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Assessment of Wetland and Riparian Resources in the Gallatin Valley and Bozeman Creek Watershed, Gallatin County, Montana

BACKGROUND

Properly functioning wetlands and riparian areas provide critical habitat for waterfowl, freshwater fish, wildlife, and migratory birds. It is the relative abundance of this wildlife, water and other natural resources that is valued by the communities of the Gallatin Valley, Montana and the newcomers attracted to it.

Development in the Gallatin Valley has reached a level that necessitates better planning and management to minimize the impacts on these important water resources. Local planning departments and municipalities often must operate with little or no information regarding conflicts between conservation of wetlands and riparian areas and development interests.

Baseline data about historic and current wetland and riparian resources as well as their hydrologic role in the Gallatin Valley is a valuable tool that planning entities and others involved with decision-making regarding these water resources and development issues can use.

In order to accomplish this, information on the location and extent of wetlands and riparian areas was needed. Beginning in 2001, the Gallatin Local Water Quality District (GLWQD) conducted an inventory of the wetlands and riparian areas in the Gallatin Valley.

The data collected from this project is benefiting land use planners, developers and resource managers by: (1) furnishing them with wetland inventory data prior to consideration of lands for subdivision suitability; (2) providing baseline data for developing a comprehensive hydrologic profile of the Gallatin Valley; (3) providing the GLWQD with water resources information relevant to local issues of concern which can be disseminated to the community, and; (3) assisting in the inventory of areas that may provide opportunities for wetland restoration.

IMPORTANCE OF WETLANDS

In terms of human development and land use, wetlands have often been viewed as wastelands or areas with limited development potential. Historically, wetlands have been drained or filled-in so that the land area could be "used for beneficial human purposes". This view of wetlands does not reflect the values and benefits associated with them.

Prior to the 1980's wetlands were mainly converted to agricultural lands. Since then, it is estimated that over 80% of wetland losses are due to non-agricultural activities (Brown & Lant, 1999).

Wetlands serve a number of important functions and provide benefits to humans and wildlife—benefits which are often overlooked (Table 1).

Table 1. WETLAND BENEFIT	EXPLANATION
Wildlife habitat	Many species are dependent upon wetlands for all or a portion of their life cycle. Wetlands provide habitat for fish, birds, mammals, reptiles, amphibians, and invertebrates.
Erosion control	Wetlands support vegetation that acts as a flood buffer and reduces stream bank erosion during flooding events.
Floodwater storage	Wetlands store water during flooding events and then slowly release the water as flooding subsides. This can significantly reduce peak flood flows and resulting flood damage downstream.
Ground water storage	Wetlands store surface water, which then infiltrates into the ground, providing recharge to aquifers. This ground water recharge in turn is slowly released back to adjacent surface water bodies, such as streams, providing water during low flow periods (base flow).
Water purification	Wetlands improve water quality by filtering polluted runoff from towns and agricultural lands. They trap sediments, utilize excess nutrients present in runoff, and breakdown many waterborne contaminants. Constructed wetlands are used to treat contaminated waters from mines, sewer systems, and urban stormwater runoff.
Recreation and economic benefits	Wetlands are often visited for recreational purposes (hiking, bird watching, wildlife photography, and hunting). These activities translate into dollars spent at local businesses, adding to the economy.
Education	Wetlands make excellent and inexpensive outdoor laboratories for students of all ages. For example, the Cherry River recreation site located north of Bozeman is visited by hundreds of school children each year.

IMPORTANCE OF RIPARIAN AREAS

Like wetlands, riparian areas serve a number of important functions and provide benefits to humans and wildlife. However, rather than being viewed as wastelands, riparian areas are often targeted for residential and commercial development for aesthetic reasons.

While low levels of development within riparian areas may not cause significant problems, widespread development in and adjacent to riparian corridors can degrade the ecological function of the area and present public health and safety problems. These safety problems are mainly due to the natural flooding processes that occur in riparian habitat. Table 2 summarizes the benefits of riparian areas which are often overlooked.

What is a riparian area? The areas of land adjacent to rivers and streams. For the purposes of this project, it is defined as land in and adjacent to streams where woody vegetation (trees and shrubs) is present.

Figure 1. House destroyed by flooding of the West Gallatin River in June 1986. Note the proximity of the house to the river and the riparian vegetation around the home site.

Table 2. RIPARIAN AREA BENEFITS	EXPLANATION
Erosion control	Roots of trees, shrubs and native grasses hold soil in place along the banks of rivers and streams, reducing the potential for bank erosion, and deposition of sediment in streams and rivers.
Flood control	Native vegetation along the banks of rivers and streams and within the floodplains slows the movement of flood waters. The vegetation also aids in dispersing the floodwaters and allowing some of the water to soak into the floodplain adjacent to the river or stream
Wildlife habitat	Riparian areas provide important wildlife habitat. Trees and other vegetation provide cover and shelter for wildlife. The riparian areas also serve as vital migration corridors for wildlife. Roots from trees and shrubs along the banks of rivers and streams often form "holes" that provide shelter for fish.
Temperature control	Trees and shrubs adjacent to rivers and streams provide shade, reducing and moderating water temperatures. Extreme fluctuations and high water temperatures harm fish and other aquatic life.
Recreation and economic benefits	Like wetlands, riparian areas are often visited for recreational purposes such as hiking, bird watching, wildlife photography, fishing, and hunting. These activities can translate into dollars spent at local businesses, adding to the local economy.
Filtering of runoff	Riparian vegetation in floodplains and along rivers and streams act as natural filters to remove sediment and other contaminants from stormwater runoff from adjacent land surfaces which can adversely impact water quality and aquatic habitat.

THE PROJECT AREA

The project area is located within Gallatin County, in southwestern Montana and covers approximately 520 square miles centered over the Gallatin Valley. Also included in the project area is the upper Bozeman Creek watershed (Figure 2).

With the exception of the western margin, the project area is located within the boundary of the Gallatin Local Water Quality District (GLWQD) which covers 815 square miles (Figure 3).

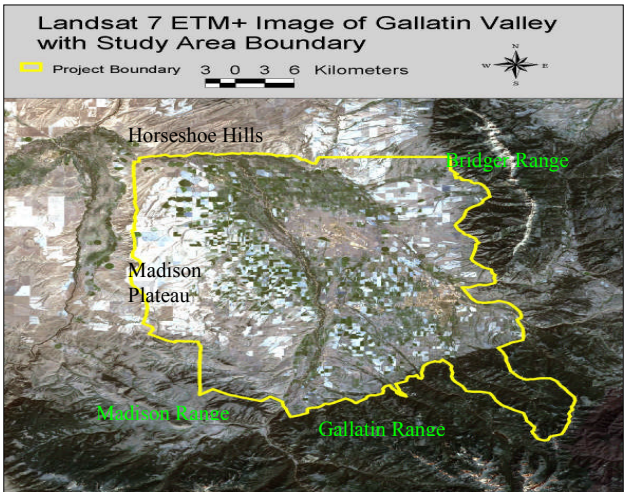

Figure 2. Oblique Landsat satellite view of the Gallatin Valley showing the project area and the major landforms surrounding it.

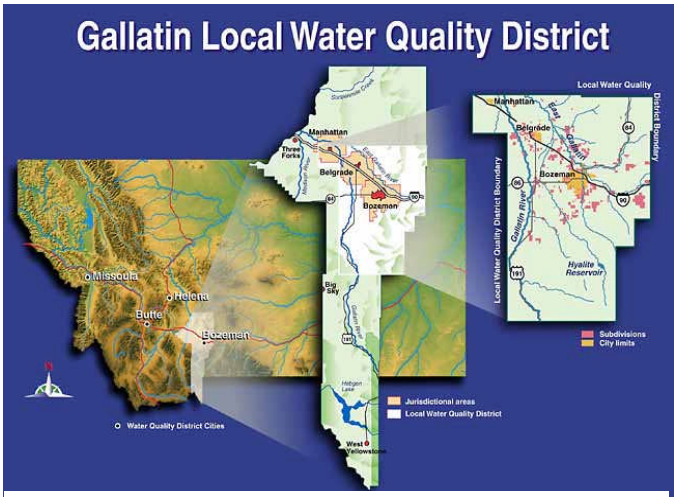

Figure 3. Location of Gallatin County and Gallatin Local Water Quality District in Montana.

PROJECT DESCRIPTION

Color Infrared (CIR) Aerial Photography of the Gallatin Valley. Warm temperatures, low humidity, and low precipitation dominates the weather in southwestern Montana from August through September . The lack of moisture during this period promotes plant senescence (die off) in upland plant communities. However, the prevalence of water in wetland areas enables many of these plant species to continue growing until cold temperatures limit plant function.

The CIR imagery used as the primary reference for this project was developed from aerial photographs taken on September 9, 2001. The flight was timed between the end of the growing season and the first killing frost for most upland plants. By September, most plants still actively photosynthesizing were either irrigated, growing in sub-irrigated areas (shallow ground water), or growing in wetlands and riparian areas.

The CIR photographs were transformed (orthorectified) into digital orthophoto quadrangle (DOQ) maps that cover the same areas as published U.S. Geological Survey 7.5-minute quadrangle maps.

The GIS Database. The CIR DOQs were used as base maps for constructing a GIS (geographic information system) database using ArcView™ software. The focus of this spatial database is on the geographic location of the inventoried wetland and riparian areas.

These inventoried areas were identified utilizing several methods: Review of existing reports containing information on local wetlands, visits to several conservation easements, field checks of 200 sites to help assure the accuracy of the computer mapping, and low altitude aerial flights to inspect and photograph wetland and riparian areas.

Historical Conditions. Research to obtain information on how and where human activities in the Gallatin Valley have impacted wetland and riparian areas was conducted. The focus was on changes since circa 1800, prior to modern human settlement in the area. Several methods were utilized:

Historical Mapping. The historical extent of wetlands and riparian areas was determined using a combination of aerial photographs, research, and existing spatial databases. Due to the limitations of these resources the historical extent of wetlands and riparian areas could not be determined separately. The areas mapped represent the "*maximum potential historical extent of aquatic resources*." This GIS layer includes potential historical wetlands and riparian areas, and surface water features (Figure 5).

Oral History and Literature Research. Interviews with long-time Valley residents and local resource managers were conducted to provide insight into some of the common human activities that have resulted in changes to wetland and riparian areas. In addition, library and museum documents, and old newspaper articles were reviewed.

From this research, a general pattern of human activities in the Gallatin Valley that have impacted wetland and riparian areas emerged. In chronological order from earliest activities to current activities the following activities appear to be the most significant:

1. *Trapping of beaver and significant reductions in beaver populations.* The result was a decrease in wetlands, ponds and back water areas.

2. *Agricultural development.* Draining of wetlands, grazing of wet meadows and clearing of riparian vegetation for increased grazing and hay production has had a negative impact. However, the construction of irrigation ditches and canals has created a significant number of linear riparian and wetland features.

3. *Construction of transportation corridors.* Roads and railroad beds have altered surface water flow patterns by damming surface water on the uphill side and reducing surface and subsurface flow on the downhill side.

4. *Urban development.* This has generally resulted in a decrease in wetland and riparian habitat due to the intensive land use changes within urban areas. Urban

Project Limitations—Wetlands

The land areas identified in this project as **wetlands** are considered to be **ecological wetlands** rather than **jurisdictional wetlands** as defined by the Army Corp of Engineers and do not represent **delineated wetlands** for regulatory purposes.

The wetland areas are referred to as **inventoried**, and were located using a combination of color infrared (CIR) aerial imagery, ground-truthing, and existing information.

Project Limitations—Riparian/Wetlands Mixed

Primarily inventoried based on **visible** indications of color and texture on the CIR imagery, the focus was on woody riparian trees and shrubs easily identified on the imagery.

Wetlands are present in many areas of visible woody vegetation, however, these cannot be viewed through the riparian canopy.

The areas inventoried as ***wetlands*** and ***riparian/wetlands mixed*** are considered representative of conditions as of the September 9, 2001 flight date. Ground-truthing (field checks) and the low altitude aerial flights were conducted through the summer of 2003.

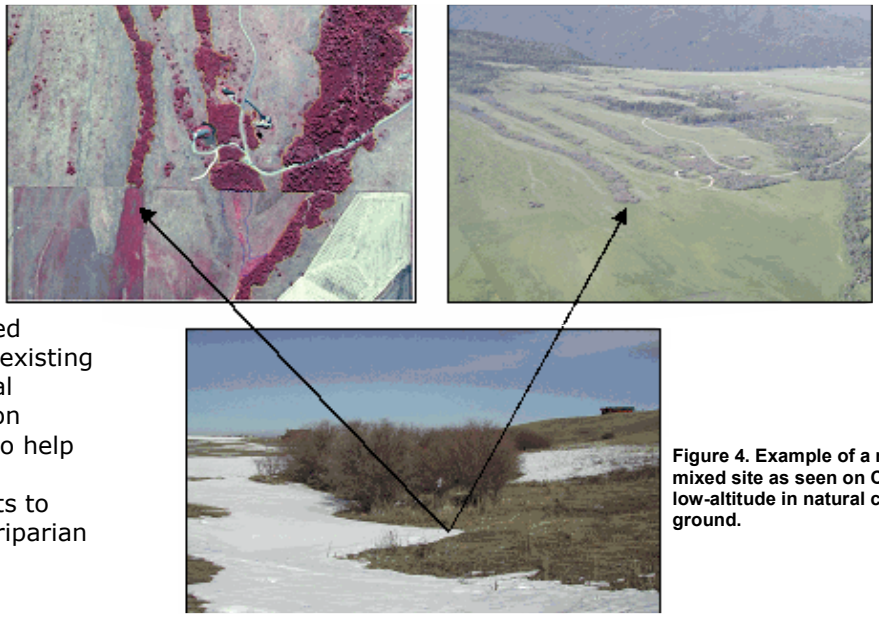

Figure 4. Example of a riparian/wetland mixed site as seen on CIR imagery, from low-altitude in natural color, and from the ground.

development associated with the growth of Bozeman appears to have had the largest impact. Much of the land area now occupied by the City of Bozeman may have been covered by wetlands and riparian areas. Bozeman Creek has been significantly altered by urban development and flows underground through downtown Bozeman.

5. Suburban development. This has resulted in widespread impacts to wetlands and riparian areas. Suburban development has displaced or altered wetland and riparian habitat.

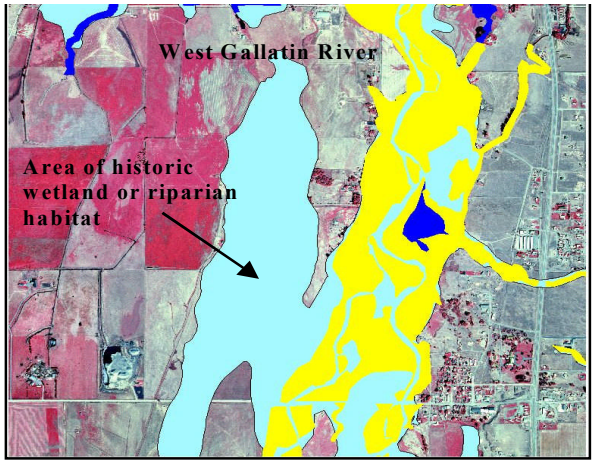

Figure 5. Example of GIS layer showing the *maximum historical extent of aquatic habitat* (light blue) with the 2001 *wetland* layer (dark blue) and 2001 *riparian/wetland mixed* layer (yellow) for comparison.

If the maximum historical extent of aquatic habitats in the Gallatin Valley is compared directly to the areas mapped for 2001, only about 38% of the original wetland and riparian habitat in the Gallatin Valley remains.

This compares with a national average of 46% of historical wetland areas remaining.

INVENTORY RESULTS

Table 3 compares and summarizes the results of the inventory of wetlands and riparian areas and the historical extent of aquatic habitats. Table 4 provides a descriptive summary of the regional hydrology patterns present in the Gallatin Valley based on the CIR imagery.

Table 3. Area Comparison of Historical Aquatic Habitat, Inventoried Wetlands, and Inventoried Riparian/Wetlands Mixed Areas for the Gallatin Valley.

GIS Layer	Area (acres)	Percent of Project Area
Maximum Historical Extent Aquatic Habitat (circa 1800)	59,849	17.9
2001 Wetland Habitat	8,981	2.7
2001 Riparian/Wetland Habitat Combined	13,924	4.2

Table 4. Hydrologic Patterns in the Gallatin Valley by Region based on CIR Imagery from September 9, 2001.

Region	Description
North-Northwestern	This region contains the large concentration of wetland features in the Valley. Much of the land in this area is subirrigated, with numerous springs and spring creeks. Ground water flow mapping by Hackett (1960), and Slagle (1995) shows that this area represents the regional ground-water discharge area for the Gallatin Valley aquifer system.
West & East Gallatin Rivers	The second largest concentration of wetland and riparian features is associated with the West and East Gallatin Rivers. Both these rivers support a continuous series of wetland and riparian areas.
Southeastern	In this portion of the valley, numerous smaller, more linear wetland features are present, which follow the general pattern of the perennial drainages coming off of the Gallatin Range. These wetland features are more discontinuous, with riparian wetlands and sloping wetlands formed by springs or leaking irrigation ditches being the predominant type of wetlands. The associated riparian features follow the same drainage patterns.
Western	This region, which includes the Madison Plateau area, is also dry. Extensive irrigation in this area has resulted in the formation of numerous artificial wetlands and riparian areas associated with leaking irrigation ditches, and irrigation return flow in low areas.
Bozeman Creek Watershed	Numerous small wetland features were documented in this watershed, but many areas were smaller than the minimum mapping unit size of ½ acre. One exception is the Mystic Lake area, which contains several large wetland areas. Mystic Lake was dammed in the past, but the dam has since been breached. The land area that was previously flooded by the dam is now mainly wet meadow.

RECOMMENDATIONS for WETLAND and RIPARIAN AREAS PRESERVATION and RESTORATION

This project has compiled a significant amount of information on wetlands and riparian areas within the Gallatin Valley. While the scope of the project and methods used did not allow for detailed analysis of these areas, the information will provide a solid starting point for more in-depth analysis. The project also provides a good starting point for more detailed assessments of wetlands in the Gallatin Valley as well as baseline data for the spatial distribution of wetlands and riparian features in 2001.

Areas identified for potential wetland preservation and restoration include: The northwestern portion of the Valley with a significant concentration of both wetland and riparian features. This area is also supported by regional ground water discharge resulting in shallow water tables, stable water tables and numerous springs and creeks. Wetland features north of Bozeman along the East Gallatin River, south of Bozeman along Bozeman Creek, and east of Bozeman along Rocky Creek should also be targeted for preservation as these resources have the potential for impacts from future development.

Funding

This project was partially funded by the Montana Department of Environmental Quality (DEQ) Wetland Protection Program in the amount of $53,989. Funding originated through the U.S. Environmental Protection Agency (EPA) Region VIII Ecosystems Protection Program. In addition, cash and in-kind services of more than $40,122 were contributed as match. The Gallatin Local Water Quality District (GLWQD) administered this project and provided cash and in-kind match totaling $17,570. Additional agencies and organizations contributing either cash or in-kind matching funds were: Bozeman Watershed Council, City of Bozeman Planning Department, Gallatin County Disaster and Emergency Services, Gallatin County GIS Department, and Gallatin County Planning Board.