Valles Caldera National Preserve

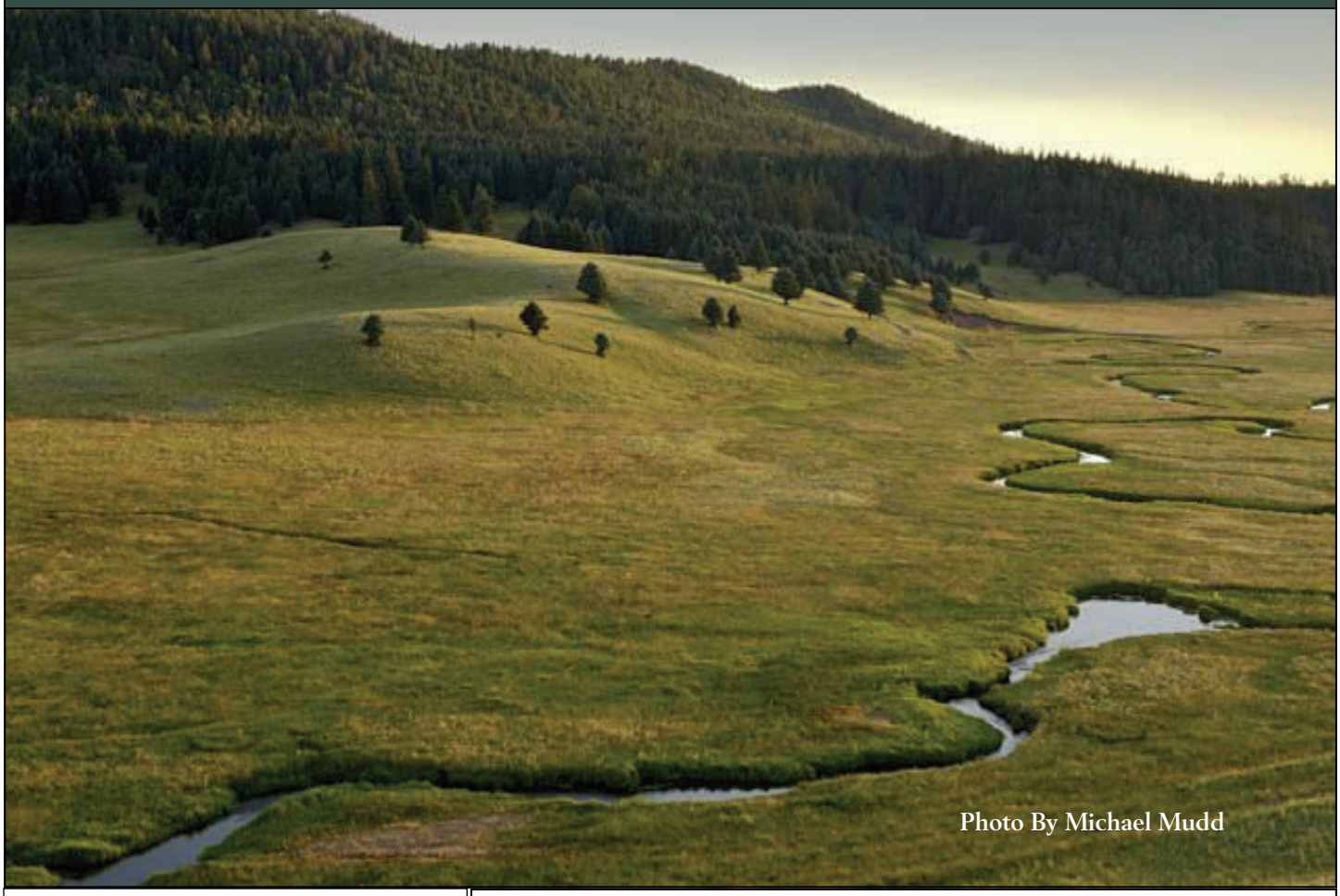
Photo By Michael Mudd

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Environmental Assessment

San Antonio Watershed - Wetlands & Riparian Restoration

Draft for Review and Comment

Stewardship Register

NRMR—San Antonio

Valles Caldera National Preserve

San Antonio Watershed – Wetlands & Riparian Restoration

Environmental Assessment

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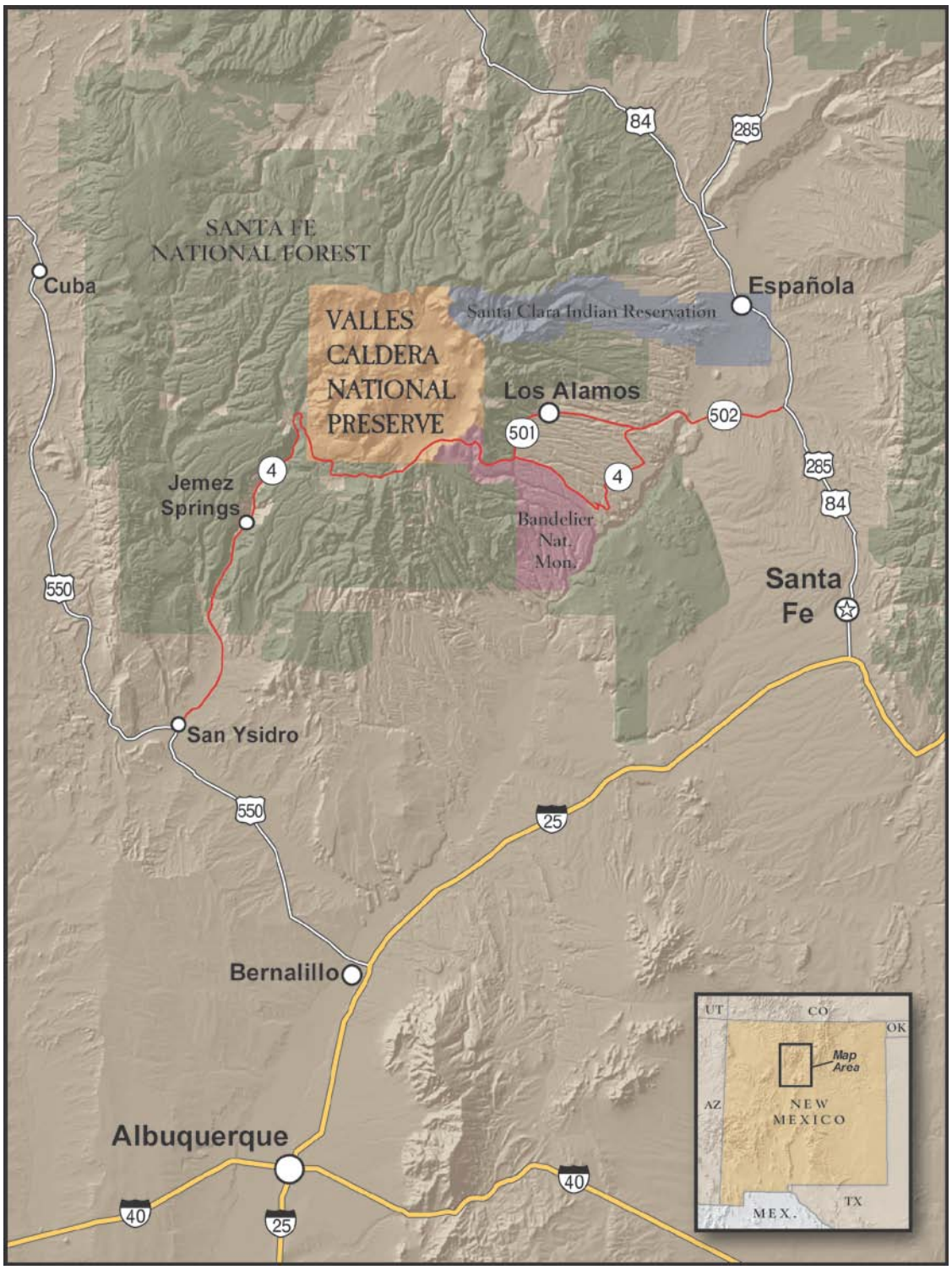


Valles Caldera National Preserve

Environmental Assessment

Stewardship Action: San Antonio Watershed – Wetlands & Riparian Restoration

Chapter One - Purpose and Need/Proposed Action

1.1 Introduction

This document is an Environmental Assessment (EA) summarizing an environmental analysis completed regarding proposed restoration activities within the San Antonio and Sulfur Creek watersheds on the Valles Caldera National Preserve (Preserve). The Preserve is located in north central New Mexico, Sandoval and Rio Arriba counties (Figure 1)

Watershed is the term used to define a geographic area of land from which water drains to a shared destination. Watersheds can be defined at a variety of scales. For the purpose of this EA, three scales will be defined (**Error! Reference source not found.**):

- The 5th level Hydrologic Unit Code (HUC) Jemez Watershed as defined by the United States Geologic Survey (USGS). The Valles Caldera National Preserve is entirely within the 5th HUC 13020202 Jemez Watershed.
- The 6th level HUC watersheds, also USGS defined, that are sub units of the 5th level HUC. The proposed action occurs within the San Antonio and Sulfur Creek 6th level HUC.
- Sub-basin watershed user defined areas, delineated using ARCHydro, Geographic Information System (GIS) software (T.E.A.M.S. 2007). These are smaller watersheds within the 6th code HUC's defined at a scale useful for management.

1.2 Purpose and Need

In July 2007 intensive aerial and pedestrian photographic surveys of San Antonio Creek riparian corridor and wetlands from its headwaters to the Preserve boundary were conducted. The purpose of the reconnaissance was to quantify the condition of the wetland and riparian system within the San Antonio and Sulfur watersheds.

Numerous issues were inventoried and mapped. Many of the issues are infrastructure related. Poorly located roads; roads in disrepair; poorly located, improperly installed or sized, culverts; and poorly located fences are contributing directly, indirectly, and cumulatively to the degradation of the wetland and riparian systems.

Earthen tanks and culverts, often located to actually drain wetlands; as well as past grazing, logging, and road building; have combined to reduce the extent of wetlands and floodplains throughout the San Antonio Creek sub-basins. Numerous meanders are at risk to being cutoff increasing the likelihood for rapid degradation to occur in the near future (Van Clothier; Stream Dynamics Inc. 2008).

In fall, 2007, design reconnaissance of wetland issues at Alamo Canyon was conducted. The primary pressures on the wetlands in the canyon are the placement of geothermal well pads and the abandoned roadbed causing head-cuts in wetlands adjacent to the road (Van Clothier; Stream Dynamics Inc. 2008).

The watershed condition of the Preserve has been assessed at a variety of scales using measurements of water quality, functioning condition, benthic diversity, and upland and riparian biotic and abiotic indicators. All assessments indicate an overall moderate departure from a *reference condition* (T.E.A.M.S. 2007). The term reference condition means "*the composition of landscape vegetation and disturbance attributes that, to the best of our collective expert knowledge, can sustain current native ecological systems and reduce future hazard to native diversity*" (USDA - USFS Rocky Mountain Research Station 2005). Measurements taken over time indicate that degraded wetland and riparian systems are beginning to rehabilitate due to road maintenance projects and a reduction in the intensity of domestic livestock grazing (T.E.A.M.S. 2007).

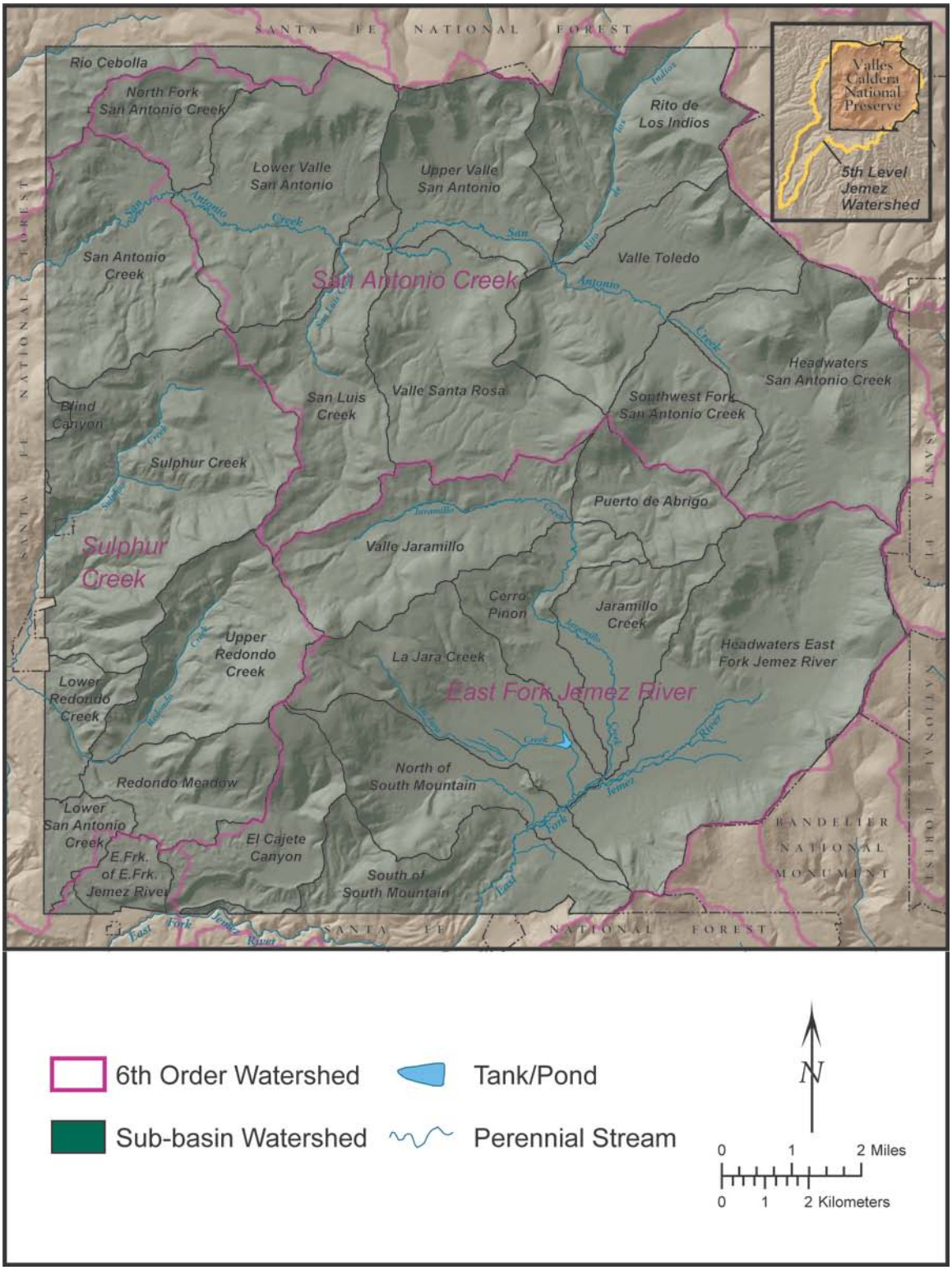
Restoration activities are being proposed to:

- Reduce future risks to the wetland and riparian systems;
- Initiate rehabilitation in areas where processes have degraded beyond the point where they can be naturally restored;
- Support the restoration that has already occurred or is occurring; and
- Restore and protect a unique wetland complex that occurs in Alamo Canyon.

The Valles Caldera Preservation Act lists the protection and preservation of the scientific, scenic, geologic, watershed, fish, wildlife, cultural, historic and recreation values of the Preserve as among the purposes for acquisition and the goals for management of the Preserve. The U.S. Environmental protection Agency (EPA) describes wetlands as the link between the land and the water. Further identifying them as "*transition zones where the flow of water, the cycling of nutrients, and the energy of the sun meet to produce a unique ecosystem characterized by hydrology, soils, and vegetation—making these areas very important features of a watershed.*" Using a watershed-based approach to wetland protection ensures that the whole system, including land, air, and water resources, is protected.

This water-collecting basin of the Preserve contains a number of unique aquatic and wetland features, ranging from warm and extremely acidic geothermal waters to numerous springs, seeps, and boggy wetlands. These water-rich environments, combined with the Preserve's many creeks and streams, provide a robust foundation for the ecological diversity and productivity that characterize the Preserve. The restoration of watershed, wetland, and riparian systems within the San Antonio and Sulphur Creek watershed (6th code hydrologic units) areas is being proposed in support of the resource protection purposes and goals enumerated in the Valles Caldera Preservation Act.

Figure 2 – Watershed Delineations



1.3 Proposed Action

The Valles Caldera Trust in cooperation with the New Mexico Environment Department Surface Water Quality Bureau (NMED-SWQB) and Los Amigos de Valles Caldera (Los Amigos) is proposing to implement a series of projects within the San Antonio and Sulfur 6th level HUC's (Figure 2) to restore and protect the riparian and wetland systems.

1.3.1 Activities (Figure 3):

#1 Improve drainage along VC09, VC13, VC09, VC09A – Installation of rolling dips along VC09A to move water off the road system where it can be harvested into a stable wet meadow system. Use of this road would continue to be limited to administrative uses, preferably under dry conditions only. Deferred maintenance activities on VC09, VC09A and VC13 would include:

- Culvert replacement and installation of relief culverts.
- Reshaping and crowning of the road prism to provide proper drainage to reduce erosion.
- Road realignment to reduce slope and erosion.
- Construction of low water crossings
- Intersections will be reworked to provide proper drainage and reduce erosion.

#2 Relocate/remove Fencing - Livestock fencing that is perpendicular to San Antonio Creek or otherwise located to cause trailing and erosion, would be relocated, removed, or replaced with temporary fencing depending on administrative needs.

#3 Plug gullies resulting from earthen tanks – Using structures made from native materials, rocks and/or small logs.

#4 Treat incipient meander cut-offs – Stream barbs, pointing upstream would be placed at the upper bend of the meanders; sod wads would be transplanted on outer bends. Channel shaping with heavy equipment may be necessary to adequately prevent the three most precarious of the incipient meander cut-offs. A slightly shorter new channel will be excavated to form a stable set of bends within the overall meander pattern of the creek.

#5 Restore historic delta at the confluence of Rito de los Indios and San Antonio Creek – Remove material from non functioning earthen dam, dig out historic channel and use piping to initiate historic distribution of water into the restored delta.

#6 Wetlands Restoration/enhancement – Where changes in gradients have initiated drainage of existing wetlands, use log and fabric dam, gully plugs, or Zuni bowl techniques to protect and restore wetlands along San Antonio Creek.

#7 Repair headcut west of San Antonio cabin – Plug headcut, restore historic channel, and place grade control structures in lead out ditches along VC09A.

#8 Improve drainage along VC08 through the Valle Seco – Installation of rolling dips along VC08 to move water off the road system where it can be harvested into a stable wet meadow system. Deferred maintenance would occur on VC08 and including:

- Installation and replacement of culverts
- Reshaping and crowning of the road prism to provide proper drainage to reduce erosion.
- Realignment of the road to reduce slope and erosion.
- Intersections will be reworked to provide proper drainage.

#9 Headcut mitigation in Alamo Canyon – Decommission of abandoned logging road through and along the wetlands including the construction of drainage and erosion control features.

#10 Re-establishing historic wetland complex in Alamo Canyon – Stabilizing the geothermal well pad and restoring historic water catchment and drainage patterns.

#11 Streambank and channel improvements – Projects that address site specific erosion along streambanks or channels and generally use hand labor.

#12 Connected activities - Development of existing aggregate pit locations for extracting native material.

Activities would use hand labor, mechanized equipment, and heavy equipment.

1.4 Goals, Objectives, and Monitored Outcomes

1.4.1 Goals

The proposed action supports the protection and preservation of the scientific, scenic, geologic, watershed, fish, wildlife, historic, cultural and recreational values of the Preserve as identified in the Valles Caldera Preservation Act (U.S.C. 2000). The Framework for Strategic Guidance and Comprehensive Management (Valles Caldera Trust 2005) introduces the concept that the central goal for management at the Preserve "*should be to increase the resilience and, to the extent possible the integrity of its ecological condition*." The concept of ecosystem resilience and integrity are somewhat quantified in the term, reference condition previously defined under 1.2, Purpose and Need.

1.4.2 Objectives

The project objectives are to:

- Reduce erosion associated with roads (condition, alignment and drainage),
- Address turbidity and temperature impairments in San Antonio, Alamo, and Sulfur Creeks.
- Improve habitat for fish and other wildlife that depend on riparian and wetland habitats within the project area.

- Protect and maintain the unique wetland complex and plant associations in Alamo Canyon

1.4.3 Monitored Outcomes

- Road attributes relative to standards
- Water quality measured during the ice free season
- Fish survey results (species, size, population, density, distribution)
- Benthic surveys
- Vegetation composition and structure

1.5 Performance Requirements –

The following laws, procedures, policies, and mitigative measures will be applied to reduce or eliminate potential effects to the natural, cultural, or human environment:

1.5.1 Laws, Procedures, Policies

- The Valles Caldera Preservation Act
- The National Environmental Policy Act (NEPA)
- Valles Caldera Trust – NEPA Procedures of the Valles Caldera National Preserve
- Valles Caldera National Preserve Cultural Resource Compliance Process

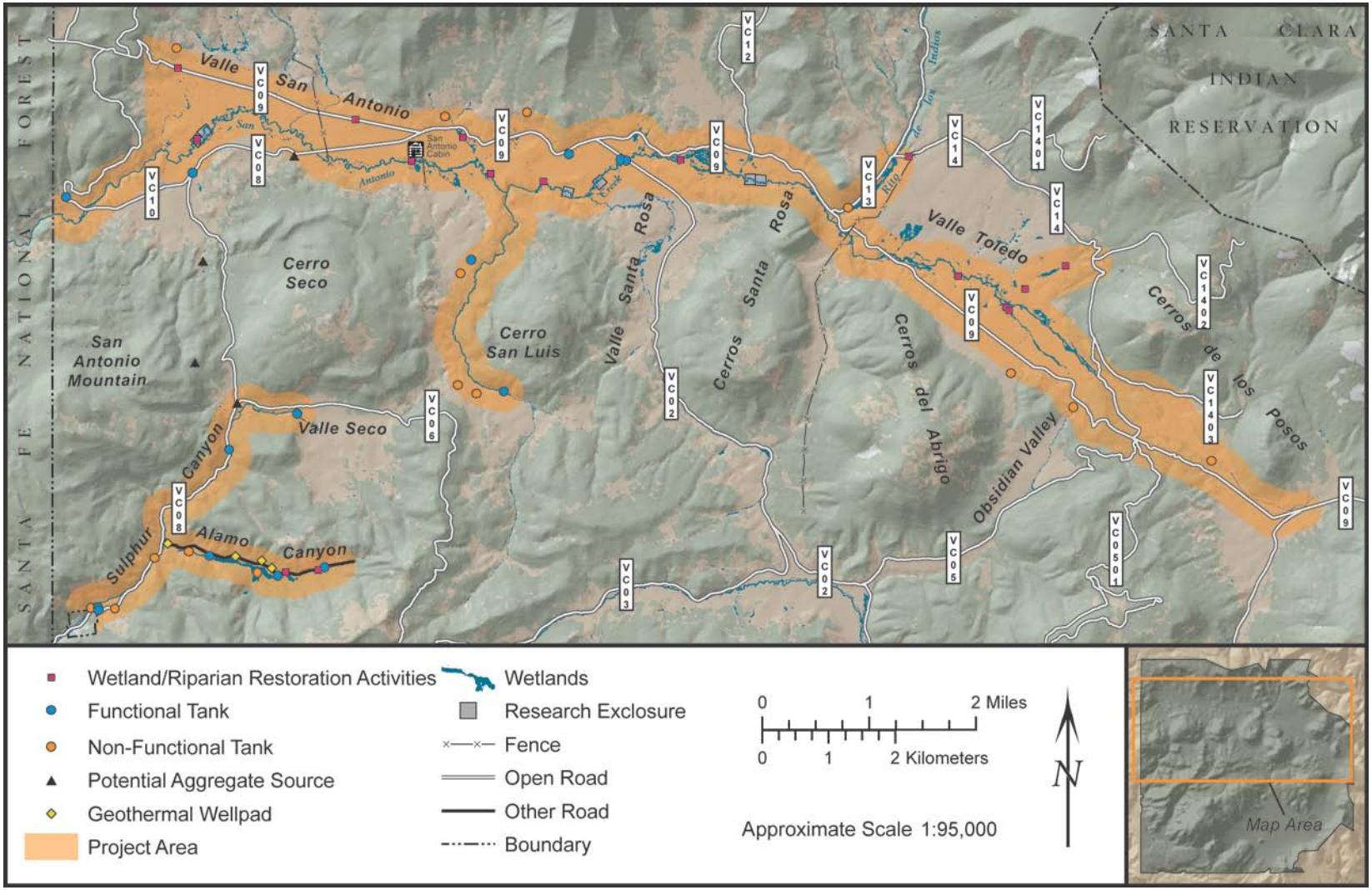
1.5.2 Mitigation Measures

- Prior to implementing on the ground activity or group of activities the Valles Caldera Trust Interdisciplinary Clearance Process (Appendix A) and Cultural Resource Compliance Process will be completed.
- Volunteer activities that include camping will occur in compliance with the Trust's guidelines for camping.
- Ground disturbing projects will employ temporary erosion control activities during the active phase of the project.
- Access for volunteers will be coordinated through the Trust and will be limited to access required to complete project activities (including inventory and monitoring)
- The following practices will be considered "Best Management Practices" for the duration of this project (until revised or rescinded).
    - Limit vehicle access to VC09A to PNM and administrative uses by the Trust.
    - Limit such administrative access during wet conditions to emergency access or urgent needs.
    - Keep culverts clean and functioning.
    - Weight resource protection vales when determining road maintenance priorities.

- Minimize the combined utilization of above ground forage (standing biomass) to 40% in the affected valles (current Preserve-wide standard.)
- Minimize cattle presence in the riparian areas using herding and/or permanent or temporary barriers.

- The Following mitigation measures will apply to the removal of aggregate materials from existing pit locations.
  - The soil, rock, organic material, and some or all vegetation will be piled on site for later use in site rehabilitation.
  - Oversized material, if present, will be stock piled on site for future use as rip-rap or derrick material.
  - Temporary erosion control features will be used during the life of the material source.
  - Permanent drainage control measures will be established after the site has been rehabilitated.
  - When excavation of the site has been completed, and the site will not be used again, the sides will be sloped, graded, or scaled and the general pit area smoothed and stabilized.
  - Organic material from the removed vegetation or soil stabilization structures will be used to enhance the nutrient availability and site conditions for establishing native vegetation (in lieu of planting or seeding).
  - Drainage and erosion control features established in the access road will be maintained during the life of material source.

Figure 3 – Project Area and Proposed Activities



1.6 Decision to be Made

The Preserve Manager is the Responsible Official for the proposed stewardship action. As governed by the Executive Director, they will decide whether to implement the activities as proposed, an alternative action, or to take no action at all.

1.7 Scope of the Analysis

1.7.1 Environmental Documentation

The proposed stewardship action consists of a variety of activities some of which could be categorically excluded from documentation in an Environmental Assessment (EA) or Environmental Impact Statement (EIS) (Federal Register 2003) and others that cannot be excluded from such documentation.

The Trust will be considering all the activities together in an Environmental Assessment to determine if their combined implementation could have a significant effect on the environment. The activities being proposed have similarities in their common timing and geography and therefore should be evaluated collectively (CEQ 2003) (§1508.25).

Items 2 and 3 as described under 1.3 *Proposed Action*, involve the management of fences and earthen tanks which were addressed in (Insert MUSY Forage reference). This redundancy is useful to ensure that indirect and cumulative effects and activities between multiple Stewardship Actions are adequately addressed.

1.7.2 Scoping and Public Involvement

The proposed stewardship action was presented at a public meeting of the Valles Caldera Board of Trustees, and posted on the Trust's website in March of 2008. Notification of the posting was distributed by email; a hard copy was mailed to stakeholders without access to the electronic version.

In addition an article was printed in the Albuquerque Journal on May 8, 2008 which further raised public awareness. In response to scoping two comments were received. One comment suggested that the Trust adopt practical methods of resource management and protection similar to the intensity that would be expected on a privately owned ranch. The second comment emphasized the importance of considering indirect effects of the proposed actions.

Internal comments included a suggestion to leave a meander cut off located within a permanent ecologic monitoring site as a control to better understand the context and intensity of effects resulting from a breach and subsequent oxbow formation.

Chapter Two Alternatives

The National Environmental Policy Act requires agencies to consider alternative actions to any proposal that involves unresolved conflicts concerning uses of available resources. While such conflicts are not always identified with smaller projects, which are narrow in scope, the Trust has found the consideration of alternative actions to be valuable in decision making.

2.1 Alternatives Considered but Eliminated from Detailed Analysis

Full or partial closure of portions of roads VC09 and VC09A - The Trust considered the closure of portions of the VC09 and 09A and the associated rehabilitation of these roads and intersections. Open access to VC09 through the Valles Toledo would have been from the east. This alternative would have reduced erosion to San Antonio Creek and protected bald eagles from disturbance by traffic. However, closure of this area to vehicle access would have affected the ability of PNM to properly inspect and maintain the natural gas pipeline. Proper inspection and maintenance of the pipeline is necessary to provide for public safety and to ensure energy needs to Los Alamos. Disturbance to the bald eagle during its period of occupation (October through mid-December) can be provided through administrative closures or partial closures.

Limiting vehicular access through the Valles Toledo (and all future maintenance responsibilities) only to PNM was also considered. Decisions regarding long term transportation needs on the Preserve were considered outside the scope of this analysis and were deferred to future consideration in context with Preserve-wide plans.

2.2 Alternatives Considered in Detail

2.2.1 Alternative A - No Action

Under this alternative, the Trust would not consider the collective activities as described in Chapter One. Routine maintenance of roads would continue.

2.2.2 Alternative B - The Proposed Stewardship Action

The proposed stewardship action includes a suite of activities as described in Chapter One, 1.3 *Proposed Action*, items 1 through 12, designed to:

- To reduce or eliminate current and future risks to the wetland and riparian systems;
- To initiate rehabilitation in areas where processes have degraded beyond the point where they can be naturally restored;
- To support the restoration that has already occurred or is occurring; and
- To restore and protect a unique wetland complex that occurs in Alamo Canyon.

Under this alternative, the meander cut-off located within the Lower San Antonio Exclosure (Figure 3) would be used as a control to monitor outcomes associated with a breach and oxbow formation.

2.2.3 Alternative C - Reduced Scope –

Under this alternative the Trust would only undertake actions to eliminate or reduce current and future risks to the wetland and riparian systems. Under this alternative, items #4., #5., #6., and #10., listed under Chapter One,1.3, Proposed Action would not be considered.

Chapter Three Environmental Consequences

The National Environmental Policy Act directs agencies to focus documentation on issues that are truly significant to the action in question. No significant issues were identified during the scoping or analysis process. Performance requirements were developed to address concerns. These requirements are identified in Chapter 1.

In lieu of significant issues, the analysis of environmental consequences focused on a determination of significance.

3.1 Environmental Consequences

This chapter summarizes the effects to the natural and human environment expected to occur as a result of either taking no action or implementing an action alternative. A discussion of the affected environment is provided where applicable. Effects are measured by context (the spatial or temporal extent of the effect) and intensity (the magnitude of the effect). Effects may be beneficial or adverse and may be direct, indirect, or cumulative.

A summary of the context and intensity of the effects is presented followed by a supporting narrative. The spatial extent of an effect is described in a narrative statement. The temporal extent of the effect is defined by three categories of duration:

- Short-term: 0-3 Years
- Mid-term: 3-10 Years
- Long-term: 10+ years

The intensity of the effect is defined by the following four levels of magnitude (intensity is influenced by context):

- Negligible: No change would occur or the magnitude of change would not be measurable.
- Minor: Changes would be measurable but would not alter the structure, composition, or function of the resource and would be limited in context.
- Moderate: Changes would be measurable and may influence the structure, composition, or function of the resource but would be limited in context.
- Major: Changes would be measurable, would alter the structure, composition or function of the resource and may be extensive in context.

3.1.1 Flora

Affected Environment

The project area is primarily within the wet meadows and wetlands of the Preserve and the surrounding montane grasslands. In their 2003 *A Vegetation Survey and Preliminary Ecological Assessment of Valles Caldera National Preserve, New Mexico* Muldavin and Tonne provide the following description of the wet meadows and wetlands of the Preserve:

Montane Wet Meadows and Wetlands occur throughout the lowland valleys, commonly adjacent to perennial streams of the valley bottoms (Figure 4), but also along seeps, springs and creeks in the uplands. These diverse communities—142 species have been recorded so far—are dominated by facultative and obligate wetland graminoid species, mostly sedges *(Carex sp.)* and rushes *(Juncus sp.)*.

In their report Muldavin and Tonne identified 15 obligate and 13 facultative wetland species as defined by the national wetlands species list. In addition, most of these communities are on sites subject to periodic flooding, or where the soils can become saturated at some point during the year in most years (most of the wet meadows and wetlands are associated with hydric Vastine soils—soils map unit 301). Accordingly, these communities would likely be considered jurisdictional wetlands under federal rules. Woody perennial species such as willows, alders and water birch are absent or very rare. Whether this is a function of hydrological and soil conditions or past overgrazing is an open question. These wet meadows correspond to the Sedge Wet Meadows of Whitford and Ludwig (1975) and Montane Meadows of Barnes (2002). In their report, Muldavin and Tonne classified these wet meadows into 17 Plant Associations (PA)among eight Wet Meadow and Wetland alliances based on dominance and indicator value. The alliances are Tufted Hairgrass *(Deschampsia cespitosa)*, Northwest Territory Sedge *(Carex utriculata)*, Water Sedge *(Carex aquatilis)*, *Woolly Sedge (Carex pellita)*, *Common Spikerush (Eleocharis palustris)*, Baltic Rush *(Juncus balticus)*, Northern Mannagrass *(Glyceria borealis)*, and Kentucky Bluegrass.

Northwest Territory sedge, water sedge, woolly sedge, and smallwing sedge *(Carex microptera)* are a set of similar species that form an operational functional group of tall coarse sedges growing near or adjacent to the stream channels and springs of the Preserve. They are difficult to differentiate morphologically (except when flowering) and their habitat seems similar: frequently flooded sites with saturated or near saturated soils. They typically form dense, sometimes wide bands along perennial channels. They are important to stream function because they serve to stabilize the banks and shade the channel.

Spikerush-dominated communities typically occur in close association with sedge communities, but along low bars and beaches within the active channels and at the interiors of spring wetlands. In contrast, Baltic rush and tufted hairgrass associations are typically found away from the channel on slightly higher ground than either the sedges or spikerushes (although sometimes these can also be found directly adjacent to the active channel). Overbank flooding still can occur but not necessarily on an annual basis, and

ground water and snowmelt may be more important, leaving soils saturated for long periods with standing water at or near the surface. Grazing may favor Baltic rush over tufted hairgrass, and with overuse, wet meadows can shift to the exotic Kentucky bluegrass and a mixture of exotic and/or weedy forbs. Accordingly, accordingly Muldavin and Tonne identified a Kentucky Bluegrass Alliance, and in many have identified a separate Kentucky Bluegrass Phase for associations that have been subject to long-term grazing.

Figure 4 - A typical wet meadow/wetland along San Antonio Creek Note the lack of woody riparian species (Muldavin 2003).

Northern mannagrass communities are associated with shallow pond and lake edges, and in the case of the Preserve, stock tanks. Northern mannagrass is a native, perennial, hydrophytic grass of cold temperate climates. Soils remain saturated during the growing season, but can dry out late in the season.

Muldavin and Tonne (Muldavin 2003) also provided the following detailed description of the montane grasslands:

Montane Valley Grasslands make up the majority of the grasslands on the Preserve, covering over 26,000 acres (10,500 ha) (Figure 8) and dominating the expansive lower elevation valles. They are also found at higher elevations along the caldera rim and in small interior mountain valleys (Figure 5). Despite their seemingly high abundance on the VCNP, montane grasslands are relatively uncommon in New Mexico. Other than in the Jemez Mountains, they are found only at the highest elevations of the Sangre de Cristo Mountains along with scattered occurrences in the Sacramento Mountains and in the Gila.

Figure 5 – Upper Montane Grassland.

On the Preserve, Muldavin and Tonne identified five Montane Grassland alliances based on relative dominance, i.e., the Parry's Oatgrass, Thurber Fescue, Arizona Fescue, Pine Dropseed *(Blepharoneuron tricholepis)*, and Kentucky Bluegrass Alliances. Besides the dominant grasses, these alliances are typified by the presence of meadow species such as Fendler's sandwort, bluebell bellflower, Parry's bellflower *(Campanula parryi)*, yarrow, beautiful fleabane *(Erigeron formosissimus)*, heartleaf buttercup *(Ranunculus cardiophyllus)*, yellow owlclover *(Orthocarpus luteus)*, woolly cinquefoil *(Potentilla hippiana)*, and Rocky Mountain iris. Overall, Muldavin and Tonne described highly diverse communities, with over 125 species of grasses and forbs recorded so far.

Muldavin and Tonne cited limited information on the dominant species of these grasslands. With respect to Arizona fescue, they referred to ecological understanding from research on Idaho fescue (*Festuca idahoensis*), a closely related species that is a dominant of montane grasslands from Colorado northward to Montana. Accordingly, Arizona fescue, like Idaho fescue, is probably one of the more favored forage species for domestic livestock, elk, and deer. Thurber fescue is less favored because it is coarser and less palatable, but it is still considered a fair forage grass (particularly in the spring). Grazing pressure tends to reduce both Thurber fescue and Arizona fescue, and Thurber fescue has been largely eliminated from many sites it once occupied. Lastly, Parry's oatgrass is less palatable and hence less impacted by grazing, and it may even be increasing as grazing pressure displaces the fescues. Under heavy grazing the exotic Kentucky bluegrass will displace both fescues and Parry's oatgrass, and its dominance in these associations is usually an indicator of severe historic grazing practices.

Although pine dropseed is a common native dominant or codominant in the Preserve's grasslands, there has been little research about its ecology. Based on their observations of habitat conditions, Muldavin and Tonnes found that pine dropseed seemed to favor lower slope sites, possibly finer soils, and occurs in areas that had heavy grazing disturbance in the past (particularly as one approaches stock tanks). More information is needed on its habitat relationships and dynamics.

The high mountain montane grasslands (>9,500 ft; 2,930 m) of the Preserve are commonly dominated by Parry's Oatgrass associations [Figure 5] and associated with Ess soils. There is the Parry's Oatgrass/Thurber Fescue association in which the two respective codominants can approach 70 to 90% canopy cover. Arizona fescue or other grasses may be present, but they are clearly subordinate. The Parry's Oatgrass/Arizona Fescue association also occurs in these ridge and mountain valley sites, but under seemingly drier conditions. The combined cover of Arizona fescue and Parry's oatgrass in this association can exceed 80%, and the combination of grass and forb cover can approach 100%. The only shrub of note is shrubby cinquefoil *(Pentaphylloides floribunda)*, which under certain conditions increases with grazing, yet it is also considered a favored browse species of elk and may be impacted by the high elk numbers on the preserve. Both associations are highly diverse assemblages, with over 50 species of grasses and forbs recorded so far in each.

Both of these associations are also prevalent in the lower elevation valles of the Preserve where they occupy the upper piedmont slopes along the forest and woodland edges (particularly on Cosey soils—soil map unit 304). In addition, in small drainages of the eastern piedmont in the Valle Grande an unusual Thurber Fescue/ Letterman's Needlegrass association codominated by Letterman's needlegrass *(Stipa lettermannii)* and where Parry's oatgrass is absent (while being present in the adjacent sites) is found. Further down the slopes on Jaramillo, Trasquilar and Cajete soils (map units 302 and 308), both Parry's Oatgrass and Thurberi fescue diminish and Arizona fescue becomes the dominant. Three Arizona fescue plant associations that tend to separate out by aspect and geomorphology were identified. The Arizona Fescue/Mountain Muhly association is found on northerly facing slopes, while the Arizona Fescue/Blue Grama associaition tends to be on southerly slopes.

The Arizona Fescue/Pine Dropseed association occurs along the lower piedmont slopes and on the mid-valley benches and terraces where it often grades into pine dropseed-dominated types. It is here that pine dropseed associations often prevail (Pine Dropseed/June Grass, Pine Dropseed/Mountain Muhly, and Pine Dropseed/Spike Muhly associations). The benches or terraces (remnants of ancient alluvial fans, stream terraces, and lake bed sediments) lie just above the valley floor and represent both the lowest topographic position of the upland grasslands and where Montane Valley Grasslands meet Montane Graminoid Wet Meadows and Wetlands that occur on the current floodplain of the valley floor.

For several of the above associations Kentucky bluegrass phases have been identified where bluegrass reaches anywhere from 10 to 50% cover, suggesting significant impacts from past livestock grazing. A Kentucky Bluegrass/Woolly Cinquefoil associations is found on benches and valley bottom terraces where almost all native grass species are absent or uncommon. Figure 6 shows a pasture adjacent to the Preserve where longterm overgrazing by livestock has led to a decline of native grass and an increase in non-native Kentucky bluegrass along with the encroachment of shrubby cinquefoil (*Pentaphylloides floribunda*) . Kentucky bluegrass also appears to be particularly abundant in pine dropseed

types, further supporting the concept that pine dropseed may be a co-increaser with Kentucky bluegrass with grazing (alternatively, abundant pine dropseed may represent an intermediate recovery phase following severe grazing).

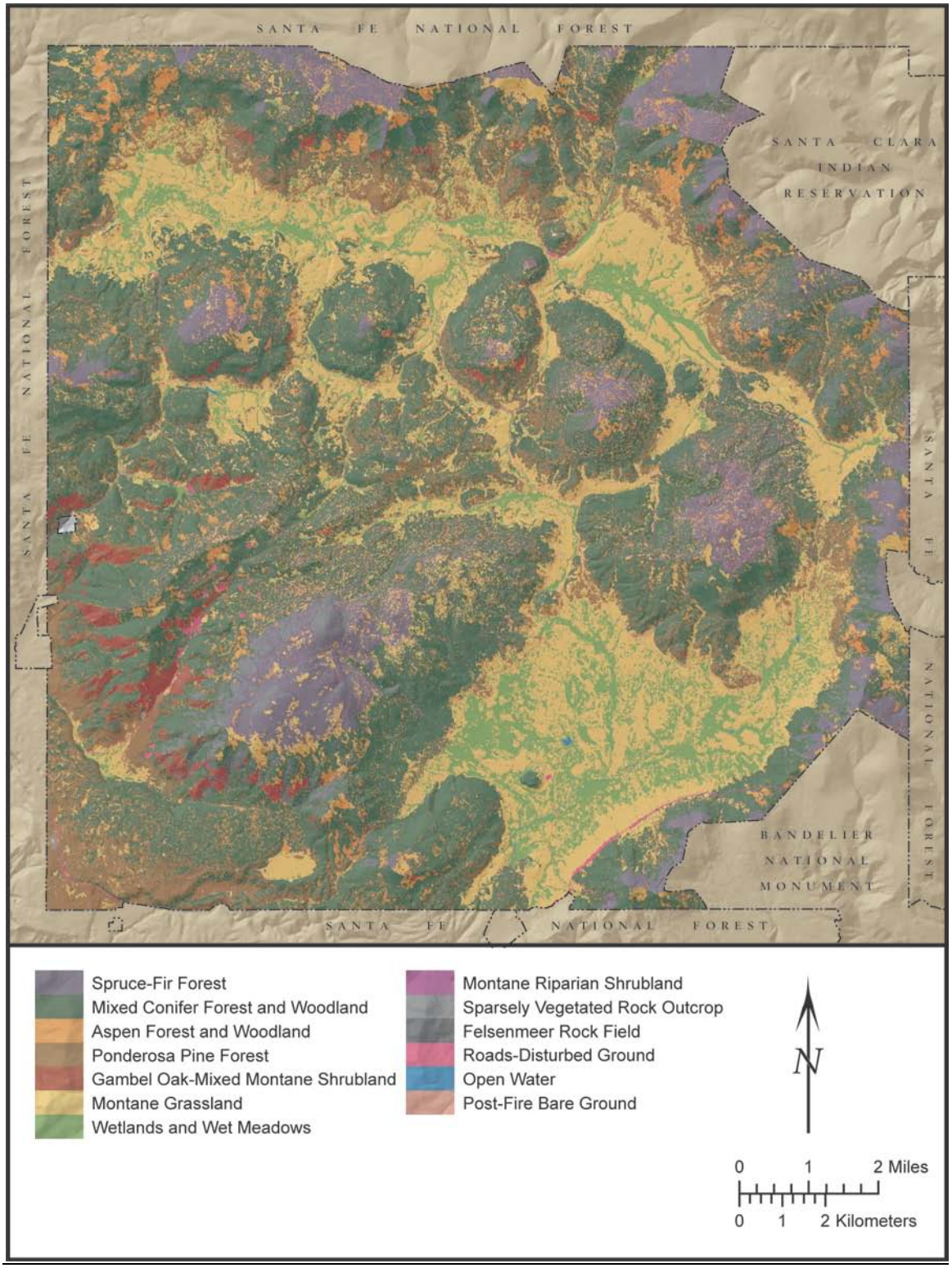
Figure 6 – Pasture adjacent to the Preserve

Muldavin and Tonne (Muldavin 2003) also describe the unique vegetation found in Alamo Canyon:

A special Bog Birch/Water Sedge/Stiff Clubmoss plant association has been identified as part of the fen complex in Alamo Canyon. Although bog birch *(Betula glandulosa)* is prevalent in the Rocky Mountains and northward, this is the only known location for it in New Mexico (Figure 7). Along with bog birch and water sedge *(Carex aquatilis)*, this association is typified by a high cover of club moss *(Lycopodium annotinum)* that forms mats in the water channel. Other obligate wetland species that are present include tufted hairgrass *(Deschampsia cespitosa)*, rough bentgrass *(Agrostis scabra)*, and Canada reedgrass *(Calamagrostis canadensis)*. The association lies at about 8,680 ft (2,650 m) along a low gradient portion of Alamo Creek adjacent to a large fen dominated by tufted hairgrass. Blue spruces is also present along the margins of the occurrence (although their vigor is much reduced).

Figure 7 - The Bog Birch/Water Sedge/Club Moss PA in the Alamo Canyon fen complex.

Figure 8 – Vegetation Map



Environmental Consequences

Alternative A – (No Action)

Under the no action alternative, there would be no direct effects to the structure or composition of the Preserve's vegetation. Indirectly, by taking no action, trends and conditions identified in the proposed action would generally persist.

Other stewardship actions being proposed or implemented on the Preserve (interim and future grazing, routine repair and maintenance of fences and tanks, routine road maintenance) may continue to protect and improve the integrity of the Rio San Antonio system. However, montane grasslands would persist in historic wetlands if specific restoration actions are not taken.

Alternative B

Summary:

Effect	Context	Intensity
Direct/indirect	Within the bounds of the project area. Short-term, mid-term, and long-term.	Minor/Moderate

Narration:

The direct and indirect effect to the existing flora is expected to be beneficial, although localized, short-term adverse effects could occur as a direct result of ground disturbing activities associated with road maintenance and reconstruction and other proposed restoration activities.

Long-term localized benefits are expected where wetlands are restored as described under items 1, 5, 6, and 10 (Chapter One, 1.3 *Proposed Action*). Species composition will move from montane grassland to wetland and wet meadow facultative and obligate wetland graminoid species, mostly sedges (*Carex* sp.) and rushes (*Juncus* sp.).

Under this alternative, a meander cutoff would likely occur within the next five years. The meander within the exclosure is at imminent risk of breach. However, this single cutoff would not be outside the natural range of this system. Effects to vegetation would include a rapid transition to wetland species composition in the affected area.

Alternative C

Summary:

Effect	Context	Intensity
Direct/indirect	Within the bounds of the project area. Short-term, mid-term, and long-term.	Minor/Moderate

Narration:

Under this alternative the proposed restoration of wetlands would not occur. The transition from upland to riparian species composition in those localized areas as well as the associated increases in diversity would not be expected to occur.

Otherwise, the direct and indirect effect to the existing flora is expected to be beneficial, although localized, short-term adverse effects could occur as a direct result of ground disturbing activities associated with road maintenance and reconstruction and other proposed restoration activities.

3.1.2 Soil and Water Resources

Affected Environment

The grassland soils of the Preserve are mostly Mollisols that have developed in the volcanic alluvium of the alluvial fans and piedmonts, or in recent water-deposited sediments of the valley bottoms. They are usually deeper and have rich organic material accumulations in the top layers along with fine textures and little rock accumulation (Muldavin 2003). The soils in the project area fall within Units 301, 302, and 304 as mapped and described by the Natural Resource Conservation Service (Table 2).

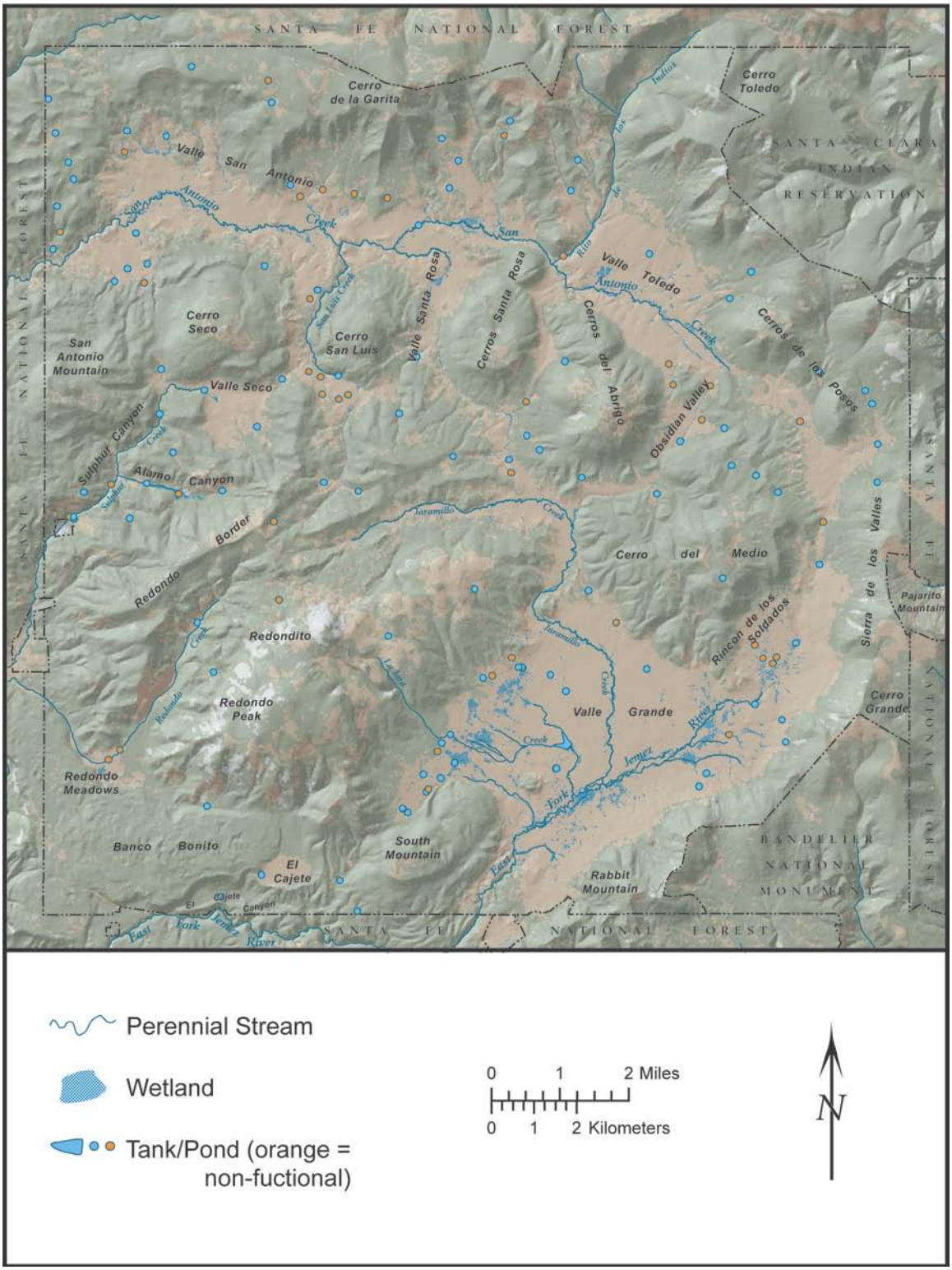
Table 1 - Soil Map Units as defined and mapped by the Natural Resources Conservation Service as part of the Soil Survey of Sandoval County.

Map Unit #	Map Unit Name	Soil Series	Soil Taxinomic Classification
301	Vastine-Jarola silt loams, 0 to 5 percent slopes	Vastine	Typic endoaquolls, fine-loamy over sandy or sandy-skeletal, mixed, frigid
		Jarola	Typic argialbolls, fine-loamy, mixed, frigid
302	Tranquilar-Jarmillo complex, 1 to 8 percent slopes	Tranquilar	Typic argialbolls, very-fine, montmorillonitic, frigid
		Jarmillo	Pachic haploborolls, coarse-loamy, mixed
304	Cosey-Jarmillo association, 2 to 20 percent slopes	Cosey	Typic paleborolls, loamy-skeletal, mixed
		Jaramillo	Pachic haploborolls, coarse-loamy, mixed

About 75 miles of perennial waters flow from the forests and meander through the grasslands of the Preserve along with associated springs, seeps and wetlands (Figure 9).

The water quality of San Antonio Creek and Sulfur Creek are impaired with temperatures and turbidity outside levels that support their designated use for cold watery fisheries.

Figure 9 – Hydrologic Features



Environmental Consequences

No Action

Summary:

Effect	Context	Intensity
Direct/Indirect	Throughout the project area.	Minor/Moderate

Narration:

The issues and trends identified in the purpose and need for action would continue. Among these issues is the addressing of "incipient meander cut-offs" (see Figure 10). These cut-offs may cause a headcut to go up channel. Incipient meander cut-offs are accelerated from inappropriate livestock grazing practices, logging, and roads which increase sediment yield to streams. The stream has incised into its banks and wetland acreage has decreased. It is natural for streams to deposit excess sediment supply on the inside of a meander. However, the stream would not be changing shape at such a rapid rate unless disturbed. If several meander cut-offs occur at the same time, the channel will steepen, degrade upstream, and change in gradient. This could cause a loss of wetlands (Van Clothier; Stream Dynamics Inc. 2008).

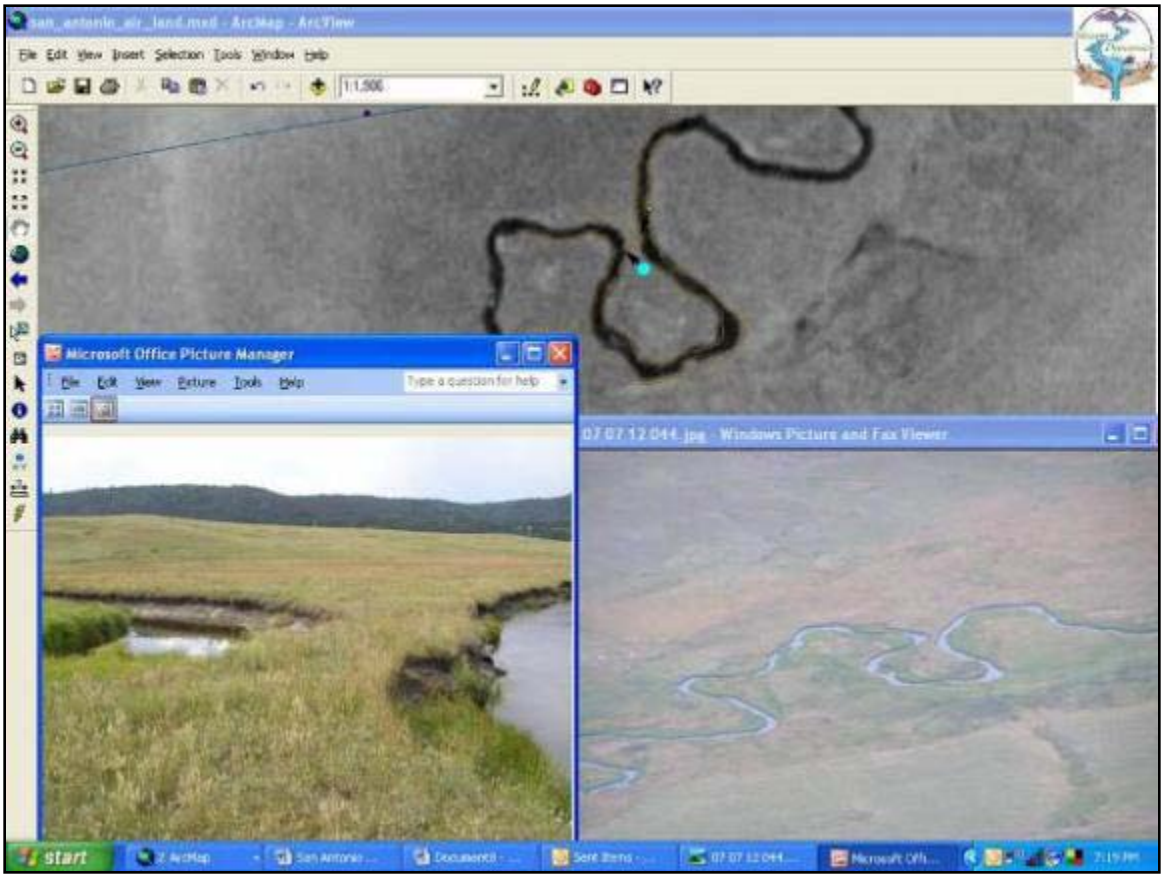


Figure 10 – An incipient meander cutoff shown from various perspectives (Van Clothier; Stream Dynamics Inc. 2008)

Alternative B

Summary:

Effect	Context	Intensity
Direct/indirect	Throughout the project area	Minor/Moderate

Narrative:

The disturbance associated with restoration activities would be localized and short-term in context, and moderate in intensity. Minor/moderate improvements in soil stabilization are expected to result from restoration activities. The proposed activities would occur on localized sites throughout the project area over a period of time. The context of the action in both time and space limits the intensity of the effects. Cumulatively the combination of activities could improve the overall abiotic condition within the project area.

Wetland restoration activities could create moderate indirect improvements by regulating water run-off during peak periods.

The incipient meander cutoff shown in Figure 10 would likely breach in a short to mid-term time frame. The resulting pulse in sediment would be moderate and short term. A single breach in the time frame described is not likely outside the natural range of variability with regard to context or intensity. In addition, information collected by monitoring this breach would be incorporated into reducing either the likelihood of other breaches or the adverse affects associated with other potential breaches.

Under this alternative the Trust would seek to reduce the rates of erosion within the remaining incipient meander cutoffs reducing the potential to incur multiple breaches within a short period of time.

Alternative C

Summary:

Effect	Context	Intensity
Direct	Limited to the specific location and duration where restoration activities are proposed.	Minor/Moderate

Narrative:

The disturbance associated with restoration activities would be localized and short-term in context, and moderate in intensity. Minor/moderate improvements in soil stabilization are expected to result from restoration activities. The proposed activities would occur on localized sites throughout the project area over a period of time. The context of the action in both time and space limits the intensity of the effects. Cumulatively the combination of activities could improve the overall abiotic condition within the project area.

Under this Alternative site specific sources of erosion would be addressed. Wetland restoration activities would not occur. Unusual high water events in the spring and summer could undermine some of the site specific mitigations such as the stabilization of meander cut-offs.

3.1.3 Fauna

This section addresses potential effects of the project to threatened, endangered, or sensitive (TES) fauna (including those species proposed for such listing) (USDA Forest Service 2007) that have been documented or have suspected occurrences within the project area. This evaluation is required by the Interagency Cooperative Regulations (Federal Register 1978), to be compliant with the provisions of the Endangered Species Act (ESA) of 1973, P.L. 93-205 (87Stat. 884), as amended. This section also addresses potential effects to species of interest. The scale of analysis used in this document to analyze the effects of the treatment activities on native fauna is within the project area and expands as appropriate in context with individual species and habitats.

The two principle laws relevant to wildlife management are the Endangered Species Act of 1973 (ESA), and the Migratory Bird Treaty Act (MBTA) of 1918.

ESA requires land managers to manage for the recovery of threatened and endangered species and the ecosystems upon which they depend. Agencies are required to consult with the United States Fish and Wildlife Service (USFWS) if a proposed activity may affect the population or habitat of a listed species.

An endangered species is an animal or plant species listed under the Endangered Species Act that is in danger of extinction throughout all or a significant portion of its range. A threatened species is an animal or plant species listed under the Endangered Species Act that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. No species listed as Threatened or Endangered reside or potentially reside within the project area or otherwise use the project area for breeding or foraging.

A sensitive species is an animal or plant species identified by the U.S. Forest Service Regional Forester for which species viability is a concern either:

- because of significant current or predicted downward trend in population numbers or density, or
- because of significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution. Threatened, endangered, and sensitive species effects are summarized in this section by TES status and species.

MBTA established an international framework for the protection and conservation of migratory birds. This Act makes it illegal, unless permitted by regulations, to "pursue, hunt, take, capture, purchase, deliver for shipment, ship, cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird . . ."

Landbirds, including NTMB, are discussed because many species are experiencing downward population trends. Discussion can be found in the section Species of Concern – Landbirds including Neotropical Migratory Birds (NTMB).

Species presence/absence determinations were based on habitat presence, wildlife surveys, recorded wildlife sightings, and non-Forest Service databases. Effects on habitats are discussed, with the assumption that if appropriate habitat is available for a species, then that species occupies or could occupy the habitat. This strategy is based upon science that demonstrates connections between species populations and viability and the quantity and condition of habitat at appropriate scales of analysis (Baydack, Campa III and Haufler 1999).

Effects on species will be determined by assessing how alternatives affect the structure and function of vegetation relative to current and historical distributions. Some wildlife habitats require a detailed analysis and discussion to determine potential effects on a particular species. Other habitats may either not be impacted or are impacted at a level which does not influence the species or their occurrence. The level of analysis depends on the existing habitat conditions, the magnitude, and intensity of the proposed actions, and the risk to the resources.

Landbirds, including NTMB, were analyzed based on review of wildlife databases for the Preserve and local scientific knowledge.

Affected Environment

The grasslands and wetlands of the preserve provide habitat for a variety of birds, animals and insects. No endangered or candidate species occur within the Preserve. The Mexican spotted owl is listed as threatened but habitat suitable for the Mexican spotted owl is not contained within the project area. No Mexican spotted owls have been located through surveys conducted on the Preserve. There are no Important Bird Areas (IBA) identified in the Preserve. There are no associations or important links between the Preserve and the closest known IBA's (Valles Caldera Trust 2002a).

Table 1 identifies sensitive species (USDA Forest Service 2007) with a likelihood of occurrence in the project area or where potential habitat for the species occurs within or adjacent to the project area. These species and the potential consequences that could result from implementation of the action alternatives or taking no action at all have been analyzed.

Table 2 – Sensitive species deemed to have suitable habitat identified or to have a documented or suspected occurrence within the project area.

Species	Status	A	B	C
Bald Eagle	Sensitive	NI	NI	NI
New Mexico Meadow Jumping Mouse	Sensitive	NI	MANLAA	MANLAA
Northern Leopard Frog	Sensitive	NI	MANLAA	MANLAA

Water Shrew	Sensitive	NI	NI	NI
Ermine	Sensitive	NI	NI	NI

Key: NI = No Impact; MANLAA = May Affect, Not Likely to Adversely Affect; MIIH = may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population.

Bald Eagle (*Haliaeetus leucocephalus*)

Figure 11 – *Bald eagle*

Wintering bald eagles (Figure 11) begin to arrive on the Preserve in October and leave by May, with peak numbers only during the coldest period of January (Johnson 2003). The location and abundance of wintering eagles is dependent on food, availability of appropriate roosting and foraging habitat, and human disturbance. Location and abundance can vary from year to year. This seasonal use by bald eagles occurs mainly along the San Antonio creek, although individuals can be observed during the day at numerous locations throughout the Preserve. Most individuals seen away from water are feeding on elk carcasses as a result of hunting activities on the Preserve. Eagles typically use the trees near the creek as overnight roosts (Parmenter 2003).

Parmenter noted that hikers and vehicle traffic from two roads near the roost sites along San Antonio creek were the main causes of disturbance for bald eagles in that area.

In general, eagle concentrations occur around reservoirs and along rivers, with a scattering of birds in terrestrial habitat (Johnson 2003). There are no large water bodies to provide breeding/foraging habitat within or near the Preserve. Breeding habitat for bald eagles is limited in New Mexico and none is known to occur in the Jemez Mountains.

Nest trees are usually larger than those trees in the surrounding stands (Smith and Weston 1990), primarily conifer, and have thick, stout limbs. Bald eagles often construct alternate nests within a territory and vary use between them from year to year (USDI 1986). Eagles roost but do not nest on the Preserve (Johnson 2003).

New Mexico Meadow Jumping Mouse (*Zapus hudsonius luteus)*

Figure 12 – *New Mexico meadow jumping mouse*

The New Mexico meadow jumping mouse (Figure 12) is considered to be an extreme habitat specialist that relies on riparian areas that have tall, dense herbaceous vegetation, especially sedges, on perennially moist soil (Frey 2006)). Frey (Frey 2006) only found the New Mexico meadow jumping mouse in areas with 2 to 3 feet of vertical cover types. Montane populations use both persistent emergent herbaceous wetland (i.e. beaked sedge and reed canary grass) and scrub-shrub wetland (i.e. willow and alder) riparian communities, specific capture sites in scrub-shrub wetlands were nearly always restricted to small patches and narrow strips of herbaceous, usually sedge-dominated, microhabitats found between the water's edge and the shrubs. Tall dense sedge on moist soil appears to be the key microhabitat utilized by New Mexico meadow jumping mouse, regardless of the community type. Preferred habitat in the Jemez Mountains contains permanent streams, moderate to high soil moisture, and dense, diverse streamside vegetation of grasses, sedges, and forbs (Morrison 1985), (State of New Mexico 2008). Some recent studies have noted possible declines in populations where jumping mice have historically been found. (J. Frey 2005).

Zwank (Zwank, Najera and Cardenas 1997) found that the breeding period for this mouse is June thru August, nesting on the surface or beneath brush, logs or stumps. It has a home range of .5 to 2 acres. It feeds on seeds, insects, and fruits and when seeds are unavailable or limited, insects may compose of up to half of its diet.

The New Mexico meadow jumping mouse is not dependent on the beaver for suitable habitat but Frey (Frey 2006) has found that the loss of beaver and beaver dams in areas could have a negative impact on the mouse habitat in two ways. The dams create the moist soils need for the microhabitat and can provide barriers to people and livestock in using the habitats favored by the New Mexico meadow jumping mouse. The Preserve has historically had beavers in Sulphur and Indios Creek and personnel have recently observed an individual moving through the area but currently there are no beaver populations located on the Preserve. A beaver restoration project in Indios Creek is ongoing to restore beaver to the area within the next 3 to 4 years (Parmenter 2008)

The meadow jumping mouse apparently requires dense vegetation for population persistence, and its scarcity may be related to livestock overgrazing in streamside habitats (State of New Mexico 2008). Periodic severe flooding may also contribute to its rarity.

No formal surveys have been completed within the Preserve although wildlife data received from the adjoining Santa Fe National Forest show two locations of this species along the San Antonio Creek within the Preserve. Inventories are proposed for summer 2009 (Parmenter 2008)

Northern Leopard Frog (*Rana pipiens)*

Figure 13 – *Northern leopard frog*

The northern leopard frog (Figure 13) is typically associated with streams and rivers, although lakes, marshes and irrigation ditches (and earthen tanks on the Preserve) are also occupied. Much of the river valley habitat of these frogs has been modified by human activities, including draining of wetlands, channelization and damming of rivers, and the development of irrigation systems (Degenhart 1996). In New Mexico, they occur at elevations of about 3,500 to 11,000'. Their habitats include cattail marshes, beaver ponds and other water sources with aquatic vegetation. Breeding can occur at any time of year following heavy rainfall or in higher elevations later in the season. Egg masses are attached to emergent vegetation or lie on the bottom of the pond in shallow slow moving or still water (Amphibia Web 2008). In New Mexico Scott and Jennings (Scott and Jennings 1985) reported eggs and small tadpoles of this species from April through July and September through October.

It will be important for breeding habitat to maintain water in most areas from July to October. Initial breeding activity is related more to temperature than precipitation (Degenhart 1996). Threats to local populations include alterations in wet areas, stocking of predatory fish; local extinctions as water dries up during years of low precipitation, and predation and competition by bullfrogs.

Food habits of northern leopard frogs are unknown but undoubtedly feed on a wide variety of invertebrate prey (Degenhart 1996). The frog may forage long distances from water in upland habitat during wet periods (Degenhart 1996).

No formal surveys have been completed within the Preserve although wildlife data received from the adjoining Santa Fe National Forest show four locations of this species within the Preserve. Three historic locations are also recorded within the Preserve. Potential habitat is present along riparian corridors within the Preserve.

Water shrew (*Sorex palustris navigator*)

Figure 14 – *Water shrew*

As the name suggests, water shrews (Figure 14) are closely associated with water often found around streams and other aquatic habitats, areas of high humidity surrounded by heavy vegetation, logs and rocks are preferred. Stream banks often provide favorable cover including boulders, large stones, tree roots, overhanging ledges, willow, alder thickets, and spruce. Also found in lakes, bogs, and other lentic habitats (NatureServe 2008).

In New Mexico, water shrews are confined, so far as known at present, to the Sangre de Cristo, San Juan, and Jemez Mountains where they occur in the vicinity of permanent streams, seldom descending below 8,000 feet in altitude. Findley observed one foraging in July of 1961 on the Rio Las Vacas in the Jemez Mountains (State of New Mexico 2008).

Both terrestrial and aquatic invertebrates are consumed by water shrews (Orrock, et al. 2000). The primary aquatic organisms consumed by shrews, including stoneflies, mayflies, and cadisflies are most abundant in streams with fast current and cobble substrate (Orrock, et al. 2000).

The water shrew breeds from February through August. Nest sites are near water in underground burrows, rafted logs, beaver lodges, and other areas providing shelter (NatureServe 2008).

Common predators include fish such as trout, bass and pickerels, monks, otters, weasels, snakes and occasionally hawks and owls (NatureServe 2008).

Although no formal surveys have been conducted, water shrew have been found within the Preserve (Hope 2008).

Ermine (*Mustela erminea murices*)

Figure 15 - *Ermine*

Existing Condition

The ermine (Figure 15) is a weasel of high altitudes (7,800-11,000 feet) in northern New Mexico in association with small rodent populations in montane meadows, and avoids dense forest. Habitat includes forest-edge, grassland, shrub, wet meadows, and riparian areas. Dens in hollow log or under log, stump, roots, brushpile, or rocks (NatureServe 2008).

Swickard, Haas, and Martin (Swickard, Haas and Martin 1971 (1972)) took five specimens in the Valles Grande in the Jemez Mountains, four of which came from a meadow and one from a rock slide. All were surrounded by mixed coniferous forest at altitudes of 8,100-8,550'. No formal surveys have been completed within the Preserve although wildlife data received from the adjoining Santa Fe National Forest show eleven locations of this species within the Preserve.

Encroachment of trees into meadows, due to fire suppression or changes in climate, may also reduce ermine habitat (Buskirk 2002).

Environmental Consequences

No Action

Narration:

There would be no effect to fauna or faunal habitat.

Alternative B

Summary:

Effect	Context	Intensity
Direct	Limited to the specific location and duration where restoration activities occurred.	Minor/Moderate

Narration:

The effects resulting from the proposed action would be expected to benefit the northern leopard frog, New Mexico meadow jumping mouse, water shrew, and ermine through improvements to habitat and riparian condition.

The proposed activities could increase the quality of riparian zones by increasing cover and ensuring good stream bank stability. The restoration of wetlands throughout the project area could also increase habitat for the New Mexico meadow jumping mouse as well as reducing potential adverse impacts from localized flooding.

Proposed restoration activities could create, improve or maintain habitat for the northern leopard frog. Threats from predation could be reduced by increases in cover provided by wetland vegetation.

The action alternatives would not be likely to affect the bald eagle's use of the Preserve although improvements to the habitat of fish and other prey species could indirectly benefit the bald eagle.

Alternative C

Summary:

Effect	Context	Intensity
Direct	Limited to the specific location and duration where restoration activities occurred.	Negligible/Minor

Narration:

The effects resulting from alternative C would be expected to benefit the New Mexico meadow jumping mouse and the northern leopard frog to a lesser degree than Alternative B. Under this Alternative active erosion would be reduced. Minor to negligible improvements in habitat could be expected, current habitat would be protected. Improvements resulting from the proposed restoration of historic wetlands would not occur. The protection and improvements to riparian habitats could indirectly benefit the bald eagle although not to the degree that it would alter use by the eagle or increase numbers.

3.1.4 Aquatic Species

This section addresses potential effects of the project to threatened, endangered or sensitive (TES) aquatic species (including those species proposed for such listing) (USDA Forest Service 2007) that have been documented or have suspected occurrences on in within the aquatic habitats on the Preserve. This evaluation is required by the Interagency Cooperative Regulations (Federal Register 1978), to be compliant with the provisions of the Endangered Species Act (ESA) of 1973, P.L. 93-205 (87Stat. 884), as amended.

The existing condition is described for each species, group of species, or habitat. Direct, indirect, and cumulative effects of alternatives are identified and discussed.

Fish surveys in the two major streams/rivers of the Preserve have been completed annually. These two streams, the East Fork Jemez River and San Antonio Creek, contained a mixture of the following species:

- Rio Grande chub (*Gila pandora*)

- Fathead minnow (Pimephales promelas)
- Longnose dace (Rhinicthys cataractae)
- Rainbow trout (Oncorynchus mykiss)
- Brown trout (Salmo trutta)
- Rio Grande sucker (Catostomus plebeius)
- White sucker (Catostomus commersoni) – One individual found

The Rio Grande cutthroat trout (Oncorhynchus clarkii virginalis) was found historically within the Valles Caldera but has been since extirpated.

Of these species, those listed in Table 3 are considered in this analysis based on their listing or potential listing as Threatened, Endangered, or Sensitive (TES) (USDA Forest Service 2007).

Table 3 – TES aquatic species and their status on the Preserve

Common Name	Scientific Name	Known to occur?	Potential to Occur?
Rio Grande sucker	*Catostomus plebeius*	Yes	Yes
Rio Grande chub	*Gila pandora*	Yes	Yes
Rio Grande cutthroat trout	*Oncorhynchus clarkii virginalis*	No	Yes

Affected Environment

Rio Grande Sucker (*Catostomus plebeius*)

Figure 16 – *Rio Grande Sucker*

The Rio Grande sucker (Figure 16) is a member of the Castomid family. This sucker is characterized by its small size, soft ray fins, and a fleshy, subterminal mouth (Rees and Miller 2005). The Rio Grande sucker is usually found in low gradient, low velocity streams (Calamusso, Rinne and Turner 2002). Specimens have been collected in pool, riffle, and glide habitat types.

The historic range of the Rio Grande sucker included the Rio Grande Basin of Colorado and New Mexico, the Mimbres River and six rivers in Mexico (Calamusso, Rinne and Turner 2002). This fish has been introduced and populations have established in the Rio Honde, Gila River basin and the San Francisco River drainage (Calamusso, Rinne and Turner 2002). Currently, the Rio Grande sucker is listed as endangered in the Colorado portion of its distribution. Within its northern New Mexico range the Rio Grande sucker

appears to be in decline. A recent survey of the Carson and Santa Fe National Forests also found a decline in range and abundance of Rio Grande sucker (Calamusso, Rinne and Turner 2002).

Rio Grande sucker abundance and condition can be negatively impacted by the deposition of fine sediments (Swift-Miller, Johnson and Muth 1999); this fish usually favors larger, coarse substrate. Competition from introduced fish has been a major factor in the decline in abundance of the Rio Grande sucker. The white sucker has especially contributed to the decline of the Rio Grande sucker (Rees and Miller 2005). Other factors contributing to the decline of the Rio Grande sucker include habitat destruction and alteration, decreased water flow and increased water temperature (Rees and Miller 2005).

The Rio Grande sucker is native to the streams of the Vales Caldera (Rees and Miller 2005) and is currently found within several streams of the Valles Caldera. A 2001 survey of the East Fork Jemez River found Rio Grande sucker present in all reaches (Simino 2002). A 2002 snorkel survey of San Antonio Creek found Rio Grande suckers present in the lower reaches of San Antonio Creek (Goodman 2003). Electro-fishing surveys in 2003, 2004 and 2005 conducted by Aquatic Consultants Inc. found Rio Grande sucker present in the East Fork Jemez River but not in San Antonio Creek (Aquatic Consultants Inc. 2003)(Aquatic Consultants Inc. 2004)(Acquatic Consultants Inc. 2005). The Rio Grande sucker's absence in the later surveys does not necessarily mean that it is now absent from the San Antonio. Declines were observed following drought events in 2002 and 2006.

In the past, the San Antonio was stocked with rainbow trout twice a year by the State of New Mexico, Department of Game and Fish (NMDGF) in two locations (Goodman 2003). The East Fork Jemez River has also been routinely stocked with rainbow trout (Simino 2002). Stocking of brown trout began in the 1930's, if not before (Simino 2002). Currently, stocking of rainbow trout and brown trout does not take place, and these species are naturally reproducing (Parmenter, Valles Caldera Trust, Chief Scientist 2008). As part of an effort to increase the assemblage of native fish, Rio Grande sucker, along with other native species, were moved from the East Fork Jemez River to San Antonio Creek in 2007. The fish dispersed from the release site but the success of introduction is not yet known (Parmenter, Valles Caldera Trust, Chief Scientist 2008).

San Antonio Creek has showed some improvement in riparian conditions since the implementation of the interim grazing program according to PFC surveys (T.E.A.M.S. 2007). Water temperature at several locations in San Antonio Creek exceeds Forest Service and New Mexico Environmental Department (NMED) standards for salmonid development. From the 2003 Forest Service report: "The water temperature data was compared to both Forest and NMED standards. The Forest standards classified San Antonio Creek as not properly functioning for salmonid development at all sites except station 5 located near the headwaters. The NMED standards classified two of the five sites as not properly functioning for water quality (State of New Mexico 2002). Other water quality factors that were found to be not properly functioning: the pH of the stream

was neutral to basic and often exceeds 8.8, and ammonia and aluminum levels can occasionally exceed water quality standards (Goodman 2003). According to the 2002 survey other physical parameters that were not properly functioning included relative sediment content in riffles, the density of large woody debris, pool development, and width-to-depth ratio (Goodman 2003).

Rio Grande Chub (*Gila Pandora)*

Figure 17 – *Rio Grande chub*

The Rio Grande chub (Figure 17) is small fish averaging five and a half inches in length that is found in both rivers and lakes. This species is often confused with other members of the *Gila* genus. The Gila chub's two dark lateral stripes with occasional dark spots and a silvery color overall (Sublette, Hatch and Sublette 1990) differentiate it from other members of this genus. There is limited information on the habitat preferences of the Rio Grande chub; they have been found in pools with overhanging banks and brush and seem to prefer sand over cobble substrate. Spawning takes place in riffles with breeding likely taking place March through June (Rees, Carr and Miller 2005). During a survey of streams in the Santa Fe and Carson National Forests Rio Grande Chub were found in many streams but were only present in reaches with a gradient of less than two percent at elevations between 5,600 and 9,200 feet (Calamusso and Rinne 1996).

Historically the Rio Grande chub was abundant and widespread throughout the Rio Grande basin, the Pecos River basin, and the San Luis Closed basin (Rees, Carr and Miller 2005).

Currently, the Rio Grande chub is likely expatriated form the main stem of the Rio Grande but still found in the Rio Grande tributaries. This fish is considered to be widespread throughout suitable habitat in the Rio Grande basin of New Mexico (Rees, Carr and Miller 2005).

A number of factors have lead to the decline of the Rio Grande chub including competition and predation from introduced species such as brook trout (*Salvelinus fontinalis*); habitat fragmentation caused by impoundments and water diversions; habitat destruction from grazing, mining and other land use practices; and changes in the thermal regime caused by water impoundment releases (Rees, Carr and Miller 2005).

The Rio Grande chub has been found within several streams of the Valles Caldera. A 2001 survey of the East Fork of Jemez River (Placeholder24) found Rio Grande chub present in all reaches (Simino 2002). A 2002 snorkel survey of San Antonio Creek (Placeholder25) found Rio Grande chub present in all reaches (Goodman 2003). Electro-fishing surveys in 2003, 2004 and 2005 conducted by Aquatic Consultants Inc. (ACI) found Rio Grande chub present in the East Fork Jemez River but not in San Antonio Creek (Aquatic Consultants Inc. 2003),(Aquatic Consultants Inc. 2004),(Acquatic Consultants Inc. 2005). The Rio Grande chub's absence in the later surveys does not indicate that it is now absent from the San Antonio. Rio Grande chub, along with other native species, were moved from the East Fork Jemez River to San Antonio Creek in 2007 in an effort to increase the native fish assemblage. The fish dispersed from the release site but the success of the re-introduction is not yet known (Parmenter, Valles Caldera Trust, Chief Scientist 2008).

For the existing stream conditions of East Fork Jemez River and San Antonio Creek stream see Rio Grande sucker affected environment/existing condition section.

Rio Grande Cutthroat Trout (*Oncorhynchus clarkii virginalis*)

Figure 18 – *Rio Grande Cutthroat Trout*

Rio Grande cutthroat trout (Figure 18) is a member of the *Oncorhynchus clarkii* polytypic species is composed of 14 subspecies and several distinct racial forms (Pritchard and Cowley 2006). Rio Grande cutthroat trout possess the bright slashes on the underside of the maxillaries and are brightly colored on the sides and belly but differ from the most closest related cutthroat, the greenback and Colorado cutthroat trout, by the fewer scales in the lateral line and more pyrolic caecae (Behnke 1992).

Rio Grande cutthroat trout have been found in a variety of habitat types from mainstems to small, first-order streams. The Rio Grande cutthroat trout species requires a variety of habitat types for different life stages. Suitable gravel is required for spawning and juvenile trout need slower waters for development. As adults increase in size they tend to move into the faster moving waters of the main stem while also relying on pools and woody debris for refugia (Pritchard and Cowley 2006)

Historically the range of Rio Grande cutthroat trout is thought to have included the Rio Grande drainage of Colorado, New Mexico and Texas; the Pecos River drainage of

Colorado, New Mexico and Texas; and the Canadian River drainage of Colorado and New Mexico. The historic range may also have included the headwaters of the Rio Conchos in Mexico (Hendrickson, et al. 2002). Currently the RGCT is found in tributaries of the Rio Grande in Colorado and New Mexico; the Carnero and Sanguache drainages in Colorado; tributaries of the Canadian River in Colorado and New Mexico; and tributaries of the Pecos River in New Mexico (Pritchard and Cowley 2006).

The Rio Grande cutthroat trout has been extirpated from its historic range by a number of factors. Currently, the greatest threat to the Rio Grande cutthroat trout comes from non-native trout such as brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), rainbow trout (O*ncorhynchus mykiss*), and other forms of cutthroat trout. These introduced species can lead to increased competition and predation as well as interbreeding with rainbow trout and non-native cutthroat trout (Pritchard and Cowley 2006). Other threats to the Rio Grande cutthroat trout include migration barriers, over-fishing, habitat disturbance, and disease.

Rio Grande cutthroat trout are not currently found within the Preserve. Historically Rio Grande cutthroat trout was found in streams throughout the Preserve. The stocking of non-native trout in the late 1800's and early 1900's was probably the main cause of the extirpation of Rio Grande cutthroat trout from the streams of the Valles Caldera.

From the 2003 San Antonio Creek stream inventory report: Rio Grande cutthroat trout has been extirpated from San Antonio Creek since the 1950's by exotic trout introductions through competition, hybridization and predation (Sublette, Hatch and Sublette 1990). German brown trout is a piscivore, consuming fish like Rio Grande cutthroat trout. Brown trout also compete with native fish for food and living space in the river (Goodman 2003).

Environmental Consequences

<u>Alternative A (No Action)</u>

Narration:

Taking no action would not directly affect any of the sensitive aquatic species described. However trends and issues identified in Chapter One would persist. Impairments currently affecting the quality of habitat such as temperature and turbidity would continue and a downward trend in the quality of the habitat could occur although the intensity of this trend in space and over time is difficult to predict.

<u>Alternative B</u>

Summary:

Effect	Context	Intensity
Indirect	Throughout the project area	Minor to Moderate

Narrative:

The activities being proposed are intended to protect and improve the riparian systems within the project area. These improvements would indirectly benefit all species discussed by improving and protecting their habitats. Specifically by reducing the deposition of fine sediments, protecting gradients, increasing vegetation (which leads to a further reduction in sediment deposition as well as a reduction in temperature), and providing important habitat for insect and other food source development. The restoration of historic wetlands along San Antonio would serve to filter water and cycle nutrients and reduce impacts from high water events. However, habitat improvements would also benefit species which prey on the Rio Grande Chub, sucker and cutthroat trout. The persistence of the predators could limit actual increases in populations in spite of the important improvement and protection of habitat achieved.

The proposed action would increase the likely success of activities that could be proposed in the future to increase or reintroduce native fish.

Alternative B

Summary:

Effect	Context	Intensity
Indirect	Throughout the project area	Minor to Moderate

Narrative:

By narrowing the scope of the action to only those activities, causing direct adverse impacts to the project area improvement and protection of habitat would be achieved to a lesser degree. While addressing current and future sources of erosion (roads, meander cut-offs, head-cuts, etc.) important improvements would be likely throughout the San Antonio by reducing the deposition of fine sediments. However, the benefits incurred from the restoration of the historic wetlands would not be achieved.

3.1.5 Air Quality

Affected Environment

The proposed action is within the Middle Rio Grande Airshed in Sandoval County, New Mexico. This is an attainment area, considered having air quality as good as or better than the National Ambient Air Quality Standards. These standards are set to protect human health and general welfare.

No Action

Narration:

There would be no effect.

Proposed Action

Summary:

Effect	Context	Intensity
Direct	Limited to the specific location and duration where heavy equipment was in use.	Negligible/minor

Narrative:

There may be negligible to minor, short-term effects to air quality from equipment and activities. These effects (dust, exhaust) would not be noticed outside the area of activity.

3.1.6 Cultural Resources

Affected Environment

Historic and prehistoric resources are ubiquitous on the Preserve. These cultural resources relate to use during the Paleo-Indian period ca. 9500 – 5500 B.C., the Archaic period from 5500 B.C. – 400 A.D., the Ancestral Pueblo period 400 A.D. to 1600 A.D., through historic uses after 1600 A.D., including livestock grazing, logging, limited agriculture, and harvest of mineral and plant resources. Prehistoric artifacts are dominated by obsidian tool making, and the most common archaeological sites include lithic scatters and subsurface deposits, and sites with defined features such as rock shelters, terrace walls and field houses. Features associated with the historic period include aspen carvings, isolated cabins, corrals, and sawmill remnants.

Within the project area prehistoric artifacts are primarily lithic scatters and subsurface deposits. Much of the project area is within the historic flood plain reducing the occurrence of prehistoric features due to the natural movement of soil and surface material. Some of the features currently affecting drainage may are being considered for their eligibility for protection under the National Historic Preservation Act (NHPA).

Alternative A (No Action):

Narrative

There would be no effect to cultural resources.

Alternatives B and C

Summary:

The Valles Caldera Trust Cultural Resources Compliance Process results in an evaluation and determination of possible effects to cultural resources. This process, to be completed prior to any individual activity would ensure that no adverse effects to any cultural resource occurred. In general most of the proposed activities would occur within the historic flood plain and terraces or within existing road prisms. The hydrologic systems do not generally support in situ artifacts due to frequent overland flows and the shifting of

the stream's meander. The existing road prism has been surveyed and mitigation measures to protect cultural resource sites have been established and are known to be effective. Connected activities including developing sites for aggregate collection and accessing individual project areas with people, vehicles and equipment will be included in the completion of the cultural resource compliance process.

As mentioned in the affected environment, some of the features contributing to the drainage of wetlands may prove to be eligible for protection under the NHPA, based on the final determination of eligibility, these features would be left in place although they would no longer serve to drain wetlands.

Effect	Context	Intensity
No Effect	N/A	N/A

3.1.7 Socioeconomic Impacts

Affected Environment

The proposed and alternative actions would occur within Sandoval County. The socioeconomic impact area for this stewardship action has been limited to the Jemez Valley and adjacent communities.

Environmental Consequences

Alternative A

Narrative

No effect

Alternatives B and C

Narrative:

There would be no effect to local, regional or other socio-economic conditions.

The proposed action is not expected to directly or indirectly increase traffic, area use, or create any changes in local or regional activities. Any socio-economic or environmental effects will not be disproportionate to any individual or population.

3.1.8 Elements of Significance (not specifically addressed in 3.1.1 – 3.1.7)

- **Public Health and Safety**

  The activities as proposed are not inherently risky to participating individuals and would not have an effect on overall public health and safety.

- **Unique Characteristics of the Geographic Area**

  The Trust's valles and water/riparian resources are rare in New Mexico. The proposed action serves to protect these unique characteristic consistent with the goals of the Valles Caldera Preservation Act.

- **Controversy, Uncertainty, or would Establish Precedence.**

The activities and methods being proposed are common practices.

- **Cumulative Effects**

  The proposed action or alternative action could mitigate the effects of historic activities or combine to support current and future activities to contribute to continued protection and improvement of the watershed. However it would not combine with any past, present or reasonably foreseeable future action to significantly impact the environment or the way in which people interact with it.

- **Compliance**

  Implementation of the proposed action or alternative would not violate any local, state, or federal law or requirement imposed for the protection of the environment.

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