Wetland Action Plan:

Upper Gallinas Watershed
Las Vegas, New Mexico
2013-2014

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Prepared for the Hermit's Peak Watershed Alliance

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Disclaimer:
The authors want to acknowledge that this report is an objective look at the current status of the Upper Gallinas Watershed with respect to wetland status and condition. It is not a statement of judgment of historical or present management strategies by landowners. Furthermore it is not an interpretation of personal management of lands in a system that is longitudinally connected, because upstream use can affect downstream conditions.

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ACRONYMS

ACRONYM	DEFINITION
ACE	Army Corps of Engineers (United States Department of Defense)
ARMAS	Achieving in Research Math and Science – Internship program at NM Highlands University
BLM	Bureau of Land Management (USDI)
BMPs	Best Management Practices
CFS/cfs	Cubic feet per second
CLV	City of Las Vegas
CWA	Clean Water Act
ENSO	El Niño Southern Oscillation
EPA	Environmental Protection Agency (USDI)
GAINS	Geospatial Applications in Natural Sciences, NMHU
GIS	Geographic Information Systems
HGM	Hydrogeomorphic
HPWA	Hermit's Peak Watershed Alliance
HQCWAL	High Quality Coldwater Aquatic Life
HQCWF	High Quality Coldwater Fishery
HUC	Hydrologic Unit Code
NMAC	New Mexico Annotated Code
NMED	New Mexico Environment Department
NMHU	New Mexico Highlands University
NMOSE	NM Office of the State Engineer
NMRAM	New Mexico Rapid Assessment Method (of riverine wetlands)
NRCS	Natural Resources Conservation Service (USDA)
QAPP	Quality Assurance Project Plan
SWCD	Soil and Water Conservation District
SWQB	Surface Water Quality Bureau (of NMED)
TBD	To be determined
TMDL	Total Maximum Daily Load
UGW	Upper Gallinas Watershed
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USGS	United States Geological Survey
UWC	United World College
W/D	Width to depth ratio
WAP	Wetlands Action Plan
WAP-UGW	Wetlands Action Plan – Upper Gallinas Watershed
WBP	Watershed Based Plan
WQCC	Water Quality Control Commission
WQS	Water Quality Standards

EXECUTIVE SUMMARY

This Wetlands Action Plan for the Upper Gallinas Watershed (WAP-UGW) was developed to assess the current status, distribution, and condition of wetlands in the Upper Gallinas Watershed and to guide future actions and initiatives for the protection, restoration and enhancement of wetlands and riparian areas in the watershed. This plan is a working document that represents the best information available at the time. The plan should be updated as more information and resources become available.
The plan builds on the following findings of previous work conducted in the watershed to:

- Prevent further fragmentation of critical natural areas, habitats, natural resources, and ecosystems;
- Improve stream water quality by reducing temperature and sediment load;
- Decrease the potential for flooding in developed areas;
- Support programs that protect, restore, and enhance wetlands and riparian areas.

Specific basin concerns are:

- Gallinas Watershed is the primary water source for the City of Las Vegas;
- Destroying or degrading wetlands can increase flooding, decrease water storage capacity, decrease water quality and reduce fish and wildlife habitat.

The WAP-UGW is divided into five main sections.

Section 1*: Introduction* - provides information on the value, definition, and classification of wetlands, a geographic description of the Upper Gallinas Watershed and the purpose and need for the WAP-UGW.
Section 2*: Gallinas Watershed Ecological Landscape Overview* - describes the natural history of the watershed.
Section 3*: Resource Analysis* - identifies current and historical wetlands within the watershed, identifies and describes a reference wetland, and identifies current threats and impairments to wetlands in the watershed.
Section 4*: Wetlands Action Plan Implementation* – provides general wetland actions (BMPs) applicable to all wetlands; identifies specific wetlands in need of protection, restoration, or enhancement including recommendations; and guides wetland monitoring.
Section 5*: Local Involvement Strategies* - focuses on ways to improve local involvement in wetland protection, restoration and enhancement in the watershed.

Extensive field assessments, using the New Mexico Rapid Assessment Method (NMRAM), were conducted at 16 sites within the watershed, upstream from the Montezuma Hot Springs, during the summer of 2013. Preliminary site assessments in 2014 were conducted at sites that were inaccessible during the previous summer. Therefore, this plan focuses on 16 wetlands surveyed in 2013. Most sites were classified as riverine wetlands, while four wetlands were classified as either riverine/slope or simply slope wetlands which are associated with seeps or springs.

The majority of the wetlands surveyed ranked in the descriptive category of 'Good.' The ranking is based on Abiotic and Biotic attributes, Wetland Size and Landscape Context (Excellent, Good, Fair, and Poor). The Reference wetland and two other sites ranked 'Excellent' because of a combination of Wetland Size and Abiotic conditions, primarily stream bank stability and cover. Those sites that ranked 'Fair' were wetlands associated with springs, relatively small in size and impacted by surrounding land use or historic livestock grazing. Proximity of wetlands to roadways, surrounding wetland land use and modifications to vegetation, physical structure and hydrology were the primary anthropogenic stressors in the watershed.

Wetland management goals were developed to address critically important ecological functions and ecosystem services of wetlands. The wetlands management goals are:

1. **Protect Wetlands** – Protect all wetlands and a suitable buffer around them from conversion to other land uses and land types (no net loss of wetlands) and from degradation.
2. **Restore Wetlands** - Re-establish naturally occurring but historically lost wetlands in suitable locations where adequate hydrology exists, and rehabilitate the ecological condition of all degraded wetlands.
3. **Enhance Wetlands** – When appropriate, enhance the functionality of man-made ponds to more closely mimic natural wetlands.

Protect Wetlands from conversion to other land uses or land types is essential for one site (G3) with an 'Excellent' rating and site G7 with a 'Good' rating. Six other wetlands (sites G8, G9, G10 and G11, TS1,2,3,4, and a site in the Municipal Watershed near the settling pond) need protection because of important regulating, supporting and cultural ecosystem functions. Wetland protection tools available to assist private and public entities include:

1. Conservation easements;
2. Transfer of wetland ownership from private to public or nonprofit organizations;
3. Wetland Protection regulations by local governments;
4. Wetlands protection as a consequence of mitigation;
5. Funding programs that incentivize wetlands protection;
6. Education programs about the value of wetlands; and,
7. Wetland and buffer protection incorporated into open space plans, development ordinances and other planning documents.

Restore Wetlands to reestablish lost wetlands in areas with adequate hydrology and to rehabilitate the condition of degraded wetlands. All wetlands identified in the watershed need some form of restoration. As with the sites in need of protection, the sites identified for restoration benefit the watershed by improving a combination of regulating, supporting, provisioning and cultural ecosystem functions. The key strategies for wetland restoration include:

1. Address needed improvements in land management related to livestock grazing and residential, agricultural, and recreational uses.

2. Rehabilitate necessary hydrology and geomorphology to either reestablish lost wetlands or improve functionality and persistence of existing wetlands.
3. Rehabilitate wetland vegetation.
4. Encourage and accommodate beaver populations.
5. Heal upland erosion and sequester sediments.

Enhance Wetlands to improve the functionality of man-made ponds so they offer more wetland services than their original intent and more closely mimic natural wetlands. Four man-made ponds were identified with good potential to enhance wetland functions and characteristics. The key strategies for wetland enhancement involve:

1. Reshape the banks of man-made ponds to enable the growth of native wetland vegetation, increase habitat diversity and improve soil water storage;
2. Plant native riparian and wetland vegetation along pond perimeters.

Priorities for protection, restoration or enhancement actions will help to achieve the most improvement in ecosystem function at the lowest effort and cost. A priority rating system was developed as a guide. The following factors were considered in the priority rating system:

- High ecosystem function and services
- Vulnerable to loss or degradation
- Ease of action
- Willing landowner
- Cost/Benefit

Priority sites for both protection and restoration include sites G2, G3, G7 and G10. In addition, sites TS1-4 could be easily restored due to the low cost/benefit ratio, landowner willingness and value to ecosystem functions and services. Two sites are the highest priority for wetland enhancement, site G2 and a site along the Gallinas River, downstream of site of G8.

The most significant gap in wetland information for the Upper Gallinas Watershed consists of the absence of NMRAM assessment for wetlands in the National Forest areas, where only general reconnaissance was completed for this plan. Furthermore, in order to implement wetland restoration and enhancement work, detailed project designs are needed.

The establishment of long-term monitoring sites for these key wetland areas (G1, G3, G7, G9 and G10) is recommended to provide data for a periodic reassessment of this WAP-UGW. Minimally, NMRAM should be used as the long-term monitoring methodology at the recommended sites. Long-term monitoring should be done in addition to effectiveness monitoring at restoration project locations. Involvement by a diverse public is crucial in order to realize wetland protection, restoration and enhancement work proposed in this plan. No single approach to reaching these diverse groups is adequate. Public involvement should consist of a combination of education programs and hands-on engagement activities. In the Gallinas and greater Las Vegas community, a very direct and personal approach to bringing the public into improving and maintaining watershed and wetland health is essential.

Other significant recommended wetland management actions discussed in this WAP are:

1. Develop a locally appropriate wetland buffer and BMP document and provide it to wetland landowners, elected officials, land management organizations, and land management government agencies.
2. Conduct a road assessment to determine current road/wetland conflicts and recommend needed road modifications to protect wetlands.
3. Review and improve local regulations, policy and planning documents related to wetlands.
4. Find funding to conduct beaver education programs and install structures to encourage human coexistence with beavers.
5. Conduct a comprehensive assessment of upland erosion and develop specific remediation priorities and project plans.
6. Identify appropriate sites and pursue wetlands mitigation partnerships.

INTRODUCTION

Wetlands and associated aquatic and riparian habitats are relatively small biotic communities in the Southwestern United States, but their overall importance is vastly disproportionate to their limited occurrence and geographic distribution (Minckley and Brown, 1994). Wetlands and riparian habitats in the Upper Gallinas Watershed have vital ecological, economic, aesthetic, and cultural value. These habitats serve many essential ecosystem functions including water purification and storage, erosion reduction, sediment storage, pollution control, nutrient cycling and carbon storage, and critical habitat for many different plants and animals. For these reasons, this Wetlands Action Plan (WAP) was undertaken to develop a coordinated management approach to protect, restore and enhance critical wetlands in the Upper Gallinas Watershed.

Ecosystems such as wetlands are dynamic interrelated collections of biological communities (plants, animals, fish, birds, microorganisms and people) interacting with each other and the physical environment (water, soil, air, topography) within a given area at a particular time. Ecosystem functions are ecological processes (biological, physical and biogeochemical) that occur within an ecosystem and are important in maintaining ecosystems, biodiversity and ecosystems services. When ecosystem functions contribute goods or services that people value they are referred to as ecosystem services, such as providing clean water quality, flood protection, and carbon sequestration. Often ecosystem functions and services are linked to each other. For instance, one wetland ecosystem function is the regulation of soil retention by minimizing soil loss with abundant vegetation cover, root biomass, and retaining rock and soil biota. People value the ecosystem services associated with soil retention in terms of the benefit of improved water quality. Therefore, the function of soil retention becomes a valued ecosystem service to people because of the benefit associated with reduced water treatment costs to the community utilizing the water resource.

Ecosystem functions can be grouped into four categories based on their functional role. Regulating functions maintain essential ecological processes and life support systems. Supporting functions provide suitable habitat for wild plants and animals. Provisioning functions provide natural resources. Cultural functions provide esthetic and life-fulfilling opportunities to people through exposure to life processes and natural systems and use of natural resources. An understanding of the interdependence of ecosystem functions and services allows communities to better manage and protect critical wetland resources.

Wetlands Definition

Wetlands are lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities (USDI: Fish and Wildlife Service, 1979). These areas are located between the aquatic and terrestrial systems and have characteristics of both systems (Reddy et al., 2000). There are three components that comprise all wetlands: hydrologic environment, biogeochemical properties and the composition of the biological community. The hydrologic environment has water for at least part of the year, either flooding above ground and/or saturating the root zone of the vegetation. The biogeochemical environment is unique and has properties of both terrestrial and aquatic areas, but tends toward anoxic (without oxygen) for at least

part of the year due to the nature of the hydrologic environment. The biologic community is also unique mainly due to the presence of terrestrial plants that can withstand water inundation of their roots and stems. In some systems this inundation is for only part of the year and in others it is permanent. Wetlands also support unique animals, such as amphibian, and microbial communities. Furthermore, the State of New Mexico defines a wetland as those areas which are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (NMAC 20.6.4; SWQB, 2012).

The upland limit of a wetland is the boundary between: 1) land that supports predominantly hydrophytic plants, soil types that are predominantly hydric, and evidence of hydrology that supports wetlands; and 2) land with predominantly mesophytic or xerophytic vegetative cover, soil that is non-hydric and land that is not saturated or flooded sometime during the growing season. The lower boundary between wetlands and deeper water habitats associated with riverine and lacustrine systems lies at two meters below low water, or the maximum depth at which emergent plants can grow.
In New Mexico, wetlands are predominately associated with distinct landforms and have certain homogeneous natural attributes. In the semi-arid southwest, wetlands occur in river and stream floodplains and at springs, around lakes, in depressional swales and as playas (Dick-Peddie, 1993). They not only include typical emergent herbaceous marshes, but also forested and shrubland wetlands of riparian zones that are dependent on surface and/or groundwater. The riparian zone is the area of vegetation and soil directly adjacent to a body of water that is influenced by the water and influences the water and is considered to be a wetland.

Wetland Action Plan Framework

The Wetland Action Plan for the Upper Gallinas Watershed (WAP-UGW) provides a framework for documenting the current location and condition of wetlands, recommending future stewardship actions for wetlands and riparian areas, identifying data gaps, and continuing public education and engagement in the watershed. Through a collaborative effort between federal and state agencies, the City of Las Vegas, non-governmental organizations (such as the Hermit's Peak Watershed Alliance), local contractors, and the public, comprehensive watershed based actions can be implemented to protect, restore and enhance wetland ecosystem functions and services. This WAP-UGW is intended to complement the Updated Watershed Based Plan for the Upper Gallinas River (WBP) published in 2012 which addresses the water quality impairment of the Upper Gallinas River (Hermit's Peak Watershed Alliance, 2012a).

Classification of Wetlands

Wetlands are as variable as the factors that result in their development. Hydrologic conditions, soil properties, geologic characteristics, vegetation, wildlife and human society all play roles in the formation or state of a wetland (Mitsch and Gosselink, 2007). Classification of wetlands is necessarily broad, because if classifications are too specific they lose functionality. For the purpose of this plan we have used the HGM classification developed for the U.S. Army Corps of Engineers (Brinson et al., 1995;

Hauer et al., 2002). This classification system has seven types of wetlands: Depression, Tidal Fringe, Lacustrine Fringe, Slope, Mineral Soil Flats, Organic Soil Flats, and Riverine. Only two of these wetland types (Riverine and Slope) occur in the Upper Gallinas Watershed (Table 1). Riverine wetlands are the most common type in the watershed. Springs, which are considered a type of slope wetland because their water source is predominately discharge of groundwater, are common in the upper watershed. Only one series of springs was surveyed during this study due to restricted access because of Santa National Forest closure during the summer 2013.

Table 1. Detailed descriptions of HGM wetland types found in the Upper Gallinas Watershed (Adapted from Hauer et al., 2002).

HGM Wetland Class	Definition
Riverine	Riverine wetlands occur in floodplains and riparian corridors in association with stream channels. Dominant water sources are overbank flow from the channel or subsurface hydraulic connections between the stream channel and wetlands. Additional water sources may be interflow or occasional overland flow from adjacent uplands, tributary inflow, and precipitation. When overbank flow occurs, surface flows down the floodplain may dominate hydrodynamics. In the headwaters, riverine wetlands often intergrade with slope or depressional wetlands as the channel (bed) and bank disappear, or they may intergrade with poorly drained flats or uplands. Perennial flow is not required. Riverine wetlands lose surface water via the return of floodwater to the channel after flooding and through surface flow to the channel during rainfall events. They lose subsurface water by discharge to the channel, movement to deeper groundwater (for losing streams), and evapotranspiration. Peat may accumulate in off channel depressions (oxbows) that have become isolated from riverine processes and subjected to long periods of saturation from groundwater sources. Bottomland hardwood floodplains are a common example of riverine wetlands.
Slope	Slope wetlands are found in association with the discharge of groundwater to the land surface or at sites with saturated overland flow with no channel formation. They normally occur on sloping land ranging from very gentle to steep. The predominant source of water is groundwater or interflow discharging to the land surface. Direct precipitation is often a secondary contributing source of water. Hydrodynamics are dominated by downslope unidirectional water flow. Slope wetlands can occur in nearly flat landscapes if groundwater discharge is a dominant source to the wetland surface. Slope wetlands lose water primarily by saturated subsurface flows, surface flows, and evapotranspiration. Slope wetlands may develop channels, but the channels serve only to convey water away from the slope wetland. Slope wetlands are distinguished from depression wetlands by the lack of a closed topographic depression and the predominance of the groundwater/interflow water source. Fens are a common example of slope wetlands.

Figure 1. Spring-fed slope wetland - site G4.

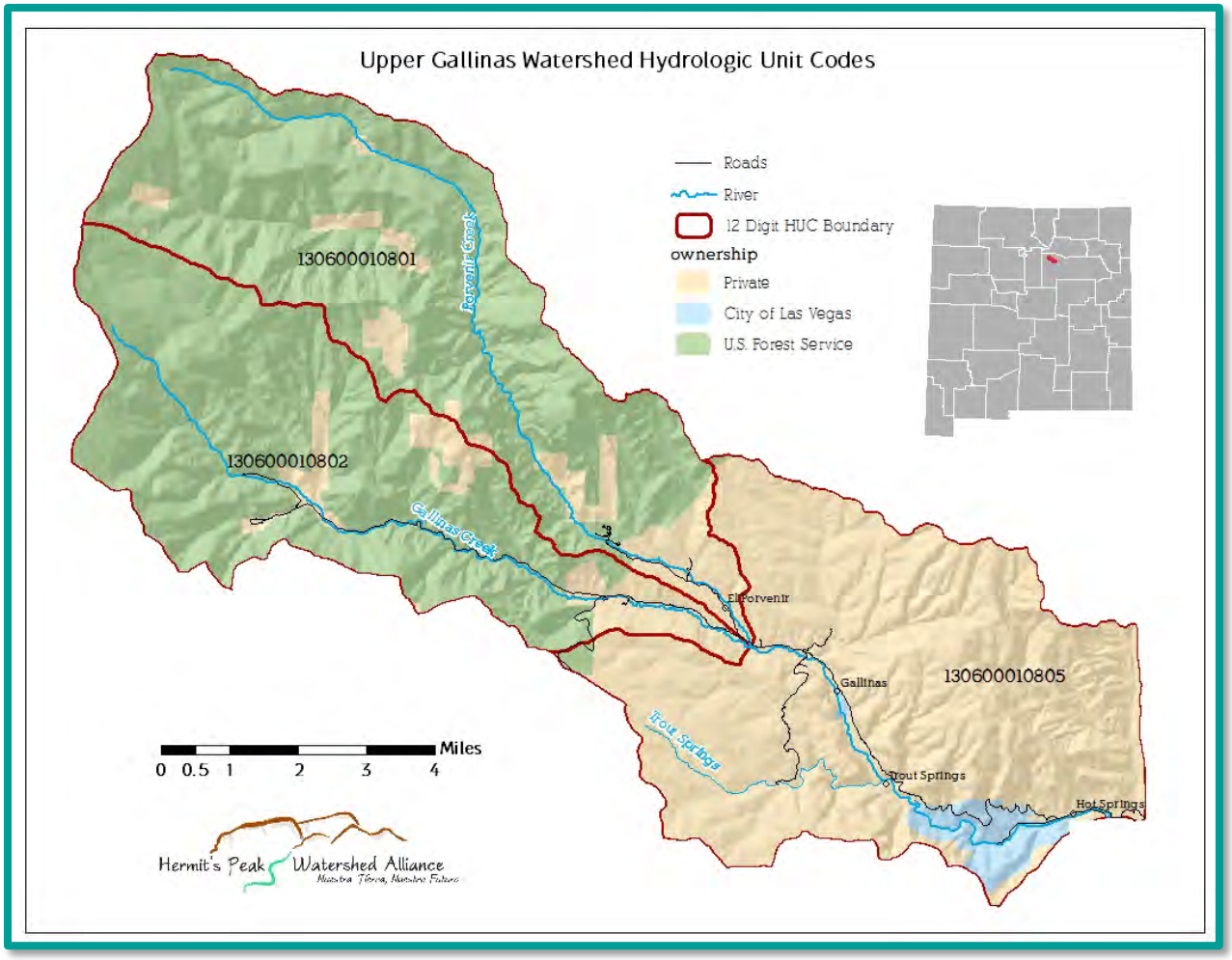
Geographic Setting

The Upper Gallinas Watershed is a sub-watershed of the Pecos Watershed and is located in northeastern New Mexico. The watershed is 54,715 acres (85.5 mile^2) from its headwaters on Elk Mountain to the Montezuma Hot Springs near Montezuma, NM, including Porvenir Canyon to the headwaters of Beaver Creek. This total of 35.3 miles of stream length descends from an elevation of 11,661' to 6,800'. The watershed covers the Gallinas River, Gallinas Creek and Porvenir Canyon, Hydrologic Unit Codes (HUC) 130600010801, 130600010802 and 130600010805 (Table 2, Figure 2). The WAP-UGW project area included the entire area covered by the WBP for the Upper Gallinas River with an additional downstream area to the Montezuma Hot Springs. The area downstream of the WBP area was added to the WAP since numerous proposals are currently being considered that affect these critical wetlands.

Table 2. Project area description for the Updated Watershed Based Plan for the Upper Gallinas River.

Name	HUC (12)	HUC Size (acres)	Main Stem Length (miles)	Description
Porvenir Canyon	130600010801	18,029	14.4	Entire length of Porvenir Creek up to headwaters of Beaver Creek
Gallinas Creek	130600010802	16,073	12.4	Gallinas Creek from confluence with Porvenir Creek up to its headwaters
Gallinas River	130600010805	20,613	8.5	Gallinas River from the Montezuma Hot Springs to its confluence with Porvenir Creek
TOTAL	**1306000108**	**54,715**	**35.3**	

Figure 2. Map of the Upper Gallinas Watershed covered in this WAP-UGW including basins/hydrologic units.



Purpose and Need

Hermit's Peak Watershed Alliance developed this Wetlands Action Plan (WAP) for the Upper Gallinas Watershed as a complementary plan to the 2012 Updated Watershed Based Plan for the Upper Gallinas Watershed (Hermit's Peak Watershed Alliance, 2012a). The primary goal of the Watershed Based Plan (WBP) was to address water quality impairments identified in the Total Maximum Daily Load (TMDL) approved by the New Mexico Water Quality Control Commission (WQCC), specifically temperature impairment of the Gallinas River and Porvenir Creek (SWQB, 2005). Riparian vegetation is the component of stream systems that contributes most significantly to meeting the stream temperature regulation and designation as a high quality coldwater aquatic life use (Hermit's Peak Watershed Alliance, 2012a). The ultimate goal of the WBP was to remove the Gallinas River and Porvenir Creek from the list of impaired waters, and understand the overall watershed health. However, it did not address the occurrence, geographic distribution, condition and management of all types of wetlands in the watershed. This Wetland Action Plan for the Upper Gallinas Watershed (WAP-UGW) incorporates conclusions drawn from the WBP as they relate to riverine and slope wetlands but goes beyond water quality issues to address all wetland concerns and functions.

This WAP-UGW was developed as a planning document to assess the current status, distribution, and condition of wetlands in the watershed and to guide future action initiatives for the protection, restoration and enhancement of wetlands and riparian areas in the watershed. This plan is a working document that represents the best information available at the time. The plan should be updated as more information and resources become available.

Based on the findings of the WBP, the WAP-UGW builds on the following:

- Prevent further fragmentation of critical natural areas, habitats, natural resources, and ecosystems;
- Improve water quality by reducing temperature and sediment load;
- Decrease the potential of flooding;
- Support programs that restore, protect and enhance wetlands and riparian areas.

The need for this document originates from the extensive wetland loss nationwide and locally. An estimated 36% of NM wetlands were lost between the 1780s and 1980s (Mitsch and Gosselink, 1993). Human activities cause wetland loss and degradation by changes in water quality, quantity and flow regimes, increased pollutant inputs and modification of species composition. Common activities that are known to alter wetland size or function include: 1. hydrologic modifications that alter the flow of water, including depositing, draining, dredging and channelizing, damming, and diverting; 2. ground water withdrawal and conveying water from the springs that support those wetlands; 3. pollution inputs from sediments, nutrients, fertilizers, pesticides, road-salt, human sewage and animal wastes; and 4. vegetation damage associated with hydrologic modification, pollution inputs, grazing by domestic livestock, and introduction of non-native species that compete with native species (US Environmental Protection Agency, 2001).

Specific concerns in the Upper Gallinas Watershed are:

- Gallinas Watershed is the primary water source for the City of Las Vegas;
- Destroying or degrading wetlands can increase downstream flooding, cause loss of water storage capacity, reduce habitat, and decrease water quality.

Planning for the protection, restoration, and enhancement of wetlands and riparian areas, stream corridors, springs, and seeps in the watershed is critical to: 1. Reverse loss and degradation of wetland and riparian areas and critical landscape functions; 2. Address impacts of gradual landscape fragmentation; and 3. Guide future development activities that minimize impacts and loss of vital water resources, encroachment, and wildlife habitat.

Wetland Action Plan Partners and Planning Process

This WAP-UGW was funded by the NMED Wetlands Program with complimentary work funded through the Clean Water Act Section 319 under the U.S. EPA-Region 6. The plan was initiated in 2013 and wetland assessments were conducted during the summers of 2013 and 2014. Besides NMED, project partners and contractors included:

- Hermits Peak Watershed Alliance (non-profit watershed stewardship organization; main project contractor)

- Joe Zebrowski – NMHU GAINS Lab
- New Mexico Highlands University professors, ARMAS program, and ARMAS interns
- Rick McNeill - Juniper Botanical Consulting
- Lisa Failing Bentson – Lux Natura Environmental Consulting

Identified stakeholders included:

- Landowners and residents of the Upper Gallinas Watershed
- City of Las Vegas
- San Miguel County
- New Mexico Office of the State Engineer
- U.S. Forest Service
- Tierra y Montes Soil and Water Conservation District
- NM Forest and Watershed Restoration Institute
- La Placita Fire Company
- United World College - USA
- Luna Community College, EPSCOR grant

This plan was compiled and authored by Lisa Failing Bentson (environmental consultant, DBA Lux Natura Environmental Consulting), Lea Knutson (project manager, HPWA Executive Director), Katie Withnall (project coordinator) and Rick McNeill (botanist, DBA Juniper Botanical Consulting). Stakeholders listed above have not explicitly endorsed or supported the statements and findings of the WAP-UGW; however they were involved in its review process. The authors assume responsibility of all content of this plan. The WAP-UGW is a living document and will be updated when then the need arises or as more information becomes available.

The planning effort was guided by a seven member steering committee. The development of a WAP consisted of the following efforts according to guidelines from the Wetlands Program of the NMED:

1. Conduct a Wetlands Resource Analysis
2. Develop a Wetlands Resource Management Strategy
3. Build a Local Public Involvement Strategy

The WAP-UGW was reviewed by the partners, steering committee, and stakeholders prior to approval by the NMED.

GALLINAS WATERSHED ECOLOGICAL LANDSCAPE OVERVIEW

The Upper Gallinas Watershed is located to the northwest of the City of Las Vegas and supplies it with 90% of its required water. The 13,753 people that live in the City of Las Vegas (U.S. Census Bureau, 2010) and some outlying areas like the Storrie Project, is therefore heavily dependent on the Gallinas River that only produces average flows of 17.3 cubic feet per second (cfs) (annual mean discharge for the past ten years) (U.S. Geological Survey, 2012). City water storage capacity is also limited, so maintaining consistent stream flows of high quality water is of utmost concern to Las Vegas.

The area has been occupied by Native American, Hispanic and Anglo people for over 300 years (deBuys, 1985). A complex interplay of ecological, cultural, economic and bureaucratic forces has given rise to the compromised condition of all wetlands and the overall health of watersheds. A relatively arid climate, fragile soils and vegetation, and complex historical interactions between Native American, Hispanic and Anglo residents and the environment has also led to depressed economies, short-term land management objectives, and land used in excess of its capacity to regenerate. The management of the area has changed as the human population size has increased and the cultures utilizing the area's natural resources have changed. This shift in natural resource utilization makes it difficult to determine the historical extent of wetlands in the watershed.

This less than healthy condition, as indicated by current and potential future stream impairments (e.g. high water temperature, limited flow, excessive sedimentation), is rooted in the type of relationship humans have with the land. For stream impairments and overall watershed health to improve and brace itself for unpredictable future conditions, addressing and improving this relationship is essential. To do this we must address the basic understanding of the value of ecological services provided by a healthy watershed, what it takes to restore and maintain a watershed, provide community support to motivate people to do so and provide the financial and technical assistance to get the job done. These key elements are addressed in the Public Involvement Strategy section.

Geology

The Upper Gallinas Watershed is in the Sangre de Cristo Range of mountains. The Sangre de Cristos are the southeastern terminus of an east branch of the Rocky Mountains. However, the mountains are young compared to the geology that has been exposed with their uplift beginning about 4 Ma bp (Millon years before present). Hermit's Peak (Cerro de Tecolote) is an ancient granitic batholith that was emplaced billions of years ago (Lindline, 2014). The heat and pressure of the intrusion metamorphosed rocks around the periphery of the formation. The emplacement took place deep in the Earth's crust. Over billions of years, climates and organisms, geological movements with plate tectonics and mountain forming events shaped the geology. Consequently, at High Point on NM65 in the roadcut above Montezuma can be seen layers of sedimentary rocks, some of which have been realigned vertically, and are topped by horizontal layers of mud- and sandstones (Lindline, 2014). The cliffs above the Skating Pond are a portion of the Hermit's Peak intrusion. On the top of Johnson's Mesa are fossil clam shells, but the road to the summit from Western Life Camp passes through areas of metamorphic rocks. The mountains to the west intercepted moisture from weather systems. The various rock types and the geological history create a varied pattern of landforms, soils and ecosystems.

The uplift of the mountains had the dual effect of increasing precipitation at higher elevations and increasing the force of water in its descent from the mountains. The mountains are continuously weathering and the regolith moving downward under the force of gravity. Uplifts tend to cause stream channels to incise where parent materials are subject to faster weathering than other areas. The steep terrain of the watershed is an indication of the recent uplift and the magnitude of down-cutting that has occurred across the landscape. Erosion and subsequent stream sedimentation are inexorable phenomena in mountains, only the rates of which change over time. Many soils on steep slopes in the watershed are gravel or cobble because fine soil particles that form are transported downslope and frost heaving and bioturbation maintain instability and mixing of the surface regolith. Fine soil materials accumulate in valley bottoms but will eventually become entrained in downstream movement. Evidence of the extent of historical erosion can be seen at the dam site above the Skating Pond, where about 20' of sediment accumulated over a period of about 40 years. Ridges in the watershed are usually very rocky or rock outcrops subject to high winds and harsh, dry conditions. Steep cliffs and scarps occur throughout the watershed but are particularly common with sedimentary rock formations.
A number of physical, chemical, and biological properties define wetland soils (Reddy, et al., 2000). The formation of wetlands soils is a product of the erosion of upland parent rock material and climate within the watershed.

Climate

The Earth's climate has fluctuated extensively throughout the geological record. Consequently, fossils of plants similar to those found in Central America have been found near Bernalillo, NM from a period of warm climate about 50 million years ago (Axelrod, 1948 and 1979). Over the past 4 million years, the uplift of the Rockies occurred; then, about 2.5 million years ago the Earth began to oscillate between ice-ages and warm interglacial periods. Ice-ages have typically persisted for about 100 thousand years (ka), while warm interglacial periods, such as that we are in today have been relatively brief (ca. 10-20 ka). The building of mountains across western North America about 4 million years ago also led to the drying of the climate in New Mexico. Most of the upper watershed was probably similar to timberline and alpine environments seen at high elevations in the Pecos Wilderness today. The elevations around that of Las Vegas would have supported the subalpine vegetation seen below timberline today. Plant species migrated from lower to higher elevations and from southern to northern latitudes as the climate rapidly warmed and dried at the end of the Pleistocene (last ice-age). The effects of the shift is believed by some to also mean that plant populations are still migrating from that dramatic change about 16 – 20 ka before present.

The current climate of the watershed is a function of its elevation and geographic position on the continent and can best be characterized as semiarid continental with a summer monsoon (CLIMAS, 2014). Three principal air masses give rise to New Mexico's weather and climate today, although over geologic time the proportional influence of the air masses has varied. The climate feature of critical importance to people and biota in New Mexico is the summer monsoon. Historically, the summer monsoon delivers about 70% of the annual precipitation to lower elevations. The summer monsoon occurs because of moist and warm Tropical Maritime air masses moving northward from the Gulf of

Mexico. Summer thunderstorms can deliver upwards of 2"(inches) of precipitation in an hour. Monsoon events with heavy downpours on saturated soils have caused downstream flooding in some years. Winter storms are from low pressure systems that arise over the northeastern Pacific Ocean in the Gulf of Alaska. Polar Maritime air masses move across the continent from west to east. If the polar and subtropical jets streams shift the air masses northward and southward, storm systems often track north of New Mexico. Upper elevations of the watershed receive significant snowfall from these weather systems, but lower elevations receive lesser amounts. Las Vegas is highly dependent on the winter snowfall that accumulates in the upper watershed.

The orographic effect of greater precipitation at higher elevations results in a sharp gradient in annual precipitation from about 14" in Las Vegas at 6500' (feet) elevation to about 40-45" at 11,000' elevation (CLIMAS, 2014). Temperatures also decline substantially with elevation. Moreover, greatest precipitation falls on west slopes of mountains from most Polar Maritime systems, usually leaving the watershed in a "snowshadow." Heavy snowfall events mostly occur when a low pressure zone is south of, or at the latitude of the watershed and strong, easterly upslope winds are present. The dry and cold, Polar Continental air mass arises over the northern latitudes of North America. The passage of a Polar Maritime system is often followed by the arrival of a dry and very cold Polar Continental air mass. Cold fronts are usually influenced by Polar Continental air masses. The watershed's distance from any ocean, and its high elevation, lead to a relatively cold, dry environment. The movement of air masses is influenced by other distant phenomena.

The El Nino Southern Oscillation (ENSO) of the Eastern equatorial Pacific Ocean causes oscillations in weather in New Mexico (WRCC, 2014). El Nino, the warm phase, results in greater precipitation in the watershed; while the cool phase, La Nina, results in drought conditions. ENSO phenomena change relatively quickly over 2-5 years compared to decade or longer cycles seen in the Pacific Decadal Oscillation or the North Atlantic Oscillation (Sheppard et al., 1999). The multi-decadal drought from the late 1940s to the early 1970s, with its greatest depth in the 1950s, was the result of sustained Pacific and North Atlantic surface temperature conditions. The climate record can be expanded with the dendrochronological records from New Mexico. A drought that spanned nearly a century directly influenced the dissolution of the Chaco Canyon phenomena in the San Juan Basin. Other severe droughts have occurred, such as in the 1400s, which had profound effects on history, people and vegetation. Droughts are a failure of moisture supply while evaporative demand continues unabated. The watershed is in the Northern Mountains Climate Zone (2) of New Mexico (ESRL, 2014). This climate zone has had an increase in temperature and aridity in the past 30 years when the post-1980 average conditions are compared to the full 127 year average. Whether this trend will continue is open to speculation. Some authors predict that climate across the entire Southwest will become like conditions in the 1950s drought (Hayes, 2008; ESRL, 2014). However, as temperatures rise the atmosphere can hold greater quantities of moisture and oceanic surface temperatures are expected to increase. Mountain ranges, such as the Sangre de Cristos, may experience increases in precipitation as the climate warms. Currently, the consensus opinion seems to be that Southwest climate will warm and dry significantly in the future continuing the current trend.

Surface Hydrology

The most extensive hydrologic data set for the Upper Gallinas Watershed is from the USGS 08380500 Gallinas Creek near Montezuma, NM stream site (USGS, 2014). The drainage area at this site is approximately 84 mi^2 and slightly smaller in size than the study area of the UGW-WAP. Over the past 87 years, the mean annual discharges have fluctuated widely around the mean of 19.5 cfs. In 1956 the record low mean annual discharge was 2.56 cfs, while in 1941 the record high mean discharge was 80.7 cfs (Figure 3). There are two seasonal peak discharge periods for the watershed as shown in Figure 4. The spring-run off peak in April and May is associated with snow-melt; and the late summer peak in August and September which is associated with monsoon moisture. During the period in which data were collected for this study (June and July, 2013), discharge was well below the historical 87 year median discharge, with the exception of one storm event in late July (Figure 5). The peak discharge in September indicates the potential for extreme flows within the watershed and need for wetlands to help mitigate flow surges.

Figure 3. Mean annual discharge for USGS 08380500 Gallinas Creek near Montezuma, NM stream site (blue line) and Mean discharge for the Calculation Period: 1926-09-01 to 2013-09-30 (red line) (USGS, 2014).

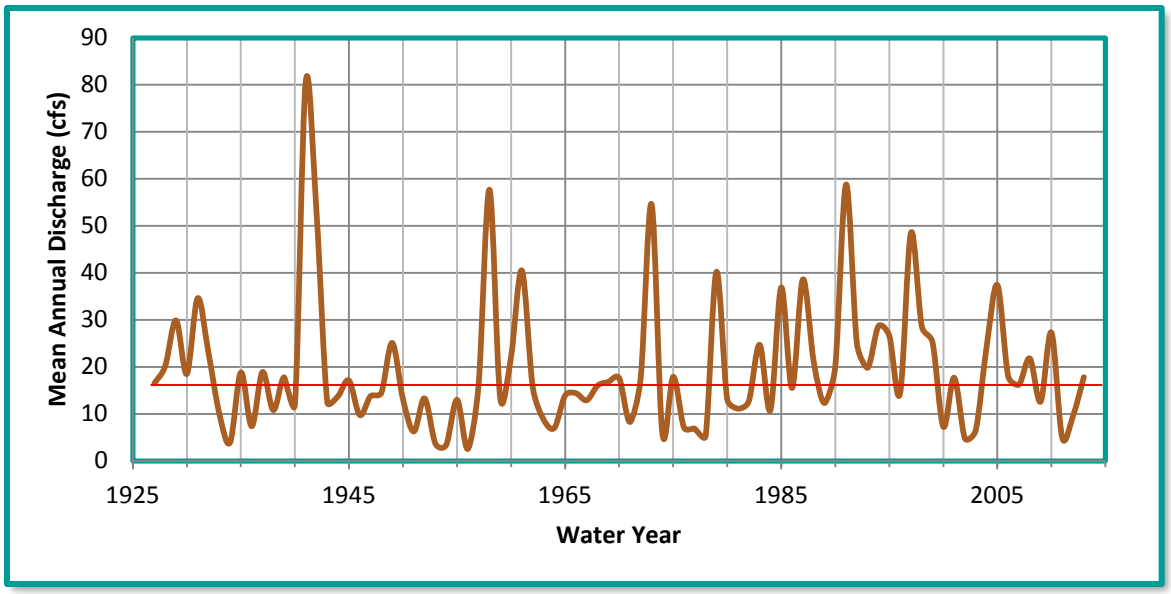


Figure 4. Mean monthly discharge for the USGS 08380500 Gallinas Creek near Montezuma, NM stream site. Error bars represent the variability of the data expressed as the Standard Error of the Mean for the 87 year period of record (USGS, 2014).

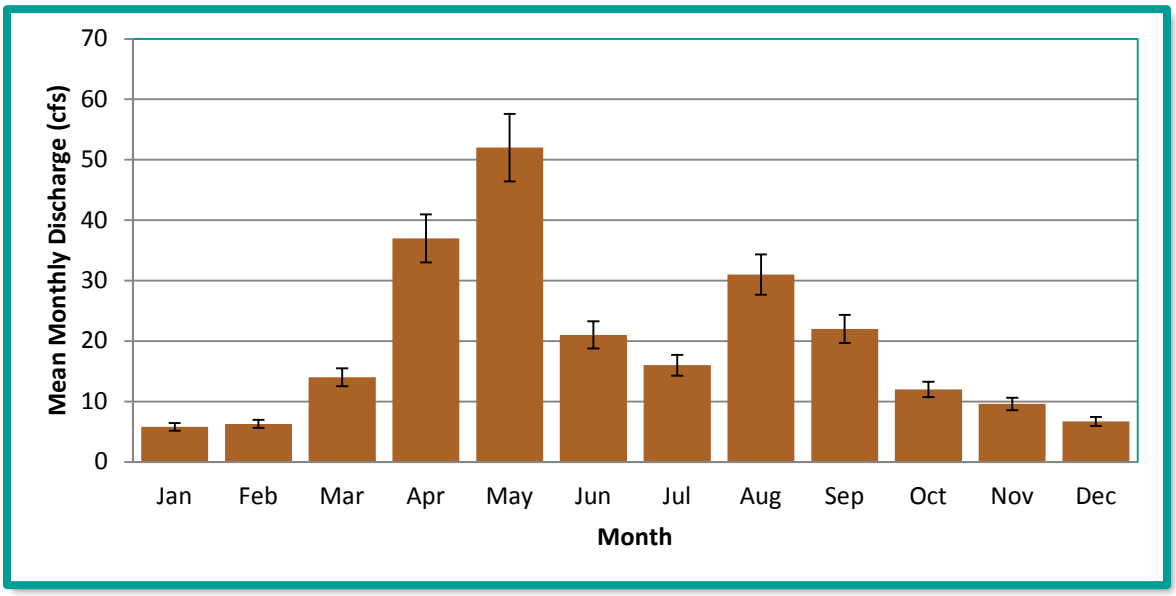
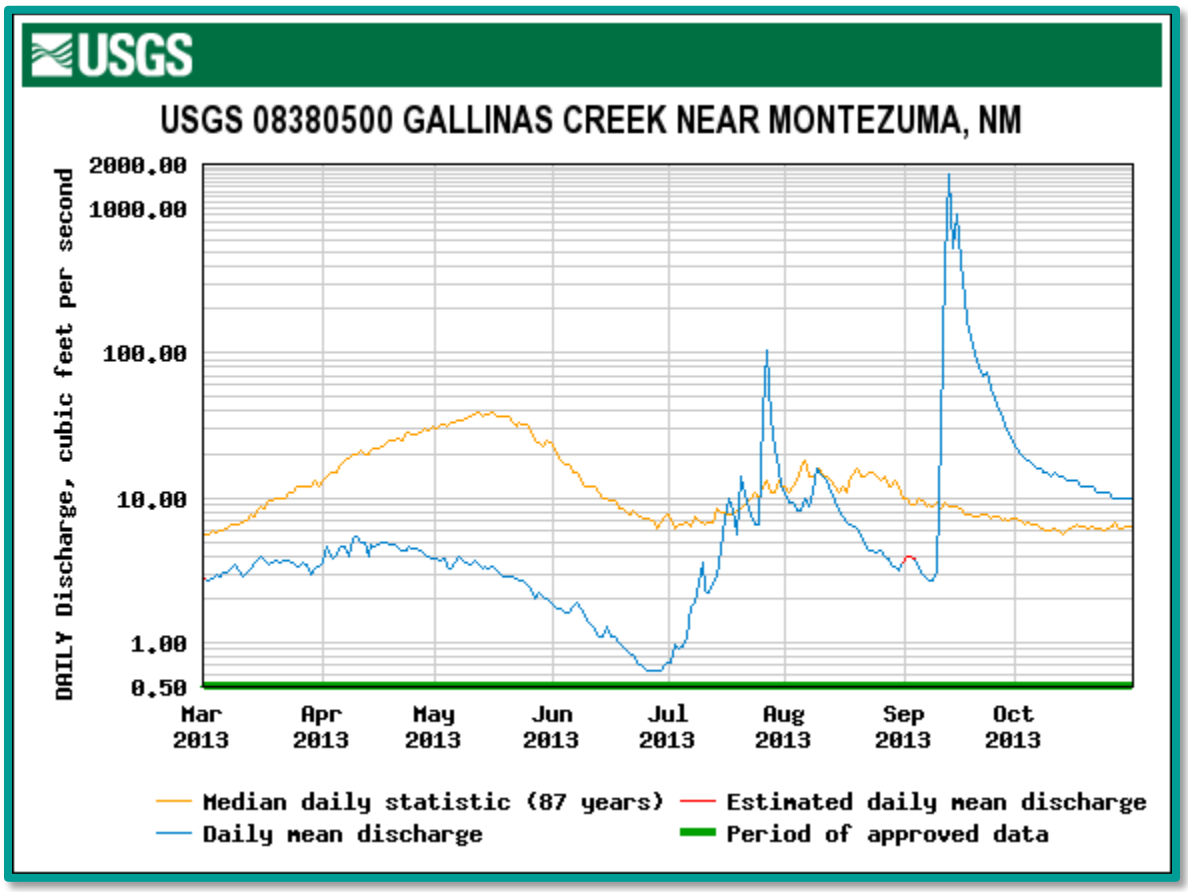


Figure 5. Mean daily discharge for USGS 08380500 Gallinas Creek near Montezuma, NM stream site for the period 2013-03-01 to 2013-10-31 (USGS, 2014).



Water Quality

The water quality standards for the watershed fall within segment 20.6.4.215 NMAC (NMAC, 2013). For this segment, the Water Quality Standard states:

- 20.6.4.215 PECOS RIVER BASIN - Perennial reaches of the Gallinas River and all its tributaries above the diversion for the Las Vegas municipal reservoir and perennial reaches of Tecolote Creek and its perennial tributaries.
- A. Designated Uses: domestic water supply, high quality coldwater aquatic life, irrigation, livestock watering, wildlife habitat, industrial water supply and primary contact; and public water supply on the Gallinas River.
- B. Criteria: the use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses, except that the following segment-specific criteria apply: specific conductance 300 µS/cm or less (450 µS/cm or less in Wright Canyon creek); the monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.
- [20.6.4.215 NMAC - Rp 20 NMAC 6.1.2212, 10-12-00; A, 05-23-05; A, 12-01-10]

The New Mexico Environment Department (NMED) determined in 2005 that high quality coldwater aquatic life is not fully supported in the Gallinas River (Las Vegas diversion to headwaters) and that temperature is the cause of that impairment (SWQB, 2005; Hermit's Peak Watershed Alliance, 2012a). The total maximum daily load (TMDL) lists nonpoint pollution sources of temperature impairment for the Gallinas River as: highway/road/bridge runoff, livestock (grazing or feeding operations), loss of riparian habitat, rangeland grazing, streambank modification/destabilization, and natural (SWQB, 2005). Impairment of other water quality parameters, such as dissolved oxygen or macroinvertebrate community health which can be affected by temperature impairment, were not reported in other studies of the watershed (SWQB, 2009; Hermit's Peak Watershed Alliance, 2012d).

HPWA conducted further assessments of stream temperature conditions in order to isolate high temperature inputs and important coldwater sources (Hermit's Peak Watershed Alliance, 2012b) and the two principal factors affecting stream temperature that are controllable by management: stream shading and stream width to depth ratio (Hermit's Peak Watershed Alliance, 2011). Data on the occurrence of beaver in the upper watershed, which are known “environmental engineers” that help moderate stream temperatures, indicate a limited occurrence in the area (Hermit's Peak Watershed Alliance, 2012c). Management measures to support load reductions are reported in the WBP (Hermit's Peak Watershed Alliance, 2012a).

Soils

Soils are formed by the action of climatic conditions and organisms on the geological materials present at a site. Weathering reduces the sizes of particles. Small particles are more easily displaced than large ones by runoff and gravity. Soils in the watershed are poorly developed in most places, often lacking organic, A or B horizons on steep hill slopes, ridges and near rock outcrops. Fine soil particles are rapidly transported downhill until they begin to accumulate where the slope is less steep and vegetation has greater density because of moisture in valley bottoms (Sumner, 2000). The transport slows but never ceases altogether in mountains because they are continuously eroding.

Historically, beavers were important geomorphic agents in the watershed. The construction of beaver dams caused sedimentation of particles from the stream and filtered sediments from upland runoff before it reached the stream. Soils deposited due to beaver activity are found just east of the village of Gallinas, where the creek has been diverted to the southern margin of the valley bottom. In this area, old cottonwoods remain in a convoluted pattern that would occur with a meandering stream occupied by beaver. Diversion of the river south has caused the stream to incise and lowered the water table in that area. Active soil erosion and deposition due to beaver activity can be seen just west of the junction to El Porvenir on NM65. Upland soils can be mobilized by various disturbances to contribute to sediment inputs along and into streams (Sumner, 2000). The watershed has historically been logged and chronically grazed and browsed by livestock. Fires have swept over the watershed or burned small portions of it over time. All of these events tend to increase the rate of soil erosion from uplands to streams.

Ground surfaces in the watershed vary with respect to their permeability to water. Metamorphic and granitic rocks are impermeable to water and any infiltration is at joints between rock bodies. Shallow, skeletal soils, which are common throughout the watershed, have high permeabilities but little water retention. Young, sandy soils do not retain moisture well but have relatively high permeability and are often fragile. Consequently, stream discharge tends to fluctuate widely with precipitation events; the stream is "flashy." Base flows in the river tend to be low because of the poor moisture retention in the rocky watershed.

The headwaters of the Gallinas system appear below the snowy ridgeline to the west where shallow regolith overlies impermeable rock. Springs appear along slopes and their flows often quickly merge into a stream. Springs are often found adjacent to the river where subsurface drainage from upslope infiltration emerges.

Vegetation Communities

The Upper Gallinas Watershed is covered by 92% forest, 6% rangeland, 2% barren and less than 1% agriculture and tundra. Vegetation distributions over broad areas are largely a function of the ratio between evaporative demand and precipitation (Woodward and Williams, 1987). Vegetation is stratified by elevation in the watershed because of plant species moisture requirements and abilities to resist evaporative demand. This elevation gradient is correlated with the decrease of temperature with an increase in elevation (NM Climate Center, 2008). Flat-pan evaporation, where water loss from a pan of standard size and shape is measured, is an indicator of evaporative demand. In Las Vegas, annual average evaporative demand is about 30". The difference between annual precipitation and flat pan evaporation is a measure of aridity, which for Las Vegas is about negative 16". However, at higher elevations in the watershed precipitation exceeds evaporative demand which results in discharge and runoff.

Evapotranspiration is the loss of water from an area of land with vegetation, and is analogous to water loss from a pan, but slower. Experimental watershed studies have shown that areas above the elevation where evapotranspiration equals precipitation can have vegetation manipulated to increase stream

discharge, but below that elevation vegetation manipulation does not change stream discharge, except in paroxysmal climate events (Ffolliot and Stropki, 2008). The elevation of this transition in the watershed corresponds with the change in vegetation from upper elevation mixed conifer (Douglas-fir, ponderosa pine, blue spruce and limber pine) to the subalpine spruce-fir forests (bristlecone pine, Englemann spruce, subalpine fir) (Dick-Peddie, 1993). The persistent snowpack often loses about a third of precipitation to sublimation (evaporation from solid ice to water vapor without going through a melt).

Invasive species are regarded as the second largest threat to endangered native species (NMDA, 2014). An invasive species is any plant, animal, or other organism (such as microbes) that is non-native to an ecosystem that has potential to cause economic or environmental harm, or harm to human health. Invasive species (sometimes also referred to as introduced or non-native) lack natural predators in the areas of introduction, and therefore tend to spread rapidly, lead to reduced biodiversity and can impose enormous cost and damage to property and natural resources. New Mexico currently has 362 non-native invasive plants reported and San Miguel County is ranked second in most invasive plant species by county (UGA Center for Invasive Species Health, 2014). The current status of reported invasive plant species in San Miguel County is 209 species. Most riparian areas of the Gallinas have significant coverage by non-native herbaceous plants, particularly grasses which have simplified plant communities.
Salt cedar (*Tamarix sp.*), while it rarely occurs in the Upper Gallinas Watershed, is of concern in terms of preventing its spread. Russian olive (*Elaeagnus angustifolia*) occurs in lower elevation areas near the Hot Springs and below and is also of concern related to its potential spread upwards and in areas of disturbance. Salt cedar and Russian olive are phreatophytes: deep rooted plants that are often found along stream sides and that obtain a significant amount of water by having roots in direct contact or at the fringe of saturated soils. In arid regions, salt cedar and Russian olive damage riparian and wetland areas by lowering stream flow and displacing native species and wildlife habitat. Increases in soil salinity (salt concentration) are associated with presence of salt cedar. Invasive forbs, herbs, and grasses found in riparian and wetland habitats can displace native species and decrease land value (NMDA, 2014).

Wildlife and Habitat

Ecological regions have been identified through the analysis of the spatial patterns and the composition of biotic and abiotic phenomena that affect or reflect differences in ecosystem quality and integrity (Omernik, 2004). These phenomena include geology, physiography, climate, hydrology, soils, vegetation, land use, wildlife, and habitat. Based on this large-scale ecological work, the Upper Gallinas Watershed is within the Southwestern Rockies Level III Ecoregion 21. It contains the following Level IV Ecoregions: 21b-Crystaline Subalpine Forests, 21c- Crystalline Mid-Elevation Forests, 21e-Sedimentary Subalpine Forests and 21f-Sedimentary Subalpine Forests (Griffith et al., 2009). The deciduous riparian vegetation along streams is noted to support coldwater fisheries and serve as wildlife corridors, particularly in the Crystalline Subalpine and Sedimentary Mid-elevation forests within the Southwestern Rockies Ecoregion (Griffith et al., 2009).

Biota Information System of New Mexico (BISON-M) was used to estimate the number of vertebrates and invertebrates within the watershed (NM Game and Fish, 2014). Using Montane Riparian GAP

Vegetation (cottonwood/alder/willow) data for riparian areas of San Miguel County, which includes the Upper Gallinas Watershed, the area is home to approximately 192 species of amphibians, reptiles, birds, and mammal. Some 143 different types of birds and 38 species of mammals have been recorded to utilize this habitat type. BISON-M lists 26 species associated with this habitat type at some risk of population decline (Table 3). On the federal list, one endangered, one threatened and one proposed species may utilize the watershed. The other species listed in Table 3 have been identified as species of concern by other government agencies or non-governmental conservation groups. A brief summary of information about the federally listed species follows.

The Southwestern Willow Flycatcher (*Empidonax traillii extimus*) is listed as federally endangered due to degradation and loss of dense riparian habitat. Historically, the primary threat was altered stream flows in critical habitat (Federal Register, 1997). Currently, riparian habitat is geographically and spatially limited and regrowth is slowed due to changes in flow. As a result, fire is also a significant risk to remaining habitats as is human disturbance of nesting sites which may result in nest abandonment (USFWS, 2014). Southwest Willow Flycatcher breeding is not known to currently occur in the watershed, however, sightings during migration have occurred (pers. comm., City of Las Vegas, Ken Garcia).

The Mexican Spotted Owl (*Strix occidentalis lucida*) is listed as a federally threatened species. It is dependent on closed-canopy mature forests with complex vertical structure and healthy riparian areas (New Mexico Avian Conservation Partners, 2014). The decline in this species is associated with habitat loss and degradation. It is unclear to the extent that Mexican Spotted Owls were present or how numerous they may have been in the headwaters of the watershed before logging and fire-suppression altered the composition and structure of these forests. Mexican Spotted Owls are known to occur in the upper portions of the watershed (pers. comm., USFS, Esther Nelson).

The Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) is listed as a federally threatened species. In New Mexico, it generally prefers dense understory vegetation and riparian woodlands most commonly in the south, along major drainages, and numerous smaller drainages. It is most vulnerable to the reduction, fragmentation, and degradation of riparian habitat and the extensive removal of exotic salt cedar (New Mexico Avian Conservation Partners, 2014). There are two records from the upper Gallinas River at Las Vegas and Montezuma suggesting that cuckoos are present in at least small numbers in the upper reaches of the Pecos River drainage (Howe, 1986).

The New Mexico Meadow Jumping Mouse (*Zapus hudsonius luteu)* is listed as a federally endangered species. It is endemic to New Mexico, Arizona, and a small area of southern Colorado (http://ecos.fws.gov/speciesProfile/profile/speciesProfile?spcode=A0BX). The jumping mouse is a habitat specialist. It nests in dry soils, but uses moist, streamside, dense riparian/wetland vegetation up to an elevation of about 8,000 feet. The jumping mouse appears to only utilize two riparian community types: 1) persistent emergent herbaceous wetlands (i.e., beaked sedge and reed canary grass alliances); and 2) scrub-shrub wetlands (i.e., riparian areas along perennial streams that are composed of willows and alders). It especially uses microhabitats of patches or stringers of tall dense sedges on moist soil

along the edge of permanent water. No known surveys of this jumping mouse have occurred in the Upper Gallinas Watershed but potential habitat occurs in many locations.

Table 3. List of amphibian, bird, and mammal species that may utilize the Upper Gallinas Watershed and their current status (BISON-M). This list was obtained using the query parameters Montane Riparian GAP Vegetation (cottonwood/alder/willow) data for riparian areas of San Miguel County (NM Dept. of Game and Fish, 2014).

Common Name	Scientific Name	Status
Northern Leopard Frog	*Lithobates pipiens*	USFS Sensitive: Region 3 (NM,AZ)
Plains Leopard Frog	*Lithobates blairi*	USFS Sensitive: Region 3 (NM,AZ)
Gray Catbird	*Dumetella carolinensis*	USFS Sensitive: Region 3 (NM,AZ)
Yellow-billed Cuckoo (western pop)	*Coccyzus americanus occidentalis*	Federal: Threatened* State NM: Sensitive taxa (informal) USFS Sensitive: Region 3 (NM,AZ)
Bald Eagle	*Haliaeetus leucocephalus*	BLM Sensitive: NM State Office (NMSO) State NM: Threatened USFS Sensitive: Region 3 (NM,AZ)
Peregrine Falcon	*Falco peregrinus anatum*	State NM: Threatened USFS Sensitive: Region 3 (NM,AZ)
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	Federal: Critical Hab. Designated (NM) Federal: Endangered State NM: Endangered USFS Sensitive: Region 3 (NM,AZ)
Northern Goshawk	*Accipiter gentilis*	BLM Sensitive: NM State Office (NMSO) State NM: Sensitive taxa (informal) USFS Sensitive: Region 3 (NM,AZ)
Zone-tailed Hawk	*Buteo albonotatus*	USFS Sensitive: Region 3 (NM,AZ)
Pinyon Jay	*Gymnorhinus cyanocephalus*	BLM Sensitive: NM State Office (NMSO)
Belted Kingfisher	*Megaceryle alcyon*	USFS Sensitive: Region 3 (NM,AZ)
Mexican Spotted Owl	*Strix occidentalis lucida*	Federal: Critical Hab. Designated (NM) Federal: Threatened State NM: Sensitive taxa (informal) USFS Sensitive: Region 3 (NM,AZ)
American Redstart	*Setophaga ruticilla*	USFS Sensitive: Region 3 (NM,AZ)
Black Swift	*Cypseloides niger*	State NM: Sensitive taxa (informal)
Pale Townsend's Big-eared Bat	*Corynorhinus townsendii*	BLM Sensitive: NM State Office (NMSO) State NM: Sensitive taxa (informal) USFS Sensitive: Region 3 (NM,AZ)
Fringed Myotis	*Myotis thysanodes*	BLM Sensitive: NM State Office (NMSO) State NM: Sensitive taxa (informal)

Common Name	Scientific Name	Status
Long-legged Myotis	*Myotis volans*	BLM Sensitive: NM State Office (NMSO) State NM: Sensitive taxa (informal)
Western Small-footed Myotis	*Myotis ciliolabrum*	BLM Sensitive: NM State Office (NMSO) State NM: Sensitive taxa (informal)
New Mexico Meadow Jumping Mouse	*Zapus hudsonius luteu*	Federal: Endangered* USFS Sensitive: Region 3 (NM,AZ) BLM Sensitive: NM State Office (NMSO) State NM: Endangered
Botta's Pocket Gopher	*Thomomys bottae actuosus; alienus; aureus; collis; connectens; cultellus; fulvus; guadalupensis; lachuguilla; mearnsi; morulus; opulentus; paguatae; pectoralis; peramplus; pervagus; planorum; rufidulus; ruidosae; tol*	USFS Sensitive: Region 3 (NM,AZ)
American Marten	*Martes americana*	State NM: Threatened USFS Sensitive: Region 3 (NM,AZ)
Pecos River Muskrat	*Ondatra zibethicus ripensis*	BLM Sensitive: NM State Office (NMSO) State NM: Sensitive taxa (informal)
Ringtail	*Bassariscus astutus*	State NM: Sensitive taxa (informal) USFS Sensitive: Region 3 (NM,AZ)
Crawford's Desert Shrew	*Notiosorex crawfordi*	USFS Sensitive: Region 3 (NM,AZ)
Water Shrew	*Sorex palustris*	USFS Sensitive: Region 3 (NM,AZ)
Common Hog-nosed Skunk	*Conepatus leuconotus*	State NM: Sensitive taxa (informal)
Long-tailed Vole	*Microtus longicaudus longicaudus; alticola; baileyi; mordax*	USFS Sensitive: Region 3 (NM,AZ)

* - Federal Status was updated with US Fish and Wildlife Service Threatened and Endangered Species list provided at: http://ecos.fws.gov/tess_public/countySearch!speciesByCountyReport.action?fips=35047

Land Use

Land ownership in the Upper Gallinas Watershed is comprised of 52% U.S. Forest Service and 48% private and local government (SWQB, 2005). Private land is comprised of approximately 315 parcels that are an average of 61 acres in size (HPWA, 2012). There are generally smaller land parcels near the river, especially in the Gallinas village, while the uplands tend to be comprised of larger ranches. Land use has transitioned over the last few decades from agriculture, focusing on timber, livestock, and hay production, to primarily full-time and part-time residential use and summer recreation. Currently, agriculture is limited to small, non-commercial production of livestock, hay (restricted to the valley bottom) and timber as well as personal subsistence farming.

The project area includes dispersed residential development with the highest density of population centering in the unincorporated village of Gallinas. Census Bureau data are not of sufficient resolution to offer population estimates of Gallinas village and surrounding rural areas in the watershed. However, based on the average household size of 2.31 for San Miguel County (2010 Census) and an estimated number of houses in the watershed, we estimate the population size to be 508 with a population density of 6.7 people per square mile. Access to the watershed is by NM State Highway 65 that largely parallels the Gallinas River until it turns into Forest Roads 263 and 261 that follow the upper stretches of the Gallinas and Porvenir Creek. Both State and Forest roads are located very close to the river courses, limiting some river and riparian restoration project possibilities.

According to the Wildland Urban Interface Community Wildfire Protection Plan (San Miguel County, 2008), the communities in the watershed have a Community Hazard to wildfire rank of High (possible ranks of low, moderate, high, very high, extreme) which corresponds to a high risk according to the New Mexico Fire Planning Task Force. To reduce the threat of large scale, high intensity crown fire, the USFS developed a plan to treat 8,169 acres of Federal forest land in the watershed (USDA Forest Service, 2005). New Mexico State Forestry Division and Tierra y Montes Soil and Water Conservation District are also involved in forest treatment projects on private lands to reduce the threat of catastrophic wildfire in the Gallinas.

RESOURCE ANALYSIS

A resource analysis of wetlands in the Upper Gallinas Watershed included obtaining and considering various sources of data to form the basis of a Wetlands Action Plan. Those sources include:

1. National Wetlands Inventory (NWI) data (US Fish and Wildlife Service, 2010),
2. Historic aerial photos (Soil Conservation Service, 1935 & 1939),
3. Current aerial photos (USDA NAIP 2013), and
4. A field assessment of wetland areas using the New Mexico Rapid Assessment Method (NMRAM) (Muldavin et al., 2011b).

NWI maps and current aerial photos were examined and coupled with HPWA knowledge of the watershed to identify known and suspected locations of wetlands for detailed field assessment. Sixteen sites were chosen for field assessment.

The New Mexico Rapid Assessment Method (Muldavin et al., 2011a and 2011b) was used to evaluate the current conditions of chosen wetlands. As a result of limited access and time constraints associated with the completion of the WAP-UGW, the data presented are based on the available information at the time of this report. As access, time and resources become available, other wetlands and potential sites can be assessed. Candidate sites for future assessment are listed in the Resource Analysis: Information Gaps section of this report.

The following analysis of wetland conditions in the Upper Gallinas Watershed is an objective, scientific assessment of the current status of known wetlands. It is not a statement of judgment of historical or present management strategies by landowners. Determining specific causes of current conditions in longitudinal systems, such as the Gallinas River, is complex in part because upstream management strategies often affect downstream conditions.

Identification, Inventory, and Condition of Existing Wetlands

Sixteen wetlands sites were identified with aerial photos and NWI and subsequently surveyed during the summers of 2013 and 2014. Some suspected wetlands in the headwaters of the Gallinas River and Porvenir Creek were not accessible during the summer of 2013 because of USFS closures due to fire dangers. Additional sites were surveyed in 2014 once access was attained and additional field time was available. Most wetlands surveyed were on private land and classified as riverine (Hauer et al., 2002; USDA Natural Resource Conservation Service, 2008). Three sites were classified as slope/springs and two sites were classified as both riverine and slope/springs. Table 4 provides information on location, ownership, area, HGM, and NWI classification. Figure 6 and Figure 7 show maps of assessed wetlands.

Overbank flow from the channel and return flow from ground water are the dominant water sources for the existing riverine wetlands in the watershed; all wetlands surveyed had unidirectional, horizontal flow as the dominant hydrodynamics feature according to the HGM classification system.

Table 4. General site description of wetlands surveyed in the Upper Gallinas Watershed, 2013-2014. Alphanumeric site numbers are based on the surface water drainage basin (G, Gallinas; TS, Trout Springs; P, Porvenir) and the relative downstream location of the site (for example: G2 is further downstream than G1). *Reference Wetland; **Hauer et al., 2002.

Site #	Location (Latitude/Longitude)	Ownership	Wetland Area (ac)	Wetland Area (ha)	HGM Classification**	NWI Classification	NWI polygon ID	Congruent with NWI
G1	35.699970 / -105.425477	USFS	1.41	0.57	Riverine			No
G2	35.695493 / -105.396551	Private	40.5	16.4	Riverine	PEM1A/ PUBHh	2249 & 2559	Partial
G3*	35.691903 / -105.384643	Private	18.0	7.28	Riverine	PSS1C	2558	Yes
G4	35.687267 / -105.374745	Private	0.60	0.24	Slope	N/A	N/A	No
G5	35.687540 / -105.368077	Private	10.2	4.15	Riverine	PFO1A/ PEM1C/ PSS1C	2555/2556/ 2554	Yes
G6	35.680656/ -105.355225	Private	0.28	0.11	Slope	N/A	N/A	No
G7	35.676780 / -105.352016	Private	7.29	2.95	Slope/Riverine	PFO1A/ PUSCx	2553/2258	Yes
G8	35.670814 / -105.350239	Private	2.22	0.90	Riverine	N/A	N/A	No
G9	35.652534 / -105.295754	City of Las Vegas	2.19	0.89	Riverine	PUBFh	2254	Yes
G10	35.651802 / -105.298757	City of Las Vegas	2.00	0.81	Riverine	PUBFh	2254	Partial

Site #	Location (Latitude/Longitude)	Ownership	Wetland Area (ac)	Wetland Area (ha)	HGM Classification**	NWI Classification	NWI polygon ID	Congruent with NWI
G11	35.654367 / -105.283799	Private	3.61	1.46	Slope	N/A	N/A	Unknown
TS1	35.660226 / -105.354725	Private	0.29	0.12	Slope/Riverine	N/A	N/A	No
TS2	35.659119 / -105.354093	Private	0.55	0.22	Riverine	N/A	N/A	No
TS3	35.659775 / -105.345415	Private	1.53	0.62	Riverine	N/A	N/A	No
TS4	35.659981 / -105.342652	Private	0.97	0.39	Riverine	N/A	N/A	No
P1	35.712166 / -105.418628	Private	3.24	1.31	Riverine	N/A	N/A	No

Figure 6. Wetland condition assessment sites in the Upper Gallinas Watershed, using NMRAM.

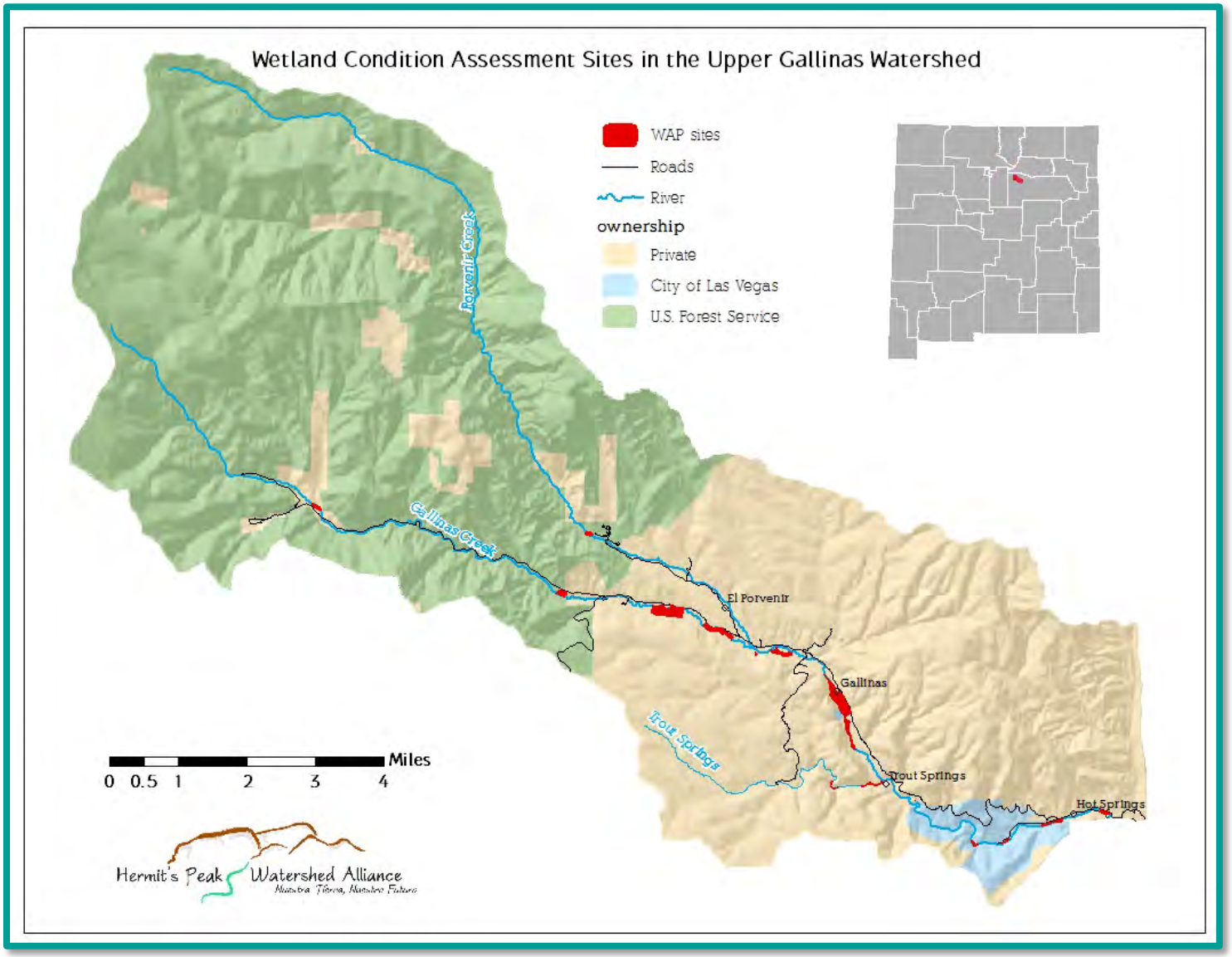
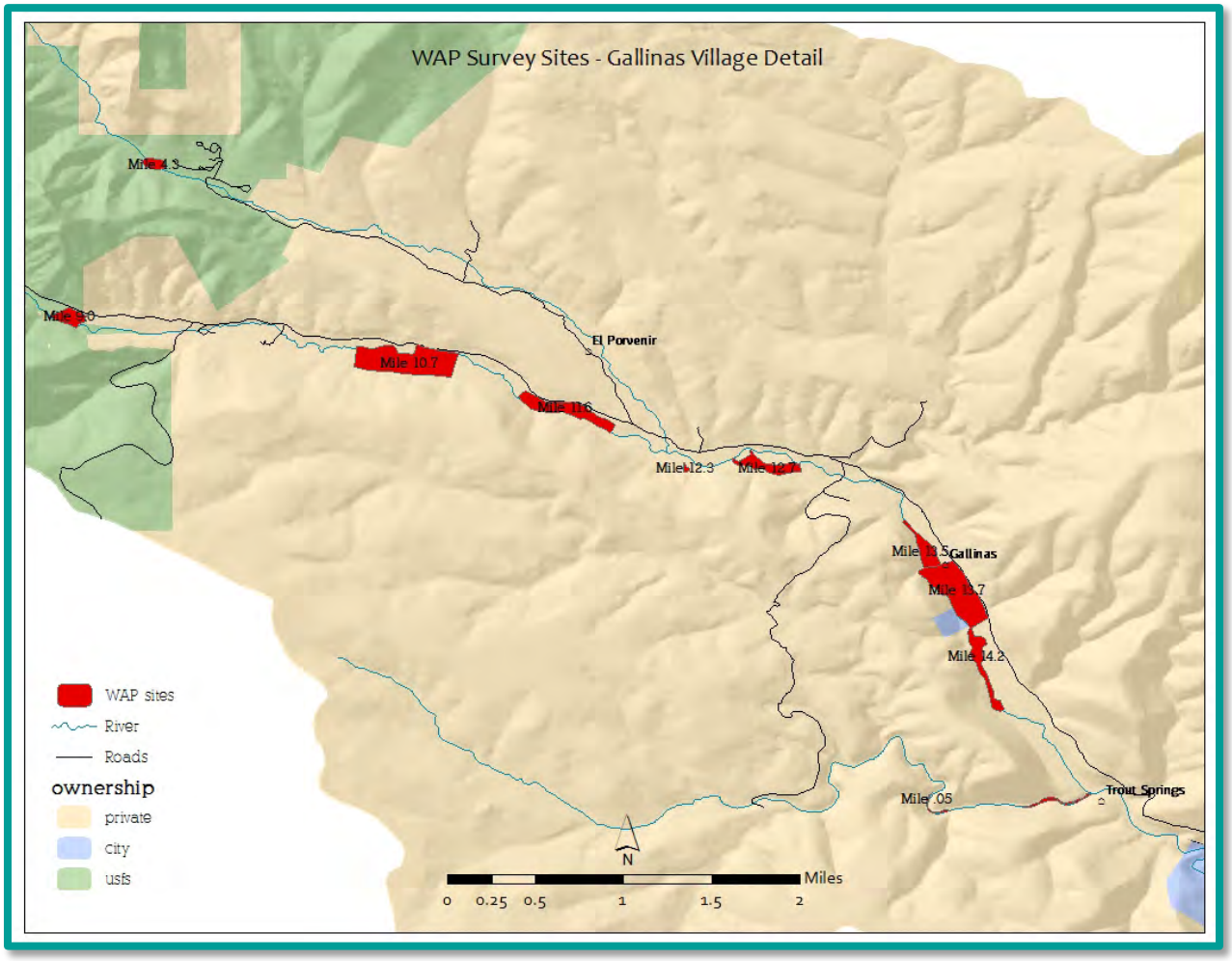


Figure 7. Detailed map of wetland survey sites in the Upper Gallinas Watershed, using NMRAM.



Wetland Condition Assessment

The NMRAM is the riverine condition assessment tool adopted by the NMED. It uses four major attribute categories to determine the relative condition of a wetland. They are: 1. Landscape Context, 2. Absolute Wetland Size, 3. Biotic Condition, and 4. Abiotic Condition. Landscape Context, Biotic and Abiotic attributes have additional individual metrics that are used to rate these major attributes, while Absolute Wetland Size is a single metric that is a stand-alone metric (Muldavin et al., 2011a and 2011b). Each major attribute category is proportionally weighted according to its contribution to the wetland ecosystem structure and function (Table 5). Scoring for individual metrics is based on a 1-4 scale (1: Poor, 2: Fair, 3: Good, and 4: Excellent). Raw score is the value rated for the metric. Final score is the raw score multiplied by weighted factor attributed to the metric (Muldavin et al., 2011b).

Figure 8. NMRAM Assessment Area and Buffer Area for site G7.

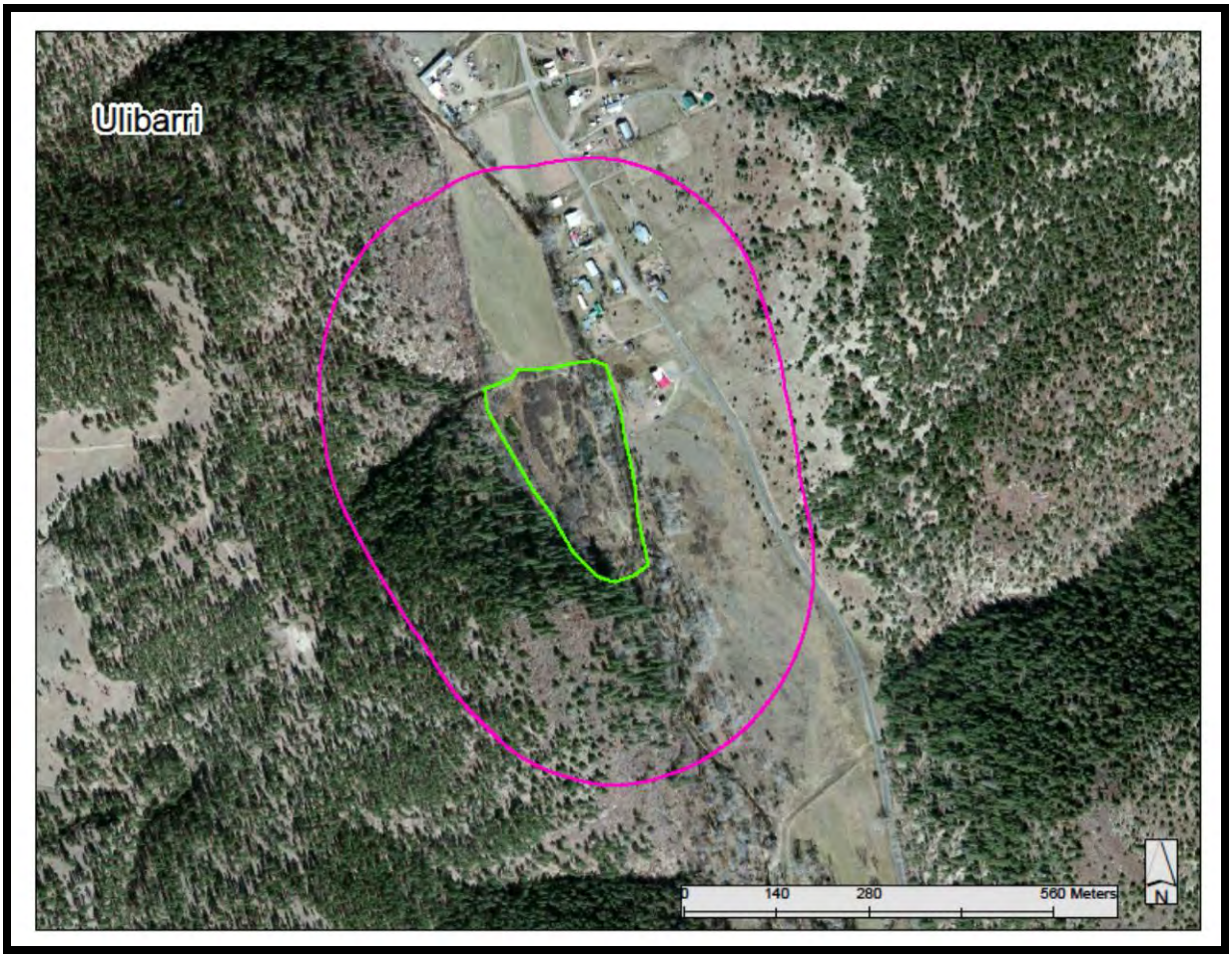


Table 5. Proportional weighting of NMRAM applied to attribute categories.

Major Attribute	Weight
Landscape Context	0.25
Size	0.15
Biotic	0.30
Abiotic	0.30

Biotic and Abiotic attributes account for 60% of the overall wetland score because these metrics represent intrinsic value to a wetland. Landscape context and Size are important with respect to the stress and threats that surrounding land use and fragmentation can have on ecosystem functions and services of wetlands. After individual metrics are incorporated into major attribute scores, an overall wetland condition is determined as a Wetland Condition Rank (A: Excellent, B: Good, C: Fair, and D: Poor) and a numeric (1-4) Wetland Condition Score (Table 6).

Table 6. NMRAM wetland condition rank and score and description of the wetland condition.

Wetland Condition Rank	Wetland Condition Score	Description of Condition
A	3.25-4.00	Excellent
B	2.50-3.25	Good
C	1.75-2.50	Fair
D	1.00- 1.75	Poor

Table 7 summarizes weighted scores and final Wetland Condition Ranks of the sixteen wetlands surveyed. The majority of wetlands surveyed in the WAP-UGW ranked in the descriptive category as 'Good.' The only sites (G4, G6, and TS1) that ranked "Fair" tended to be small in size and mostly impacted by surrounding land use, often current or historic livestock grazing. Springs were the major water source in these wetlands. See the appendices for data details.

Table 7. Summary of measurements and ratings for wetlands of the Upper Gallinas Watershed using NMRAM.

Site	Weighted Score				Wetland Condition	
	Landscape Context	Wetland Size	Biotic Condition	Abiotic Condition	Wetland Condition Score	Wetland Condition Rank
G1	1.00	0.15	1.20	0.81	3.16	B
G2	0.83	0.60	0.78	1.08	3.29	A
G3*	1.00	0.45	1.17	1.02	3.64	A
G4	0.72	0.15	0.78	0.80	2.45	C
G5	0.65	0.30	1.02	0.78	2.75	B
G6	0.70	0.30	0.81	0.48	2.29	C
G7	0.53	0.15	1.11	0.81	2.60	B
G8	0.85	0.30	1.05	0.96	3.16	B
G9	0.70	0.45	0.90	0.87	2.92	B
G10	0.55	0.45	0.87	0.81	2.68	B
G11	0.50	0.15	0.93	1.02	2.60	B
TS1	0.45	0.30	0.78	0.63	2.16	C
TS2	0.80	0.30	0.87	0.66	2.63	B
TS3	0.85	0.30	0.72	0.87	2.74	B
TS4	0.53	0.30	1.02	1.05	2.90	B
P1	0.65	0.45	1.17	1.02	3.29	A

*Reference Wetland

Stressors are anthropogenic disturbances that are expected to have negative effects on the condition of a wetland. NMRAM grouped stressors into four categories based on: 1. Landscape Context, 2. Vegetation, 3. Hydrologic, and 4. Physical Structure. These four categories were assessed at the landscape levels for the buffer area surrounding a wetland and the wetland, specifically. Major stressors

were those disturbances that occurred at greater than 10% of the area and considered significant, while minor stressors were present in less than 10% of the area. Stressors are not incorporated into the final rating of a wetland but are helpful in understanding the current condition of a wetland. Reducing stressors could effectively improve wetland quality.

Sites G9 and G10 had more stressors compared to other areas (Table 8). The major stressors that had the most significant impact on these wetlands and surrounding buffer areas were associated with land use, vegetation, physical structure and hydrologic modifications. Recreational activities including passive recreation (bird-watching, hiking, etc.) and active recreation (off-road vehicles, mountain biking, and fishing) were land uses noted as affecting more than 10% of the wetland and buffer areas. Vegetation stressors included trampling and biological resource use. Physical structure of the buffer and wetlands was most affected by trash and sedimentation. Stressors associated with hydrologic modifications included non-point source discharge of sediment and active management of stream flow by dams and diversions.

Table 8. Summary of measurements and ratings for wetlands of the Upper Gallinas Watershed using NMRAM.

Site #	Buffer Stressor		Wetland Stressor		Total Stressors
	Minor	**Major**	**Minor**	**Major**	
G1	3	0	3	0	6
G2	4	6	10	2	22
G3*	3	2	3	0	8
G4	2	6	5	6	19
G5	2	6	8	0	16
G6	4	9	2	3	18
G7	9	4	7	3	23
G8	1	5	4	2	12
G9	34	11	34	11	90
G10	42	6	42	6	96
G11	3	7	6	2	18
TS1	0	6	6	6	18
TS2	2	2	2	2	8
TS3	6	2	2	1	11
TS4	6	2	3	0	11
P1	3	4	2	3	12

*Reference Wetland

Location and Description of the Reference Wetland

One reference wetland (site G3) was identified and assessed in the watershed (Figure 9). It is a riverine wetland that is approximately 18 acres in size and located on private land. The current relative size of

this wetland is stable compared to estimates of the historical size. This wetland was assessed with remote sensing information as access was denied by the landowner.

While this wetland is in excellent condition relative to others in the area, it is not pristine. It has been impacted and constrained by the presence of a paved and commonly used road on one side of the valley bottom. Periodic removal of beaver has occurred resulting in stream entrenchment as beaver dams were not maintained. It is, however, unique in the Upper Gallinas Watershed in that it is the largest wetland area that exhibits a natural river meander pattern, spans the extent of the valley bottom, is dominated by wetland plants throughout its relatively large area, contains saturated soils throughout for much of the year, and is unencumbered by residential or agricultural land uses.

Figure 9. Aerial photograph of the reference wetland of the Upper Gallinas Watershed (site G3).

This reference wetland shows a willow-dominated ecosystem with saturated soils most of the year. The wetland spans the entire extent of the valley bottom and floodplain. The Gallinas River channel meanders throughout this site, in sharp contrast to adjacent reaches that have been mechanically straightened and relocated. Adjacent valley bottoms and floodplains have been altered for agricultural production and residential uses and show significantly drier conditions (dominated by pasture plant communities and upland plants) than the reference area.

Buffers are transitional zones between the wetland and adjacent upland areas. Buffers perform critical ecosystem functions and increase the protection of the wetland from anthropogenic stressors or impacts (Collin et al., 2008). The buffer area and the surrounding land use of site G3 are affected by anthropogenic stressors, primarily a paved road adjacent to the wetland. Approximately 50-74% of the wetland perimeter has a natural or semi-natural buffer. The condition of the buffer is moderately impacted by the presence of non-native plants, soil disturbance and trash. Biotic metrics indicate that the reference site is in excellent ecosystem health with respect to the plant community.

Native wetland vegetation is predominant in abundance and percent coverage, which generally indicates high biological diversity, stability in wetland community, improved wildlife habitat, and greater resistance and resilience to environmental disturbance (Muldavin et al., 2011a). The horizontal and vertical structure of this site suggests a high functioning riverine wetland by diversity in size and complexity of the vegetation community. Although native tree regeneration was observed from the road, there is an indication of some ecological dysfunction because of the lower number and distribution of both mature and young native riparian trees (primarily narrowleaf cottonwood). Reproduction of native riparian trees is closely tied to natural disturbance cycles which results in reproduction in patches on recently flooded areas (Crawford et al., 1993). Channelization and the increase of width to depth ratio, as reported in the WBP (Hermit's Peak Watershed Alliance, 2012), are correlated with the reduced number of young riparian trees at this and other Gallinas sites. However, saturated soils, past management strategies, or the presence of beaver that harvest cottonwood trees could have affected the number of riparian trees.

A history of abundant beaver use of this reference wetland has been noted by local residents, and recent use (within the past five years) has been documented by HPWA. Beavers have likely influenced the maintenance of wetland characteristics at this site. Eradication of beavers here and throughout the Upper Gallinas Watershed has also occurred historically and recently because of real or perceived conflicts. Stream incision is likely to have occurred when beaver dams were removed during flood events and when trapping removed beaver and dam maintenance ceased.

Abiotic metrics also support the correlation between the reduction in the population size of young riparian trees and factors affecting the hydrology at the site. Flood water access to the floodplain is moderately limited by incision, as well as by roadway constraints. Soil condition of this site is impaired due to the amount of bare streambanks, and extreme flooding may lead to further degradation. NMRAM Wetland Condition Score for this reference site is 3.64 (Wetland Condition Rank is A - Excellent); the highest score of all wetlands assessed with eight stressors listed (among the lowest).

Local History and Documentation of Historic Wetlands in the Upper Gallinas Watershed

The Soil Conservation Service began aerial photography within the watershed in the 1930s. Individual images from 1935 and 1939 were acquired from the Earth Data Analysis Center (http://edac.unm.edu). These early aerial photographs, combined with ground-based repeat photography, create a picture of the watershed not readily obtained from written reports or other sources. These historic aerial photos were visually inspected in comparison with current photos to qualitatively assess wetland changes since the 1930s.

The watershed has been inhabited by European colonists and their descendants since the 1830s. Consequently, forming an understanding of how wetlands in this watershed have changed is practically impossible due to the impacts of woodcutting, diking, channelization, water withdrawal, agriculture and grazing on these areas before aerial photography was available. The best strategy is to choose a known point of historical reference that can be used to evaluate change over time. One point of reference would be the flood of 1911, but there is no quantitative information associated with that event except flow. Another possibility is the 1939 USDA aerial photos that were taken of the watershed. These provide the ability to locate past wetlands, measure their size and estimate the composition and structure of the vegetation community, but the photos are relatively recent compared to the extent of the cultural impacts.

Extensive sheep and cattle grazing, other agricultural uses (largely for hay and sustenance farming), residential developments, and road construction impacted wetlands during the late 1800s and early 1900s (prior to the historic aerial photos). No actual pre-settlement information exists to reconstruct wetland occurrence and type. However, valley topography, soils and historic trends throughout the country lead us to infer that riverine wetlands were significantly more common throughout the lower portion of the Gallinas Valley, from EV Long Campground downstream to lower end of the study area, with the possible exception of specific areas having constrained valley bottoms (e.g. the upper end of the City Municipal Watershed).

Rich sediment depositions, remnant river channels, and a flat valley bottom indicate that beaver populations with their associated wetlands most likely occurred throughout this area. Conditions at the identified reference reach support this supposition; that area is apparently unchanged since the photos from the 1930s.

It is apparent from both historic and current aerial photos that the river channel was straightened and relocated to one side of the valley in numerous locations along its length. Remnant berms to help relocate the river channel were found as further evidence. Mechanical straightening and relocation was most likely done to increase flat bottomland for agriculture and to enable the construction of a road connecting the upper and lower reaches.

Agricultural land uses were significantly greater during the 1930s than currently evident on aerial photos. In some areas, riparian vegetation was even scarcer historically than it is today. There are only two instances of potential wetland areas evident on the historic photos that no longer exist. However, those locations were small and were likely remnant river channels; it is unclear as to the actual presence of wetland plants beyond an evident riparian tree and shrub presence.

In conclusion, the historic aerial photos show an era with even greater land manipulation (primarily agriculture) than occurs in the Gallinas Valley today. Most modifications that removed beaver, wetlands, and straightened and relocated the river channel had already occurred at this time. The identified reference reach appears largely unchanged over the period of 1939 – present. Perhaps two wetland areas have been lost during this time frame but that evidence is unclear. The 1930s aerial photos do not provide a good indication of the presence of historic wetlands in the Gallinas Valley. Topography, soils, the likely presence of beaver, and conditions found at the identified reference reach offer the greatest clues.

Identification of Threats and Impairments

NMRAM assessment, aerial photo examination and local knowledge were used to identify threats and impairments. Riparian areas, wetlands and wetland conditions in the watershed are threatened by the impacts of:

- Encroachment of residential areas, pollution, and hydrological changes due to specific land use in and around wetland areas (such as agriculture and recreational uses), roadways, resource extraction, and surface water diversions;
- Reduced surface water inflow and groundwater recharge, due to stream channel modifications such as channel straightening, entrenchment and the subsequent disconnection of the stream channel and wetlands from the historic floodplain;
- Increased temperatures leading to increased evapotranspiration losses and decreased water quality;
- Removal or destruction of vegetation due to overgrazing, potential fire, deliberate vegetation removal or recreational activities like off-road vehicle use;
- Encroachment by and proliferation of the following New Mexico listed noxious weeds:
    - Russian olive (*Elaeagnus angustifolia*),
    - salt cedar (*Tamarix sp.*),
    - Siberian elm (*Ulmus pumila*),
    - cheatgrass (*Bromus techtorum*),
    - oxeye daisy (*Leucanthemum vulgare*),
    - poison hemlock (*Conium maculatum*), and
    - musk thistle (*Carduus nutans*);
- Catastrophic ecological events, such as wildfire, destructive flooding, and erosion; and
- Lack of sufficient water to sustain wetland functions and services.

These threats are associated with three large scale trends of impairment:

- Roadways, primarily unimproved roads that channel water away from natural flow paths which are related to the threats of hydrologic changes, pollution, reduced surface water flow and groundwater recharge;
- Land use, primarily livestock grazing and small scale agriculture on small land allotments which is related to the threats of encroachment, pollution, isolation, hydrologic changes, removal of native riparian vegetation and replacement with invasive plants; and
- Ecological and climate change processes that are mostly related to the threats of increased temperatures, catastrophic events and lack of sufficient water to sustain wetland functions and services.

Information Gaps

Much has been accomplished in assessing wetlands on private land, however much remains to be done on other lands within the watershed, particularly National Forest Land. There are still gaps in information to develop an exhaustive wetland restoration, protection and management plan. Detailed design work is needed to implement wetland enhancement and restoration projects. Some of the most important information gaps include:

1. Additional Wetland Assessments are needed on National Forest Lands, particularly in Burro Canyon and upper El Porvenir Canyon. General reconnaissance was done but NMRAM assessments did not occur.
2. Ponds and adjacent wetlands at Evergreen Valley were not assessed with NMRAM.
3. Attempt to gain access to the reference wetland and other privately owned wetlands that were not assessed because of denied access.
4. Mapping: It is difficult to discern historic wetlands and make comparisons to current wetlands. Pre-1939 agricultural land use and resource extraction was extensive. A pre-1939 assessment is likely impossible except for using hydrographic and topographic information as an estimation.
5. Specific enhancement and restoration plans need to be developed for each wetland.

WETLAND ACTION PLAN IMPLEMENTATION

This section provides the plan for maintaining and improving wetland occurrence and condition in the Upper Gallinas Watershed. It offers goals, a strategy and some of the specifics needed to begin implementation, including the tools, funding mechanisms and possible partners.

Wetland Management Goals and Strategy

Because of their critically important ecological functions, the ecosystem services they provide, and because of their rarity in the local and statewide landscape, the following strict goals are recommended to guide wetland management.

Goals

1. ***Protect Wetlands*** – Protect all wetlands and a suitable buffer around them from conversion to other land uses and land types (no net loss of wetlands).
2. ***Restore Wetlands*** – Reestablish naturally occurring but historically lost wetlands in suitable locations where adequate hydrology exists and conflicts with existing land use have been resolved. Rehabilitate the ecological condition of all degraded wetlands.
3. ***Enhance Wetlands*** – When appropriate, enhance the functionality of man-made ponds to more closely mimic natural wetlands.
4. ***Monitor Wetlands*** – Conduct long-term monitoring at selected sites to track watershed-wide progress and reassess this WAP-UGW. Conduct effectiveness monitoring at protection, restoration and enhancement project sites.
5. ***Involve the Public*** – Involve the public in wetland protection, restoration and enhancement through education programs (e.g. Land Stewardship Series and Watershed Trunk), working directly with landowners on projects, and engaging volunteers in educational events and hands-on restoration projects.
6. ***Improve Planning, Policies and Regulation*** – People and organizations that are knowledgeable about wetland values and management must actively participate in revisions to land use plans, policies and regulations. Those entities must also provide information on the status and needs of wetlands to government agencies and elected officials.

The limited occurrence of wetlands and their importance necessitates seizing every opportunity to protect, restore or enhance wetlands and use all available monitoring, public involvement, planning and regulatory mechanisms available to assist in this endeavor. However, with limited resources and limited interest on the part of some landowners, priorities have been laid out in the Wetlands Action Priorities section.

Three main categories of wetland management are used to specify the types of actions that are recommended in this plan. Those categories and their definitions, based on EPA Restoration-guide (2003), are below.

Protect Wetlands – Prevent the conversion of a wetland to a non-wetland land type or land use that is not compatible with fully functional wetland characteristics. Protection includes the removal of a threat to or prevention of the decline of wetland conditions by an action in or near a wetland. It includes purchase of land or easements, repairing water control structures or fences, or structural protection such as repairing a buffer. Protection includes ensuring an adequate water supply needed to maintain a wetland. This prevents the conversion of a wetland to a different, non-wetland land type (e.g. upland plant community). This term also includes activities commonly associated with the term preservation. Protection does not result in a gain of wetland acres or function.

Restore Wetlands - The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded wetland. For the purpose of tracking net gains in wetland acres, restoration is divided into:

> *Reestablish* - the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to former wetland. Reestablishment results in rebuilding a former wetland and results in a gain in wetland acres.
> *Rehabilitate* - the manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions of degraded wetland. Rehabilitation results in a gain in wetland function but does not result in a gain in wetland acres.

Enhance Wetlands - The manipulation of the physical, chemical, or biological characteristics of a man-made pond or man-made wetland area to heighten, intensify, or improve specific function(s) to enhance its ability to more closely resemble fully-functional natural wetlands. Enhancement is undertaken for a purpose such as water quality improvement, flood water retention or wildlife habitat. Enhancement results in an improvement in wetland function(s), but may lead to a decline in some human-use functions, and it does not result in a gain in wetland acres.

Strategy

In order to approach wetland protection, restoration, and enhancement to meet the above goals, the below seven step strategy is laid out in this plan.

1. Provide general wetland management actions applicable to all wetlands; identify tools, funding mechanisms, and potential partners;
2. Identify specific wetlands in the Upper Gallinas Watershed requiring protection, restoration, and enhancement;
3. Identify specific needs and actions for each identified wetland;
4. Identify priorities for protection, restoration and enhancement;
5. Recommend a wetland monitoring approach to track success;
6. Recommend opportunities to involve the public in implementing this plan;
7. Identify regulatory and planning mechanisms that are important to wetland management.

General Wetland Management Actions

General recommended actions, tools, funding, and partners available to meet Wetland Management Goals to protect, restore and enhance wetlands are presented below as they apply to all wetlands. These are summarized in Table 11 at the end of this section. Protection, restoration and enhancement actions for specific wetlands are offered in the section titled Identification of Wetlands in Need of Protection, Restoration, and Enhancement. Actions and tools are presented to address wetland protection, restoration, and enhancement separately. Funding and partnerships usually apply to those three types of actions so are presented in one section titled Funding and Partnerships.

Protect Wetlands

Protecting existing wetlands from conversion to other land uses (e.g. agricultural, industrial or residential) and land types (non-wetland, upland plant communities), remains a significant challenge and high priority nationwide, across New Mexico, and in the Upper Gallinas Watershed. However, wetland conversion has already occurred to a large extent, making wetland restoration and enhancement a larger potential effort than protection.

Actions

1. Secure ownership and/or management mechanisms (Conservation Easements) that support wetland protection and prevent conversion to other land uses.
2. Incorporate wetland protection in local and regional planning.
3. Improve upon wetland/riparian area/springs protection regulations at the state and local level.
4. Identify wetland mitigation sites for developing In-Lieu Fee Programs or wetland credits.
5. Use funding programs to incentivize wetland monitoring and protection.
6. Start an Adopt-a-Wetland Program.

Tools

Wetland protection tools available to help implement these actions are described below.

1. *Transfer wetland ownership or management responsibilities to a suitable organization that can ensure its protection.* Such ownership or management assistance transfers would normally be initiated by the landowner but organizations interested in assuming ownership or management responsibilities should also pursue potential landowners. Specific wetlands in the Gallinas that are a high priority for this type of protection are listed in the Wetland Action Priorities section. Organizations that could be pursued to hold wetlands for protection or assume management responsibilities include: public entities, community groups, or nonprofit conservation organizations. While donation or sale of private lands to public ownership may not be desirable in many situations, it may be appropriate in others. If an ownership transfer is not desirable, a collaborative relationship between the landowner and another organization that can assist in management is an option. Such relationship has been developed between the City of Las Vegas and the Hermit's Peak Watershed Alliance at the City's property adjacent to the La Placita Fire Station. HPWA has obtained grant funding and is overseeing a significant wetland restoration project on behalf of the City.

Large wetlands with little or no adjacent infrastructure and little potential for other uses could be offered to public agencies that hold land in trust for use by the public or managed to provide ecosystem services. An organization that helps explore these potential land transfers to government organizations is the Trust for Public Land with an office in Santa Fe. Government organizations that might entertain such transfers include: the City of Las Vegas, San Miguel County, Energy, Minerals and Natural Resources Department: State Parks Division, NM State Land Office, NM Department of Game and Fish, US Fish and Wildlife Service, and US Forest Service.

Non-governmental organizations may be potential holders of wetland properties either through purchase or donation. Community or neighborhood groups interested in maintaining the character or health of an area are possibilities. In Gallinas the La Placita Volunteer Fire Company who has an interest in the local water supply, and fire and flood damage protection may be a possibility. The Gallinas Land Grant Association may be in the position to facilitate land transfers or hold valuable properties for community use and protection purposes. Alternatively, wetland property could be donated to an appropriate nonprofit organization whose mission includes the stewardship of watersheds, natural areas, or fish and wildlife habitat. Examples of such organizations are: local watershed groups like the Hermit's Peak Watershed Alliance, The Nature Conservancy, Trout Unlimited and the Audubon Society. The Santa Fe Conservation Trust or the New Mexico Land Conservancy may be able to help orchestrate a land transfer with the addition of a Conservation Easement. The Hermit's Peak Watershed Alliance is the only one of those organizations that has a local presence.

2. *Obtain a Conservation Easement or open space designation for wetlands and their buffers.* Placing private and public lands that contain wetlands and a suitable buffer to maintain wetland functions under a Conservation Easement (surrender of development rights with tax incentives) offers the greatest long-term protection. Conservation Easements should be explored and information provided to all interested wetland landowners to provide incentives for their protection and maintenance. Land trust organizations that operate in the watershed and help with obtaining and managing Conservation Easements include: Santa Fe Conservation Trust, New Mexico Land Conservancy, and Taos Land Trust. Wetlands in New Mexico are a high priority land type for placement in Conservation Easements since they offer considerable public benefit. Such transactions are between willing landowner and a land trust organization, however, entities such as Hermit's Peak Watershed Alliance, and land trust organizations should offer educational information to Gallinas landowners.

3. *Incorporate wetland protection in local and regional planning.* Ensure that wetland protection and management is included in local and statewide land use planning efforts to help provide funding and promote attention to wetlands.

Tools related to including wetlands in planning include:

- *Participate in Plan Development* – The Hermit's Peak Watershed Alliance or other interested organizations should work with City, County and State agencies to include wetland protection, restoration and enhancement in planning efforts such as City Comprehensive Master Plans, San Miguel County Hazard Mitigation Plans, comprehensive Watershed Based Plans (developed by HPWA), and NE Regional Water Plan (NM Office of the State Engineer). Those entities responsible for developing these, and other plans, should ensure that wetland protection is covered in their plans.

- *Establish Wetland Buffers and BMPs* –Local wetland buffers are not recognized nor are there accepted BMPs to guide wetland activities. Wetland buffer guidelines and recommended management practices within wetland buffers should be developed to be used for planning documents, local regulations, or private and public land management plans and circulated to all appropriate landowners and land management entities. The development and distribution of wetland buffer guidelines and BMPs could be funded by the City of Las Vegas or San Miguel County as part of their planning efforts. Alternatively grant funding from NMED, Water Trust Board, Drinking Water State Revolving fund, or private funding should be sought if local funds are not available. Independent contractors or watershed organizations that are experts in wetland functions and management such as the Hermit's Peak Watershed Alliance can either produce these guidelines or seek funding for their development independently.

- *Roads* **-** Federal (USFS), State (NMDOT) and San Miguel County (SMC) road departments should fund the assessment and reconstruction of road placement, surface composition, drainage and the provision of adequate vegetated buffers between roads and wetlands. Such assessments and redesigns should occur with the assistance of wetland and stream ecosystem specialists, like: Zeedyk Ecological Consulting, Riverbend Engineering, Rangeland Hands, and Watershed Artisans.

- *Encourage low impact developments and green infrastructure* – In county or local planning documents, include goals to maintain low impact developments and green infrastructure in areas adjacent to wetlands, their buffer areas and in all floodplains. In planning efforts, wetlands should be included as a viable means to treat storm water (see applicable regulations Table 9), and mitigate floods and wildfire. City, County, and State agencies responsible for land use plans should seek assistance from experts that can help guide such low impact developments and green infrastructure. Such wetland experts include: Southwest Urban Hydrology, Watershed Artisans and Riverbend Engineering.

4. *Improve upon wetland/riparian area/springs protection regulations at the state and local level.* Wetland regulations and guidelines exist at all levels of the government (federal, state, county, city) to help protect wetlands and prevent their degradation or conversion. However, a review of

existing regulations, especially at the local level, is needed to determine if wetland protection is adequately addressed. Such a review should occur by independent entities rather than the responsible agency. This review should not only address wetland protection but also cover wetland buffers and BMPS, floodplain land uses, and the use of wetlands for storm water treatment and flooding mitigation.

In addition to such a review, wetlands advocates like HPWA should work with government entities to improve upon, promote, inform and enforce wetland protection regulations and guidelines. Responsible agencies, with help from HPWA, water user's organizations, and community groups, should develop and deliver educational programs to inform landowners and managers about existing wetland regulations and guidelines. Existing wetland regulations and the agencies responsible for enforcement are listed in Table 9.

Table 9. Wetland Related Regulations or Guidelines and their Responsible Agencies.

Wetland Regulations or Guidelines	Responsible Agency
National Environmental Policy Act (NEPA) applicable to actions on public lands.	US Environmental Protection Agency
Clean Water Act, Section 404 applicable to all waters (surface water) of the US.	US Army Corps of Engineers, US Environmental Protection Agency
Clean Water Act, Section 402 National Pollution Discharge Elimination System (NPDES)	US Environmental Protection Agency, NM Environment Department
401 Water Quality Certification as part of CWA Section 404 process.	NM Environment Department, Surface Water Quality Bureau
Endangered Species Act applicable to all lands of the US.	US Fish and Wildlife Service
No net loss of wetlands policy on National Forest Land. Grazing Permit Process on National Forest Land requires a 10 year review of permits and annual operating plans to ensure that requirements for wetlands are adequate and in practice.	US Forest Service
National Historic Preservations Act applicable to all private and public lands.	US Park Service, Advisory Council on Historic Preservation, State Historic

Wetland Regulations or Guidelines	Responsible Agency
	Preservation Officers
Determination of designated uses and water quality standards for wetlands and waters of NM	NM Environment Department, Surface Water Quality Bureau
NM Forest Practices Guidelines	NM State Forestry (NM State Forestry, 2008)
Water rights	NM Office of the State Engineer
San Miguel County Flood Damage Prevention Ordinance	San Miguel County Note: A review of local ordinance and improve upon wetland protection, buffers and BMPs is needed.
San Miguel County Road Ordinances and practices	San Miguel County
County Subdivision Ordinances	San Miguel County

5. *Identify wetland mitigation sites for developing In-Lieu Fee Programs or wetland credits.* The CWA Section 404 permit program (enforced by the US Army Corps of Engineers) may require compensatory mitigation to offset unavoidable wetland impacts by replacing lost wetland functions and values. Permittees may participate by paying a fee to an In-Lieu Fee Program and those funds are used elsewhere to protect or restore wetlands. By offering a wetland as a mitigation site, landowners may obtain support to protect or restore a wetland through an In-lieu-Fee Program. Wetlands identified in this WAP-UGW as those needing protection or restoration could potentially serve as such mitigation sites. The need exists to explore the feasibility, find willing landowners, and identify wetland mitigation options to provide to the US Army Corps of Engineers in the event of 404 permits that require mitigation. An In-lieu-Fee Program could also be established if a sponsor can be identified. For more information see *https://www.fws.gov/habitatconservation/Corps%20In-lieu-fee%20guidance.pdf*

6. *Use funding programs to incentivize wetland monitoring and protection.* See Funding and Partnerships section for a complete list of potential funding programs that support wetland protection, restoration and enhancement. In addition to more traditional funding sources from government and private grants, creative and community-based funding strategies should also be pursued to help protect and monitor wetlands. Some ideas include: local fundraising events like bake sales and fishing derbies, special wetland related fundraisers or even crowd funding.

7. *Start an Adopt-a-Wetland Program*. A collaborative wetland stewardship effort by schools and/or other community groups could offer important assistance to landowners to protect specific wetlands and simultaneously support wetland education. Land managers or landowners in need of assistance could initiate this relationship with schools or other pertinent community groups. However, this would be more effectively done by a coordinating organization like HPWA. The USFWS and their related Friends of the Las Vegas Wildlife Refuge have a deep commitment to wetland protection so could offer a potential entity to develop and coordinate such a program. No other community groups currently exist in the area to spearhead such an effort.

Restore Wetlands

Restoring wetlands in the Upper Gallinas Watershed is the greatest effort addressed in this plan; it affects the largest area, involves the greatest number of partners, and has the potential to have the greatest improvement on all wetland-related attributes. Restoration consists of both rehabilitating healthy conditions and ecological functions to degraded wetlands and reestablishing lost wetlands where they naturally occurred (usually in floodplains). Restoration first involves adjusting land management practices that have led to degradation or wetland losses. Then it involves employing a variety of tools to rehabilitate degraded ecological conditions and reestablish lost wetlands.

This section first recommends actions and tools to address needed changes in land management. Then it presents actions and tools related to wetland restoration, treating rehabilitation and reestablishment separately. The term restoration may be used interchangeably with rehabilitation and reestablishment.

Actions to Address Changes in Land Management

These recommended actions are based on stressors identified in the Condition Assessment of wetlands that have historically impacted or are currently impacting wetlands. Identified stressors that are addressed here include: vegetation impacts by livestock and direct removal of vegetation for landscaping purposes, impacts of roads, non-point source pollution of sediments from upland erosion, alterations of water flow from dams and diversions, invasion by non-native plants, and loss of vegetation and soil compaction and trash from recreation and residential activities.

1. Develop and implement Wetland Sensitive Grazing Plans collaboratively with landowners and managers.
2. Assess and modify residential, agricultural or recreational land uses near wetlands to address soil degradation, hydrology modifications that dry out wetlands, and vegetation impacts.
3. Develop a comprehensive road assessment with recommendations for improvements.
4. Identify and treat invasive species where they are reducing plant diversity and ecological functions.

Tools to Address Changes in Land Management

Suggested improvements to land management to help restore healthy conditions of wetlands and their buffer areas are detailed below.

1. *Livestock Management Improvements.* Assisting landowners in the development and implementation of Wetland Sensitive Grazing Plans was identified as a high priority for implementation. Providing financial and technical assistance to develop and implement Wetland Sensitive Grazing Plans customized to meet landowner needs and objectives and at the same time preventing the degradation of wetlands and their buffer is critical. HPWA, NRCS and Tierra y Montes SWCD can offer technical and financial assistance to landowners to develop and implement Wetland Sensitive Grazing Plans. Such plans, as they apply to streams and riparian areas, were developed for a number of landowners and an example of these plans can be viewed on the HPWA website: www.hermitspeakwatersheds.org.

   Wetland Sensitive Grazing Plans should direct stocking rates, timing, duration and grazing intensity by using tools like: fencing, herding, development of alternative water sources, alternatives to grazing or supported rest periods, and enhancing productivity in upland pastures.

   - *Wetland fencing* – Total enclosure of the entire wetland area and a protective buffer with livestock-proof fencing is often required in pastures that are continuously grazed. Livestock use may be incompatible with maintaining healthy wetland functions so fencing can be essential. In wetlands that can withstand some grazing, fencing allows livestock use to be carefully controlled and monitored. Wetland fencing is likely required in combination with other tools to effectively manage livestock use. Partial fencing or other structures to discourage livestock use may be an alternative to total wetland enclosures if livestock use is carefully monitored.
   - *Livestock herding* – In lieu of pasture fencing, implement livestock herding or livestock training to avoid grazing in wetlands.
   - *Water development away from wetlands* – Wetland perimeters are usually saturated so the use of wetlands to water livestock degrades vegetation and soils. Watering systems built well away from wetlands is recommended. Well development, water pumping, limited water gaps or water catchment systems are viable alternatives. Water sources away from wetlands also disperse grazing to less vulnerable upland areas.
   - *Rest pastures with wetlands* **–** Rest degraded pastures to allow plant re-growth and eroding surfaces to recover. Pursue the use of grass banks or payments to defer grazing to allow a period of rest.
   - *Enhance upland pastures* – Improve upland pasture forage productivity by developing irrigation systems, weed management, forest management or supplemental pasture seeding. While this will improve livestock use of upland pastures, it must be done in combination with fencing and carefully managed grazing in riparian areas.

2. *Improve Management of Residential, Agricultural, and Recreational Areas.* Impacts to wetlands from residential, agricultural or recreational land uses are either unintentional consequences of general use of the area or are related to intentional landscaping (usually removal of wetland vegetation) for aesthetics or access purposes (Hermit's Peak Watershed Alliance, 2012e). Often impacts can be reduced with thoughtful and educated changes to landscaping. Other causes of degradation are because buildings and other infrastructures are located too close to wetlands. This often limits the hydrologic patterns and the natural dynamics of the wetland ecosystem and its buffer and isolates wetland areas from adjacent natural areas.

   HPWA and Tierra y Montes SWCD can offer technical and financial assistance to landowners and managers wanting to modify land uses to reduce wetland impacts. Alternatively, landscape architects with some training in hydrology or river and wetland restoration contractors can also assist. A booklet produced by the NMED called Healthy Streamside Wetlands (http://www.nmenv.state.nm.us/swqb/Wetlands/HSW/index.html) provides good background and specific guidance. Management actions to improve degraded wetlands that are near lands used for residences, agriculture and recreation include: guided vegetation management and landscaping, improve recreational use, relocate infrastructures away from wetlands, improve roadways (see the following section), and establish wetland buffers.

   - *Develop and implement guided vegetation management and landscaping.* Landowners should seek technical assistance, tools and incentives to help manage wetlands and a buffer area to meet landowner objectives, local site-specific conditions, and to encourage establishment and maintenance of wetland vegetation and intact wetland soils. Strategies for wetland restoration and maintenance might include planting native herbaceous vegetation, native fruit trees, and other native woody vegetation, and developing well placed but limited paths and wetland access points. Suitable and diverse vegetation provides surface roughness to capture and stabilize sediment. Tall trees and shrubs provide shade help regulate water temperatures and provide a long term supply of woody debris and other biological resources to wetland systems. Habitat structural diversity and plant community interspersion should be considered to provide the highest quality wetland appropriate for the site.

   - *Improve management of recreational use.* Private landowners and the USFS should assess impacts to wetlands, riparian vegetation and streambanks from recreational use. Impacts will often appear as bare soils, soil compaction, soil erosion, compromised vegetation, or desiccating wetland area. Such assessment can be done by knowledgeable staff, Tierra y Montes SWCD, HPWA or private consultants. Needed improvements may be to: relocate or modify trails or high intensity use areas and wetland access points, address garbage management, or revegetate degraded areas with wetland or riparian plants.

   - *Relocate infrastructure out of riparian areas.* Identify infrastructures (e.g. buildings, corrals, unnecessary road crossings or roads) adjacent to wetlands and in riparian areas that are causing impacts to wetland vegetation or soils and can be practically relocated. Assistance with

relocation, both financially and technically may be available through HPWA, Tierra y Montes, or NRCS (see Funding and Partnerships section).

- *Limit human activities in wetlands and their buffer area.* By limiting all human activities in wetlands and a reasonable buffer around them, vulnerable soils and wetland vegetation will be best protected. Until specific wetland buffer area recommendations become available (see Tools in the General Wetland Management Actions: Protect Wetlands section), limit use in the wetland area where soils are saturated at least part of the year and where wetland vegetation exists. Ideally, a small zone (about 50') outside of that should also be protected from excessive use.

3. *Road Improvements.* Roads, depending on their design and location, can either degrade wetlands and watershed drainage patterns or assist in maintaining the hydrology that wetlands require. All roads whether paved and well-traveled or infrequently used unimproved roads, can dewater wetlands or deliver concentrated and polluted waters to wetlands. Special engineering of roads with attention to the needs of wetland ecosystems is essential.

   - *Conduct a Comprehensive Road Assessment with Recommended Improvements* - A comprehensive review of improved and unimproved roads, including their design and layout, their construction and maintenance practices is needed. These considerations should include road:
     - Placement - reduce encroachment of roads into wetlands/riparian areas/streambank.
     - Drainage - provide proper drainage to maximize use of water through a vegetated buffer before reaching a stream or wetland.
     - Structures - culverts, road crossings, and bridges must be adequately sized and positioned to handle flooding conditions without significantly affecting hydrology.

   - *Road drainage* – Improve road drainage to route storm water through effective, well-vegetated buffers and filter zones before it reaches wetlands. Storm water runoff directly from road surfaces can elevate water temperatures and deliver excessive sediments and toxins to wetlands (Zeedyk, 2012).

   - *Storm water retention ponds* – Investigate adding storm water retention ponds/wetlands and filter basins in areas with road or impervious surface areas (e.g. parking lots) to help filtering of sediments and impurities. Such ponds should be constructed as fully functional, vegetated wetlands when possible but not replacing or altering natural wetland sites.

   - *Vegetated Wetland buffers* – In areas where roads are located close to wetlands, ensure that an adequate vegetated buffer occurs between the wetland and road. Vegetated buffers ideally consist of grasses, forbs, shrubs and trees; however, any of these plant types by themselves provide some benefit.

4. *Weed Control and Management.* Weed infestations can significantly alter the ecological functions and services that wetlands can provide; they especially simplify plant and animal communities that help perform important functions. Areas that are dominated by only one species of plant (e.g. reed canary grass) may indicate a weed problem. The identification and treatment of weeds usually requires professional assistance. Not all weeds require treatment but noxious or invasive weeds do. Treatment techniques are varied and often complex, especially as they relate to wetlands where chemical toxicity and mechanical treatments may be problematic.

    - Seek professional assistance in identifying and treating suspected weed problems. Contact local Tierra y Montes Soil and Water Conservation District or the Local Cooperative Extension Service for assistance.
    - Exercise early weed detection, weed mapping and treatment; it is significantly easier, more effective and often costs very little or nothing.
    - Prevent soil disturbances (including overgrazing); they normally result in weed infestations. If soil disturbance must occur, follow it with planting appropriate, native wetland or upland vegetation to outcompete weeds.
    - Adopt mechanical or biological means of treating weeds near wetlands if at all possible.
    - Chemical weed treatment must be supervised by a professional with experience in the chemical toxicity to wetland ecosystems.

Actions to Address Rehabilitation

Rehabilitation of degraded wetlands is aimed at restoring necessary water flow into and through wetlands that is needed to maintain wetland characteristics. To further restore wetland functions, rehabilitation of wetland vegetation in the aquatic and riparian zones is critical. Encouraging and accommodating beaver use as an agent of both wetland creation and maintenance is an important action to ensure long-term wetland functions on a watershed scale. Healing upland erosion and providing buffer areas of vegetation or sediment sequestration will reduce sediment loads delivered to wetlands. Rehabilitation actions are:

1. Rehabilitate necessary hydrology,
2. Rehabilitate wetland vegetation,
3. Encourage and accommodate beaver populations,
4. Heal upland erosion and sequester sediments.

Tools to Address Rehabilitation

1. *Rehabilitate necessary hydrology.* Man-made (e.g. levees, roads, diversions) or natural structures (e.g. flood-deposited cobble and woody debris) have isolated existing or historic wetlands from a consistent supply of water that has diminished or destroyed wetland characteristics including plants and soils. Restoration work might include removing or altering natural or man-made structures that have prevented water delivery to wetlands. Because of these structures and other watershed-wide

activities, stream geomorphology may also have been altered (e.g. stream entrenchment, stream channel migration) in such a way as to isolate wetlands from receiving floodwaters from stream channels, hence their desiccation.

At locations where it has been determined that a lack of adequate water flow into and through wetlands is degrading wetland functions, a site-specific assessment is needed to determine the cause of limited water flow and determine the appropriate remediation. Restoration tools include: instream restoration structures to heal entrenchment and improve stream access to its floodplain, removing man-made or natural structures that impede flow to wetlands, or re-constructing channels to restore water flows in areas where they have been destroyed.

A special circumstance commonly exists in Gallinas and other areas related to abandoned acequias. Historically used acequias have often incidentally re-routed stream flows into a straightened acequia channel during flood events. When acequias capture the majority of stream flow they become further straightened and entrenched, reducing stream flow access to its historical channel and floodplain. By moving stream flow back to its historic channel, stream length is usually increased substantially, floodplain access is improved and water flow to adjacent wetlands can be restored.

Restoring wetland hydrology is usually a complex endeavor requiring the services of restoration specialists with specific expertise in hydrology and wetland ecosystems. Without such expertise, more damage than repair can occur. Also, this type of restoration work may involve permitting (US Army Corps of Engineers, NMED, NM OSE) and collaboration with a number of entities like adjacent landowners, acequia associations, San Miguel County, and NM Dept. of Transportation. A coordinating entity, like HPWA, is very helpful to spearhead these types of projects (e.g. find collaborators and funding), coordinate restoration designs within the watershed context, and oversee progress through to completion.

Hydrologic restoration work can be costly so obtaining suitable funding can be a long-term commitment. Refer to Table 10 and Table 11 for potential funding sources and partners. Consult HPWA to seek funding and project coordination.

2. *Rehabilitate wetland vegetation.* Restore or maintain close to 100% soil coverage by plants along wetland perimeters and in a buffer areas adjacent to wetlands. Emphasize planting tall woody vegetation including willows (e.g. peachleaf willow, bluestem willow), cottonwoods, alder, or aspen in wetland areas that will support woody vegetation and have land management measures in place to maintain it. Plant herbaceous vegetation (e.g. sedges, rushes, grasses, forbs) if woody plants cannot be supported or are not desirable and to improve soil retention and prevent erosion along streambanks. A well-vegetated wetland perimeter is needed to reduce erosion, sedimentation, provide stability, filter pollutants, and offer fish and wildlife habitat. Use local sources of plants whenever possible.

Wetland restoration specialists and watershed groups like HPWA can assist in selecting, obtaining and planting new vegetation. Such planting efforts can be more easily accomplished with the help from volunteers such as those available through HPWA, the local United World College, and the NM Highlands Conservation Club as examples. NM State Forestry offers riparian plants for sale twice a year (http://www.emnrd.state.nm.us/SFD/treepublic/ConservationSeedlings.html) and the John T. Harrington Forestry Research Center at Mora has plants available. Plant materials and planting information that is relevant to our area is also available thru the Los Lunas Plant Materials Center (http://www.nrcs.usda.gov/wps/portal/nrcs/main/plantmaterials/pmc/west/nmpmc/). Tierra y Montes SWCD and NRCS provide funding to help purchase plants and provide information about planting techniques. Master Gardeners like those involved in the Las Vegas Tree Board can also help with planting techniques and plant selection.

3. *Encourage and accommodate beaver populations.* Beaver occurrence is currently limited to a few locations in the Gallinas in spite of the likelihood of their historical widespread populations. Beavers have the capacity to restore and maintain fully functional wetlands if allowed to do their work. Under current conditions and with improved riparian and wetland conditions, it is anticipated that beaver may expand their range in the watershed. With that expansion it is expected that beaver/human conflicts may increase.

   Because beavers are a keystone species and provide numerous ecosystem services that significantly contribute to wetland, river, watershed health and biodiversity, the resources to reduce those conflicts are needed. Installation of "beaver deceiver" structures that protect infrastructures from flooding, keep beavers out of irrigation systems and culverts, and beaver wire wraps that protect valuable trees from felling should be offered to landowners. Hands-on education about the benefits of beaver to watershed health and techniques for living with beaver are also needed (Hermit's Peak Watershed Alliance, 2012e). Animal Protection of New Mexico (http://apnm.org/) may have resources available to help install structures to reduce beaver conflicts. HPWA can help locate other experts, funding and volunteers to help with their installation.

4. *Heal upland erosion and sequester sediments.* Upland areas that are void of protective vegetation or have actively eroding arroyos can deliver excessive amounts of sediments to wetland systems during heavy storm events. Gully and sheet erosion control structures should be installed and critical areas revegetated where upland erosion contributes excessive sediments to wetland areas. Restoring upland plant cover and healing arroyo erosion can trap sediments controlling the amount that reaches wetlands and water courses. By trapping sediments in upland areas, the improved soil structure and nutrient availability will help to support further plant growth and the cycle of excessive erosion can be stopped. A comprehensive assessment of upland erosion problems in the watershed did not occur in this planning effort and is needed. Entities like HPWA and Tierra y Montes SWCD should seek funding and partners to do this assessment.

Actions to Address Reestablishment

Reestablishing natural wetlands in areas where the hydrology exists to support them and where current land uses are not in conflict with them is an important action to replace lost wetlands. This restoration will provide numerous benefits to the watershed as a whole and to the local communities including improved: water storage, water filtration, soil moisture, sediment and carbon sequestration, flood mitigation, and fish and wildlife habitat. Actions are:

1. Determine suitable wetland reestablishment locations,
2. Restore hydrology and wetland vegetation.

Tools to Address Reestablishment

Numerous properties exist throughout the watershed that have suitable locations for reestablishing riverine wetlands, and some landowners have expressed interest in such actions should funding become available to do the work. Wetland restoration has become a popular and successful endeavor and numerous contractors exist with experience in this work. The shift of land uses in the watershed away from agricultural production to more residential and recreational land uses provides new opportunities for wetland restoration.

Potential locations to restore riverine or slope wetlands are typically where existing infrastructures or land uses do not pose a conflict with saturated soils, flooding conditions and dense vegetation and where landowners are willing to steward wetlands. Other desirable locations for new wetlands are areas with wide, undeveloped floodplains where new wetlands can help provide the ecosystem services of flood control and sediment and debris sequestration.

The exact location of wetland reestablishment sites and the design of those projects must be site-specific and carefully accomplished by a restoration specialist. The section titled Wetlands in Need of Restoration offers a list of recommended areas to pursue for wetland rehabilitation and reestablishment based on available hydrology, a lack of conflicting infrastructures and land uses, landowner interest and a sizeable floodplain to attenuate floods, but that list is not exhaustive.

Wetlands that need restoration and protection can offer a potential wetland mitigation site to offset wetlands lost or degraded elsewhere. Partnerships must be pursued to link wetlands in need of restoration and protection with entities needing to provide wetland mitigation as part of CWA 404 permit requirements. In-lieu Fee payments to private or public landowners for wetland restoration and protection can provide financial incentives to offset the costs of wetland protection or restoration. In order for a wetland to be eligible to meet mitigation requirements, they may need to be protected with a Conservation Easement.

Tools for wetland reestablishment are the same as those discussed in the above section – Tools to Address Rehabilitation.

Enhance Wetlands

Wetland enhancement in this document refers to the improvement of man-made ponds beyond their original intent to better approximate wetland ecological functions. While pond construction was historically for the purposes of livestock watering and water storage for irrigation, increasing the functionality of man-made ponds will help to offset lost natural wetlands and provide greater ecosystem services to the watershed. With some modifications, man-made ponds can serve the additional functions of flood mitigation and fish and wildlife habitat.

Actions and Tools to Enhance Man-made Ponds

1. *Enhance pond perimeter.* Man-made ponds typically have steep, simple, straight banks. Steep banks reduce the amount of water infiltration, storage and filtering in surrounding soils. Steep banks and minimal edge complexity cannot support diverse vibrant wetland vegetation, thus reducing wetland shading and water temperature regulation and the input of essential organic material to the pond ecosystem. The lack of edge complexity and shape variability also minimizes the diversity of fish and wildlife habitat that a pond can support. Gently sloping banks and banks with a range of slope angles can be created at the perimeter of constructed ponds to enhance their functionality and habitat diversity. In addition, increasing the diversity of the pond bottom with logs, rocks and mounds also increases habitat for aquatic organisms. After reshaping pond perimeters, wetland vegetation should be planted along the banks to hasten wetland plant growth and discourage weed infestations. Reshaped wetland banks could include areas that are constructed specifically to accommodate livestock watering to prevent excessive trampling or erosion. Specific redesigns could also address intentional access points for water withdrawal for irrigation and other uses. Redesigns should also consider maintaining pond inflow and outflow with structures that prevent down cutting or lateral movement of the conveyance channels. Wetland restoration specialists should be sought to develop and implement enhancement designs to maximize benefits, ensure habitat requirements for specific plants and wildlife, and to discover current techniques available.

2. *Enhance wetland vegetation.* To the extent that it is appropriate to current pond uses, adding tall woody vegetation, especially trees, to all or part of the wetland perimeter will decrease pond water temperatures, reduce evaporative losses, contribute important organic material to better support aquatic organisms like trout, and offer habitat diversity for many wildlife species. Woody vegetation may not be compatible with some man-made pond uses (e.g. warm water fish, fishing access, aesthetics); adding it in specific locations interspersed with open areas of low lying, herbaceous vegetation (grasses and forbs) can accommodate human needs and some degree of ecological functions. Where woody vegetation is not desirable, encouraging herbaceous, wetland vegetation to cover ground surfaces is recommended, as well as leaving unvegetated shoreline surfaces for shorebirds and other wildlife.

Funding and Partnerships

A variety of funding sources are available to incentivize and assist with wetland protection, restoration and enhancement on private and public lands. Some of these sources are available directly to landowners or managers, while other funding must go through a government entity, nonprofit organization, or some other organization. Funding sources are often very dynamic; well-funded some years and no funding others. New funding sources also become available periodically. No central entity maintains up-to-date information on all available funding to help follow the ever-changing funding opportunities. Landowners, land managers and interested organizations (e.g. HPWA) must independently stay abreast of current funding sources using the below listed sources as a guide. HPWA can be a first point of contact to determine current funding availability as they keep abreast of new opportunities. Other land management and conservation organizations (e.g. Quivira Coalition) likewise can be contacted individually to search for opportunities. HPWA attempts to access wetland protection, restoration and enhancement funds and make them available to landowners and other stakeholders as much as possible. The NM Environment Department (Surface Water Quality Bureau) periodically has funding opportunities; however, most of those are not available to individuals. Contacting them may uncover additional funding sources.
Potential funding sources and suggested groups suitable to pursue these sources are provided below.

Funding Sources

- *US Fish and Wildlife Service* - Partners for Fish & Wildlife Program offers funding to private and public landowners/managers to improve the condition of lands for fish and wildlife habitat. Wetland protection and restoration is a priority for USFWS. Landowners can contact USFWS directly to pursue this funding or contact Tierra y Montes SWCD or HPWA to assist with identifying and designing projects and serving as a local coordinator. Contact Nancy Baezek, the State Coordinator at the USFWS office in Albuquerque 505.346.2525 or go to: https://www.fws.gov/southwest/es/NewMexico/PFW_home.cfm for general information.

- *US Fish and Wildlife Service* - National Wetlands Conservation Act (NAWCA) grants are available to collaborative groups of organizations, not individuals. A Standard Grant Program is available for large, significant projects involving public-private partnerships to perform long-term protection, restoration, and/or enhancement of wetlands and associated uplands. A Small Grants Program also exists of $25,000 or less. A partnership with USFWS is needed to pursue these grants. See https://www.fws.gov/birdhabitat/Grants/NAWCA/index.shtm.

- *US Environmental Protection Agency* – Clean Water Act section 319 grants. This funding is available through the NM Environment Department. It is available to citizen watershed groups, non-profit organizations, for-profit organizations, individuals, and federal, state and local agencies (including those of Indian Nations, Pueblos, and Tribes). Contact NMED for more details and funding opportunity announcements at: http://www.nmenv.state.nm.us/swqb/.

HPWA has obtained numerous 319 grants and funds provided have then become available to private landowners for doing river, general watershed, and wetland related projects. Contact www.hermitspeakwatersheds.org for more information.

- *USDA Natural Resource Conservation Service* – Numerous funding programs exist to improve sound land management for agricultural producers; most programs are not specific to wetlands but many have some wetland-related work that is covered. Programs include: Environmental Quality Incentives Program (EQIP), Wildlife Habitat Incentives Program (WHIP), and Wetlands Reserve Enhancement Program (WREP), Conservation Stewardship Program (CSP), all offer potential funding programs to private landowners that qualify as agricultural producers. Landowners can pursue this funding directly by contacting the local NRCS office in Las Vegas (505.425.3594) or visiting the NRCS website for general information http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/.

- *NM Environment Department* – River Stewardship Program. This is a potential funding opportunity in years when funds are appropriated through the NM legislature Capital Outlay Bill. Entities eligible to apply for these funds include: towns, cities, counties, soil and water conservation districts, irrigation districts, for-profit and not-for profit organizations, Indian Nations, Pueblos and Tribes. Federal and state agencies are not eligible for funding. For more information see http://www.nmenv.state.nm.us/swqb/RiverStewards/

- *Tierra y Montes Soil & Water Conservation District* – Small project funding is often available directly to landowners for erosion control, riparian and wetland restoration projects, and land management work to support stream and wetland systems (e.g. fencing). Contact their office at 505.425.9088.

- *Private Foundations or Conservation Nonprofits* - Funding from special interest nonprofits or private foundations is periodically available from organizations with interests in wetlands like: Ducks Unlimited, Trout Unlimited, National Audubon Society, local watershed groups (e.g. Hermit's Peak Watershed Alliance).

Partners

In order to take advantage of the above funding sources, obtain technical assistance and obtain help developing feasible wetland protection and restoration projects, a number of organizations can serve as partners.

Table 10 Potential Partners for Wetland Protection, Restoration, and Enhancement.

Partner Name	Potential Partner Roles
NM Environment Department, Wetlands Program	Provides guidance for wetland assessment and monitoring, knowledge of wetland protection, restoration, and enhancement

Partner Name	Potential Partner Roles
	funding.
New Mexico Department of Game and Fish	Provide funding for water catchment systems, offer fish planting, provide information on fish and wildlife habitat needs.
US Fish and Wildlife Service	Partners for Fish and Wildlife Program for protection and restoration. Provide information on fish and wildlife habitat needs. Facilitate wetland protection through Conservation Easements.
Friends of the Las Vegas Wildlife Refuge	Education and community engagement programs related to wetlands.
Santa Fe Conservation Trust, NM Land Conservancy, Trust for Public Lands	Assistance with Conservation Easements or land transfers.
Local community based nonprofits & natural resource conservation groups: Hermit's Peak Watershed Alliance, Upper Pecos Watershed Association, Ducks Unlimited, Trout Unlimited, Native Plant Society, National Audubon Society, NM Riparian Council, Quivira Coalition, Albuquerque Wildlife Federation	Diverse interests in conservation of natural resources – usually have some specialty (e.g. duck, trout management and enhancements). Watershed groups have broader interests. Most have some staff but rely on community volunteers. Often have knowledge of grant funding to do restoration work.
Hermit's Peak Watershed Alliance	The community watershed group that serves the Upper Gallinas Watershed and surrounding watersheds. Has monitored stream, floodplain and wetland conditions, developed plans to restore healthy conditions, works with landowners to improve conditions, engages the community in restoration and monitoring activities.
Land Grant Associations	Guide activities in the Las Vegas and Gallinas Land Grants.
Acequia Associations	Help with improving the condition of acequias.
Restoration Specialist Contractors: Zeedyk Ecological Consulting, Watershed Artisans,	Experts in design and on-the-ground work for watershed, river and wetland restoration, hydrology, watershed functions, biological resources, storm water treatment, green infrastructure,

Partner Name	Potential Partner Roles
Southwest Urban Hydrology, Riverbend Engineering, Hydra Inc.	plant materials. A comprehensive list of potential restoration contractors can be found at http://www.nmenv.state.nm.us/swqb/wps/
Conservation Corps type of organizations: **SW Conservation Corps, Western Hardrock Watershed Team Chimayo Conservation Corps**	Offer job experience programs for young people working in the field of natural resource management and restoration. CC crews may be available to work with public and private organizations to do on-the-ground work.
Neighbors	Work together to find funding and assistance for projects that span multiple landowners. Physical help with land management improvement and restoration projects. Encourage government entities to modify regulations and plans and find funding to protect, restore or enhance wetlands.

Table 11. Summary of Actions, Tools, Funding, and Partners to Protect, Restore and Enhance Wetlands.

Actions/Tools	Funding	Key Partners
PROTECT WETLANDS		
Transfer wetland ownership or management responsibilities to a suitable organization that can ensure its protection	Private funding	Trust for Public Lands, HPWA, La Placita Fire Co., Land Grant Associations, City of Las Vegas, San Miguel County, NM Energy, Minerals and Natural Resources Department: State Parks Division, NM State Land Office, NM Department of Game and Fish, US Fish and Wildlife Service, and US Forest Service
Obtain a Conservation Easement or open space designation for wetlands and their buffers	Private funding	Santa Fe Conservation Trust, NM Land Conservancy, HPWA
Incorporate wetland protection in local and regional planning		City of Las Vegas, San Miguel County, NM OSE, HPWA
Improve upon wetland/riparian		Elected Officials, NMED, City of Las

Actions/Tools	Funding	Key Partners
area/springs protection regulations at the state and local level		Vegas, San Miguel County, HPWA
Identify wetland mitigation sites for developing In-Lieu Fee Programs or wetland credits		US Army Corps of Engineers, HPWA
Use funding programs to incentivize wetland monitoring and protection	319, EQIP, small grants, Partners for Fish and Wildlife	NMED, HPWA, NRCS, TyM SWCD, USFWS, NMED
Start an Adopt-a-Wetland Program	Private Foundations, community fundraising	HPWA, USFWS
RESTORE WETLANDS		
Changes in Land Management		
Livestock Management Improvements	EQIP, small grants from TyM, water catchment grants	NRCS, TyM SWCD, NMG&F, HPWA, Quivira Coalition
Improve Management of Residential, Agricultural, and Recreational Areas	EQIP, TyM small grants, CWA 319, community fundraising	USFS, TyM SWCD, NRCS, NMED, HPWA, private consultants
Road Improvements	EQIP	San Miguel County, NRCS, USFS, Zeedyk Ecological Consulting, Rangeland Hands
Weed Control and Management	TyM SWCD support	TyM SWCD, County Extension Serv.
Rehabilitate Wetlands		
Rehabilitate necessary hydrology	319 grants, River Stewards	US Army Corps of Engineers, NMED, NM OSE, HPWA
Rehabilitate wetland vegetation	EQIP, TyM small grants, CWA 319, River Stewards	NRCS, TyM SWCD, NM State Forestry, Mora Research Station, HPWA
Encourage and accommodate beaver populations	NM Game Code	NM G&F, HPWA, Animal Protection of NM

Actions/Tools	Funding	Key Partners
Heal upland erosion and sequester sediments	EQIP, TyM small grants, CWA 319	NRCS, TyM SWCD, HPWA
Reestablish Wetlands		
Restore hydrology and wetland vegetation	EQIP, TyM small grants, CWA 319, River Stewards	NRCS, TyM SWCD, NMED, HPWA
ENHANCE WETLANDS		
Enhance pond perimeter	EQIP, TyM small grants, CWA 319	NRCS, TyM SWCD, HPWA
Enhance wetland vegetation	EQIP, TyM small grants, CWA 319	NRCS, TyM SWCD, HPWA

Identification of Wetlands in Need of Protection, Restoration, and Enhancement

Using the Resource Analysis section coupled with knowledge gained during the development of the WBP, this section identifies specific wetlands deserving protection, needing restoration, and locations that present opportunities for enhancement. Figure 10 shows the locations of those identified wetlands and Table 12, 13, and Table 14 provide detailed lists.

Specific projects identified here are designed to further the goals laid out in the Wetlands Management Goals and Strategy section and to protect or restore one or more major ecosystem functions. Ecosystem functions are grouped into four categories based on their functional roles. Regulating functions maintain essential ecological processes and life support systems. Supporting functions provide suitable habitat for wild plants and animals. Provisioning functions provide natural resources. Cultural functions provide esthetic and life-fulfilling opportunities to people through exposure to life processes and natural systems and use of natural resources.

The WBP identified 9.9 miles of stream segments in need of improved shading to reduce stream temperature and prioritized them based on the severity of riparian cover deficiencies related to the 61.5% stream shade standard established by NMED (Hermit's Peak Watershed Alliance, 2012a). The work to remedy stream shade deficiencies related the temperature impairment in the Upper Gallinas River is addressed in the WBP and following On-the-Ground Improvement Projects currently underway. This WAP-UGW extends the potential for On-the-Ground projects to also include other types of wetlands and other watershed health concerns.

Wetlands in Need of Protection

Eight existing wetlands in the Upper Gallinas Watershed have been identified as areas deserving special protection. These wetlands have a condition ranking of 'Excellent' or 'Good,' and require protection measures to maintain this status since no such measures are currently in place (Table 12). While the immediate threat of wetland conversion or degradation does not appear to be significant in the watershed, no specific safeguards are in effect to secure the future of existing wetlands. This is of particular concern related to the two highest quality wetlands (sites G3 and G7), so protection of these two wetlands is a high priority.

All but one of the wetlands deserving protection (site G8) could also benefit from restoration work to improve some degraded conditions so they are also included in the following Wetlands in Need of Restoration section.

A close up view and aerial photograph of the area near the Village of Gallinas (site G7) shows an example of a wetland to protect and a wetland to restore (Figure 11 and Figure 12). By combining protection and restoration efforts a larger wetland area can be obtained.

Figure 10. Recommended Wetland Actions - Sites for Protection, Restoration and Enhancement.

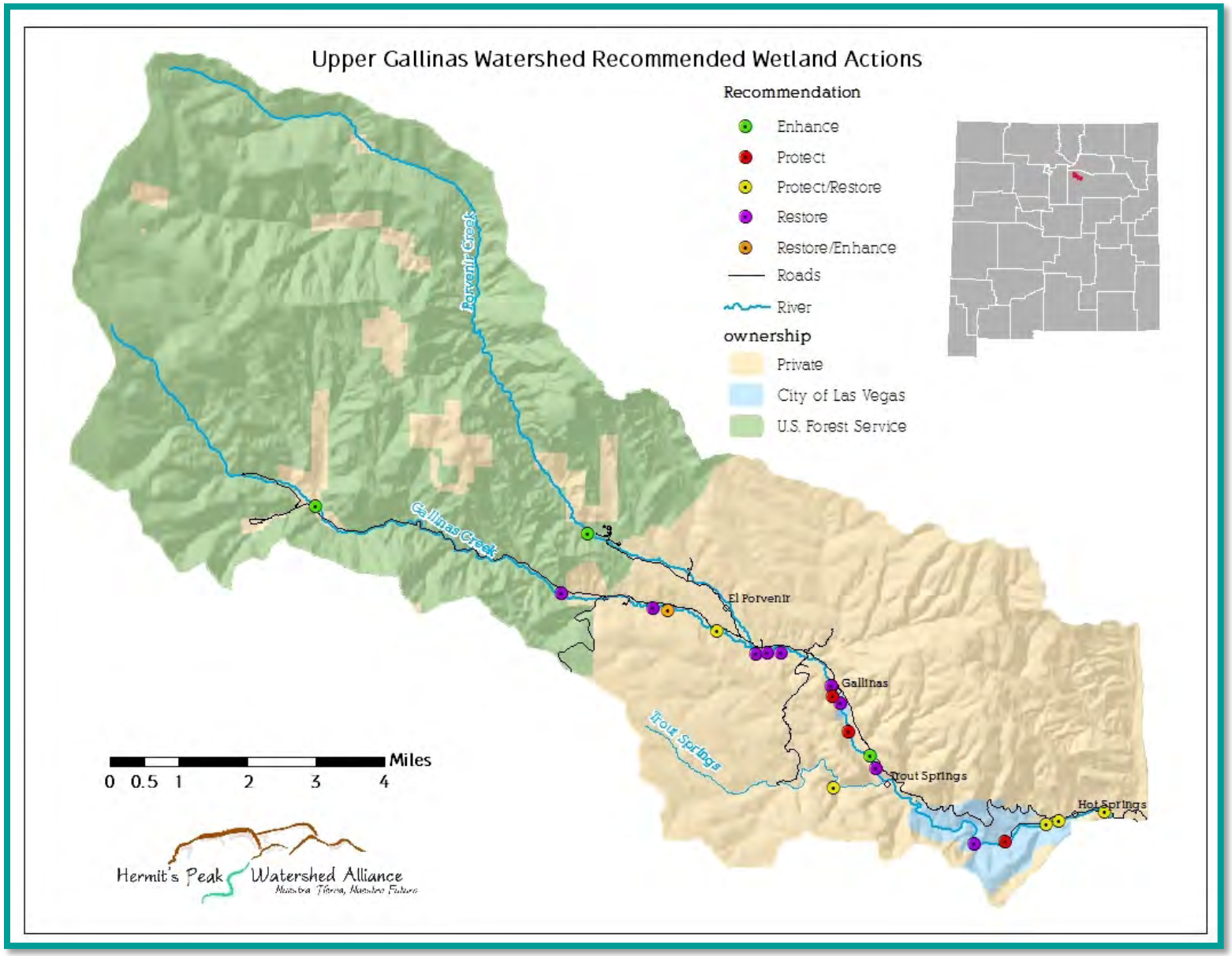


Table 12. Wetland Protection - Wetlands that require protection in order to maintain or improve their current status.

Site	Wetland Condition Rank	Implementation Strategies	Benefits
G3	A	Encourage and support the current landowner in obtaining a Conservation Easement or transferring ownership to an owner that commits to protecting this most valuable wetland.	Largest intact functional wetland in the watershed that serves as a reference of healthy wetland conditions. Protects the regulating and supporting ecosystem functions.
G7	B	Encourage and support the current landowner in obtaining a Conservation Easement. This landowner is already committed to protecting this most valuable wetland.	With protection of this wetland and restoring wetlands on a neighboring City of Las Vegas property, a larger wetland area is possible which protects regulating and supporting ecosystem functions.
G8	B	Encourage and support the current landowner in obtaining a Conservation Easement. This landowner is already committed to protecting these valuable wetlands.	Although these ponds were initially man-made, they perform as functional wetlands (replacing ones that were historically lost). Protecting them protects the regulating and supporting ecosystem functions.
Gallinas River, CLV Municipal Watershed near settling pond	Not surveyed	Encourage the City of Las Vegas to develop land management plans that protect this important wetland and accommodate beaver occurrence to maintain it.	This old beaver pond functions as one of the last wetland areas to help store storm water before it reaches populated areas in Montezuma and Las Vegas. Coupled with potential reestablishment of wetlands immediately downstream of this site, substantial ecosystem functions can be restored; protects the regulating and supporting ecosystem functions.
G9	B	Encourage the City of Las Vegas to develop land management plans that protect this important wetland.	Protects the regulating, supporting, and cultural ecosystem functions.
G10	B	Encourage the City of Las Vegas to develop land management plans that protect this important	Protects the regulating, supporting, provisioning and cultural ecosystem

Site	Wetland Condition Rank	Implementation Strategies	Benefits
		wetland.	functions.
G11	B	Assist the United World College in developing ownership or management alternatives that protect this important wetland.	Protects the cultural ecosystem functions.
TS1, 2, 3, 4	B	Encourage and support the current landowner in obtaining a Conservation Easement. This landowner is already committed to protecting these valuable wetlands.	Protects the regulating and supporting ecosystem functions.

Figure 11. Site G7 requiring both protection and restoration.

Figure 12. Aerial photograph of site G7 and neighboring property that should be restored. The current wetland in need of protection is at the downstream (lower right) end of the bright green meadow and extends along the south (left) side of Gallinas River about ¼ mile downstream. The dry, undeveloped floodplain area to the north (right) of the river between the road and the river is the site of a recommended wetland restoration project (i.e. restore floodplain connectivity and hydrology needed to support historic wetlands).

Wetlands in Need of Restoration

Seventeen wetlands in the Upper Gallinas Watershed have been identified as potential areas to restore healthy wetland conditions that would result in improved overall watershed health and improvement of the current Wetlands Condition Rank of each wetland as calculated using NMRAM. Specific activities for each of these wetlands are described in Table 13. Restoration includes both reestablishment and rehabilitation.

Six of the 17 surveyed wetlands (sites G2, G4, G5, G6, G7, and G8) have been or are currently affected by livestock use. Sites G5, G7 and G8 currently have suitable livestock management plans (developed in 319 On-the-Ground Improvement Projects) in place and adequate fencing to enable careful management so livestock management strategies are not included in the table below. Site G2 has a livestock management plan but some implementation of it has yet to be done. Livestock has been removed from site G7 for the foreseeable future. Monitoring these locations would ensure an upward

trend and improvement to the wetland and ensure that other factors (stressors) are not contributing to wetland degradation. Sites G2, G4, and G6, could still use livestock management improvements.

Nine out of the 17 surveyed wetlands require improved management actions related to residential, agricultural and recreational uses (sites G1, G2, G3, G4, G5, G6, G9, G10, and G11). Recommended actions include: guided vegetation management and landscaping, relocate infrastructures away from wetlands, improve management of recreational use, improve roadways, and establish wetland buffers.

Restoring hydrologic and stream channel conditions to better support riverine wetlands is recommended for eight sites (site G1, upstream of G2, G2, G3, upstream of G5, G5, Gallinas R. upstream of Trout Springs confluence, Gallinas R. downstream of CLV settling pond, TS2). Of those, five sites provide good opportunities to reestablish riverine wetlands (site G2, upstream of G5, G5, Gallinas R. upstream of Trout Springs confluence, Gallinas R. downstream of CLV settling pond).

Wetland vegetation rehabilitation is recommended at all sites after restoration work is done and is particularly recommended at 5 sites (sites G4, G6, TS1, 2, 3).

The reference site (G3) shows evidence of long-term historic and current beaver use that have likely been responsible for its reference condition. Periodic trapping is known to have occurred. As a result, the presence and removal of beaver has impacted hydrologic conditions including sediment deposition and erosion. Enhancement activities would increase the persistence of this site as a healthy functioning reference wetland. Recommended improvements to reference site (G3) include the following:

- Improve instream habitat diversity with rock and log structures;
- Arrest incision and reduce excessive streambank erosion with planting and erosion control structures;
- Assess and remedy channel width to depth ratio;
- Assess and treat noxious and invasive weeds;
- Develop beaver use mitigation structures to discourage beaver use of diversions and acequias.

Table 13. Wetland Restoration - Wetlands that should be restored (includes both rehabilitation and reestablishment) in order to improve their current Wetland Condition Rank and implementation strategies.

Site	Wetland Condition Rank	Implementation Strategies	Benefit
G1	B	With instream structures and streambank reshaping, reinstate hydrologic connectivity to a riverine wetland that was compromised during Sept. 2013 flood. Support beaver population with structures to reduce conflicts with landowner.	Improves regulating, supporting, provisioning and cultural ecosystem functions
Gallinas River, upstream of Site G2	Not surveyed	Reconnect floodplain connectivity to reestablish an adjacent wet meadow.	Improves regulating, and supporting ecosystem functions
G2	A	Reestablish floodplain/riverine wetland.	Improves regulating, and supporting ecosystem functions
G3	A	Reduce entrenchment to increase overland flow and erosion potential. Improve instream habitat diversity. Assess and treat noxious and invasive weeds. Resolve beaver conflicts in acequia diversion.	Improves regulating, and supporting ecosystem functions
G4	C	Implement livestock exclusion and management. Plant riparian vegetation and guided landscaping.	Improves regulating, supporting, and provisioning ecosystem functions
Gallinas River upstream of G5	Not surveyed	Reestablish floodplain/riverine wetland.	Improves regulating, and supporting ecosystem functions
G5		Reconnect stream flow from the river to the adjacent meadow potentially creating a wet meadow. Also a good site to reestablish riverine wetlands.	Improves regulating, and supporting ecosystem functions
G6	C	Implement livestock exclusion and management. Plant riparian vegetation.	Improves regulating, supporting, and provisioning ecosystem functions

Site	Wetland Condition Rank	Implementation Strategies	Benefit
G7		Reestablish floodplain connectivity, and riverine wetlands	
Gallinas River and Ponds upstream of the confluence of Trout Springs	Not surveyed	Modify bank shape and stability of existing pond to support wetland vegetation. Reestablish floodplain connectivity to support wet meadow.	Improves regulating, and supporting, ecosystem functions
Gallinas River downstream of the City of Las Vegas Municipal Watershed settling pond.	Not surveyed	Reestablish riverine wetland in a location where wetlands were likely inundated by historic ice ponds.	Improves regulating, and supporting, ecosystem functions
G9	B	Reduce impact of recreational use, sediment loading from parking areas and unimproved road.	Improves regulating, supporting, and cultural ecosystem functions
G10	B	Reduce impact of recreational use, sediment loading from parking areas and unimproved road.	Improves regulating, supporting, provisioning and cultural ecosystem functions
G11	B	Improve recreational management.	Improves cultural ecosystem functions
TS1	C	Improve native riparian tree regeneration, surrounding land use, and all abiotic metrics.	Improves regulating, and supporting ecosystem functions
TS2	B	Improve native riparian tree regeneration and hydrologic connectivity, surrounding land use, vegetation community structure, macro-topographic complexity.	Improves regulating, and supporting ecosystem functions
TS3	B	Improve native riparian tree regeneration, vegetation community	Improves regulating, and supporting ecosystem

Site	Wetland Condition Rank	Implementation Strategies	Benefit
		structure,	functions
TS4	B	Improve riparian corridor connectivity.	Improves regulating, and supporting ecosystem functions

Figure 13. Aerial photograph of the pond at site G2 that lacks riparian vegetation and requires enhancement (listed in the next section) and a potential wet meadow restoration area at the lower left dried section (to the left of the riparian area).

Man-made Wetlands that Would Benefit from Enhancement

Four man-made ponds were identified with good potential to enhance wetland functions and characteristics (Table 14). Detailed hydrologic and topographic assessment and design is required to enhance these potential sites in order to proceed with wetland enhancement projects. Furthermore,

working with landowners to couple enhancements with landowner objectives and willingness is needed. Pursuit of the tools and funding discussed in Funding and Partnerships section are necessary for these projects.

These man-made ponds lack the supporting biotic and abiotic attributes of functional wetlands. An aerial photograph of the man-made pond at site G2 is an example and shows the lack of riparian vegetation and a potential wet meadow restoration area (Figure 13). This site's Wetland Condition Ranking of 'A' is influenced by the area size and less on biotic condition. As a result planting riparian vegetation and reshaping the pond perimeter to provide more habitat diversity and to better support wetland vegetation is the recommended way to improve the overall wetland condition associated with the pond.

Another example of a man-made pond that is currently degraded, and offers few ecosystem services and natural resources to the landowner is a pond downstream of site G8 shown in Figure 14. Reshaping the pond's perimeter to create gradually sloping banks and a more natural and diverse shape, planting wetland vegetation and connecting floodwater to it from the adjacent river channel would improve its condition, improve ecosystem services it provides, reduce evaporative water loss, and increase its value to the landowner.

Table 14. Wetland Enhancement – Man-made ponds that would benefit from enhancement and methods to attain improved wetland ranking.

Site	Implementation Strategies	Benefit
Evergreen Valley (Not surveyed)	Enhance perimeter of man-made ponds to encourage wetland plan growth. Develop and implement livestock management plans.	Multiple man-made ponds in Evergreen Valley would benefit from enhancement in spite of the lack of NMRAM survey data; enhances the regulating, and supporting ecosystem functions.
G2	Implement livestock management improvements to include fencing and alternative water systems. Reshape pond perimeter to support wetland plants followed by planting both woody and herbaceous riparian vegetation around perimeter of the pond.	Improves regulating, and supporting, ecosystem functions
Gallinas River, downstream of Site of G8* (Not surveyed)	Enhance man-made pond to support wetland function.	Improves regulating, supporting, and provisioning ecosystem functions
P1 (wetland rank - A)	Improve man-made pond, address recreational use and soil surface condition.	Improves regulating, supporting, provisioning and cultural

Site	Implementation Strategies	Benefit
		ecosystem functions

Figure 14. Aerial photograph of a man-made pond that could be restored by modifying the bank shape and planting riparian vegetation (downstream of G8).

Wetland Action Priorities

Priorities for protection, restoration and enhancement actions will help to achieve the most improvement in ecosystem function at the lowest effort and economic cost. A priority rating system was developed as a guide. The following factors were considered in the priority rating system:

- High ecosystem function and services
- Vulnerable to loss or degradation
- Ease of action
- Willing landowner
- Cost/Benefit

The qualitatively assessed rating scale of 1-4 (poor, fair, good, and excellent, respectively) for the ability to obtain the proposed action was used. Those sites with a high priority rating have high ecosystem function, are vulnerable to loss or degradation, are accessible and have a low cost/benefit ratio. Sites with ratings of good or fair lack some factor that reduces the attainment of the proposed action. Sites with a poor priority rating are limited by high cost and reduced benefit. All sites with a Priority Rating of 16 or greater are highest priority, while sites rating less than 10 are lowest priority. Table 15 provides the results of our wetland action priorities.

Table 15. Priority rating for sites surveyed in 2013 and potential new wetland protect/enhance/restore sites. The rating scale of 1-4 (poor, fair, good, and excellent, respectively) was used for individual categories and added together to derive the priority rating.

Site	Wetland Condition Rank	Action	High ecosystem values & services	Vulnerable to loss or degradation	Ease of action	Willing land owner	Cost/ Benefit	Priority Rating
G1	B	Restore	4	3	1	1	2	11
G2	B	Enhance & Restore	4	1	3	4	4	16
G3	A	Protect/Restore	4	3	4	1	4	16
G4	C	Restore	1	3	4	2	2	12
G5	B	Restore	4	2	3	4	3	16
G6	C	Restore	1	3	4	1	2	11
G7	B	Protect/Restore	4	4	2	4	3	17
G8	B	Protect	3	1	2	1	2	9
G9	B	Protect/Restore	3	2	2	2	2	10
G10	B	Protect/Restore	4	3	3	2	4	16
G11	B	Protect/Restore	3	2	3	4	3	15
TS1	C	Protect/Restore	4	2	4	4	4	18
TS2	B	Protect/Restore	4	2	3	4	4	17
TS3	B	Protect/Restore	4	2	3	4	4	17
TS4	B	Protect/Restore	4	2	3	4	4	17
P1	A	Enhance	3	2	3	3	3	14
Gallinas River, upstream of Site G2 – wet meadow	Not surveyed	Restore	4	1	3	4	4	16

Site	Wetland Condition Rank	Action	High ecosystem values & services	Vulnerable to loss or degradation	Ease of action	Willing land owner	Cost/ Benefit	Priority Rating
Gallinas River upstream of G5	Not surveyed	Restore	4	2	3	2	3	14
Gallinas River, downstream of Site of G8	Not surveyed	Enhance	4	4	2	2	4	16
Gallinas River, Pond upstream of the confluence of Trout Springs	Not surveyed	Restore	4	2	3	3	3	15
Gallinas River Beaver pond near City Settling Pond	Not surveyed	Protect/Restore	3	3	3	3	3	15
Evergreen Valley	Not surveyed	Enhance	3	2	3	4	3	15

Wetlands Monitoring

The Upper Gallinas Watershed wetlands have had no systematic assessment, or monitoring until this project. The New Mexico Environment Department provided remotely mapped wetland information in 2013, but these data still need on-the-ground verification and provide little indication about the status or threats to the wetlands.

As the NMRAM protocol is updated, it will be essential to determine the effect these changes have on wetland condition ranking within the watershed. Sites with easy public access such as site G1 (USFS ownership) and sites G9 or G10 (City of Las Vegas ownership) should be included in a long-term monitoring and tracking strategy that also uses the newer versions of NMRAM. These sites represent the upper (G1) and lower (G9 or G10) reaches of the watershed and differing ecosystem functions that were identified in the Identification of Wetlands in Need of Protection, Restoration, and Enhancement section.

The reference wetland (G3) represents the best riverine wetland condition in the watershed. However, access to the site is restricted. More extensive aerial photographs of the area could verify local conditions without infringing on private ownership rights. If access limitations continue to persist, use of this site in long-term monitoring may not be possible.

Site G7 and adjacent City of Las Vegas property is the final site that should be considered for long-term monitoring, because it represents an area of both private and public landownership in an area of combined residential and agricultural land use. Furthermore, it is a site of proposed river and wetland restoration and protection activities.

The establishment of long-term monitoring sites for these key wetland areas (G1, G3, G7, G9 and G10) would provide beneficial tracking to periodically reassess this WAP-UGW. Minimally, NMRAM should be used as the long-term monitoring methodology at the recommended sites. Long-term monitoring should be done in addition to effectiveness type monitoring at project locations.

Should protection, restoration or enhancement projects be implemented, pre- and post-treatment monitoring (using NMRAM) in addition to other metrics to track project successes and meet permit requirements (e.g. stream channel geomorphology, stream temperature, width: depth ratio, and canopy shade) should be conducted. This type of success monitoring is essential to determine tangible outcomes of restoration and guide future work.

Additionally, the Watershed Based Plan for the Upper Gallinas Watershed (HPWA, 2012a) recommends the following monitoring to track stream temperature changes with the implementation of watershed restoration. That monitoring consists of continuous stream temperature monitoring every year during summer months throughout the eight years covered in the WBP. Sampling locations will include the 12 baseline sites and additional sites as necessary. At the end of each implementation phase, a repeat of field-measured stream shade and width: depth on 50 random sites will occur watershed-wide. Aerial

photo interpretation of stream shade will occur once per phase if new aerial photos become available. Effectiveness monitoring of each project site will include field stream shade, width:depth, and Rosgen Level II Geomorphology at each project site before treatment. After treatment, field stream shade, width: depth and geomorphology monitoring will occur at each project site in the final year of each phase or longer as stipulated in any 404 permit agreements. This recommended monitoring will occur by HPWA providing funds are available.

PUBLIC INVOLVEMENT STRATEGY

The future of wetlands in the Upper Gallinas Watershed depends on if they continue to receive water, maintain typical wetland soils, and support hydrophytes. Basically, wetlands need to stay wet and well-vegetated. Potential decline in water supply and quality related to climate change is of concern to communities within the watershed, and especially the City of Las Vegas, because such declines have serious implications to the availability of drinking water, public health, and ecosystem stability and productivity. Without intervention, wetlands and riparian areas may degrade further or be lost in the near future and with their demise the entire Gallinas community will lose the natural benefits wetland ecosystems provide.

In order for protection, restoration and enhancement actions laid out in this plan to occur, support from all sectors of the community is necessary. Especially important are the following groups:

Gallinas Wetland Stakeholders

- Private landowners and land managers that operate independently or cooperatively including:
    - Rio Gallinas Acequia Association and local ditches
    - Gallinas and Las Vegas Land Grant Associations
    - La Placita Volunteer Fire Department
    - Private Landowners or caretakers/ranch managers
    - Organizations that own property (United World College, El Porvenir Christian Camp)

- Public land and natural resource related government agencies:
    - City of Las Vegas
    - San Miguel County
    - Tierra y Montes Soil and Water Conservation District
    - West and East Las Vegas City Schools
    - NM Highlands University
    - Luna Community College
    - NM State Office of the State Engineer
    - NM State Forestry
    - NM Department of Game and Fish
    - NM Environment Department

- US Forest Service
- US Fish and Wildlife Service

Strategies for involving these groups and the general public start with education and extend to engagement, and finally policy, regulation, planning, and financial support. A presentation given to the Wetlands Roundtable on stakeholder engagement in Nov. 2014 is offered to provide additional thoughts (see Appendix, Stakeholder Engagement section).

Wetland Education Program Recommendations

The small size and long history of the Gallinas and Las Vegas community in contrast to large urban areas, calls for unique approaches to delivering education programs. Building and maintaining personal, one-on-one opportunities to share wetland information that is specific to each landowner is the most effective approach. To offer other opportunities and invite new people to begin learning about wetlands and watershed stewardship, diverse approaches to reach various people is key. Since many residents in the Gallinas area still do not have access to the internet, reliance on web-based communication will exclude important groups. The following means of advertising events & conducting education programs provide a diverse approach:

- Radio (KFUN/KVLK, KNMX) advertisements and regular shows
- Newspaper (Las Vegas Optic) advertisements and article submission
- Digital – website, Facebook, email distribution
- Newsletters for various organizations including HPWA

The Hermit's Peak Watershed Alliance currently conducts regular educational programs on topics relevant to Watershed Stewardship (including wetlands); it is called the Land Stewardship Series. This series started in late 2013 and has held 12 events thru November 2014. The small, informal character of these events encourages a wide diversity of people to attend.
Future topics to cover in the Land Stewardship Series or other educational programs should include:

- *Importance of Wetlands* to our water supply, natural environment, and quality of life
- *Wetland Appreciation* – fun and engaging programs to experience wetland areas, botany, birding, fishing, nature study
- *Tools for Wetland Protection* – Conservation Easements and land ownership transfers, funding programs
- *Tools for Wetland Enhancement* – livestock management for wetland health, managing backyard wetlands, managing recreation areas with wetlands, road construction and maintenance, upland erosion control, planting wetland vegetation, instream restoration, weed identification and treatment, turning manmade ponds into functional wetlands, living with beaver.
- *Tools for Wetland Restoration* – building a functional wetland

Continuing this series is an appropriate and supported venue for delivering educational information to landowners/managers and the general public. However, since programs are usually in the evenings and weekends, government agency staff attendance is not encouraged. Expanding the Land Stewardship Series by collaborating with other organizations doing similar education work (e.g. Friends of the Las Vegas Wildlife Refuge, U.S. Fish and Wildlife Service, Tierra y Montes Soil and Water Conservation District, NM Highlands University) will help it to become more sustainable and available to diverse groups. Also extending the series to occur during times that are more conducive to government agency participation is recommended.

Including wetland lessons in school curricula is another important educational endeavor. Without fostering a growing understanding of wetland ecosystems among young people, long-term progress will be slow. Numerous resources already exist to deliver wetland and watershed educational materials to teachers (e.g. Aquatic Wild). HPWA is working to bring some of those sources together into a Watershed Trunk of activities for middle school students and presenting that to local area teachers.

Wetland Engagement Opportunities

Beyond participation in the education programs described above, actively engaging stakeholders and the general public in wetland stewardship is a valuable means of fostering support for wetlands. Such engagement activities could involve:

- Working with landowners to protect, enhance, or restore wetlands on their property;
- Including volunteers in carrying out educational program;
- Including volunteers in hands-on wetland enhancement or restoration work on private or public lands. Examples of appropriate work for volunteers are: planting, weed treatments, hand-built erosion control structures, fencing, and perhaps some supervised monitoring work.

The principal local, non-governmental organizations that do this type of work in the Gallinas area are HPWA, Tierra y Montes Soil & Water Conservation Service and the Friends of the Las Vegas Wildlife Refuge.

Participation in local or statewide wetland policy and regulation revisions, and local or statewide planning or funding efforts by non-governmental organizations, pertinent government agencies, and knowledgeable or interested community members is important. City Council meetings, County Commission meetings, SWCD Board meetings and others provide a forum for keeping abreast of policy and regulation changes, funding priorities and to voice concerns. Various planning efforts potentially include wetland and watershed components offering opportunities to be involved, including: Forest Plans (US Forest Service), Regional Water Plans (NM Office of the State Engineer), County Land Use Plans (San Miguel County), Economic Development Plans (Las Vegas Chamber of Commerce), and City Comprehensive Land Use Plans (City of Las Vegas).

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APPENDICES

NMRAM Data

Scoring is based on a 1-4 scale (1: Poor, 2: Fair, 3: Good, and 4: Excellent). Raw score is the value rated for the metric. Final score is the raw score multiplied by weighted factor attributed to the metric (Muldavin et al., 2011b).

Landscape Context Metrics and Absolute Wetland Size

Landscape Context Attribute Final Score is comprised of the following metrics and the weighted factors for each.

- **Buffer Integrity Index** is based on the average of the rating for 3 sub-metric and a weight of 0.3 that is applied to the final score
    - Buffer Percent
    - Buffer Width
    - Buffer Condition
- **Riparian Corridor Connectivity** is attributed a weight of 0.3 that is applied the final score.
- **Relative Wetland Size** indicates the reduction of the current wetland relative to the estimated historical wetland size and is attributed a weight of 0.2 that is applied to the final score.
- **Surrounding Wetland Use** is attributed a weight of 0.2 that is applied to the final score.

Absolute Wetland Size is a standalone measure of the intrinsic importance of size of a wetland and is attributed a weight of 1.

Table A1. Raw and final score for landscape context metrics and the landscape context attribute final score for wetlands surveyed in the Upper Gallinas Watershed during 2013. *Reference site.

Site	Buffer Percent	Buffer Width	Buffer Condition	Buffer Integrity Index (raw/final)	Riparian Corridor Connectivity (raw/final)	Relative Wetland Size (raw/final)	Surrounding Land Use (raw/final)	**Landscape Context Attribute Final Score**	**Absolute Wetland Size**
G1	4	4	4	4/1.2	4/1.2	4/0.8	4/0.8	4.0	1
G2	3	3	3	3/0.9	4/1.2	4/0.8	2/0.4	3.3	4
G3*	3	4	2	3/0.9	3/0.9	4/0.8	2/0.4	3.0	3
G4	2	3	2	2.6/0.8	3/0.9	3/0.6	3/0.6	2.9	1
G5	2	4	3	3/0.9	3/0.9	2/0.4	2/0.4	2.6	2
G6	2	3	3	1.7/0.51	4/1.2	3/0.6	2/0.4	2.8	2
G7	2	3	2	2/0.6	3/0.9	2/0.4	1/0.2	2.1	1
G8	4	4	3	3.4/1.2	4/1.2	3/0.6	2/0.4	3.4	2
G9	4	3	3	3/0.9	3/0.9	4/0.8	1/0.2	2.8	3
G10	3	4	3	3/0.9	1/0.3	3/0.6	2/0.4	2.2	3
G11	1	1	4	2/.6	2/0.6	3/0.6	1/0.2	2.0	1
TS1	2	4	4	3/0.9	1/0.3	2/0.4	1/0.2	1.8	2
TS2	4	4	3	4/1.2	4/1.2	2/0.4	2/0.4	3.2	2
TS3	4	4	3	4/1.2	4/1.2	2/0.4	3/0.6	3.4	2
TS4	4	3	3	3/0.9	2/0.6	2/0.4	1/0.2	2.1	2
P1	3	4	2	3/0.9	3/0.9	2/0.4	2/0.4	2.6	3

Biotic Metrics

The following five biotic metrics are used to measure key biological attributes within a wetland that reflect ecosystem health:

- **Relative Native Plant Community Composition** is attributed a weight of 0.2 that is applied to the final score.
- **Vegetation Horizontal Patch Structure** is attributed a weight of 0.2 that is applied to the final score.
- **Vegetation Vertical Structure** is attributed a weight of 0.3 that is applied to the final score.
- **Native Riparian Tree Regeneration** is attributed a weight of 0.2 that is applied to the final score.
- **Invasive Exotic Plant Species Cover** is attributed a weight of 0.1 that is applied to the final score.

Table A2. Raw and final score for biotic metrics and the biotic condition attribute final score for wetlands surveyed in the Upper Gallinas Watershed during 2013. *Reference site.

Site	Relative Native Plant Community Composition	Vegetation Horizontal Patch Structure	Vegetation Vertical Structure	Native Tree Regeneration	Invasive Exotic Plant Species Cover	**Biotic Condition Attribute Final Score**
G1	4/1.2	4/0.8	4/0.8	4/0.4	4/0.8	4.0
G2	2/0.6	3/0.6	4/0.8	4/0.8	1/0.2	2.6
G3*	4/1.2	4/0.8	4/0.8	3/0.3	4/0.8	3.9
G4	3/0.9	2/0.4	3/0.6	3/0.3	2/0.2	2.6
G5	3/0.9	3/0.6	2/0.4	2/0.2	3/0.6	2.7
G6	3/0.9	3/0.6	4/0.8	4/0.4	2/0.4	3.1
G7	3/0.9	3/0.6	2/0.4	2/0.2	3/0.6	2.7
G8	3/0.9	4/0.8	3/0.6	4/0.4	4/0.8	3.5
G9	4/1.2	2/0.4	2/0.4	2/0.2	4/0.8	3.0
G10	3/0.9	3/0.6	3/0.6	2/0.2	3/0.6	2.9
G11	3/0.9	3/0.6	4/0.8	4/0.4	2/0.4	3.1
TS1	3/0.9	2/0.4	2/0.4	1/0.1	4/0.8	2.6
TS2	4/1.2	3/0.6	2/0.4	1/0.1	3/0.6	2.9
TS3	3/0.9	2/0.4	2/0.4	1/0.1	3/0.6	2.4
TS4	4/1.2	3/0.6	4/0.8	2/0.2	3/0.6	3.4
P1	4/1.2	4/0.8	4/0.8	3/0.3	4/0.8	3.9

Abiotic Metrics

Five abiotic condition metrics, grouped into the categories of hydrology and soil condition, were used to assess the functional status of a wetland. Each metric has a weight that is applied to the final score.

- Hydrology (factors reflecting hydrology at a site and its effects on biodiversity and ecosystem services)
    - **Hydrologic Connectivity** is attributed a weight of 0.3.
    - **Macrotopographic Complexity** is attributed a weight of 0.2.
    - **Channel Stability** is attributed a weight of 0.2.
- Soil Condition (factors reflecting direct disturbance impacts such as livestock grazing, roads, and other anthropogenic disturbances)
    - **Stream Bank Stability** is attributed a weight of 0.2.
    - **Cover and Soil Surface Condition** is attributed a weight of 0.1.

Table A3. Raw and final score for abiotic metrics and the abiotic condition attribute final score for wetlands surveyed in the Upper Gallinas Watershed during 2013.

Site	Hydrologic Connectivity	Macro-topographic Complexity	Channel Stability	Stream Bank Stability and Cover	Soil Surface Condition	**Abiotic Condition Attribute Final Score**
G1	1/0.3	3/0.6	3/0.6	4/0.8	4/0.4	2.7
G2	4/1.2	3/0.6	4/0.8	4/0.8	2/0.2	3.6
G3*	3/0.6	3/0.6	3/0.6	4/0.8	2/0.2	3.2
G4	2/0.6	2/0.4	3/0.6	3/0.6	2/0.2	2.4
G5	2/0.6	2/0.4	3/0.6	4/0.8	2/0.2	2.6
G6	1/0.3	2/0.4	2/0.4	2/0.4	1/0.1	1.6
G7	1/0.3	2/0.4	2/0.4	2/0.4	2/0.4	1.6
G8	2/0.6	4/0.8	3/0.6	4/0.8	4/0.4	3.2
G9	4/1.2	2/0.4	2/0.4	3/0.6	3/0.3	2.9
G10	4/1.2	2/0.4	2/0.4	2/0.4	3/0.3	2.7
G11	4/1.2	3/0.6	3/0.6	4/0.8	2/0.2	3.4
TS1	2/0.6	2/0.4	2/0.4	2/0.4	3/0.3	2.1
TS2	1/0.3	2/0.4	3/0.6	3/0.6	3/0.3	2.2
TS3	2/0.6	3/0.6	3/0.6	4/0.8	3/0.3	2.9
TS4	4/1.2	3/0.6	3/0.6	4/0.8	3/0.3	3.5
P1	4/1.2	3/0.6	3/0.6	4/0.8	2/0.2	3.4

Stakeholder Engagement

Stakeholder Engagement: Getting Beyond the Obligation

It's All about Relationships

A Talk at the Wetlands Roundtable

November 3, 2014

Introduction

HPWA has a **vision** of involving our entire community in caring for its watersheds but we have struggled with how to make that really happen. We see people all harmoniously working together on the ground, in meetings, around kitchen tables – young people, old people, poor people and rich people; it's an honorable vision but really hard to make happen.

We've tried a number of things; some have worked well, while some have failed. It seems particularly challenging to build that vision in our rural area but all areas have their unique challenges. So this is really a discussion – HPWA is not the expert – we need your ideas on this to improve our approach.

In our efforts to:

- Build scientific support,
- Gain political support,
- Find funding,
- Work through regulations, policy, and institutional structures,
- Keep up with putting out the everyday fires, and
- Do great things on the ground for wetlands and other natural areas.

It's easy to forget the human side – the real people behind the work we do.

We've continually come to the conclusion that without strong personal relationships – stakeholder engagement and buy-in does not happen.

Building relationships with people is stuff we all know but may need reminders to devote enough time to it.

What Is Stakeholder Engagement?

Stakeholder engagement is one of the key phrases included in most of our grant proposals and work plans. But what does it really mean and who are stakeholders.

A definition - Wikipedia says ……

> **Stakeholder engagement** is the process by which an organization involves people who may be affected by the decisions it makes or can influence the implementation of its decisions. They may support or oppose the decisions, be influential in the organization or within the community in which it operates, hold relevant official positions or be affected in the long term.

Simply – It's involving affected people in the process rather than imposing something on them.

So, we can involve them in a procedural manner – like inviting them to a public meeting or having them comment on draft documents – but does that really involve them? We need to genuinely examine how to do that.

Types of Stakeholders -

- General Community – "the man on the street" – they get forgotten
- Landowners
- Organization leaders and members
- Educational institutions and students
- Government organizations
- Supporters
- Opponents
- Many Others …….

Why We Need It?

Longevity - Really if we don't involve the people affected by our work in the work it likely will not continue. We all know any one of us alone can't really do all the work that is needed – even if we think we can. Unless people are really sold on an idea it won't last beyond our tenure or will not be effective.
Our Understanding - We may not really understand a problem nor come up with the right solution to a problem if we work on it in a vacuum.
Cooperation on the Ground – Without landowners and managers that are willing to work with us to restore and improve wetlands, riparian areas and our watersheds – we cannot be effective.

Fundamental Basis – It's All About Relationships

Ben, the President of our Board, advised early on that "It's all about relationships." The depth of what that meant didn't really become apparent until I was in the middle of doing just that.
The most critical and fundamental part of stakeholder engagement is building relationships. The relationships that people have with the LAND and the relationships we have with EACH OTHER. Those relationships must be deep and committed. They must have intellectual, spiritual, physical and emotional depth to withstand the test of time.
The way we approach stakeholder engagement has a profound effect on our successes to protect, enhance and maintain wetland ecosystems.
Building those relationships is easily as complex and sensitive as the natural ecosystem that we are working with.
It's about:

- Watching and savoring the moments of connection with people and place ……
- Watching a child sitting on a rock in the stream hand fishing, then catching and kissing a small fish she caught,
- It's about sitting on the porch hearing the stories of an elder,
- Visiting a well-known place with people who have passed by it for a life time but really seeing it for the first time,
- Endless phone calls, emails, discussions ……..
- Working together with shovels in hand – cleaning an acequia, cutting sod, carrying rock

- People connecting with people and the place they call home

We've reduced this idea of relationships with people to the notion of "Stakeholder Engagement." But it's really so much more than that ……..
Principals for building relationships with stakeholders:

- Meet people where they are at; whether they are scientific experts, Mayors, politicians, inspectors, house wives, wanderers, retirees, or just simply members of the human race.
- It's taking to the time to figure out where they are coming from – and to connect with them in a meaningful way – honoring who they are, what they know, then what's important to them.
- Developing and keeping relationships takes time – time to build trust and connection, factor in the time it takes to build and foster these relationships.
- It's mending broken fences with humility and genuine concern.
- It's having the patience to build a relationship – only with that will it last.
- Look at the community you are working in ……. Observe what seems to be important to them.
- Start by exploring the relationships, find creative ways to connect people with you, with each other, and with the LAND.
- Continually foster those relationships.

An Approach to Stakeholder Engagement and Building Buy-In

Building and maintaining relationships takes considerable time; the amount of time it takes isn't always supported in our grant-funded work. Coming up with a stakeholder engagement strategy at the beginning of an effort is important. We need to factor in enough time to build personal relationships. We also need to be flexible enough to adapt the strategy if it doesn't work; it needs to be a very dynamic and iterative strategy. It needs to be diverse since there are many different types of stakeholders.

1. **Identify the stakeholders** of your work – those affected and those that can affect it. Build a database of those people to use for mailing, volunteering, and events.
    a. Local landowners
    b. Local residents
    c. Patrones
    d. Local organizations – acequia associations, neighborhood associations, water users associations, land grants, volunteer fire departments, agricultural coops, social groups – RURAL groups will be different than URBAN groups.

2. Think about the **demographics** and tailor the approach to match that.

3. **Emphasize getting to know people one-on-one** –interviews, community leader coffees in their homes. It's important to be already be a part of the community – so can talk neighbor-to-neighbor.

   Beth Bardwell (Audubon's director of Freshwater Conservation) at the "Southwest Women in Conservation" gathering in Sept. said …… "When it comes to freshwater conservation, you need to be familiar with the community, the resource and the geography. There is no better way to attain that understanding than working in your own backyard. "

4. **Fun- community spirit events** for visibility and camaraderie – e.g. Watershed Olympics, cleanups.

5. **Public Meetings –** there is a place for them but they shouldn't be the center fold of stakeholder engagement.

6. **Consistent Educational events** – Land Stewardship Series

7. **PR with a Personal Touch** is most effective in rural communities - Plan time to deliver flyers, make phone calls, send personal emails.

8. In project plans & budgets **factor in enough time to build relationships** and have a personal touch.

Glossary

Acre An area of land containing 43,560 square feet or 0.4 hectares. Approximately equal to the playing area of an American football field.

Aquatic Habitat Habitat that is wholly aquatic and is inhabited by organisms that could not survive without complete submersion.

Aquatic Plant Plants adapted to living in water. This includes obligate wetland plants and facultative wetland plants, but also includes plants that are either totally submerged or plants that do not root in soil and are totally free floating.

Biological diversity Used loosely to mean the variety of life on Earth, but scientifically typically used as to consisting of three components: 1. Genetic diversity- the total number of genetic characteristics; 2. Species diversity (which includes three concepts: species richness, species evenness and dominance); and 3. Habitat or ecosystems in a given unit area.

Buffer A zone around a wetland that can mitigate the effects of activities or events on surrounding land. For example, a riparian buffer may trap sediment and trash from being washed into a stream. For our assessment the buffer was considered to be 250 meters.

Canopy The more or less continuous cover of branches and foliage formed collectively by the crowns of adjacent trees and other woody growth.

Community, ecological A group of populations of different species living in the same local area and interacting with one another. A community is the living portion of an ecosystem.

Creation Converting a non-wetland (either dry land or unvegetated water) to a wetland.

Ecosystem An ecological community and its local abiotic components. An ecosystem is the minimum system that includes and sustains life.

Edge Any transition between two or more habitats that makes it favorable to wildlife. For example, the transition between a pasture and surrounding forests is considered 'edge.'

Enhancement The manipulation of the physical, chemical, or biological characteristics of a man-made pond or man-made wetland area to heighten, intensify, or improve specific function(s) to enhance its ability to more closely resemble fully-functional natural wetlands. Enhancement is undertaken for a purpose such as water quality improvement, flood water retention or wildlife habitat. Enhancement results in an improvement in wetland function(s), but may lead to a decline in some human-use functions, but it does not result in a gain in wetland acres. This definition is based on EPA Restoration-guide (2003) with some modifications for our purposes.

Facultative Plant A plant that occurs in either upland or wetland habitat (USDA Plants, 2014).

Facultative Wetland Plant A plant that usually occurs in wetland habitat, but are sometimes found in upland habitat.

Facultative Upland Plant A plant that usually occurs in upland habitat but are sometimes found in wetland habitat.

Floodplain Flat topography adjacent to a stream in a river valley that has been produced by the combination of overbank flow and lateral migration of meander bends.

Habitat The place where a plant or animal can live and maintain itself.

Hydrogeomophic Approach (HGM) A wetland classification method based hydrologic properties and geomorphic structure, developed by the U.S. Corps of Engineers (Brinson et al. 1995; Hauer et al., 2002).

Hydrophyte A plant that grows only in or on water. Hydrophytic (adjective).
Mesophyte A plant that needs only a moderate amount of water. Mesophytic (adjective).
Native species A species that has evolved in, and lives only within, a specific location. Also referred to as endemic.
Non-native species A Species introduced into a new area, one in which it had not evolved. Also referred to as exotic or introduced.
Nutrient Cycling The movement and exchange of nutrient elements within an ecosystem, mostly between plants and soil but also including mineral and atmospheric inputs and losses.
Obligate Upland Plant Plants that will only occur in uplands (terrestrial) habitats.
Obligate Wetland Plant Plants that will only occur in wetland habitats.
Orographic Relating to mountains, especially with regard to their position and form. Clouds or rainfall resulting from the effects of mountains in forcing moist air to rise.
Phreatophytes Deep-rooted plants often found along stream sides in the phreatic zone (zone of saturation) or the capillary fringe above the phreatic zone. They obtain a significant amount of water by having roots in direct contact or at the fringe of saturated soils.
Protection Prevent the conversion of a wetland to a non-wetland land type or land use that is not compatible with fully functional wetland characteristics. Protection includes the removal of a threat to or prevention of the decline of wetland conditions by an action in or near a wetland. It includes purchase of land or easements, repairing water control structures or fences, or structural protection such as repairing a barrier island. Protection includes ensuring an adequate water supply needed to maintain a wetland. This prevents the conversion of a wetland to a different, non-wetland land type (e.g. upland plant community). This term also includes activities commonly associated with the term preservation. Protection does not result in a gain of wetland acres or function. This definition is based on EPA Restoration-guide (2003).
Restoration The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded wetland (EPA Restoration-guide, 2003).
For the purpose of tracking net gains in wetland acres, restoration is divided into:

Re-establishment - the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to former wetland. Re-establishment results in rebuilding a former wetland and results in a gain in wetland acres.

Rehabilitation - the manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions of degraded wetland. Rehabilitation results in a gain in wetland function but does not result in a gain in wetland acres.

Riparian Zone The area of vegetation and soil directly adjacent to a body of water that is influenced by the water and influences the water. It is usually considered to the extent of the active flood plain or the distance that a tree can fall and still have some part of it end in the water. It is a type of wetland.
Terrestrial Habitat Habitat that is inhabited by organisms that could not survive inundation of saturated soils for more than a very short amount of time.
Riverine Wetland A wetland that receives water from either overbank flow from the channel or is irrigated subsurface through a floodplain aquifer. A type of hydrogeomorphic (HGM) wetland.

Slope Wetland A wetland that receives water from groundwater discharging from upslope infiltration (a spring). A type of Hydrogeomorphic (HGM) wetland.

Snowshadow A region having little snowfall because it is sheltered form prevailing moisture –bearing winds by a range of hills or mountains.

Watershed An area of land that forms the drainage of a stream or river. If a drop of rain falls anywhere within a watershed, it can flow out only through that same stream or river.

Wetland A comprehensive term for landforms such as marshes, swamps, bogs, prairie pot holes, or ephemeral pools. Their common feature is that they are wet at least part of the year and as a result have a particular type of vegetation and soil. Wetlands form important habitats for many species of plants and animals, while serving a variety of natural service functions for other ecosystems and people.

Xerophyte A plant that requires very little water. Xerophytic (adjective).