Bluewater Creek Wetlands Action Plan

January 2026

Compiled and Edited by

River Source

Justification and Credits

This Wetlands Action Plan (WAP) was prepared in partnership with the New Mexico Environment Department's Surface Water Quality Bureau Wetlands Program, with additional support from the United States Forest Service Cibola National Forest and Mount Taylor Ranger District and stakeholders of the Bluewater Creek watershed.

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Cover Photo Credit: Shush'kin Fen Photo by Anabella Miller (2025). *A fen is a wetland characterized by slow-moving water, often on a slope and containing peat-forming soils.*

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Table of Acronyms

Acronym	Full Name
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentive Program
ESA	Endangered Species Act
NM	New Mexico
NMDGF	New Mexico Department of Game and Fish
NMDOT	New Mexico Department of Transporation
NMED	New Mexico Environment Department
NRCS	Natural Resource Conservation Service
SGCN	Species of Greatest Conservation Need
SWQB	Surface Water Quality Bureau
T&E	Threatened and Endangered
USEPA	United State Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WAP	Wetlands Action Plan

Purpose, Need and Objectives of the Wetland Action Plan

Purpose and Need

Purpose

The purpose of the Bluewater Headwater Wetlands Action Plan (WAP) is to bring together stakeholders in the region to articulate and document a comprehensive approach to protecting and restoring wetlands in the headwaters of Bluewater Creek. The wetlands of the upper watershed of Bluewater Creek are unique in the arid Southwest where water resources are sparse and critical for the needs of the environment and people. The WAP includes background information and prioritizes wetlands in the project area where protection and restoration activities should be designed and implemented as funds become available.

Need

The wetlands of Bluewater Creek provide a source of water for downstream communities such as the Village of Bluewater, Grants, and Acoma Pueblo in addition to Bluewater Lake. The waters are valuable for wildlife habitat for a variety of species, and recreational use and cultural values for local people. Certain historic land uses have degraded and diminished the wetland soils and vegetation, leading to a loss of wetland health and wildlife habitat, and degradation and loss of water from wetlands through soil erosion and stream channel incision along Bluewater Creek. ***While several actions have taken place to improve Bluewater Creek, particularly since the 1980s, that have significantly improved very degraded conditions, the wetlands have tremendous restoration potential that has not been realized.***

The information in this plan is based upon historical records, available data, and Steering Committee and stakeholder input, as well as information provided by the US Forest Service (USFS), non-profit organizations, and individuals who have spent years studying the flora and fauna of the Zuni Mountains. The WAP also identifies data gaps in order to inform future planning activities.

Currently, many different entities have interests in the wetlands of the headwaters of Bluewater Creek. The stakeholder group consists of Acoma Pueblo, the Ramah Chapter of the Navajo Nation, several non-profit organizations including Bat Conservation International and the Forest Stewards Guild, the New Mexico Native Plant Society, and federal agencies including the USFS and the Mount Taylor Ranger District of the Cibola National Forest and the US Environmental Protection Agency (USEPA). The Zuni Collaborative Forest Landscape Restoration Project (Zuni CFLRP) led by the USFS and Forest Stewards Guild has worked together with many diverse partners in the region to assess and improve forest conditions and helped the WAP team recruit stakeholders for this project. The Steering Committee consists of individuals shown in Table 1.

Table 1. *Steering Committee Members*

Partner	Contact Person(s)	Partner Role
Surface Water Quality Bureau Wetlands Program, NM Environment Department	Shabana Shoukath Shinya Burck (primary contact) Maryann McGraw	Project funding through grant awards, technical assistance
River Source	Rich Schrader Carlos Herrera Anabella Miller Kathy Hillock	Project management for the Bluewater Wetlands Action Plan
United States Forest Service Mt. Taylor District and Cibola National Forest	James Turner, Natural Resources Planning, and Ryan Washam, District Ranger	USFS project coordination and sharing of existing research information
Pueblo of Acoma	Kathleen Clemons Stephen Concho	Consultation on tribal values and interests
Ramah Chapter of the Navajo Nation	Michael Henio	Consultation on tribal values and interests
Forest Stewards Guild	Mateo Pomilia	Coordination of the Collaborative Forest Landscape Restoration Program for the Zuni Mountains
Bat Conservation International	Dan Taylor	Restoration design input and knowledge of past projects
New Mexico Department of Game and Fish	Andrea Petrullo	Guidance on NM State wildlife priorities
Private Individuals	John Trochet Jim McGrath Livia Crowley	Native birds expert Native plants expert Retired hydrologist, US Forest Service
Rio Grande Valley Broadband of the Great Old Broads for Wilderness	Susan Ostlie	Native plant and ecology

We learned during this project that working with the USFS and deepening the understanding about grazing permittees would be very important. District Ranger Ryan Washam served as the primary point of contact to invite grazing permittees to public meetings and to share the draft WAP for their feedback.

Objectives

The primary objective of the WAP is to collect and summarize existing data, collect information on current conditions and provide a road map for prioritizing wetland protection and restoration strategies/actions. Secondary objectives include identifying information gaps and summarizing funding resources for implementing the plan.

Introduction

Due to the legacy use of wetlands and riparian areas in the project area and the resultant degradation of these ecosystems, management efforts are necessary to improve ecological conditions. The headwater wetlands of Bluewater Creek have been heavily impacted by logging, roads, off-road vehicles, and livestock grazing as well as drought and climate change.

Restoration efforts in the project area have been longstanding for several years with more intensive efforts starting in the 1980s to reclaim, restore and protect Bluewater Creek and associated wetlands. While significant progress has been made, there is much more potential for restoring wetland and riparian conditions.

Project Area Description

The Headwater Wetlands of Bluewater Creek are located in Cibola County in the Zuni Mountains within the Cibola National Forest–United States Geological Survey (USGS) Hydrologic Unit Code (HUC-12) Agua Media-Bluewater Creek -130202070201 and Ojo Redondo-Bluewater Creek - 130202070205, Figure 1–in Western New Mexico.

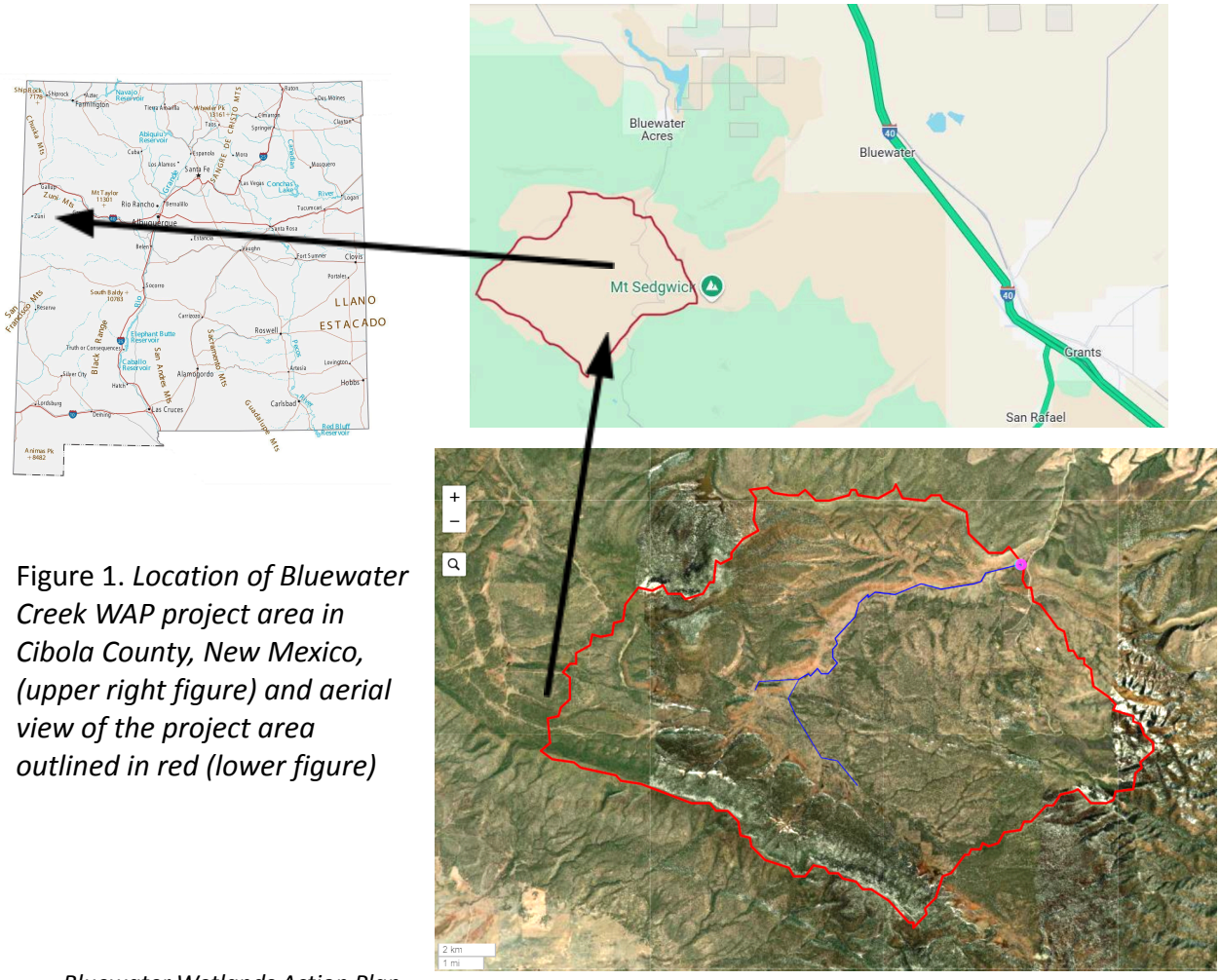

Figure 1. *Location of Bluewater Creek WAP project area in Cibola County, New Mexico, (upper right figure) and aerial view of the project area outlined in red (lower figure)*

Land Use

Historic

The headwaters of the Bluewater watershed were used historically by several different peoples, including for hunting, collection of medicinal plants, and cultural practices. For centuries, people from Acoma and Zuni Pueblos and in the past two hundred years Navajo (Diné) people and have valued the springs and wetlands of the Zuni Mountains for a variety of purposes. Spanish colonizers also passed through the Zuni Mountains and may have travelled through the headwaters of Bluewater Creek. Starting in the mid 1800s, following the Mexican-American War, Puebloan and Diné access to the Zuni Mountains was reduced due to US Government policies that encouraged land appropriation by nontribal populations (Zuni History, n.d.).

Much of the Zuni Mountains became private land during the United States Territorial era. The area was heavily logged and grazed starting as early as the 1840s and into the 1930s. Railroad lines and roads were built to ship logs out of the Zuni Mountains, and some of the railbeds of these areas are still visible today. As the roads and railways proliferated, the stream channels became eroded, the bed of the channels became incised, and the land became denuded, particularly in the lower floodplain. For example, a trout fishery that once existed filled with silt from soil erosion and suffered from high water temperatures due to the lack of riparian vegetation (Bluewater Creek, n.d.).

The Zuni National Forest was established in 1909, though it was not until the 1940s that much of the current inventory of USFS land in the Zuni Mountains and Bluewater Creek became part of the National Forest (Baker, 1988). Heavy grazing persisted until the 1970s, with an estimated 15,000 head of cattle and sheep using the land until 1973 (Bluewater Creek Story, USFS, n.d.). Off-road vehicle use occurred in the floodplains, which impacted the health of wet meadows and Bluewater Creek. Additionally, local citizens were concerned about the sedimentation of Bluewater Lake, a popular fishing destination downstream, and water quality for downstream irrigators.

Starting in the 1980s, the US Forest Service staff, including Bill Zeedyk and many others, started planning and implementing riparian plantings, installing erosion control structures, and introducing grazing management. Volunteers were contacted and some of the first groups to respond were the Albuquerque Wildlife Federation and Trout Unlimited. Sedges and other wetland plants started to return. Bill Zeedyk told the WAP authors that much improvement has been made compared to the conditions he witnessed in the 1970s, but much more work is needed.

Present

The dominant land uses in the headwaters of the Bluewater watershed are livestock grazing (Figures 2 and 3) and recreation. Six different grazing allotments lie within the Bluewater Creek WAP area. According to Curtis Chee, range staff with the Mount Taylor Ranger District of the Cibola National Forest and Grasslands, the active dates of the livestock grazing season in each of the

allotments are as follows: May 1 to October 31, Agua Fria and El Muerto; May 16 to October 15, Bluewater and Mt. Sedgewick; May 14 to October 1/May 15 to October 15, Cottonwood/Las Tuces. Wells Spring is a forage reserve (email communication, 2025). There are also several private land inholdings in the headwaters (Figure 4 and Table 2).

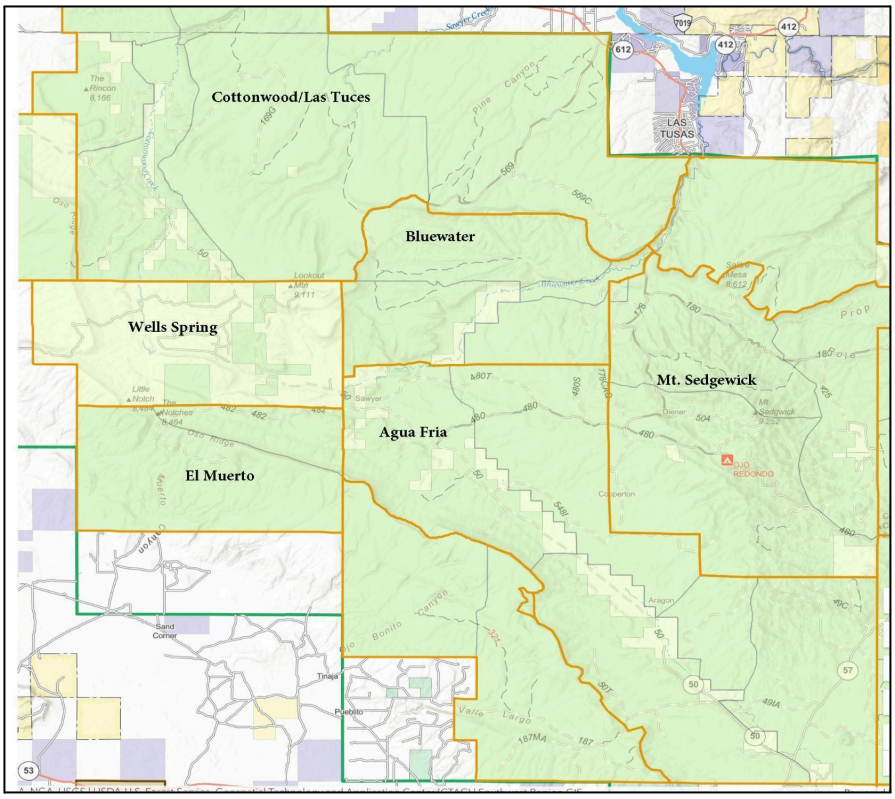

Figure 2. *Grazing allotments within the Bluewater Creek WAP project area (USFS, 2025)*

Forest thinning and managed burning has been occurring in the study area for several years by the USFS to reduce fuel loads and improve forest structure, range productivity, and wildlife habitat. These activities can have a positive impact on wetlands by reducing the chances of catastrophic fire and flooding.

Figure 3. *Photo of livestock grazing near Shush'kin Fen (a fen is a wetland characterized by slow-moving water, often on a slope and containing peat-forming soils)*

Hunting and camping are active recreational land uses in Bluewater Creek. Off-road vehicle use is a concern in several areas particularly where unofficial roads get established. Several of the official roads are not properly drained and alter the water movement across the landscape, which can concentrate and accelerate water runoff and cause soil loss and gully formation (Figure 5). Degradation of official and unofficial roads is still a concern where poor drainage has led to soil erosion, sedimentation of streams, and roads being so impassable that alternative roads are established in appropriate areas nearby.

On private land there are several earthen dams to store water for livestock or recreation. Some of the earthen dams have failed or have partially failed.

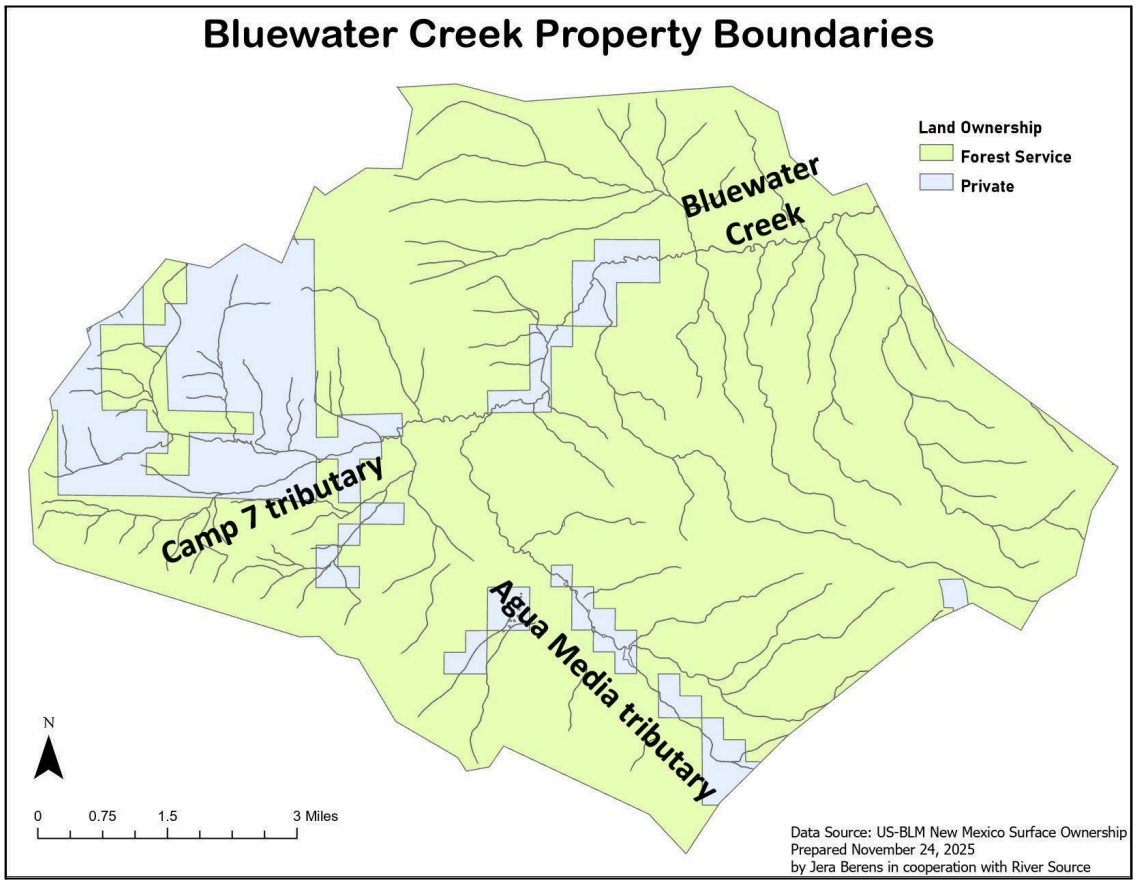

Figure 4. *Land ownership in the Bluewater WAP project area*

Table 2. *Land ownership in the project area*

Land Ownership	Acres in Project Area	Percentage of Area
US Forest Service	36,311	86%
Private	6,134	14%
Totals	**42,445**	**100%**

The primary wetland stressors from land use include poorly managed grazing, off road vehicle use, poorly managed roads, degraded earthen dams, and encroachment by invasive species.

Figure 5. *Road crossing the Camp Seven tributary showing significant incision and soil erosion. This road crossing connects Bluewater Creek to a long stretch of road on the terrace behind the truck that could be maintained to drain sediment into upland meadows instead of the creek.*

Landscape Characteristics

Climate and topography

The highest elevation in the watershed and the Zuni Mountains is Mount Sedgewick at 9,256 feet elevation where up to 20-24 inches of rain can fall per year. The lowest point in the study area is 7,560 feet elevation where the Bluewater Creek enters a canyon upstream of Bluewater Lake and annual rainfall is typically 14-16 inches (TMDL for Bluewater Lake, 2021). The Oso Ridge on the southern boundary of the watershed forms the Continental Divide and averages 8,800 feet elevation.

Winter precipitation typically comes from the west originating from the Pacific Ocean, often resulting in low-intensity rainfall and snow. Summer monsoon rainfall from late spring to early fall originates from the Gulf of Mexico and can result in high-intensity, short-duration storms. The Zuni Mountains are a relatively low elevation range, which makes the area more at risk during climate change with warmer temperatures. Limited snowfall records collected in the 1980s show that snowfall in the basin ranged from 16 inches at lower elevations to 40 inches on the Oso Ridge. In the past two decades, snowpack depths generally have been low and likely not reached the average levels experienced in the 1980s.

Geology

The Zuni Mountains are an uplifted core of Precambrian granite and metamorphic rocks, surrounded by Permian sandstone and the Triassic Chinle group (TMDL for Bluewater Lake, 2021). The range was formed through uplift of the ancient, solidified igneous and metamorphic rocks from the Paleoproterozoic era and then more recent sedimentary rocks formed during the Laramide orogeny, approximately 75 million years ago. The headwaters of Bluewater Creek on the west consist of sedimentary rock, whereas the eastern side consists of granite and metamorphic rocks. Soils in the watershed are typically well-drained with the exception of some units found on the valley floor. Parent material for modern soils is typically bedrock or the alluvium and colluvium derived from it. Bedrock varies in depth from surface outcrops to greater than 60 inches below the surface. Where soils are well developed, they are typically loams with varying sand and clay content (USFS Hydrologic Function Analysis for Bluewater Creek, 1986, and the TMDL for Bluewater Lake, 2021). Figure 6 and Table 3 indicate Bluewater Creek geologic designations and distribution in the WAP project area.

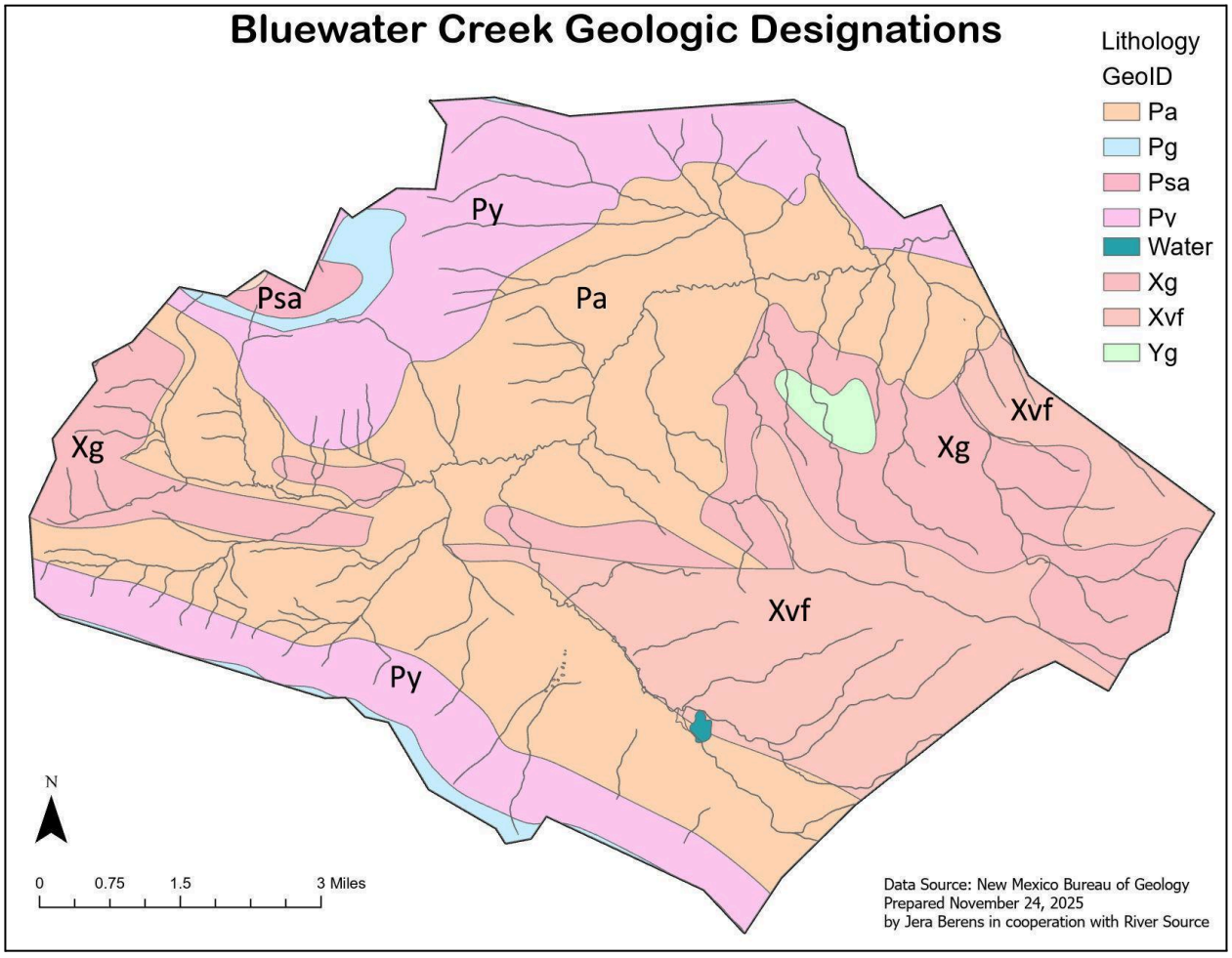

Figure 6. *Geology of the headwaters of Bluewater Creek and the project area (State Geologic Map of New Mexico - https://geoinfo.nmt.edu/publications/maps/geologic/state/home.cfm)*

Table 3. *Geologic designations and distribution in the study area*

GeoID	Designation	Percentage of Area
Pa	Abo formation	40%
Pg	Glorieta sandstone	2%
Psa	San Andres formation	1%
Py	Yeso formation	21%
Tmb	Basaltic to andesitic lava flows	<1%
Xg	Paleoproterozoic quartzite	17%
Xvf	Paleoproterozoic rhyolite and felsic volcanic schist	18%
Yg	Mesoproterozoic granitic plutonic rocks	1%

Hydrogeology and Surface Hydrology

Two primary tributaries feed the upper reaches of Bluewater Creek, plus an additional source of water from Shush'kin Fen (Figure 7). The west tributary (called Camp Seven tributary in the WAP) originates in the Camp Seven and the Red Wall Canyons that start on the US Forest Service land and then pass through private lands before re-entering public lands. During the August and November 2025 surveys we found the Camp Seven tributary had intermittent flow with less than 1 cubic foot per second when running over bedrock. Otherwise the tributary was dry except for isolated pools. For example, in November we observed very low streamflow of less than 1 cubic foot per second in an isolated location where the stream ran through a rocky canyon on private land. The spot observations of streamflow during the 2025 field season appear much lower than wetter periods in past years.

The Agua Media tributary originates from the east on the slopes of Mount Sedgewick and joins with the valley coming out of Shush'kin Fen about a half-mile upstream from the confluence with the Camp Seven tributary. The Agua Media tributary is perennially flowing in the reach near Shush'kin Fen, although at low flows (1-2 cubic feet per second). This section of stream supports an isolated population of Rio Grande chub (Rio Grande Chub, 2021) and Rio Grande sucker, which was confirmed in 2017 (email communication with Yvette Paroz, 2025).

The confluence of the Camp Seven and Agua Media tributaries produces Bluewater Creek, which is mostly perennial except for a short segment about 1 mile upstream of the box canyon that is dry but supports a dense willow stand. The creek flows perennially again once it enters the box canyon.

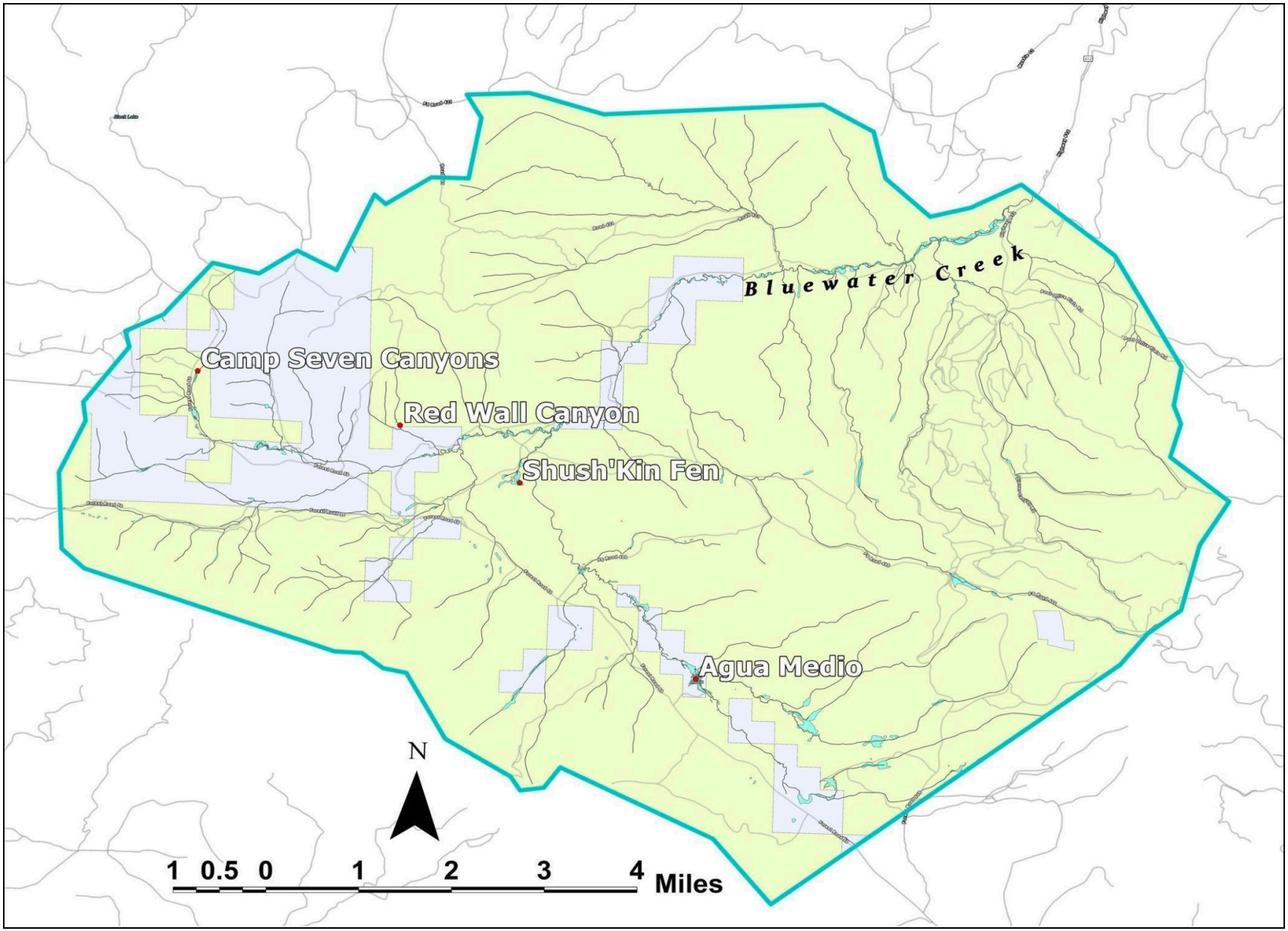

Figure 7. *Surface water drainage and wetland features in the Bluewater WAP project area with private lands indicated in white-grey and USFS lands in yellow-green*

For instance, during the November 2025 survey, we observed streamflow in the study area at approximately 0.5 to 1 cfs in Bluewater Creek downstream of the confluence of the Camp Seven and Agua Media tributaries. The surface water flowed steadily and then infiltrated into the ground starting several hundred feet above the stand of coyote willows at the lower end of the study area about 1.5 miles upstream from where Bluewater Creek enters the canyon.

In the past, Bluewater Creek had a USGS stream gauge upstream of Bluewater Reservoir where the creek comes out of the canyon where discharge was measured from October 1960 through January 4, 1973 (station 08342000 Bluewater Creek). The average of the daily mean discharge for Bluewater Creek was 4.91 cubic feet per second (cfs) with a median flow of 1.60 cfs and a maximum of 36 cfs. The average discharge during a much wetter period from 1989 to 2000 was approximately 9.5 cfs (Curtis, 2008).

Water Quality

Surface water quality in the watershed is under-monitored due to limitations of budget and personnel. Water quality impairments in the project area are listed in Table 4.

Table 4. *Water quality impairments in the project area as of 2025 (NMED last assessed in 2021)*

Impaired Creek Name	Impairment (water quality problem type) from 303d list of NMED
Bluewater Creek (Perennial part of Bluewater Lake to headwaters)	Marginal exceedance of the 20 degree C for 6T3 (temperature standard exceeded for six or more consecutive hours in a 24-hour period on more than three consecutive days) from the 2021 season of thermograph sampling. The temperature impairment remains as of the current 2024-26 303d list prepared by NMED. The Forest Stewards Guild thermograph in Agua Media tributary near the exclosure of Shush'kin Fen shows temperature impairments in July and August 2024.

Bluewater Creek was first listed for temperature and nutrient impairments in 1998. Since then the nutrient impairment has been delisted from the 303d list while the temperature impairment remains. A Total Maximum Daily Load (TMDL) plan was developed in 2007. The TMDL attributes the sources of the water quality problems to forest roads (road construction and use), loss of riparian habitat, natural sources, rangeland grazing, silviculture harvesting, and streambank modifications/destabilization. The water quality sampling station for monitoring the watershed is located approximately two miles downstream of the study area just upstream of Bluewater Lake.

Soils

Soils in the project area are dominated by entisols, alfisols, mollisols and inceptisols (Figure 10 and

Table 5). The largest sub group at 33 % is the *Typic Ustorthents/Entisols* that are characterized by recent formation and a lack of significant soil horizon development. They can occur in a wide range of climates and from various parent materials, but their defining feature is their lack of development. They are found in many different environments, floodplains, and steep, eroded slopes. They are also often found on steep, eroded uplands. The soil moisture regime is "ustic," meaning the soil is dry for more than 180 days in the growing season and moist for less than 90 consecutive days when conditions are favorable for plant growth.

Much of the wetlands in the watershed occur in the *Cumulic Haploborolls–Aquic Haploborolls/Mollisols,* which covers 19% of the project area. These soils occur in aggrading landscape positions, such as toeslopes or concave areas, where the slow, periodic addition of fresh sediment allows for the continuous buildup of a thick organic surface horizon. The soils occur in areas that are generally cold-region grasslands that are either very thick-surfaced due to sediment accumulation or wet due to saturation, or a combination of these features.

The *Typic Eutroboralfs/Alfisols*, comprising 24% of the WAP project area, are found in the cool, forested areas that have moderately leached, highly fertile soils, typically developed under forest or mixed vegetation. They feature a subsurface horizon of accumulated clay and have a relatively high supply of essential plant nutrients, indicated by a base saturation of 35% or greater. This soil type is known for its thick, dark, humus-rich surface horizon (mollic epipedon) that develops in grassland ecosystems.

The soil order called *Typic Haplustalfs–Rock outcrop–Eutric Glossoboralfs/Alfisols* is characterized by moderate leaching, high native fertility, and a subsurface horizon of clay accumulation. The Alfisols suborder has an aridic (dry) soil moisture regime for part of the year but is moist during the growing season. This soil type makes up 14% of the project area.

The soil order called *Typic Dystrochrepts–Rock outcrop–Lithic Ustorthents/Inceptisols* is characterized by areas with exposed bedrock or a mosaic of shallow soils with minimal development of soil horizons. These soils are more developed than Entisols but lack the accumulation of certain materials like clays or iron oxides that are found in more developed soil orders. This soil type makes up 9% of the project area.

The smallest soil type at 1% is *Typic Argiborolls/Mollisols,* which is a subgroup of mollisols that includes an argillic horizon, a subsoil layer that has a higher content of fine clay particles compared to the layers above it. These soils typically have a dark surface and an argillic horizon with accumulated clay beneath and are found throughout the Rocky Mountains.

For additional soil descriptions, a complete Custom Soil Resource Report for the project area may be generated by the National Cooperative Soil Survey (USDA NRCS Web Soil Survey).

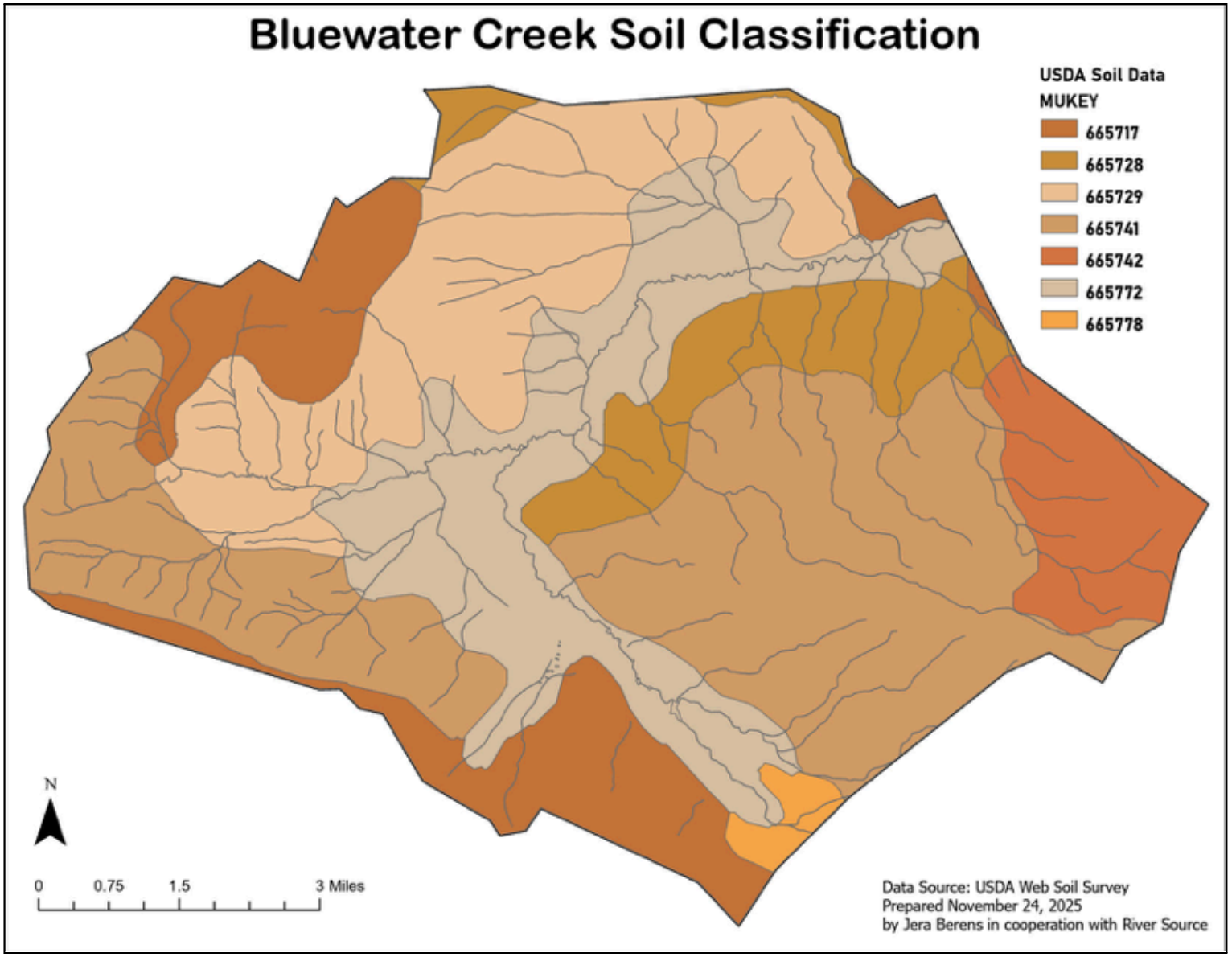

Figure 8. *Soil types in the Bluewater WAP project area*

Table 5. *Soil series distribution in the Bluewater WAP project area*

KEY	Soil Type	Percentage of Area
665717	Typic Haplustalfs–Rock outcrop–Eutric Glossoboralfs/Alfisols	14%
665728 & 665729	Two very similar soil types of Typic Eutroboralfs/Alfisols	24%
665741	Typic Ustorthents/Entisols	33%
665742	Typic Dystrochrepts–Rock outcrop–Lithic Ustorthents/Inceptisols	9%
665772	Cumulic Haploborolls—Aquic Haploborolls/Mollisols	19%
665769	Typic Argiborolls/Mollisols	1%

Ecoregion

The project area is located within the Montane Conifer Forest ecoregion of the Arizona/New Mexico Mountains (Figure 11) (US EPA, and Griffith, et al, 2006). The land is characterized by Ponderosa pine forests (dominant tree type), grasslands, mesas, and river valleys. Most streams are ephemeral with some intermittent streams and few perennial streams.

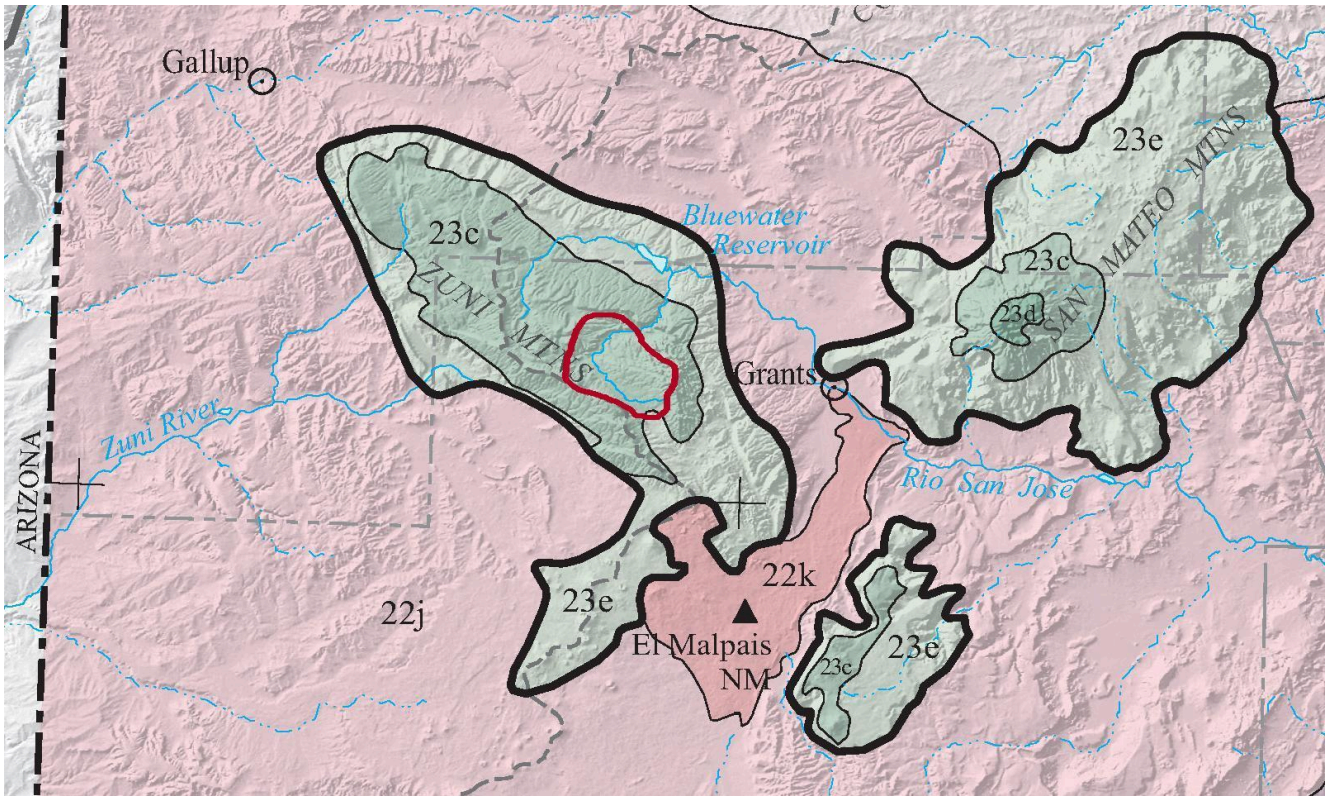

Figure 9. *WAP project area circled in red in the Montane Conifer Forest (23c) of the Arizona/New Mexico region (adapted from Griffith et al., 2006)*

Description of the Headwater Wetlands of Bluewater Creek

Wetlands are keystone ecosystems in arid environments and comprise only approximately 0.3% of the surface area of the arid Southwest (Cowardin et al., 1979). Wetlands are crucial for providing good water quality, creating habitat for many species of wildlife, reducing the risk from flooding, and offering recreational opportunities.

Wetland types and Descriptions in the Bluewater Headwaters

The streamside, fen, and spring wetlands and wet meadows described in the following sections represent a subset of mapped wetlands in the Bluewater headwaters and do not reflect all wetlands, particularly those that may be smaller and unmapped, in the WAP project area.

Streamside wetlands (lotic-Riparian wetlands) - Bluewater Creek

Lotic wetlands are aquatic ecosystems characterized by flowing water such as the drainages originating from the Agua Media and Camp Seven tributaries and Bluewater Creek, which forms after these two tributaries come together. The plants usually seen on the banks of lotic wetlands include wetland grasses, sedges, rushes, and riparian shrubs and trees such as willows and cottonwoods that help stabilize the soils and create shade to cool water in the stream.

The banks and bottomlands of Bluewater Creek and its tributaries largely do not have riparian shrubs with a few exceptions. Significant lengths of the streambanks are trampled and the soils eroded due to ungulate grazing. We observed that long lengths of the stream have incised channels and several historic meanders are abandoned and cut off by livestock trailing (Figures 12 and 13).

Figure 10. *Stream banks at the Camp Seven tributary illustrating degradation such as isolated pools and signs of grazing pressure that has destabilized streambank soils and straightened the channel*

Figure 11. *Camp Seven tributary in the Serna Pasture with a historic tall terrace in the background and low streamflow located in a floodplain showing more recent channel incision*

We also observed pastures in the lower elevation reaches of Bluewater Creek that had more grass cover, less bank erosion, and in some areas Nebraska sedge *(Carex nebrascensis)* growing in the channel with low flow of water (less than 1 cubic foot per second) (Figure 14).

Figure 12. *Bluewater Creek with Nebraska sedge, a plant native to New Mexico, growing at the bottom of the channel*

We observed two significant stands of coyote willows, the first located below an earthen dam on private land downstream of the confluence of the Red Wall Canyon tributary with the Camp Seven tributary (Figure 15). We also found a large stand of coyote willow in the area at the bottom of the study area next to Bluewater Creek (Figure 16).

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Figure 13. *Willow stand near the confluence of Red Wall Canyon and Camp Seven tributaries downstream of an earthen dam on private land*

Figure 14. *Dense stand of coyote willows at the lower elevation of Bluewater Creek with musk thistle invading several patches (note 4-feet-tall head cut in the channel and pool of water)*

Fen and spring wetlands

Fen wetlands are fed by artesian water pressure, often occur on slopes, and are characterized by saturated soils, a layer of peat, and vegetation dominated by sedges and grasses. Fens are important for water purification, flood control, and as habitats for a wide variety of plant and animal species.

The ***Shush'kin Fen*** is the only known fen wetland in the headwaters of Bluewater Creek and was recently enclosed in 2023-24 with pipe fencing by the USFS working with New Mexico Department of Game and Fish, Bat Conservation International, and Rocky Mountain Elk Foundation. River Source assessed the condition of the fen with support from the Forest Stewards Guild and the USFS in 2024. The conditions include 12-18 inch tall pedestals of wetland sod with eroding soils along the edges of the fen, the presence of plants indicating the process of drying out and declining health of the area such as bent grass (*Agrostis stolonifera*) and Kentucky blue grass (*Poa pratensis*), and decreasing hydrologic conditions with the elevation of the surface water flowing 12-20 inches lower than the upper soil surface of the plant pedestals. The pipe fence appears to be effective at reducing cattle grazing, but the historic impacts have not been addressed.

Five springs form what have been named the Bluewater Springs by the Springs Stewardship Institute (SSI, 2022 report) that are located near the Shush'kin Fen. SSI described the springs as having low geomorphological integrity and elevated ecological risk due primarily to livestock impacts. Hoof trampling, formation of pedestals, and elimination of firm soil substrata are described as the reasons for the elevated risk. Three of the springs on the Agua Media tributary have also been fenced with pipe fencing in addition to Shush'kin Fen.

Research by Rebecca Frus (UNM PhD dissertation, 2016) indicates that the water source for the fen and nearby springs originates primarily from snowmelt that has been resident in local groundwater for over 70 years. This finding that spring water originates from snowmelt was confirmed by Luke Collins (UNM Master's Thesis, 2021). Frus found that her overall results show that springs of the Zuni Mountains are drying and those that are remaining are essential to water quality and biodiversity.

The spring-fed wetland of ***Red Wall Canyon*** was identified by ornithologist Dr. John Trochet recently in a sub-basin of the Camp Seven tributary (Figures 17 and 18). Dr. Trochet observed the site in 2023 and again in August 2025. He noticed that a beaver dam that was actively being maintained in 2023 did not show signs of recent beaver activity in 2025.

Figure 15. *Red Wall Canyon, photo taken likely in 2023 (Photo by Dr. John Trochet)*

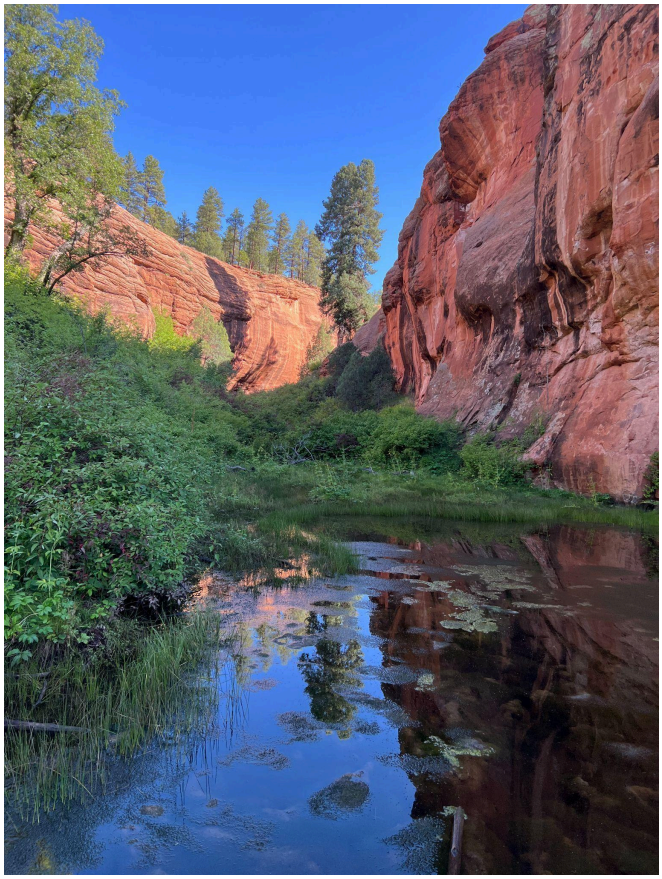

Figure 16. *Red Wall Canyon in August 2025 (Photo by Dr. John Trochet)*

Wet Meadows

Two wet meadows were identified in the headwaters including in the Agua Media tributary and the Camp Seven tributary.

The ***Agua Media wet meadow*** occurs in the southeast of the WAP area on private land (Figure 17). The site was observed in early November 2025. The Agua Media wet meadow has a very wide and flat watershed with less than 1% slope and no active flowing water through the valley. The presence of water was found in the private land section and was in very poor condition for watershed function. Much of the land throughout the valley was heavily grazed with very little presence of grasses or wetlands plants. Several old dead willows were seen. Additionally, the pond behind the earthen dam at Agua Media was heavily trampled by hoof prints from cows, deer, and elk, with broken fences located along the dry creek. While there are signs of damage along the fence line, the fence on the east side downstream of the lake has been breached, allowing this to be the main access point for livestock. Water levels appeared to be quite low compared to some of the high water marks, indicating that the pond can be much larger than when we observed the area. A qualitative inspection of the water revealed a dark green appearance and a sour smell, indicating a lack of running water reaching the pond. The ground around the pond was very dry and cracked, and showed signs of salinization of mineral accumulations that may be negatively affecting the ability of wetland plants to thrive.

Figure 17. *Agua Media wet meadow and pond created by an earthen dam showing low ground cover next to the water with grasses that have been heavily graze*d

The ***Camp Seven wet meadow*** occurs on USFS land (Figure 20). This area had several isolated pools with no flow during the August 2025 survey. Baltic rush and Nebraska sedge plants were identified, as well as eight tall willow plants that were browsed down low with growing leaves above the browse line for elk and cattle. A dry stream channel was observed with short reaches; it was filled in with grasses, yarrow, Baltic rush and sedges and eventually flattened into a meadow.

Figure 18. *Camp Seven Canyon wet meadow with an isolated pool and willows that are suspected to be peachleaf (Salix amygdaloides) or Scouler's willows (Salix scouleriana) but have not been identified authoritatively (tree-like shape likely due to browsing ungulates; no regeneration of willow occurring)*

The US Fish and Wildlife Service and partner organizations have created detailed wetlands maps called the National Wetlands Inventory (NWI). River Source utilized the NWI data to target their surveys of wetland for the Wetlands Action Plan. Most of the wetlands found in the study area are classified in the hydrogeomorphic categories of slope wetlands or riparian wetlands. Figures 19 and 20 show two important wetland areas that the River Source team observed to complete the Plan.

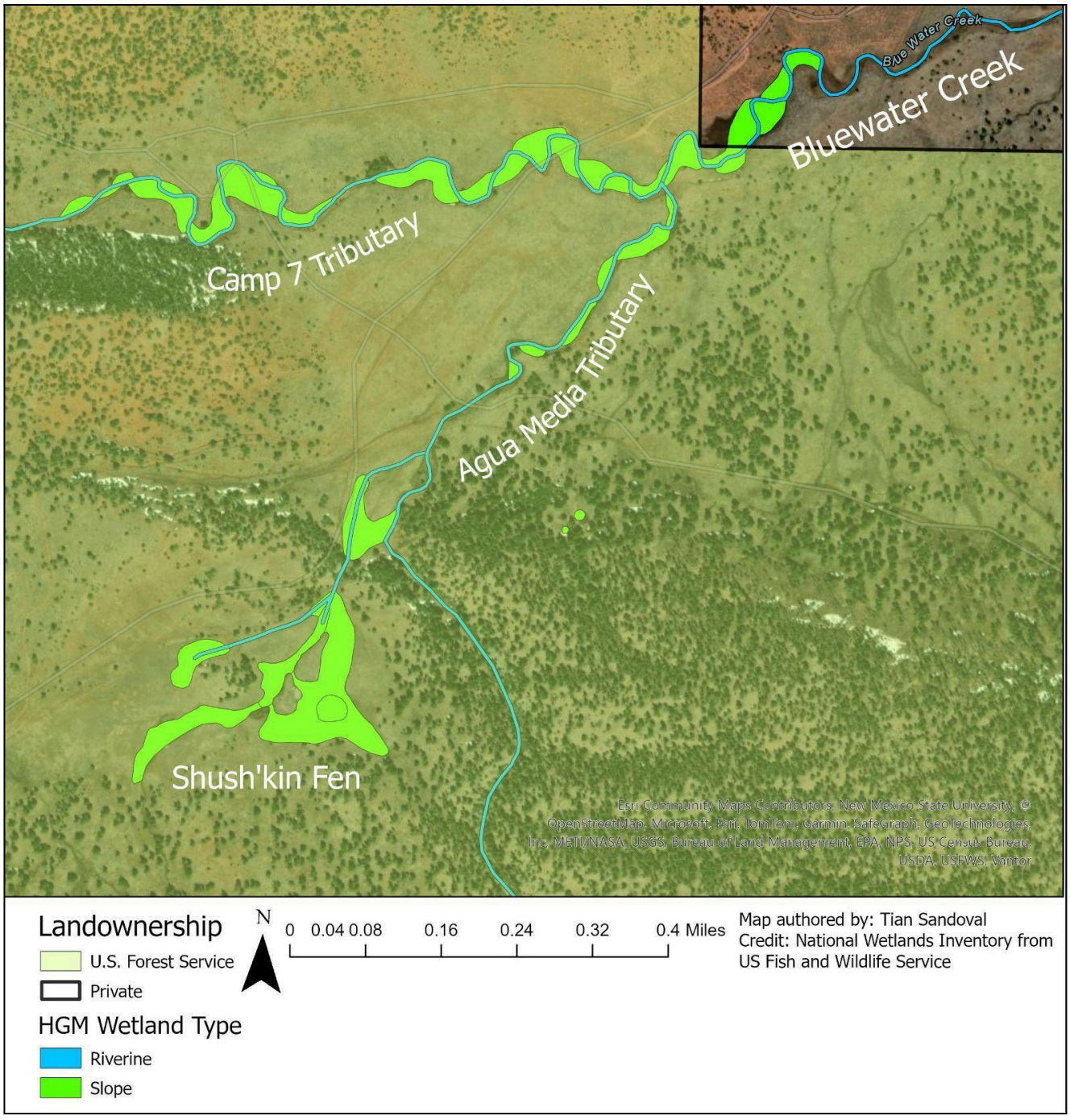

Figure 19. *Landownership and Wetland types at Shush'kin Fen and nearby tributaries*

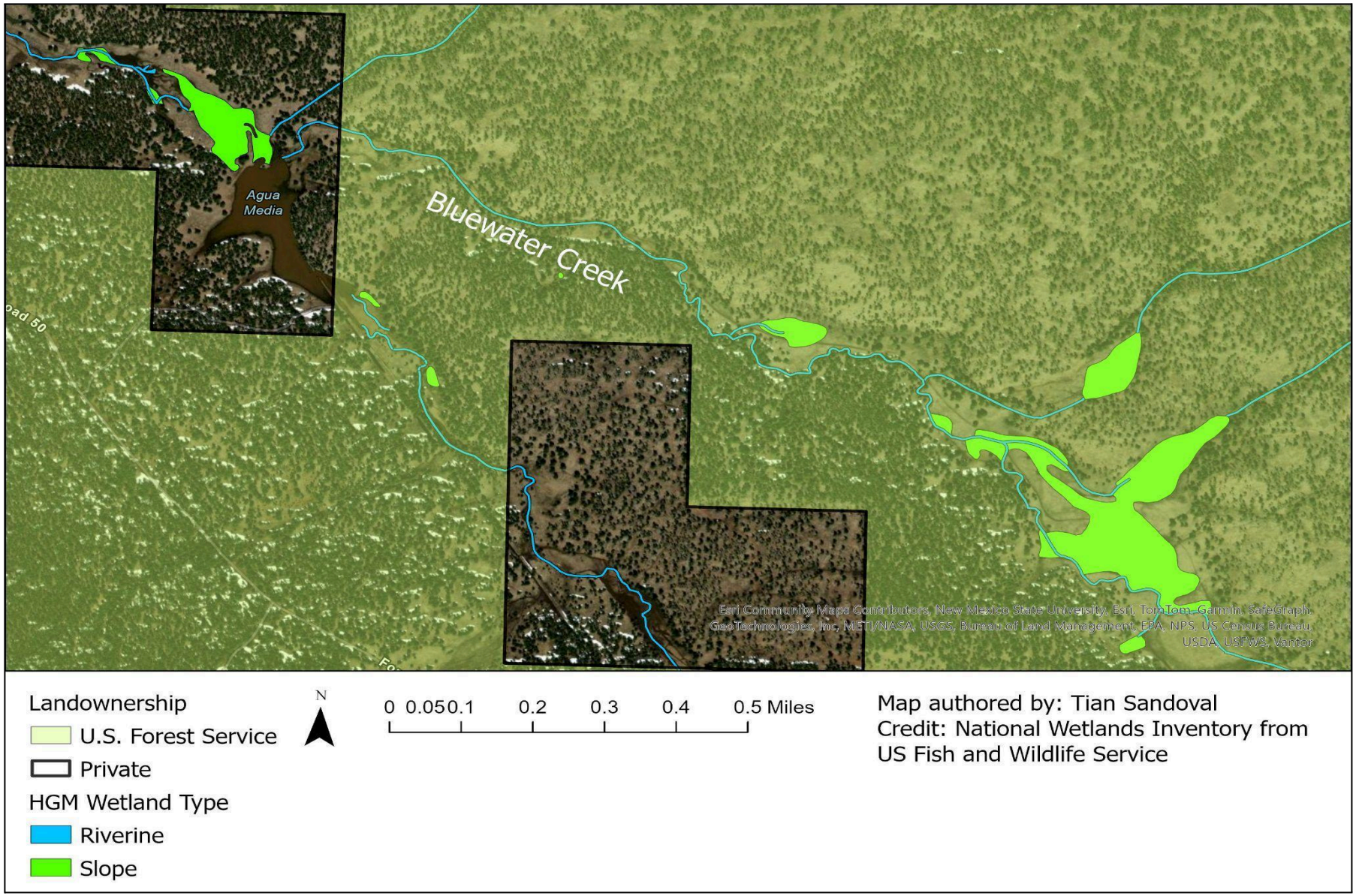

Figure 20. *Landownership and Wetland types on Agua Medio tributary to Bluewater Creek*

Wildlife Habitat

Special Status Species

The headwater springs of Bluewater Creek, which are part of the Rio Grande–Elephant Butte Geographic Management Unit, are home to an isolated population of the ***Rio Grande chub* (RGC) *(Gila pandora)*** (Rio Grande Chub, 2021). The New Mexico Department of Wildlife's 2025 State Wildlife Action Plan lists RGC as a Species of Greatest Conservation Need (SGCN), with specific criteria including Climate Change Vulnerability, Decline, Disjunct, and Vulnerable. The 10-year Plan, 2021-2030, of the *Rio Grande Chub Conservation Strategy* identifies the Bluewater Creek RGC population in Objective 3 of the Strategy to "Restore the RGC population" by replicating at-risk populations. Additionally, Objective 4 of that Strategy, to "Secure and Improve Watershed Conditions", includes Bluewater Creek as part of nine miles of riparian and instream habitat to protect and improve (Rio Grande Chub, 2021).

Yvette Paroz of the USFS also confirmed the presence of the ***Rio Grande sucker (Catostomus plebeius)*** in the Bluewater Creek headwaters in 2017 (email communication, November 2025), another endemic fish listed as SGCN by the NM Department of Wildlife. The isolated population is the farthest west location ever documented for the species.

Additionally, the willow expanse along Bluewater Creek offers potential habitat for nesting willow flycatchers, including the ***Southwestern willow flycatcher (Empidonax traillii extimus),*** listed as Endangered under the U.S. Endangered Species Act (ESA) and SGCN in New Mexico. The *extimus* subspecies habitat includes dense areas of riparian willows amid saturated soils, pools, and streams, generally below 8,500 feet in elevation (USFWS, n.d.). A participant at the September 2025 WAP Steering Committee meeting raised the concern of elevation as a consideration and potential limitation for whether the *extimus* subspecies could be found in the Bluewater WAP project area, offering opportunity for additional study. The 2011 USFS Watershed Restoration Action Plan says that the *Southwestern willow flycatcher* has been documented as nesting within the riparian habitat associated with Bluewater Creek.

Noxious Weeds and Invasive Animals

Invasive weed species in the project area include **Bull thistle (*Cirsium vulgare*), Musk thistle (*Cirsium nutans*), Russian olive (*Elaeagnus angustifolia*)**, and **Siberian elm (*Ulmus pumila*)**.

During the August and November 2025 field observations, we saw widespread Bull and Musk thistle in the dense willow patch inside the willow stands at the lower elevation portion of the study area. We also saw both thistles in the area of Shush'kin Fen. The Forest Stewards Guild also monitored and mapped Bull and Musk thistle in the Shush'kin Fen area in 2024 (Figure 21).

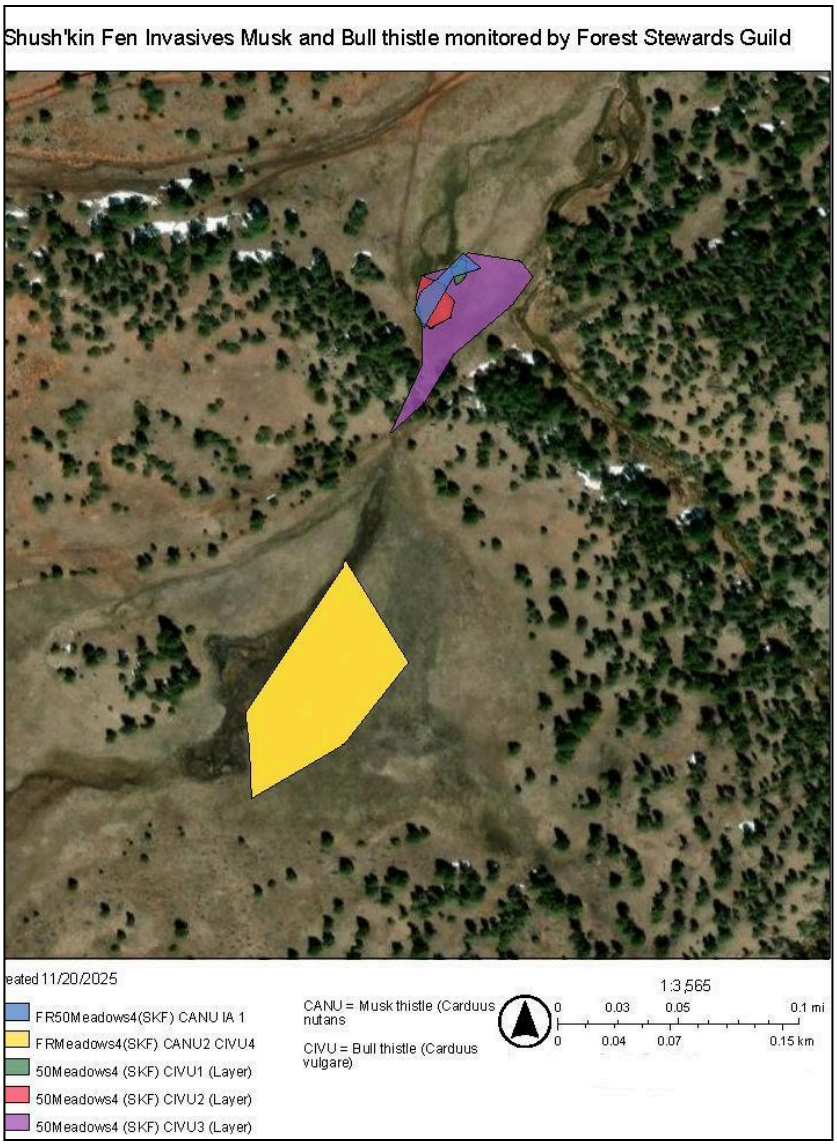

Figure 21. *Map of Bull and Musk thistle near Shush'kin Fen by Forest Stewards Guild*

Individual Russian olive and Siberian elm trees were also observed with most specimens being heavily browsed. They are relatively mature with leaves growing above the browse line of ungulates, and relatively sparse and isolated in the lower elevation areas of the project area. We did not see a wide distribution nor sprouts or saplings of these trees.

Management measures will need to include control of these invasive species to protect wetland integrity in the project area. Controlling invasive and noxious species will ensure that native species will not be outcompeted in their native habitat. Management of biennial non-native thistles have been successfully completed in other locations, if the people power is available. This can be done by removing the basal rosettes in the first year and/or flower heads in the second year before seed set and the branches sever so that flowers will not develop. Chemical weed treatments require hiring a consultant with a pesticide operator's license from the New Mexico Department of

Agriculture who may be aware of the different treatment options. The Forest Guild is looking into their staff or contractors for fulfilling the need for weed treatments.

More information on control of specific noxious weed species in New Mexico may be found at the New Mexico Department of Agriculture Noxious Weed Information website (https://www.nmda.nmsu.edu/nmda-homepage/divisions/apr/noxious-weed-information/). Troublesome Weeds of New Mexico is another great resource for controlling undesirable species (Ashigh et al., 2010).

Crawfish are present in Bluewater Creek and in the Agua Media tributary below the fen where the Rio Grande chub and sucker are located and also in the downstream segment near the bridge over Bluewater Creek.

Climate and Climate Change

Low elevation mountain ranges such as the Zuni Mountains are more at risk to climate change because they are more susceptible to shifts in temperature, a decrease in snowfall, and the loss of reflective snow and ice cover during the winter, which increases warming. Reduced snowfall and earlier snowmelt can disrupt the water supply for downstream communities that rely on mountain rivers for Bluewater Lake, for drinking water, and for irrigation. The local effects of climate change include a significant increase in the severity and duration of drought, the severity and intensity of precipitation events, increased stream water temperatures, and earlier snowpack runoff, all of which will increase stress on riparian and wetland systems and put them at risk (Garfin et al., 2013). Figures 22 and 23 demonstrate a trend from 1925 to 2025 of rising temperatures and over the last twenty years mostly lower than average precipitation rates in the Southwest Mountain region, where the Zuni Mountains are located (NOAA, 2025).

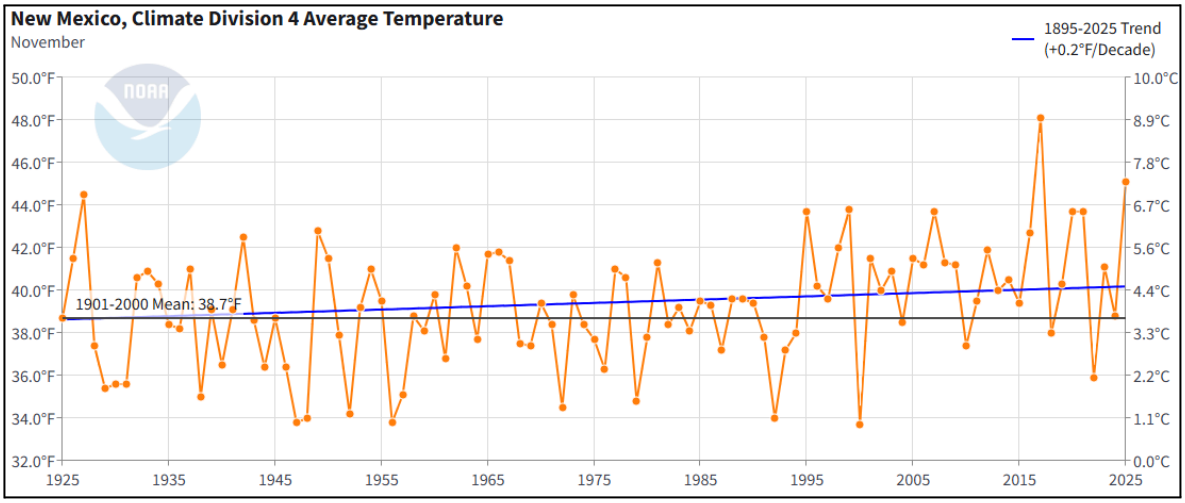

Figure 22. *Trend from 1925 to 2025 showing rising temperatures in the Southwest Mountain region where Zuni Mountains are located (NOAA, 2025)*

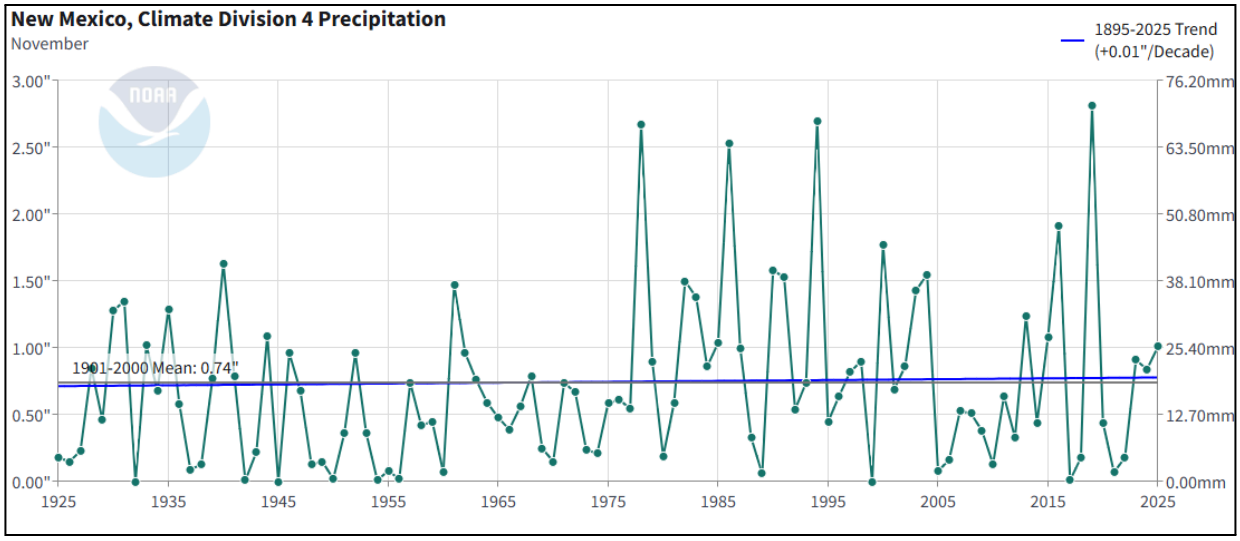

Figure 23. *Mostly lower than average precipitation rates over the last twenty years in the Southwest Mountain region of New Mexico (NOAA, 2025)*

Higher temperatures and less water in the form of snowpack are forecasted for the region. These two factors create climatic stress on wetlands that threaten to dry up streams and springs. Since wetlands provide a crucial source of resilience to climate change in local watersheds, designing and implementing restoration work to resist these trends will serve to provide a protective buffer for Bluewater Creek and associated springs and for downstream communities such as at Bluewater Lake and the Village of Bluewater.

Wetlands Action Plan

Implementation Actions to Protect and Restore Wetlands

Criteria for Priority Actions

The Steering Committee identified the following priorities and criteria for wetlands protection and restoration:

- **Fenced-in wetlands** — These will be prioritized for future restoration due to the importance of fencing and since infrastructure resources needed for further protection are already present.
- **Roads and Off-Road Vehicle Use** — This includes wetlands either directly or indirectly impacted by roads. Headcuts and erosion at some wetlands were observed due to run-off from adjacent USFS roads. Ideally, recommendations can be laid out to prevent further runoff and erosion. Locations with off-road vehicle use through wetlands will be prioritized to divert traffic away from these areas.
- **Diversity** — Wetlands have high taxonomic diversity of plants compared to adjacent upland areas. As such, wetlands are prioritized in order to sustain biodiversity and connectivity.
- **Slope wetland like Shush'kin Fen** - Wetlands capable of or those currently holding surface water are prioritized to maintain wetland integrity and ecosystem functionality. We will particularly focus on fens at the headwaters of the watershed.

- **Grazing pressure** — Nearly every wetland observed was impacted by livestock grazing within the watershed. Those wetlands that are not fenced are often degraded by cattle grazing. Wetlands heavily impacted by grazing will be recommended to have new or improved fencing infrastructure built and maintained. These areas need alternative management to reduce grazing pressure, and until that pressure is reduced, heavily grazed wetlands will have a lower priority for restoration projects. The US Forest Service is currently working with partners to install new fencing in the Serna Pasture that surrounds the Shush'kin Fen to improve grazing management in this area.
- **Land status** — Wetlands on public land will be prioritized.
- **Invasive species presence** — Invasive species were commonly detected throughout the watershed. Their presence does not influence the selection of wetlands for priority. However, we will make recommendations for their removal.
- **Degree of degradation and potential for restoration** — Relatively low-cost projects on sites with high potential for recovery will be prioritized.

Implementation actions for Streamside (Lotic) wetlands such as Bluewater Creek

The types of protection and restoration for Bluewater Creek include induced meandering structures such as baffles, one rock dams, post vanes, and structures made from wicker weir to increase the sinuosity and restore floodplain access of the creek. Head cut structures such as Zuni bowls and rock rundowns are needed to stop the progression of steep erosion features advancing upstream.

One specific reach of Bluewater Creek that is a high priority for induced meandering is where the Agua Media and Camp Seven tributaries meet (see Figure 24). The stream reach on the Agua Media tributary (downstream of the wetlands with pipe fenced exclosures and up to the private land inholding) has the greatest potential for restoration. The Agua Media stream at this location has perennial water flow, several eroding headcuts in the channel, and several lengths of straightened channel due to livestock trailing. The USFS staff of the Mt. Taylor Ranger District has prioritized this reach of the Agua Media tributary for restoration and started work in 2025.

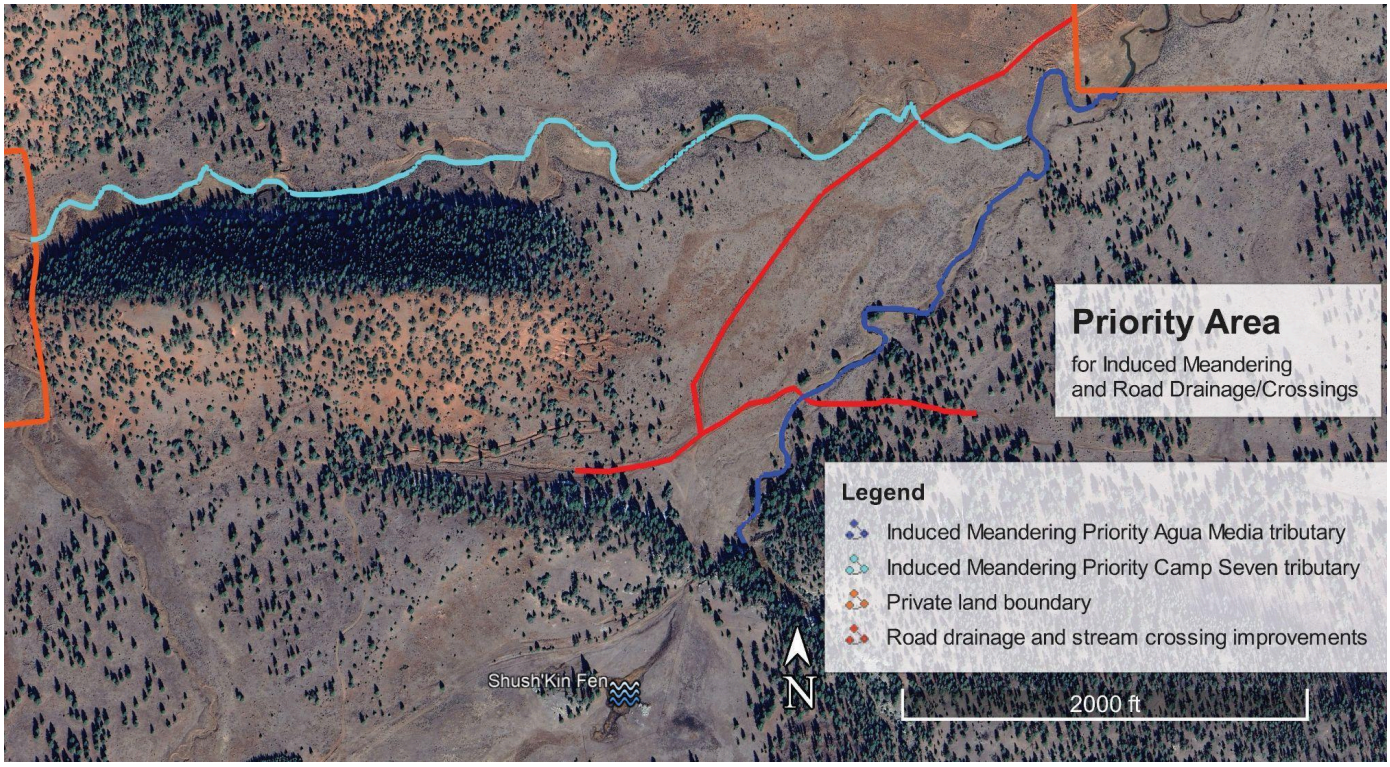

Figure 24. Priority area for induced meandering and road improvements

Another recommended priority is to extend the induced meandering restoration work up the Camp Seven tributary from the confluence with the Agua Media tributary to the private land boundary. For both of these priorities we recommend reaching out to adjacent landowners to do restoration work on the private land creek segments to benefit the overall area's wetlands, including reducing soil erosion, and improving forage production and wildlife habitat benefits in the area.

Improved grazing management is needed in several areas such as in the Serna pasture to decrease livestock utilization and to allow riparian shrubs such as willows to become established and to thrive on the banks of the creek. In some areas, cattle trailing–induced soil erosion has led to land degradation where livestock repeatedly walk over the same areas, leading to the loss of topsoil along straight lines. Cattle trailing has led to the straightening of some stream channels by eroding soil and leading to capturing the valley bottom into shorter and incised channels. In these areas cross fencing is needed to reduce or change the cattle movement patterns across the floodplain so the livestock do not take the straight path. Construction of induced meandering will also help to aggrade and reconnect the incised channel to the floodplain.

In the areas of existing stands of coyote willow, improved management to reduce grazing will help the willows thrive and provide habitat for birds. Riparian revegetation with willow and cottonwood poles will increase the amount of shade over the channel and help decrease water temperatures in the creek and will improve habitat for fish and birds. Riparian revegetation work needs to be coupled with changes in grazing management such as fencing to make sure that livestock do not

destroy the plantings. Using fencing exclosures to protect the intact wetland shrub communities at the two relatively large willow stands at the lower portion of the study area and by the earthen dam near private land on the Camp Seven tributary will be important actions to protect and improve bird habitat in the project area.

Fen and spring wetlands

The recent installation of pipe fencing around Shush'kin Fen is a good start for protecting the area from further degradation from livestock grazing. The impacts from historic erosion and deer/elk trails on the edge of the wetland are still causing the Fen to dry out, so additional restoration work is needed. The conceptual restoration design can be viewed at https://arcg.is/qTf5a. The planned work includes swale construction using wetland sod plugs and installing brush piles to protect the swales from hoof trampling and cut off trails along the edge of the fen that are still being used by elk and deer. The sod plug method follows techniques described in Characterization and Restoration of Slope Wetlands in New Mexico (2014). We suggest that building temporary elk and deer fence along the pipe fence exclosure of the fen will also help the fen recover and protect the investment of sod plug swales that will be built by fall 2027 or sooner.

Pipe fencing has been installed around three of the five springs identified by the Springs Stewardship Institute that are on the Agua Media near Shush'kin Fen. The fencing appears to be effective in reducing soil loss and helping to protect fish habitat in Bluewater Creek. Connecting the existing exclosures to make a larger contiguous exclosure is recommended to eliminate the eroding areas that are now located in between. Fencing at the other two springs upstream of the current exclosures is also recommended to be fenced to reduce the impacts from livestock.

Wet meadows

The wet meadows of Agua Media occur on private land and Camp Seven Canyon on USFS land, and both can benefit from implementing rotational and short duration grazing. In Camp Seven Canyon, the rare and unique willow trees should be protected from fire and fencing installed to prevent them from being damaged by livestock.

Other identified actions that would help sustain and restore Bluewater wetlands are listed in Table 6, Priority Actions.

Improving Road drainage, crossings, and management

Several roads within the project area have poor drainage, altering water movement and concentrating water flow that leads to soil erosion and gully formation. In addition, managing *Off Road Vehicles (ORVs)* has been identified by the USFS and stakeholders as a significant concern and needs to be addressed. Closing and obliterating roads that threaten wetlands will be an important step toward protecting wetlands. The draft

USFS Agua Media Watershed Restoration Action Plan (WRAP) highlights reducing road density and closing unauthorized roads.

Roads that are not closed need to be maintained using the principles and practices in Water Harvesting from Low-Standard Rural Roads (Zeedyk, 2006) and Managing Roads for Wet Meadow Ecosystem Recovery (Zeedyk, 1996). Starting in the 1980s, several road segments were relocated or repaired to improve wetlands and formed the basis for the Wet Meadow Ecosystem Recovery report by Bill Zeedyk. This work needs to continue in the WAP region to stop draining and causing wetlands to degrade or fill with sediment. Maintaining existing roads can also improve rangeland and wildlife habitat productivity. One high priority road improvement is located between the confluence of Agua Media and Camp Seven tributaries (see Figure 24). Work that drains the incised roads in the meadow between the Agua Media and Camp Seven tributaries will increase forage production and ecological integrity of the grassland. In addition, stabilizing the channel where the roads cross the streams with rock structures that create open, low water crossings will stabilize the channel beds from further incision.

Table 6. *Priority actions*

Action	**Potential Result**
Grazing Management	Improving livestock grazing management will help to ensure that wetland species are not over-utilized by herbivores. In 2025-26 the US Forest Service is installing new fencing in the Serna Pasture surrounding the Shush'kin Fen for an area of approximately 960 acres. Managing the duration and and intensity of the livestock use will also put less stress on streambank soils, improve vegetation cover and help protect wetland grasses, forbs, shrubs and trees.
Induced Meandering in Bluewater Creek and tributaries	Restoring floodplain access and stream sinuosity in channels incised by historical land use can be accomplished with the practice of induced meandering. The technique uses baffles, one rock dams, wicker weirs, post vanes and other structures that are described in several resources such as Let the Water Do the Work (Clothier & Zeedyk, 2009).
Shush'kin Fen Restoration	Using sod plugs to fill gaps where surface water is draining out of the fen will help prevent further draining and drying of the fen. Placing deterrent obstacles such as brush on top of the swales and along the edges of the fen will discourage trailing that creates hummocks and drying of the fen from elk and deer that will continue to jump the pipe fence and graze and drink water from the fen. Additional actions such as installing temporary elk fencing on the perimeter may also be necessary to enable the fen to recover. NMED has initiated a contract to begin some of this work starting in 2026.

Action	Potential Result
Road management, road closure, and restricting ORV use in or near wetland areas	Assessing roads for drainage improvements and closing roads will improve forage productivity by harvesting water into meadows, decreasing soil erosion, and improving fish habitat. Building structures such as rolling dips, armouring low water crossings and relocating roads out of valley bottoms or out of deeply entrenched roads will benefit water quality and improve land productivity (Zeedyk, 1996 and Zeedyk, 2006). Restricting ORV use is also a very important project using strong barriers and educating users of ORVs. Funding and staff resources to build vehicle barriers to areas in wetlands is highly recommended by several stakeholders.
Restoring and Protecting Riparian Shrubs, Trees, Grasses & Forbs	Pole planting cottonwoods and willows will increase wildlife habitat, reduce water temperature, and help stabilize streambanks. Protecting the existing stands of willows will sustain and improve bird habitat, reduce soil erosion, and improve water quality. Protecting existing vegetation and encouraging natural propagation of native plants in riparian areas and springs is also needed. Continued work on forest thinning and managed burning can have a positive impact on wetland vegetation by reducing the chances of catastrophic fire and flooding.
Invasive Species Control	Controlling invasive and noxious species will ensure that native species will not be outcompeted in their native habitat. There are many resources with information about the control of invasive species including NMDA, the USFS and NRCS.
Fill in Data Gaps	Fill in data gaps such as the condition of wetlands along the creek between the Agua Media earthen dam and Shush'kin Fen. Follow-up on the condition of Red Wall Canyon wetland is needed. Better information about the extent of noxious weeds is needed. This information will help land managers and stakeholders to better refine actions.
Research	Identify and document locations of sensitive wetland resources. Research and monitor sensitive resources to inform best management practices, including rare and endangered species.

Data Gaps

Additional information and data collection is needed to document detailed conditions, wetland functions, and wetlands in the study area. In particular, work is needed to understand wetland acreage, conditions of streambanks, planned land use by public and private landowners, and the feasibility of restoration and protection of wetlands. Filling in data gaps will help land managers, private landowners, and stakeholders better refine their actions. The following data gaps have been identified:

1. Conditions of wetlands located on the tributary of Agua Media between the Shush'kin Fen area

and the earthen dam

2. Precise landownership information near the Red Wall Canyon wetland to know if the wetland is located entirely on public land
3. Under-monitored surface water quality in the watershed due to limitations of budget and personnel.
4. Under-monitored groundwater quantity and quality data also due to limitations of budget and personnel
5. Distribution of noxious weed species. The Forest Stewards Guild has mapped areas near the Shush'kin Fen and is planning on mapping more areas in the Zuni Mountains.

Funding Sources

Wetland restoration and protection typically requires collaborative partnerships between government agencies, non-profits, and contractors from federal or state grants, or from internal funding from state agencies. Table 7 lists potential funding sources by agency and funding type.

Table 7. Potential funding sources

Source	Agency	Funding type and eligible entities
Federal	US Forest Service internal funds from the Cibola National Forest	For USFS projects and for contractors working for the USFS to undertake work. In the current funding climate, these sources are likely to be constrained.
	US Forest Service Collaborative Forest Landscape Restoration Program (CFLRP)	For collaborative stakeholders including governmental agencies and non-profits. The Bluewater WAP project area is within the Zuni Mountain (CFLRP). If reauthorized as expected, the USFS will receive $1 million for the next six years that could be used to support the WAP recommendations (chat comment at public meeting, 2025).
	Lava Soil and Water Conservation District and Natural Resources Conservation Service such as Environmental Quality Improvement Program (EQIP), Wetlands Reserve Easements (WRE) and other grants	For private landowners. Helps fund conservation planning and implementation. For more information go to https://www.nrcs.usda.gov/state-offices/new-mexico
State	319 Non-point source pollution program (from US EPA as the source)	For non-profit, tribal, government agencies for watershed planning and on-the-ground implementation of watershed restoration work
	New Mexico River Stewardship Program	For non-profit, tribal, and government agencies for watershed planning and on-the-ground implementation of watershed restoration work

Source	Agency	Funding type and eligible entities
	New Mexico Environment Department Wetlands Program (from US EPA as the source)	For non-profit organizations and contractors to complete wetland restoration and planning projects
	New Mexico Land of Enchantment Legacy Fund and the Conservation Legacy Permanent Fund	Two recently established funds are available for non-profits, contractors, landowners and tribes for natural resource protection including wetlands
	New Mexico State Forestry noxious weed management grant program	For non-profits, government agencies, and tribes
Private	National Forest Foundation	A variety of grant programs including invited grants and a matching awards program. For more information go to https://www.nationalforests.org/grant-programs

Potential funding opportunities also exist with the New Mexico Department of Wildlife, which has expressed an interest in funding work in the Shush'kin Fen once a schedule and permits are finalized (comment at public meeting, 2025). Additionally, the USFS and the Forest Stewards Guild have been discussing potential restoration work in the Bluewater Lake area that is already under an approved USFS Watershed Restoration Action Plan. This could include additional riparian work and addressing trespass/fencing issues in the WAP project area (comment at public meeting, 2025).

Education and Outreach

Public education and engagement are also essential to achieve these improvements for wetlands over time. Multiple opportunities exist for involving youth and recreationalists of all ages in the stewardship of the Bluewater WAP project area.

Summer Camps and Youth Crews

The Ramah Chapter of the Navajo Nation has had summer camps that may be interested in holding field trips for youth. In addition, the non-profit Cottonwood Gulch located in Thoreau has summer programming and a Youth Conservation Corps (YCC) crew that could use the area for learning experiences. The Forest Stewards Guild also runs a YCC crew that could use the area for education and conduct wetlands monitoring and restoration work.

Local Schools

Local elementary, middle, and high schools could use the wetlands as an outdoor classroom and study area. This would require the engagement and input of teachers and adequate access and funding for transportation to the area, perhaps through opportunities such as the New Mexico Outdoor Equity Fund. At the public meeting held in December 2025, participants specifically

suggested engaging students from the elementary schools in Bluewater and Prewitt and looking to schools in other surrounding communities such as Grants, Acoma, and Laguna.

Off-road Recreation Communities and Clubs

Opportunity also exists to engage off-road recreationalists in increasing awareness, education, and cooperation to protect the wetlands. As noted at the public meeting, recreational use and its associated impacts to fencing and and gates, as well as unauthorized road use, are significant stressors to the WAP project area. Recruiting members of the off-road community as volunteers and to self-monitor all-terrain vehicle (ATV)/utility terrain vehicle (UTV) use would be an important mitigation step. Among the strategies suggested are to designate selected areas for ATV/UTV use and to prohibit their use in other selected areas, to erect physical barriers along the creek to stop off-road use there, and to develop alternate hiking and multi-use trails where appropriate. Groups or events suggested for outreach include the following:

- Backcountry Horsemen (https://www.bchnm.org)
- Cibola Trails Alliance (https://www.cibolatrails.org/)
- New Mexico Off-Highway Vehicle Alliance (https://www.nmohva.org/)
- Rugged West—an annual music and ATV race event (information available through Grants Chamber of Commerce)

Outreach to Landowners with Private Land Inholdings

Outreach to promote and coordinate collaborative work with private landowners in the project area is recommended. Many of the private inholdings have prime wetland habitat such as in the Agua Media and the Camp Seven tributaries and along the mainstem of Bluewater Creek. The wetlands of Bluewater Creek cross property boundaries between public and private land. Wetland protection and restoration actions that integrate and extend work beyond land ownership boundaries will magnify the benefits for water quality and wetland habitat.

Managing Public Mapping Services to Protect Sensitive Wetland Areas

Yet another opportunity exists to do outreach to mapping services such as All Trails and Gaia Maps to have them remove trail crossings and roads in sensitive habitat and other areas where recreational use would continue to degrade the wetlands. A public meeting participant shared that the Bureau of Land Management was successful with such an effort in Arizona.

Summary

The Wetlands Action Plan describes the values of the wetlands in the headwaters of Bluewater Creek and the current conditions of wetlands, explains the wetland stressors, and recommends actions for the conservation and restoration of the springs and wetlands. The goal is to help

landowners, community members, and land managers protect and restore the condition of the wetlands to support water quality and wildlife habitat and the health and wellbeing of people who use the wetlands and downstream communities.

Many of the wetlands in the headwaters of Bluewater Creek are in degraded conditions from a variety of stressors coming from natural and human sources. The most important natural stressors include drought and climate change, which lead to extended dry periods combined with intense rain storms and flash floods. The human stressors are primarily driven by livestock grazing and off-road vehicle uses, which lead to disturbance and decrease of plants, soil erosion, and sedimentation in the creek. Additional impacts of the stressors include downcutting/incision of the stream channel, degradation of wildlife habitat quality, and diminished water quality and amount of water. Invasive plants due to bare soil and the eroding soils found in headcuts also are a result of the natural and human stressors.

Specific objectives to curb the deterioration of wetlands and protect and restore them include addressing the impacts from human stressors and mitigating/reversing the historical negative uses. The specific actions include: (a) improving grazing management by changing the duration and intensity of livestock use; (b) halting eroding headcuts and channel degradation and successfully raising channel elevations to improve floodplain access with Zuni bowls and induced meandering among other practices; (c) restoring spring-fed and fen wetlands such as the Shush'kin Fen; (d) managing and improving roads for proper drainage, armoring low water crossings, and closing or relocating roads out of valley bottoms; (e) restoring native vegetation and protecting streamside plants such as willows, cottonwoods, and other associated wetland and aquatic plants; (f) controlling invasive and noxious plant species to ensure native plants are not outcompeted; and (g) filling data gaps by conducting assessment and designing wetland restoration projects. Additional study is needed to understand the total acreage and condition of wetlands in the WAP area as not all areas have been assessed.

To achieve the goal of conserve and revitalize the wetlands, the WAP recommends three strategies: (1) conducting assessments and research; (2) implementing biological and physical protection of wetlands and wetland restoration activities and projects; and (3) promoting educational outreach activities with off-road vehicle users, nearby landowners, and school/educational groups. By undertaking the actions in Table 6 with funding resources from Table 7, the USFS; tribal leaders; and staff, local landowners, and multiple partner organizations involved in the Zuni Collaborative Forest Landscape Restoration Project can ensure that headwater wetlands of Bluewater Creek become protected and restored for future generations.

References

Ashigh, J., Wanstall, J., & Sholedice, F. (2010). Troublesome weeds of New Mexico. New Mexico State University, College of Agricultural, Consumer and Environmental Sciences, Cooperative Extension Service.

The Bluewater Creek Story—Rebuilding a Land Ethic. (n.d.). United States Forest Service position paper received from Cibola National Forest.

Baker, Robert. (1988) Timeless Heritage: A History of the Forest Service in the Southwest. USDA Forest Service.

Clothier, V., & Zeedyk, W. (2009). Let the Water Do the Work: Induced Meandering, an Evolving Method for Restoring Incised Channels. Chelsea Publishing - Chelseagreen.com. First published by the Quivira Coalition.

Collins, L. (2021). Characterizing and Assessing the Hydrological Connection of Sawyer Fen to Nearby Bluewater Creek in the Zuni Mountains, New Mexico. Master of Water Resources Professional Project, University of New Mexico.

Curtis, Jan. (2008). An Assessment of Surface Water-Groundwater Interactions with Water Quality in Bluewater Creek New Mexico. Master of Water Resources Professional Project, University of New Mexico.

Frus, R.J. (2016). Multidisciplinary Work to Determine Hydrology of Arid Land Springs and How Spring Waters Influence Water Quality and Ecosystem Health for Desert Environments. UNM Master's Thesis.

Garfin et al. (2013). Assessment of Climate Change in the Southwest United States. Island Press.

Griffith, G.E., J. M. Omernik, M. M. McGraw, G. Z. Jacobi, C. M. Canavan, T. S. Schrade, D. Mercer, R. Hill, and B. C. Moran. 2006. Ecoregions of New Mexico: Reston, Virginia, U.S. Geological Survey.
https://dmap-prod-oms-edc.s3.us-east-1.amazonaws.com/ORD/Ecoregions/nm/nm_front.pdf
https://dmap-prod-oms-edc.s3.us-east-1.amazonaws.com/ORD/Ecoregions/nm/nm_back.pdf

Hydrologic Function Analysis Bluewater Creek Watershed Preliminary Report. Mt. Taylor Ranger District, Cibola National Forest. USDA Forest Service. (1986).

Museum of Northern Arizona Springs Stewardship Institute. (2022, March). Inventory And Assessment Of Springs On Cibola National Forest To Support Forest Planning 2021 Final Project Report.

New Mexico Environment Department, Surface Water Quality Bureau. (2024). Surface

Water Quality Bureau 2024-26 State of New Mexico Clean Water Act Integrated List & Report. Appendix A. Santa Fe, New Mexico.

New Mexico Department of Agriculture. (2020). New Mexico Noxious Weed List.

New Mexico Department of Wildlife. (2025). State Wildlife Action Plan for New Mexico.

Natural Resources Conservation Service. Web Soil Survey. Data is accessible from this link.

NOAA National Centers for Environmental Information, Climate at a Glance: Divisional Time Series, published December 2025, retrieved on December 17, 2025 from https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/divisional/time-series

Rio Grande Chub Conservation Strategy by the Rio Grande Chub and Rio Grande Sucker Conservation Team. New Mexico Department of Game and Fish. (2021).

State Geologic Map of New Mexico. New Mexico Bureau of Geology and Mineral Resources - https://geoinfo.nmt.edu/publications/maps/geologic/state/home.cfm

Total Maximum Load for (TMDL)for Bluewater Lake. New Mexico Environment Department Surface Water Quality Bureau Monitoring, Assessment, and Standards Section. (Final draft, 2021).

United States Environmental Protection Agency. (n.d.). Level III and IV Ecoregions by State. www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states.

United States Forest Service. (2025, April 28). Selected GIS Data Sheets for the Southwest Region, Range Management Units. https://www.fs.usda.gov/r03/data-tools/gis

U.S. Fish & Wildlife Service. National Wetland Inventory on the National Wetlands Mapper https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper/

U.S. Fish & Wildlife Service. (n.d.). Southwestern Willow Flycatcher. https://www.fws.gov/species/southwestern-willow-flycatcher-empidonax-traillii-extimus

Walton, M and Zeedyk, W. (2014). Characterization and Restoration of Slope Wetlands in New Mexico. New Mexico Environment Department and Quivira Coalition.

Watershed Restoration Action Plan for Bluewater Lake-Bluewater Creek Watershed. (2011). US Forest Service, Mt. Taylor District, Cibola National Forest.

Zeedyk, W. (1985, December). Is Bluewater Creek Worth It? N.M. Outdoor Reporter.

Zeedyk, W. (1996). Managing Roads for Wet Meadow Ecosystem Recovery. USFS FHWA-FLP-96-016.

Zeedyk, W. (2006). Water Harvesting from Low-Standard Rural Roads. New Mexico Environment Department, Quivira Coalition, and Bureau of Land Management.

Zeedyk, W. (2009). An Introduction to Induced Meandering (4th ed.). Quivira Coalition.

Zuni History, Pueblo of Zuni Department of Tourism. http://zunitourism.com/about-zuni/zuni-history/