**Final Report**
**May 2019**

**New Mexico Rapid Assessment Method for Lowland Riverine Wetlands, Rio Grande/Lower Pecos Watersheds and Regulatory Module for USACE**

**Assistance Agreement No. CD-00F736-01-0A (FY 2013)**



Unconfined Lowland Riverine Wetlands on the Rio Grande (Fall, 2018) (photo K. Menetrey)

**New Mexico Environment Department**
**Surface Water Quality Bureau**
**Wetlands Program**

## Project Goals and Objectives

This Project is a continuation of the development of wetlands rapid assessment methods geared towards arid land wetlands with a focus on unconfined lowland riverine wetlands in the Middle Rio Grande and Lower Pecos River watersheds in New Mexico. New Mexico Rapid Assessment Method (NMRAM) data were collected from 34 Sample Areas (SAs) - 21 preliminary SAs in 2015, and an additional 13 SAs with the final suite of metrics in 2019. The project resulted in the development of NMRAM Lowland Riverine Wetlands Version 2.1 for large river systems (https://www.env.nm.gov/surface-water-quality/wetlands-rapid-assessment-methods/ and attached).  The SWQB Wetlands Program developed Version 1.1 (2016) of Lowland Riverine NMRAM on the Gila River in southwestern New Mexico since it is largely an intact lowland river system. However, riverine wetlands of the Lower Pecos and Rio Grande have expanded our reference set by providing data from lowland riverine wetlands that are impacted and threatened by groundwater extraction, flood control and irrigation activities confining channels, agricultural nutrients, livestock grazing, floodplain development and urbanization. Most of the rapid assessment metrics from Version 1.1 were revised and one new metric (Groundwater Index) was designed and tested as part of this project. In addition, a different approach to stressors resulted in a new stressor checklist that emphasizes processes within the watershed rather than a stressor footprint.

Some of the unique challenges included designing metrics for mowed and altered floodplains, sizing the sample area to accurately reflect wetland conditions on much larger floodplains and still complete an assessment in a day, and developing a metric that would accurately reflect water table conditions beneath the SAs (assessment site).

This Project included the continued enhancements of the SWQB Surface Water Quality Bureau Information Database (SQUID) to accept and store NMRAM data.  The New Mexico Wetlands Roundtables, maintained by the SWQB Wetlands Program, include roundtable meetings in the northern and southern part of the state that were conducted in Santa Fe and Las Cruces in the spring and fall of 2016 and 2017. Version 2.0 of the draft NMRAM Manual was also completed under this project. A bonus outcome was the invitation to develop a chapter on lowland riverine wetlands assessment in the Elsevier Publication "Wetlands and Stream Rapid Assessments, Development, Validation, and Application" edited by John Dorney, Rick Savage, Ralph Tiner and Paul Adamus. The Chapter is called "Rapid Assessment of Arid Land Lowland Riverine Wetland Ecosystems: A New Mexico Case Study" by Maryann McGraw, Esteban Muldavin, and Elizabeth Milford.

In addition to the development of the Lowland Riverine NMRAM, work was conducted on a regulatory version of NMRAM for United States Department of the Army Corps of Engineers' (USACE) use. This work was conducted in conjunction with the Albuquerque District of the Corps of Engineers, who also had a grant from EPA Region 6 to test the metrics in the field and comment on their utility and application to Before and After Mitigation Implementation (BAMI) procedures. Under this grant, a draft NMRAM Riverine Wetlands Regulatory Version 1.0 Field Guide was developed, and field training was conducted for both USACE and SWQB staff to test metrics in the field. In addition, two new metrics were created for the regulatory version of NMRAM and draft electronic data collection worksheets were completed.

## Project Outputs

Through this project ten major objectives were accomplished:

1) Data collection, analysis, and validation for New Mexico's Lowland Riverine NMRAM including the development of NMRAM Lowland Riverine Field Guide 2.1 and NMRAM Lowland Riverine Wetland electronic data collection worksheets Version 2.3;

2) Completion of Version 2.0 of the NMRAM Manual to cover all field guides and metrics developed to date;

3) Formation of a Technical Advisory Committee which met two times to provide input to Lowland Riverine NMRAM development;

4) A Multi-metric Analysis Report using all NMRAM Lowland Riverine Wetlands data to date;

5) Completion of a draft version 1.0 of NMRAM Riverine Wetlands Regulatory Version 1.0 and draft electronic data collection worksheets;

6) Two NMRAM trainings for potential end-users, one using NMRAM for Lowland Riverine Wetlands for a variety of participants, and one using NMRAM for Riverine Wetlands Regulatory for USACE personnel (Technical Transfer);

7) Vegetation classification of 34 expanded Sample Area floodplains (Wetlands of Interest);

8) Upgrades and enhancements to the wetlands version of the SQUID database;

9) New Mexico Wetlands Roundtables maintained in the northern and southern parts of the state each meeting twice per year for a total of four times under this project - the meetings focused on the objectives established by the group and included co-sponsorship by an NGO organization;

10) The development of NMRAM has been shared locally and nationally through presentations, public events, and a chapter in a scientific publication.

Figure 2. Chris Canavan (SWQB Watershed Protection Section Supervisor) and Brian Lang (NHNM technician) walking transects for the Floodplain Hydrology Connectivity metric on a Lowland Riverine Sample Area (SA) in the Rio Grande (photo M. McGraw).

## Project Outcomes

- The SWQB Wetlands Program and partners are providing wetland assessment capability to require better wetlands protection, restoration and mitigation.
- This project creates a tool for evaluating the condition of New Mexico's lowland riverine wetlands in comparison to a level of human disturbance and that is relevant to New Mexico.
- NMRAM is filling a critical piece of an integrated and comprehensive approach to wetlands protection by SWQB and its partners.
- NMRAM will provide the supporting data and information needed to develop water quality standards for subclasses of New Mexico's wetlands resources.
- The NMRAM can be used to identify reference standard wetlands in need of special protection, and to identify those that are particularly impacted and those that can be restored.
- Working collaboratively with USACE in the development of NMRAM Riverine Wetlands Regulatory Version increases the capacity of both agencies to require better and more equitable mitigation and protection of scarce wetland resources in New Mexico.
- As future wetlands subclasses are described and assessed, an iterative monitoring program linked to water quality assessments by watershed will continue to be developed and will increase the capacity and understanding of ecological linkages, natural variability and changes that result from human activities.
- Through our development of an integrated SQUID database at SWQB, wetlands assessment data will be available for inclusion in CWA Section 305(b) reports, increasing access to stakeholders and decision makers to improve their knowledge and understanding of wetlands issues.
- The oversight of NMRAM wetlands data at NMED will provide the capability to combine wetlands data and results with other SWQB water quality programs that will result in overall improvement to water resources of the State.
- Expanding and maintaining the New Mexico Wetlands Roundtable in Southern and Northern New Mexico including meetings especially located, designed and planned to inform partners relevant to their region, establishes and solidifies new partnerships, increases the capacity of the Wetlands Program to reach a variety of stakeholders with relevant and up-to-date information and data-sharing regarding wetlands in New Mexico.

## Project Location

The Reference Domain for NMRAM for Lowland Riverine Wetlands development includes lowland river valleys of the Rio Grande from Velarde to the State border and Lower Pecos from Fort Sumner to the State Border in central and SE New Mexico (Figure 3). The results of this project have statewide application for large lowland unconfined river systems in New Mexico and throughout the arid west. The NMRAM for Riverine Wetlands Regulatory Version has Statewide application to both Montane and Lowland subclasses of riverine wetlands and also can be applied to montane and lowland unconfined river systems in the arid west.
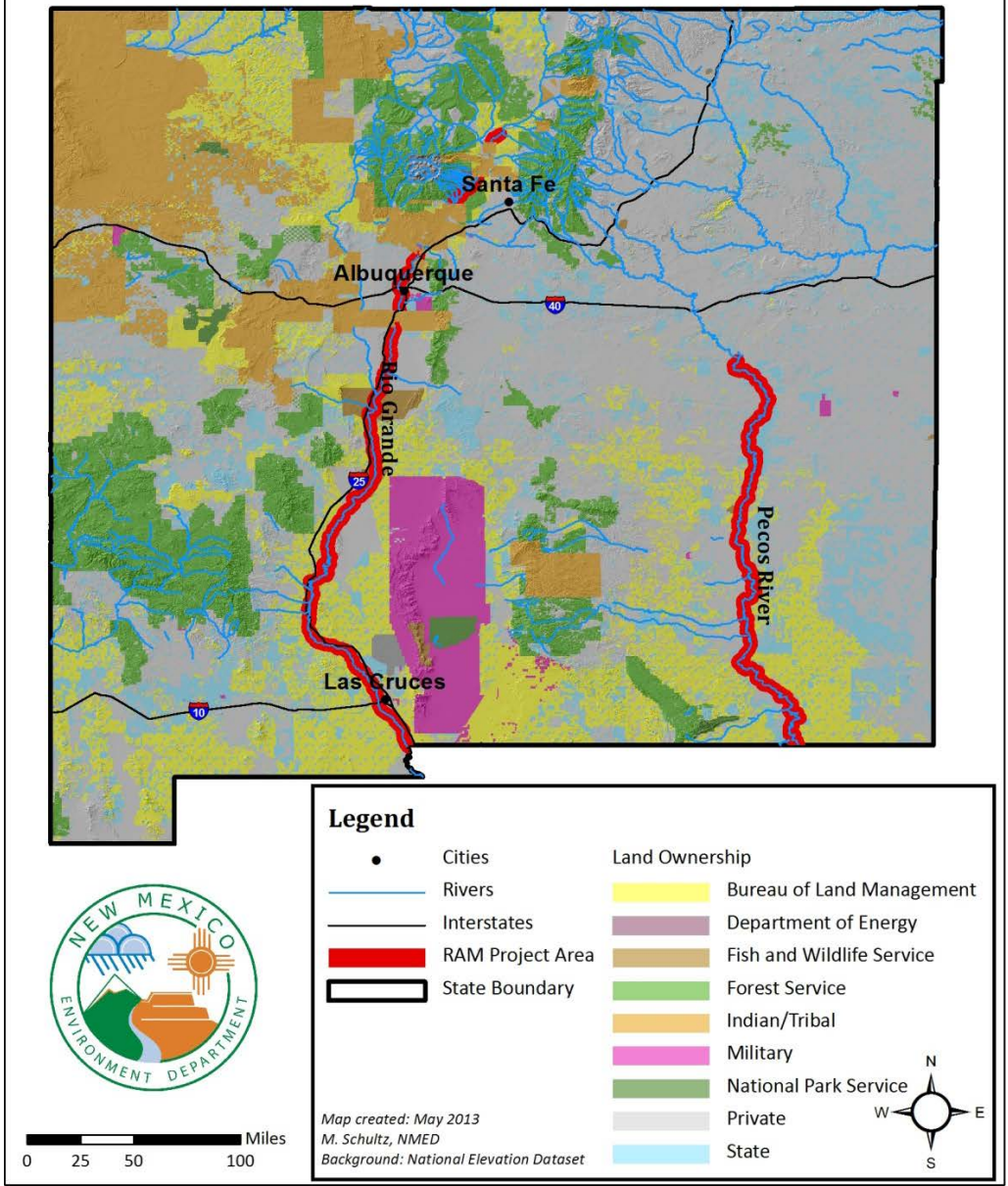
Figure 3. Reference Domain Boundaries of the Lowland Riverine subclass for this Project.

## Original Timeframe

Federal Assistance was awarded for this project on October 1, 2013 under the FY13/14 Wetland Program Development Grant Opportunity. In May 2016, the grant award for all projects under CD #00F736-01-0 which included FY14-awarded projects and this project was provided a no cost extension until May 2019. The stated goals and objectives of the project remained the same, as well as the key project Tasks and deliverables.

## Partners Involved

UNM Natural Heritage New Mexico was the principal contractor in partnership with SWQB Wetlands Program in developing the Lowland Riverine NMRAM 2.1 for this Project. TEKSystems, Inc. is responsible for developing the enhancements to the SQUID database at SWQB to accept NMRAM data, and for the interactive data collection worksheets. USEPA (Arlene Gaines, Betty Ashley, Sondra McDonald, Sharon Daugherty, Allison Fontenot and Leslie Rauscher) provided project progress guidance and technical assistance.

SWQB Wetlands Program was involved in every aspect of project and co-authored the Field Guides and data collection worksheets along with UNM Natural Heritage New Mexico (co-authors: Esteban Muldavin, Elizabeth Milford and Maryann McGraw). The Project involved an Advisory Committee whose members are as follows:

### Advisory Team Members

| Name | Organization |
|---|---|
| Julie Alcon | U.S. Army Corps of Engineers |
| Shelly Barnes | NMED/SWQB |
| Beth Bardwell | Audubon Society |
| Hannah Burnham | UNM Nat Her |
| Chris Canavan | NMED/SWQB |
| Joneen Cockman | Bureau of Land Management (AZ) |
| Davena Crosley | NMED/SWQB |
| Deanna Cummings | U.S. Army Corps of Engineers |
| Gina Dello Russo | Save Our Bosque Task Force |
| Kathy Granillo | US fish and Wildlife Service - Sevilleta Wildlife Refuge |
| Mark Horner | UNM Nat Her |
| Rachel Jankowitz | NMED/SWQB |
| Roy Jemison | USFS |
| Cassandra Hendricks | State Land Office |
| Meg Hennessey | NMED/SWQB |
| Ondrea Linderoth Hummel | U.S. Army Corps of Engineers and Tetra Tech |
| Gwen Kolb | US Fish and Wildlife Service – Partners for Wildlife |
| Judy Majoras | Percha Creek Watershed |
| Chad McKennah | GeoSystems |
| Karen Menetrey | NMED/SWQB |
| Aaron Miller | U.S. Department of Agriculture, Natural Resources Conservation Service |
| Miguel Montoya | NMED/SWQB |
| Yasmeen Najmi | Middle Rio Grande Conservancy District |
| Dana Price | U.S. Army corps of Engineers |
| Susan Rich | New Mexico State Forestry |

| Daniela Roth | State Botanist- NM Energy Minerals and Natural Resources Department |
| Emile Sawyer | NMED/SWQB |
| Jacqueline Smith | UNM Nat Her |
| Paul Tasjian | US Fish and Wildlife Service |
| Lori Walton | U.S. Bureau of Reclamation |
| Brooke Wyman | Middle Rio Grande Conservancy District |

**Independent Reviewers of the NMRAM Field Guides and Data Collection Worksheets:**

| Deanna Cummings | U.S. Army Corps of Engineers |

**Rio Grande/Pecos NMRAM Technical Team (field site selection, data collection, geodatabase development)**

| Hannah Burnham | UNM Nat Her |
| Chris Canavan | NMED/SWQB |
| Yvonne Chauvin | UNM Nat Her |
| Mark Horner | UNM Nat Her |
| Davena Crosley | NMED/SWQB |
| Abraham Franklin | NMED/SWQB |
| John Moeny | NMED/SWQB |
| Teri Neville | UNM Nat Her |
| Emile Sawyer | NMED/SWQB |
| Susan Styer | NMED/SWQB |
| Amy Urbanovski | UNM Nat Her |

**Southern New Mexico Wetlands Roundtable Presenters, April 11, 2016:** Southwest Environmental Center, SWQB Wetlands Program, USACE, National Wild Turkey Federation, RCS Southwest, UNM Natural Heritage, CNM. Co-Sponsor: National Wild Turkey Federation.

**Northern New Mexico Wetlands Roundtable Presenters, April 16, 2016:** NOAA, Western Landowners Alliance, NM Riparian Council, Amigos Bravos, Corrales Bosque Task Force, USACE. Co -Sponsor: Western Landowners Alliance

**Northern New Mexico Wetlands Roundtable Presenters, November 14, 2016: (National Park Service and Migratory Bird Treaty Celebration)** NPS Valles Caldera National Preserve, NPS Pecos National Historic Park, Hydra Aquatics, Inc., BLM-Rio Grande del Norte National Monument, NM Department of Game and Fish, USACE, NMDOT, Los Amigos de Valles Caldera, Keystone Restoration Ecology, Zeedyk Consulting, Inc. Co-Sponsor: Los Amigos de Valles Caldera.

**Southern New Mexico Wetlands Roundtable Presenters, December 7, 2016: (National Park Service and Migratory Bird Treaty Celebration)** White Sands National Park, Rio Grande Return, Pitchfork Ranch, Carlebad Caverns National Park, Eastern Arizona College, NMDOT, USACE. Co-Sponsor: Rio Grande Return

Additional partners who contributed to this project:

Some of the match for the IGA with UNM Natural Heritage Program has been contributed to this project by University of New Mexico, Natural Heritage New Mexico Museum of Southwestern Biology.

## Funding
The original Federal amount was **$437,847.00** and **$149,000.00** match. The final federal amount spent was approximately **$417,670.86** (pending final accounting) and the **final match amount was $186,401.21 ($37,401.21 overmatched).** See semi-annual reports for details.

## Major Project Highlights and Chronology

- This project was awarded federal assistance by EPA Region 6 on October 1, 2013 under the FY13/14 Wetland Program Development Grant Opportunity.
- Maryann McGraw, the Wetlands Program Coordinator (WPC) and Project Officer for this Project, met with Este Muldavin (University of New Mexico Natural Heritage Program (NHNM)) and Deanna Cummings (US Army Corps of Engineers (USACE)) on December 16, 2013 to discuss and develop a scope of work and timeline for the USACE NMRAM development.
- An Intergovernmental Agreement (IGA) and scope of work for NHNM to work as the principal contractor for this project was signed on May 12, 2014.
- NHNM has identified approximately 125 relevant research papers and background documents on the Rio Grande for the Literature review Task 3.
- The WPC has been in contact with NAIP imagery contractors to acquire additional imagery on the Pecos River during 2014.
- The WPC discussed water quality sampling site selection relative to potential wetlands Sample Areas (SAs) with Surface Water Quality Bureau (SWQB) Monitoring and Assessment staff since water quality station site selection was already completed. This is for the completion of Task 5 Coordination with Middle Rio Grande Intensive Water Quality Survey. A shapefile of the Middle Rio Grande Intensive Water Quality Survey sites will be added to the geodatabase for this project to select NMRAM SAs relevant to the water quality sites.
- In the Summer of 2014, the WPC provided draft metrics developed from previous NMRAM for the Corps to test in the field and provide feedback for USACE NMRAM development.
- The WPC is working with NMED IT staff on the wetlands database development contract and schedule.
- The WPC and Este Muldavin (NHNM) met with Deanna Cummings (USACE) on June 9, 2014, to review current mitigation procedures (Before and After Mitigation Implementation (BAMI)), the use of CRAM in these procedures as an example of how NMRAM can be used, and the current shortcomings of CRAM use for New Mexico sites was discussed.
- The WPC and Neal Schaeffer (SWQB), Este Muldavin and Elizabeth Milford (NHNM), Deanna Cummings (USACE), and Chris Cudia (NMDOT) met on July 23, August 19, and August 27, 2014 to discuss each metric and determine the limits of a SA, stressors and site scoring for the USACE NMRAM.

- NHNM staff and the WPC developed a set of draft paper data sheets and the team met on Cedro Creek near Tijeras to conduct an NMRAM training for Deanna, Neal (401 Certification Officer) and Chris who would be conducting the data collection to test the NMRAM for USACE applications under a grant from EPA to USACE. The NMRAM datasheets were developed to test a variety of riverine applications except ephemeral.
- The USACE Team visited 19 NMRAM sites around the state. Fifteen of the sites were NMRAM test sites that had scores from NMRAM development in 2009-2010.
- The WPC attended the three-day workshop on Restoration of Streams & Riparian Areas for Water Quality and Ecological Functions, May 13-15, 2014, sponsored by the USACE Albuquerque District. The training was focused on stream and riparian restoration in the Middle Rio Grande in areas where NMRAM SAs could be selected.
- A Professional Services Contract for TEKSystems to work on integrating NMRAM data into the SWQB Surface Water Quality Information Database (SQUID) was completed on October 27, 2014.
- The WPC provided an update on NMRAM to the New Mexico Southern Wetlands Roundtable on December 4, 2014. At the same Roundtable the USACE provided an update on USACE NMRAM.
- The WPC attended and presented at the New Mexico Acequia Commission meeting December 19, 2014 at the State Capitol Rotunda. The presentation was to inform the Acequia Commission of the Wetlands Program and activities and the New Mexico Wetlands Roundtables and to invite them to future meetings.
- The USACE distributed a copy of their final report to EPA to the USACE NMRAM development team in early December 2014. A subsequent meeting on March 20, 2015 was conducted to discuss changes necessary for the USACE to use the method.
- On January 29, 2015, the WPC attended a half-day Partners meeting organized by NHNM to network with other agencies that collaborate with and contribute data to NHNM. The meeting was intended to explore ways for data sharing among the agencies and UNM.
- The WPC participated in National Wetlands Monitoring and Assessment Work Group (NWMAWG) conference calls on December 12, 2014 and February 26, 2015 regarding the number of NWCA sites for western states. The results of NWCA for western states were hindered by the limited number of western sites in 2011. Sites will be re-distributed and western states will be better represented in 2016.
- Elizabeth Milford (NHNM Ecologist) gave a presentation about NMRAM at the Crawford Symposium on March 3, 2015 in Albuquerque, New Mexico.
- The WPC and NHNM staff conducted Assessment Team meeting on March 3, 2015 to develop the Rio Grande Pecos Version of the Field Guide and Manual updates.
- The WPC and Elizabeth Milford (NHNM) attended a one-day workshop on March 12, 2015 for "*South Pacific Division Mitigation and Monitoring Guidelines and Mitigation Ratio Setting Checklist*," sponsored by the USACE Albuquerque District.
- A meeting was organized by NHNM to explicitly discuss the abiotic metrics for Lowland Riverine Systems on April 20, 2015. UNM Hydrology Professors Mark Stone and Grant Weaver were invited to provide their comments on the current metrics. Este Muldavin (NHNM) provided a power point of the abiotic metrics under discussion.
- An invitation to the first Advisory Committee meeting for Rio Grande-Pecos Lowland Riverine NMRAM was circulated on April 30, 2015.
- A draft list of potential data collection sites was prepared by NHNM.

- A definition for the project Lowland Riverine subclass has been drafted and will be used in the development of the project QAPP.
- A meeting to review the abiotic metrics for NMRAM USACE Module was held on May 8, 2015.
- The first AA-Team meeting for the Rio Grande-Pecos Lowland Riverine NMRAM was conducted on May 21-22, 2015 at the Sevilleta National Wildlife Refuge. Ten participants with knowledge of the Rio Grande and the Pecos attended and provided input on the draft metrics, selection of a sample area within the Wetland of Interest, metric rankings and other information. Este Muldavin (NHNM), Maryann McGraw (WPC) and Elizabeth Milford (NHNM) provided presentations and lead the discussions.
- TEKSystems has completed a draft of Lowland Riverine interactive PDF worksheets Version 1.0 for use in the field.
- The geodatabase assembled by NHNM includes collateral data. NHNM added a "jetty jacks" layer that Mark Horner (UNM GIS Tech) created from Albuquerque to San Marcial, and interpolated surface of sediment depths that Mark derived from the jetty jack layer. Kellner jetty jacks were installed along the Rio Grande in the late 1940's to catch sediment and channelize the river as well as to build up the floodplain to contain floods and prevent overbank flooding. A series of levees were also built along the Rio Grande at this time and in the 1930's.
- NHNM used the geodatabase to select the 100 initial sites, the pilot study sites and the 40 field data collections sites. All sites were selected to give the best distribution across the range of condition and also across the length of the river reaches on the Pecos and Rio Grande.
- The WPC developed a checklist of floodplain features to be used as collateral data during the data collection effort at 40 sites. The checklist was revised after the Pilot Study before use by the data collection team for the final selected sites.
- The QAPP (Q-Track 15-364) for this project was completed and approved by EPA on July 14, 2015 and covered NMRAM and USACE NMRAM data collection.
- A Pilot Study for Lowland Riverine NMRAM on the Rio Grande and the Pecos was conducted on July 20-22, 2015. Permission to visit 9 sites was obtained by NHNM and WPC. During the pilot study, land managers and landowners were interviewed on-site to gain additional historic information about the site.

Figure 4. Location of Pilot Study sites on the Rio Grande and Pecos River.

- A set of data collection metrics (including totally new ones developed for testing on riverine systems) were developed for data collection and revised during the pilot study.
- NHNM staff and the WPC met with Paul Tasjian, Hydrologist for the USFWS and expert on Pecos and Rio Grande hydrology, on August 20, 2015, to obtain additional information about flooding and floodplains, especially since both the Pecos and Rio Grande are controlled systems and Bosque del Apache Wildlife Refuge is located on the Rio Grande and has many years of hydrology data at Paul's disposal.
- The WPC presented details of the Wetlands Rapid Assessment tool for the determination of wetlands condition for lowland riverine systems (NMRAM) to the Corrales Bosque Advisory Commission (CBAC) on Thursday, September 10, 2015.
- Permit applications and permissions to collect data at selected NMRAM Sampling Areas were completed by NHNM. Data packets and all field supplies were assembled and checked for the field teams.
- Assessment field teams were trained in the field for completing the field metrics on August 25, 2015 and October 20, 2015.
- Data Collection from 21 NMRAM sites located on the Pecos and Rio Grande began on August 26, 2015 and continued through October 2015, with 6 of those sites on the Pecos, 4 on the Rio Grande below Elephant Butte, and 11 on the Rio Grande between Bernalillo and Bosque del Apache.

Figure 5. Este Muldavin (NHNM), Brian Lang (NHNM), Allison (Kitto) Fontenot (EPA R6), and Chris Canavan (SWQB) discuss Abiotic Metrics during a lunch break during data collection on the Rio Grande Floodplain (photo M. McGraw).

- Esteban Muldavin (NHNM Director) met the field team in the field weekly to ensure that data collection was going smoothly and to approve any adjustments needed to data collection protocols. Maryann McGraw (WPC) also visited the field team on September 1, 2015 with Allison (Kitto) Fontenot (EPA R6 Technical Advisor) to review how data was being collected, what adjustments needed to be made and to ensure that all data collection field members were following QAPP protocols.
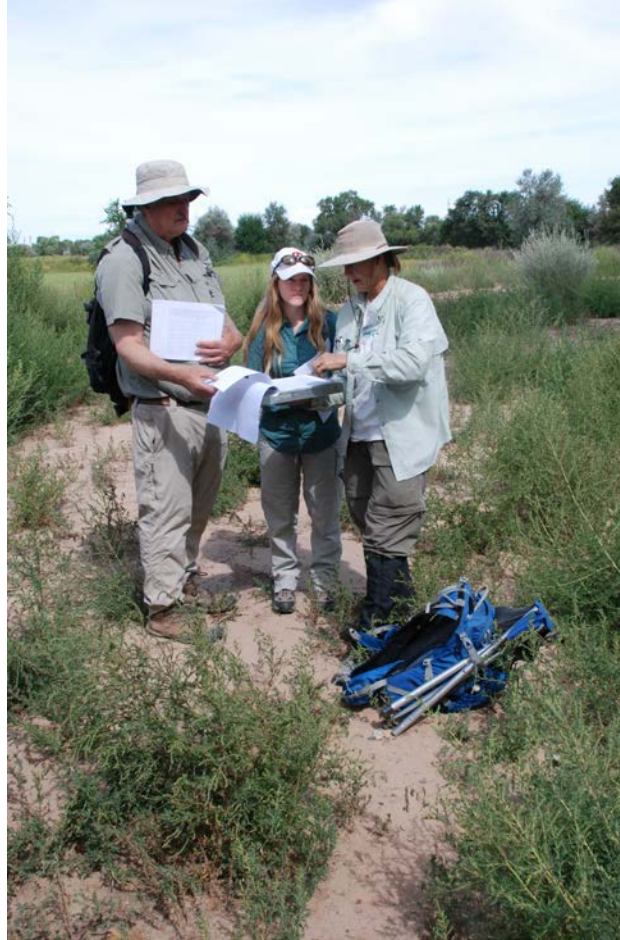
Figure 6. Esteban Muldavin and Yvonne Chauvin (NHNM) explain biotic metric data collection protocols that are being developed for NMRAM to Allison (Kitto) Fontenot (EPA R6) (Photo by M. McGraw).

- Because of the size of the Sampling Areas (SA) and the extreme overgrowth from above-average wet monsoon season, each SA took 1 to 1.5 days to complete, so fewer sites were visited for data collection than planned. (On one field day, one of the field technicians got so disoriented in the overgrowth that Search and Rescue had to be called to find the team member.)
- Ten out of 16 water quality survey sites overlapped wetland SAs within the Reference Domain on the Rio Grande.
- A draft set of Lowland Riverine datasheets Version 1.0 in interactive PDF form were developed by TEKSystems. As the SQUID database becomes compatible with NMRAM data through our work with TEKSystems, a query for both sets of water quality and wetlands data for analyses will be possible.
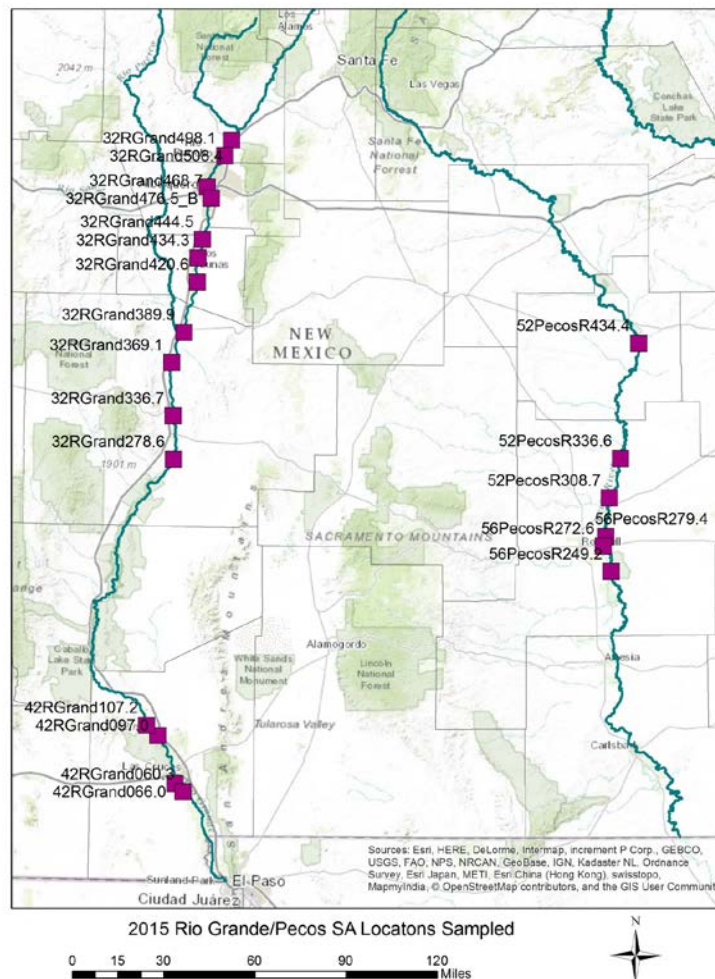
Figure 7. 2015 Rio Grande and Pecos River sampling locations.

- NHNM staff began entering vegetation polygon and community type data in an NHNM Access database starting November 2015 and continuing through March 2016. These data will be analyzed for sensitivity and ranking.
- The WPC met with NHNM staff on March 2 and March 14, 2016 to prepare new metrics for USACE NMRAM.  The new USACE Module metrics include Internal Riparian Corridor Connectivity and Sample Area Land Use.  SWQB staff, UNM staff and USACE staff met on March 24, 2016, to review a draft of a revised field guide and new metrics for the NMRAM USACE module.
- Two Agency/NGO Wetlands Roundtables, one for Southern New Mexico in Las Cruces and one for Northern New Mexico in Santa Fe, were conducted on April 11, 2016 and April 18, 2016, respectively. NHNM Staff made a Lowland Riverine NMRAM presentation at the Southern New Mexico Wetlands Roundtable.
- In May 2016, the grant award for all projects under CD #00F736-01-0 which includes this project was provided a no cost extension until May 2019.
- A new small purchase contract with TEKSystems to continue database development for this project was completed on May 30, 2016.

- Data base entry into an in-house Access database and quality control by NHNM staff for metric data analyses was completed in May 2016.
- The WPC and NHNM staff met on April 28, 2016 and June 14, 2016 to work on NMRAM metrics and NMRAM USACE module metrics on real permitting sites and situations, and to prepare for data collection by USACE staff during summer 2016.
- In October 2016, the WPC meet with Deanna Cummings (USACE) to go over data collected by USACE staff using the USACE NMRAM draft and new metrics. The metrics showed sensitivity to changes expected for pre and post implementation for BAMI.
- The WPC attended a Partners meeting on May 16, 2016, conducted by NHNM. The meeting included a wetlands and riparian break out session and the WPC informally presented the NMRAM, mapping data and other forms of data that the Wetlands Program can share. The WPC also promoted the idea of creating a statewide wetlands conservation plan.
- Thank you letters to landowners and land managers for allowing us to collect data on their land was sent by NHNM for each site visited by the field team both for the Pilot Study and for the data collection.
- Two fall New Mexico Wetlands Roundtable meetings were conducted in November and December 2016. The Northern Wetlands Roundtable was co-sponsored by the Los Amigos de Valles Caldera and was held in Santa Fe on November 14, 2016. The Southern Wetlands Roundtable was co-sponsored by Rio Grande Return, and held at Las Cruces City Hall on December 7, 2016.
- Registration and air travel were purchased for Emile Sawyer (Wetlands Program WPO) to attend Rosgen Level 2 Training in July 2017.
- A 4-year contract for TEKsystems under a price agreement to work on NMRAM database development was signed by NMED and TEKSystems on May 18, 2017. The larger contract includes federal funds from this project for SQUID Enhancements for Lowland Riverine Wetlands NMRAM data.
- NHNM staff produced a set of map units and mapping protocol for Wetland of Interest vegetation maps of the Rio Grande and Pecos sampling areas from 2016 data collection at 21 sites. The map units are designed to cross-walk to the National Vegetation Classification as well as prior mapping efforts related to NMRAM development.
- A new MOA with UNM Natural Heritage was signed on February 26, 2018 to expend remaining contractual funds on unfinished tasks.
- The new MOA includes data collection at 10 additional sites to compensate for the shortage of sites during the first data collection and to test metrics on additional sites.
- The WPC has co-authored a case-study publication on the Lowland Riverine NMRAM entitled "Rapid Assessment of Arid Land Lowland Riverine Wetland Ecosystems: A New Mexico Case Study" by Maryann McGraw, Esteban Muldavin and Elizabeth Milford. The case study will be published in a larger Elsevier publication on Stream and Wetlands Rapid Assessment Methods due out in 2018.
- The WPC is on the planning committee and reviewing abstracts for concurrent sessions for the Society of Wetland Scientists Annual Meeting in Denver Colorado in May 2018. She will also chair at least one concurrent session during the conference.
- The WPC was selected by the Environmental Law Institute to receive the National Wetlands Award for Program Development for 2018 and attended the Award Ceremony in Washington, D.C. in May 2018. Prior to the Awards Ceremony, a panel discussion on RAMSAR wetlands was conducted. The WPC gave a presentation on New Mexico's RAMSAR wetland, Roswell Artesian Wetlands.

Figure 8. Maryann McGraw (WPC) and Marla Stelk (ASWM Director) at National Wetlands Awards Ceremony, May 2018.

- The WPC presented a poster on NMRAM for Lowland Riverine Systems at the Society of Wetland Scientists Annual Meeting in Denver, Colorado as well as giving an oral presentation on Playas NMRAM and chairing two sessions May 29-June 1, 2018.
- The multi-metric analyses for 2015 Rio Grande/Pecos Lowland Riverine Sample Areas combined with Gila Lowland Riverine Sample Areas was completed by UNM Natural Heritage.
- The WPC and UNM Natural Heritage staff updated, revised and added metrics to Lowland Riverine NMRAM based on the multi-metric analyses. Also, the Stressor Checklist has been replaced with a new version that is more processed based.
- A new QAPP for data collection from Lowland Riverine Sampling Areas using updated metrics was approved by EPA on February 13, 2019 (Q-Trak 19-146).
- The Follow-up Advisory Team meeting was held on March 7, 2019 with 20 participants in attendance.
- A three-day training for Lowland Riverine NMRAM was conducted on April 23-25, 2019 with 20 participants in attendance.

Figure 9. Poster on Lowland Riverine NMRAM presented at Society of Wetland Scientist Meeting in Denver Colorado May 2018.



Figure 10. Classroom portion of Lowland Riverine NMRAM Training at UNM Science and Research Park.

- The WPC, USACE staff, and UNM Natural Heritage staff completed edits of the Regulatory Version of NMRAM 1.0 for submittal to ERDC for review. In addition, TEKSystems completed the changes to Regulatory Version 1.2 of the active data collection worksheets.
- Este Muldavin gave a presentation on Lowland Riverine NMRAM at the Southern New Mexico Wetlands Roundtable in Las Cruces on March 28, 2019.
- The WPC attended the Society of Wetland Scientists Rocky Mountain Chapter Meeting in Golden, Colorado April 10, 2019.
- A one-day training for the UNM Natural Heritage/SWQB Technical Team to collect data for additional Sampling Areas using revised metrics was conducted on April 26, 2019.
- UNM Natural Heritage/SWQB Technical Team completed data collection for 13 additional Sampling Areas on the Rio Grande using updated and revised metrics including one new metric, Groundwater Index. The data collection started April 29 through May 8, 2019.
- A one-day training for the Regulatory Version of NMRAM was conducted for Albuquerque District USACE staff on May 20, 2019.
- UNM delivered a geodatabase with all the Sample Areas represented as points and polygon layers of vegetation communities and other NMRAM data to the SWQB Wetlands Program.
- The NMRAM Manual Version 2.0 is complete.
- The NMRAM Lowland Riverine Field Guide Version 2.3 with active data collection worksheets is complete.

Figure 11. Reference set of Sample Areas on the Rio Grande and Pecos for developing NMRAM for Lowland Riverine Wetlands Version 2.1.
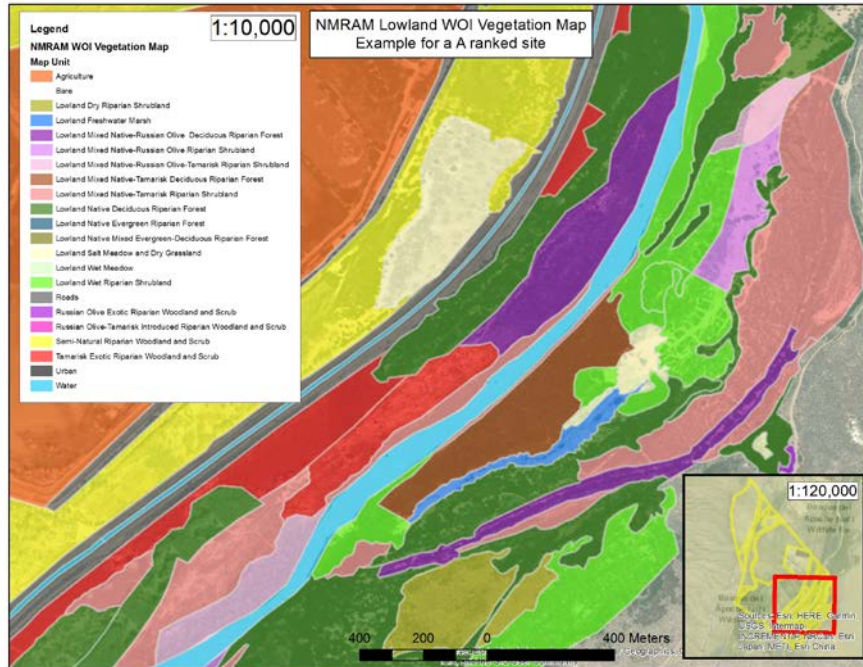
Figure 12. Wetland of Interest Vegetation Map Detail for an A-ranked site, Bosque del Apache National Wildlife refuge.
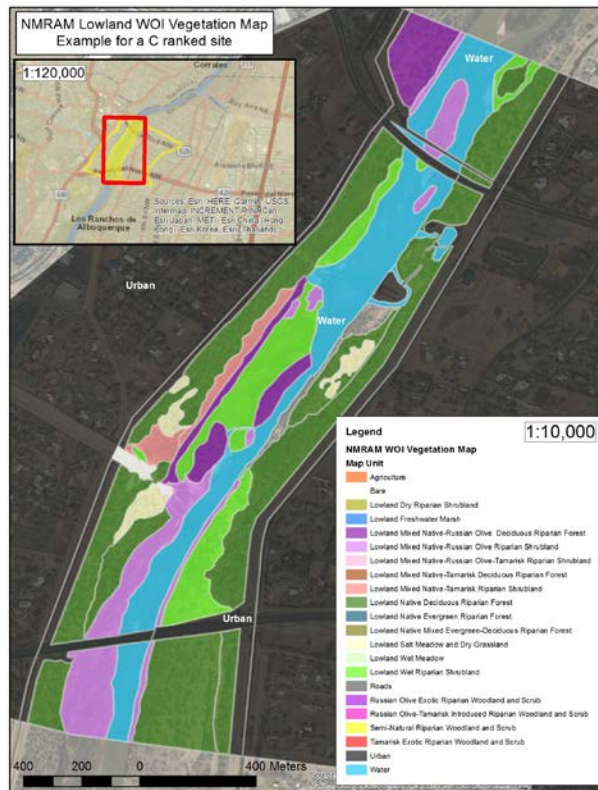


Figure 13. Detail of Wetland of Interest Vegetatio Map for C-ranked site, Albuquerque, NM.

Figure 14. Detail of Wetland of Interest Vegetation Map for D-Ranked Site, Las Cruces, NM.

## List of Major Deliverables

- New Mexico Rapid Assessment Method, Lowland Riverine Wetlands Field Guide Version 2.1 (2019) and electronic data collection worksheets Version 2.3.
- Multi-Metric Analysis Report.
- NMRAM Lowland Riverine Training Materials and sign-in sheets.
- NMRAM Manual Version 2.0
- New Mexico Rapid Assessment Method Riverine Wetlands draft Regulatory Version and data collection worksheets draft.
- 34 Wetlands of Interest with vegetation classified floodplains in GIS and PDF.
- NMRAM data sheets and site photos for 34 reference sites.
- New Mexico Rapid Assessment Method Riverine Wetlands draft Regulatory Version 1.0 and data collection worksheets draft.
- Agenda and Presentation for NMRAM Riverine Wetlands Regulatory Version One-day training.
- New Mexico Wetlands Roundtable agendas and presentations for four Roundtable Meetings.
- IGA, MOA and IT Contracts and amendments.

- Two QAPPs.
- Semi-Annual Reports and Final Report, Match reporting.

## Lessons Learned

This project continued development of NMRAM for large river systems in an arid setting. A challenge was setting the physical limits for the floodplain assessment while still accurately reflecting condition. It was determined that as river systems and their associated floodplains increased in size and discharge, so did the size of vegetation communities and fluvial landforms associated with them (the larger the discharge, the larger the river bars and floodplains, and the vegetation stands that grow on them). Thus, among metrics that are scale dependent, as the SA size goes up, the assessment scores can go up.

Because both the Rio Grande and the Pecos are flow-controlled river systems, there was much debate about scaling the rankings within the current river permanent constraints. We decided to still rank the systems based on natural conditions established during the first Phase of NMRAM development in the Gila River Reference Domain to compare and further understand the lower end functionality and ecosystem integrity of large river systems.

*What made the project successful?*

Development of the NMRAM for Riverine Wetlands Regulatory Version 1.0 will be a useful tool for establishing meaningful mitigation ratios. The purpose of the Regulatory Version is to have a stand-alone condition assessment methodology for use in impacts and mitigation area assessment associated with Clean Water Act Section 404 permits issued by USACE. The Regulatory Version is a modified version from the most current riverine versions of NMRAM (Montane 2.3 and Lowland 2.1) and includes new metrics developed specifically for the Regulatory Version. The new metrics assess impacts within the SA since projects such as bridge expansion for example, will already have a footprint within the SA. In addition, the Regulatory Version could be used to simulate "after construction impact" assessment and as a prediction tool or as a goal for mitigation sites.  The Regulatory Version includes both metrics for Lowland and Montane to increase its applicability to the Regulatory Program in general, and to address application issues including assessment area size related to permit area. The premise of the Regulatory NMRAM is that the current condition for the WOI applies to the permit area, pre-project. NMRAM data are collected using GIS applications surrounding and within an SA that includes the permit area, and data collected on-the-ground within an SA that includes the permit area, so long as the permit area SA is within a minimum size area as specified in the Field Guide. Using an area smaller than minimum may be reflected in lower scores.

NMRAM is proving to be a successful tool for identifying the condition of wetlands by subclass in New Mexico, identifying their range and abundance, and evaluating their condition. NMRAM adds a useful and versatile tool for the management of the State's wetland resources.

The expansion of the New Mexico Wetlands Roundtable has been invaluable as a change agent for the way the state views its wetlands. Wetlands are now more valued and work on assessment, restoration and protecting wetlands is more common. Wetlands are recognized as an indispensable resource.

The acceptance of SWQB to integrate, expand and maintain wetlands data as part of SQUID database ensures compatibility and integration with other state water quality databases and future EPA databases.

*What made the project not so successful?*

This project has been overall successful in achieving its goals.

**Technical Transfer**
*What information can you pass along to other agencies, cooperators or local landowners in other watersheds about this project?*

Agencies, Cooperators and local stakeholders have been invited to participate on the Technical Advisory Committee and to trainings to promote the understanding and use of NMRAM. The NMRAM for Lowland Riverine Wetland Version 2.3 is available on the SWQB website for others to use NMRAM.

Development of the database compatible with SQUID will eventually have a web-access feature so that others can view the results on line and enter their own data.

**EPA Feedback Loop**
*What would you suggest that EPA do differently to improve the process in regard to this project?*

EPA was very supportive in all aspects of this project during the project period, especially allowing grant period extensions to complete high quality and meaningful work.

**Future Activity Recommendations**

- USACE NMRAM will be reviewed by ERDC and their recommendations will be incorporated into USACE NMRAM Version 2.0 under another grant. Additional trainings and outreach regarding the utility of USACE NMRAM should be conducted for USACE staff as well as the regulated community.
- The SWQB Wetlands Program will be conducting an "All Hands" data collection effort to engage more agencies, non-profit groups and for-profit companies in using the New Mexico Rapid Assessment Method for a variety of purposes. More trainings will be conducted in wetlands assessment methods to engage others in collecting needed wetlands data.
- New Mexico is in the process of developing rapid assessment methods (NMRAM) for various wetland subclasses throughout the state. There is a need to continue validation of our landscape and rapid assessment methods using more detailed and intensive methods and indicators, to ensure that NMRAM is providing an accurate picture of wetland condition.
- Another adaptation will be to consider NMRAM as an iterative tool for long term monitoring of wetlands.