Data review and verification are key steps for ensuring the integrity, suitability and usability of the data. The SWQB Project Officer will verify data following each data collection event to ensure the correct channel pattern, profile, and dimension are obtained prior to implementing restoration efforts. An elevation point will not be accepted if it appears to be out of the ordinary from the data set.

Two monitoring participants (one of which may be the SWQB Project Officer) will be present during vegetation monitoring to verify vegetation species determinations. If data are questionable, the consultant will perform this monitoring once again at those locations to confirm or deny original data collected. If a species cannot be identified, a specimen in flower should be collected, pressed, and taken to an expert or herbarium for determination.

No laboratory generated analytical data will be obtained and therefore no validation procedures are required.

D2.0 VALIDATION AND VERIFICATION METHODS

The SWQB Project Officer will be responsible to ensure that valid and representative data are acquired.

The verification for geomorphology monitoring may occur in the field or in spreadsheet form as tables and graphs and is based on best professional judgment and knowledge of the project area and methods used. The SWQB Project Officer will participate in collection of geomorphology monitoring data. If the data appears invalid, the SWQB Project Officer will consult with project participants to determine appropriate action.

Verification of vegetation monitoring will occur in the review of data performed by the SWQB Project Officer. SWQB Project Officer will consult with project personnel to assess data to determine if questionable data are found.

Results of the verification process will be included in semi-annual and final reports.

D3.0 RECONCILIATION WITH DATA QUALITY OBJECTIVES

Once all data have been verified they will be reported and analyzed and incorporated in the final project report. This project relies on qualitative and quantitative anecdotal data and information, and therefore a quantitative reconciliation with user requirements cannot be performed.

REFERENCES

Harrelson, Cheryl C; Rawlins, C. L.; Potyondy, John P. 1994. Stream channel reference sites: an illustrated guide to field technique. Gen. Tech. Rep. RM-245. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 61 p.

Herrick, J. C.; Van Zee, J. W.; Havastad, K. M.; Burkett, L. M.; Whitford, W.G. 2005 *Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems Volume I: Quick Start.* USDA-ARS Jornada Experimental Range, Las Cruces, New Mexico.

NRCS, 2006. *Field Indicators of Hydric Soils in the United States,* Version 6.0., G.W. Hurt and L.M. Vasilas (eds.). USDA, NRCS, in cooperation with the Technical Committee for Hydric Soils.

Pendleton, R. L., D. Nickerson. 1951. Soil colors and special Munsell soil color charts. Soil Science 71:35-43.

Resource Technology, Inc. 2002. *Total Maximum Daily Load Report for the Jemez River Watershed*. December 2002. Accessed at: http://www.nmenv.state.nm.us/swqb/ Jemez_Watershed_TMDLs/Section5G.pdf. Accessed on: June 8, 2007.

Rosgen, Dave. 1996. *Applied River Morphology.* Wildland Hydrology, Pagosa Springs, CO.

Schoeneburger, P.A., Wysoki, D.A., Benham, E.C., and Broderson, W.D. (editors), 2002. Field book for describing and sampling soils, Version 2.0. Natural Conservation Resources Service, National Soil Survey Center, Lincoln, NE.

Soles, Ellen S. Monitoring Surface and Groundwater Interactions to Assess Riparian and Wetland Restoration Efforts.

SWQB, 2004. *Standard Operating Procedures for Sample Collection and Handling.* Accessed at: http://www.nmenv.state.nm.us/swqb/SOP/StandardOperatingProcedures_06-22-04.pdf. Accessed on: June 8, 2007.

SWQB, 2007*a*. *2006-2008 State of New Mexico Integrated Clean Water Act Sections 303(d)/305(b) Report.* Accessed at http://www.nmenv.state.nm.us/swqb/303d-305b/2006-2008/index.html. Accessed on: June 8, 2007.

SWQB, 2009. *Quality Assurance Project Plan for Water Quality Management Programs.* April 2009.

U.S. Army Corps of Engineers. 1987. *Corps of Engineers Wetlands Delineation Manual,* U.S. Army Engineer Waterways Experiment Station, Environmental Laboratory, Vicksburg, MS.

U.S. Army Corps of Engineers. 2002. Wetlands Regulatory Assistance Program's Technical Note ERDC TN-WRAP-00-02. Installing Monitoring Wells/Piezometers in Wetlands.

U. S. Army Corps of Engineers. 2005. "Technical Standard for Water-Table Monitoring of Potential Wetland Sites," *WRAP Technical Notes Collection* (ERDC TN-WRAP-05-2), U. S. Army Engineer Research and Development Center, Vicksburg, MS.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2007. National Soil Survey Handbook, title 430-VI. [Online] Available: http://soils.usda.gov/technical/handbook/ .

U.S. Environmental Protection Agency, 2002. Guidance on Choosing a Sampling Design for Environmental Data Collection for Use in Developing a Quality Assurance Project Plan. EPA QA/G-5S. Accessed at: http://www.epa.gov/QUALITY/qs-docs/g5s-final.pdf. Accessed on: June 11, 2007.

Vrooman, Steve and Richard Schrader, 2004. *Rio Puerco Monitoring Workbook for the Rio Puerco Management Committee*. Version 1.3. August 23, 2004.

Winward, Alma H. *Monitoring the Vegetation Resources in Riparian Areas*. 2000. US Department of Agriculture, Forest Service, Rocky Mountain Research Station, Gen. Tech. Report RMRS-GTR-47. Accessed at: http://www.fs.fed.us/rm/pubs/rmrs_gtr047.pdf. Accessed on: June 8, 2007.

Wolman, M.G. 1954. *A method of sampling coarse riverbed material*. Amer. Geophys. Union Trans. 35(6):951-965.

APPENDICES

E1.0 RECEIVING FORM

New Mexico Environment Department Surface Water Quality Bureau

Restoring and Protecting Wetlands in Cebolla Canyon Closed Basin Quality Assurance Project Plan Acknowledgement Statement

This is to acknowledge that I have received a copy (in hard copy or electronic format) of the Restoring and Protecting Wetlands in Cebolla Canyon Closed Basin *Quality Assurance Project Plan*.

As indicated by my signature below, I understand and acknowledge that it is my responsibility to read, understand, become familiar with and comply with the information provided in the document to the best of my ability.

_____
Signature

_____
Name (Please Print)

_____
Date
Return to SWQB Project Officer (Matt Schultz)

E2.0 INFORMAL DRAFT FINAL REPORT GUIDANCE

Informal Draft Final Report Guidance
3/11/99

1. Executive Summary (general overview about the project)
* Title
* Define NPS problem(s) being addressed
* WQ goals and objectives
* Original timeframe
* Cooperators involved
* Funding (Fed and State)
* Possible BMPs to implement

Source of information: Workplan cover sheet, workplan and any associated amendments

2. Project Chronology
* Describe major project highlights
* Monitoring DQOs (if applicable)
* BMPs implemented and why
* Obstacles
* Measures of Success (give estimates of how much NPS Pollution Pollution was achieved)

Source of information: Workplan, QAPP(if applicable), Quarterly/Semi-annual Reports and any associated amendments

3. Lessons Learned
* What made the project successful?
* What made the project not so successful?
* What would you do differently in terms of effectiveness?

4. Technical Transfer
* What information can you pass along to other agencies, cooperators or local landowners in other watersheds about this project.
* What other projects that are currently in progress or on the drawing board could benefit from this information?

5. EPA Feedback Loop
* What would you suggest EPA do differently to improve the NPS process in regard to this project?
* What about the other Federal partner(s) if any?