

Final Report
East Fork Jemez River Innovative Wetland Restoration Using
Contour Swales, Sod Bowls and Sod Berms

Assistance Agreement No. CD#01F39601-0 (FY2018)



Headwater slope wetlands on the East Fork of the Jemez River on Valles Caldera National Preserve.

New Mexico Environment Department
Surface Water Quality Bureau
Wetlands Program

August 2023

Project Description

Climate change is expected to increase temperatures in New Mexico and change the discharge of headwater streams. Peak flows are expected to be smaller and occur earlier in the spring, whereas flows from summer monsoons have already become erratic and unpredictable. Headwater wetlands in New Mexico are critical for stream flow maintenance because they absorb winter snowmelt and summer monsoons, tempering the intensity of storms, cooling and slowly releasing the subsurface water to streams throughout the year. Unfortunately, headwater wetlands in the Valles Caldera National Preserve (VCNP) are dissected and channelized due to stressors such as vehicle tracks, livestock grazing and trailing, historic mining and wildlife grazing and trampling. These impacts have partially drained the wetlands, reducing their size and quality. Continued drying and loss of these headwater wetlands results in diminished watershed health overall. Loss of headwater wetlands has negative downstream effects including increased erosion, sedimentation, fragmented wildlife habitat, loss of riverine wetlands/riparian vegetation, encroachment of upland vegetation, reduced base flows, increased nutrient loading, and warmer stream temperatures. Restoring headwater wetlands has significant positive downstream effects that buffer climate change by increasing the quality and quantity of downstream riverine wetlands, reducing stream sediment, nutrient loading, and temperature, supporting wildlife habitat, and regulating and increasing stream base flows.

The Valles Caldera National Preserve (VCNP) is one of the newest National Park System properties, but it carries the legacy of heavy livestock grazing from many decades of private land ownership. In the project area, gullies were created by cattle trailing up and down the slope from the valley bottom. Water collected along the trails, which progressively became channels and gullies. Some of the former wetlands are now dissected and drained and are unlikely to recover without intervention. The contour swale approach will be effective because the immediate result of the swale is to divert water away from a headcut and re-wet adjacent former wetlands. Located above the headcut, it will catch water before it reaches a gully. Contour swales can be used in groups and series to allow water to reach farther on to the adjacent wetlands. The sod bowls will have the advantage of using materials available immediately adjacent to the site. Sod berms will be effective soft permeable alternatives to slow water and infiltrate water in saturated or partially saturated areas, as opposed to hard grade control structures, because the sod berms will use wetland plants and dense wetland plant root masses that support the spread of more wetland plants. This method will take advantage of the root density and strong binding capabilities of sedges. These methods will be appropriate for restoring wetlands on slopes with gradients of less than 4%.



Figure 1 Plug and Pond Restoration Structures on the East Fork. The very top of the gully formation can be seen here at the bottom of the photo. Darker lines are contour swales diverting water flow away from the headcut and spreading water to surrounding areas,

Project Goals and Objectives

The main goal of this Project was to develop a demonstration restoration project to restore at least 30 acres of former wetlands in the upper reaches of the East Fork Jemez River watershed on the VCNP using contour swales, sod bowls and sod berms. The project demonstrates the effectiveness of these innovative water-slowing, spreading, and infiltrating structures and at the end of project implementation 65 acres of former wetlands were restored. Design and implementation information about the new techniques was shared with agencies, landowners, restoration volunteers, and the public through a series of restoration workshops, guided tours, presentations, and the distribution of a Technical Guide. The new techniques are applicable to gullies and erosion of slope wetlands on gentle topographic gradients that have vegetation and soils characteristic of former wetlands. The contour swales, sod bowls and sod berms work together in series to redirect and slow the flow of water at various locations along the flow path within a degraded channel: 1) upstream of a headcut, 2) at the headcut, and 3) downstream of the headcut. This project also convened stakeholders to develop a Wetlands Action Plan for the East Fork Jemez River watershed to guide future monitoring, restoration, management and protection in a coordinated and comprehensive manner.

To further the goals of this project, a technical guide about contour swales, sod bowls and sod berms was produced and is distributed through the SWQB Wetlands Program website and hard copies available from the SWQB Wetlands Program. The information on design and restoration techniques used for this project were shared through volunteer workshops, field trips, Roundtable presentations and other venues.

This Project was developed to create strategies that build capacity on public lands in New Mexico as a demonstration that emphasizes proactive climate change activities shaping policy for land and water management by restoring headwater wetlands on the VCNP managed by the National Park Service (NPS). It builds capacity on public lands by including VCNP staff, the surrounding Santa Fe National Forest, and the Pueblo of Jemez in planning through the WAP process, in the project design and restoration, through inclusion in outreach, and by sharing technical materials.

Another final goal of this Project was to create strategies that build capacity at the local level by including and incentivizing local volunteer groups and local organizations in developing a Wetland Action Plan (WAP) in coordination with other agencies, organizations and stakeholders that focuses on restoring wetlands using adaptive low technology solutions.



Figure 2 Subcontractor Keystone Restoration Ecology creating an excavator plug that will re-direct and spread water from the channel into historic wetlands.

Project Outputs

Through this project major outputs accomplished were:

**East Fork Jemez River Innovative Wetland Restoration Using Contour Swales, Sod
Bowls and Sod Berms
Final Report
August 2023**

- A Wetland Action Plan titled “East Fork Jemez River Wetlands Action Plan” was developed by The Rio Puerco Alliance, along with input from Keystone Restoration Ecology, VCNP staff, and SWQB Wetlands Program Staff;
- A Technical Guide titled “Wetland Restoration Technical Guide Using Innovative Sod Structures” was created as a guide for innovative wetland restoration techniques using only native sod and soil in contour swales, sod bowls, and sod berms.



Figure 3 Volunteers for the Outdoors members building sod structures using wetland sod

- The East Fork Jemez River Wetlands Restoration Project Assessment and Design Report.
- Quality Assurance Project Plan (QAPP) for East fork Jemez River Innovative Wetland Restoration Using Contour Swales, Sod bowls and Sod Berms.
- East Fork Jemez Permanent Photo Monitoring Report.
- East Fork Project Presentation
- 2021 Assessment Report for adaptive management.
- A Contractor Final Report produced by our contractor Rio Puerco Alliance.

East Fork Jemez River Innovative Wetland Restoration Using Contour Swales, Sod Bowls and Sod Berms
Final Report
August 2023

Project Outcomes

- The SWQB Wetlands Program and partners developed innovative restoration techniques that will be applicable to protecting, restoring, increasing the quantity, and sustaining the quality of wetlands.
- Increasing water-holding capacity and rewetting headwater wetlands including damaged headwater slope wetlands has multiple benefits, including filtration of pollutants, improving downstream aquatic ecosystems that sustain fish, wildlife and other biota, and enhancing economic, recreational and subsistence activities.
- Two volunteer workshops employing “Volunteers for the Outdoors” members and SWQB Wetlands Program staff assisted in the installation of sod and rock structures and educated the volunteers about these innovative restoration techniques.



Figure 4. Workshop 2 restoration volunteers at VCNP Visitors Center.

- Partners including the VCNP, volunteer organizations, restoration contractors and others have additional tools for the management of thousands of acres of public lands and for the restoration of headwaters in the lands they manage and protect.
- In the short term, the application of contour swales, sod bowls and sod berms to headwater wetlands in the VCNP will increase the quality and quantity of wetland acres. This project increased wetland acreage from 33.8 acres to 98.8 acres of restored hydrology and wetland acreage.

East Fork Jemez River Innovative Wetland Restoration Using Contour Swales, Sod Bowls and Sod Berms

**Final Report
August 2023**

- In the long term, the SWQB Wetlands Program and its partners will use these new restoration tools to increase wetlands acreage throughout New Mexico and in neighboring states.
- The Wetlands Action Plan provides information and history about the East Fork Jemez River watershed, it identifies its partners, future actions and expectations to restore and protect wetland resources in the watershed.
- This final report describes project results, effectiveness, and lessons learned and is available on the NMED Wetlands Program website [Wetlands Projects \(nm.gov\)](https://www.nm.gov/wetlands-projects) for access by practitioners and the general public.

Project Location

This project took place in the headwaters of the East Fork Jemez River watershed within the 38,134-acre Valles Caldera National Preserve. This area falls in the 12-digit HUC 1302020203. The restoration work occurred in the southeast corner of VCNP. The results of this project have statewide application for headwater slope wetlands in mountainous regions in New Mexico and throughout the Rocky Mountain region.

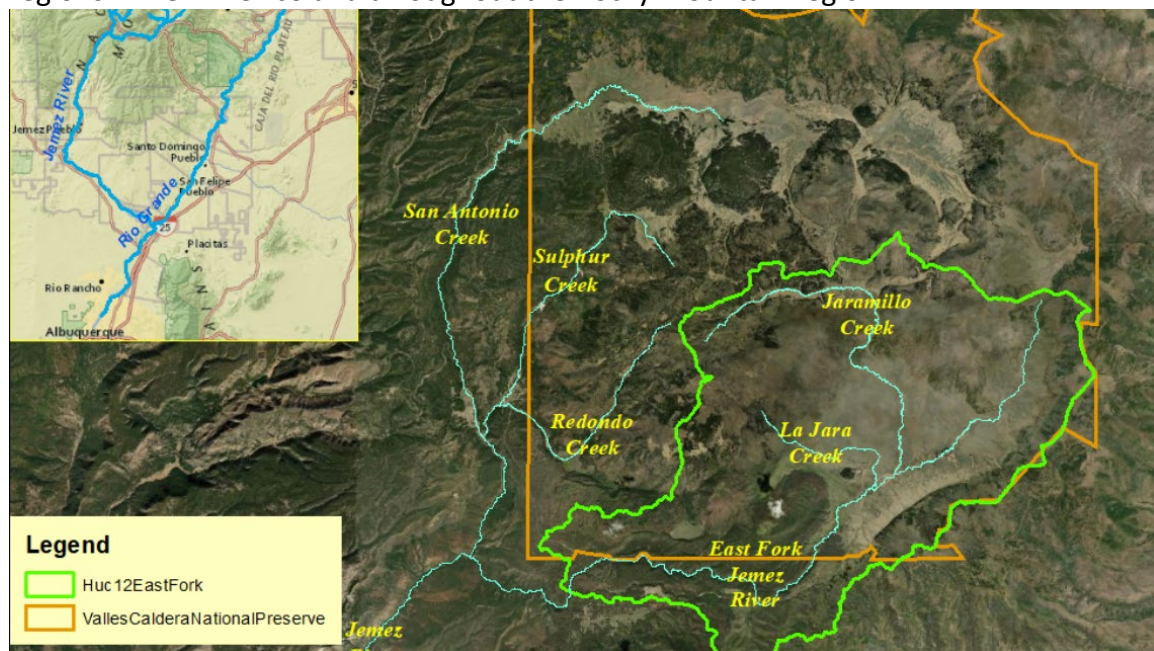


Figure 5 East Fork of the Jemez River Watershed.

Original Timeframe

Federal Assistance was awarded for this project on September 6, 2017, to begin on October 1, 2017. On December 16, 2019, EPA approved a no-cost grant amendment to extend the grant term to December 31, 2022. Due to unforeseen delays due to fire and

East Fork Jemez River Innovative Wetland Restoration Using Contour Swales, Sod Bowls and Sod Berms

Final Report

August 2023

Stage 3 Fire Restrictions, and restrictions on the VCNP due to COVID, on October 22, 2022, EPA approved a second no-cost grant extension for the Award to August 31, 2023. The stated goals and objectives of the project remained the same, as well as the key project Tasks and deliverables. A Sub-Award Agreement was executed with the Rio Puerco Alliance on March 5, 2020 to help implement Tasks 2-10 of the Project Workplan. A no-cost Sub-Award Amendment was approved to extend the Sub-Award Agreement from December 21, 2022 to August 15, 2023.

Partners Involved

The Rio Puerco Alliance (RPA) was the principal contractor in partnership with SWQB Wetlands Program for the WAP, the technical guide, and the demonstration restoration work. RPA entered into a sub-contractor agreement with Keystone Restoration Ecology (KRE) to complete the design, implementation, and monitoring of the restoration work and write the technical guide. USEPA Region 6 (Sharon Daugherty, Leslie Rauscher, and Kyla Chandler) provided project progress guidance and technical assistance.

SWQB Wetlands Program was involved in every aspect of the project including photo-monitoring and the photo-monitoring report, co-authored the WAP with RPA Barbara Johnson, and provided review and input to the Technical Guide. VCNP staff were involved in all aspects of the project including vegetation monitoring, state and federal clearances, and allowing access to the property by contractors, NMED staff and volunteers.

The Project involved a stakeholder planning meeting for the WAP on the VCNP with the following interested parties attending:

Abe Franklin – NMED Watershed Protection Section
Maryann McGraw – SWQB Wetlands Program Coordinator
Steve Vrooman - Keystone Restoration Ecology
Barbara Johnson – Rio Puerco Alliance
Bob Parmenter – VCNP Division Chief
Jack Crane – Rio Puerco Alliance
Sara Hall – VCNP-NPS
Dale Counce – Los Amigos
Mara Yarborough – Albuquerque Wildlife Federation
Mike Shelley – VCNP-NPS
Arnold Atkins – Truchas Chapter Trout Unlimited
Harris Klein – Trout Unlimited
Herbert Tsosie Jr. – Pueblo of Jemez
Anasthasia Piliouras – LANL
Ivan Gachupin – Pueblo of Jemez
Christopher Toya – Pueblo of Jemez
Jen Vrooman – Keystone Restoration Ecology

**East Fork Jemez River Innovative Wetland Restoration Using Contour Swales, Sod
Bowls and Sod Berms
Final Report
August 2023**



Figure 6 Attendees at October 7, 2021 Wetlands Action Plan Stakeholder Planning Meeting



Figure 7 Steve Vrooman explaining the historic flow paths of the East Fork of the Jemez and what we might achieve with the restoration.

A Technical Guide Technical Advisory Committee Conference Call was held on May 18, 2022. The WAP stakeholders were invited to join the call for the TAC for the Technical Guide.

Two wetland restoration volunteer workshops with the New Mexico Volunteers for the Outdoors (NMVFO) were held on the East Fork Restoration site on the VCNP. Workshop #1 was held on October 21, 2022, with Maryann McGraw (NMED), Steve Vrooman (KRE), and 19 NMVFO volunteers. Tasks included plugging gaps in three contour swales and repairing four excavator plugs near the East Fork of the Jemez River. Volunteers also built a culvert inlet structure to raise a pond six inches and used sod to repair six plug and pond structures up the main drainage.



Figure 8 New Mexico Volunteers for the Outdoors at Workshop #1.



Figure 9 Volunteers collecting rock for one rock dams and for culvert inlet structure during Workshop #1.

Workshop #2 was held on June 2, 2023 and was attended by NMED staff (Tiffany Anders, Codie Vilen, Dustin Nelson), Steve Vrooman (KRE), and 19 NMVFO volunteers. This workshop involved building a number of one rock dams, some minor repairs of sod dams, contour swales, and other structures built out of sod and soil.

Funding

The original Federal amount was **\$299,568.00** and **\$108,691.00** match. The federal amount spent was **\$260,576.17** and the **final match amount** was **\$122,268.72 (\$13,577.72 overmatched)**. See semi-annual reports for details.

Major Project Highlights and Chronology

- SWQB Wetlands Program was awarded federal assistance for this project. The Cooperative Agreement between NMED and EPA was awarded on September 6, 2017 and the budget period began on October 1, 2017.
- Karen Menetrey (Wetlands Program Project Officer (WPO)) is the Project Officer for this project.

East Fork Jemez River Innovative Wetland Restoration Using Contour Swales, Sod Bowls and Sod Berms
Final Report
August 2023

- The WPO initiated the procurement process to secure a contractor for the project.
- The WPO requested that Valles Caldera National Preserve conduct an archaeological survey to obtain cultural clearance for project work.
- The Wetlands Project Officer (WPO) requested and on October 18, 2018 received approval from EPA to conduct the project through a subgrantee award.
- The Wetlands Project Officer (WPO) prepared a Solicitation for Applications in order to establish a subgrantee for the project.
- The WPO worked with the Valles Caldera National Preserve to schedule an archaeological survey of the project area.
- The Wetlands Project Officer (WPO) issued a Solicitation for Applications on July 25, 2019 in order to establish a subgrantee for the project. One application was received and was processed as sub-grant agreement.
- Construction was completed on the River Stewardship State-funded project that is match for this project: The Restoring La Jara Creek from Damage from the Thompson Ridge Fire Valles Caldera National Preserve (Project #17-H).



Figure 4 Albuquerque Wildlife Federation volunteers building a rock rundown structure that stabilizes the channel and spreads water into adjacent wetlands for the La Jara Creek project.

**East Fork Jemez River Innovative Wetland Restoration Using Contour Swales, Sod
Bowls and Sod Berms
Final Report
August 2023**

- An Archaeological Survey was completed for the project area for the VCNP in Summer 2019.
- A sub-grant agreement was executed with Rio Puerco Alliance on March 5, 2020.
- The Subgrantee, through a sub-agreement with Keystone Restoration Ecology conducted project assessment and preliminary design in April 2020 and submitted a draft assessment and design report.
- The Wetlands Program Project Officer (WPO) held a kick-off meeting and preliminary design review on May 8, 2020.
- EPA approved the QAPP Q-TRAK 20-306 on July 6, 2020.
- The Subgrantee finalized the design and the WPO approved the design.

- The WPO, VCNP and Subcontractor Keystone Restoration Ecology conducting pre-implementation monitoring in August 2020.



Figure 5 Photo from the draft Project Assessment and Design Report showing gullies created by a historic road that have dewatered wetlands by channelizing water.

- Subcontractor Keystone Restoration Ecology began construction September 15, 2020.
- Subcontractor Keystone Restoration Ecology implemented construction on March 8th and 19th, 2021 and took additional photo points documenting structure efficacy.
- Subcontractor Keystone Restoration Ecology plans to make the necessary repairs on the restoration structures in July 2021.
- Subgrantee Rio Puerco Alliance has begun working on the Wetlands Action Plan and organizing the Technical Advisory Committee.
- JT Jones is the newest Wetlands Project Officer (WPO) for the SWQB Wetlands Program and took over management of this project in June 2021.

- Subcontractor Keystone Restoration Ecology submitted an assessment report to the WPO for evaluating structures in March 2021, and made repairs to implemented structures in July 2021 as a result of the March assessment Report.



Figure 6 Subcontractor Steve Vrooman, Keystone Restoration Ecology, in front of a newly constructed contour swale that is partially filled with water.

- Subcontractor Keystone Restoration Ecology (KRE) and NMED Wetlands Project Officer took follow up photo points and structural photos in August & September 2021 capturing the water retention in the structures following monsoon season.
- JT Jones (WPO) gave a presentation on the East Fork restoration and monitoring at the SWQB Watershed Protection Section meeting on September 21, 2021.
- Subgrantee Rio Puerco Alliance (RPA) has initiated work on the Technical Guide, but it has been placed on hold until a Technical Advisory Committee Meeting can be scheduled in the spring of 2022.
- RPA and KRE organized a stakeholder meeting for Wetlands Action Plan development on the Valles Caldera National Preserve (VCNP) which took place on October 7, 2021.



Figure 7 Steve Vrooman (KRE) presenting at October, 2021 Stakeholder meeting

- Subgrantee Rio Puerco Alliance (RPA) developed a draft outline for the Technical Guide, and a Technical Advisory Committee Meeting is scheduled for the spring of 2022.
- A Restoration Workshop is scheduled for May 6 for New Mexico Volunteers for the Outdoors (NMVO) on the East Fork at the Valles Caldera National Preserve.
- A no-cost Grant Amendment #2 extended the end date for this grant to August 31, 2023.
- A no-cost Sub-Award Amendment #2 was approved to extend the Sub-Award contract from December 21, 2022 to August 15, 2023.
- A Technical Guide Technical Advisory Committee Conference Call was held on May 18, 2022.

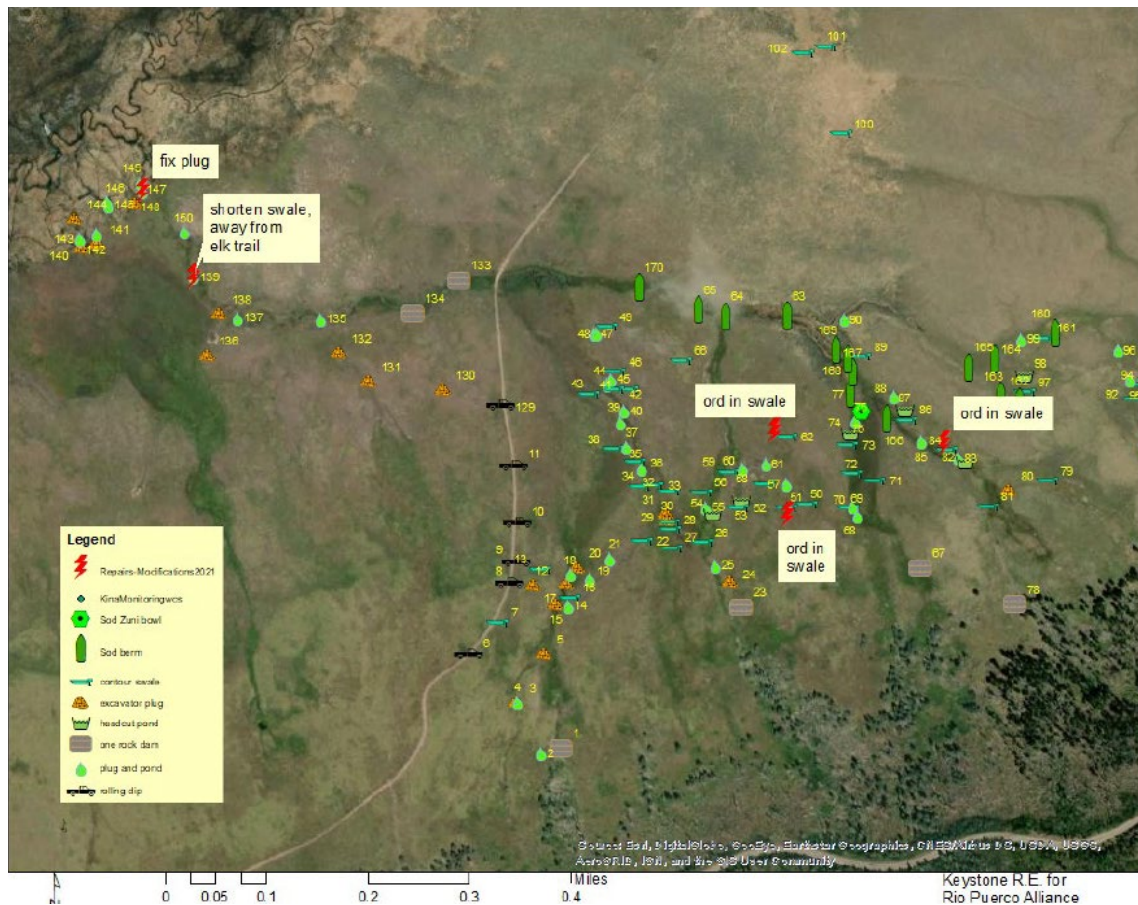


Figure 8 East Fork Headwaters, Spring Runoff Assessment 2021.

- The QAPP for this project was updated and approved by EPA on June 17, 2022 (QTRAK 22-284).
- A draft Wetlands Action Plan was forwarded to the WPC by Rio Puerco Alliance and an edited version was returned to the author for updates.
- A tour of the East Fork Project at the Valles Caldera National Preserve was scheduled for September 20, 2022 but had to be cancelled.
- The East Fork Restoration Workshop for New Mexico Volunteers for the Outdoors (NMVO) was conducted on October 21, 2022 with 19 volunteers and the WPC attending.

**East Fork Jemez River Innovative Wetland Restoration Using Contour Swales, Sod
Bowls and Sod Berms
Final Report
August 2023**



Figure 9 Volunteers for the Outdoors gather large rocks along the road for use in building and repairing restoration structures on the East Fork on October 21, 2022.



Figure 10 Example Photo point taken in August 2020 (left) and again in August 2022 (right). Because of the improvement to wetlands, the structures were nearly invisible due to plant growth and restoration of wetland land form.

- The WPC collected photo monitoring data on the East Fork on August 16 and August 17, 2022.

**East Fork Jemez River Innovative Wetland Restoration Using Contour Swales, Sod
Bowls and Sod Berms
Final Report
August 2023**

- Rio Puerco Alliance requested the use of sod work and monitoring that was completed through the State-Funded River Stewardship Program on Jaramillo Creek, a tributary of the East Fork, as match for this project. The request was accepted by the Wetlands Program Project Officer and the River Stewardship Program.
- Steve Vrooman from Keystone Restoration Ecology gave a presentation at the Northern Wetlands Roundtable on March 21, 2023, on restoration completed on Jaramillo Creek as match for this project.
- The next East Fork Restoration Workshop for New Mexico Volunteers for the Outdoors (NMVO) is planned for June 2023.
- Rio Puerco Alliance and Keystone Restoration Ecology continue to work on the Wetlands Action Plan and the Technical Guide.



Figure 11 New Mexico Volunteers for the Outdoors at the East Fork Volunteer Restoration Day, October 21, 2022.

Participants

Participant	Join/Leave
Amina Sena USDA Forest Service	10:44 / 11:27
Jessica Johnston	10:44 / 11:27
Stephen Hampton	10:44 / 11:27
Ethan Sandoval BCI Restoration Team	10:44 / 11:27
Reid Riley	10:44 / 11:27
Dan Taylor	10:44 / 11:27
Donald Serrano	10:44 / 11:27
allen haden	10:44 / 11:27
Jeremy Ott	10:44 / 10:58
Katie Sandborn	10:44 / 11:27
George Veni - NCKRI	10:44 / 11:27
Eliza Martinez	10:44 / 11:27
Andy Otto	10:44 / 11:27
Abe Franklin	10:44 / 11:27
David Atencio	10:44 / 11:27
Dustin Chavez-Davis, CABQ Open Space	10:44 / 11:27

Figure 12 Screenshot of Northern NM Roundtable presentation on the project by Steve Vrooman.

- Rio Puerco Alliance requested the value of rocks and sod that was collected by volunteers for the East Fork Volunteer Workshop in 2022 to be used as match. The request was accepted by the Wetlands Program Project Officer.
- The second East Fork Restoration Workshop for New Mexico Volunteers for the Outdoors (NMVO) was held June 2, 2023.
- The Rio Puerco Alliance completed a Wetlands Action Plan for the East Fork of the Jemez River and it is available on the SWQB Wetlands Program website.
- Keystone Restoration Ecology completed the “Wetland Restoration Technical Guide Using Innovative Sod Structures” technical guide and it is available on the SWQB Wetlands Program website.
- Rio Puerco Alliance completed the Contractor Final Report and submitted it for approval by the SWQB Wetlands Program.
- The SWQB Wetlands Program completed photo monitoring for the East Fork

List of Major Deliverables

- A Wetland Action Plan titled “East Fork Jemez River Wetlands Action Plan.”
- A technical guide titled “Wetland Restoration Technical Guide Using Innovative Sod Structures.”
- Stakeholder meeting agenda and sign-in sheet.
- Restoration Workshop #1, conducted on October 21, 2022, sign-in sheet.
- Restoration Workshop #2, conducted on June 2, 2023, sign-in sheet.
- The East Fork Jemez River Wetlands Restoration Project Assessment and Design Report.

East Fork Jemez River Innovative Wetland Restoration Using Contour Swales, Sod Bowls and Sod Berms
Final Report
August 2023

- Quality Assurance Project Plan (QAPP) for East fork Jemez River Innovative Wetland Restoration Using Contour Swales, Sod bowls and Sod Berms.
- East Fork Jemez Permanent Photo Monitoring Report.
- East Fork Project Presentation by Steve Vrooman for the Northern Wetlands Roundtable.
- 2021 Assessment Report for adaptive management.
- A Contractor Final Report produced by our contractor Rio Puerco Alliance with Appendices.
- This Final Report for the East Fork Jemez River Innovative Wetland Restoration Using Contour Swales, Sod Bowls and Sod Berms.

Lessons Learned

This project was a demonstration in innovative techniques using wetland sod, and soils to restore ecologic functioning and growth of wetlands in the mountain regions of northern New Mexico, and the larger Rocky Mountain region. One challenge of the project was designing the structures to both function with current water-table and precipitation levels, while accounting for storm runoff. KRE determined that some of the contour swales required the addition of one-rock dams to raise the water table and keep the swale saturated. Another challenge of this project was the performance of these structures under the pressure of the large local elk population. At the lowest end of the project near the East Fork of the Jemez, Elk trailing had captured the desired sheet flow and dried out the wetland. Elk had also trampled one excavator plug and pond and diverted water back into the channel. Excavator and shovel work fixed both these issues. Additionally, the sod berms in the channel worked, however, they were flat and held water, attracting Elk to trail over them. This pooled water easily spilled over in locations due to Elk movement. Some small repairs and lowering the invert (steepening the sod berm) kept water flowing to the end of the structure.

Another challenge that the project faced was scheduling of volunteer workshops and field trips due to logistics at the VCNP, closures due to wildfire and Stage 3 fire restrictions, and due to COVID restrictions during the pandemic. Volunteer activities could not be scheduled in 2020 because of pandemic restrictions on National Preserve lands. In addition, VCNP management would not approve camping on VCNP by Albuquerque Wildlife Federation (AWF) who then were unable to recruit and schedule volunteer work at VCNP on the East Fork. RPA was able to organize two single day volunteer events through New Mexico Volunteers for the Outdoors (NMVFO) which were very successful in completing restoration tasks. Also, KRE was allowed to complete construction work on-site under the strict pandemic guidelines of the VCNP.

**East Fork Jemez River Innovative Wetland Restoration Using Contour Swales, Sod
Bowls and Sod Berms
Final Report
August 2023**

What made the project successful?

The restoration portion of the project was extremely successful in wetting the valley bottom, restoring historic sheet flow and restoring headwater wetlands. A Wetland Delineation was conducted in the project area in 2020 before the demonstration restoration and again in 2023 after the restoration implementation in 2021 and 2022, using evidence including increases in wetland vegetation, decreases or die-off of upland vegetation, and hydrology indicators including drift lines, surface water and high water tables. The delineation showed wetland acreage increased from 33.8 acres to 98.8 acres of restored hydrology and wetland acreage.

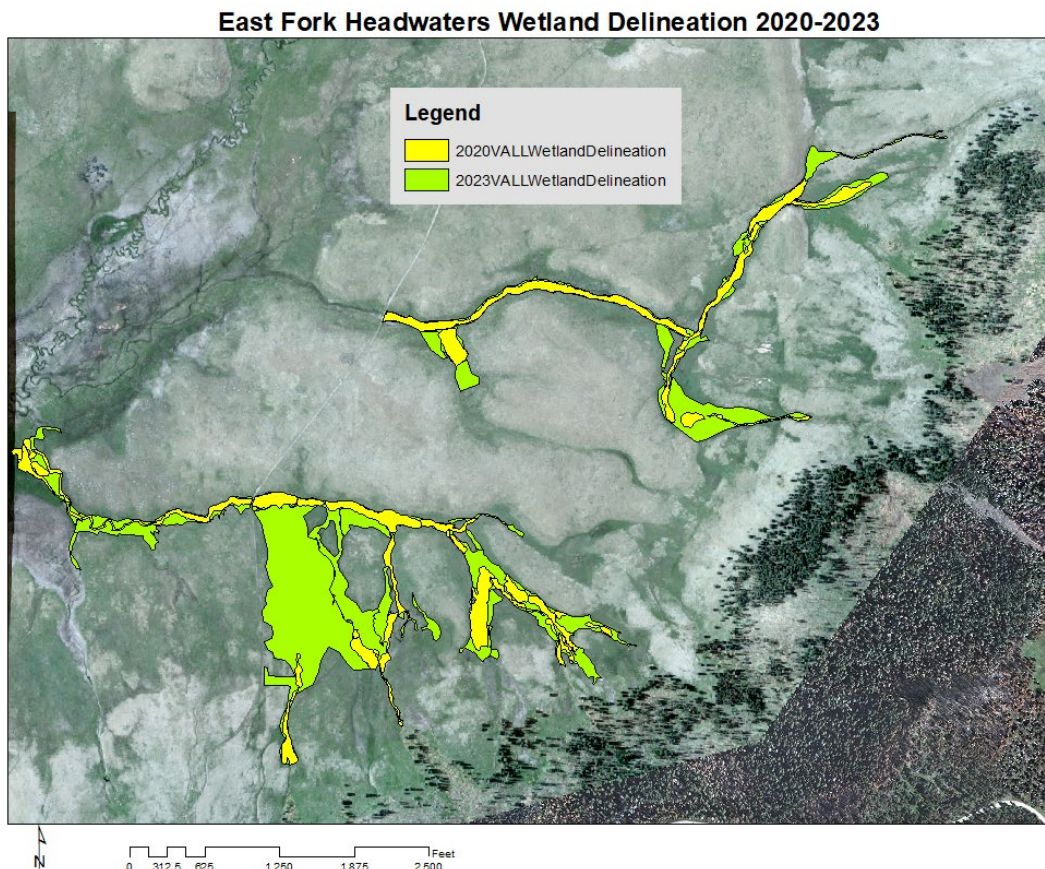


Figure 20 Map from the Technical Guide showing location of wetlands on the East Fork project in 202 and in 2023.

The Technical Guide records the previous conditions, the impacts that lead to a downward trend in conditions and design and implementation that restored the hydrology of the upper watershed. Technical Guides recording techniques and results should be a required output for any successful restoration project so that lessons learned can be shared. The guide also promotes the use of LiDAR to design and implement small to medium sized techniques using only native sod and soil but having a profound affect on wetland area

**East Fork Jemez River Innovative Wetland Restoration Using Contour Swales, Sod
Bowls and Sod Berms
Final Report
August 2023**

that also affects thousands of acres in the VCNP and downstream. The Wetlands Action Plan records partnerships and future tasks to continue to improve the upper watershed of the East Fork of the Jemez.

What made the project not so successful?

The project was successful in achieving its goals. However, due to natural disasters like forest fires and fire closures, and restrictions due to COVID it was hard to schedule and conduct on-site field tours for stakeholders and the public and to schedule more volunteer workdays. However, visits to the restoration site will continue on a voluntary basis even after this project has ended due to the successful techniques that are demonstrated at this important headwater location.

Technical Transfer

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

The “East Fork of the Jemez River Wetlands Action Plan” is a guide for the planning and implementation of projects and activities essential to the understanding, conservation, protection, restoration and management of wetlands in the watershed, and indeed can be a guide for the creation of additional WAPs in the northern New Mexico mountain regions.

The “Wetland Restoration Technical Guide Using Innovative Sod Structures” provides a clear path forward in the potential use of native rock, sods, and soils to restore wetlands across the Rocky Mountain region, using extremely cost-effective and low-impact techniques. The guide also shows that working at the watershed scale on headwater streams allows for treatment of hundreds of acres for the cost of a single restoration project on a stream or river and leads to landscape-wide benefits for wildlife and ecosystem stability. Most of the treatments demonstrated in this guide work on the same principle of diverting water captured in an incised channel back to its natural and historic flow path spread across the valley floor. The sod plug or berm stops sediment that is carried in an incised channel due to shear stress along steepened channel banks and allows the channel to backfill, raising the local water table as well as the bed elevation to the floodplain or alluvial fan surface. The raising of the water table and spreading the flow across the valley surface restores wetland plants and hydrology. Finally, the concept of looking for stream capture on the smallest scales and restoring natural flow paths can be done anywhere, and the techniques are merely a way to achieve that goal. A desert project, for example, would most likely use rock, wood, native plants like willow cuttings and native soils in the structures rather than sod, which would not be available on-site. One of the best results from using sod structures on the East Fork is that the structures

blended into the landscape so well it was difficult to even see where they were located after even one growing season. This is evident in the photo-monitoring which did not pick up structures well in the photo points. Everything just looked wetter and greener across the valley bottom. This is especially important in a National Park where the native landscape is the attraction and the goal.

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 during times of uncertainty and change.

Future Activity Recommendations

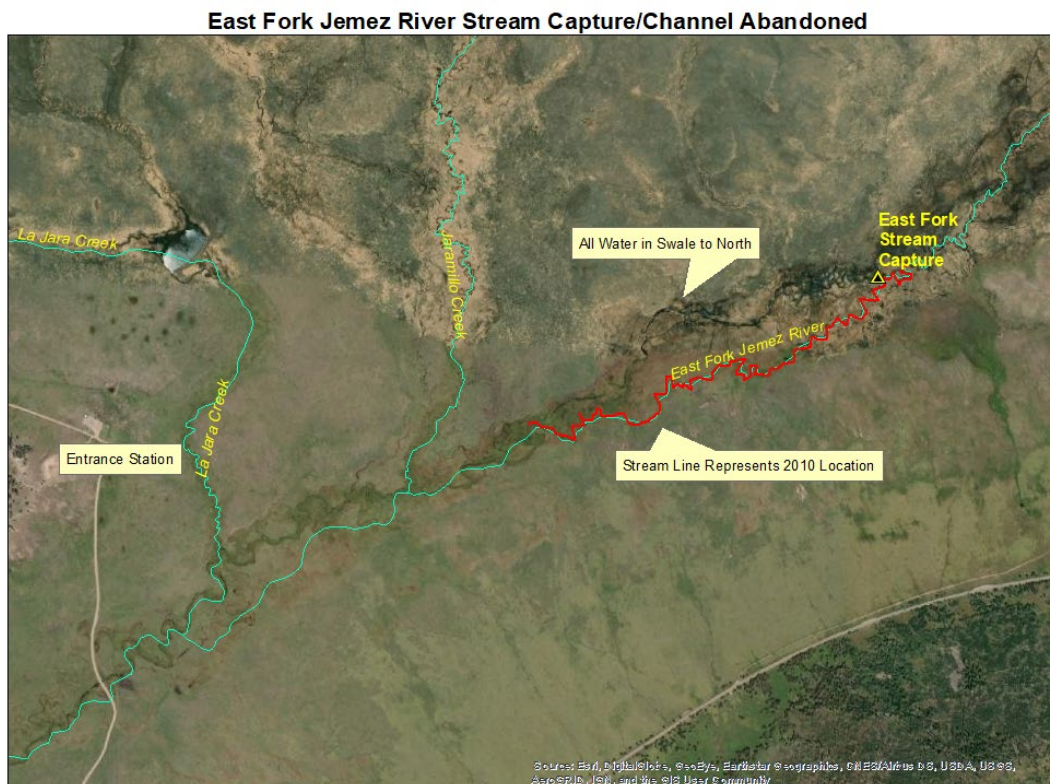
The Wetlands Action Plan provides future recommendations for the East Fork Watershed.

1. Soldades

Repeat the East Fork of the Jemez River demonstration project in the Soldades area, which is closer to the Headwaters.

2. East Fork Stream Capture

There is an area on the East Fork where the stream has been captured and moved to the north side of the valley. The water is now all in a swale on the north side, and the East Fork (blue/red lines) is dry. A solution would be to block the current channel to back up water into the channel to retain the wetland in the swale and also to return some of the flow back to the historic channel to reduce erosion potential.



More projects in the EFJR like the EFJR Headwaters project. LANL has shared report data from Carbon-sequestering monitoring they did. Preliminary data suggests that

Nina's Spring on the San Antonio may be sequestering more carbon than a relatively healthy nearby wetland area that was not restored. So our wetland restoration projects may be

3. Mitigation for Climate Change

Researchers from LANL reported that these restoration wetlands are sequestering more carbon from the atmosphere than we thought.

4. Road Remediation and Trails

Poorly designed and constructed low-standard roads, with little or no culvert or other drainage structures, and poor maintenance, have led to poor distribution of runoff onto the wet meadows. Specifically, the East Fork sub-watershed has numerous gullies that start at the road crossings and are being exacerbated by erosion from trails formerly created by livestock walking up and down the drainage channels. These trails captured water and funneled it directly down the channel creating V-shaped gullies. These gullies were some of the demonstration sites for the contour swales, sod bowls, and sod berms. Poorly maintained roads have contributed significantly to sedimentation and have degraded fish habitat. The increased fine stream sediment concentrations that result from poorly constructed and badly maintained roads has been associated with decreased fry emergence, decreased juvenile densities, loss of winter carrying capacity, and increased predation of fishes.

The Jaramillo/East Fork watershed road system was poorly designed, very difficult to adequately maintain and adds significant sediment to the streams. Major improvements to the drainage facilities of the road system would need to be undertaken to restore the watershed wetlands to pre-road ecology.

5. Wildfire Flood Protection

The reducing conditions that develop in restored wetlands can help buffer transport of nutrients to downslope areas and streams, and the extent of reduction observed suggests such ponding may be effective for reducing concentrations of some redox sensitive contaminants. Sampling at restoration sites even showed restored wetlands can process slurry from fire retardant that was captured in a plug and pond structure. The nutrient spike occurred after a heavy rainfall event, and levels returned to baseline in one month's time in the highly reducing environment sub-surface. Plug and pond and other restoration structures could be utilized as a protective measure for post-fire flood management, either immediately after the fire, or preventively, before a watershed burns. The installation of a series of plugs could capture a great amount of the sediment and nutrient produced by post-fire flooding and use this sediment to restore gullied wetlands and alluvial fans while protecting downstream resources such as water quality, wildlife, and infrastructure.

