PROYECTO EMBUDO DE AGUA SAGRADA: A PLAN FOR RESTORING THE RIO EMBUDO WATERSHED

Produced by Ecotone Landscape Planning, LLC

With support from the NM Environment Department - Surface Water Quality Bureau

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NEW MEXICO ENVIRONMENT DEPARTMENT

This project was produced by:

Ecotone Landscape Planning, LLC (Jan-Willem Jansens), in collaboration with Lauren Auer (intern) and the Forest Stewards Guild (mapping support). The project received technical and financial support from the NMED- Surface Water Quality Bureau, Santa Fe, New Mexico.

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- New Mexico Environment Department (NMED)- Surface Water Quality Bureau
- US EPA
- Arid Lands Institute (Peter Arnold)
- Embudo Valley Regional Acequia Association
- The late Estevan Arellano
- Many residents of the Lower Embudo watershed

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Questions?

Contact Jan-Willem Jansens at Ecotone Landscape Restoration, LLC

(505) 470-2531

jwjansens@ecotonelandscapeplanning.com

https://www.ecotonelandscapeplanning.com/

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Purpose of the 2019 Watershed Plan Update

This document is a summary of the 2019 Update of the Watershed Based Plan (WBP or Watershed Plan) for the Lower Embudo watershed in northern New Mexico. This updated Watershed Plan is dedicated to the late Juan Estévan Arellano who is remembered for his life-long work on the preservation of the knowledge of and care for land, culture, and acequia agriculture in northern New Mexico.

This Watershed Plan aims to outline steps toward improving the water quality of the Rio Embudo between 2020 and 2040. Compiled by Ecotone Landscape Planning, this plan serves as a tool for the Embudo Valley Regional Acequia Association (EVRAA) and other local leaders in their efforts of improving the water quality of the Rio Embudo. Over a period of more than 5 years, the plan grew out of the work of many partners, including the Arid Lands Institute, landowners, forest and watershed groups, and government agencies. The New Mexico Surface Water Quality Bureau provided oversight and funding support for the plan.

The waters of the Rio Embudo

The State of New Mexico has determined that the water in the Lower Rio Embudo watershed is polluted with sediment at levels that do not meet the standards for water quality defined by the state and EPA. The water quality problems are outlined in the USEPA-approved 2018-2020 State of New Mexico Clean Water Act Integrated Report (§303(d)/§305(b), Appendix A). This report states that the water quality standards are not met due to turbidity (cloudiness of the water), sedimentation (too much dirt and silt in the water), and high temperature.

Turbidity, sedimentation, and temperature in the Embudo Creek are all intricately linked to high rates of erosion in the watershed area and the flow of the loose dirt down

arroyos and roads into the river. However, community-wide measures can over time reduce the amount of dirt that ends up in the Rio Embudo and the Rio Grande. This 2019 Watershed Plan Update is a response to the need for a plan to reduce sedimentation/siltation and turbidity in the Lower Embudo watershed.

The overall goal of the 2019 Update of the Watershed Plan is to:

- Identify problem areas in the watershed area
- Develop methods for action
- Identify interventions (a.k.a. management measures) aimed at reducing or eliminating the flow of sediment into the creek at selected priority locations
- Inform and motivate watershed stakeholders, especially local residents and landowners, to self-organize and take initiative to develop activities that reduce pollutant discharges into the streams.

Much of the Lower Embudo watershed is made up of rocky outcrops and exposed hillsides.

The Lower Embudo Watershed

Area Description

A watershed is an area of land where all of the water flowing through it drains into a common body of water such as a river or lake. The Lower Rio Embudo watershed encompasses a large area of land to the southeast of the Rio Grande (Figure 1). In total, it covers approximately 60,362 acres (94.32 mi²) and includes the Rio de las Trampas, Cañada de Ojo Sarco, the Rio Embudo, and more than a hundred arroyos.

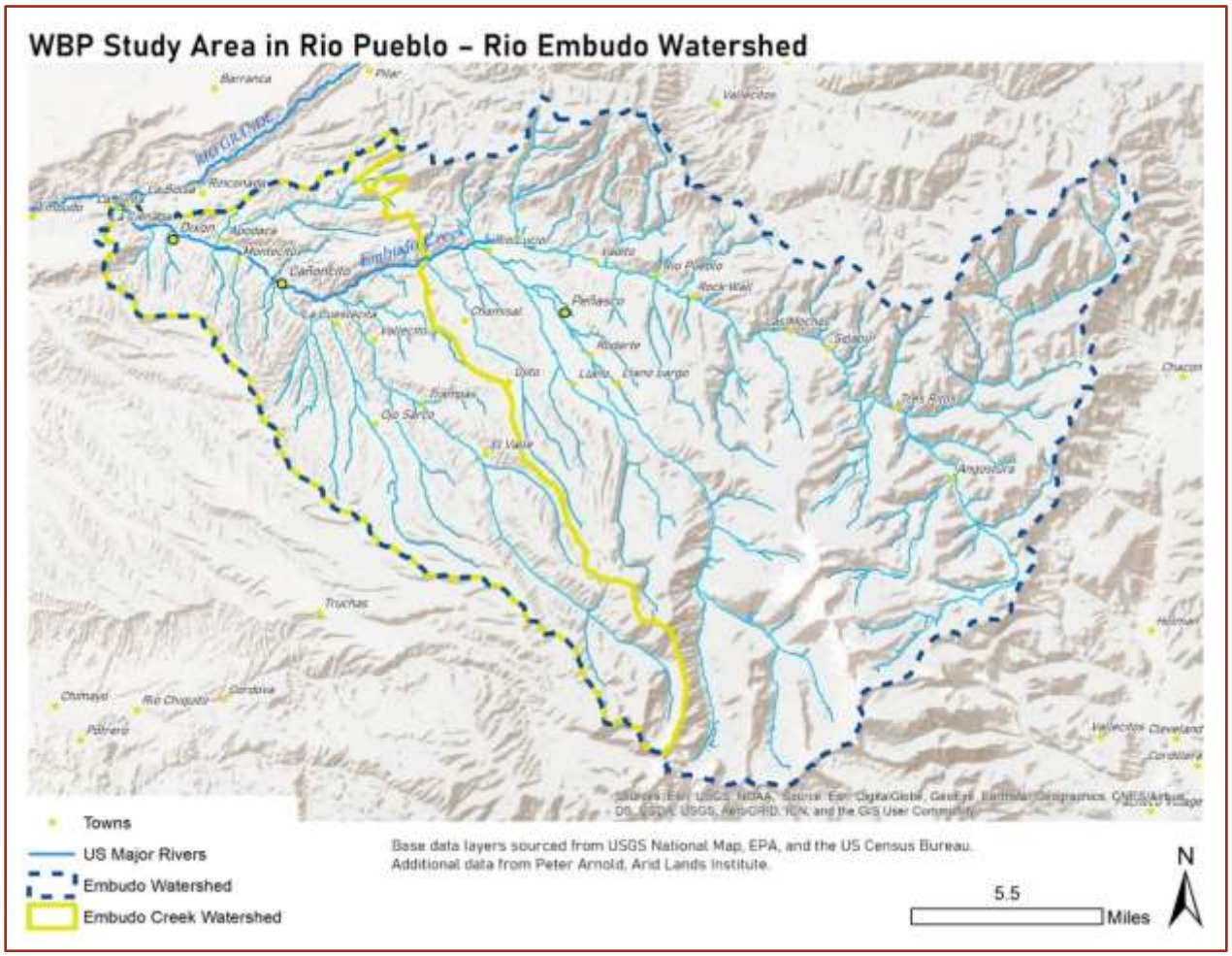

Figure 1: *This map shows the entire Rio Embudo-Rio Pueblo watershed which is outlined with a blue dashed line. The eastern section of the Rio Embudo watershed is comprised of forested, high elevation terrain. For this project, we focus specifically on the Lower Embudo watershed which is located on the far western side of the entire Rio Embudo-Rio Pueblo watershed and is outlined with a solid yellow line. Exposed rocky outcrops and hillsides, sandstone mesas, arroyos, and irrigated fields make up much of the Lower Embudo watershed.*

Both the Rio de las Trampas and Cañada de Ojo Sarco deliver water and sediment (dirt) from the high reaches of the watershed to the Rio Embudo. Many arroyos within the watershed drain into the Rio Embudo as well, and deliver large loads of sediment during high precipitation events to the Rio Embudo. Located in the northwest corner of the watershed is the village of Dixon, NM. A couple of miles to the northwest of Dixon, the Rio Embudo merges with the Rio Grande. Here at the confluence of the two rivers, all of the water and sediment from the arroyos, streams and smaller rivers within the watershed feed into the Rio Grande and get transported downstream. For this reason, the Rio Embudo is an important tributary to the Rio Grande with a view to water quality concerns.

The Water of the Lower Embudo

The amount of water and the water quality in the Rio Embudo have changed a lot in the past 50 years. There are more years with less water, the water carries more sediment, and as a result, fish, wildlife, recreation, infrastructure, and farming activities are impacted. When there is an excess amount of sediment in a stream, it is referred to as sediment pollution. In order to better understand sediment pollution in the Rio Embudo watershed, and more specifically to examine where the sediment is coming from and ways to reduce erosion and sediment pollution, multiple studies and projects have been carried out in the watershed.

In 2007, local consultants wrote a report for the State that lists some of the regional sedimentation problems. In 2010, the Embudo Valley Regional Acequia Association (EVRAA) started working with several groups to map the area and do several projects to stop erosion and improve acequia problems. Several years in a row, the EVRAA also organized the annual *Celebrando las Acequias* event to share technical and cultural knowledge about the acequias. Then, in 2013 and 2014, the EVRAA worked with a partnership of groups and agencies to do a scientific study of the erosion and the amount of sediment ending up in the Rio Embudo.

We can correlate water depth with high precipitation events. Such events contribute to large amounts of sediment that end up in the river.

Research Findings

The year 2013 was a dry year, and 2014 was very wet with many large storms and floods in the Dixon area. In most years, a majority of the rain falls higher up in the mountains of the watershed, but in 2014 many storms fell around Dixon and eroded the soft sandstone mesas and arroyos. It was therefore not a surprise that the study results for

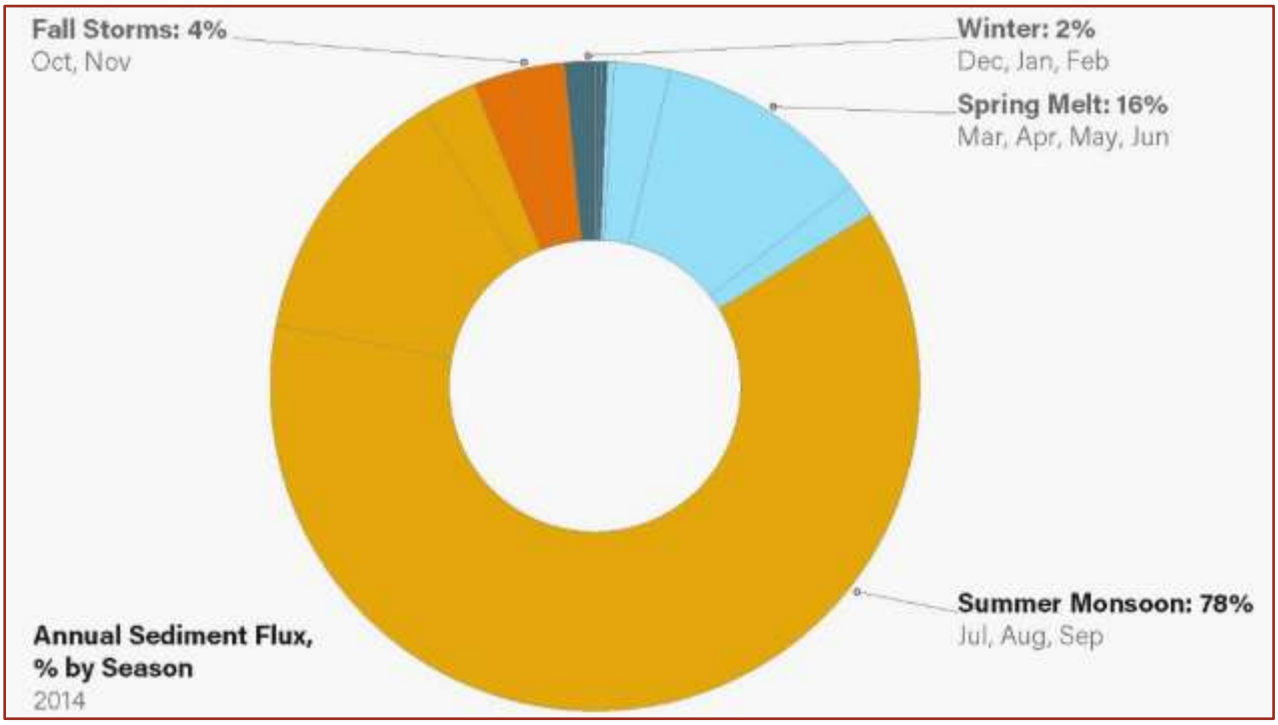

Figure 2: *This plot illustrates the percentage of sediment that came from the Rio Embudo watershed during each season in 2014. You can see that the highest percentage of sediment (78%) came from the watershed during the summer monsoon months.*

2014 showed that the major cause of water pollution in the valley was sediment carried by monsoonal rainfall runoff, primarily coming from the nearly bare, steep hillslopes in the Lower Embudo valley (Figure 2).

In dry years, such as 2013, the amount of sediment that comes from the Lower Embudo Valley is much less, and proportionally more sediment comes from higher up in the mountains. However, in years with a high frequency of rainstorms, such as 2014, most of the sediment comes from the Lower Embudo Valley. When it rains, water rushes into arroyos and flows into the Rio Embudo. From there, the water, sediment and debris flow into the Rio Grande.

In 2014, the Rio Embudo transferred about 18,990 tons of sediment into the Rio Grande (think about 1,900 ten-ton dump trucks). About 13,760 tons (or 72.5%) came from the Lower Embudo Valley, below the Cañada de Ojo Sarco, and only 5,233 tons (27.5%) came from the vast area higher up the mountain. The intensity of the summer monsoons combined with the dry conditions of arroyos loosened up large amounts of dirt that spread across fields, overflowed the roads, and clogged acequias, bar ditches, and culverts. In some areas, the dirt plugs prevented normal stream flow and caused flooding, bank erosion, and serious damage to acequia infrastructure. The 2014 study estimated that 78% of the sediment that washed down from the watershed resulted from rain events during the summer monsoon months of July, August, and September, with July alone accounting for 62% of the total sediment load.

The Rio Embudo contributes a significant but a highly variable amount of the sediment that the Rio Grande carries past Embudo Station. In some years, such as in 2013, the Rio Embudo contributes as little as 4% of the dirt in the Rio Grande, and in wetter years, or years with high precipitation events such as in 2014, it's 40% or even much greater.

An arroyo, used as a road, which carries lots of dirt to the river during high runoff events.

Causes of Sediment Pollution

Much of the erosion and sediment pollution is caused by natural forces, such as the energy of rainfall, soft and exposed rocky material, and poor plant cover due to drought and various other kinds of disturbances. The problems are remarkably worse in extremely wet years that follow extremely dry years, such as in 2014. However, there are other reasons too. The soil is so exposed and dry because of many activities that have damaged the soil and plants, such as off-road vehicles, livestock grazing, and the removal of plants along arroyos, acequias and the river. Heavy loads of sediment in and around Dixon also come from the use of arroyos as roads that run perpendicular to the river.

Arroyos in the Lower Embudo watershed respond to the weather patterns with greater amounts of sediment being carried into the Rio Embudo during high floods. When

arroyos function correctly, they instead allow for much of the rainfall to soak into the ground, recharging the supply of groundwater. The gradually changing weather patterns change the behavior of arroyos. For example, dry years result in fewer plants growing and covering the land. Without plants present, the bare dirt is more likely to erode, and the rainfall is less likely to soak into the ground. Our future will likely include more dry years and more extreme rainfall events that will carry greater amounts of sediment into arroyos and the Rio Embudo, making the problem worse.

Pollution Sources

Sediment pollution comes from a variety of source areas in the Lower Embudo watershed. The map below illustrates where the problem areas are located (Figure 3). Green colors indicate areas of low erosion whereas the deep red colors indicate areas of high erosion. Areas in red are generally steep, rocky, and exposed areas or streambanks.

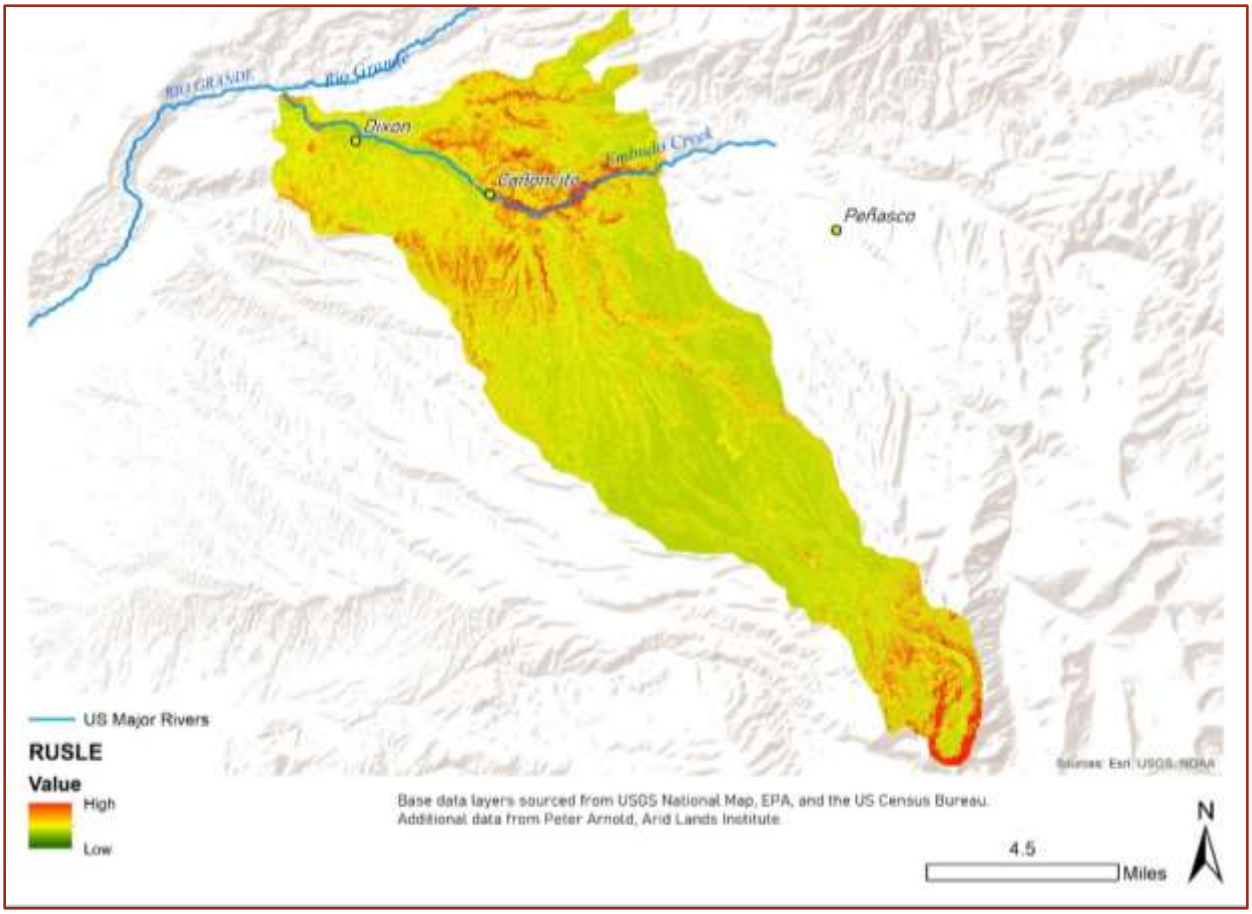

Figure 3: *Map of erosion sites: Green colors show areas of low erosion. Deep red colors indicate areas of high erosion. The red areas are generally steep, rocky, and exposed areas or streambanks.*

A variety of activities and factors influence where high erosion and sediment transport occur and how severe the erosion rates are. Listed below are the major sources of sediment pollution in the watershed area:

- ***Natural sources:*** Weather and terrain play a large part in soil loss and sediment transport. Areas with poor vegetation are highly susceptible to erosion because the soil is exposed to the elements. Heavy rainfall, concentrated storm-water runoff, and wind, particularly along exposed ridges and plateaus, lead to mass sediment transport. Slope steepness and length are also contributing factors to sediment movement. Erosion is often more severe along steep slopes due to gravitational forces.

These hills and ridges are highly susceptible to erosion due to the steepness of the slopes and the lack of vegetation to hold down the dirt.

- ***Historical land clearing and soil disturbance:*** Cumulative activities, such as grazing, mining, and the deliberate conversion of woodland to grassland have reduced vegetation cover and have caused the soil to be exposed to natural erosive forces.
- ***Degraded riparian habitat:*** Removal of natural riparian vegetation due to construction, vegetation removal, dumping of construction debris and other waste, off-road vehicle activity, wildfire, and natural causes.
- ***Cleared sites:*** For example, in association with land development and redevelopment, waste dumping, preparation of fields, and removal of undesirable vegetation.
- ***Unpaved roads:*** In forests, woodlands, and rangelands, and in arroyos and other locations that lead to concentrated storm water runoff on or along unpaved roads.
- ***Two-track (rural) roads/off-road vehicle use:*** Including the inadvertent creation of tracks, hollow roads, and associated highly erodible bare strips across sensitive rangeland soils.

Arroyos and streambanks contribute to a large part of the sediment pollution in the watershed. When it rains or when snow melts rapidly in the upper reaches of the watershed, swift flows of storm water rush down hillsides, through arroyos, and across fields and roads. The loose dirt in arroyos is then easily mobilized and carried down by the torrents.

This arroyo has recently been eroded due to rainfall.

Concentrated flows of water and sediment create many rills and gullies (arroyos) and can lead to the collapse of roads. Previously existing arroyos and streambanks often widen or deepen as well. The establishment of roads and tracks through arroyos exacerbates these conditions and can lead to the accumulation of large amounts of soil and debris along arroyos, roads, and streambanks.

The Effects of Sediment Pollution

Sediment pollution has many consequences, not just for the people and wildlife at the source of the pollution, but for those downstream as well. Sediment pollution is a challenge for humans and wildlife in the following ways:

- ***Clogging of bar-ditches, acequias, and culverts:*** Sediment removal is difficult and can be expensive and time consuming – especially when sediment clogs are frequent. Bar ditches, acequias, and culverts are designed to carry water away from homes and roads, and when they get clogged, the potential for flooding increases greatly.

Flood waters in 2014 clogged many acequias in the Lower Embudo watershed.

- ***Irrigation:*** Irrigation of fields and orchards becomes difficult when acequias are plugged with sediment.
- ***Fish:*** Excess sediment clogs the gills of fish and also impairs fish egg and larvae development. When there is too much sediment, conditions for fishing in the Rio Grande are reduced, as well as the food supply for many other species who feed off of the fish in the river.
- ***Recreation***: Sediment deposits in the river can alter the flow and depth of the water and make recreational navigation difficult.

Project Goals and Management Strategies

The overarching goal of this project is to reduce soil loss and sedimentation to levels where the Rio Embudo meets the Target Loads and Load Reduction Goals described in a State report of 2005 that determines the Total Maximum Daily Load ("TMDL") of sediment pollution. However, this goal can be broken down into a number of smaller goals. Specific goals of this project are to:

- Build local leadership and increase local knowledge of land use practices and land management measures. In doing so, it is also important to encourage local control of water quality improvements and land restoration projects
- Establish collaboration with local agencies and those who are interested in and/or affected by the project
- Promote community collaboration and broad stakeholder participation for private land restoration
- Improve top soil conditions and stabilize the soil
- Improve vegetation cover by re-vegetating the land with diverse, native plants and grasses.

At a recent community meeting in Dixon in September of 2019, local residents agreed that their vision for the future of the Lower Embudo Watershed is as follows,

"Communities in the Lower Embudo watershed live in a landscape that sustains the historic, local, agricultural lifestyle based on acequia irrigation, which is a form of integrated land use and agricultural technology as well as an expression of land-based democracy. In turn, this form of local and collaborative agriculture – both in its traditional subsistence and contemporary commercial forms – involves the community's collaborative stewardship of the land and its water resources in ways that sustain the community's way of life and the local economy."

With this vison in mind, the plan presents a watershed restoration strategy with four key components:

Community members and volunteers meet with the Forest Service for a day of restoration work in the Lower Embudo watershed. Participating in events like these is a great way to learn about methods to restore or preserve your own land, as well as to connect with and learn from public land management agencies.

1) ***Developing large legislative initiatives*** that protect water sources, water supplies, and water quality throughout northern New Mexico
2) ***Developing watershed-wide initiatives***, especially in collaboration with public land management agencies
3) ***Developing many smaller projects*** at a local scale to address site-specific erosion and sediment problems
4) ***Providing information, educational sessions, and incentives*** to private residents, landowners, and businesses to help them undertake best practices that decrease soil erosion and sediment transport and to partner with them in providing supplies, labor, and other services to local restoration initiatives.

The large amounts of sediment that flow from the Rio Embudo into the Rio Grande should be a state-wide concern because the sediment affects stream health, reservoir management, drinking water installations, and irrigation districts downstream. Hundreds of thousands of residents in the state are affected and many millions of dollars are at stake in association with the Rio Embudo's sediment delivery to the Rio Grande.

The cost of equipment and labor to remove sediment from roads, acequias, and ditches is very expensive.

Unlike other parts of the state, such as the Middle Rio Grande Irrigation District and the Elephant Butte Irrigation District, northern New Mexico is not included in any form of regional water management

district. However, a future regional water management district for northern New Mexico could potentially contribute to long-term solutions for improved water quality, better flood management, and resilient ecosystems in the Lower Embudo watershed.

Local institutions, such as EVRAA, and local projects would benefit from working together with institutions, such as the Bureau of Land Management (BLM), the NM Department of Transportation (NMDOT), and the Rio Grande Water Fund. The BLM conducts forest thinning projects in order to reduce the risk of wildfire, NMDOT annually removes sediment from roads and ditches that transport water away from infrastructure, and the Rio Grande Water Fund assists in carrying out forest and stream restoration projects.

Public Agencies

More than 80% of the 60,362-acre watershed is managed by three different public agencies: the U.S. Forest Service manages 31,877 acres, the BLM 16,062 acres, and the State 2,588 acres. About 9,835 acres are privately owned (Figure 4). All three agencies are planning or conducting several management practices:

- ***Forest thinning:*** Reduces forest overcrowding and stress on trees and improves the health of the understory (shrubs, grasses, flowers, and soil). Thinning also reduces fire hazard and protects nearby infrastructure in case a fire does occur.

This area has been frequented by all-terrain-vehicles (ATV's). Repeated ATV use in undesignated areas can cause high level disturbances to the land.

- ***Fire:*** Fire is an essential process necessary for the health and longevity of many native species. Managed wildfires and prescribed fire reduce excessive amounts of brush, shrubs, and trees in a forested area and naturally add nutrients back to the soil which encourages the growth of new vegetation. Periodic, prescribed burns or managed wild fires also reduce the risk and spread of catastrophic wildfires that burn so hot that they strip the soil of nutrients and cause significant flooding and erosion.

- ***Removal of invasive trees:*** Invasive trees can outcompete native vegetation and alter the functions and structures of ecosystems; removing invasive trees generally improves overall land health.
- ***Road and trail maintenance:*** Many roads and trails are severely eroding and are in need of frequent maintenance.
- ***Road and trail closures*:** Closures in selected areas allow vegetation to regenerate and the land to heal.
- ***Erosion control:*** Reducing soil loss goes hand in hand with improving vegetation cover, reducing runoff and flooding, restoring riparian areas, and protecting infrastructure.

U.S. Forest Service Treatments

The Carson National Forest (CNF) has outlined a series of forest health treatments that include a variety of thinning and prescribed fire treatments across several different forest types, as well as road maintenance and repair projects. Additionally, the CNF has two ongoing fuelwood projects (one in the Ojo Sarco area and the other in the Entrañas area) where permit holders can go and harvest wood from a designated location. All of these activities are expected to reduce erosion and sediment flows.

BLM Treatments

The Taos Field Office of the BLM works to improve forest and woodland health as well as wetland health with thinning treatments in ponderosa pine forests and in piñon-juniper woodlands with a ponderosa pine overstory. The agency also proposes to light prescribed fires in treatment areas after thinning and to manage natural wildfire to reach land restoration goals. BLM also plans to remove invasive trees along the Rio Embudo and to improve and maintain rural dirt roads.

Some forest thinning activities on BLM lands and State Trust Lands include scattering of branches on the forest floor and providing firewood for local residents. This method, called "lop and scatter" reduces soil movement and returns nutrients back to the soil.

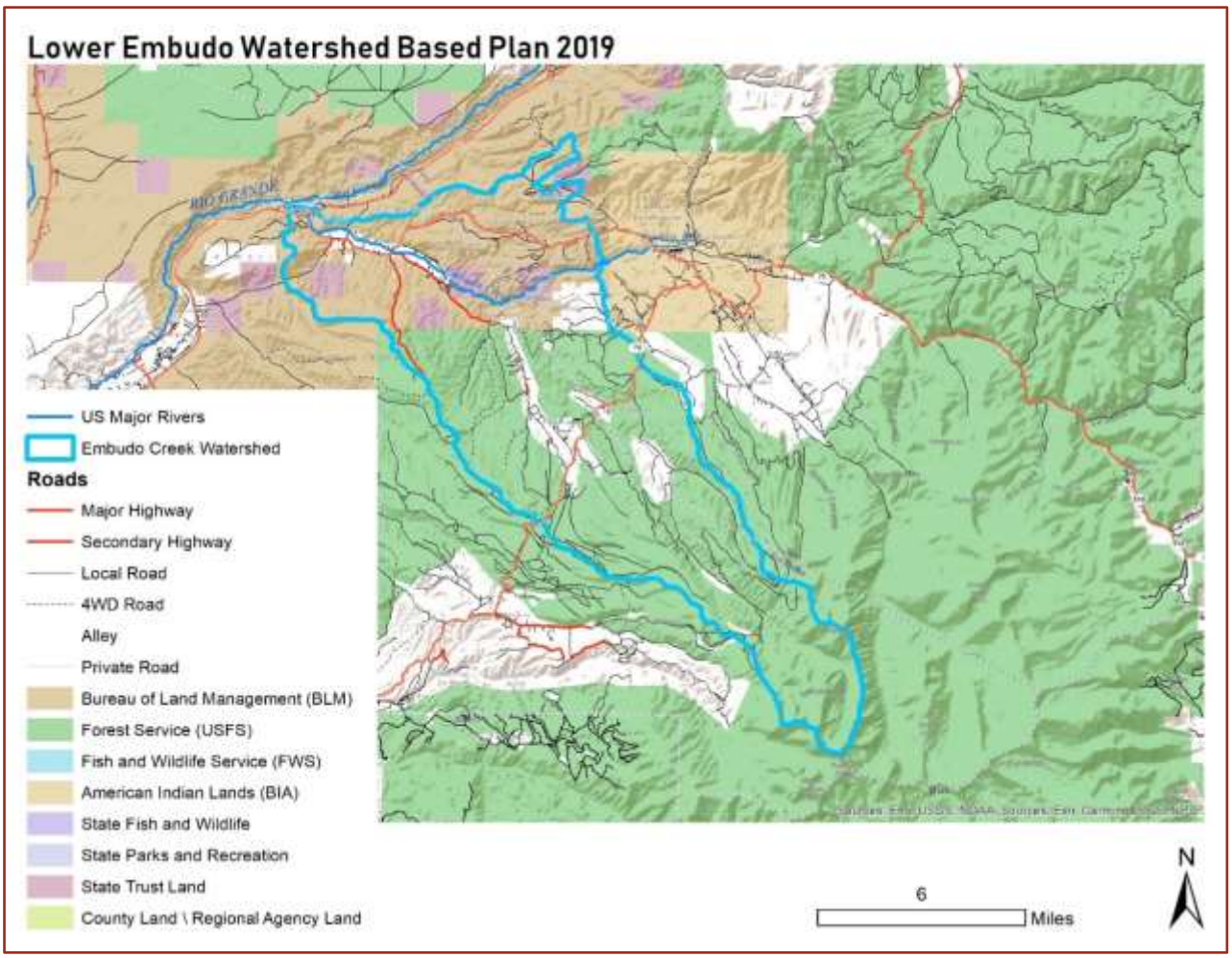

Figure 4: *Map of surface ownership in the Lower Embudo watershed. Note the white areas on the map that indicate private lands and land grant areas.*

NM State Land Office Treatments

The NM State Land Office (NM SLO) plans to undertake small-scale treatments similar to those proposed by the BLM. These proposed treatments may be conducted in conjunction with BLM treatments in order to achieve a regional effect of the treatments. NM SLO will work with regional non-profit partners to accomplish its planned forest and woodlands restoration work.

When added up, the management measures these agencies are currently implementing and planning serve to achieve about 21% of the state's sediment Load Reduction Goal of 50,098 lbs/day of sediment. With time and public support, the agencies may double or

triple this achievement over the life of the Watershed Plan. It is estimated that the greatest sediment load reductions will be achieved on BLM Land and State Trust lands. Additionally, rigorous application of management measures on private properties and on unpaved County and BLM roads and driveways would also have a significant impact toward meeting sediment load reduction goals. Over several decades, the sediment Load Reduction Goal could be achieved thanks to the cumulative effects of all treatments across the landscape.

Where to Start

Community members and private land owners can utilize a variety of methods to reduce soil erosion and sediment pollution, and increase the productivity of the land and their crops. These practices can also reduce the maintenance costs associated with protecting roads and infrastructure. Below is an aerial image that exemplifies a sample of methods land owners and community members can implement in the watershed, as well as an example of the specific locations where these methods can be applied.

Figure 5: Green oval= hedge row; Red oval= cover cropping or mulching on bare ground; Thin pink arrow= bar ditch; Orange arrow= drainage along dirt roads; Light blue line= terrace

- ***Hedgerows and buffers***: A hedgerow is a line of closely planted shrubs or trees that function as a barrier or as a boundary marker. Landowners can plant hedgerows and dense grasses as buffers at the base of slopes, in fields, and along acequias, arroyos or the river to slow runoff and sediment flows. Hedgerows serve a variety of functions. First, they function as a sediment trap. Sediment that moves down a slope gets trapped behind the dense row of vegetation. Over time, sediment will continue to accumulate and spread behind the hedgerow. Water is also slowed and spread by the vegetation. Second, hedgerows function as windbreaks that slow wind speeds across fields and filter out dust and chemical particles carried by the wind. This function protects top soil from wind erosion and water from chemical and dust pollution. The roots of the dense vegetation also act as a natural "net" that stabilize the surrounding soil and hold it in place. Lastly, buffers of native, water-loving vegetation planted along streams can serve to filter out dirt, organic debris, and chemicals from polluting the water.

  Soil loss reduction: Hedgerows could reduce soil loss in the Lower Embudo watershed by 70 percentage points to thirty percent of what the natural soil loss would be if hedgerows were not planted. Riparian buffers have the potential to reduce natural soil loss by up to thirty percentage points to 70 percent of what the natural soil loss would be!


Cover Crops to Protect Soil

- ***Cover Cropping/ Mulching***: Cover crops are plants cultivated on fields in between commercial cropping cycles (i.e., in off season or in years of rest/fallow) to provide soil cover with the purpose of protection and improving soil conditions in order to maintain or enhance soil productivity during the next production cycle. This management measure is typically applicable on private farmlands. The idea is to continually cover and protect exposed soil from natural forces such as wind and rain that can wash the soil away and strip the soil of nutrients. Cover crops also slow the speed of water across the land which improves infiltration (a.k.a the amount of water absorbed by the soil), and in turn increases the productivity of the vegetation in the area.

- **Mulching** is another effective measure to protect soils. Mulch is organic material such as decaying leaves and bark, or manure that is spread over soil. Common locally available mulch products in the Lower Embudo watershed are pebbles and gravel, wood chips, hay, straw, and small plant/woody debris (twigs, leaves, etc.). Not only do plant mulches provide the same functions as cover cropping, they also provide extra nutrients to the soil which improves the health and vigor of plants.
  Soil loss reduction: It is estimated that cover cropping could reduce natural soil loss by 80 percentage points to 20 percent of what the natural soil loss would be without cover cropping. Mulching would account for a 99% reduction of natural soil loss.

- ***Bar Ditches*:** A bar ditch is a small channel dug along the sides of roads to help with drainage. These ditches divert water off and away from roads, and carry the water to a vegetated area where the water is spread. If constructed properly, bar ditches can significantly reduce the amount of erosion on roads. The only caveat is that bar ditches need to be periodically "cleaned" in order to function optimally. Bar-ditches can accumulate sediment and debris that needs to be dug out every now and then. It is not easy to estimate the soil loss reduction capacity on improved dirt roads. However, it is expected that improved road management in the Lower Embudo watershed would contribute significantly to the attainment of pollution reduction targets.

Bar ditch with a one rock dam to further slow water and hold back sediment

- ***Drainage along Dirt Roads***: Rolling dips and lead out ditches are other effective management measures to protect roads from erosion. Rolling dips can be used to drain roads with grades between 3% and 15%. They are very reliable and easy to maintain. Like a strip of bacon cooking on the griddle, roads with rolling dips have a gentle wave appearance. The rolling dip collects surface runoff from the road or road ditch and directs the water away from the roadway. Rolling dips are sized according to the types of vehicles that travel along the road. To allow for trucks with trailers and semis, the rolling dips should be long and gentle. For roads that are used only by SUV's and pickups, the rolls can be relatively short, steep, and abrupt.

Lead out ditches are small ditches along roadways that carry or *lead* water away from roads and onto vegetated areas. Like bar-ditches, lead out ditches need to be periodically cleaned when trash, debris, or sediment has accumulated.

- ***Terracing***: Terraces are like steps cut into the natural contour of slopes. They decrease erosion along slopes by reducing slope length and slope steepness. Terracing of fields, pastures, and rangeland areas is a common soil conservation practice worldwide and also in the Lower Embudo watershed. Many farms along streams have terraced fields, pastures, and orchards. Ditches associated with the acequia system are also often incorporated at the edge of terraces. This is an important management practice to continue into the future.
  Soil loss reduction: It is estimated that terracing would reduce soil loss by 85 percentage points to 15 percent of what the natural soil loss would be without terracing.

These management practices have enormous potential for reducing soil loss, but of course there are other ways you can help to reduce erosion and improve water quality in the Lower Embudo watershed.

More Ways You Can Help

It is important that local residents have a say in and preferably lead planning and decision making for water quality improvements and land restoration and repair. There are many opportunities for residents to get involved in the implementation of the watershed plan. Ways you can get involved include:


A community meeting in Peñasco about forest treatments

- Talk to people about this issue
- Attend meetings and activities of the Embudo Valley Regional Acequia Association (EVRAA), the Rio Embudo Watershed Coalition, and other groups
- Advocate for the establishment of a regional water management district for northern New Mexico

- Re-vegetate with diverse and native plants and grasses on your own land, and see if you can encourage others you know to do the same on their land
- Grow seed and plants for local and regional restoration projects
- Work with others to research ways to get paid for smart farming and the cleaning up of acequias and other ditches that collect dirt
- Apply for funding to begin projects
- Volunteer your time to participate in the construction of small erosion and water harvesting projects structures such as the rock and log structures pictured. These small structures can retain hundreds of tons of sediment each for a decade or more when constructed properly!

Rock structure to control the flow of water

Picket and wicker structure to hold dirt

Are there any other ways you can think of for people to help in this project?

Funding Sources

There are many potential sources for project funding. Various government and private grant programs annually provide funds through grants and contracts for ecological restoration programs. Another possibility would be to develop a payment for ecosystem services (PES) scheme, not unlike the water management program in the Santa Fe Watershed or the Rio Grande Water Fund, coordinated by the Nature Conservancy (http://riograndewaterfund.org/). In these PES programs, beneficiaries downstream pay regional entities that coordinate restoration activities to ensure the continued flow of clean water. In some PES programs landowners or farmers are paid for providing ecosystem services, such as erosion control or maintaining healthy streams. Beneficiaries downstream benefit from the security of adequate supplies of clean water and save money in water purification and infrastructure maintenance.

Several Federal agencies, such as the Environmental Protection Agency (EPA), the Bureau of Reclamation (BOR), FEMA, and the Natural Resource Conservation Service (NRCS) provide a great variety of technical assistance and funding programs. State programs that provide funding and information come from the New Mexico Environment Department (NMED), the New Mexico Department of Agriculture (NMDA), State Forestry, and the New Mexico Game & Fish. Funding may also come from private foundations and donors, or certain collaboratives, such as the Rio Grande Water Collaborative, New Mexico Counties, and the New Mexico Soil and Water Conservation District. Colleges and universities across the state, as well as various non-profits, such as Amigos Bravos, Native Plants Society, and Trout Unlimited, may also be able to provide additional resources and/or technical assistance with projects.

Perhaps you can think of more sources!

Acknowledgements

Thank you to all the residents and volunteers in the Dixon area who have made efforts to safeguard the land, the water, and the community in the Embudo Watershed. No effort is too small, and we greatly appreciate your involvement and input in protecting the Embudo Watershed. We hope to continue to work with you and receive your feedback in the years to come.

Do you want to participate or learn more?

Contact Jan-Willem Jansens at Ecotone Landscape Restoration, LLC

(505) 470-2531

jwjansens@ecotonelandscapeplanning.com

https://www.ecotonelandscapeplanning.com/

ECOTONE
Landscape Planning LLC