

Developing a Framework for Integrating Wetland Considerations into Watershed Restoration Plans

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Introduction

In the State of Montana it is estimated that wetlands make up less than one percent of the landscape. Mapped wetlands in Montana average two acres in size (USFWS 2008). Their small size and landscape coverage percentage belies their importance to the ecological health of the state and its waters. Depending on the landscape position of wetlands, they provide a variety of ecosystem functions including: groundwater recharge/discharge, flood attenuation, flow regulation, nutrient and pollutant removal, and wildlife habitat. Wetlands provide functions that are generally not apparent to the eye and often misunderstood. As a result, while potentially protected at the federal and state level, wetlands are often not the focus of protection at a local level. This is in part due to limited understanding of their importance to environmental quality. This limited understanding leads watershed groups, landowners, local governments, and others to focus more on streams and water quality than the associated wetlands which are a vital part of the aquatic functioning of a watershed. The widespread absence of wetland protection at the local level contributes to indirect impacts to wetlands that cumulatively can greatly affect the health of a watershed. As Cappiella et al. (2006) states, "Watershed [restoration] plans effectively direct the application of regulatory and non-regulatory tools for aquatic resource protection at the local level. Wetland protection, however, has historically been delegated to federal or state permitting authorities who have little control over local land use decisions and as a result wetlands cannot be effectively managed and protected." Integrating wetlands into watershed restoration plans is one of the most effective means of protecting wetlands from the indirect impacts of urbanization and other land uses and can fill the gaps where wetlands fall outside of state or federal jurisdiction.

Developing a framework for integrating wetland considerations into watershed restoration plans was a project designed to highlight the contribution of wetlands to the functions of the broader aquatic ecosystem and how wetland restoration can be used to achieve watershed restoration goals and objectives. The goals of the project were: 1) develop two comprehensive watershed restoration plans; 2) increase the capacity of local governments and watershed groups to develop comprehensive watershed restoration plans; 3) demonstrate and develop a framework outlining the steps, techniques and tools necessary for incorporating wetlands into the Nine Elements of watershed restoration planning; 4) demonstrate how the incorporation of wetlands into watershed restoration plans can contribute to reducing pollutant loads identified in the TMDL planning process; and 5) expand the incorporation of wetlands into watershed restoration plans through the transfer of knowledge gained in the demonstration watersheds.

The Montana Department of Environmental Quality's Wetland Program, Montana Wetlands Legacy Partnership, Big Hole Watershed Committee, and Greater Gallatin Watershed Council all participated in this project. To accomplish the five goals outlined above, eight tasks with multiple products were completed. The tasks follow the general order of writing a watershed restoration plan from start to finish. All of the project goals were accomplished scriptum est., with the exception of goal 1). It was unrealistic for the watershed groups to complete a comprehensive watershed restoration plan in the time allotted by this project. Instead, both watershed groups drafted documents that either form the basis of the watershed restoration plan or are an addendum to the watershed restoration plan. The description of the tasks outlines the work that was completed, outcomes, and suggestions for improvement.

Task 1: Gather relevant information, and identify programmatic resources and gaps in the protection of aquatic resources

When first considering the proper approach to take for integrating wetlands into watershed restoration plans, all groups needed to take a step back and look at the information that was available for each watershed. The information gathering step was important, as it formed the basis upon which all future steps were built. Through sharing and discussing the information collected, it also put all partners working on this project at the same basic understanding of the current situation within each watershed. Each group was responsible for collecting relevant pieces of information where they had expertise. The Montana Department of Environmental Quality (MDEQ) and Montana Wetlands Legacy Partnership (MWLP) took responsibility for gathering watershed wide information about wetland, their functions, and how wetlands contribute to water quality. The pilot watersheds, Greater Gallatin Watershed Council (GGWC) and Big Hole Watershed Committed (BHWC), were responsible for collecting information about their capacity to develop a watershed restoration plan, partners within the watershed, and local rules and regulations regarding wetlands and other aquatic resources within all political boundaries encompassed by watershed.

The information gathering step is a time and personnel intensive step. More time intensive than any of the partner groups first estimated. In the original work plan, GGWC and BHWC were given two months to complete the information gathering step. This was an unrealistic time frame considering the length and depth of the questions asked in the Needs and Capabilities Assessment (NCA) and the 8-Tools Audit, and the time it took to evaluate the impaired water contributing area and sub-watershed wetland profile reports. As an example our best guess estimate on the cost, based on time, to complete the NCA and 8-Tools Audit was \$650. The Greater Gallatin Watershed Council on their time to complete this step spent 3 times what was initially budgeted.

Task 1 incorporates Principles 1-4 and 5 from Cappiella (2006), which are incorporated into U.S. EPA's Steps in the Watershed Planning and Implementation Process. Specifically Task 1 gathers relevant information for Step 1: Building Partnerships and Step 2: Characterizing the Watershed. It does not directly address one of U.S. EPA's Nine Minimum Elements of Watershed Plans but builds the base on which a watershed restoration plan can be developed. The Montana DEQ TMDL Bureau is usually responsible for parts of the characterization of watershed. The characterization of the watershed for Big Hole and Gallatin was repeated specifically for wetlands as wetlands were not included in the original characterization or assessment.

1.1 - Impaired Water Contributing Area Reports

Impaired water contributing area (IWCA) reports are reports developed to assist the pilot watershed groups and partners in the quick identification of wetland types that should be targeted for restoration or protection based on their predicted ability to address identified water quality and quantity impairments. Impaired waters are the streams that MDEQ has listed on the 2008 303d list for not or partially supporting their designated beneficial uses. The contributing areas are all areas that could contribute water, pollution, or pollutants to a 303d listed stream from the outflow to the headwaters, see [figure 1](#).

The impaired water contributing area reports are brief two page reports that provide information about:

- Pollutants, pollution, and the impairment sources within a contributing area

- A basic characterization of the wetlands and riparian areas within the contributing area
- Wetland types and functions that will address known pollutants, pollution, and impairment sources.
- Percent of each wetland type within the watershed that should have the ability to address known water quality impairments based on their functions.
- Proportion of wetland types and riparian areas within a contributing area, and the percent of those that are hydrologically modified.
- Recommendations as to which wetland type should address water quality and quantity impairments within a contributing area

IWCA and the reports were developed in several steps in ArcGIS and Excel. All of the data used were spatial data and is at the scale of the contributing area. Two data sets were used to compile the impaired waters contributing area reports, the 2008 303d listed stream segments (MDEQ Dataset) and provisional national wetland inventory maps (MTNHP). Provisional wetland maps were used for two reasons. First, at the time this work was being completed, the Montana Natural Heritage Program had completed mapping in our two pilot watersheds, this data had not though been posted to the National Wetlands Inventory (NWI) Mapper, and thus is considered as provisional. Second, the Montana Natural Heritage Program developed a value added dataset of the NWI that includes wetlands functions based on LLWW identifiers. LLWW identifiers are important as they rate how a wetland functions on a scale of low, medium, or high for 11 different functions and allow us to relate these to water quality and quantity impairments (Tiner 2002a).

The steps taken to develop the impaired water contributing area reports were:

1. Using the 2008 303d streams water quality assessed stream segments were combined for each line named stream, for example Wise River. All of the pollutants, pollution, and impairment sources were also combined.
2. Using the lowest downstream point identified as impaired for a combined stream segment the contributing area was mapped using the spatial analysis tool 'Watershed' in ArcGIS.
3. The wetlands within each contributing area were extracted including the LLWW value added attributes.
4. Relationships were run between wetland functions and the pollutants, pollution, and sources of impairment within each contributing area to determine which wetland types and functions should be restored to address water quality and quantity impairments.
5. General wetland characteristics and wetland profiles within each contributing area were calculated.
6. The wetland profiles were related to the IWCA's and targeted wetland types and functions were identified to help inform the watershed groups and other partners.

The Greater Gallatin Watershed Council and the Big Hole Watershed Committee used the IWCA's in different ways. GGWC went through each of the IWCA's and directly linked their initial goals and objectives to the information provided in these reports. This method and their initial goals and objectives will be discussed in more detail in Step 2. The Big Hole Watershed used the information presented less to form initial goals and objectives and more to help inform them as to the type of wetlands and their functions to target for on the ground surveys using the Exploring your Aquatic Resources Web Application in Step 3. Neither uses of these IWCA reports is right or wrong. Both methods took similar amounts of time and effort. The method that GGWC took helped the Council think

more on a sub-watershed basis about all of the aquatic resources within the watershed, how they interact, and where wetlands fit into the larger picture of watershed restoration planning.

Examples of Impaired Waters Contributing Area Reports can be found in [Appendix A](#). A tutorial on using Impaired Waters Contributing Area Reports can be found at: [Using IWCA's](#).

1.2 - Sub-Watershed Wetland Profile Reports

The sub-watershed wetland profile reports were designed to be complimentary to the impaired waters contributing area reports and provide information for wetland restoration where streams are either meeting their designated beneficial uses or were not assessed. The basis behind the sub-watershed reports is the identification of what is the typical wetland profile for an “unimpacted reference” sub-watershed, and how does the wetland profile of an impacted sub-watershed compare to this. The sub-watershed wetland profiles can then give the user a general target for wetland and riparian restoration or goals based on wetland type. With the thought that restoring or protecting wetlands of a certain type within the impacted sub-watershed will bring its profile closer to that of the “un-impacted reference” wetland profile. Thus, improving the health of the wetlands, riparian areas, and other aquatic resources within the sub-watershed. Sub-Watershed Wetland Profiles are based on work by Johnson (2005) in Colorado.

Sub-watershed wetland profiles were developed for both the Big Hole and the Gallatin Watersheds. Sub-watersheds are based on the HUC 6 boundaries, which in some cases were split on topographical breaks. In the initial step, the HUCs were grouped into regions based on their geomorphic and hydrologic similarities; elevation, slope, 10 year precipitation averages, geology, and stream characteristics. ArcGIS was used to develop variables describing each of the geomorphic or hydrologic characteristics. The variables generated include:

1. Mean elevation of sub-watershed
2. Relief of sub-watershed
3. Mean slope of sub-watershed
4. Mean precipitation of sub-watershed
5. Mean stream order with in a sub-watershed
6. Majority stream order with in a sub-watershed
7. Maximum stream order with in a sub-watershed
8. Percent of 1st order streams with in a sub-watershed
9. Percent of 2nd order streams with in a sub-watershed
10. Percent of 3rd order streams with in a sub-watershed
11. Percent of 4th order streams with in a sub-watershed
12. Percent of 5th order streams with in a sub-watershed
13. Percent of 6th order streams with in a sub-watershed
14. Percent of Open water with in a sub-watershed
15. Percent of Other Sedimentary with in a sub-watershed
16. Percent of Unconsolidated with in a sub-watershed
17. Percent volcanic with in a sub-watershed
18. Percent Intrusive with in a sub-watershed
19. Percent Metamorphic with in a sub-watershed
20. Percent Sedimentary (Shale and Sandstone) with in a sub-watershed

Region grouping was then conducted on various combinations of the variables using K-means cluster analysis in SPSS to create region groups that minimized within group variance and maximized variance between groups. By doing this we ended up with sub-watersheds that are similar in nature and comparable with a measure of confidence. In the Gallatin watershed K-means cluster analysis determined that the sub-watersheds fit into three distinct region groups ([Figure 2](#)), Low Elevation, Mid Elevation, and High Elevation. In the Big Hole watershed there were four distinct region groups ([Figure 3](#)), Valley Bottom, Low Elevation, Mid Elevation, and High Elevation.

The next step was to determine within each watershed and region group which sub-watersheds can be considered as “reference” sub-watersheds, and which are impacted. “Reference” sub-watersheds are in quotes as no sub-watershed is truly unimpacted. “Reference” and impacted watersheds were determined based on the threats within a watershed. The threats used were; land use, roads, hydrologically modified wetlands, ground water withdrawals, density of septic systems, points of diversion (water rights), and streams not meeting their designated beneficial uses. ArcGIS was used to develop variables describing each of the threats. The variables generated include:

1. Total Length of roads with in a sub-watershed
2. Meters of roads per acre with in a sub-watershed
3. Percent Altered land cover with in a sub-watershed
4. Percent Natural Land cover with in a sub-watershed
5. Percent Intensive Agriculture with in a sub-watershed
6. Percent Impacted Wetlands with in a sub-watershed
7. Number of Ground water withdrawal sites per sub-watershed
8. Number of septic systems per acres within a sub-watershed
9. Number of septic systems within a sub-watershed
10. Percent of 303d streams in a sub-watershed
11. Number of 303d stream miles in a sub-watershed
12. Average number of diversion points per stream mile within a sub watershed
13. Cumulative maximum number of gallons taken from points of diversions.

Separating the sub-watersheds into impacted and “reference” was conducted using K-means cluster analysis in SPSS on various combinations of the threat variables in a step-wise fashion.

Wetland profiles were then created for each sub-watershed and a general “reference” wetland profile for each region group. These were calculated using provisional NWI data obtained from the Montana Natural Heritage Program with LLWW identifiers. The percentage each wetland HGM-type that was classified as hydrologically modified was also calculated. The wetland profiles show the proportion of wetland HGM-types relative to other wetland HGM-types and riparian areas within a sub-watershed. These wetland profiles were then incorporated into a one page report that provides the following information ([Figure 4](#)):

- Watershed name, impacted or “reference”, and unique ID.
- Brief description of topographic and hydrological characteristics.
- Brief description of impacts observed in the sub-watershed.
- Acres of wetlands and hydrologically modified wetlands within the sub-watershed.
- Percent of each wetland type that is predicted to display a high capacity to provide an associated wetland function.

- Wetland profile showing the proportion of wetland types of each sub-watershed and its comparable general “reference” wetland profile.

It was envisioned at the start of this project that the sub-watershed reports would be used to help the pilot watershed groups form preliminary wetland specific goals and objectives, and guide them in searching for potential wetland restoration projects. Using Birch Creek in the Big Hole as an example from past studies, local knowledge, or other sources we know that Birch Creek has an issue with increased nutrients. The table in the wetland profile report ([Figure 4](#)) shows that both depressional and slope wetlands a high capacity to attenuate nutrients are present in this sub-watershed. Using this information we can form a preliminary goal:

- Slope and depressional wetlands in Birch Creek will be evaluated for restoration or protection based on their ability to attenuate nutrients.

This statement can then be further refined using information taken from the wetland profile chart ([Figure 5](#)). Comparing the proportions of wetland types in Birch Creek we see that in this sub-watershed the proportion of depressional wetlands is greater than the proportion in the general “reference” sub-watershed. While the proportion of slope wetlands is less. Using this knowledge we can refine our preliminary goal statement:

- In Birch Creek sub-watershed to increase nutrient attenuation, previously ditched or drained slope wetlands will be evaluated for potential restoration opportunities, while existing depressional wetlands and riparian areas will be evaluated for long-term protection opportunities.

Restoring slope wetlands where they have been lost will increase their proportion in the watershed and decrease the overall proportion of depressional wetlands and riparian areas. Bringing Birch Creek’s wetland profile closer to the general “reference” wetland profile for low elevation sub-watersheds in the Big Hole. Protecting existing depressional wetlands and riparian areas is included as part of the initial goal statement because it is important to protect and maintain the existing aquatic resources on the landscape in perpetuity.

The sub-watershed wetland profiles went largely un-used as part of this project. As a pilot project, it was important for the Big Hole and Gallatin to prioritize areas and concentrate work load. Having 303d listed streams already identified in the watershed focused this project to where wetland restoration and protection can address known water quality and quantity impairments in 303d listed streams and their contributing areas. The sub-watershed reports would be more useful when developing a watershed restoration plan or informing wetland restoration and protection where stream assessments have not or will not be completed.

Complete methods and geo-processing steps to determine sub-watershed and impact groups can be found in [Appendix C](#). Examples of sub-watershed wetland profile reports can be found in [Appendix B](#). A tutorial on using Impaired Waters Contributing Area Reports can be found at: [Using Sub-watershed Wetland Profiles](#).

1.3 - Exploring Your Aquatic Resources Web Application

The exploring your aquatic resources web application was developed to help the pilot watershed groups facilitate the development of preliminary wetland specific goals and objectives to address water quality impairments. And, aid in the selection of wetland and riparian areas that may improve the water quality and quantity impairments identified by MDEQ through the water quality assessment and 303d listing process. This web application was built and designed by the GIS Department and Wetland Program at MDEQ. It is currently active for the two pilot watersheds with the possibility that it can be expanded statewide, or to watersheds interested in using this product.

When developing a watershed restoration plan, the group tasked with writing the plan is inundated with information. Generally these come in the form of reports, static maps, tables, graphs, etc. Through the water quality assessment and 303d listing process at MDEQ, wetland mapping at Montana Natural Heritage Program, and other sources there is a lot of spatial information available to help in the planning process. The exploring your aquatic resources web application was an attempt to develop a tool where all of this spatial information could be compiled in one location so the watershed group would have most of the relevant and current information easily accessible. This tool that allows the user to remotely collect site specific information before going on-site and conducting a field investigation. It is also an education tool as it visually presents where and how wetlands function in a watershed to protect water quality and quantity. As this is a web application the users do not need to have access to GIS or have the knowledge and ability to use GIS. The web application is built using open source technology that links spatial data to maps on the web, so the only technology needed is an internet connection and the ability to navigate a program like Google Maps®.

During the course of this pilot project the web application went through two iterations. The first iteration was available when the pilot watershed groups were developing their preliminary wetland specific goals and objectives and identifying potential sites for wetland restoration. This iteration, as most first iterations are, was not user friendly and took time for the user to become acquainted with the program and to properly use it. Based on suggestions from both pilot watersheds, the second iteration changed web mapping platforms from ESRI based to Bing Maps. This was a visually more appealing, easier, and quicker platform to use. We also added more base maps including multiple years of aerial photos, and USGS topographic maps. We added new data to aid in planning and site identification including hydric soils and Land Cover. And, added an expanded search function that allowed the user to search by both physical address and latitude/longitude. Adding multiple years of aerial photography to the web application was important for more effectively identifying sites for wetland restoration or protection. In the initial iteration only 2005 aerial photography was available. Development in and around Bozeman was happening at such a rapid rate that when GGWC would identify a site near the city, often this had already been developed by 2011. The multiple years of photos also allows for an easy way to “flip” between years to visually see how development and other land uses, which may be more important in rural watershed, are changing over time.

The current information that the Exploring Your Aquatic Resources web application displays are:

- Wetlands by HGM-type and Function
- Historic NWI wetlands, (1980s where available)
- Impaired Water Contributing Areas and links to Reports
- Sub-Watershed Wetland Profiles and links to Reports
- ESRI Hydric Soils
- REGAP Land cover information using NatureServe Ecological Systems
- Cadastral Information (Property Ownership, Physical Address, Mailing Address, parcel size)

- HUC 4 Watershed Boundaries
- Township, Range, and Section Maps
- Counties and town
- Base Maps including: Aerial and CIR Photography (2011 & 2009), USGS topographic Maps, Terrain Maps, and general road maps.
- Search function: by physical address and Lat/Long
- Georeferenced Site Photos with direction taken.

BHWC used the web application through the course of this project to help them identify potential locations to further investigate the possibility of wetland restoration or protection. A series of go-to meetings were held with the Big Hole Watershed Committee and Montana Wetlands Legacy Partnership to investigate and evaluate possible wetland restoration projects. The GGWC started using the first iteration of the web application but chose instead to develop their own GIS database that incorporated most of the information that is available through the web application. For a group that has the capability and expertise to do so, developing your own GIS database for planning purposes has its distinct advantage as new information can be incorporated as it becomes available.

The exploring your aquatic resources web application was developed for groups that do not have capability or expertise to make use of the spatial information available during the planning process. Based on final comments and suggestions from the pilot watersheds MDEQ is planning on revising this product and making it available as a tool to other watershed groups or partners interested in wetland restoration and protection. One suggestion is the addition of the ability to print maps, this would allow the watershed group to have a printed map they can take in the field when doing an onsite investigation as a potential wetland restoration site.

An unexpected outcome of this product is that several groups within MDEQ, including State Superfund, have been using the exploring your aquatic resources web application to help inform them as to wetlands present on their project sites. The State Superfund program is now developing their own web application modeled after the exploring your aquatic resources for their specific uses.

The exploring your aquatic resources web application can be found at: [web application](#). A tutorial on its intended use can be found at: [Web Application Tutorial](#).

1.4 - Needs and Capabilities Assessments (NCA) and 8 – Tools Audit: How did we and could we use this information.

The NCA and 8-tools audit are two tools developed by the Center for Watershed Protection (Cappiella, 2006) to help a watershed group do an initial assessment of the local capacity to implement a watershed restoration plan. These tools provided a way to organize basic watershed and community demographics, key watershed management resources, and to evaluate how local programs and regulations measure up to specific watershed protection goals. These tools also help to easily identify gaps where improvement is needed. These tools were designed so that the information that is learned about the watershed and the gaps that are identified can easily be translated into goals and objectives in a watershed restoration plan or other local planning document. The Center for Watershed Protection specifically designed the NCA and 8-Tools for this purpose with the understanding that the most effective protection of aquatic resources, and wetlands specifically, is done at the local level (Cappiella, 2006).

As part of this project we had both of the pilot watershed groups fill out these documents as one of their first steps. It was hoped that they would do a self-evaluation of their capacity, increase their understanding of wetlands and how they fit into the larger picture of watershed restoration planning, and that these documents would help them form some of the preliminary wetland specific goals and objectives for their watershed restoration plans. It was also useful for MDEQ and MWLP to better understand the watershed groups and the watersheds they are working in.

The NCA and 8-tools audits are long documents that take time to properly fill out and disseminate all of the information contained in them. This is even more apparent when we look at the size of the watersheds in Montana and the number of counties these contain. For example the Big Hole Watershed contains four different counties: Madison, Beaverhead, Silver Bow, and Jefferson. Each of these counties have different local ordinances regarding wetlands, development, etc. This is something to consider when undertaking the development of these documents, is the time investment worth the information that is learned?

From conversations with both of the pilot watershed groups, Greater Gallatin Watershed Council and Big Hole Watershed committee, the time and effort put forth to develop these documents did in the long run prove useful. In review of the documents; for me, one important aspect in the Gallatin watershed I learned is the dramatic difference in the protection of aquatic resources between Bozeman and Gallatin County. Gallatin County lacks any kind of wetland protections, while Bozeman's are model ordinances. Increasing wetland protection ordinances in Gallatin County could then be included as an overall goal with objectives that target specific activities such as non-point source pollution as a result of development.

There is room for improvement with these documents. I don't think that all of the sections are relevant to Montana, especially rural Montana. The NCA and 8-tool Audits were developed for Eastern US watersheds and reflect the different demographics and political climate found there. An improvement for use in Montana would be to go through each the section and look at where Montana specific questions can be asked. Some of these questions should deal specifically with range management, haying, and agriculture and their impacts on wetlands and other aquatic resources. Questions concerning floodplains and the wetlands that lie within them would also be important. As is evidenced from the 2011 flooding in Montana, functioning floodplains and wetlands that store flood waters are important for protecting health and property.

1.4.1 - Needs and Capabilities Assessment

The NCA is designed to give the watershed group a broader view of its strengths and weaknesses; and help identify programs, resources, and partners to development and implement an effective watershed restoration plan. The Needs and Capabilities Assessment form used for this project can be found in [Appendix D](#).

What follows are MDEQ Wetland Program's comments and thoughts on specific questions with in the needs and capabilities assessment. And, in some instances how we can more effectively use this data to inform us when developing a watershed restoration plan.

Part 1

5 & 7 – T&E, SOC species

While using T&E and SOC species may not be directly linked to the pollutants and chemical or physical water quality impairments identified in TMDL implementation plans. Generally the species that would be affected under a wetlands project would be negatively impacted by water quality impairments. For this reason, we must consider the goal of the Clean Water Act and how it relates to the TMDL development process. The goal of the CWA is to protect the chemical, physical, and biological integrity of the nation's waters [including wetlands]. TMDL's, generally address only the chemical integrity goal of the clean water act and are thus limited in their scope. Watershed restoration plans can and should be broader and more holistic by also incorporating goals and objectives that help to protect and restore the physical and biological integrity of the nation's waters, including wetlands.

- **BHWC** – Which species are listed? And how can these species be tied to the protection and restoration of wetlands. For example *Spiranthes diluvialis*, associated with Rocky Mountain Lower Montane - Foothill Riparian and Shrubland ecological system is present in all of the surrounding drainages that comprise of the upper Missouri River headwaters. The areas where *S. diluvialis* exists have largely been converted to agricultural uses and livestock grazing. Both of these land uses influence the hydrology of the sites and negatively influence the habitat for this federally listed species.

Arctic Grayling, *Thymallus arcticus*, is also listed as a candidate species and extirpated in most areas of the state. As it is well known, the Big Hole holds one of the remaining populations of fluvial arctic grayling in the state. What are the issues surround the threats to this species in the Big Hole Drainage, and how can wetland protection and restoration be incorporated into the current recovery efforts for this species?

- **GGWC** – Listed out several species that are federally listed and made a note that the Gallatin watershed does contain species of conservation concern. One T&E species is threatened and a FACW species (*Spiranthes diluvialis*). SOC species were not listed but those specific to wetlands include *Boloria frigga*, *Castilleja exilis*, *Castilleja gracillima*, *Primula incana*, *Ranunculus hyperboreus*, *Thelypodium sagittatum*, and *Eleocharis rostellata*.

While this information has not explicitly been used in this project, one of the goals was to use the need and capabilities statement to inform and guide future steps in this project in regard to the incorporation of wetlands into the Watershed Restoration Planning. For T&E and SOC species this information could be built upon through investigating where current populations exist within the watershed, the habitats associated with these species, and the land-use practices most affecting these species and then using this information to set both goals and objectives and to add more information when evaluating and prioritizing wetland sites that have been identified for potential restoration or protection.

For example, four of the species listed, including *Spiranthes diluvialis*, are associated with Rocky Mountain Lower Montane - Foothill Riparian and Shrubland ecological system. This ecological system is relatively common in the Gallatin valley and encompasses the riparian areas, palustrine shrublands, and wet meadows bordering the Gallatin and East Gallatin Rivers. North of Belgrade and Manhattan is a large area of ground water discharge that historically has been ditched and drained for pasture or hay lands and whose ecological system was most likely Rocky Mountain Lower Montane - Foothill Riparian and Shrubland. This area also has the only

documented population of *Spiranthes diluvialis* in Gallatin County. Knowing just this information could help to identify this area as a priority, or an area to evaluate for potential wetland restoration or protection opportunities.

8 – Specially-designated wetlands

As the NCA states funding may be available for implementing conservation and restoration projects in these wetland complexes, and as specially-designated sites may be good candidates for restoration. It is recommended that specially-designated wetland sites within a watershed be automatically added to an initial list of projects to be evaluated for restoration and protection potential. It is also important to evaluate the surrounding lands to these specially designated wetlands to see where there may be opportunities restore wetlands to increase the connectivity of these sites to other aquatic resources. It is important to look at the surround land use practices to determine stressors, if any, that are affecting the chemical, physical, and biological integrity of the specially-designated wetlands and what measures can be taken to reduce their influence on the site.

- **BHWC** – In the NCA BHWC stated that they did not know if there are any specially designated wetlands in the Big Hole Watershed. This is something important to find out as these areas can be further evaluated to determine if there are adjacent restoration opportunities that will increase the connectivity of specially –designated wetlands to other aquatic resources. It is also good to evaluate these areas to ensure that they are adequately protected and that the stressors from surround land-uses are minimized. Conversely, are there wetland areas that should receive this designation for their importance to T&E species, water quality, or cultural significance?
- **GGWC** – In the NCA GGWC identified that there are specially designated wetlands in the watershed. These though were not listed out, nor is it clear if these wetlands have been incorporated into the Watershed Restoration Plan. As the NCA states funding may be available for implementing conservation and restoration projects in these wetland complexes, and as specially-designated sites may be good candidates for restoration. It is recommended that specially-designated wetland sites within a watershed be automatically added to an initial list of projects to be evaluated for restoration and protection potential. It is also important to evaluate the surrounding lands to these specially designated wetlands to see where there may be opportunities restore wetlands to increase the connectivity of these sites to other aquatic resources. It is important to look at the surround land use practices to determine stressors, if any, that are affecting the chemical, physical, and biological integrity of the specially-designated wetlands and what measures can be taken to reduce their influence on the site.

10 – Wetland alterations and 404

- **BHWC** – BHWC stated that they did not know if wetland alterations were frequently permitted in their watershed. A query of the USACE database should have information on CWA 404 permits which regulate the discharge of dredged or fill materials into a water of the United States. This database should be organizable by county. Another source is Jeff Ryan with Montana DEQ that will have information on 401 certification of 404 permits and State 318 permits that may impact wetlands.
- **GGWC** – GGWC stated that yes there are frequent impacts to wetlands that are permitted in their watershed. A need may be to understand which permits are being used for wetland alterations, and what activities associated with these permits are driving the wetland alterations

in the Gallatin Valley. This information can then be used further to look at potentially where local regulations can help to limit these impacts, or be used as a tool to require that wetland alterations be avoided, minimized, and potentially mitigated for. One of the goals was to get wetland specific goals and objectives into the Watershed Restoration Plan. These goals and objectives are not necessarily project sites and restoration opportunities; they may be education, incorporation of wetlands into local regulations or growth policies, or understanding the current situation to better address impacts to aquatic resources.

12 – Potential Recharge Areas

- **GGWC & BHWC** – Both groups stated that “yes” there are potential recharge areas in their respective watershed. While not surprising since yes should be answered for all watersheds that are the size of the Gallatin and Big Hole, this information can be used. Just as with the specially-designated wetland sites, these recharge areas should be identified, mapped, and then be put on a list of potential projects to evaluate for restoration or protection. Potential recharge areas are important as it is these areas that help to maintain groundwater aquifers, maintain late season stream flows, and moderate stream temperature fluctuations.

Notes:

- **GGWC & BHWC** – The BHWC brought up a good point of working more closely with the conservation districts for added wetlands protection. I would also suggest working with the local NRCS office as they too have wetland protection and restoration programs under the farm bill, specifically the Wetland Reserve Program and the “Swampbuster” Act. Aside from helping to increase protection of wetland in both watersheds, these two groups generally have a good report with the local landowners.

Part 2

13 – Watershed Studies

- **BHWC & GGWC** - Compile a list of these resources for future reference or to review. For example, the BHWC funded a study to look at the cost per acre foot for different water storage alternatives. This document alone makes a pretty compelling argument for wetland restoration and the return of beavers to unoccupied streams as cost effective means of water storage. All of this added information can feed into a watershed restoration plan to make it more comprehensive in protecting and restoring all aquatic resources.

14 & 15 – Interagency workgroups

- **BHWC** – Is the interagency workgroup the BHWC or the group dealing with the CCA in the Upper Big Hole?
- **GGWC** – One of the goals of this project was to integrate wetlands into the watershed restoration plan and have GGWC start to consider and evaluate potential wetland and restoration projects. As far as one of the goals of this project we have addressed this need (#15 marked as “no”) as the Water Resources Task Force now does work to identify wetland restoration and protection projects and coordinate their efforts. It was never our intent to have wetlands as a separate piece, only to integrate it so that it is considered alongside all other water resources.

17 – Wetland monitoring data

- **BHWC** – See notes for GGWC. Also note that DEQ currently does not do any monitoring of wetlands, nor is there any information on wetland water quality. The Montana Natural Heritage Program has conducted some monitoring of wetlands in the Big Hole watershed through their 5-year rotating basin project and the results are available in report format through their website. While this information can help inform BHWC about the current wetland resources in the watershed it is not sufficient for planning/protection purposes.
- **GGWC** – The GGWC stated that currently no wetland water quality or monitoring data is collect in the Gallatin Watershed. As part of this project, it was the intent to begin collecting basic data that could form the basis of a wetland monitoring program that focuses on the condition, Ecological Integrity, of wetlands and their current functional state. And, using this data to help inform where restoration and protection measures are necessary. The ecological integrity assessment methodology that was presented as part of this project is a method that can be used to look at the condition of a wetland, and the stressors influencing a site and tracking them over time. In the 3/9/12 meeting it was discussed to train the stream water quality monitors on these methods in hopes that this will help GGWC further understand the condition of wetlands in the Gallatin Valley and provide additional wetland sites for restoration or protection.

22 – Wetland Mitigation Efforts

- **BHWC** – There are several wetland mitigation efforts undergoing in the Big Hole Watershed. These are completed or in the works by the Montana Department of Transportation and the Hamilton Ranch Mitigation Bank near Twin Bridges. I do not know if technically the Hamilton Ranch is in the Big Hole or the Beaverhead watershed. It is important to locate these as wetland mitigation sites may be important to further evaluate for surrounding restoration or mitigation projects. Increasing the connectivity of wetland habitats through restoration and compatible land uses is an important component when looking at aquatic resource protection in a watershed.

23 – Inventories of natural areas

- **BHWC & GGWC** – Both Groups stated that inventories have been conducted to evaluate natural area remnants. What are these inventories and how can we use them to help us better integrate wetlands into the watershed restoration plan, or plans used by other agencies that have identified these natural areas. It would be good to see the reports on the evaluated natural areas, and use them to help identify and prioritize wetland sites for restoration or protection. Just as with the specially-designated wetlands and potential recharge areas, identifying sites that will increase the connectivity of natural areas should be considered and at a minimum included on the initial list of sites to further evaluate. While this may not address the TMDL and chemical integrity of our waters it does potentially address the physical and biological aspects of the Clean Water Act.

24 – Threatened natural areas

- **BHWC & GGWC** – Both groups stated that they have a sense of which remaining natural areas are likely to be threatened by development. If there is an idea of where these natural areas are and which are likely to be threatened, were these areas evaluated as part of this project? If not, it gets back to the statement for #23 that at a minimum these areas should be included on an initial list of sites to be evaluated for restoration or protection, and measures to reduce stressors to these sites.

25 – Sensitive and high quality wetlands.

- **BHWC** – The BHWC stated that they didn't know if there were any sensitive or high quality wetlands within their watershed. One place to look for this maybe the Montana Natural Heritage work for their rotating basin and where they identified high quality sites. As the USFS also is a large landowner in the watershed, they may have plans that identify sensitive and high quality wetlands. For example, the Skull Creek Natural Research area in the Wise River drainage. This complex of patterned fens is a high quality and unique wetland.
- **GGWC** – Sensitive and high quality wetlands have already been identified. But, has this information been used to help identify sites or inform us as to how wetlands are functioning within the Gallatin watershed? These sites should be evaluated for multiple reasons: 1) are they currently and adequately protected, 2) what are some of the surrounding stressors affecting the sites that can be addressed in a watershed restoration plan, 3) are there surrounding areas where there is opportunity to restore lands to increase the connectivity of sensitive or high quality wetland to other natural areas or aquatic resources, and 4) if high quality, performing Ecological integrity and functional assessments can help inform us as to how similar wetland types in similar landscape positions should function and can be used as reference sites for similarly placed restored wetlands.

27 – Delineated contributing areas to HQ/sensitive wetlands

- **BHWC** – Most likely this has not been done in the Big Hole Watershed. If HQ/sensitive wetlands are identified delineating their contributing areas is important to evaluate the upstream threats to the wetlands that may contribute to the degradation of the site and water quality impairments.
- **GGWC** – While this has not been done, GGWC is developing a GIS database of potential wetland restoration and protection sites. In the future incorporating other sites (specially-designated wetlands, Sensitive/HQ wetlands, Natural Areas, Recharge areas) mentioned can further help to identify and prioritize wetland and restoration sites. Contributing areas to all of these sites is something that could easily be developed and incorporated as one layer within a GeoDatabase. The advantage of delineating the contributing areas is that from a water quality aspect, we can evaluate upstream stressors flowing into a site that may be contributing to water quality issues. For restoration sites, it may also help us identify how wetlands may help to reduce some of the stressors that are affecting water quality in nearby streams and rivers. This is a need that can be addressed by expanding the current GIS database development project.

30 –Wetland mitigation banks and in-lieu fee

- **BHWC** – There is a private mitigation bank near the confluence of the Big Hole and Beaverhead Rivers on the Hamilton Ranch. This bank serves the entire Upper Missouri River Basin. The effect of the location of this bank is that any impact to wetlands and their functions in the Big Hole Watershed are in effect lost and the functions potentially replaced at the outlet of the watershed. This is only the case when credits are purchased from the mitigation bank for unavoidable impacts. MDT also developed a mitigation reserve at the confluence of Seymour Creek and the Big Hole River. This site was developed for impacts to wetlands when working on HWY 43. The lands surrounding the mitigation bank and mitigation reserve bank should at a minimum be evaluated initially for opportunities for wetland restoration and protection projects.

- **GGWC** – While a mitigation bank does exist for the service area (Upper Missouri) that Gallatin watershed is in, this mitigation bank is not within the Gallatin Watershed. The effect this has is that for any wetland impacts within the Gallatin watershed they are mitigated for outside of the watershed. Thus in effect, the Gallatin watershed is losing the beneficial functions that were provided by the impacted wetlands. Technically, as mitigation banks and in-lieu fee programs deal with federal permits, 404 specifically, it may be hard for local governments to address the loss of function provided by wetlands within the watershed, one way to potentially deal with this is to work with the state in-lieu fee program (Montana Aquatic Resource Services) to identify sites within the Gallatin watershed that will help to provide no-net loss of wetland function and acreage within the Gallatin watershed.

31 – Operating Budget leverage

- **BHWC** – BHWC stated that there are existing funds that can be used or leveraged for watershed related purposes. What are these funds, who do they come from, and are they non-federal? The availability of funds for leveraging projects is important as restoration is expensive and funding sources generally need to be cobbled together. I would suggest that these funds are looked at to see what is applicable for their use, and whether or not wetlands would qualify.
- **GGWC** – Has this been looked into? Funding of restoration and protection, or securing grant funds for projects is a game of numbers and the ability to show leveraged funds is important. If GGWC was to undertake a wetland restoration project, the availability of leveraging some of these funding sources should be looked into.

1.4.2 - 8 Tools Audit

The 8 tools audit is a much more detailed analysis of local environmental regulations and programs related to watershed protection. The results of an 8 tools audit should be used to make recommendations as part of the final watershed restoration plan. The 8-Tools Audit used for this project can be found in [Appendix E](#).

What follows are MDEQ Wetland Program's comments and thoughts on specific questions with in the 8-Tools Audit. And, in some instances how we can more effectively use this data to inform us when developing a watershed restoration plan.

Background Information

5 – Community growth

- **BHWC** – While the BHWC did answer that there is currently little growth in the area occurring, it is an area that is considered as desirable due to its proximity to the surrounding recreational opportunities. For this reason this may be a good opportunity to begin working with counties and their growth policies to get solid natural resources protections in place before a concerted development effort happens as it did in the Middle Madison Watershed.

9- Primary Concerns driving watershed protection

- **BHWC** – The BHWC listed 5 primary concerns driving local watershed protection efforts. Conservation of wetlands and/or forests was included in this list. The main priority is water quality which is reflected in the other choices that were made. Of note is the diversion of drinking water for Butte from the Big Hole watershed. The effects this has downstream, while

probably evaluated, could also be looked at as a means of possible funding for projects to improve the quantity and quality of water in the watershed.

- **GGWC** – GGWC identified 5 of the 8 primary concerns as drivers behind local watershed protection. These were; *Maintain stream quality, sustain fishery, protect quality of drinking water sources, protect groundwater and maintain recharge, and maintain rural character*. It is interesting to note that for the first four concerns the *conservation of wetlands and forest* directly relate to them; yet, wetlands were not selected as a primary concern. It was one of the goals of this project to help make the link between wetlands and how then can help address these primary concerns and become incorporated as standard operating procedure when developing watershed restoration plans.

16 – Watershed awareness about wetlands

- **BHWC** – The BHWC stated that there is a mixed to low awareness of wetlands and how they function in the watershed and this is largely dependent upon who is asked. I think this is important to consider as this shows that a targeted education campaign about wetlands and their functions may be needed. One of the first steps is to look at who owns the largest amount of wetlands in the watershed and what is their awareness of wetlands. For example with water quantity an issue, where are the wetlands that will help to maintain stream flow located and are these publically or privately owned. In general it is probably ranching operations that own these lands, so what is their awareness of wetlands and the functions they provide, and how can we target them for educational purposes.
- **GGWC** – GGWC indicated that in their watershed the awareness about wetlands and how they function is low, as is concern about wetlands. Based off of this as wetlands are being incorporated into the watershed restoration plan for the Gallatin Watershed, it might be good to have goals and objectives for public education and outreach concerning wetlands and how they function and contribute to water quality. This need for information can be combined with information learned in the needs and capabilities sections to target the outreach and education to those most responsible for the land uses affecting wetlands and water quality in the Gallatin Watershed.

Tool 1

1.2 - Comprehensive plan

- **BHWC** – While all four counties have growth policies in place, BHWC stated that there are few regulations in place that support any of the natural resources growth policies. And that the counties rely upon federal and state regulations. While good for many aquatic resources this can leave a gap in the protection of wetlands. In general local regulations to protection wetlands are considered the most effective. While not usually politically feasible, it is something to consider when attending the growth policy updating review meetings. It is mentioned that Silver Bow and Deer Lodge have specifically addressed wetlands in their growth policies. Are these adequate? And if so can a case be made to Beaverhead and Madison Counties that wetlands have been incorporated in the surrounding counties where the communities have accepted them, and they are effective in protecting wetlands?
- **GGWC** – The City of Bozeman does have a very good comprehensive plan that outlines Environmental Quality and Critical Lands. There is a lot of good information and objectives

already developed for wetland protection and restoration. The information learned for this question could be better incorporated into the project, so that any wetland specific goals and objectives identified in the Watershed Restoration Plan complement or are in line with the goals and objectives in their Community Plan. One of the hopes of this project is that the process of integrating wetlands into watershed restoration plans would be a seamless integration with other community plans, growth policies and watershed restoration plans. Not a separate component that would stand alone. Thus, as the GGWC continues to look forward to identifying specific wetland sites that will help to address water quality impairments, it is also important to look back and see how this work helps accomplish the goals and objectives of other plans developed for the area. The county does seem to have some kind of plan, none is listed though. What is interesting for the county information is that everything is to “encourage” protection of aquatic resources. From the information provided it does not seem that there is any regulatory basis to protect wetlands at the local level.

1.3 Local Zoning Authority

- **BHWC** – As zoning is not politically feasible, or in many cases advisable due to the rural nature, what other options may exist for wetland protection? In the Big Hole I think about BMPs to protect slope wetlands and riparian areas on the Big Hole’s feeder streams. Can these be incorporated into a growth use policy or land use planning document? Can NRCS be brought in to help promote “wise-use” policies as part of swampbusters or the farm bill? What other type of easement programs exist that would protect the wetlands and riparian areas? Another place for more information is the Montana Audubon Planning Guide: <http://www.mtaudubon.org/issues/wetlands/planning3.html#3>

1.7 – Local Regulations

- **BHWC** – The reliance on state water quality law for the protection of wetlands is generally inadequate. Current law leaves many gaps in the protection of wetlands. It is advised, and generally considered as most the most effective means of protection, to have local ordinances that cover wetlands and fill the gaps missed by state and federal law.
- **GGWC** – In the 8 – tools audit GGWC stated that in their local regulations there is compensatory mitigation allowed for impacts to wetlands. I would be interesting to see further where the impacts were and how they were mitigated for and how the watershed group can influence where compensatory wetland mitigation is conducted or how the money paid to an in-lieu fee sponsor can be directed toward restoration of wetlands sites that target water quality impairments within the Gallatin watershed. For the county they don’t have local regulations for wetlands and instead rely upon state and federal. This leaves gaps in protection where the state and federal government do not have jurisdiction over wetlands. One of the big issues identified was that local enforcement of wetland protection is not adequate.

1.9 Local wetland inventories

- **BHWC & GGWC** – The Big Hole and Gallatin watersheds do have inventories and ecological integrity assessments of wetlands that have been conducted in the last 5 years. This information was collected by the Montana Natural Heritage Program. As part of this project the wetland mapping does include information about function. The functions are based on LLWW identifiers developed by Tiner, 2002. How can we better use this information that they collected to identify and prioritize sites for wetland restoration and protection?

1.13 Recharge or groundwater protection

- **BHWC** – It is important to find out if there are recharge areas mapped for the Big Hole Watershed. As these areas are important places to protect to maintain water quality and quantity. The recharge areas can also be evaluated for restoration opportunities both within the area and surround the area. Another reason to have clearly defined recharge areas is that you can look upstream in the contributing area to evaluate potential threats to these areas and work to minimize them.
- **GGWC** – The county, and probably to a smaller extent Bozeman, lack local protection of groundwater recharge areas. These areas are often times wetlands or wetland complexes. One thing to consider is to use information from the 8 tools audit to help add goals and objectives, or to guide future projects. For example, work with the City of Bozeman and Gallatin County to identify and increase protection on areas that provide recharge of groundwater resources.

Notes:

- **BHWC** – The awareness that no cumulative effects studies/reviews of development and impervious cover is good. It is well documented that as these stressors increase in a watershed the water quality degrades. It would be interesting for to see a goal in the watershed restoration plan looking at the cumulative effects of development and impervious surfaces on all water quality and quantity in the watershed.
- **GGWC** – *“Regulations only apply if you are in a zoning district, in a floodplain, or are subdividing. A lot of development projects that impact water resources do not fall into these categories.”* As this is a gap that was identified, it is something that should be considered as part of the watershed restoration plan on how to address these gaps, especially considering the reliance upon state and federal regulation to protect wetlands. The purpose of the 8-tools audit is to learn more about the current tools in the watershed to protect wetlands and aquatic resources, and to identify where gaps exist in this protection and a watershed restoration plan can help to address these gaps.

Tool #2 Land Conservation

2.3 Groundwater Recharge Areas

- **BHWC** – Ask local county GIS people if they have a GIS dataset that clearly outlines these areas. If they do not, informal conversations with area hydrologists, ranchers, and farmers may point you in the right direction to where these areas are located.
- **GGWC** – Identified that Groundwater recharge areas have been delineated in the GLWQD Wetland Mapping Project 2001. This information should be used to help GGWC identify wetland areas that will contribute to recharge the groundwater, as well as the function of recharge areas contributing to maintain stream flows and moderate temperatures in streams and rivers. This information could also be used to help further prioritize already identified sites. It seems as if this information has been pushed aside in this project to accomplish other goals.

2.4 RTE species and sensitive areas

- **GGWC** – This maybe a good topic of education and outreach to the City and County Planning staff that can address natural resource protection. While this education and outreach shouldn't

be wetland specific, GGWC did identify eight Rare, Threatened, and Endangered species and educating the planning staff on the habitats of these species and providing them with the tools or materials necessary to incorporate protection of these species habitats is important.

2.11 – Local government administration of Conservation Easements

- **BHWC** – While this is set up for the Upper Watershed through the Candidate Conservation Agreement with Assurances, can it be used in the Lower and Middle Big Hole? Would this be a more effective way of getting buy in for conservation easements, since the local government would be the holder and not an outside conservation organization? Another question on the flip side, will the local governments be effective and viable in the long-term from a management and monitoring of the easement?

2.13 Conservation Opportunities in the Watershed

- **BHWC** – BHWC stated that conservation opportunities have been identified in the watershed and that these should be consolidated for inclusion in the Watershed Restoration Plan. The conservation opportunities should also be further evaluated for the possibility of wetland projects that can add value to any conservation project. As we did look at many sites, I am not aware that we looked at pre-identified conservation opportunities to incorporate wetlands into the watershed restoration plan.
- **GGWC** – GGWC stated that the Heart of the Rockies has identified priority conservation lands in the GYE. Are any of these wetland areas? This information could be incorporated into the GIS database that GGWC is developing as part of this project. The priority conservation lands can be used as both an added dataset to prioritize currently identified projects or used to help identify potential wetland restoration and protection sites that will help to address water quality impairments in the Gallatin Watershed.

2.15 Prioritizing conservation opportunities

- **BHWC** – Because prioritization processes have been established is there a way to re-evaluate these and see where wetlands can be incorporated? This would help all groups working with the NHWC to evaluate these projects begin to consider wetlands as just one more of the aquatic resources within this watershed.
- **GGWC** – How has this information been incorporated into this project to help GGWC prioritize potential wetland restoration and protection sites that have been identified as part of this project?

2.16 Federal, state and local funding sources

- **BHWC & GGWC** – Stated that yes there is funding available for purchasing easements or acquiring land in their watersheds. When evaluating and prioritizing potential wetland restoration and protection sites, this information should be included and used to help prioritize areas. All of this information is important to consider, as both time and funds for these types of projects are limited.

Tool 3 Aquatic Buffers

3.1 stream, wetland or shoreline buffers

- **BHWC** – While there is a 150 foot setback along the Big Hole River as recent floodplain studies have shown this is probably ineffective in protecting not only river function, but human health and infrastructure. Outside of the Big Hole River I am not aware of any other restrictions for buffers of aquatic resources. This is something to consider when working with counties to update their growth policies. The overlay district has more to do with the planning and having buffers clearly identified in a GIS databases so that you can overlay multiple sources of data to guide you in decision making. These are important tools if you have the ordinances in place, basically just one more piece of the puzzle.
- **GGWC** – Interesting statement for the City of Bozeman: *“Isolated wetlands with a size of less than 400 ft² regardless of property boundaries, are exempt from this chapter [Chapter 18 BMC?] unless the wetland provides habitat for threatened, endangered species or Species of Concern on review by MTFWP.”* I am assuming that isolated wetlands are those wetlands that are not considered as waters of the United States. Also important that in general 400 ft² is less than 1/10 of an acre and so the USACE in general would not regulate the discharge of dredged or fill material to these sites, nor require mitigation, essentially giving these sites no protection under federal or local regulations. Calculating what the loss could be based on mapped NWI wetlands, there is less than one acre when adding up the total area of the 181 acres of palustrine wetlands < 400 ft². If you add riparian areas into this, the number increases to 1.23% of all wetland and riparian areas. Thus, if this exemption applies to riparian areas also, the impacts of this exemption should be examined. For more information, if we look at all impacts less than 1/10 of an acre that may not be regulated, in the Gallatin watershed there is ~174 acres that are vulnerable. For Gallatin County there are buffers on streams but not on wetlands. This is a gap in protection that can be addressed as a potential project within a watershed restoration plan to work with the county to update their growth policy to incorporate buffers on wetlands.

3.2 Buffer Widths

- **BHWC** – BHWC stated that the buffer widths on the main stem of the Big Hole can be expanded to connect wetlands with their upland habitats. Does this mean that if a wetland is within 150 of the high water mark, the actual 150 foot buffer could be from the edge of the wetland and not the edge of the river? If so has this been done? It is particularly important as many of the riverine wetlands adjacent to the main stem of the Big Hole could be used to increase the required buffer and thus better protect all of the aquatic resources within the Big Hole watershed.

3.4 Buffer exclusions

- **GGWC** – City of Bozeman buffers are excluded from private properties boundaries in new residential subdivisions or commercial development. Unless I am reading this wrong, this may be another good place to look at to increase the protection of aquatic resources and to limit the exclusions for residential subdivisions and commercial development. Both of these areas are big contributors to urban non-point source pollutants.

3.8 Physical demarcation of buffers

- **GGWC** – GGWC stated that in the City of Bozeman this is sometimes required. The concern I have is that for wetlands the workers may not be able to delineate a wetland from an upland area and thus encroach upon the required buffer. This is a problem in Arid states where wetlands are typically dry for portions of the year, especially during the construction season. I

would suggest that one goal could be to do education and outreach on BMPs for identifying wetlands in construction sites.

3.9 Are buffers clearly established in ordinance?

- **BHWC** – The excluded uses/activities should be clearly established in buffer ordinances. One place on the policy aspect that could be a goal or objective within the watershed restoration plan is identifying these exclusions and getting them clearly stated in rule.
- **GGWC** – The city of Bozeman’s unified Development Ordinance clearly documents these ordinances and should leave few questions as to what is permissible. The city of Bozeman’s ordinances under the listed sections should be held up as examples for both Gallatin County and other local governments for buffer ordinances. One of the only places I would suggest to look at is the exemption of Agriculture/Livestock as they are large contributors to NPS pollutants such as sediment and nutrients. Both of which are known impairments of water quality in the Gallatin Watershed.

3.17 GIS mapping of Buffers

- **GGWC** – GGWC is developing a GIS database for looking at potential wetland restoration projects in the Gallatin watershed. As noted in other sections this database could be expanded to incorporate more information about the status of aquatic resources in the watershed. A project of identifying good/bad buffers through remote sensing could be valuable and help guide GGWC to potential wetland/riparian restoration or protection projects.

Notes:

- **GGWC** – *“Watercourse setbacks are not functionally equivalent to a buffer because they do not limit the activities that can occur within the setback or specify the resource management objectives for the setback.”* From the document and looking at information provided this is apparent and it seems that problem activities (i.e. septic systems) are allowed in the “Buffer”. A goal in the Watershed Restoration Plan could be to work with the county to address where these activities allowed in the buffer may be contributing to water quality impairments and tighten up regulations to minimize their impacts.

Tool 4

4.1 Zoning or Subdivision Codes

- **BHWC** – BHWC stated that there are zoning or subdivision codes for new and residential development. What are these criteria? And do they apply on a county wide basis or is it only in developed areas with zoning or when a property is going through the subdivision permitting process?

4.5 Overlay district or “red Flag” system

- **GGWC** – only for FEMA floodplain maps. Yet there was talk of other sensitive areas, natural areas, specially designated wetlands and recharge areas. As GGWC is developing their GIS database expanding it beyond just the potential wetland restoration and protection sites could help to address this. By compiling this information, it could easily be incorporated into any planning department at the city or county with GIS capabilities.

Tool 5 Erosion and Sediment Control

5.2 Are there local erosion and sediment control ordinances

- **BHWC** – see note for Gallatin County, as the issues could in the future present themselves as the Big Hole continues to develop. While the percentage of 303d streams listed for sediment in the Big Hole watershed are comparable to the Gallatin, only 11% of the 303d listed streams have identified development as a source of sediment. So this brings up the question, are there other BMPs that could be looked at from the issue of erosion and sediment specifically dealing with agriculture, grazing, and silviculture.
- **GGWC** – For Gallatin County there are no local erosion and sediment control ordinances. Consider that 18 of 24 of the impaired water contributing areas list sediment/siltation as impairment, 50% of these have development listed as a possible source of the pollutant. This is an issue directly impacting water quality issues in the Gallatin Watershed. It is something to consider incorporating into a watershed restoration plan to protect all aquatic resources.

5.5 Erosion control along sensitive areas

- **BHWC** – I would look into this further especially with a federal candidate species present in the watershed and a state species of concern also present. More stringent criteria also streams and rivers where arctic grayling and cutthroats are presents would be a good addition to any regulations and for the most part the community would probably be amenable as these species have gotten lots of attention.

5.7 Erosion and sediment control for logging

- **BHWC** – 23% of streams listed for sediment identify logging as one of the potential sources. Montana has good voluntary buffer regulations for minimizing sediment resulting from silviculture. With ¼ of the streams impacted by logging it may be beneficial to look at if there is a common problem at all of these sites that are contributing sediment to the listed streams. And, if there is it could be a goal or objective within the watershed restoration plan to work with the timber companies or silviculture association to address these specific issues.

5.9 & 5.10

- **GGWC** – It is stated that inspection of construction sites for erosion and sediment control is supposed to be once every 7 days or after a rainfall event. The discrepancy is with 5.10 when the actual frequency is only when a complaint is filed. One way to make use of this information could be to look at how much sediment and other pollutants in the waterbodies are contributed by these activities. If it accounts for a high proportion of sedimentation to include in the Watershed Restoration Plan a goal of working with the county/municipal inspector to better address these issues. It is well document though that there is a lack of staff capable of doing the inspections.

5.14 & 5.15

- **BHWC** – This question wasn't answered, but training programs are important to consider. They have been effective in training construction professionals about the regulations, and the purpose of these regulations, realtors, and home owners. If these trainings are not available consider these as part of the education aspect that has been talked about for the watershed restoration plan. There are ready made courses for Montana that the Montana Water Center and Montana Watercourse have been sponsoring

- **GGWC** – Notice that the City sponsors erosion and sediment control for the contractors and Engineers, while the County does not. This is not to say though that groups are missed by not having a county sponsored training program. One important group here that is missing are the developers. The City’s training program is good in that it covers many of the issues affecting TMDLs and wetlands. One way to use this information is to look at sites in Gallatin County where erosion and sediment control is an issue and see if the contractors, engineers, and developers have participated in the City sponsored training programs. And thus, if there is a need to expand these trainings to contractors, engineers, and developers working outside of the Bozeman city limits.

5.19

- **GGWC** – Gallatin County lacks erosion control practices along streams and wetland buffer boundaries. What affect is this having on the water quality of these receiving waters and the quality of the buffers? If it is impacting these resources, and the quality of these resources differs from those within Bozeman, it could be a goal or objective to bring these erosion control practices/regulations in the county in line with those of Bozeman.

Tool 6 Storm Water Management

- **BHWC & GGWC** – No Comments

Tool 7 Non-Storm Water Discharges

- **BHWC & GGWC** – No Comments

Tool 8 Watershed Stewardship Practices

- **BHWC & GGWC** – No Comments

Task 2: Develop preliminary watershed goals and objectives that include wetland specific goals and objectives.

Defining preliminary goals and objectives early in the watershed planning process is important to help guide the watershed planning process. The first task focused on gathering all of the relevant information that could be incorporated in to a watershed restoration plan or inform the planning process. Using the initial information collected and compiled in Task One, the watershed groups developed preliminary goals and objectives that would later be refined and incorporated into a final watershed restoration plan. Not all of the information that was collected was wetland specific, the information gathering process covered all aquatic resources, development issues, and facets of government. The watershed groups were encouraged to use all of the information collected to define watershed goals and objectives. We did, though, require that the pilot watershed groups identify wetland specific goals and objectives and how their restoration or protection can help address known water quality and quantity impairments within the watershed.

Keeping within the definition of a goal and objective, we asked that goals be written as a broad-level or general statement that expressed what the watershed plan should accomplish and that the objectives reflect the actions that will be taken to accomplish the goal. Aside from this general description of goals and objectives, MDEQ and MWLP did not require the pilot watershed groups to follow any specific format. The purpose of this was to allow the pilot watershed groups to develop a document that would

be most useful to them in the watershed planning process, could be refined through Tasks 3 and 4, and easily incorporated in to their watershed restoration plan. Both wetlands followed this general guidance and developed two very different preliminary goals and objectives documents.

GGWC's Goals and Objectives

The Greater Gallatin Watershed Council used only the information provided in the Impaired Water Contributing area reports for the Gallatin Watershed. They took the information that was presented and developed one goal for each impaired water contributing area that related the restoration and/or protection of specific wetland types to known water quality impairments. Their preliminary objectives then closely reflected the goal statement and were broken out by which specific wetland types to target. A general objective was also included in each goal of contacting land owners and conducting Level 2 assessments on the wetland types identified in each impaired water contributing area. Fundamentally GGWC's preliminary goals and objectives were written to specifically address the goals of the pilot project and requirements of their contract with MDEQ. The Gallatin Watershed has 77,000+ mapped wetlands in the National Wetlands Inventory. Having very specific goals and objectives that identify specific wetland types will be useful in guiding GGWC to identify sites for further evaluation. GGWC also used the source of the impairment to develop an objective, this is a good objective because it targets land uses and attitudes that are impacting wetland and riparian areas and may in the long run prove more useful for guiding watershed activities. An example of one of GGWC's goal and objects is:

GIS ID Gallatin 13: Sourdough (Bozeman) Creek TMDL Contributing Area

Point Source Pollutants: *Escheria coli*, Phosphorus, Sedimentation/Siltation, and Total Kjehldahl Nitrogen

Non-Point Source Pollutants: Alteration in stream-side or littoral vegetative covers and chlorophyll-a

Potential Pollutant Sources: Channelization, grazing in riparian or shoreline zones, irrigated crop production, loss of riparian habitat, septage disposal, and yard maintenance

Goal: Identify riparian areas, depressional, and slope wetlands for restoration and/or protection in order to stabilize streambanks, retain sediments and reduce siltation, and increase nutrient attenuation in the Sourdough TMDL contributing area.

- *Objective #1:* Target slope and depressional wetlands because of their capacity to attenuate nutrients (65% and 22%, respectively); Target slope wetlands because of their capacity to retain sediments (32%).
- *Objective #2:* Target depressional wetlands because of their hydrologic alteration as reported by the NWI database (385 acres).
- *Objective #3:* Target areas where limiting or eliminating grazing in riparian areas would allow for protection or restoration of original hydrologic functions.
- *Objective #4:* Contact landowners and conduct Level 2 assessments on wetlands identified in Objectives 1, 2, and 3.

As previously mentioned GGWC's goals and objectives were written to specifically address the goals of the pilot project and requirements of their contract with MDEQ. One of the overall goals of the pilot project was to identify wetland restoration and/or protection projects that could be worked on after the life of this project. GGWC's goals and objectives for wetlands, if incorporated into their watershed restoration plan, will help accomplish this goal. In the first task a lot of information in addition to the impaired water contributing area reports were collected that could have been incorporated into the preliminary goals and objectives. For example, the information collected through the Needs and

Capabilities Assessment and 8-Tools Audit were not incorporated into the preliminary goals and objectives. In section 1.4 during the review of the NCA and 8-Tools Audit highlighted the dramatic difference in the protection of wetland resources between Bozeman and Gallatin County. Gallatin County lacks any kind of wetland protections, while Bozeman's are model ordinances. A good wetland specific goal would be to increase wetland protection ordinances in Gallatin County with objectives that target specific activities such as non-point source pollution as a result of development that were identified in the 8-Tools Audit.

The Greater Gallatin Watershed Council's preliminary wetland integration goals and objectives can be found in [appendix F](#).

BHWC's Goals and Objectives

The Big Hole Watershed Committee used most of the information that was collected in Task 1. Unlike GGWC's preliminary goals and objectives, BHWC are more general and cover topics other than the restoration and protection of wetlands. The BHWC identified one primary goal, the improvement of water quality and quantity, with four strategic directions to accomplish this goal, specific objectives under each strategic direction, and general sites under each strategic direction. The four strategic directions and specific objectives are:

1. *Planning and Research* – Incorporate wetland goals into watershed planning efforts and other plans and policies. Support with research.
 - Incorporate Wetlands Prioritization into the Middle-Lower Watershed Restoration Plan
 - Support the Wetland Prioritization with research and studies.
2. *Educate* – Incorporate wetland education into BHWC education strategies, including interpretation, materials, youth, and landowner education.
 - Provide wetland interpretation where appropriate, such as within fishing access sites.
 - Include wetland function in landowner education efforts.
3. *Restoration* – Restore non-functional wetland sites. Utilize natural methods where possible.
 - Identify and implement high quality wetland restoration projects that will have direct impact on goal
4. *Preserve/Protect* – Seek protections of high quality wetland zones through policy, easement, grazing plans, and other means.
 - Work with four counties to include wetland protection in county Growth Policies.
 - Work with three Conservation Districts on wetland permitting, protection and education.
 - Include language for wetland role and protection in the Big Hole Watershed Committees Land Use Planning effort - a committee working towards protection of channel migration zones from development.
 - Seek support for landowners to protect lands through easement and work. Solicit landowners that own lands with identified high quality wetlands to participate in easement.

As part of the strategic directions and objectives for Restoration, Education, and Preservation actions at general locations were identified that would address the primary goal. Under restoration and preservation BHWC used the wetland types identified in the impaired waters contributing area reports

to create general goals for using wetland restoration/protection to address water quality and quantity impairments. One example for restoration is:

Site	Landowner	WQ Goal	Description	Wetland Type
Big Hole Pasture Land	Zuckers Big Hole Ranch	Maintain Flows Temperature	Alter pasture management and grazing plan to allow rewetting of historic wetland	Riverine

The Big Hole Watershed Committees draft preliminary wetland integration goals and objectives can be found in [Appendix G](#).

Task 3: Map and assess wetland and other aquatic resources within watershed for the identification of priority sites for conservation, restoration and /or mitigation

3.1 Mapping wetlands in the pilot watersheds

As part of this project, MDEQ worked with the Montana Natural Heritage Program (MTNHP) to ensure that complete National Wetlands Inventory (NWI) was available for both pilot watersheds. Wetland mapping was previously completed for the Big Hole watershed and approximately 90% complete for the Gallatin Watershed. To finish the mapping MDEQ contracted with MTNHP to map the four missing quads in the Gallatin Watershed. This information was then sent to the U.S. Fish and Wildlife Service for inclusion in the National Wetlands Inventory. MTNHP's contract stipulated that LLWW identifiers (Tiner, 2002) be included as a value added attribute to the NWI dataset. MTNHP is adding LLWW to all of its new NWI mapping and had an established procedure for doing this.

Accurate wetland maps with value added LLWW attribution are one of the main components of this project. They are used to relate wetlands and their functions to identified water quality and quantity impairments, develop wetland profiles, provide information on hydrologic alterations, and aid in identifying wetland restoration and protection sites. Without the availability of accurate, up to date wetland maps it is difficult for both watershed groups to incorporate wetlands into a watershed restoration plan, and for MDEQ's TMDL Planning Section to accurately characterize all aquatic resources when developing a TMDL Implementation Plan.

One issue we ran into was having to use provisional NWI data for information gathering and site identification. Provisional data is data that has either not yet been QA/QC'd by the USFWS or has not yet been posted to the national database. The provisional data also has the value added LLWW identifiers that are removed when the data is posted to the national database. The LLWW identifiers are the basis we used for relating wetland functions and their ability to address water quality and quantity impairments. We were therefore required to use provisional data, regardless if it had been posted to the national database or if it had completed all QA/QC checks. To eliminate these potential sources of error it is recommended that the NWI national database include and house value added attribute information such as LLWW. This would ensure that we are using QA/QC'd data, minimizing our error when collecting

information and characterizing the wetlands and their functions a watershed, and save time spent investigating only properly classified wetlands as potential sites for restoration or protection.

Information on the current status of wetland mapping by watershed in Montana can be found at:

http://mtnhp.org/nwi/images/WatershedNWI_Map.jpg. Links and ways of downloading wetland information for Montana can be found at: http://mtnhp.org/nwi/nwi_data.asp.

3.2 Revising methodology for creating value added NWI database with LLWW

As was stated earlier, NWI with LLWW value added attribution was one of the main tools used in the development of this project. The Montana Natural Heritage Program began working to develop LLWW, an HGM-type attribute, as a tool to help determine the change in wetland function over time within a watershed. This work was done in three watersheds; Gallatin, Big Hole and Bitterroot. While this work was not able to accurately detect change in wetland function, it did demonstrate the usefulness, applicability, and value of adding LLWW descriptors to the NWI database.

The HGM-type attributes include four main descriptors. These LLWW descriptors are landscape position, landform, waterbody type, and water flow path.

- Landscape position defines the relationship between a wetland and an adjacent waterbody, if present.
- Landform is the physical form of a wetland or the predominate land mass upon which it occurs.
- Water flow path indicate the type of directional flow of water associated with a wetland (Tiner 2003).

LLWW descriptors can be applied to all wetlands in the NWI database through interpreting individual wetland characteristics using a variety of data sources such as USGS topographic maps. The LLWW descriptors, in conjugation with the Cowardin classification used in NWI, are then used to produce a more complete description of the characteristics associated with mapped wetlands and waterbodies, i.e. wetland functions (Tiner 2003). LLWW describes 10 functions, nine of which are applicable to Montana:

1. Surface water detention
2. Streamflow maintenance
3. Nutrient transformation
4. Sediment and other particulate retention
5. Shoreline stabilization
6. Provision of fish and shellfish habitat
7. Provision of waterfowl and waterbird habitat
8. Provision of other wildlife habitat
9. Conservation of biodiversity.

NWI with LLWW value added attribution is intended to be used for watershed planning purposes; specifically, for targeting wetlands that may provide the functions that will address known water quality and quantity impairments. An advantage of having NWI with LLWW value added attribution is that wetland functions can be field-verified when evaluating a potential site for restoration and or protection. During this project we used NWI with LLWW extensively to help inform the planning process and for identification of sites for wetland restoration or protection based on their functions. Through this process we found that the HGM-type descriptor from the NWI database quite often did not reflect what was encountered during field evaluations. And thus, the related wetland functions that address the known water quality and quantity impairments may not be present. This was especially apparent for

slope and basin wetlands, where in the first iteration in the Big Hole and Gallatin no slope wetlands were identified.

As a result, MDEQ approached the Montana Natural Heritage Program with funds to update their methodology for adding LLWW attribution to the NWI database. Included in this update was using the data collected during their Rotating Basin Assessments in Southwest Montana to inform and calibrate their LLWW attribution methodology. A portion of this data was reserved to validate the revised methodology.

Initial accuracy assessments indicated that only 47.7% ([Figure 6](#)) of the time was the HGM-type descriptor determined using GIS the same HGM-type descriptor determined while conducting an Ecological Integrity Assessment. The range of accuracy for the different wetland types varied greatly; 50% for basin wetlands, 81.3% for slope wetlands, and 25% for riverine wetlands ([Figure 7](#)). In terms of effort spent looking for potential wetland restoration and protection sites, there was the probability that 50% of the time spent in the field to evaluate a basin wetland and its associated functions, it would actually be a different wetland type and may or may not display the wetland functions we were interested in.

Montana Natural Heritage Program formed a small Technical Advisory Committee (TAC) to evaluate their process for assigning LLWW descriptors to NWI wetlands. MTNHP took the TAC's suggestions and where possible revised the methodology. The methodology was revised twice and for each revision the accuracy was tested using the validation dataset. Both times the overall accuracy increased from the previous iteration. In the final iteration the overall accuracy increased from 47.7% to 77.1% ([Figure 8](#)). The revised methodology produced mixed results for specific wetland types, though. For both basin and slope wetlands the accuracy for an HGM-type descriptor determined using GIS would be the same HGM-type descriptor determined while conducting an EIA increased, 50% to 100% and 81.3% to 87.5%, respectively. Yet for riverine wetlands this accuracy dropped to 0% ([Figure 9](#)).

Due to time and financial constraints, MDEQ was unable to allow for a third iteration of methodology to be developed and the accuracy re-assessed. Fortunately, MTNHP secured their own funds to continue to work on revising the methodology for adding LLWW descriptors to NWI. This project is currently in progress and is greatly expanded in both scope and support, financial and technical support.

3.3 Trainings

To increase the watershed group's capacity and knowledge regarding wetlands MDEQ and MWLP, in conjunction with the Montana Natural Heritage Program, provided two wetland specific trainings. The first training was on conducting the Ecological Integrity Assessment methods that were developed by the Montana Natural Heritage Program. The second training was a wetland and riparian plant identification training provided by MTNHP Botanist Scott Mincemoyer.

3.3.1 Ecological Integrity Assessment Training

Ecological integrity assessments provide information on the ambient condition of wetland resources, inform management decisions, and determine the effectiveness of wetland restoration projects. This assessment method evaluates the chemical, physical, and biological integrity of a wetland based on its condition for determining its ecological integrity. The Montana Natural Heritage Program designed the

ecological integrity assessment methodology to follow the Level 1-2-3 framework for wetland assessment and monitoring recommended by U.S. EPA. For the purposes of this project, the ecological integrity assessments used only the Level 2 & 3 assessments. The Impaired Water Contributing Area Reports and Sub-Watershed Wetland Profiles were considered as Level 1 Landscape Assessments characterizing wetland and the land uses across a given area.

The ecological integrity assessment (EIA) training focused on the Level 2 Rapid Assessment methodology. Rapid assessments are used to evaluate the general condition of wetlands using observable field indicators. The score from a rapid assessment represents where the wetland site under evaluation falls along a condition gradient from least-disturbed to highly degraded for similar wetland types. Using the information collected in an EIA, we hoped it would help inform us as to the need for restoration or protection based on its relation to a high quality reference wetland. And for restoration, what the major stressors are that may be impacting the wetland site. The information could also be used to help screen potential wetland restoration sites based on a breakdown of their Ecological Integrity Scores. A good example of this is EPA's Recovery Potential Screening tool displaying results in 3D "Bubble Plots." A discussion on this can be found at: [Using Bubble Plotting as a Recovery Potential Screen Tool](#). The data and information collected using the EIA could also be useful when determining restoration success, the trajectory of the restoration project and whether a site can be restored to a reference standard or an acceptable alternative state (Suding and Gross, 2006).

The ecological integrity assessment training was conducted on June 21st, 2011 by MTNHP through a DEQ contract for the pilot watershed groups. This training was attended by 13 representatives from the Greater Gallatin Watershed Council and the Big Hole Watershed Committee. After going through the training, both groups decided that, while a rapid assessment, the time and expertise needed to complete an EIA at a potential site during the initial visit was too much. And for an initial visit it would be more time effective to gauge landowner interest and if the site would fulfill the goals and objectives outlined under the watershed restoration plan. EIA, it was agreed, would be useful but at a later date in the development of a project site for restoration or protection. For the initial intent of this project, not using the ecological integrity assessments meant that we were not able to test out the applicability of using them as a potential screening tool for restoration sites, and that if they are used, they would be used more to inform restoration success and trajectories.

Montana Natural Heritage Program Ecological Integrity Assessment protocol can be found here: <http://mtnhp.org/wetlands/docs/Protocol.pdf>

3.3.2 Wetland Plant Identification Training

A second training on wetland plant identification was conducted on August 9th, 2011 by Scott Mincemoyer, botanist with the Montana Natural Heritage Program. This training was less well attended than the ecological integrity assessment training, but did have more groups represented. For the wetland plant identification training both pilot watersheds attended as well as a representative from the Non-Point Source Planning Bureau at MDEQ. It was important to have the Non-Point Source Planning Bureau at the training as they administer the 319 projects in Montana which fund the majority of watershed restoration plans written in the state.

The wetland plant identification training had two main goals. First was educating both groups on what constitutes wetland vegetation so that they are able to more easily recognize when they encounter wetland systems. While this may seem intuitive, in the arid west where many wetlands are dry for long

periods of time, the vegetation present is not the characteristic vegetation seen in emergent wetlands with longer hydroperiods. Second, was to educate and demonstrate using wetland vegetation as a means to identify stressors to and condition of a wetland community. The second goal was accomplished by educating and demonstrating the use of wetland plant species coefficient of conservatism (COC) and how it rates a plants ability to tolerate disturbance (Swink and Wilhelm 1979). For example, a site with wetland plant species having low COC values would be considered as a site having a low ecological integrity and thus a potential restoration site. Whereas a site with wetland plant species having high COC values in indicative of a high quality site with little disturbance and the site should be considered for protection more so than restoration.

3.4 Identifying wetlands through the interpretation of natural color and color infrared aerial photography

A large proportion of the responsibilities of the pilot watershed groups under Task 3 were to identify potential sites for wetland restoration and/or protection that would address known water quality impairments or their preliminary watershed goals. Using the NWI with LLWW descriptors and the exploring your aquatic resources web mapping application gave the groups one means of identifying potential sites remotely. This methodology did provided several quality sites for restoration or protection. But not all existing wetlands are mapped nor are historic wetlands, those now under a different land classification, identified in the current NWI database. Historic wetlands in particular are ideal areas for restoration as the functions they provided have been lost and maybe restorable. The ability to discern wetlands from aerial photos without the aid of NWI increases the number of sites that could be evaluated as potential wetland restoration and/or protection projects. For these reasons, MDEQ provided sponsorship to both watershed groups to attend a 2 day training provided by the Confederated Salish and Kootenai Tribe on identifying wetlands through aerial photo interpretation. Only a representative from GGWC and DEQ's Wetland Program were able to attend the training.

Through this training, participants were taught to identify wetlands by Cowardin Classification using natural color and color infrared aerial photography. The instructors also expanded their training to incorporate the identification of certain wetland plant species with specific signatures. This is useful as it help in determining what may be present before conducting a site visit. A brief PowerPoint presentation is available on CSKT's website: http://www.cskt.org/tr/epa_wetlands.htm. It provides an excellent resource for aerial photo interpretation and explaining Cowardin classification.

3.5 List and Map of Recommended Priority wetland sites for restoration and/or protection

The Greater Gallatin focused their work to two main areas, Rocky Creek and Bozeman Creek. Both of these creeks are tributaries to the East Gallatin River and are 303d listed. A complete list of landowners contacted, including maps can be found in [Appendix H](#).

The Big Hole Watershed Committee focused more on individual land owners with conservation size properties in the watershed. A complete list of landowners contacted, including maps can be found in [Appendix I](#).

Task 4: Site visits and meeting with landowners interested in wetland conservation or restoration

The pilot watershed groups were asked, as part of this project, to contact at least 10 landowners that would be willing to allow us to access their properties. The purpose of gaining access was to evaluate both the willingness of the landowner to do a restoration project and evaluate the potential of wetland for restoration and/or protection. At each of the wetland sites the watershed groups and Tom Hinz with the Montana Wetlands Legacy Partnership collected extensive notes about site conditions, management alternatives, and future strategies.

It was initially planned that at each site visit a level II MTNHP Ecological Integrity Assessment would be conducted. The Level II EIAs were to be used to help inform each watershed group about the need for restoration at a site, the stressors affecting the site, and to highlight what components of the wetland are most impaired, i.e. hydrology, invasive species. After the EIA training and initial attempts at conducting assessments, both watershed groups determined that it was too early in the process to conduct an in-depth assessment and that time would be better spent evaluating the whole property and spending time with the landowners.

The Greater Gallatin Watershed Group was able to get permission from 11 out of 29 landowners who were approached. All 11 landowners were in the more urban sections, while no rural landowners were willing to allow us on their properties. Landowners were contacted by phone to talk about the Wetland Integration project and the GGWC's interest in viewing their property. The dialogue was developed by GGWC board members that had extensive experience working with landowners on easements and restoration projects. The entire phone message is included below. It addressed the GGWC, the Wetland Integration project, the importance of wetlands in our ecosystem, the assessment process, and potential funding for wetland restoration and conservation. The dialogue was used to call the landowners within the Camp Creek and Urban contributing areas. All phone calls were conducted by an AmeriCorps Volunteer that was working with GGWC, if needed or questions arose, Tom Hinz usually called the landowner back with more in-depth information.

"Hello Mr. or Mrs. _____, my name is Marianne Pott. I'm a volunteer with Greater Gallatin Watershed Council, a local non-profit dedicated to protecting the water resources in this area that we all rely on. I am calling to discuss a current project we have. GGWC was awarded funding to locate wetlands in the valley and investigate ways to enhance them. Wetlands are important units of watersheds that can maintain a high water table, provide in-stream flows during dry periods, and improve water quality for all water users. Your property at (give address) was listed as having a wetland. GGWC would like to work with you to assess the health of this wetland. Can I tell you a bit more about the project and how we might work together in a mutually beneficial way?

The first step is to have a group of 3-4 of our dedicated volunteers access the area of your property that our mapping program shows has a wetland. The volunteers will be on your property for about 3 hours examining vegetation, soils, and water flow to assess the state of the wetland. In the future, if there is interest from you and available funding, we can work together to enhance the wetland in a way that will benefit both you and the watershed. Are you interested in participating in our project? "

The Big Hole Watershed Committee took a different approach from GGWC whereby they relied upon contacts within the watershed committee to help make initial introductions with landowners. Initial site visits were largely “drive-by” that were decided by looking at potential wetland sites using the “Exploring your aquatic resources web application. In these “drive-by” visits, time was spent looking at the broad picture surrounding a wetland to determine if it was worth the effort to make contact with the landowners. If a site was adequate, phone calls were then made to the landowners and times for us to access the property or meet with the landowner were set. While more time consuming, this approach was much more effective in getting us out on the ground in the rural areas, with most of the landowners at least willing to hear us out. As Tom Hinz pointed out, by taking this approach, you are cultivating a relationship with the landowner that may take a decade before any on the ground work could happen.

Task 5: Develop a final list of prioritized watershed recommendations including priority wetland recommendations that make up a final watershed restoration plan

The two pilot watersheds were finally asked to compile all of the information they collected and learned from Tasks 1 - 4 and develop a list of prioritized wetlands recommendations to be included in their final watershed restoration plan. There was no set guidance on how these final wetland recommendations should be developed or what they should/ should not include. This was done so that each watershed would develop recommendations that would be useful to them, and thus more likely to be included in their final watershed restoration plan.

The GGWC decided that instead of concentrating on individual properties scattered around the Gallatin valley it would be better from a water quality, work load, and funding availability to concentrate on one sub watershed. For a pilot project concentrating on one sub-watershed and identifying multiple wetland sites within, will mean that it is more likely a measurable effect can be made on the water quality. This watershed was Bozeman Creek and its tributaries which run through the heart of Bozeman. GGWC’s prioritized watershed recommendation can be found in [Appendix J](#). While this prioritizes the work, it limits GGWC’s ability to be competitive for 319 funding for wetland projects that are not within the Bozeman Creek sub watershed.

The BHWC took a broader approach and built upon their structure of the 4 strategic directions and objectives that were developed for the preliminary goals and objectives in Task Two. In their final product to MDEQ they expanded upon the potential projects, prioritized them under each strategic direction and added a section outlining other watershed restoration projects that with a peripheral benefit to wetlands. BWHC’s plan can be found in [Appendix K](#).

Task 6: Develop a framework document that allows managers in other watersheds to follow specific steps to incorporate wetlands into the watershed planning process

MDEQ’s Wetland Program and the Montana Wetlands Legacy Partnership drafted a framework document outlining the steps that were taken to integrate wetlands into watershed restoration plans in our two pilot watersheds. This framework document was formatted so that it relates the “steps in the watershed planning and implementation process” and the “nine minimum elements to be included in a watershed restoration plan” (USEPA 2008) to the 11 steps Cappiella et al (2006) outlined for integrating

wetlands into watershed restoration plans. Added to this we included the purpose of each step, and the pros and cons we encountered when completing each step.

The purpose of the framework document is to provide interested watershed groups in Montana a template on how they too can incorporate wetlands in to their watershed restoration plans. This document, though, is not specific to wetlands. We demonstrated that incorporating wetlands into the watershed restoration planning process need not be and should not be a separate process. Wetlands should be incorporated as just one of the aquatic resources and the steps in the framework document can be and do apply to all aquatic resources addressed in any watershed restoration plan.

The framework document can be found in [Appendix L](#).

Task 7: Provide a series of trainings (minimum 2) on using the framework for incorporating wetlands in to the watershed planning process

MDEQ's Wetland Program, the Montana Wetlands Legacy Partnership, BHCW, and GGWC presented this project targeting two different groups. The first training at the Montana Watershed Coordination Council Summer Forum August 16-17, 2012 in Helena, MT targeted the Watershed Groups developing Watershed Restoration Plans in Montana. Unfortunately the presentation was attended only by five watershed groups, and five "agency" people. Of the watershed groups present, 4 of the 5 already had plans to incorporate wetlands into their watershed restoration plans. It is not clear how they plan on doing so and if their approaches will be targeted toward using wetlands to address water quality impairments. The group from the Flathead watershed did express interest in exploring the approach we took to integrating wetlands into watershed restoration plans. Maybe a more beneficial outcome of this training was the attendance of the MDEQ Nonpoint Source Program who is responsible for the 319 program which is the main funding source for watershed restoration plan development.

The second training was November 15th, 2012 at the Montana Wetland Council Meeting. This training was geared toward the diverse group of wetland professionals in Montana that comprise the Montana Wetland Council. The MWC meeting was attended by state, federal, and local government organizations, watershed groups, non-profits, and private consultants. Approximately 70 people attend this meeting and were present for the presentation. This presentation generated a lot of discussion as to how we can more effectively coordinate partners to further the integration of wetlands into watershed restoration plans. Another group, in addition to the Flathead, expressed interest in applying the methods we have developed to explore the use of targeting wetland restoration as a means of addressing water quality impairments. Both trainings were effective in furthering the object of this project of getting wetland integrated into watershed restoration plans. The presentation from the Montana Wetland Council Meeting can be found here: <http://deq.mt.gov/wqinfo/Wetlands/PDFs/Nov2012WetlandCouncil/Carpenedo.pdf>.

Task 8: Expanded educational projects to further promote wetlands and their importance in watershed restoration planning.

In the initial proposal \$20,000 was budgeted for Task 3, Product 3.1 to complete the NWI mapping with LLWW value added attribution in the pilot watersheds. Through the watershed selection process one of

our deciding factors was whether watersheds had completed or nearly complete current NWI mapping. As a result of this, we did not need the full budgeted amount and asked to use these funds to enhance other parts of this project. Besides what is listed below, we doubled the contracted amount to each watershed group as it became apparent that the original amount was not sufficient for them to adequately complete this project. This revision in the budget was asked for and approved on 1/30/2012 by the project officer at U.S. EPA and was reflected in the updated workplan dated February 10th, 2012.

8.1 Wetland plant identification trainings

MDEQ's Wetland Program and MTNHP has for the past two years provided free wetland plant identification trainings to wetlands professionals across Montana. In 2012, as part of this project we were able to provide five more wetland plant identification trainings. These trainings were held: 7/17 in Kalispell, 7/19 in the Bitterroot Valley, 7/31 in Whitehall, 8/2 in the Malta Area, and 8/8 in Billings. These training were attended by 114 people. The participants were mainly from the federal government, followed by state government, consultants, tribal government, local governments, and NGOs. These trainings have been very successful with professionals in other regions asking for trainings to be held in their areas. MDEQ and MTNHP are currently exploring ways that we can make these trainings a permanent, and provide a series each year in varying locations around Montana.

8.2 Common Native and Invasive Wetland Plants in Montana

The Common Native and Invasive Wetland Plants in Montana Booklet was first printed in 2010 using wetland program development grant funds from CD 97874701. The 2000 copies quickly were distributed both within Montana and to most of the surrounding states. In the interim, information contained in the booklet became obsolete as the U.S. Army Corps of Engineers moved toward defining areas based on the Major Land Resource Areas and approve 2012 version of the Wetland Plant Indicator Status for these regions. Resulting from the demand and the changes MDEQ's Wetland program updated and reprinted the "Common Native and Invasive Wetland Plants in Montana". One thousand copies were printed and distributed across the state to locations where people can pick them up. The 2012 version can also be accessed electronically at: [Common Native and Invasive Wetland Plants in Montana](#).

8.3 25% Restoration Concept Design – Story Mill Property Bozeman, MT

Montana Wetlands Legacy Partnership has been working with the Trust for Public Land on a potential restoration project in the Gallatin Watershed identified and prioritized through this project. The wetlands on the Story Mill Property were first evaluated to address water quality impairments on the East Gallatin River and Sourdough (Bozeman) Creek as part of this project. These impairments include, nutrient impairments, sedimentation tied to nutrients, and stream flow maintenance. Located on this property are both depressional and riparian wetlands according to NWI with value added LLWW attribution. Based on the LLWW value added attribution the wetland and riparian areas on the Story Mill Property would help address sediment retention, and flood abatement. From on the ground site visits, the position of the depressional wetlands should also contribute to Streamflow maintenance. Their hydrology is largely influenced by ground water where direct discharge into the East Gallatin River would help to maintain late season flows. Currently these wetlands have a series of ditches that remove water from the wetlands and impact their storage capacity and ability to influence late season flows.

The Trust for Public Lands recently purchased the Story Mill Property from American Bank which held title to the property. They have invited several partners to help them with the scoping process to

determine the future of the property. Currently the idea is to restore and enhance the wetland and riparian areas, develop recreational trails, and potentially develop affordable housing on one section of the property. It is hoped that the wetland and riparian areas and recreational trails will be incorporated as a new city park in Bozeman. A public meeting is also being held to get input from the community on what could or should be done with the property. The public news release can be found here: http://www.bozemandailychronicle.com/news/city/article_9219469e-4a64-11e2-a0c3-0019bb2963f4.html

I am pleased that as a result of identifying wetlands to address water quality a site was secured and planning progressed far enough that MDEQ was able to contribute funds from Product 8.3 to help develop the 25% Conceptual Wetland Restoration Design Plan. The 25% Conceptual Wetland Restoration Design Plan will be presented to the public February 7th, 2013 in Bozeman, MT for comments and suggestions. The 25% Conceptual Wetland Restoration Design Plan can be found in [Appendix M](#).

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Figures

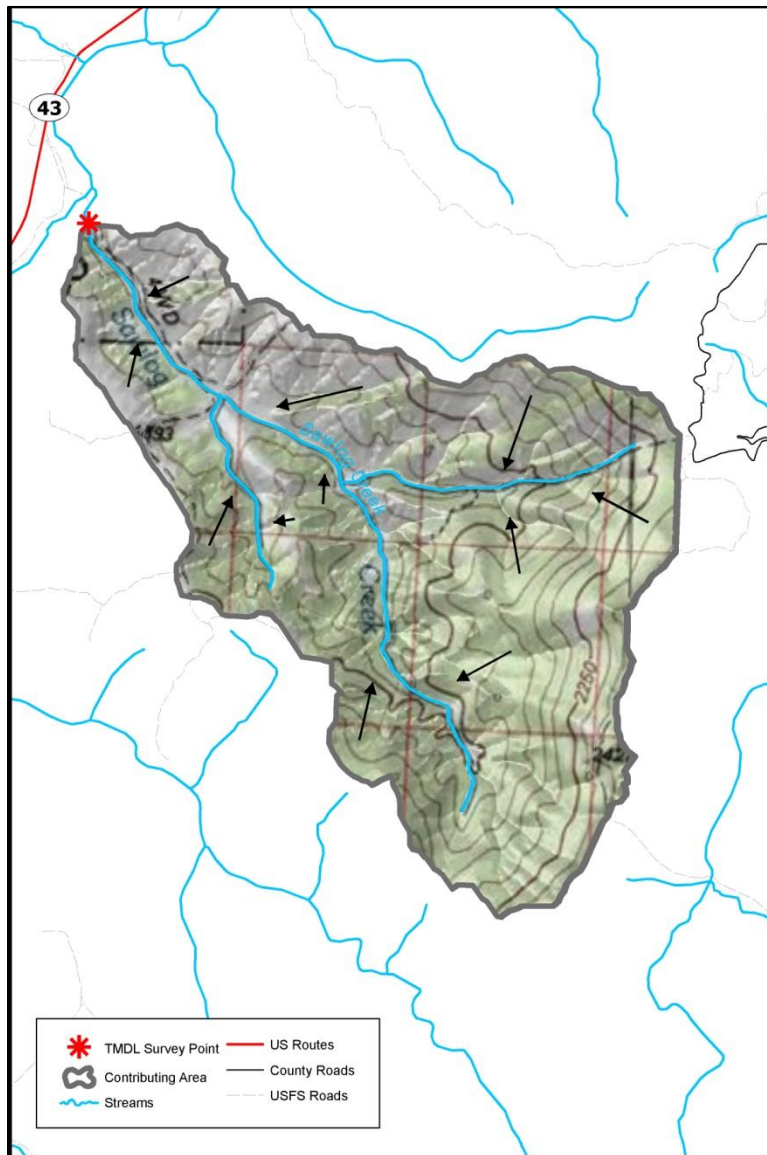


Figure 1: Contributing Area of 303d listed Stream. Furthest downstream TMDL survey point is used as the out flow for the contributing area.

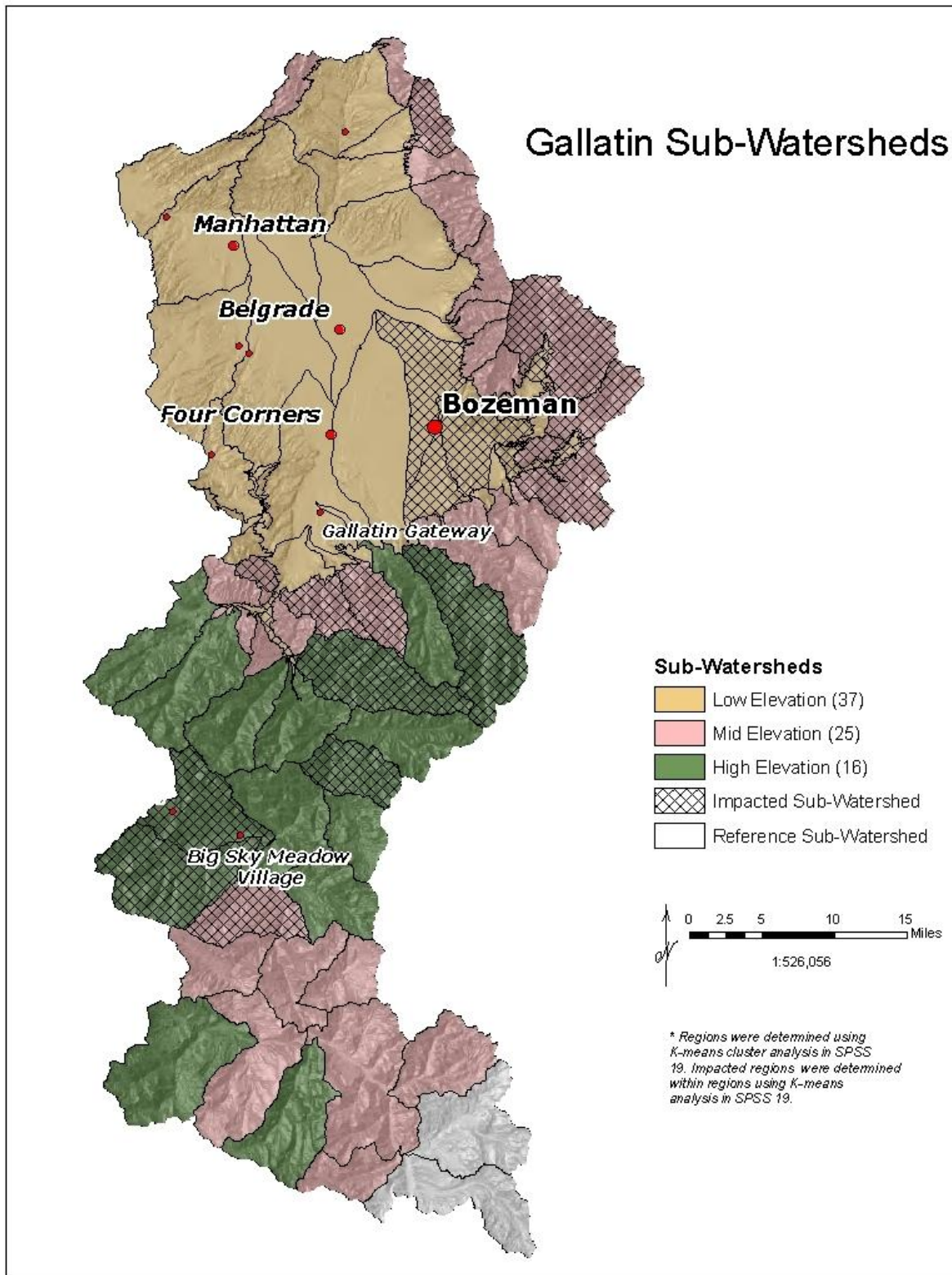


Figure 2: Sub-watershed wetland profiles for the Gallatin Watershed

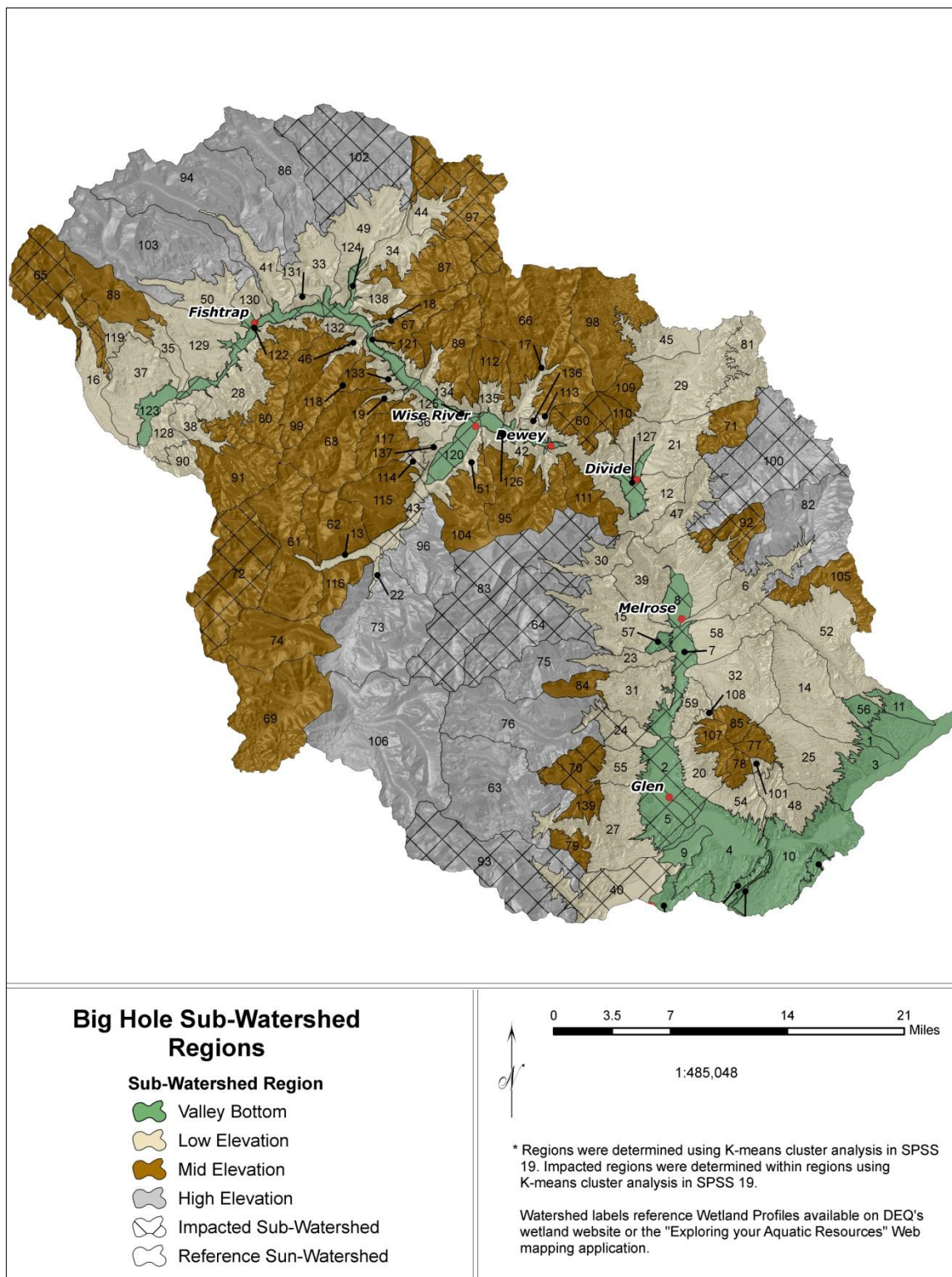


Figure 3: Sub-watershed wetland profiles for the Big Hole Watershed

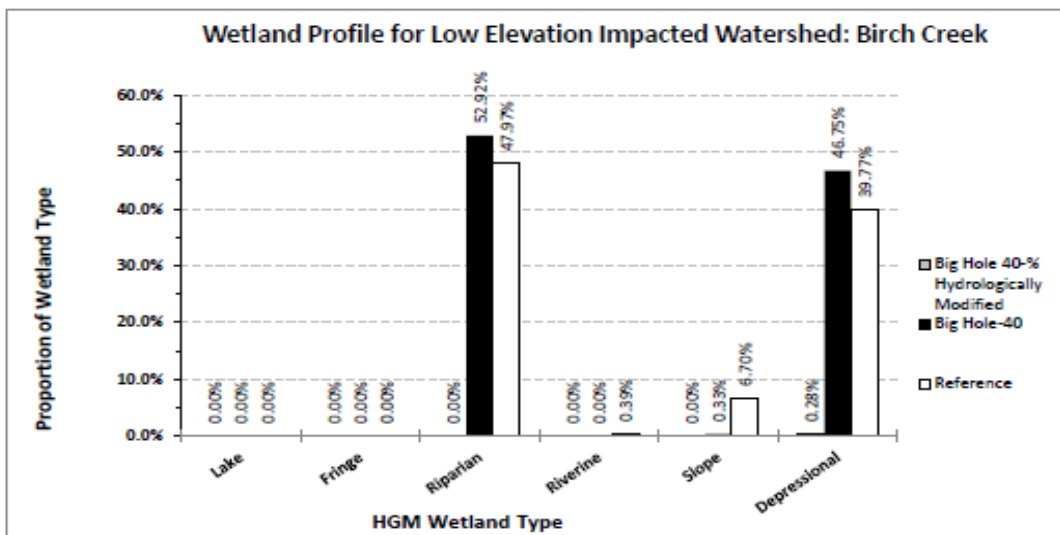
Wetland Profile: Impacted Watershed Big Hole-40, Birch Creek

This brief report summarizes the wetland profiles for the Birch Creek Sub-Watershed: Big Hole-40. This sub-watershed is grouped into the Low elevation sub-watershed group. It has a mean elevation of 1769.8 m, a mean slope of 8.5 degrees, a total relief of 386 m, with the majority of stream segments having a Strahler stream order of 3.

Based on the percent of stream miles on the 303d list (41%), percent of altered landcover (22%), the average number of water diversion points per stream mile (16), and the meters of roads per acre (10.3) within the sub-watershed. Birch Creek watershed is considered as a/an Impacted sub-watershed in the Low elevation sub-watershed group for the Big Hole Watershed.

Birch Creek sub-watershed contains 1126 acres of wetlands. Of which, 1 acres are considered as being modified in the National Wetlands Inventory database. The percent of wetlands in each HGM wetland type that have a high capacity to provide functions that may target water quality and quantity impairments in Birch Creek are listed below.

	Flood Attenuation	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Fringe	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Riparian	67.31%	0.00%	0.00%	0.00%	17.24%	0.00%
Riverine	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Slope	5.17%	9.33%	88.37%	0.00%	0.00%	0.00%
Depressional	17.22%	8.70%	24.58%	0.00%	0.00%	0.00%



* Note: Big Hole 40-% Hydrologically Modified denotes the percentage of wetlands within that HGM Wetland type that are considered as modified in the NWI Database. Percentages of HGM Wetland Types in the reference and Big Hole-40 watersheds are proportions of the total. For example, as the proportion of one HGM Type increases, the other wetland types will decrease.

Created: November 30, 2012

Figure 4: Sub-Watershed Wetland Profile Report for Birch Creek.

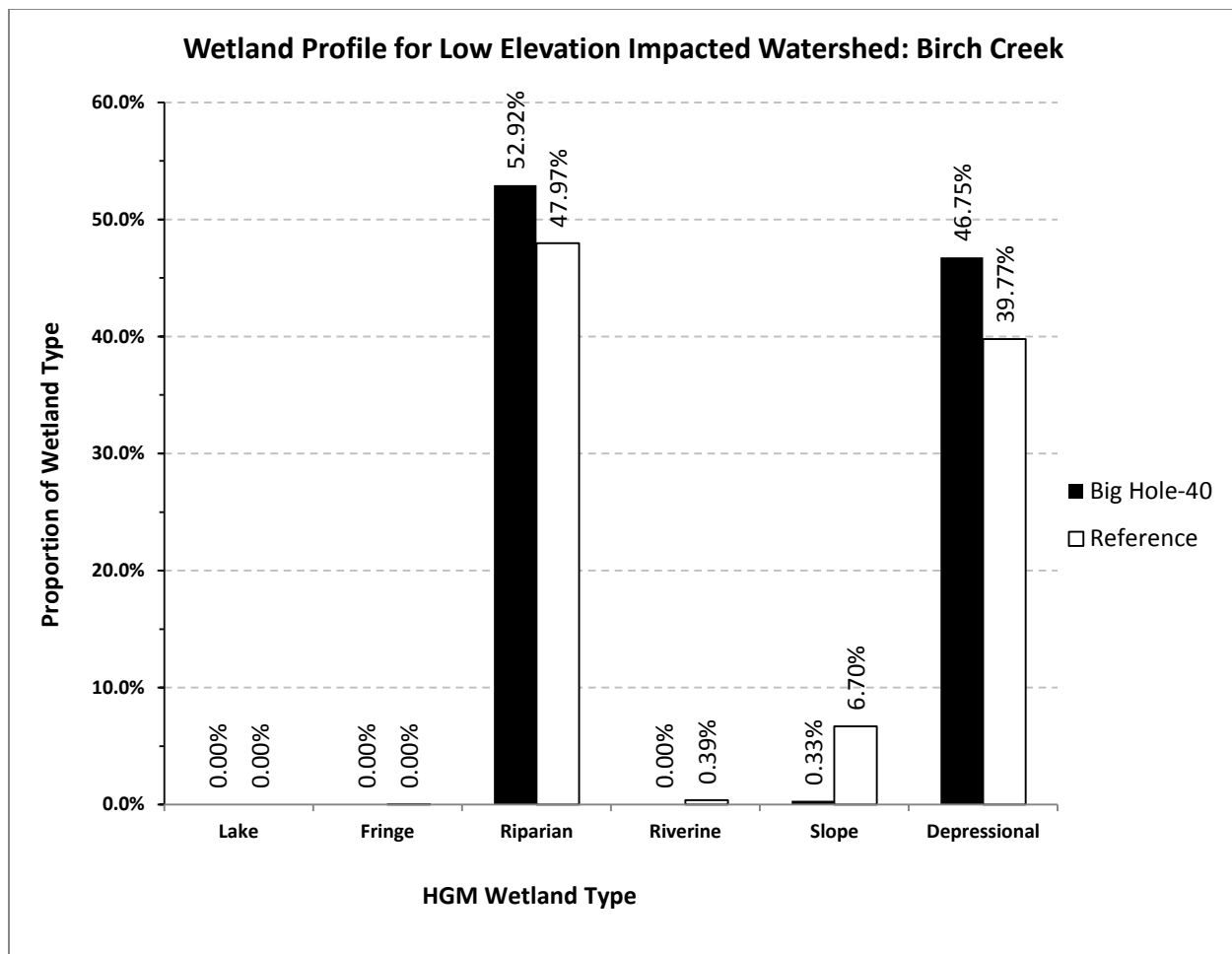


Figure 5: Birch Creek Sub-Watershed Wetland Profile.

		Ground Truth				No. of Sites Classified
		Basin	Fringe	Slope	Riverine	
GIS	Basin	2	2	0	0	4
	Fringe	0	0	0	0	0
	Slope	3	0	13	0	16
	Riverine	1	1	16	6	24
No. of ground truth sites		6	3	29	6	44
Overall Accuracy (%):						47.7%

Figure 6: Initial Accuracy Assessment of LLWW Attributes of Mapped Wetlands in the Madison, Gallatin, and Big Hole Watersheds.

Users Accuracy:	%
Basin	50.0
Fringe	0.0
Slope	81.3
Riverine	25.0

Figure 7: Probability that a HGM-type descriptor determined using the original GIS methodology was the same HGM-type descriptor determined while conducting an EIA.

		Ground Truth				No. of Sites Classified
		Basin	Fringe	Slope	Riverine	
GIS	Basin	2	0	0	0	2
	Fringe	1	0	0	0	1
	Slope	1	0	35	4	40
	Riverine	3	0	2	0	5
No. of ground truth sites		7	0	37	4	48
Overall Accuracy (%):						77.1%

Figure 8: Accuracy Assessment of LLWW Attributes of Mapped Wetlands in the Madison, Gallatin, and Big Hole Watersheds Using Revised Methodology.

Users Accuracy:	%
Basin	100.0
Fringe	0.0
Slope	87.5
Riverine	0.0

Figure 9: Probability that a HGM-type descriptor determined using the revised GIS methodology was the same HGM-type descriptor determined while conducting an EIA.

Appendices

[Appendix A: Impaired Waters Contributing Area Reports](#)

[Appendix B: Sub-Watershed Wetland Profiles](#)

[Appendix C: Sub-Watershed Wetland Profiles Methodology](#)

[Appendix D: Modified Needs and Capabilities Assessment Form](#)

[Appendix E: Modified 8-Tools Audit Form](#)

[Appendix F: Preliminary Goals and Objectives: GGWC](#)

[Appendix G: Preliminary Goals and Objectives: BHWC](#)

[Appendix H: Landowner Contacts and Maps: GGWC](#)

[Appendix I: Landowner Contacts and Maps: BHWC](#)

[Appendix J: Prioritized Watershed Recommendations: GGWC](#)

[Appendix K: Prioritized Watershed Recommendations: BHWC](#)

[Appendix L: Framework Steps and Processes for Incorporating Wetlands into Watershed Restoration Plans](#)

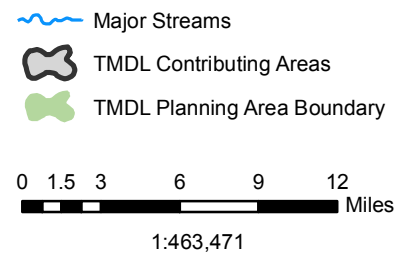
[Appendix M: Story Mill 25% Concept Design](#)

Appendix A: Impaired Waters Contributing Area Reports

Middle and Lower Big Hole TMDL Planning Areas: TMDL Contributing Areas Map



Each TMDL Contributing Area is associated with a PDF report. This report identifies wetland types and riparian areas that can be targeted as sites for restoration or protection to address identified water quality impairments. Each report is found on the PBworks tracking page or linked to DEQ's Wetlands website at:
http://www.deq.mt.gov/wqinfo/Wetlands/PDFs/TMDL_CA_Reports/Big%20Hole_###.pdf
 Where the ## is the number of the TMDL Contributing area from the map above.



Identifying wetland and riparian areas to improve water quality and quantity

Oregon Creek Impaired Waters Contributing Area, Big Hole Watershed

GIS ID: Big Hole 1

This brief report summarizes the types of wetland and riparian areas in Oregon Creek Impaired Waters Contributing Area. And, identifies which wetland types or riparian areas can be targeted for restoration or protection based on their contribution to water quality and quantity. Oregon Creek watershed has had a water quality assessment conducted and may be listed as a 303d stream under the Clean Water Act thus requiring the development of a TMDL (Total Maximum Daily Load). If no information on impairments are listed this assessed water is meeting its designated beneficial uses and no TMDL development was needed. Specific information on the water quality assessment for Oregon Creek can be found at: <http://cwaic.mt.gov/>

Impairment Cause(s) - Pollutants: Arsenic [CFL 2000], Copper [CFL 2000], Lead [CFL 2000], Sedimentation/Siltation [CFL 1990]
Impairment Cause(s) - Pollution: Alteration in stream-side or littoral vegetative covers, Other anthropogenic substrate alterations, Physical substrate habitat alterations

MDEQ identified the following as potential causes of impairment of the observed pollutants and pollution:

Acid Mine Drainage, Agriculture, Atmospheric Deposition - Toxics, Channelization, Dredge Mining, Erosion from Derelict Land (Barren Land), Forest Roads (Road Construction and Use), Highways, Roads, Bridges, Infrastructure (New Construction)

Targeting wetlands for restoration and protection based on their capacity to provide water quality and quantity functions can be an effective means of reducing the amount of pollutants entering streams and rivers. In the Oregon Creek impaired waters contributing area, restoring and protecting wetland and riparian areas that have a high capacity to provide the functions marked with an X in the chart below can help moderate the negative affects from the identified causes of impairment and improve water quality and/or water quantity.

Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
	X			X	

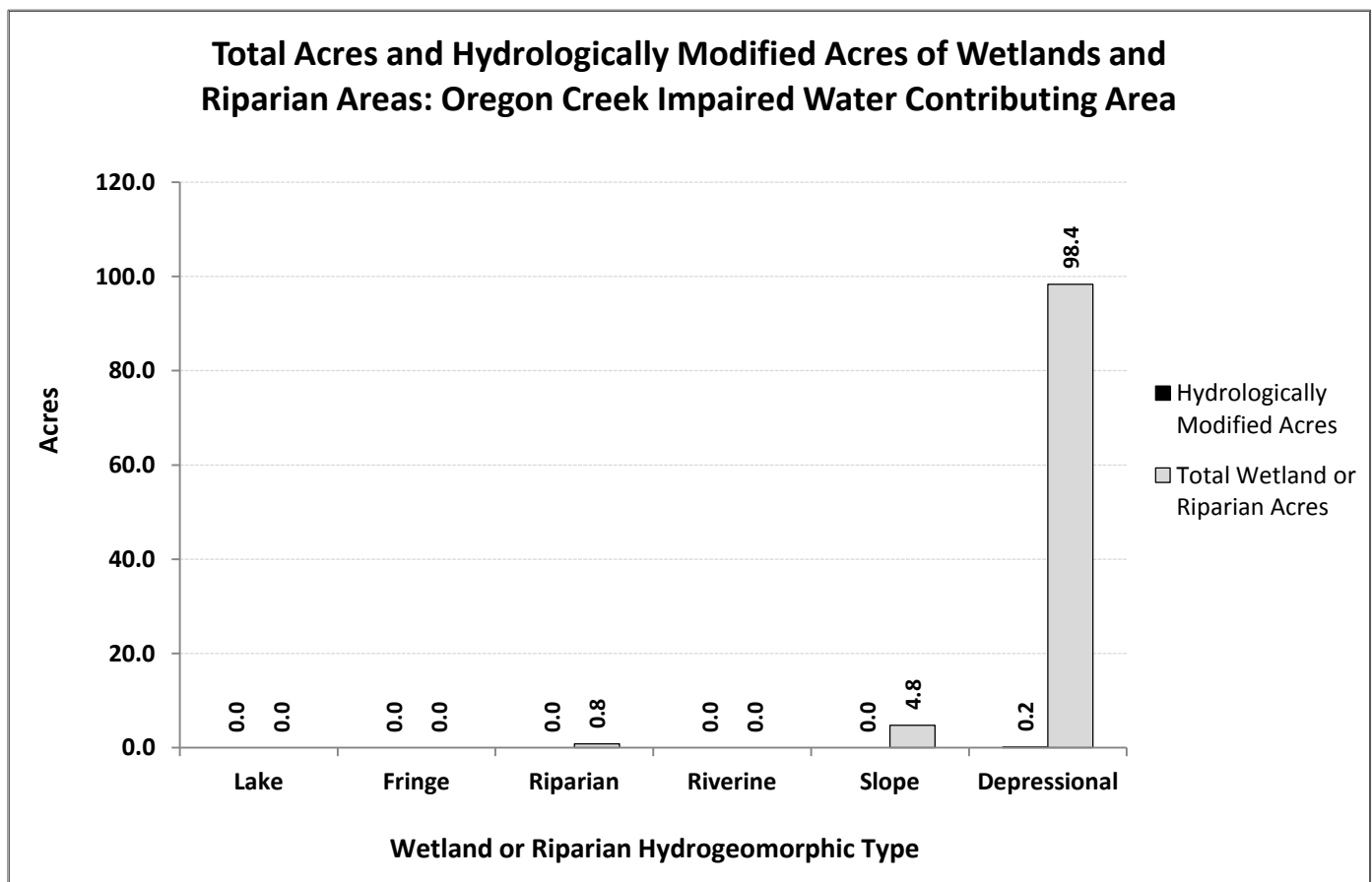
Each wetland type has the ability to perform all of the identified water quality/quantity functions to a degree. Some wetlands, though, are better at providing these functions than others. For Example, in the Oregon Creek impaired waters contributing area 14.9% of Depressional wetlands display a high capacity to retain sediments and reduce siltation. The proportion of each wetland type and riparian area within this impaired water contributing area that displays a high capacity to perform an identified water quality/quantity function is listed below. The wetland type and riparian areas that are in bold italics have the greatest capacity to moderate the negative impacts from the identified pollutant sources. Values of 0.0% in the chart means that these wetland types or riparian areas have only a medium to low capacity to moderate the negative affects from identified impairment causes.

Type	Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fringe	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Riparian	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Riverine	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Slope	5.9%	12.6%	81.4%	0.0%	0.0%	0.0%
Depressional	58.7%	14.9%	30.5%	0.0%	0.0%	0.0%

Oregon Creek has a total of 104 wetland and riparian acres within its impaired waters Contributing Area, with 0 acres (0%) considered as hydrologically modified in the National Wetland Inventory database. The majority of wetlands or riparian areas are Depressional (94.6%), followed by Slope (4.6%), and Riparian (0.8%).

Using Oregon Creek impaired waters contributing area's wetland and riparian areas profile and associated hydrogeomorphic (HGM) functions. Restoring and/or protecting the following wetland types and riparian areas in Oregon Creek impaired water contributing area should help to moderate the negative affects from the identified causes of impairment and provide the following water quality and/or water quantity benefits:

Improve stream temperatures for aquatic life:	
Reduce flood peaks and desynchronize flood flows:	
Stabilize the banks along watercourses:	
Retain sediments and reduce siltation:	Riparian Areas, Slope Wetlands, Depressional Wetlands
Increase attenuation of nutrients:	
Maintain late season streamflows:	



Identifying wetland and riparian areas to improve water quality and quantity

Corral Creek Impaired Waters Contributing Area, Big Hole Watershed

GIS ID: Big Hole 2

This brief report summarizes the types of wetland and riparian areas in Corral Creek Impaired Waters Contributing Area. And, identifies which wetland types or riparian areas can be targeted for restoration or protection based on their contribution to water quality and quantity. Corral Creek watershed has had a water quality assessment conducted and may be listed as a 303d stream under the Clean Water Act thus requiring the development of a TMDL (Total Maximum Daily Load). If no information on impairments are listed this assessed water is meeting its designated beneficial uses and no TMDL development was needed. Specific information on the water quality assessment for Corral Creek can be found at: <http://cwaic.mt.gov/>

Impairment Sedimentation/Siltation [CFL 1992] Cause(s) - Pollutants:
Impairment Alteration in stream-side or littoral vegetative covers, Physical substrate habitat alterations Cause(s) - Pollution:

MDEQ identified the following as potential causes of impairment of the observed pollutants and pollution:

Natural Sources, Rangeland Grazing, Silviculture Activities

Targeting wetlands for restoration and protection based on their capacity to provide water quality and quantity functions can be an effective means of reducing the amount of pollutants entering streams and rivers. In the Corral Creek impaired waters contributing area, restoring and protecting wetland and riparian areas that have a high capacity to provide the functions marked with an X in the chart below can help moderate the negative affects from the identified causes of impairment and improve water quality and/or water quantity.

Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
	X			X	

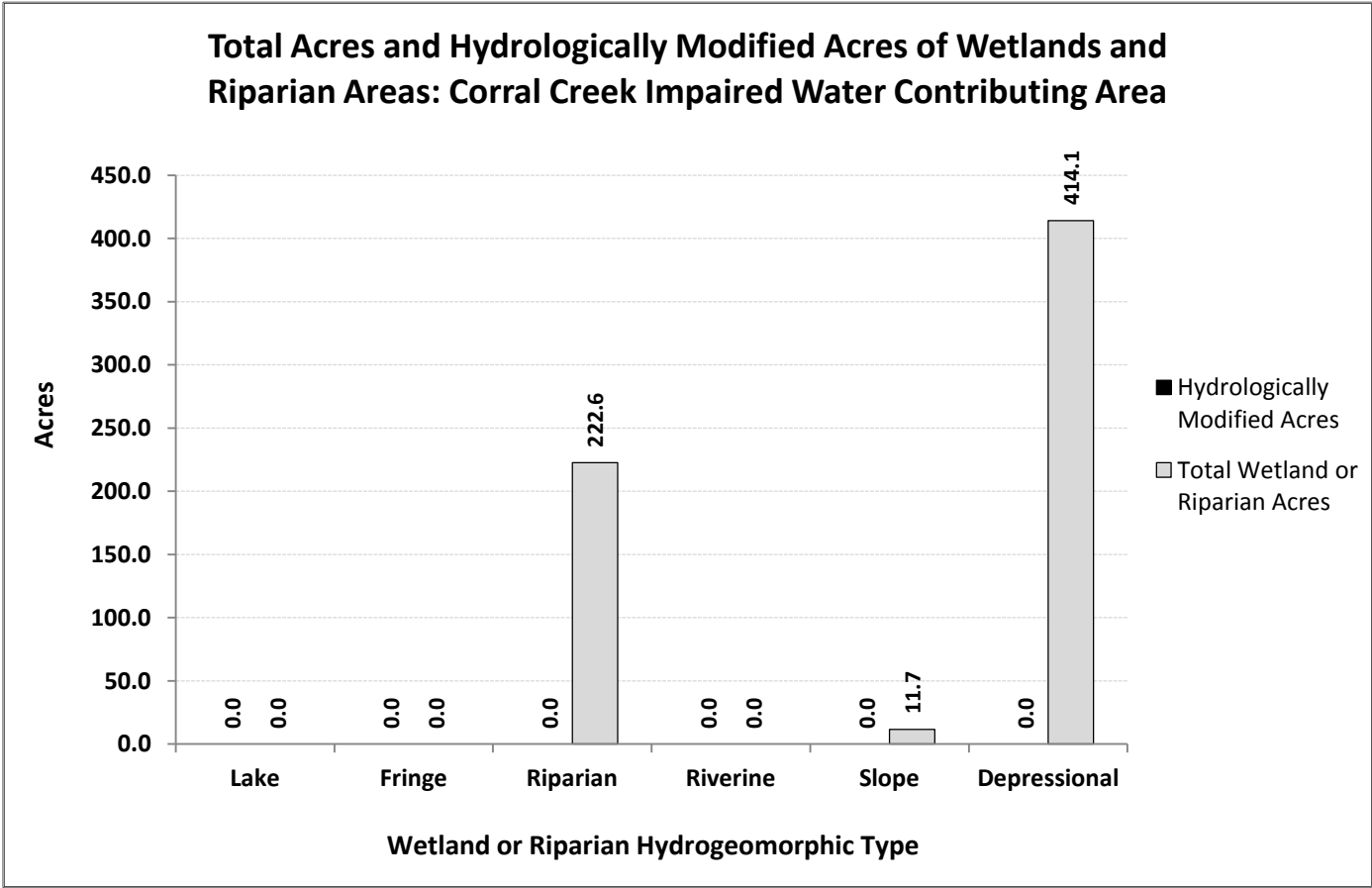
Each wetland type has the ability to perform all of the identified water quality/quantity functions to a degree. Some wetlands, though, are better at providing these functions than others. For Example, in the Corral Creek impaired waters contributing area 59.5% of Slope wetlands display a high capacity to retain sediments and reduce siltation. The proportion of each wetland type and riparian area within this impaired water contributing area that displays a high capacity to perform an identified water quality/quantity function is listed below. The wetland type and riparian areas that are in bold italics have the greatest capacity to moderate the negative impacts from the identified pollutant sources. Values of 0.0% in the chart means that these wetland types or riparian areas have only a medium to low capacity to moderate the negative affects from identified impairment causes.

Type	Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.0%	<i>0.0%</i>	0.0%	0.0%	<i>0.0%</i>	0.0%
Fringe	0.0%	<i>0.0%</i>	0.0%	0.0%	<i>0.0%</i>	0.0%
Riparian	98.0%	<i>0.0%</i>	0.0%	0.0%	<i>5.3%</i>	0.0%
Riverine	0.0%	<i>0.0%</i>	0.0%	0.0%	<i>0.0%</i>	0.0%
Slope	26.7%	<i>59.5%</i>	40.1%	0.0%	<i>0.0%</i>	0.0%
Depressional	68.7%	<i>12.1%</i>	20.0%	0.0%	<i>0.0%</i>	0.0%

Corral Creek has a total of 648 wetland and riparian acres within its impaired waters Contributing Area, with 0 acres (0%) considered as hydrologically modified in the National Wetland Inventory database. The majority of wetlands or riparian areas are Depressional (63.9%), followed by Riparian (34.3%), and Slope (1.8%).

Using Corral Creek impaired waters contributing area's wetland and riparian areas profile and associated hydrogeomorphic (HGM) functions. Restoring and/or protecting the following wetland types and riparian areas in Corral Creek impaired water contributing area should help to moderate the negative affects from the identified causes of impairment and provide the following water quality and/or water quantity benefits:

Improve stream temperatures for aquatic life:	
Reduce flood peaks and desynchronize flood flows:	
Stabilize the banks along watercourses:	Riparian Areas,
Retain sediments and reduce siltation:	Riparian Areas, Slope Wetlands, Depressional Wetlands
Increase attenuation of nutrients:	
Maintain late season streamflows:	



Identifying wetland and riparian areas to improve water quality and quantity

Sevenmile Creek Impaired Waters Contributing Area, Big Hole Watershed

GIS ID: Big Hole 3

This brief report summarizes the types of wetland and riparian areas in Sevenmile Creek Impaired Waters Contributing Area. And, identifies which wetland types or riparian areas can be targeted for restoration or protection based on their contribution to water quality and quantity. Sevenmile Creek watershed has had a water quality assessment conducted and may be listed as a 303d stream under the Clean Water Act thus requiring the development of a TMDL (Total Maximum Daily Load). If no information on impairments are listed this assessed water is meeting its designated beneficial uses and no TMDL development was needed. Specific information on the water quality assessment for Sevenmile Creek can be found at: <http://cwaic.mt.gov/>

Impairment Sedimentation/Siltation [CFL 1990] Cause(s) - Pollutants:
Impairment Alteration in stream-side or littoral vegetative covers Cause(s) - Pollution:

MDEQ identified the following as potential causes of impairment of the observed pollutants and pollution:

Natural Sources, Rangeland Grazing, Streambank Modifications/destablization

Targeting wetlands for restoration and protection based on their capacity to provide water quality and quantity functions can be an effective means of reducing the amount of pollutants entering streams and rivers. In the Sevenmile Creek impaired waters contributing area, restoring and protecting wetland and riparian areas that have a high capacity to provide the functions marked with an X in the chart below can help moderate the negative affects from the identified causes of impairment and improve water quality and/or water quantity.

Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
	x			x	

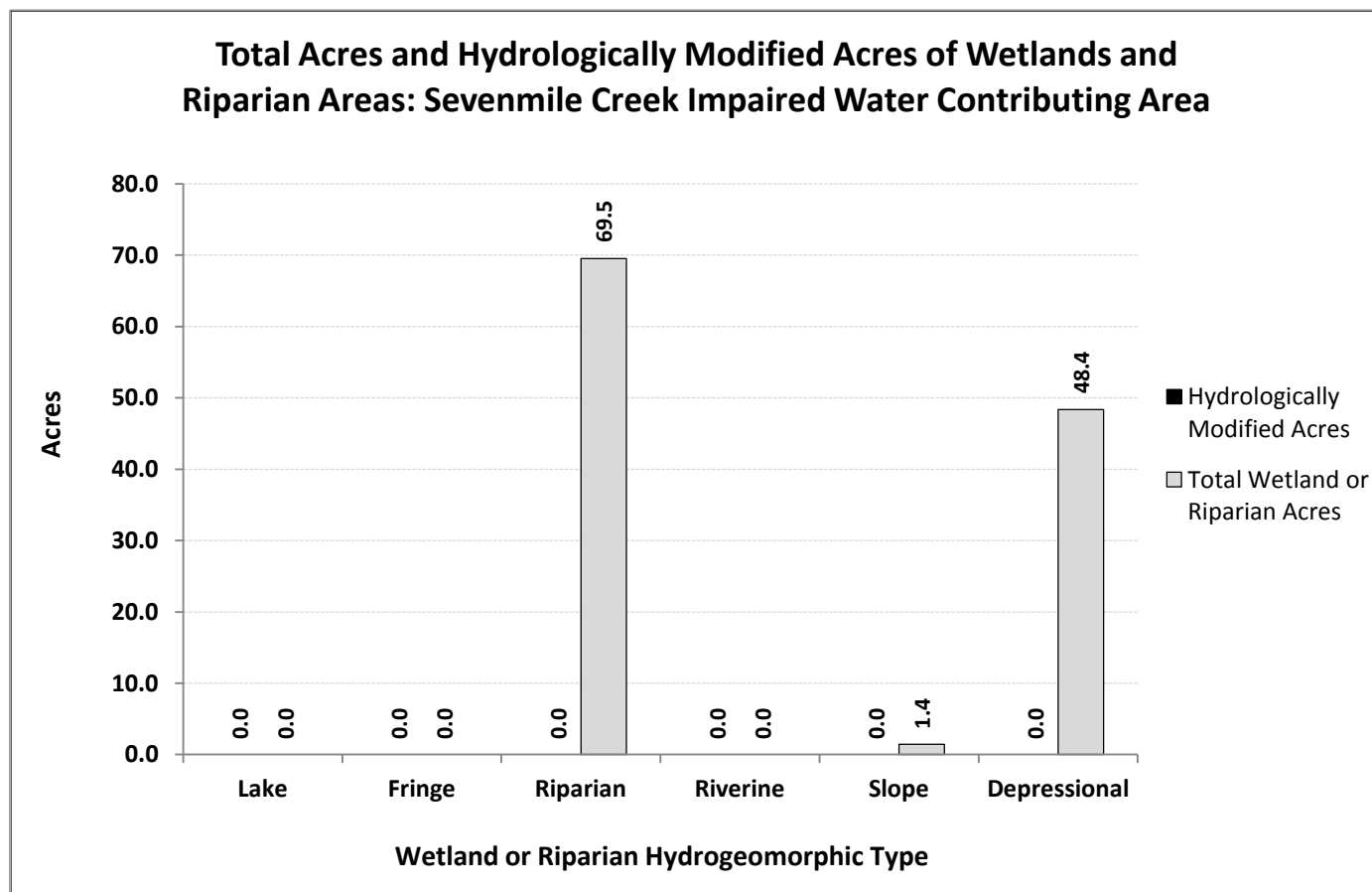
Each wetland type has the ability to perform all of the identified water quality/quantity functions to a degree. Some wetlands, though, are better at providing these functions than others. For Example, in the Sevenmile Creek impaired waters contributing area 24.2% of Slope wetlands display a high capacity to retain sediments and reduce siltation. The proportion of each wetland type and riparian area within this impaired water contributing area that displays a high capacity to perform an identified water quality/quantity function is listed below. The wetland type and riparian areas that are in bold italics have the greatest capacity to moderate the negative impacts from the identified pollutant sources. Values of 0.0% in the chart means that these wetland types or riparian areas have only a medium to low capacity to moderate the negative affects from identified impairment causes.

Type	Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.0%	<i>0.0%</i>	0.0%	0.0%	<i>0.0%</i>	0.0%
Fringe	0.0%	<i>0.0%</i>	0.0%	0.0%	<i>0.0%</i>	0.0%
Riparian	100.0%	<i>0.0%</i>	0.0%	0.0%	<i>0.0%</i>	0.0%
Riverine	0.0%	<i>0.0%</i>	0.0%	0.0%	<i>0.0%</i>	0.0%
Slope	3.9%	<i>24.2%</i>	75.3%	0.0%	<i>0.0%</i>	0.0%
Depressional	79.8%	<i>5.1%</i>	16.4%	0.0%	<i>0.0%</i>	0.0%

Sevenmile Creek has a total of 119 wetland and riparian acres within its impaired waters Contributing Area, with 0 acres (0%) considered as hydrologically modified in the National Wetland Inventory database. The majority of wetlands or riparian areas are Riparian (58.3%), followed by Depressional (40.5%), and Slope (1.2%).

Using Sevenmile Creek impaired waters contributing area's wetland and riparian areas profile and associated hydrogeomorphic (HGM) functions. Restoring and/or protecting the following wetland types and riparian areas in Sevenmile Creek impaired water contributing area should help to moderate the negative affects from the identified causes of impairment and provide the following water quality and/or water quantity benefits:

Improve stream temperatures for aquatic life:	
Reduce flood peaks and desynchronize flood flows:	
Stabilize the banks along watercourses:	
Retain sediments and reduce siltation:	Riparian Areas, Slope Wetlands, Depressional Wetlands
Increase attenuation of nutrients:	
Maintain late season streamflows:	



Identifying wetland and riparian areas to improve water quality and quantity

Sixmile Impaired Waters Contributing Area, Big Hole Watershed

GIS ID: Big Hole 4

This brief report summarizes the types of wetland and riparian areas in Sixmile Impaired Waters Contributing Area. And, identifies which wetland types or riparian areas can be targeted for restoration or protection based on their contribution to water quality and quantity. Sixmile watershed has had a water quality assessment conducted and may be listed as a 303d stream under the Clean Water Act thus requiring the development of a TMDL (Total Maximum Daily Load). If no information on impairments are listed this assessed water is meeting its designated beneficial uses and no TMDL development was needed. Specific information on the water quality assessment for Sixmile can be found at: <http://cwaic.mt.gov/>

Impairment Sedimentation/Siltation [CFL 2002] Cause(s) - Pollutants:
Impairment Physical substrate habitat alterations Cause(s) - Pollution:

MDEQ identified the following as potential causes of impairment of the observed pollutants and pollution:

Rangeland Grazing, Silviculture Activities, Streambank Modifications/destablization, Unspecified Unpaved Road or Trail

Targeting wetlands for restoration and protection based on their capacity to provide water quality and quantity functions can be an effective means of reducing the amount of pollutants entering streams and rivers. In the Sixmile impaired waters contributing area, restoring and protecting wetland and riparian areas that have a high capacity to provide the functions marked with an X in the chart below can help moderate the negative affects from the identified causes of impairment and improve water quality and/or water quantity.

Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
	x			x	

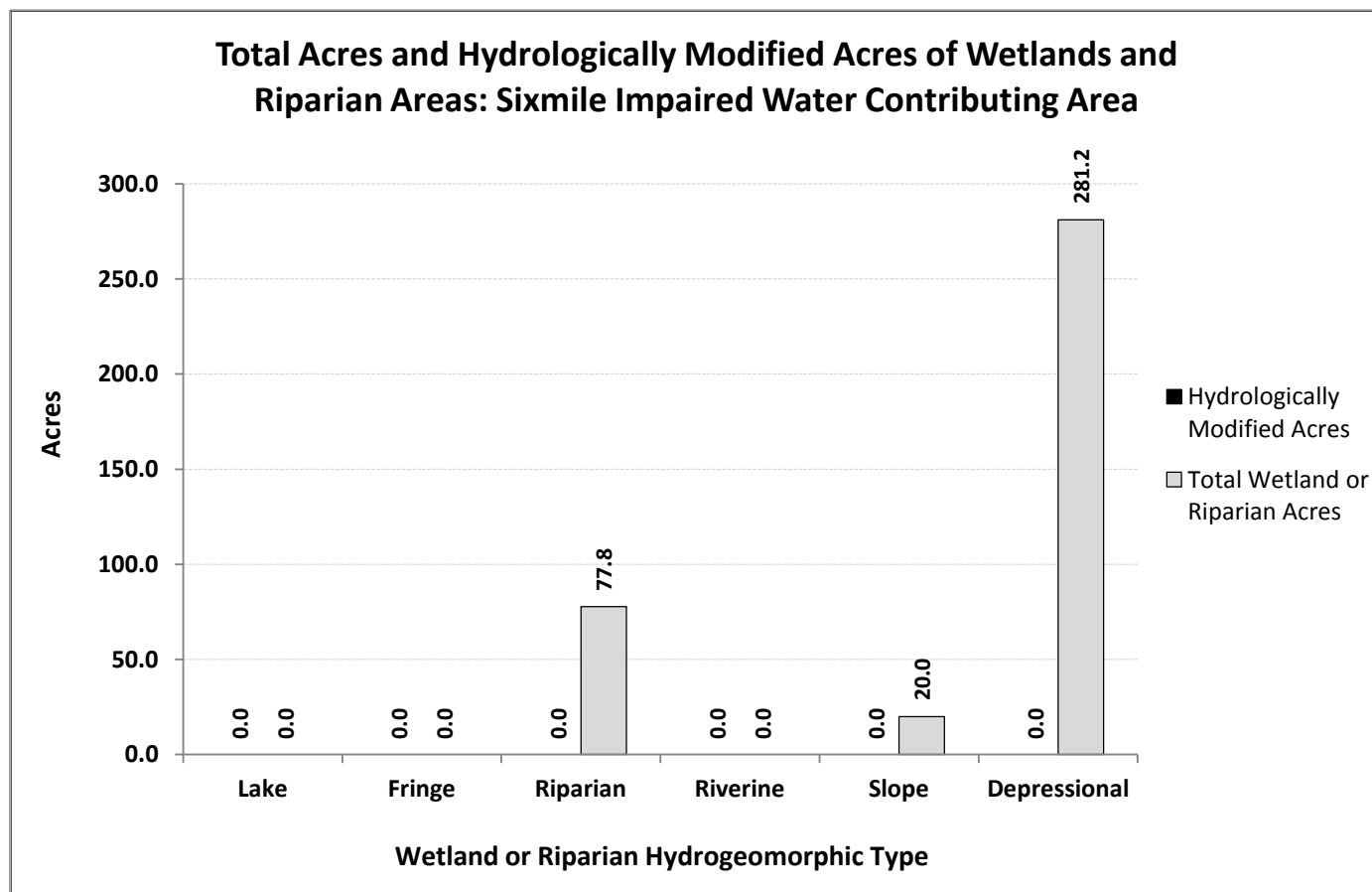
Each wetland type has the ability to perform all of the identified water quality/quantity functions to a degree. Some wetlands, though, are better at providing these functions than others. For Example, in the Sixmile impaired waters contributing area 12.7% of Slope wetlands display a high capacity to retain sediments and reduce siltation. The proportion of each wetland type and riparian area within this impaired water contributing area that displays a high capacity to perform an identified water quality/quantity function is listed below. The wetland type and riparian areas that are in bold italics have the greatest capacity to moderate the negative impacts from the identified pollutant sources. Values of 0.0% in the chart means that these wetland types or riparian areas have only a medium to low capacity to moderate the negative affects from identified impairment causes.

Type	Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fringe	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Riparian	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Riverine	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Slope	4.9%	12.7%	86.8%	0.0%	0.0%	0.0%
Depressional	33.7%	4.2%	26.4%	0.0%	0.0%	0.0%

Sixmile has a total of 379 wetland and riparian acres within its impaired waters Contributing Area, with 0 acres (0%) considered as hydrologically modified in the National Wetland Inventory database. The majority of wetlands or riparian areas are Depressional (74.2%), followed by Riparian (20.5%), and Slope (5.3%).

Using Sixmile impaired waters contributing area's wetland and riparian areas profile and associated hydrogeomorphic (HGM) functions. Restoring and/or protecting the following wetland types and riparian areas in Sixmile impaired water contributing area should help to moderate the negative affects from the identified causes of impairment and provide the following water quality and/or water quantity benefits:

Improve stream temperatures for aquatic life:	
Reduce flood peaks and desynchronize flood flows:	
Stabilize the banks along watercourses:	
Retain sediments and reduce siltation:	Riparian Areas, Slope Wetlands, Depressional Wetlands
Increase attenuation of nutrients:	
Maintain late season streamflows:	



Identifying wetland and riparian areas to improve water quality and quantity

Twelvemile Creek Impaired Waters Contributing Area, Big Hole Watershed

GIS ID: Big Hole 5

This brief report summarizes the types of wetland and riparian areas in Twelvemile Creek Impaired Waters Contributing Area. And, identifies which wetland types or riparian areas can be targeted for restoration or protection based on their contribution to water quality and quantity. Twelvemile Creek watershed has had a water quality assessment conducted and may be listed as a 303d stream under the Clean Water Act thus requiring the development of a TMDL (Total Maximum Daily Load). If no information on impairments are listed this assessed water is meeting its designated beneficial uses and no TMDL development was needed. Specific information on the water quality assessment for Twelvemile Creek can be found at: <http://cwaic.mt.gov/>

Impairment Sedimentation/Siltation [CFL 1992] Cause(s) - Pollutants:
Impairment Cause(s) - Pollution:

MDEQ identified the following as potential causes of impairment of the observed pollutants and pollution:

Grazing in Riparian or Shoreline Zones, Silviculture Harvesting

Targeting wetlands for restoration and protection based on their capacity to provide water quality and quantity functions can be an effective means of reducing the amount of pollutants entering streams and rivers. In the Twelvemile Creek impaired waters contributing area, restoring and protecting wetland and riparian areas that have a high capacity to provide the functions marked with an X in the chart below can help moderate the negative affects from the identified causes of impairment and improve water quality and/or water quantity.

Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
	x			x	

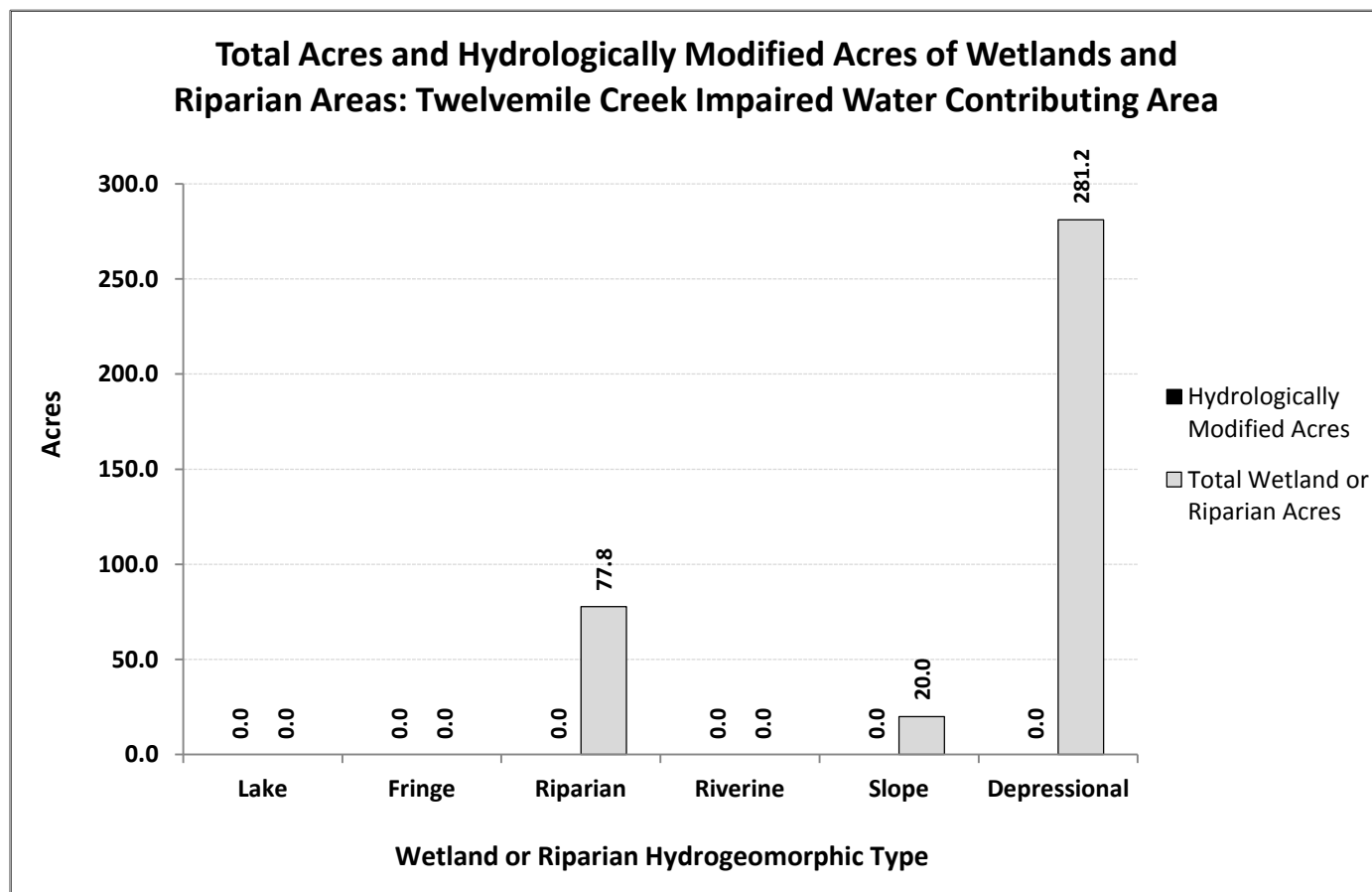
Each wetland type has the ability to perform all of the identified water quality/quantity functions to a degree. Some wetlands, though, are better at providing these functions than others. For Example, in the Twelvemile Creek impaired waters contributing area 29.1% of Riparian wetlands display a high capacity to stabilize the banks along watercourses. The proportion of each wetland type and riparian area within this impaired water contributing area that displays a high capacity to perform an identified water quality/quantity function is listed below. The wetland type and riparian areas that are in bold italics have the greatest capacity to moderate the negative impacts from the identified pollutant sources. Values of 0.0% in the chart means that these wetland types or riparian areas have only a medium to low capacity to moderate the negative affects from identified impairment causes.

Type	Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fringe	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Riparian	100.0%	0.0%	0.0%	0.0%	29.1%	0.0%
Riverine	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Slope	39.2%	18.2%	81.1%	0.0%	0.0%	0.0%
Depressional	71.6%	14.6%	22.8%	0.0%	0.1%	0.7%

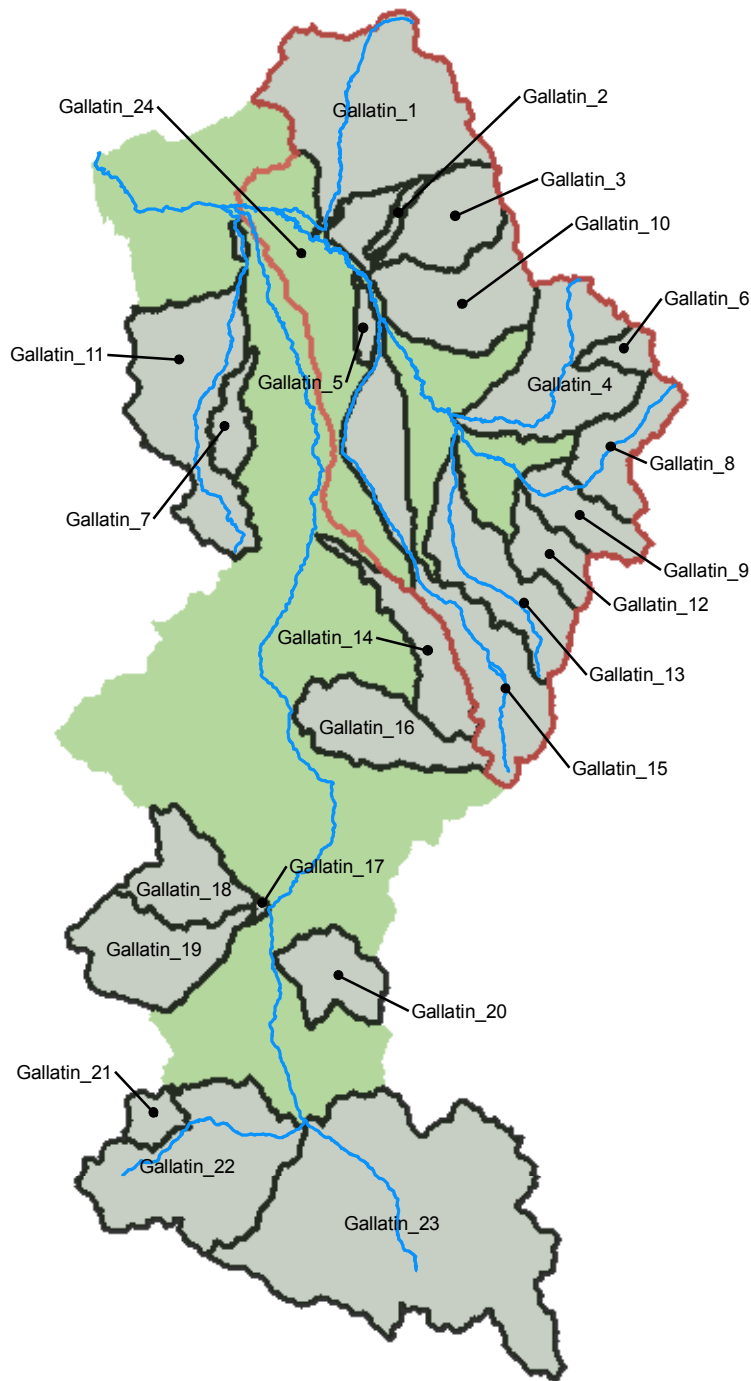
Twelvemile Creek has a total of 379 wetland and riparian acres within its impaired waters Contributing Area, with 0 acres (0%) considered as hydrologically modified in the National Wetland Inventory database. The majority of wetlands or riparian areas are Depressional (74.2%), followed by Riparian (20.5%), and Slope (5.3%).

Using Twelvemile Creek impaired waters contributing area's wetland and riparian areas profile and associated hydrogeomorphic (HGM) functions. Restoring and/or protecting the following wetland types and riparian areas in Twelvemile Creek impaired water contributing area should help to moderate the negative affects from the identified causes of impairment and provide the following water quality and/or water quantity benefits:

Improve stream temperatures for aquatic life:	
Reduce flood peaks and desynchronize flood flows:	
Stabilize the banks along watercourses:	Riparian Areas, Depressional Wetlands
Retain sediments and reduce siltation:	Riparian Areas, Slope Wetlands, Depressional Wetlands
Increase attenuation of nutrients:	
Maintain late season streamflows:	

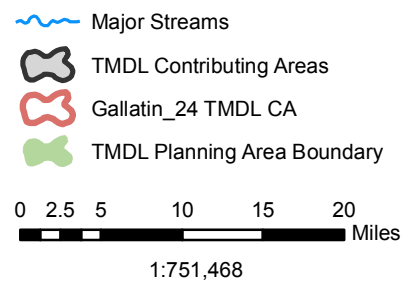


Gallatin Watershed TMDL Planning Area: TMDL Contributing Areas Map



Each TMDL Contributing Area is associated with a PDF report. This report identifies wetland types and riparian areas that can be targeted as sites for restoration or protection to address identified water quality impairments. Each report is found on the PBworks tracking page or linked to DEQ's Wetlands website at:
http://www.deq.mt.gov/wqinfo/Wetlands/PDFs/TMDL_CA_Reports/Gallatin_###.pdf
Where the ## is the number of the TMDL Contributing area from the map above.

Map Updated: 5/12/2011 Steve Carpenedo



Identifying wetland and riparian areas to improve water quality and quantity

Dry Creek Impaired Waters Contributing Area, Gallatin Watershed

GIS ID: Gallatin 1

This brief report summarizes the types of wetland and riparian areas in Dry Creek Impaired Waters Contributing Area. And, identifies which wetland types or riparian areas can be targeted for restoration or protection based on their contribution to water quality and quantity. Dry Creek watershed has had a water quality assessment conducted and may be listed as a 303d stream under the Clean Water Act thus requiring the development of a TMDL (Total Maximum Daily Load). If no information on impairments are listed this assessed water is meeting its designated beneficial uses and no TMDL development was needed. Specific information on the water quality assessment for Dry Creek can be found at: <http://cwaic.mt.gov/>

Impairment Nitrogen (Total) [CFL 2000], Phosphorus (Total) [CFL 2000], Sedimentation/Siltation [CFL 1992] Cause(s) - Pollutants:
Impairment Alteration in stream-side or littoral vegetative covers, Cause Unknown, Physical substrate habitat Cause(s) - alterations Pollution:

MDEQ identified the following as potential causes of impairment of the observed pollutants and pollution:

Agriculture, Channelization, Source Unknown

Targeting wetlands for restoration and protection based on their capacity to provide water quality and quantity functions can be an effective means of reducing the amount of pollutants entering streams and rivers. In the Dry Creek impaired waters contributing area, restoring and protecting wetland and riparian areas that have a high capacity to provide the functions marked with an X in the chart below can help moderate the negative affects from the identified causes of impairment and improve water quality and/or water quantity.

Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
	X	X		X	

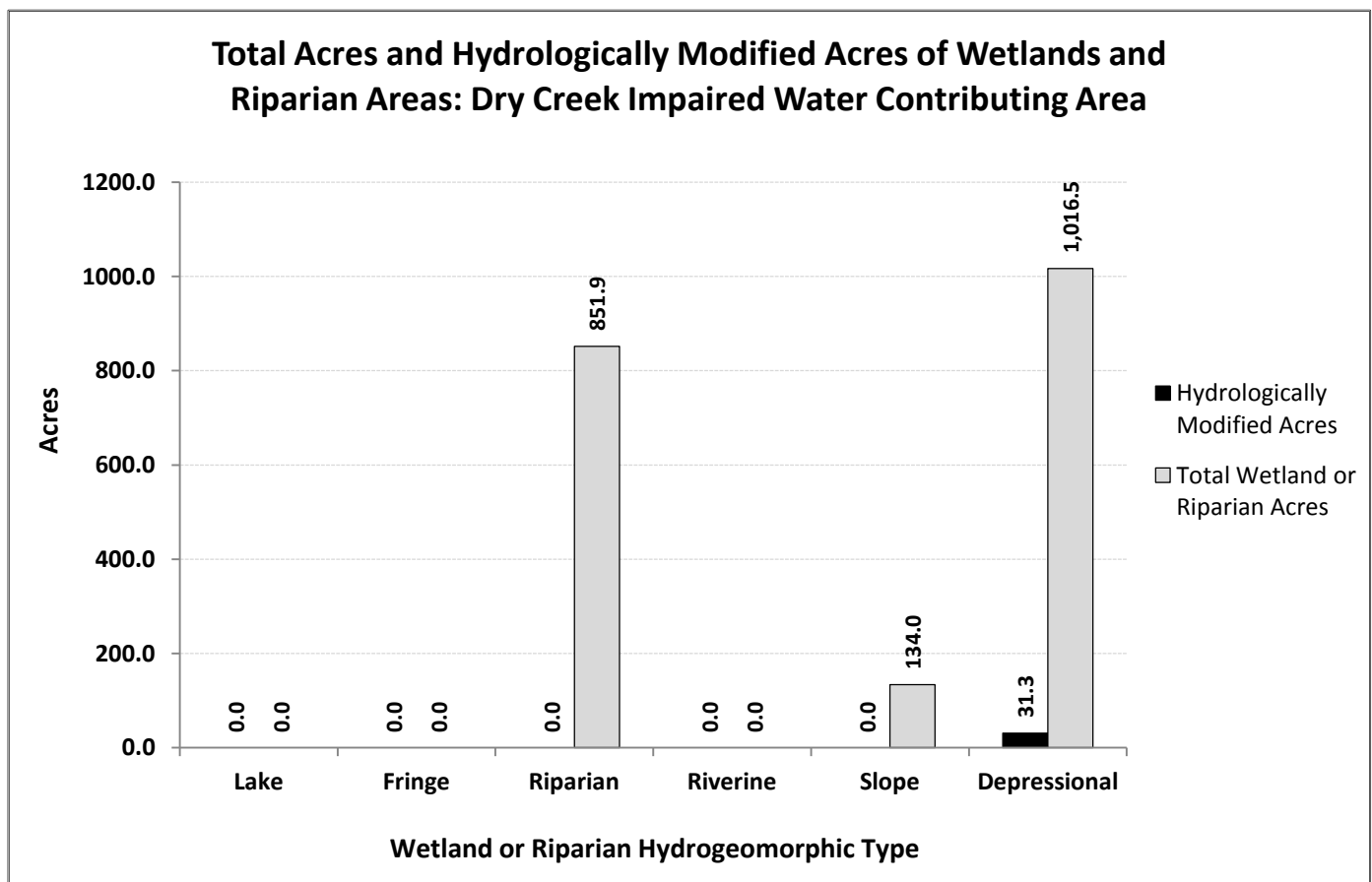
Each wetland type has the ability to perform all of the identified water quality/quantity functions to a degree. Some wetlands, though, are better at providing these functions than others. For Example, in the Dry Creek impaired waters contributing area 61.2% of Slope wetlands display a high capacity to attenuate nutrients. The proportion of each wetland type and riparian area within this impaired water contributing area that displays a high capacity to perform an identified water quality/quantity function is listed below. The wetland type and riparian areas that are in bold italics have the greatest capacity to moderate the negative impacts from the identified pollutant sources. Values of 0.0% in the chart means that these wetland types or riparian areas have only a medium to low capacity to moderate the negative affects from identified impairment causes.

Type	Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fringe	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Riparian	72.8%	0.0%	0.0%	0.0%	25.9%	0.0%
Riverine	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Slope	13.7%	38.6%	61.2%	0.0%	0.0%	0.0%
Depressional	59.1%	6.1%	19.7%	0.3%	0.0%	0.1%

Dry Creek has a total of 2002 wetland and riparian acres within its impaired waters Contributing Area, with 31 acres (2%) considered as hydrologically modified in the National Wetland Inventory database. The majority of wetlands or riparian areas are Depressional (50.8%), followed by Riparian (42.5%), and Slope (6.7%).

Using Dry Creek impaired waters contributing area's wetland and riparian areas profile and associated hydrogeomorphic (HGM) functions. Restoring and/or protecting the following wetland types and riparian areas in Dry Creek impaired water contributing area should help to moderate the negative affects from the identified causes of impairment and provide the following water quality and/or water quantity benefits:

Improve stream temperatures for aquatic life:	
Reduce flood peaks and desynchronize flood flows:	
Stabilize the banks along watercourses:	Riparian Areas,
Retain sediments and reduce siltation:	Riparian Areas, Slope Wetlands, Depressional Wetlands
Increase attenuation of nutrients:	Slope Wetlands, Depressional Wetlands
Maintain late season streamflows:	



Identifying wetland and riparian areas to improve water quality and quantity

East Gallatin River Drainage Impaired Waters Contributing Area, Gallatin Watershed

GIS ID: Gallatin 2

This brief report summarizes the types of wetland and riparian areas in East Gallatin River Drainage Impaired Waters Contributing Area. And, identifies which wetland types or riparian areas can be targeted for restoration or protection based on their contribution to water quality and quantity. East Gallatin River Drainage watershed has had a water quality assessment conducted and may be listed as a 303d stream under the Clean Water Act thus requiring the development of a TMDL (Total Maximum Daily Load). If no information on impairments are listed this assessed water is meeting its designed beneficial uses and no TMDL development was needed. Specific information on the water quality assessment for East Gallatin River Drainage can be found at: <http://cwaic.mt.gov/>

Impairment Cause(s) - Pollutants:
Impairment Cause(s) - Pollution:

MDEQ identified the following as potential causes of impairment of the observed pollutants and pollution:

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Targeting wetlands for restoration and protection based on their capacity to provide water quality and quantity functions can be an effective means of reducing the amount of pollutants entering streams and rivers. In the East Gallatin River Drainage impaired waters contributing area, restoring and protecting wetland and riparian areas that have a high capacity to provide the functions marked with an X in the chart below can help moderate the negative affects from the identified causes of impairment and improve water quality and/or water quantity.

Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature

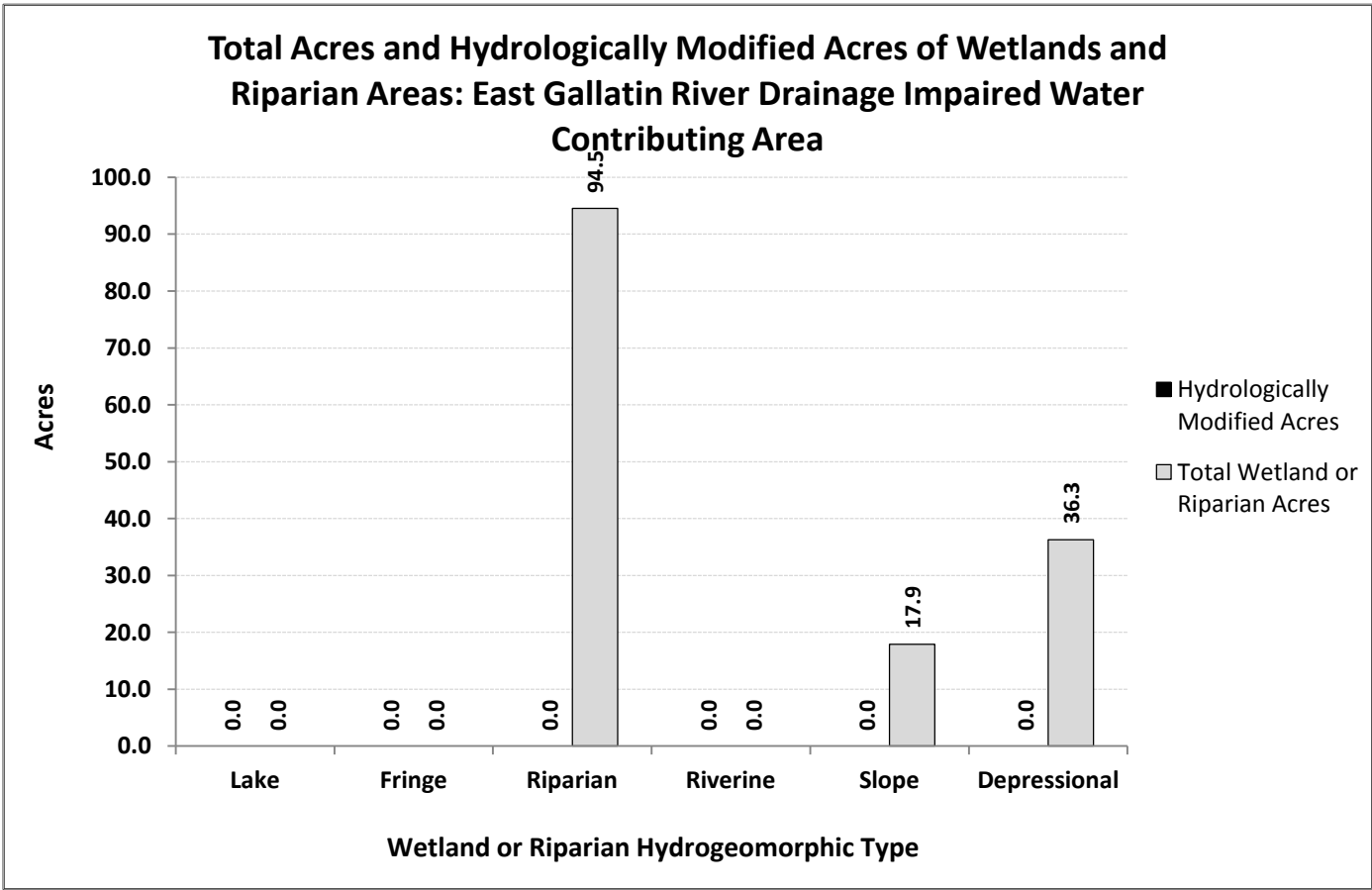
Each wetland type has the ability to perform all of the identified water quality/quantity functions to a degree. Some wetlands, though, are better at providing these functions than others. In this section of the East Gallatin River Drainage impaired water contributing area, causes of impairment were not identified. Please refer to the chart below showing the proportion of wetland types that display a high capacity to address impairment causes within the watershed. Values of 0.0% in the chart means that these wetland types or riparian areas have only a medium to low capacity to moderate the negative affects from identified impairment causes.

Type	Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fringe	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Riparian	92.3%	0.0%	0.0%	0.0%	42.9%	0.0%
Riverine	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Slope	8.8%	51.4%	47.7%	0.0%	0.0%	0.0%
Depressional	76.6%	42.8%	61.5%	0.0%	0.0%	0.0%

East Gallatin River Drainage has a total of 149 wetland and riparian acres within its impaired waters Contributing Area, with 0 acres (0%) considered as hydrologically modified in the National Wetland Inventory database. The majority of wetlands or riparian areas are Riparian (63.6%), followed by Depressional (24.4%), and Slope (12.1%).

Using East Gallatin River Drainage impaired waters contributing area's wetland and riparian areas profile and associated hydrogeomorphic (HGM) functions. Restoring and/or protecting the following wetland types and riparian areas in East Gallatin River Drainage impaired water contributing area should help to moderate the negative affects from the identified causes of impairment and provide the following water quality and/or water quantity benefits:

Improve stream temperatures for aquatic life:	
Reduce flood peaks and desynchronize flood flows:	
Stabilize the banks along watercourses:	
Retain sediments and reduce siltation:	
Increase attenuation of nutrients:	
Maintain late season streamflows:	



Identifying wetland and riparian areas to improve water quality and quantity

Reese Creek Impaired Waters Contributing Area, Gallatin Watershed

GIS ID: Gallatin 3

This brief report summarizes the types of wetland and riparian areas in Reese Creek Impaired Waters Contributing Area. And, identifies which wetland types or riparian areas can be targeted for restoration or protection based on their contribution to water quality and quantity. Reese Creek watershed has had a water quality assessment conducted and may be listed as a 303d stream under the Clean Water Act thus requiring the development of a TMDL (Total Maximum Daily Load). If no information on impairments are listed this assessed water is meeting its designated beneficial uses and no TMDL development was needed. Specific information on the water quality assessment for Reese Creek can be found at: <http://cwaic.mt.gov/>

Impairment Fecal Coliform [CFL 1988], Nitrates [CFL 2000], Phosphate [CFL 2000], Solids (Suspended/Bedload) Cause(s) - [CFL 1990] Pollutants:
Impairment Cause(s) - Pollution:

MDEQ identified the following as potential causes of impairment of the observed pollutants and pollution:

Agriculture

Targeting wetlands for restoration and protection based on their capacity to provide water quality and quantity functions can be an effective means of reducing the amount of pollutants entering streams and rivers. In the Reese Creek impaired waters contributing area, restoring and protecting wetland and riparian areas that have a high capacity to provide the functions marked with an X in the chart below can help moderate the negative affects from the identified causes of impairment and improve water quality and/or water quantity.

Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
	X	X		X	

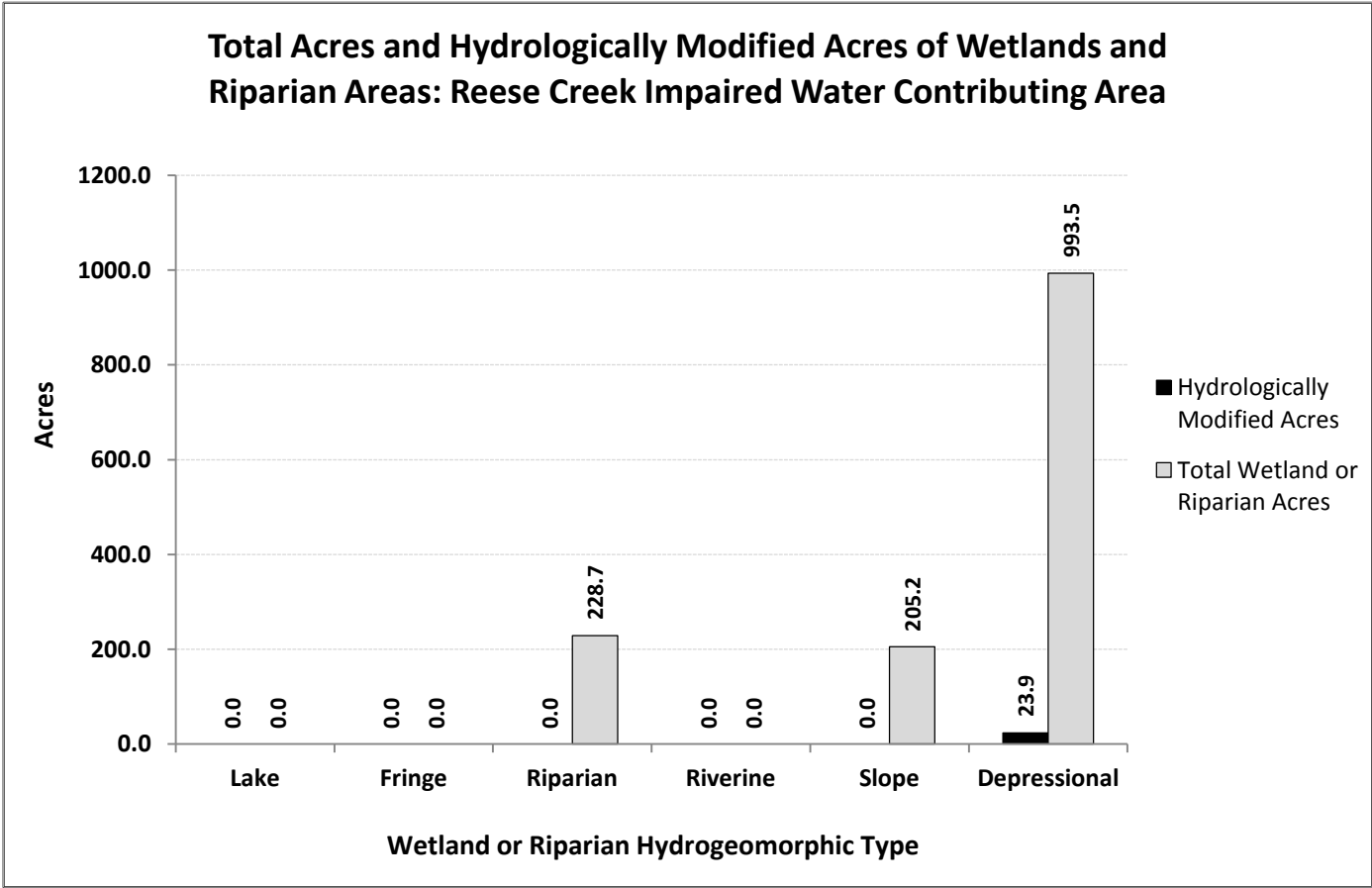
Each wetland type has the ability to perform all of the identified water quality/quantity functions to a degree. Some wetlands, though, are better at providing these functions than others. For Example, in the Reese Creek impaired waters contributing area 82.5% of Slope wetlands display a high capacity to retain sediments and reduce siltation. The proportion of each wetland type and riparian area within this impaired water contributing area that displays a high capacity to perform an identified water quality/quantity function is listed below. The wetland type and riparian areas that are in bold italics have the greatest capacity to moderate the negative impacts from the identified pollutant sources. Values of 0.0% in the chart means that these wetland types or riparian areas have only a medium to low capacity to moderate the negative affects from identified impairment causes.

Type	Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fringe	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Riparian	95.1%	0.0%	0.0%	0.0%	53.5%	0.0%
Riverine	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Slope	6.1%	82.5%	15.9%	0.0%	0.0%	0.0%
Depressional	48.5%	10.7%	23.0%	3.3%	0.0%	0.1%

Reese Creek has a total of 1427 wetland and riparian acres within its impaired waters Contributing Area, with 24 acres (2%) considered as hydrologically modified in the National Wetland Inventory database. The majority of wetlands or riparian areas are Depressional (69.6%), followed by Riparian (16%), and Slope (14.4%).

Using Reese Creek impaired waters contributing area's wetland and riparian areas profile and associated hydrogeomorphic (HGM) functions. Restoring and/or protecting the following wetland types and riparian areas in Reese Creek impaired water contributing area should help to moderate the negative affects from the identified causes of impairment and provide the following water quality and/or water quantity benefits:

Improve stream temperatures for aquatic life:	
Reduce flood peaks and desynchronize flood flows:	
Stabilize the banks along watercourses:	Riparian Areas,
Retain sediments and reduce siltation:	Riparian Areas, Slope Wetlands, Depressional Wetlands
Increase attenuation of nutrients:	Slope Wetlands, Depressional Wetlands
Maintain late season streamflows:	



Identifying wetland and riparian areas to improve water quality and quantity

Bridger Creek Impaired Waters Contributing Area, Gallatin Watershed

GIS ID: Gallatin 4

This brief report summarizes the types of wetland and riparian areas in Bridger Creek Impaired Waters Contributing Area. And, identifies which wetland types or riparian areas can be targeted for restoration or protection based on their contribution to water quality and quantity. Bridger Creek watershed has had a water quality assessment conducted and may be listed as a 303d stream under the Clean Water Act thus requiring the development of a TMDL (Total Maximum Daily Load). If no information on impairments are listed this assessed water is meeting its designated beneficial uses and no TMDL development was needed. Specific information on the water quality assessment for Bridger Creek can be found at: <http://cwaic.mt.gov/>

Impairment Phosphorus (Total) [CFL 2006], Total Kjeldahl Nitrogen (TKN) [CFL 2006] Cause(s) - Pollutants:
Impairment Chlorophyll-a Cause(s) - Pollution:

MDEQ identified the following as potential causes of impairment of the observed pollutants and pollution:

Grazing in Riparian or Shoreline Zones, Impacts from Resort Areas (Winter and Non-winter Resorts), Unspecified Unpaved Road or Trail

Targeting wetlands for restoration and protection based on their capacity to provide water quality and quantity functions can be an effective means of reducing the amount of pollutants entering streams and rivers. In the Bridger Creek impaired waters contributing area, restoring and protecting wetland and riparian areas that have a high capacity to provide the functions marked with an X in the chart below can help moderate the negative affects from the identified causes of impairment and improve water quality and/or water quantity.

Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
		X			

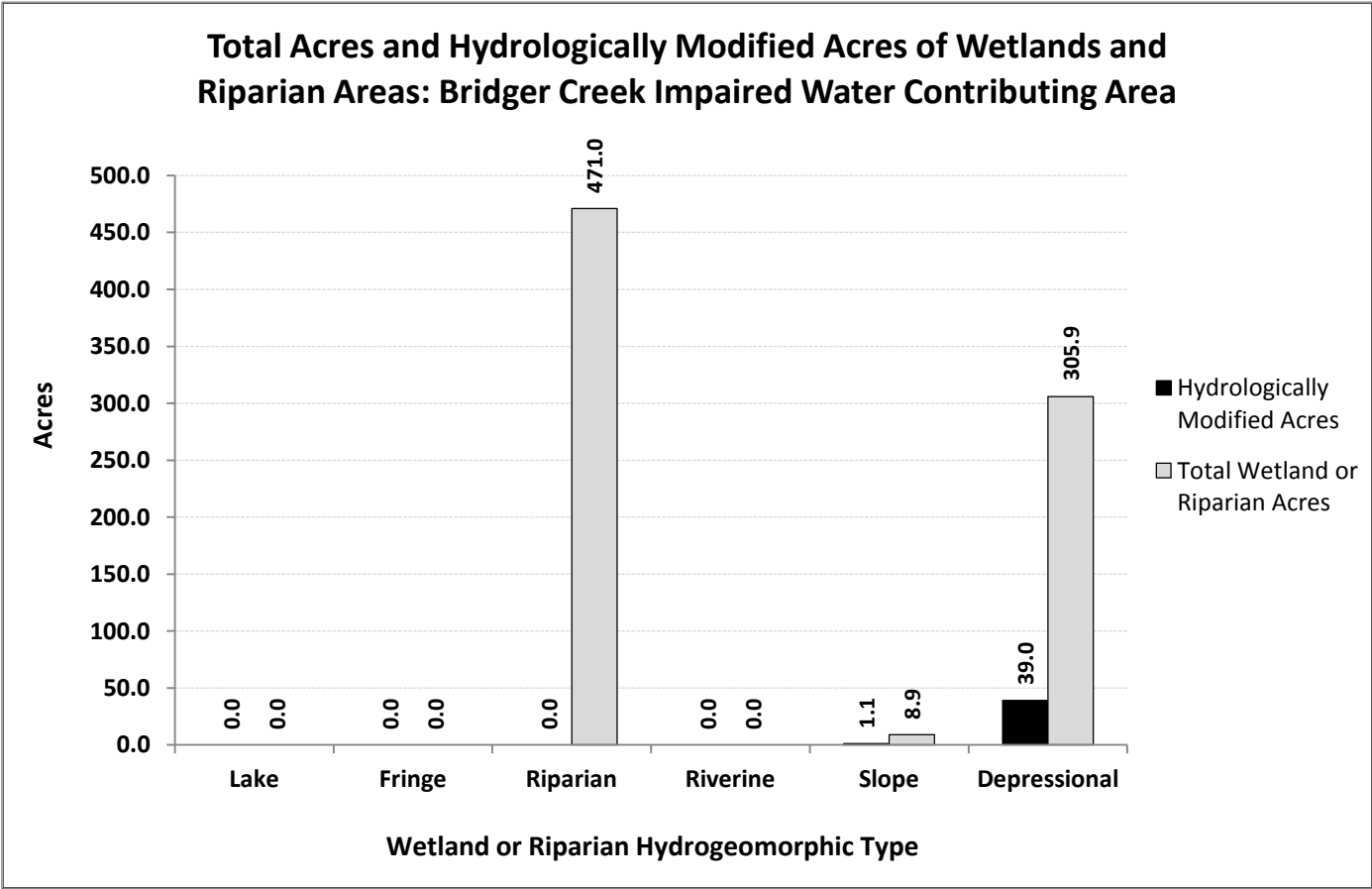
Each wetland type has the ability to perform all of the identified water quality/quantity functions to a degree. Some wetlands, though, are better at providing these functions than others. For Example, in the Bridger Creek impaired waters contributing area 83% of Slope wetlands display a high capacity to attenuate nutrients. The proportion of each wetland type and riparian area within this impaired water contributing area that displays a high capacity to perform an identified water quality/quantity function is listed below. The wetland type and riparian areas that are in bold italics have the greatest capacity to moderate the negative impacts from the identified pollutant sources. Values of 0.0% in the chart means that these wetland types or riparian areas have only a medium to low capacity to moderate the negative affects from identified impairment causes.

Type	Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fringe	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Riparian	98.2%	0.0%	0.0%	0.0%	45.6%	0.0%
Riverine	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Slope	40.6%	0.0%	83.0%	0.0%	0.0%	0.0%
Depressional	50.5%	27.1%	35.8%	0.5%	0.0%	1.1%

Bridger Creek has a total of 786 wetland and riparian acres within its impaired waters Contributing Area, with 40 acres (5%) considered as hydrologically modified in the National Wetland Inventory database. The majority of wetlands or riparian areas are Riparian (59.9%), followed by Depressional (38.9%), and Slope (1.1%).

Using Bridger Creek impaired waters contributing area's wetland and riparian areas profile and associated hydrogeomorphic (HGM) functions. Restoring and/or protecting the following wetland types and riparian areas in Bridger Creek impaired water contributing area should help to moderate the negative affects from the identified causes of impairment and provide the following water quality and/or water quantity benefits:

Improve stream temperatures for aquatic life:	
Reduce flood peaks and desynchronize flood flows:	
Stabilize the banks along watercourses:	
Retain sediments and reduce siltation:	
Increase attenuation of nutrients:	Slope Wetlands, Depressional Wetlands
Maintain late season streamflows:	



Identifying wetland and riparian areas to improve water quality and quantity

Thompson Creek Impaired Waters Contributing Area, Gallatin Watershed

GIS ID: Gallatin 5

This brief report summarizes the types of wetland and riparian areas in Thompson Creek Impaired Waters Contributing Area. And, identifies which wetland types or riparian areas can be targeted for restoration or protection based on their contribution to water quality and quantity. Thompson Creek watershed has had a water quality assessment conducted and may be listed as a 303d stream under the Clean Water Act thus requiring the development of a TMDL (Total Maximum Daily Load). If no information on impairments are listed this assessed water is meeting its designated beneficial uses and no TMDL development was needed. Specific information on the water quality assessment for Thompson Creek can be found at: <http://cwaic.mt.gov/>

Impairment Nitrogen (Total) [CFL 2006], Sedimentation/Siltation [CFL 1990] Cause(s) - Pollutants:
Impairment Alteration in stream-side or littoral vegetative covers, Chlorophyll-a Cause(s) - Pollution:

MDEQ identified the following as potential causes of impairment of the observed pollutants and pollution:

Grazing in Riparian or Shoreline Zones

Targeting wetlands for restoration and protection based on their capacity to provide water quality and quantity functions can be an effective means of reducing the amount of pollutants entering streams and rivers. In the Thompson Creek impaired waters contributing area, restoring and protecting wetland and riparian areas that have a high capacity to provide the functions marked with an X in the chart below can help moderate the negative affects from the identified causes of impairment and improve water quality and/or water quantity.

Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
	X	X		X	

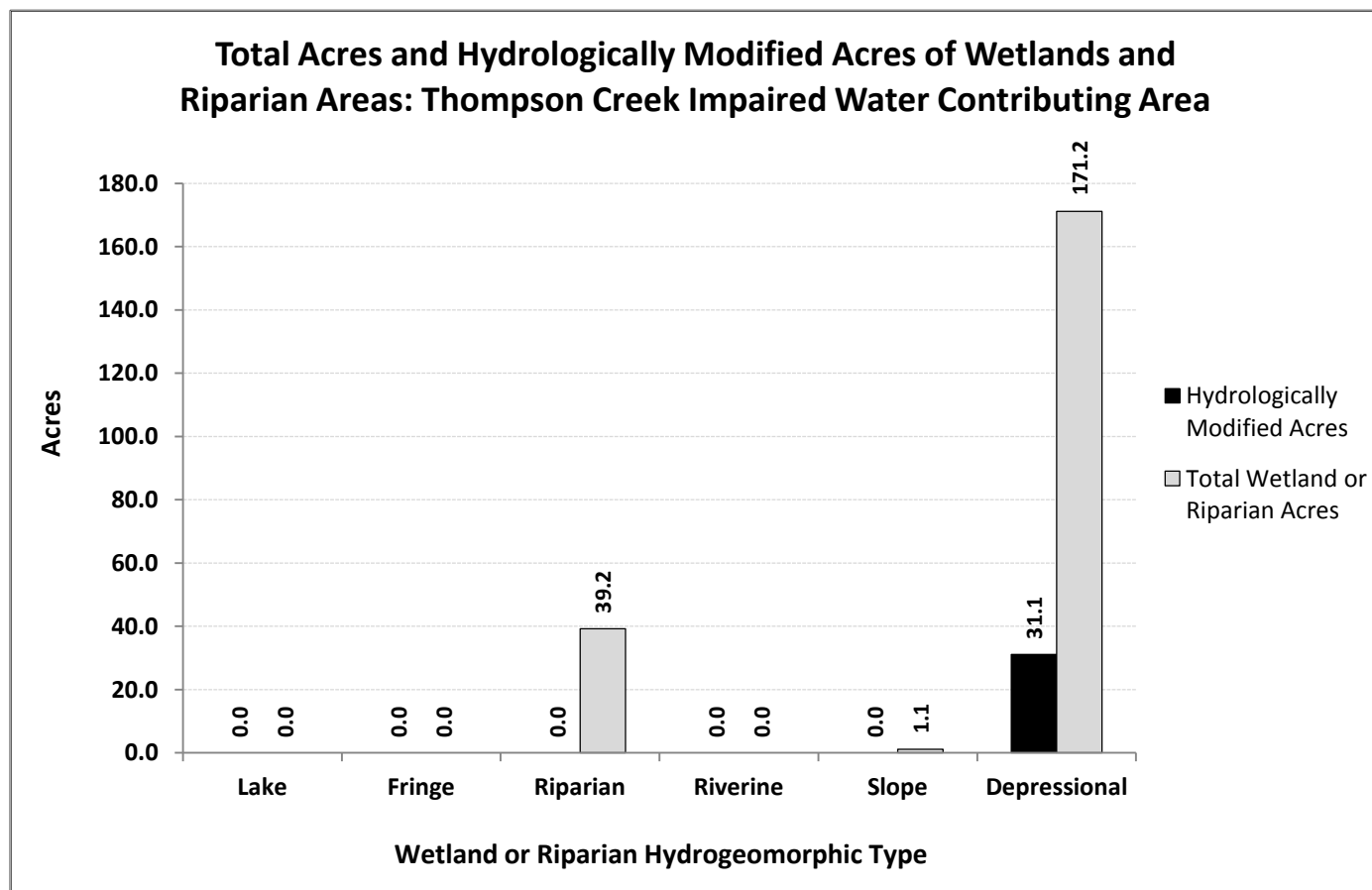
Each wetland type has the ability to perform all of the identified water quality/quantity functions to a degree. Some wetlands, though, are better at providing these functions than others. For Example, in the Thompson Creek impaired waters contributing area 78.8% of Slope wetlands display a high capacity to attenuate nutrients. The proportion of each wetland type and riparian area within this impaired water contributing area that displays a high capacity to perform an identified water quality/quantity function is listed below. The wetland type and riparian areas that are in bold italics have the greatest capacity to moderate the negative impacts from the identified pollutant sources. Values of 0.0% in the chart means that these wetland types or riparian areas have only a medium to low capacity to moderate the negative affects from identified impairment causes.

Type	Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fringe	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Riparian	23.2%	0.0%	0.0%	0.0%	30.6%	0.0%
Riverine	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Slope	38.6%	0.0%	78.8%	0.0%	0.0%	0.0%
Depressional	24.5%	16.5%	11.1%	0.3%	0.0%	0.5%

Thompson Creek has a total of 212 wetland and riparian acres within its impaired waters Contributing Area, with 31 acres (15%) considered as hydrologically modified in the National Wetland Inventory database. The majority of wetlands or riparian areas are Depressional (80.9%), followed by Riparian (18.6%), and Slope (0.5%).

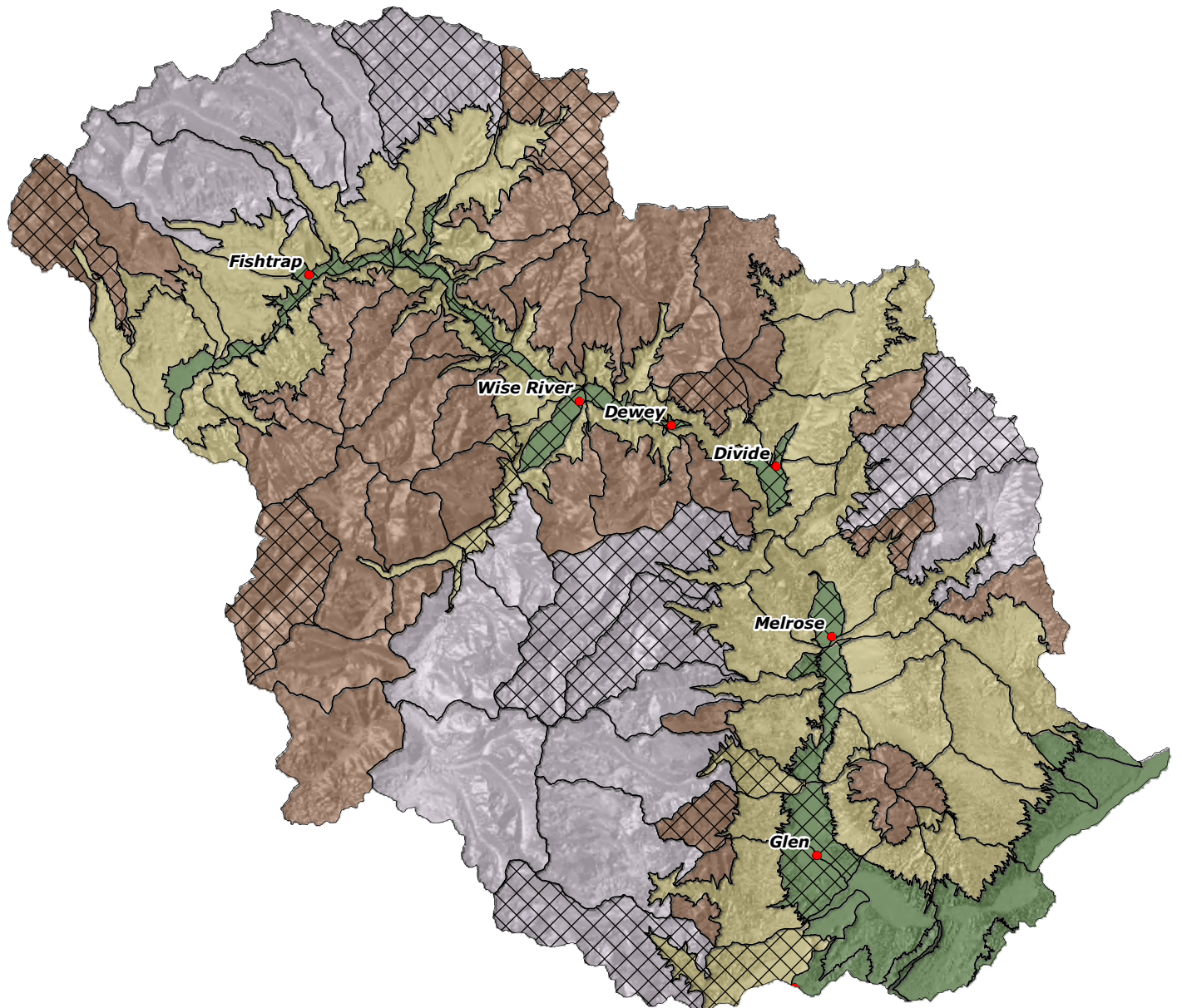
Using Thompson Creek impaired waters contributing area's wetland and riparian areas profile and associated hydrogeomorphic (HGM) functions. Restoring and/or protecting the following wetland types and riparian areas in Thompson Creek impaired water contributing area should help to moderate the negative affects from the identified causes of impairment and provide the following water quality and/or water quantity benefits:

Improve stream temperatures for aquatic life:	
Reduce flood peaks and desynchronize flood flows:	
Stabilize the banks along watercourses:	Riparian Areas,
Retain sediments and reduce siltation:	Riparian Areas, Depressional Wetlands
Increase attenuation of nutrients:	Slope Wetlands, Depressional Wetlands
Maintain late season streamflows:	









Appendix B: Sub-Watershed Wetland Profiles

Big Hole Sub-Watershed Groupings



Sub-Watersheds (Total / # Impacted)

-  Valley Bottom (22 / 12)
-  Low Elevation (63 / 5)
-  Mid Elevation (39 / 5)
-  High Elevation (15 / 6)

-  Reference Sub-Watershed
-  Impacted Sub-Watershed

0 1.5 3 6 9 12
Miles

1:495,646

** Sub-Watersheds and Impacted Sub-Watersheds were determined using K-means cluster analysis in SPSS.*

Final: 3/29/2011

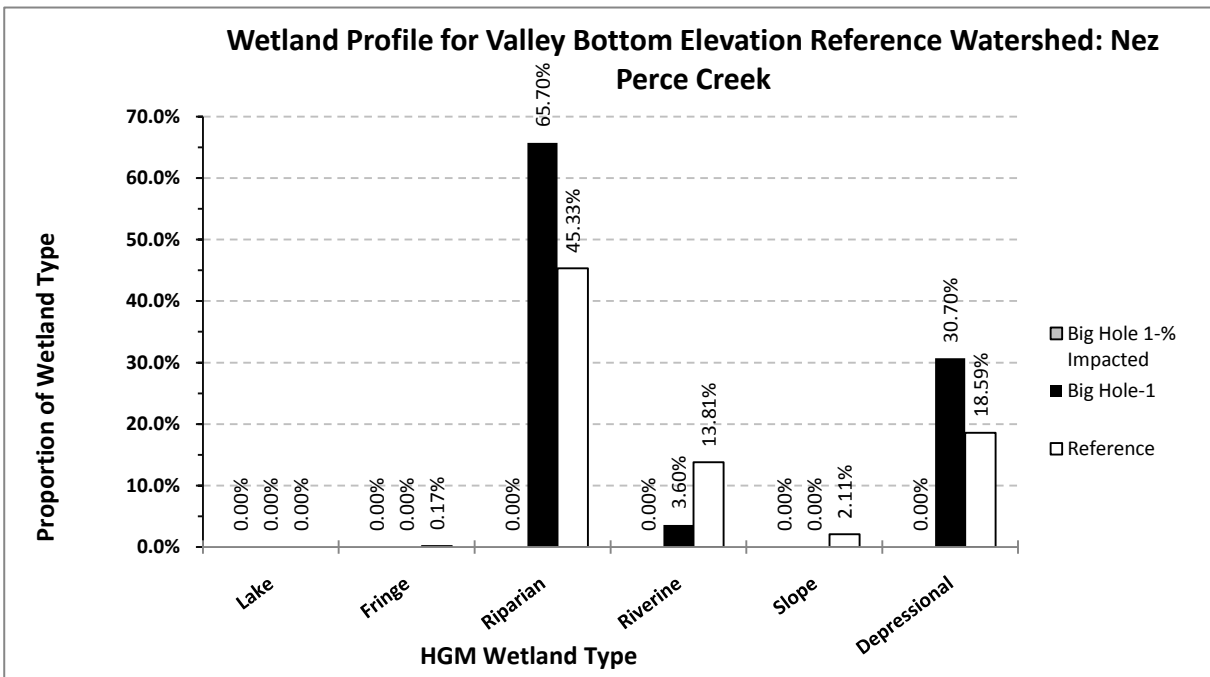
Wetland Profile: Reference Watershed Big Hole-1, Nez Perce Creek

This brief report summarizes the wetland profiles for the Nez Perce Creek Sub-Watershed: Big Hole-1. This sub-watershed is grouped into the Valley Bottom elevation sub-watershed group. It has a mean elevation of 1533.4 m, a mean slope of 8.7 degrees, a total relief of 175 m, with the majority of stream segments having a Strahler stream order of 3.

Based on the percent of stream miles on the 303d list (0%), percent of altered landcover (2%), percent of intensive agriculture (0%), and the meters of roads per acre (1.1) within the sub-watershed. Nez Perce Creek watershed is considered as a/an Reference sub-watershed in the Valley Bottom elevation sub-watershed group for the Big Hole Watershed.

Nez Perce Creek sub-watershed contains 3 acres of wetlands. Of which, 0 acres are considered as being modified in the National Wetlands Inventory database. The percent of wetlands in each HGM wetland type that have a high capacity to provide functions that may target water quality and quantity impairments in Nez Perce Creek are listed below.

	Flood Attenuation	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Fringe	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Riparian	100.00%	0.00%	0.00%	0.00%	9.52%	0.00%
Riverine	0.00%	99.99%	0.00%	0.00%	0.00%	100.00%
Slope	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Depressional	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%



* Note: Big Hole 1- Impacted denotes the percentage of wetlands within that HGM Wetland type that are considered as modified in the NWI Database. Percentages of HGM Wetland Types in the reference and Big Hole-1 watersheds are proportions of the total. For example, as the proportion of one HGM+38:38Type increases, the other wetland types will decrease.

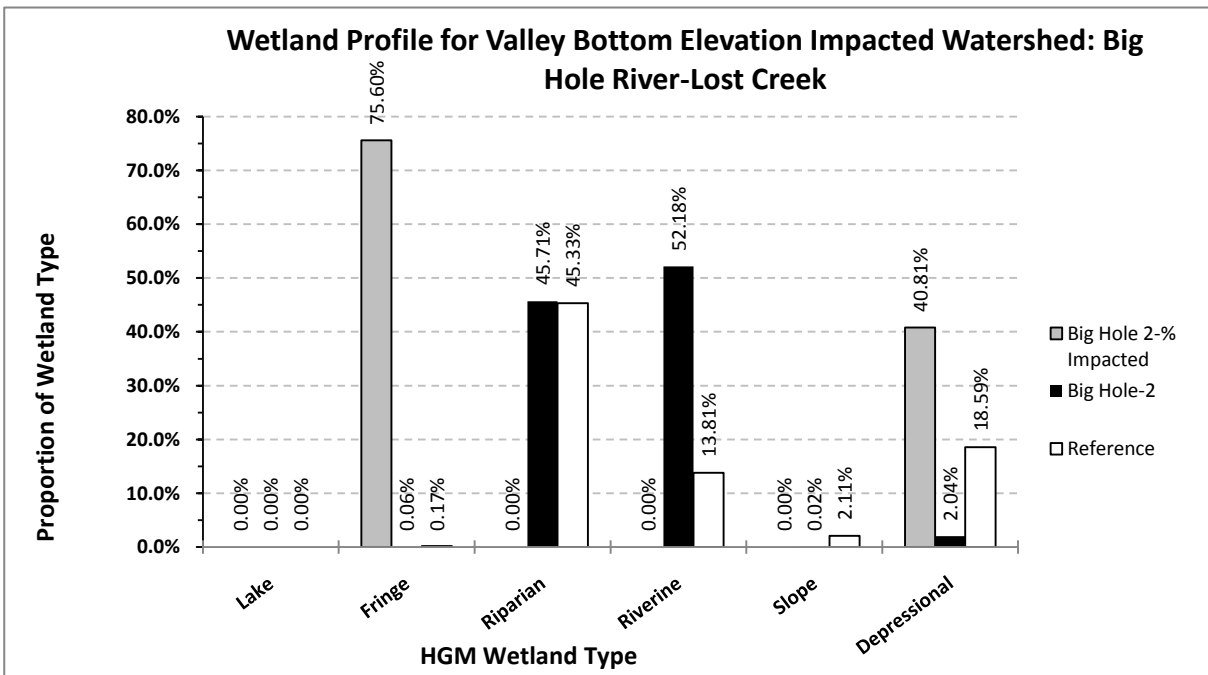
Wetland Profile: Impacted Watershed Big Hole-2, Big Hole River-Lost Creek

This brief report summarizes the wetland profiles for the Big Hole River-Lost Creek Sub-Watershed: Big Hole-2. This sub-watershed is grouped into the Valley Bottom elevation sub-watershed group. It has a mean elevation of 1545.4 m, a mean slope of 4.4 degrees, a total relief of 102 m, with the majority of stream segments having a Strahler stream order of 1.

Based on the percent of stream miles on the 303d list (29%), percent of altered landcover (52%), percent of intensive agriculture (13%), and the meters of roads per acre (8.9) within the sub-watershed. Big Hole River-Lost Creek watershed is considered as a/an Impacted sub-watershed in the Valley Bottom elevation sub-watershed group for the Big Hole Watershed.

Big Hole River-Lost Creek sub-watershed contains 1229 acres of wetlands. Of which, 11 acres are considered as being modified in the National Wetlands Inventory database. The percent of wetlands in each HGM wetland type that have a high capacity to provide functions that may target water quality and quantity impairments in Big Hole River-Lost Creek are listed below.

	Flood Attenuation	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Fringe	0.00%	88.03%	88.03%	0.00%	0.00%	75.60%
Riparian	89.23%	0.00%	0.00%	0.00%	0.00%	0.00%
Riverine	7.63%	100.00%	0.00%	0.00%	0.00%	100.00%
Slope	0.00%	0.00%	58.95%	0.00%	0.00%	0.00%
Depressional	0.00%	74.87%	60.45%	0.00%	0.00%	52.94%



* Note: Big Hole 2-% Impacted denotes the percentage of wetlands within that HGM Wetland type that are considered as modified in the NWI Database. Percentages of HGM Wetland Types in the reference and Big Hole-2 watersheds are proportions of the total. For example, as the proportion of one HGM+38:38Type increases, the other wetland types will decrease.

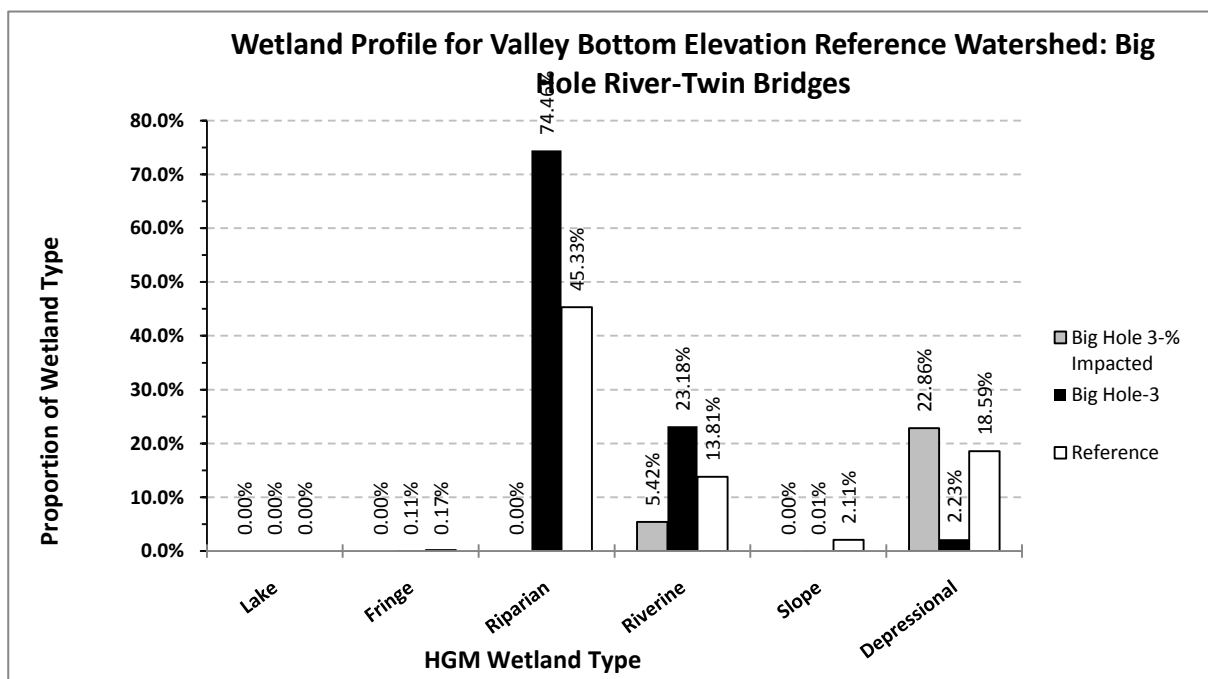
Wetland Profile: Reference Watershed Big Hole-3, Big Hole River-Twin Bridges

This brief report summarizes the wetland profiles for the Big Hole River-Twin Bridges Sub-Watershed: Big Hole-3. This sub-watershed is grouped into the Valley Bottom elevation sub-watershed group. It has a mean elevation of 1488.3 m, a mean slope of 5.1 degrees, a total relief of 203 m, with the majority of stream segments having a Strahler stream order of 5.

Based on the percent of stream miles on the 303d list (19%), percent of altered landcover (23%), percent of intensive agriculture (2%), and the meters of roads per acre (3.6) within the sub-watershed. Big Hole River-Twin Bridges watershed is considered as a/an Reference sub-watershed in the Valley Bottom elevation sub-watershed group for the Big Hole Watershed.

Big Hole River-Twin Bridges sub-watershed contains 1284 acres of wetlands. Of which, 23 acres are considered as being modified in the National Wetlands Inventory database. The percent of wetlands in each HGM wetland type that have a high capacity to provide functions that may target water quality and quantity impairments in Big Hole River-Twin Bridges are listed below.

	Flood Attenuation	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Fringe	0.00%	90.26%	90.26%	0.00%	0.00%	0.00%
Riparian	98.29%	0.00%	0.00%	0.00%	0.00%	0.00%
Riverine	4.80%	99.43%	0.00%	0.00%	0.00%	94.78%
Slope	0.00%	0.00%	61.83%	0.00%	0.00%	0.00%
Depressional	0.97%	96.80%	87.13%	0.00%	0.00%	73.58%



* Note: Big Hole 3-% Impacted denotes the percentage of wetlands within that HGM Wetland type that are considered as modified in the NWI Database. Percentages of HGM Wetland Types in the reference and Big Hole-3 watersheds are proportions of the total. For example, as the proportion of one HGM+38:38Type increases, the other wetland types will decrease.

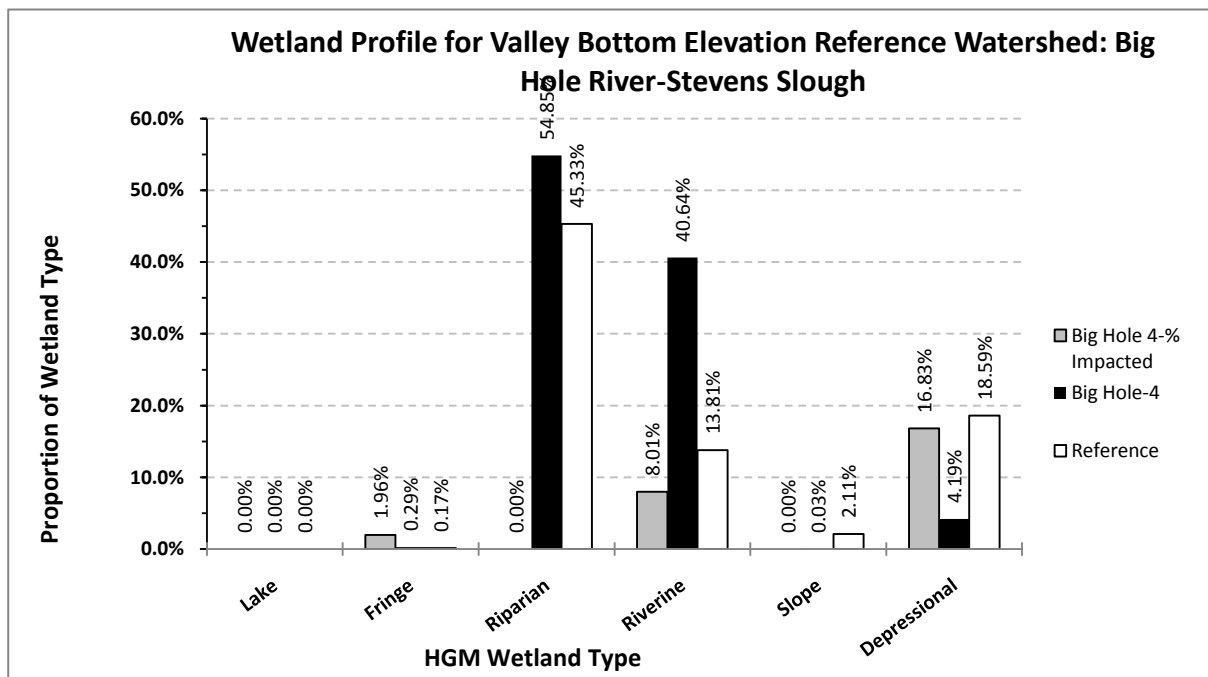
Wetland Profile: Reference Watershed Big Hole-4, Big Hole River-Stevens Slough

This brief report summarizes the wetland profiles for the Big Hole River-Stevens Slough Sub-Watershed: Big Hole-4. This sub-watershed is grouped into the Valley Bottom elevation sub-watershed group. It has a mean elevation of 1541.3 m, a mean slope of 6.2 degrees, a total relief of 162 m, with the majority of stream segments having a Strahler stream order of 1.

Based on the percent of stream miles on the 303d list (20%), percent of altered landcover (24%), percent of intensive agriculture (5%), and the meters of roads per acre (3.4) within the sub-watershed. Big Hole River-Stevens Slough watershed is considered as a/an Reference sub-watershed in the Valley Bottom elevation sub-watershed group for the Big Hole Watershed.

Big Hole River-Stevens Slough sub-watershed contains 1086 acres of wetlands. Of which, 43 acres are considered as being modified in the National Wetlands Inventory database. The percent of wetlands in each HGM wetland type that have a high capacity to provide functions that may target water quality and quantity impairments in Big Hole River-Stevens Slough are listed below.

	Flood Attenuation	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Fringe	0.00%	90.08%	68.81%	0.00%	0.00%	1.96%
Riparian	89.80%	0.00%	0.00%	0.00%	0.54%	0.00%
Riverine	7.49%	94.39%	0.00%	0.00%	0.00%	91.66%
Slope	0.00%	0.00%	61.16%	0.00%	0.00%	0.00%
Depressional	3.82%	62.94%	54.00%	0.00%	0.00%	47.47%



* Note: Big Hole 4- Impacted denotes the percentage of wetlands within that HGM Wetland type that are considered as modified in the NWI Database. Percentages of HGM Wetland Types in the reference and Big Hole-4 watersheds are proportions of the total. For example, as the proportion of one HGM+38:38Type increases, the other wetland types will decrease.

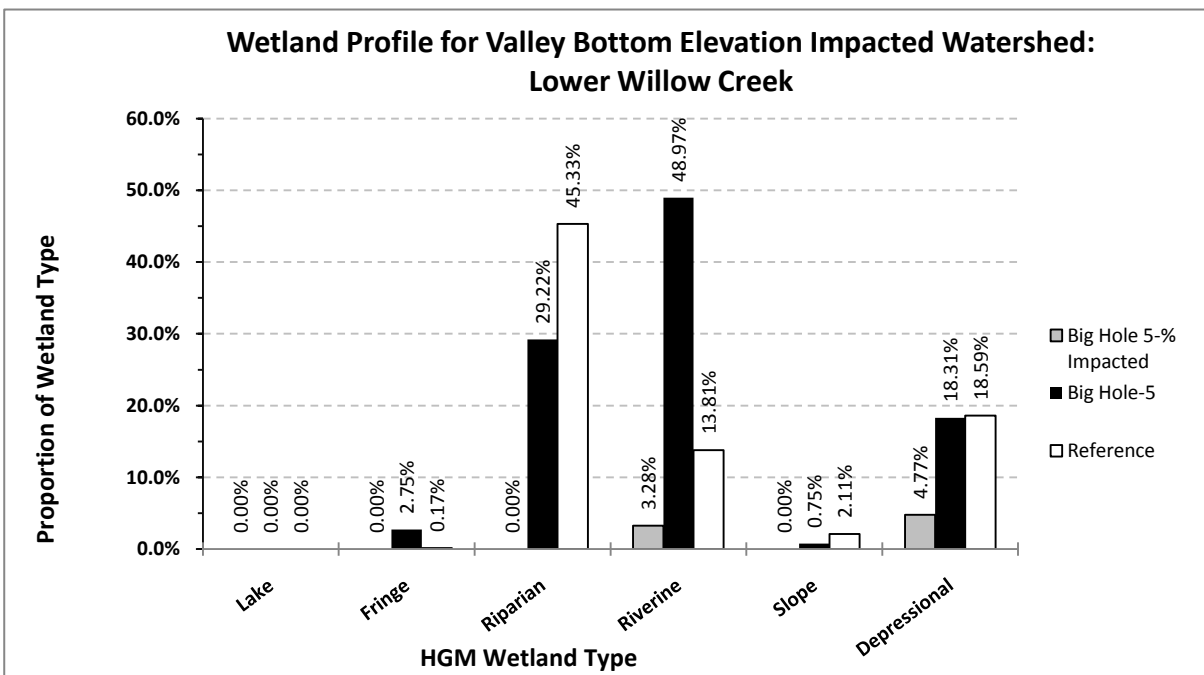
Wetland Profile: Impacted Watershed Big Hole-5, Lower Willow Creek

This brief report summarizes the wetland profiles for the Lower Willow Creek Sub-Watershed: Big Hole-5. This sub-watershed is grouped into the Valley Bottom elevation sub-watershed group. It has a mean elevation of 1552 m, a mean slope of 4.8 degrees, a total relief of 122 m, with the majority of stream segments having a Strahler stream order of 2.

Based on the percent of stream miles on the 303d list (26%), percent of altered landcover (56%), percent of intensive agriculture (20%), and the meters of roads per acre (8.5) within the sub-watershed. Lower Willow Creek watershed is considered as a/an Impacted sub-watershed in the Valley Bottom elevation sub-watershed group for the Big Hole Watershed.

Lower Willow Creek sub-watershed contains 591 acres of wetlands. Of which, 15 acres are considered as being modified in the National Wetlands Inventory database. The percent of wetlands in each HGM wetland type that have a high capacity to provide functions that may target water quality and quantity impairments in Lower Willow Creek are listed below.

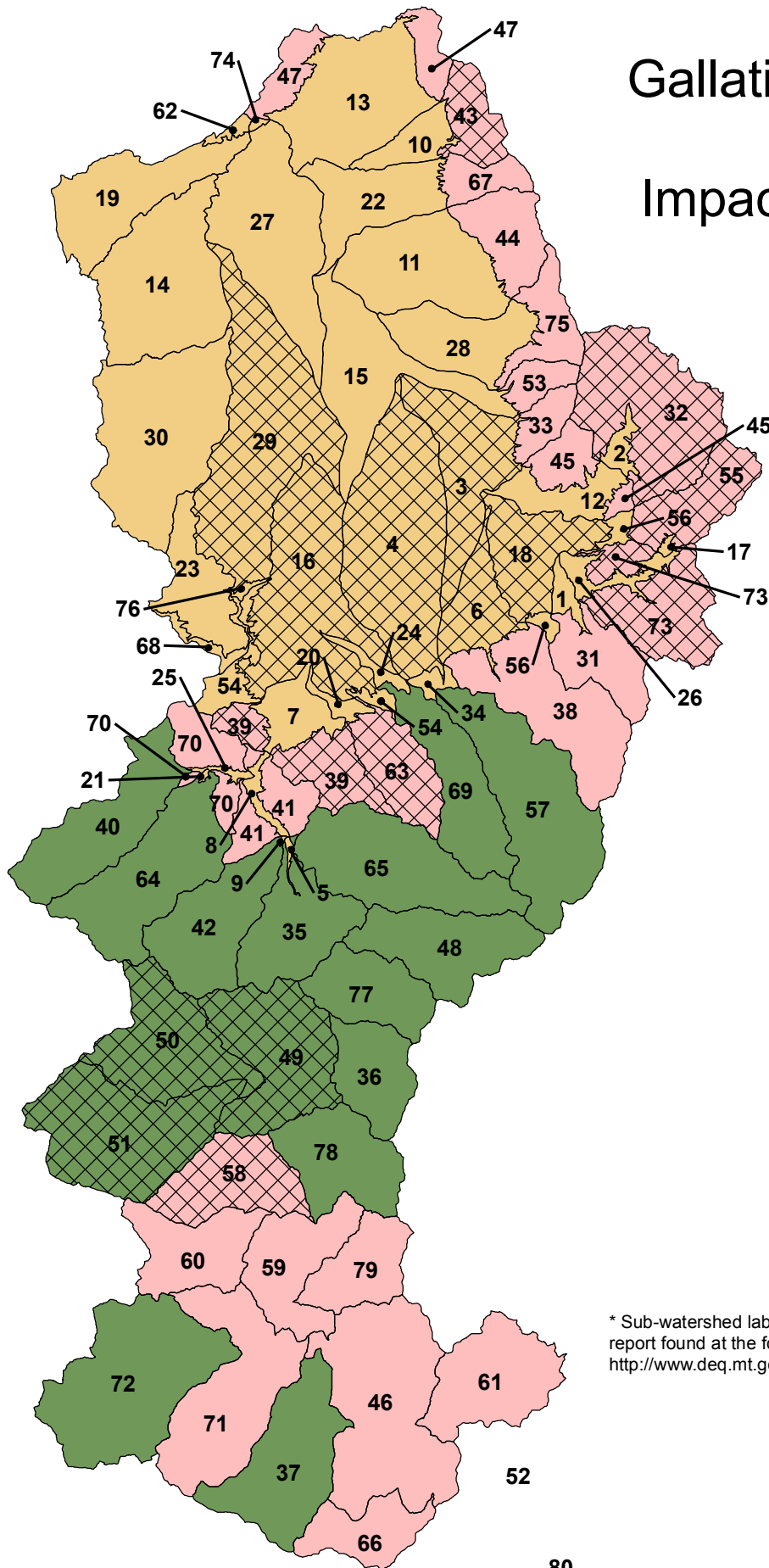
	Flood Attenuation	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Fringe	0.00%	95.59%	95.59%	0.00%	0.00%	0.00%
Riparian	73.42%	0.00%	0.00%	0.00%	23.61%	0.00%
Riverine	16.26%	99.35%	0.00%	0.00%	0.00%	97.88%
Slope	0.00%	19.79%	61.47%	0.00%	0.00%	0.00%
Depressional	8.87%	4.18%	27.62%	0.00%	0.00%	2.65%



* Note: Big Hole 5-Impacted denotes the percentage of wetlands within that HGM Wetland type that are considered as modified in the NWI Database. Percentages of HGM Wetland Types in the reference and Big Hole-5 watersheds are proportions of the total. For example, as the proportion of one HGM+38:38Type increases, the other wetland types will decrease.

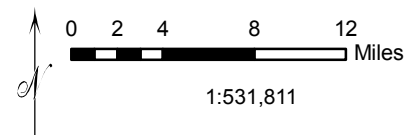
Gallatin Sub-Watersheds

Impacted vs. Reference



Sub-Watersheds

- Low Elevation (37)
- Mid Elevation (25)
- High Elevation (16)
- Impacted Sub-Watershed
- "Reference" Sub-Watershed



* Sub-watershed labels correspond to the number (##) of the Sub-watershed report found at the following link:
http://www.deq.mt.gov/wqinfo/Wetlands/PDFs/WP_Gallatin/Gallatin_##.pdf

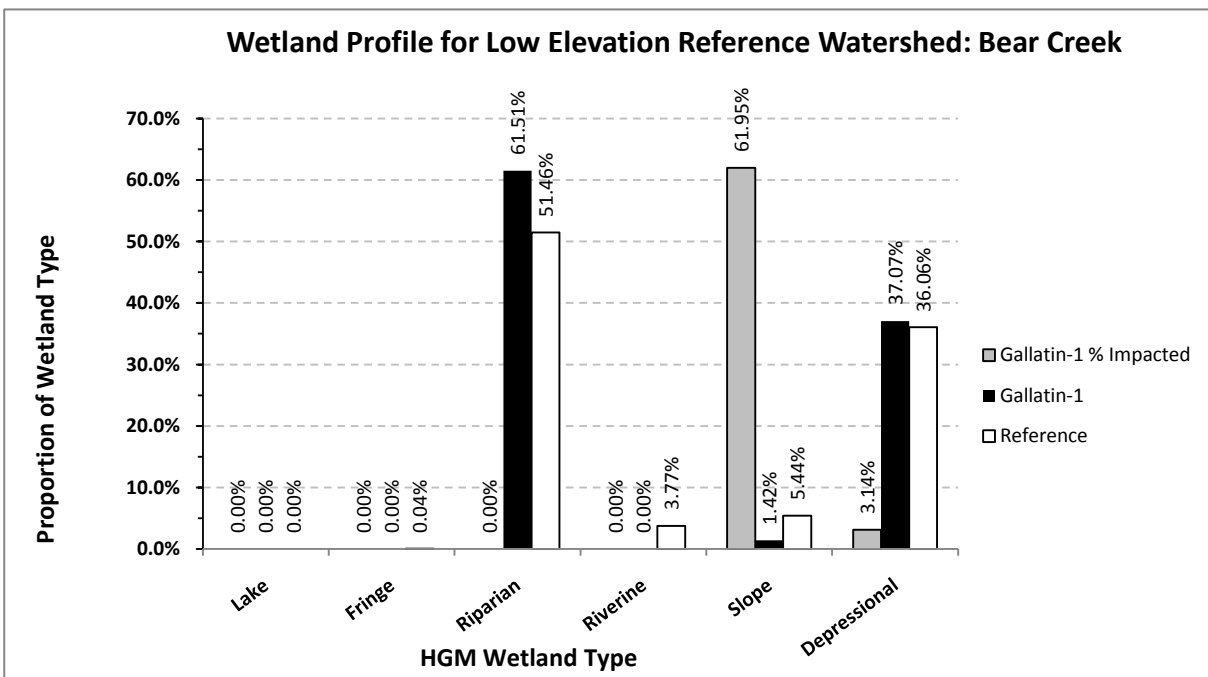
Wetland Profile: Reference Watershed Gallatin-1, Bear Creek

This brief report summarizes the wetland profiles for the Bear Creek Sub-Watershed: Gallatin-1. This sub-watershed is grouped into the Low elevation sub-watershed group. It has a mean elevation of 1591.64 m, a mean slope of 6.9 degrees, a total relief of 221 m, with the majority of stream segments having a Strahler stream order of 3.

Based on the meters of roads per acre (10.16), percent of altered land cover (52), percent of intensive agriculture (29.24), number of groundwater wells (94), and density of septic systems per acre (0.03155) within the sub-watershed. Bear Creek watershed is considered as a/an Reference sub-watershed in the Low elevation sub-watershed group for the Gallatin Watershed.

Bear Creek sub-watershed contains 136 acres of wetlands. Of which, 3 acres are considered as being modified in the National Wetlands Inventory database. The percent of wetlands in each HGM wetland type that have a high capacity to provide functions that may target water quality and quantity impairments in Bear Creek are listed below.

	Flood Attenuation	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Fringe	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Riparian	93.53%	0.00%	0.00%	0.00%	51.80%	0.00%
Riverine	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Slope	0.00%	61.95%	16.52%	0.00%	0.00%	0.00%
Depressional	30.32%	19.83%	23.00%	0.00%	0.00%	0.00%



* Note: Gallatin-1 % Impacted denotes the percentage of wetlands within that HGM Wetland type that are considered as modified in the NWI Database. Percentages of HGM Wetland Types in the Reference and Gallatin-1 watersheds are proportions of the total. For example, as the proportion of wetlands in one HGM Type increases, the other wetlands types will decrease.

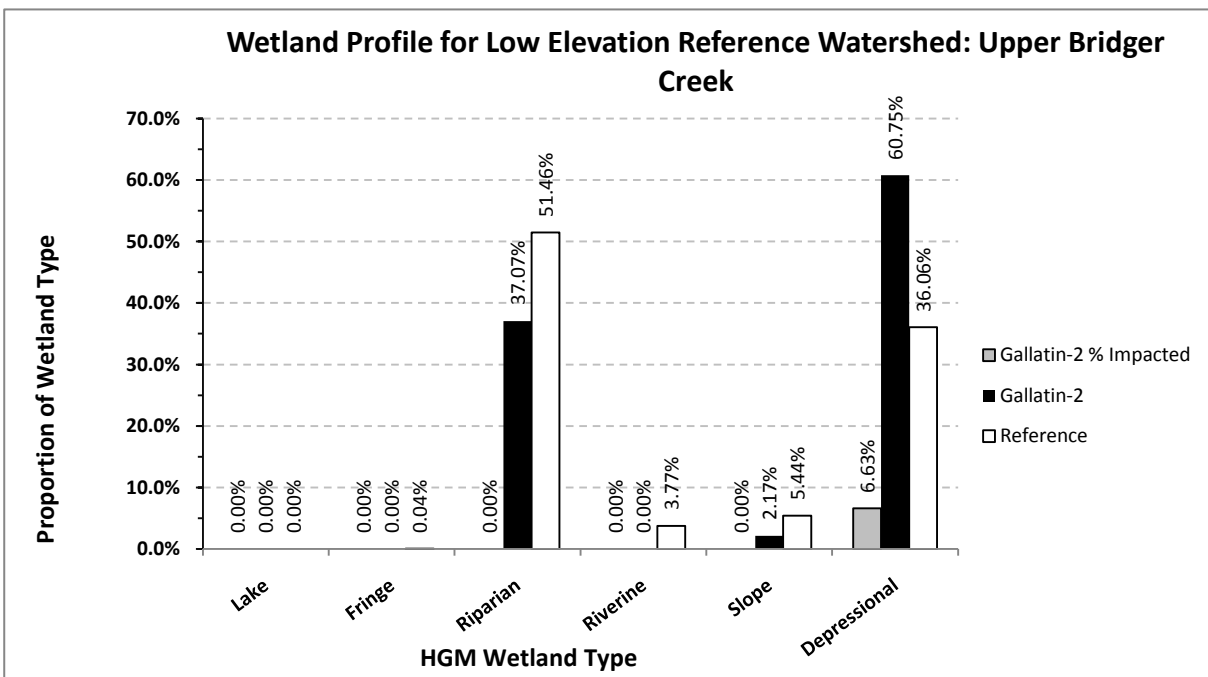
Wetland Profile: Reference Watershed Gallatin-2, Upper Bridger Creek

This brief report summarizes the wetland profiles for the Upper Bridger Creek Sub-Watershed: Gallatin-2. This sub-watershed is grouped into the Low elevation sub-watershed group. It has a mean elevation of 1645.17 m, a mean slope of 6.28 degrees, a total relief of 113 m, with the majority of stream segments having a Strahler stream order of 3.

Based on the meters of roads per acre (12.37), percent of altered land cover (31), percent of intensive agriculture (18.72), number of groundwater wells (65), and density of septic systems per acre (0.03062) within the sub-watershed. Upper Bridger Creek watershed is considered as a/an Reference sub-watershed in the Low elevation sub-watershed group for the Gallatin Watershed.

Upper Bridger Creek sub-watershed contains 166 acres of wetlands. Of which, 7 acres are considered as being modified in the National Wetlands Inventory database. The percent of wetlands in each HGM wetland type that have a high capacity to provide functions that may target water quality and quantity impairments in Upper Bridger Creek are listed below.

	Flood Attenuation	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Fringe	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Riparian	99.91%	0.00%	0.00%	0.00%	50.30%	0.00%
Riverine	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Slope	100.00%	0.00%	58.22%	0.00%	0.00%	0.00%
Depressional	80.97%	67.20%	71.63%	0.00%	0.00%	0.71%



* Note: Gallatin-2 % Impacted denotes the percentage of wetlands within that HGM Wetland type that are considered as modified in the NWI Database. Percentages of HGM Wetland Types in the Reference and Gallatin-2 watersheds are proportions of the total. For example, as the proportion of wetlands in one HGM Type increases, the other wetlands types will decrease.

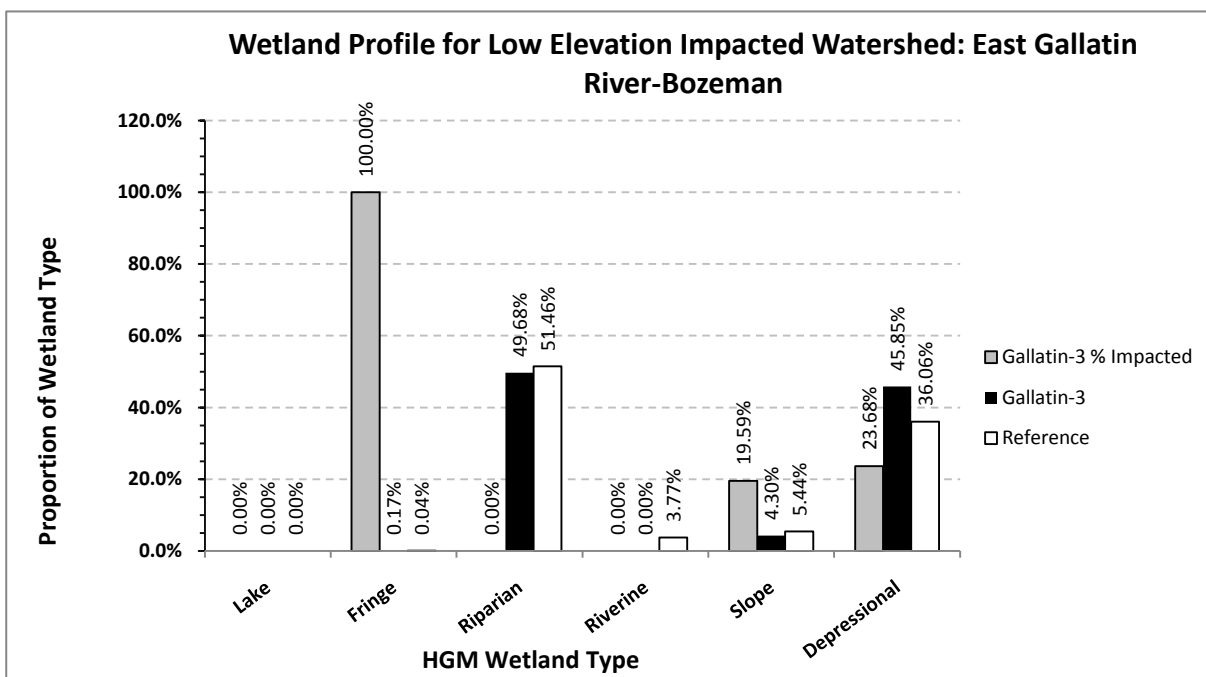
Wetland Profile: Impacted Watershed Gallatin-3, East Gallatin River-Bozeman

This brief report summarizes the wetland profiles for the East Gallatin River-Bozeman Sub-Watershed: Gallatin-3. This sub-watershed is grouped into the Low elevation sub-watershed group. It has a mean elevation of 1455.3 m, a mean slope of 2.62 degrees, a total relief of 346 m, with the majority of stream segments having a Strahler stream order of 1.

Based on the meters of roads per acre (16.74), percent of altered land cover (67), percent of intensive agriculture (29.11), number of groundwater wells (1379), and density of septic systems per acre (0.12646) within the sub-watershed. East Gallatin River-Bozeman watershed is considered as a/an Impacted sub-watershed in the Low elevation sub-watershed group for the Gallatin Watershed.

East Gallatin River-Bozeman sub-watershed contains 1053 acres of wetlands. Of which, 125 acres are considered as being modified in the National Wetlands Inventory database. The percent of wetlands in each HGM wetland type that have a high capacity to provide functions that may target water quality and quantity impairments in East Gallatin River-Bozeman are listed below.

	Flood Attenuation	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Fringe	0.00%	88.84%	0.00%	0.00%	0.00%	15.88%
Riparian	95.50%	0.00%	0.00%	0.00%	39.13%	0.00%
Riverine	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Slope	2.37%	78.22%	16.00%	0.00%	0.00%	0.00%
Depressional	22.67%	7.57%	13.02%	0.36%	0.00%	0.40%



* Note: Gallatin-3 % Impacted denotes the percentage of wetlands within that HGM Wetland type that are considered as modified in the NWI Database. Percentages of HGM Wetland Types in the Reference and Gallatin-3 watersheds are proportions of the total. For example, as the proportion of wetlands in one HGM Type increases, the other wetlands types will decrease.

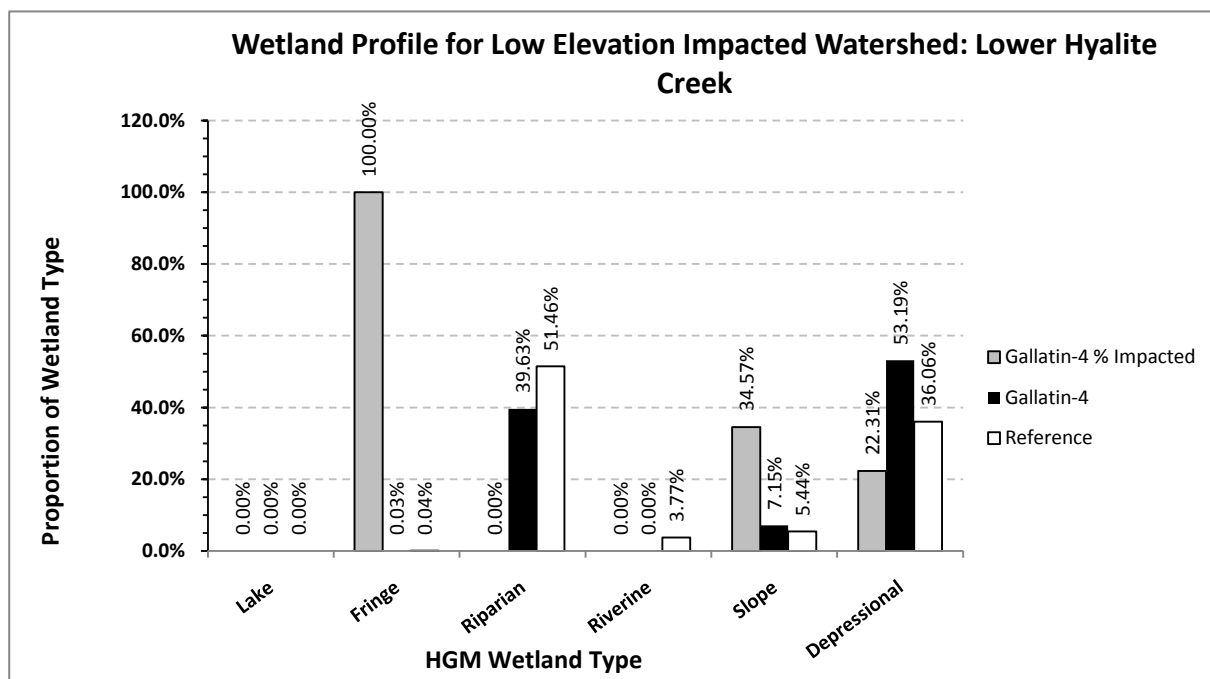
Wetland Profile: Impacted Watershed Gallatin-4, Lower Hyalite Creek

This brief report summarizes the wetland profiles for the Lower Hyalite Creek Sub-Watershed: Gallatin-4. This sub-watershed is grouped into the Low elevation sub-watershed group. It has a mean elevation of 1477.79 m, a mean slope of 1.26 degrees, a total relief of 352 m, with the majority of stream segments having a Strahler stream order of 1.

Based on the meters of roads per acre (9.01), percent of altered land cover (90), percent of intensive agriculture (46.77), number of groundwater wells (1905), and density of septic systems per acre (0.08575) within the sub-watershed. Lower Hyalite Creek watershed is considered as a/an Impacted sub-watershed in the Low elevation sub-watershed group for the Gallatin Watershed.

Lower Hyalite Creek sub-watershed contains 2547 acres of wetlands. Of which, 366 acres are considered as being modified in the National Wetlands Inventory database. The percent of wetlands in each HGM wetland type that have a high capacity to provide functions that may target water quality and quantity impairments in Lower Hyalite Creek are listed below.

	Flood Attenuation	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Fringe	0.00%	81.56%	0.00%	0.00%	0.00%	71.34%
Riparian	96.41%	0.00%	0.00%	0.00%	72.56%	0.00%
Riverine	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Slope	4.53%	70.53%	18.42%	0.00%	0.00%	0.00%
Depressional	25.46%	6.03%	10.99%	0.48%	0.00%	0.73%



* Note: Gallatin-4 % Impacted denotes the percentage of wetlands within that HGM Wetland type that are considered as modified in the NWI Database. Percentages of HGM Wetland Types in the Reference and Gallatin-4 watersheds are proportions of the total. For example, as the proportion of wetlands in one HGM Type increases, the other wetlands types will decrease.

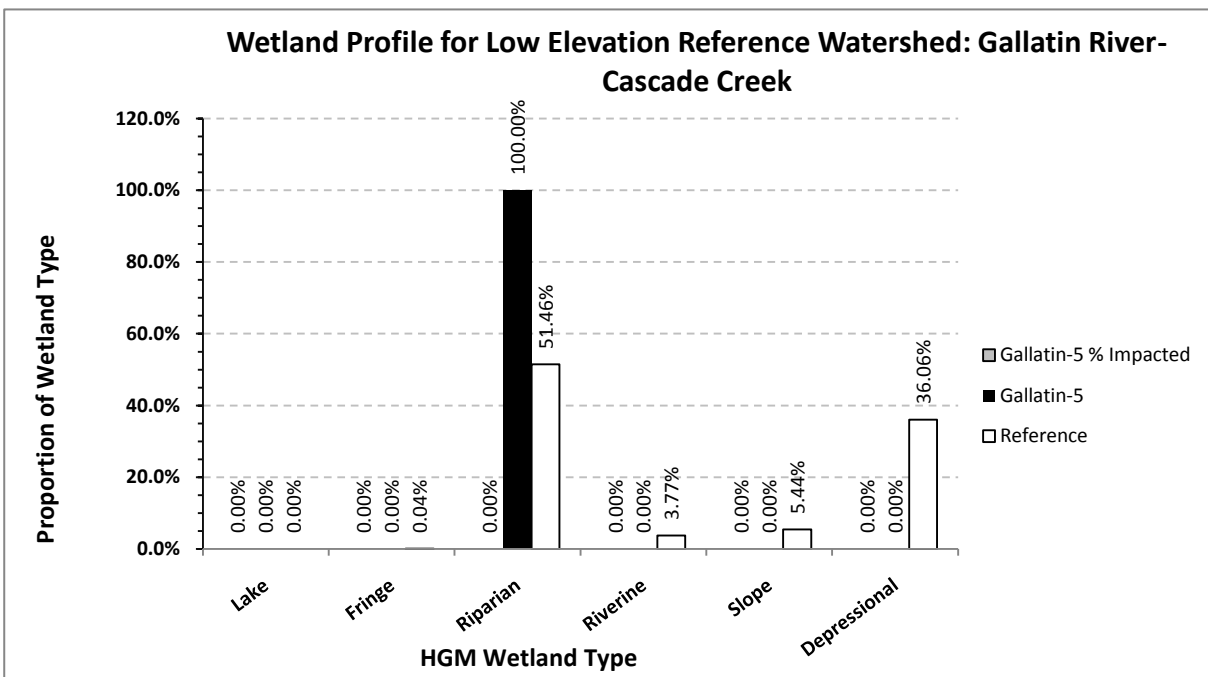
Wetland Profile: Reference Watershed Gallatin-5, Gallatin River-Cascade Creek

This brief report summarizes the wetland profiles for the Gallatin River-Cascade Creek Sub-Watershed: Gallatin-5. This sub-watershed is grouped into the Low elevation sub-watershed group. It has a mean elevation of 1659.85 m, a mean slope of 12.79 degrees, a total relief of 85 m, with the majority of stream segments having a Strahler stream order of 5.

Based on the meters of roads per acre (28.16), percent of altered land cover (17), percent of intensive agriculture (0.6), number of groundwater wells (32), and density of septic systems per acre (0.18267) within the sub-watershed. Gallatin River-Cascade Creek watershed is considered as a/an Reference sub-watershed in the Low elevation sub-watershed group for the Gallatin Watershed.

Gallatin River-Cascade Creek sub-watershed contains 34 acres of wetlands. Of which, 0 acres are considered as being modified in the National Wetlands Inventory database. The percent of wetlands in each HGM wetland type that have a high capacity to provide functions that may target water quality and quantity impairments in Gallatin River-Cascade Creek are listed below.

	Flood Attenuation	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Fringe	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Riparian	99.01%	0.00%	0.00%	0.00%	0.00%	0.00%
Riverine	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Slope	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Depressional	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%



* Note: Gallatin-5 % Impacted denotes the percentage of wetlands within that HGM Wetland type that are considered as modified in the NWI Database. Percentages of HGM Wetland Types in the Reference and Gallatin-5 watersheds are proportions of the total. For example, as the proportion of wetlands in one HGM Type increases, the other wetlands types will decrease.

2. All data sets were clipped (Shapefiles) or extracted by mask (rasters) to the extent of the HUC6 sub-watersheds. All files prior to clipping were checked to make sure the spatial references were the same
3. HUC6 sub-watersheds were divided into sub-watershed regions based on elevation. This is so that when looking at grouping of sub-watershed regions and wetland profiles there are similarities within the grouping, and more dissimilar between the groupings. Elevation break for Gallatin was 1683 m and was determined based on the point where the southern portion of the valley transitions from mountains to the valley. The Big Hole was divided into two different elevation break classes. These breaks were determined based on the geomorphology of the Big Hole watershed using the elevation several points along the river bottom to characterize the flat channeled river area (1810, 1735, 1669 and 1600 meters) and the elevation of the 1st bench (1975 m).
4. Mean elevation and relief was calculated using Zonal Statistics as Table with the HUC 6 shapefile as the zone data, ID as zone field and 30 m DEM as the input value raster. A separate table is generated and then joined to the HUC 6 shapefile and pertinent information copied.
5. Mean slope was calculated using Zonal Statistics as Table with the HUC 6 shapefile as the zone data, ID as zone field and the Slope Raster as the input value raster. The slope raster used was the Fed.Slope 30 raster found on L:\DEQ\Layers. A separate table is generated and then joined to the HUC 6 shapefile and pertinent information copied.
6. Precipitation data can be obtained for each watershed from NRIS. It is the 10 year average from 1990 – 2000. This is originally a shapefile, and preprocessing is necessary.
 - a. Clip to HUC 6 Boundary.
 - b. Dissolve based on Range field.
 - c. Convert to Raster from polygon.
 - d. Mean precipitation was then calculated using Zonal Statistics as Table with the HUC 6 shapefile as the zone data, ID as zone field and the Precipitation Raster as the input value raster. A separate table is generated and then joined to the HUC 6 shapefile and pertinent information copied.
7. Geology data is available in several formats. For these study areas the 500k Montana Bureau of Mines data was used because it was the only complete dataset. This is originally a shapefile and preprocessing was necessary.
 - a. Clip to HUC 6 boundary
 - b. Create Grouping (Field Rock-Type). This was generally done using information described in Litha field.
 - i. Open Water
 - ii. Metamorphic (meta. Intermediate,)
 - iii. Intrusive (int. intermediate, int. felsic)
 - iv. Other Sedimentary (Calcareous, Continental Sedimentary, Carbonate, siltstone, Conglomerate)
 - v. Sedimentary (Sandstone and Shale)
 - vi. Unconsolidated (Moraine and Alluvium)
 - vii. Volcanic (ext. intermediate – flow and ext. intermediate – volcanoclastic).
 - c. Dissolve by grouping to create new shapefile.
 - d. Convert to raster from polygon (Geology Grouping)
 - e. Percent of each group was then calculated using Tabulate Area with the HUC 6 shapefile as the zone data, ID as zone field and the Geology Grouping Raster as the input value raster and Rock Type as the value field. Name the table generated as “Geology_table”.
 - f. Add a float field “total” to Geology_Table.

Data Necessary Reference of Impacted Sub-Watershed Identification

1. REGAP Land Cover (Raster)
2. Roads (Shapefile)
3. USDA Crops 2009
4. National Wetlands Inventory
5. GWIC Ground Water Wells
6. Estimation of Septic Systems (DEQ Internal Dataset)
7. Points of Diversion (water rights)
8. 303d stream layer

Variables Generated:

14. Total Length of roads with in a sub-watershed
15. Meters of roads per acre with in a sub-watershed
16. Percent Altered land cover with in a sub-watershed
17. Percent Natural Land cover with in a sub-watershed
18. Percent Intensive Agriculture with in a sub-watershed
19. Percent Impacted Wetlands with in a sub-watershed
20. Number of Ground water withdrawal sites per sub-watershed
21. Number of septic systems per acres within a sub-watershed
22. Number of septic systems within a sub-watershed
23. Percent of 303d streams in a sub-watershed
24. Number of 303d stream miles in a sub-watershed
25. Average number of diversion points per stream mile within a sub watershed
26. Cumulative maximum number of gallons taken from points of diversions.
27. Impact Grouping

Preprocessing to determine impact grouping of sub-watersheds

1. Roads data was obtained from DEQ SDE and am assuming this is tiger data. Preprocessing is necessary for this dataset.
 - a. Clip roads shapefile by HUC 6 boundaries
 - b. Dissolve roads with no unique identifier (this will leave one record and treats all roads as equally impacting a watershed, this can be changed if desired and dissolved on road type)
 - c. Run Python script C:\Watershed_GIS\Scripts\Clip Roads to HUC and Calculate Percent by Area.py in Idle. This script will calculate the meters of road per acre within a given sub-watershed.
 - i. Input variables:
 1. Root folder (i.e. c:\Watershed_GIS\BigHole)
 2. HUC 6 Shapefile (name of shapefile including file extension.shp)
 3. Roads (name of dissolved Roads shapefile including file extension.shp)
 4. Text file (name of text file to write output to including file extension .txt)
 - d. Open text file in excel and save as *.xlsx file.
 - e. In ArcGIS join HUC 6 shape file and the road excel file and copy the stream length and road ratio fields.
 - f. Remove all joins

2. Land cover data was obtained from the REGAP dataset. Preprocessing is necessary for this dataset.
 - a. Clip REGAP to HUV 6 Boundaries
 - b. Reclassify data (file product should be a raster with two rows of data (Impacted (1) and Natural (2))
 - i. Impacted (1)
 1. Value field
 - a. 21 – Developed Open Space
 - b. 22 – Developed low intensity
 - c. 23 – Developed Medium intensity
 - d. 31 – quarries, mines, gravel pits
 - e. 81 – pasture / hay
 - f. 82 – cultivated crops
 - g. 8402 – Introduced upland vegetation - shrub
 - h. 8403 – introduced upland vegetation - forbland
 - i. 8404 – introduced upland vegetation – annual grassland
 - j. 8405 – introduced upland vegetation – perennial grassland
 - k. 8406 – introduced riparian and wetland vegetation
 - l. 8601 – Harvested forest-tree regeneration
 - m. 8602 – Harvested forest-shrub regeneration
 - n. 8603 – Harvested forest-grass regeneration
 - ii. Natural (2) – all other values not included in impacted
 - c. Open attribute table for Land cover reclass file and highlight record for Impacted (1).
 - i. Calculate area using Zonal Statistics as Table with HUC 6 as zone data, ID field as zone field and land cover reclass for input value raster. Name output table Impacted.
 - d. Repeat Step 2.c this time highlight record for natural (2) and name output table natural.
 - e. Open Impacted table and add two fields (Float)
 - i. Perc_Altered
 - ii. Perc_Natural
 - f. Join Impacted table and natural table based on value field.
 - i. Calculate perc_altered using the following formula in field calculator
 1. $\text{Impacted:Perc_Altered} = \text{Impacted:Area} / (\text{Impacted:Area} + \text{Natural:Area})$
 - ii. Calculate perc_natural using the following formula
 1. $\text{Impacted:Perc_Natural} = 1 - \text{Impacted:Perc_Altered}$
 - iii. Remove all joins from impact table
 - g. Join HUC 6 shapefile to Impacted table and copy perc_altered and perc_natural to HUC 6 table.
 - h. Remove all joins
3. Crop data was obtained from the 2009 USDA Cropland database available on the web through USDA/NASS. Preprocessing is necessary for this dataset.
 - a. Clip crop data to HUV 6 boundaries
 - b. Reclassify data (file product should be a raster with two rows of data (Intensive Ag (1) and other (0))
 - i. Intensive Ag (1) *note in other watershed other forms of intensive ag may be present and should be included in this list (i.e. 41-sugar beets):
 1. 1-Corn

2. 4-Sorghum
 3. 5-Soybeans
 4. 6-Sunflowers
 5. 12-Sweet Corn
 6. 13-Pop. Or Orn. Corn
 7. 14-Mint
 8. 21-Barley
 9. 22-Durum Wheat
 10. 23-Spring Wheat
 11. 24-Winter Wheat
 12. 25-Other small grains
 13. 28-Oats
 14. 29-Millet
 15. 33-Safflower
 16. 35-Mustard
 17. 36-Alfalfa
 18. 37-Other Hays
 19. 38-Camelina
 20. 42-Dry beans
 21. 43-Potatoes
 22. 53-Peas
 23. 58-Clover/Wildflowers
 24. 59-Seed/Sod Grass
- ii. Other (0) – all values not included in intensive.
 - c. Calculate the area of Intensive Ag and other per sub-watershed using the Tabulate area tool under the Spatial Analyst/Zonal toolset. With HUC 6 for the feature zone data, ID for zone field, crop reclass raster for input raster, value for class field and name the output table intensive_ag.
 - d. Open intensive_ag table and add field (float) named perc_imp_Ag.
 - e. Calculate perc_imp_ag using the following formula in field calculator
 - i. $\text{Value}_1 / (\text{Value}_0 + \text{Value}_1)$
 - f. Open Huc 6 shapefile attribute table and add field perc_imp_ag (Float)
 - g. Join HUC 6 shapefile to Intensive_ag table and copy perc_imp_ag to HUC 6 table.
 - h. Remove all joins
4. Provisional Wetland data was obtained from the natural heritage program as the complete dataset has not yet been posted to the NWI database. This shapefile contains both wetland, lacustrine, riverine and riparian data. Preprocessing on this data is necessary
 - a. Clip the wetland shape file to HCU 6 boundaries.
 - b. Open clipped wetland shapefile and add new field Impacted (Float)
 - c. Start editing wetland shapefile.
 - i. Delete all records that are:
 1. L1% (Deepwater habitat)
 2. R%US%, or R%UB%, or R%SB% (do not delete other veg classes like EM or AB).
 - ii. Select by attributes to determine altered wetlands using the following formula
 1. 'ATTRIBUTE' LIKE '%x' OR 'ATTRIBUTE' LIKE '%d' OR 'ATTRIBUTE' LIKE '%h' OR 'ATTRIBUTE' LIKE '%f'
 - iii. Calculate Impacted using field calculate for selected records

1. 'Impacted' = 1
 - iv. Stop editing and save edits.
- d. Select by attributes to differentiate between wetland and riparian areas using the formula
 - i. 'ATTRIBUTES' LIKE 'P%' or 'ATTRIBUTES' LIKE 'L%'
 - ii. Export wetlands to new shapefile named wetlands
 - iii. Switch selection (so Riparian and Riverine are highlighted) and export to new shapefile name riparian
- e. Dissolve wetlands shapefile based on the Impacted field and name impacted_wetlands_dissolve.shp
- f. Run python script C:\Watershed_GIS\Scripts\Clip Wetlands to HUC and Calculate Percent.py. This will calculate the percent of wetland area within a sub-watershed that is impacted or not impacted. Output is a text file.
 - i. Input variables:
 1. Root folder (i.e. c:\Watershed_GIS\BigHole)
 2. HUC 6 Shapefile (name of shapefile including file extension.shp)
 3. Impacted Wetlands Shapefile (name of dissolved Wetlands shapefile including file extension.shp)
 4. Text file (name of text file to write output to including file extension .txt)
- g. Open text file in excel and save as *.xlsx file.
- h. In ArcGIS join HUC 6 shape file and the impacted wetland excel file and copy the perc_impacted_wet field to HUC 6 shapefile.
- i. Remove all joins
5. Groundwater data was obtained from the Montana Groundwater Information Center Water Well Data (GWIC GW) from 2010.
 - a. Perform a spatial join of the HUC 6 shapefile with the GWIC GW shapefile, under #2 check the sum. Name the new shapefile GW_SJ
 - b. Open the HUC 6 attribute table and add two new fields named GW_Wells (Short Integer) and max_gal_per_min (short Integer, ArcGIS will shorten)
 - c. Join the HUC 6 shapefile and the GW_SJ shapefile based on the id fields
 - i. Calculate GW_Wells field using field calculator with the following expression:
 1. HUC 6.GW_Wells = GW_SJ.Count_
 - ii. Calculate max_gal_p_ field using field calculator with the following expression (only done for Big Hole Watershed):
 1. HUC 6. max_gal_p_ = GW_SJ.Sum_Yield
 - d. Remove all joins
6. Septic system data was obtained from an internal DEQ Database (L:\PPA\TFA\Data\ArcData\Septic_centroids\Estimated_septics.shp). This is only an estimation of septic systems per residential property outside of city limits where it is assume that sewer systems exist. Metadata for this shapefile exists and explains the methods used for development.
 - a. Clip septic data to HUC 6 boundaries.
 - b. Perform a spatial join of the HUC 6 shapefile with the clipped septic shapefile, under #2 check the sum. Name the new shapefile septic_SJ
 - c. Open the HUC 6 attribute table and add two new fields named Num_septic (Short Integer) and Septic_per_Acre (float)
 - d. Join the HUC 6 shapefile and the septic_SJ shapefile based on the id field
 - i. Calculate num_septic field using field calculator with the following expression:

1. HUC 6.num_septic = septic_SJ.Count_
 - ii. Calculate septic_per_acre field using field calculator with the following expression:
 1. HUC 6.septic_per_Acre = septic_SJ.count_ / HUC 6.Acre
 - e. Remove all joins
7. 303d stream data was obtained from DEQ's Water Protection Bureau. Used was the 2008 final data, use the most current finalized data as provisional data does exist. (this was run only for the big hole)
 - a. Clip 303d streams to HUC6 Boundaries
 - b. Dissolve the 303d streams
 - c. Run python script C:\Watershed_GIS\Scripts\Clip TMDL Streams to HUC and Calculate Percent.py. This will calculate the total length of NHD Medium res streams in a sub-watershed, the total length of 303d streams per sub-watershed, and the percent of 303d listed streams within a sub-watershed. Output is a text file.
 - i. Input variables:
 1. Root folder (i.e. c:\Watershed_GIS\BigHole)
 2. HUC 6 Shapefile (name of shapefile including file extension.shp)
 3. Streams (name of shapefile identifying dissolved NHDPlus streams including file extension.shp)
 4. 303d listed streams (name of dissolved 303d streams shapefile including file extension.shp)
 5. Text file (name of text file to write output to including file extension .txt)
 - d. Open text file in excel and save as BH_303d_Stats.xlsx file.
 - e. Open the HUC 6 shapefile and add a two new fields, Perc_303d (float) and Stream_Miles (float)
 - f. In ArcGIS join HUC 6 shape file and the 303d excel file.
 - i. Copy the perc_impaired field to Perc_303d field in the HUC 6 shapefile.
 - ii. Copy the stream total field in excel file to "stream_miles" field in the HUC 6 shapefile using the following expression:
 1. HUC 6.Stream_miles = BH_303d_Stats.Stream_total * 0.000621371192
 - g. Remove all joins
8. Obtain the points of diversion shape file from MT NRIS for the area of interest (this was run only for the Big Hole sub-watershed).
 - a. Clip points of diversion to HUC 6 boundaries.
 - b. Run python script C:\Watershed_GIS\Scripts\Clip Points of Diversion to HUC and count.py. This will count the number of documented points of diversions within a sub-watershed. Output is a text file.
 - i. Input variables:
 1. Root folder (i.e. c:\Watershed_GIS\BigHole)
 2. HUC 6 Shapefile (name of shapefile including file extension.shp)
 3. Points of diversion (name of shapefile identifying points of diversion including file extension.shp)
 4. Text file (name of text file to write output to including file extension .txt)
 - c. Open text file in excel and save as Points_of_Div_Stats.xlsx file.
 - d. Open the HUC 6 shapefile and add a new field "Pts_of_Div" (float).
 - e. In ArcGIS join HUC 6 shape file and the points of division excel file

- [illegible]

1. Using SPSS open *watershed_stats.xlsx*.
2. Calculate K – means cluster analysis for 3 groups with Cases labeled by ID
 - a. Try all combinations of data variables for sub-watershed region identification (not impact regions)
 1. For example:
 1. Iteration 1: Mean_elev, Relief, Mean_slope, Mean_precip, SO_Maj
 1. Iteration 2: Mean_elev, Relief, Mean_slope, Mean_precip, SO1_perc, So2_perc, So3_perc, So4_perc, So5_perc, PErc_OW, Perc_oth_S, Perc_Unc, PErc_Vol, Perc_Intr, Pec_meta, Perc_Sed
 - b. Using box plots and Shannon's diversity index (or other method) test to see which combination of sub-watershed region identification variables used to develop grouping shows the least diversity within sub-watershed regions and the greatest diversity between sub-watershed regions.
 - c. Export SPSS results to excel file keeping only the best sub-watershed region grouping (*watershed_stats_results.xlsx*.)
3. In ArcGIS, join HUC 6 to SPSS results table based on ID fields and copy the sub-watershed region grouping information to the HUC 6 shapefile.
4. Remove all joins.

1. Using SPSS open watershed_stats_results.xlsx. (the following steps are done individually for each sub-region watershed grouping which can be setup through “select cases”
2. Calculate K –means cluster analysis for 2 groups with cases labeled by ID
 - a. Data variables to be used are
 - i. Road Ratio
 - ii. Perc_Altered
 - iii. Perc_int_ag
 - iv. Perc_imp_wetland
 - v. GW_Wells
 - vi. Septic_per_acre
 - vii. Num_Septic
 - viii. Perc_303d
 - ix. Pts_of_Div
 - x. Max gal p

- b. Using box plots and Shannon's diversity (or other method) test to see if groups show the least diversity within impact group and the greatest diversity between impact grouping within a given sub-watershed region group. Play with different combinations of variables to see statistically which grouping is best.
 - c. Export to excel file (*watershed_stats_all.xlsx*)
 3. In ArcGIS join HUC 6 to SPSS results table based on ID fields and copy the impact grouping information to the HUC 6 shapefile.
 4. Remove all joins.

Appendix D:

Needs and Capabilities Assessment (NCA)

The **Needs and Capabilities Assessment (NCA)** is a simple tool to help you quickly organize known programs and resources that can be potentially applied to watershed protection and restoration, as well as identify potential resources you may not have considered. This NCA has been modified to help determine where and how to best incorporate wetland into the Watershed Restoration Planning Process for each of the pilot projects associated with the “Integrating Wetlands into Watershed Planning” demonstration project.

Please take a few minutes to complete the following questionnaire for a specific watershed. If your watershed contains multiple jurisdictions/communities, choose the one that has the most area or land use authority in the watershed. The NCA is divided into five sections designed to identify existing resources you can use as support for protection and restoration activities.

Part 1. Regulatory Forces Driving Watershed Planning

This part examines federal and state “regulatory drivers” that influence watershed management in the region and can possibly provide financial or technical resources for implementation. Such drivers may include regulatory mandates of the Clean Water Act, Safe Drinking Water Act, Endangered Species Act, and regulations such as TMDLs, MS4 NPDES storm water permits, or Source Water Control Plans.

Part 2. Local Agency Capacity

This part is used to discern local program capability for watershed protection, data availability, restoration and protection experience, and funding and mapping resources.

Part 3. Your Local Agency Restoration Rolodex

This part identifies key local agencies and staff to involve in watershed planning in your area. You should get to know these people and programs and integrate them into your protection and restoration efforts.




Part 4. Adding Non-local Government Partners to Your Rolodex



This part helps recruit additional stakeholders and resources outside of local government such as private, non-profit, regional, state, or national partners that can provide financial, technical, or programmatic assistance for your watershed planning and implementation.







Part 5. Community Attitudes

This part identifies current community attitudes towards streams, wetlands, and watersheds. Community support can make or break your efforts. Smart watershed managers have their finger on the pulse of the community and can utilize local media and community groups to target their restoration and protection endeavors.

Part 1. Regulatory Forces Driving Watershed Planning	
1. Do your communities have Phase I or II EPA NPDES storm water permits? <i>If so, local municipalities are required to meet a set control measures to minimize stormwater impacts. These measures include implementing education and outreach, stormwater retrofits, illicit discharge detection and elimination programs, etc. that you can leverage for support.</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
2. Are any waters in your watershed not meeting water quality standards? <i>If yes, a TMDL that deals with NPS controls may need to be developed. If not, you may have identified some high quality streams or wetlands that you may want to focus your protection efforts on (i.e. land conservation, better site design, and stringent stormwater criteria).</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
3. Do your communities have combined or sanitary sewer overflows? <i>If yes, then your communities would certainly benefit from stormwater reduction activities. Alternatively, municipalities may be in the process of sewer separation and outfall modifications that might be linked with your riparian restoration efforts.</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
4. Is your watershed part of a drinking water supply? <i>Many sole-source drinking water watersheds require a Source Water Protection Plan.</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
5. Are endangered species present in your watershed? <i>If so, watershed activities may be prompted under the ESA (i.e. Pacific salmon, Barton Springs salamander, etc.). Think about how your community should adapt its land use planning and stormwater management practices to better protect these species. If Yes, are wetlands considered as critical habitat for these species? Please list which species.</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
6. Is your watershed encompassed within a regional or multi-state watershed agreement? <i>If so, look to MOUs and agreements, mitigation ratios, 6217, and NEP program guidance to assist in establishing watershed goals or providing financial or technical support for planning efforts.</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
 7. Are any state species of concern present in the watershed that rely upon wetland and riparian areas as critical habitat? <i>If Yes, please list the species and their State and Global Rankings. This information is generally found through the MT Natural Heritage Program or the Department of Fish, Wildlife and Parks.</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
 8. Are any specially-designated wetlands located in your watershed? <i>State Wetland Conservation Plans, Special Area Management Plans, Important Bird Areas, Advanced Identification, and other assessments and reports may have identified wetlands with special designation (such as outstanding natural resource waters) due to high functional value or high quality. Funding may be available for implementing conservation and restoration projects in these watersheds, and these sites should be recommended as priorities for mitigation</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
 9. Is environmental protection or enhancement a strong factor in local land use decisions, redevelopment incentives, or transportation planning? <i>If so, consider utilizing local environmental regulations to support your efforts (i.e., forest conservation, stormwater utility, wetland protection, environmental overlay districts, open space requirements, buffer ordinances, and incentive programs).</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know

	10. Are wetland alterations frequently permitted in your watershed? <i>If so, become familiar with federal 404 wetland protections, 401 WQ certification, and other features of the Clean Water Act as well as state certifications such as 310 and 318 designed to help you protect your aquatic resources.</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
	11. Does your state or local communities have its own wetland protection regulations? <i>Some states/locales have adopted protection standards more stringent than federal requirements. Some provide protection for wetland types or sizes that are not currently protected by the federal program; others require wetland buffers, or regulate activities that are not addressed by the federal program.</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
<i>If not, you may consider pursuing adoption of local wetland protection regulations, since federal regulations may not protect all critical wetland resources. These local regulations can employ additional site development criteria to protect both wetlands and the areas that drain to them.</i>		
	12. Does your watershed have potential recharge areas? <i>These areas may be critical for maintaining the quantity and quality of groundwater supplies, wetlands, and other hydrologic features. Many communities have land use planning criteria for recharge areas that you may be able to use.</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
<p>► Do you have any untapped regulatory resources in your communities? (Try listing at least 2)</p> <p>1.</p> <p>2.</p>		

Part 2. Local Agency Capacity		
13. Have any watershed studies, plans or research been conducted in the past ten years? <i>The data and mapping from past watershed studies can help set a baseline.</i>		
<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know		
14. Does an interagency workgroup exist to coordinate watershed issues?		
<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know		
	15. Do interagency workgroups exist to coordinate wetland restoration and protection efforts? <i>Consider as part of a larger watershed workgroup, having a subcommittee dedicated to coordinating wetland mitigation, permitting, protection, tracking, and assessment efforts.</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
16. Do you know which agencies are responsible for collecting water quality samples and other monitoring data? <i>If so, please list who and contact information.</i>		
<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know		
	17. Is wetland water quality or other wetland monitoring data collected? <i>If so, who is responsible for collecting this data, and is it publically available. Please list group(s) or agency(s) collecting data and contact information.</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
18. Do existing public outreach education programs exist?		
<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know		

	19. Do local wetland protection or storm water management regulations require local engineers to evaluate stormwater impacts on downstream wetlands? <i>This data may be able to assist you in identifying vulnerable wetlands, running models to predict loss of wetland functions, and identifying restoration opportunities.</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
	20. Is local engineering staff engaged in storm water retrofitting? <i>If not, watershed groups can provide this service for local governments, particularly those under pending Phase II permits</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
	21. What agencies own the largest blocks of land in your watershed? <i>You may be surprised to see how much land is publicly owned in your watershed. Some of the most feasible restoration projects occur on publicly owned land. Consider which protection techniques to apply to surrounding or upstream or neighboring parcels to help maintain the quality of this open space.</i>	<input type="checkbox"/> Schools <input type="checkbox"/> Parks <input type="checkbox"/> Utility <input type="checkbox"/> Golf course <input type="checkbox"/> Municipality <input type="checkbox"/> Don't Know
	22. Are any greenway or wetland mitigation efforts planned or underway in your watershed? <i>If so, these are great opportunities for you to slip in some restoration projects and educate watershed residents on proper buffer and landscape practices.</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
	23. Have any inventories been conducted to evaluate natural area remnants (e.g. forests, wetlands, or open space)? <i>Some communities have compiled detailed inventories of remaining forest, parks, and wildlife areas—these can be extremely helpful in identifying natural area remnants before going out in the field. Wetland inventories are harder to come by, particularly information on condition, function, and restorability.</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
	24. Do your communities have a sense of which remaining natural areas are likely to be threatened by development? <i>Development often fragments forests and directly or indirectly alters wetland function. Do your communities know what your wetland functions are and which ones you will likely lose as the watershed develops?</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
	25. Has your community identified sensitive wetland communities and high quality wetlands? <i>Some communities have identified their wetlands that are considered sensitive to storm water runoff, which include high quality wetlands that are conservation priorities.</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
	26. Do your communities maintain natural resource maps at the local scale (i.e. wetlands, forest cover, open space, sensitive habitats)?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
	27. Have your communities delineated contributing drainage areas to sensitive or high quality wetlands?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
	28. Are floodplains mapped and managed based on FEMA requirements?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
	29. Does a storm water utility or other dedicated funding mechanism exist for storm water infrastructure maintenance or upgrades? <i>A growing number of communities have established a utility to support storm water planning and maintenance, which can be a dedicated source of funding for watershed restoration.</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
	30. Do wetland mitigation banks or in lieu fee mitigation programs exist for your watershed? <i>If so, this indicates that compensation for unavoidable impacts to wetlands may be being provided through funding from local development projects.</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
	31. Do capital or operating budgets exist that can be used or leveraged for watershed-related purposes? <i>Examine local capital and operating budgets to find line</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know

items and program areas that are related to watershed management.

32. Do you understand the procurement pathways for municipal contracting for restoration design and construction? *Most restoration projects are built using local dollars, so it helps to know the municipal contracting process to develop restoration projects.* ☐ Yes ☐ No ☐ Don't Know


33. Have communities in your watershed received any environmental grants available from state, federal, or private sources in the last two years? *Check with your state environmental agency(ies) to see what grants are available and what has been previously awarded. EPA also maintains a list of federal grants for watershed and wetland restoration. Review the project reports for previous grants.* ☐ Yes ☐ No ☐ Don't Know


► Is your community watershed capacity lacking in any areas? (Try listing at least 2)

1.

2.

Part 3. Your Local Agency Watershed Rolodex

 **34. Do you know what agency is primarily responsible for mapping & GIS? Are they doing fine scale mapping of wetland and riparian areas?** Agency:
Name:
Phone:






 **35. Do you know what local agency is primarily responsible for conducting stream or wetland assessments?** Agency:
Name:
Phone:

36. Do transmission lines cross your watershed? *If yes, these guys can be great financial partners in riparian restoration and stream stabilization projects.* ☐ Yes ☐ No ☐ Don't Know
Contacts:

37. Do any units handle land stewardship within the local parks agency? *Most local park agencies have naturalist, biologists and other staff that manage natural areas. Be sure to enlist them to spread the stewardship message and provide support on protection and restoration projects.* ☐ Yes ☐ No ☐ Don't Know
Contacts:

38. What agency handles street and storm drain maintenance? *Public Works Departments play a strong role in restoration through their municipal pollution prevention efforts.* Agency:
Name:
Phone:

39. Which department handles storm water and flood plain management functions?	Agency: Name: Phone: <input type="checkbox"/> Don't Know
40. Which agency coordinates emergency spill response? <i>Preventing polluted runoff at storm water hotspots is an important element of watershed protection. These people can help identify pollution risks and develop pollution prevention and spill response plans.</i>	Agency: Name: Phone: <input type="checkbox"/> Don't Know
41. Which utilities manage the sanitary sewer network and if they are in compliance? <i>Sewer lines often run along stream corridors and cross wetland complexes, so these folks will be integral to your efforts.</i>	Utility: Name: Phone: <input type="checkbox"/> Don't Know
42. Who is responsible for pollution prevention compliance at municipal operations? <i>Good housekeeping for municipal operations is not only a NPDES Phase II requirement, but is also a good way to demonstrate environmentally sensitive practices.</i>	Agency: Name: Phone: <input type="checkbox"/> Don't Know
43. Which agency(s) handles household hazardous waste, used oil recycling, composting and other personal stewardship programs? <i>Consider integrating watershed education (i.e., downspout disconnection, proper lawn maintenance, pet waste, buffer management) with these existing homeowner stewardship programs.</i>	Agency: Name: Phone: <input type="checkbox"/> Don't Know
44. Do you know the unit that plants and maintains trees? <i>You may have public lands in need of reforestation and street trees, and these folks can be a great source for planting materials and equipment.</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know Agency: Name: Phone:

	<p>45. Do you know who designs and constructs wetland and stream restoration projects in your area whether government, for-profits corporations, or nonprofit entities? <i>Successful wetland and stream restoration can be elusive and projects can easily become expensive failures.</i></p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
		Company:
		Name:
		Phone:
	<p>46. Do you know the department that handles development review and land use planning? <i>Watershed development can negatively impact stream and wetland quality, and there are many stages along the land development process where environmental safeguards can be applied.</i></p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
		Agency:
		Name:
		Phone:
	<p>47. Do you know who reviews/establishes stormwater management or drainage criteria? <i>If you want to protect sensitive resources, you may want to work on requiring more stringent design criteria, performance monitoring, and proper maintenance.</i></p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
		Agency:
		Name:
		Phone:
	<p>48. Do you know what agency reviews/establishes grading requirements or oversees erosion and sediment control (ESC) implementation? <i>Site construction can be one of the most critical phases of the development cycle in terms of impacts to streams, wetlands, and other receiving waters. ESC often fails due to improper practice installation and maintenance, so you may want to encourage enhanced enforcement in sensitive areas (i.e. upstream of sensitive wetlands).</i></p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
		Agency:
		Name:
		Phone:
	<p>49. Do you know who enforces local protection of natural resources, such as trees and forests, open space, wetlands, and their buffers?</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
		Agency:
		Name:
		Phone:



50. Do you know who tracks septic system installation and maintenance? *Very few communities have a good grasp on how many septic systems are in their watershed, much less how well they are maintained until there is a significant problem.*

☐ Yes ☐ No ☐ Don't Know

Agency:

Name:

Phone:

► Who in the local government is missing from your rolodex? (Try listing at least 2)

1.

2.

Part 4. Adding Non-Local Government Partners to Your Rolodex

51. Do any colleges or universities exist in or near your watershed? *If so, consider all the free academic research and graduate student labor you can direct towards your watershed. You may also be able to tap into the scientific community (e. g., Society of Wetland Scientists), student environmental groups, or use library resources.*

☐ Yes ☐ No ☐ Don't Know

University:

Name:

Phone:

52. Are local civic associations in your rolodex? *Garden clubs, scout troops, church and youth groups, neighborhood association, etc. are a terrific source for volunteers.*

☐ Yes ☐ No ☐ Don't Know

Group:

Name:

Phone:



53. Do any regional organizations have resources or expertise to lend to the watershed effort? *Do you have any non-profits in your area that can contribute to the watershed effort? Think about councils of governments, soil and water conservation districts, extension agencies, and "friends of" groups.*

☐ Yes ☐ No ☐ Don't Know

Group:

Name:

Phone:


	<p>54. Are there any national organizations that might have an interest in your watershed? <i>What about Ducks Unlimited, Trout Unlimited, Audubon, or the Nature Conservancy— these groups are great advocates for wetland and habitat protection!</i></p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
		Organization:
		Name:
		Phone:
<p>55. Do developable areas still exist in your watershed? <i>If so, get to know your local homebuilders association. Open space design can be mutually beneficial to builders and environmentalists. In some cases, additional conservation and restoration or opportunities may present themselves. Keep your eye open for storm water retrofit, wetland restoration, and land reclamation opportunities. Opportunities for improving storm water treatment may also be found during redevelopment.</i></p>		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
		Group/Company:
		Name:
		Phone:
<p>56. Are there large tracts of state, federal or institutional land present in the watershed? <i>If so, these landowners should be invited to participate in the planning effort. If there are large tracts of privately held land, landowner interviews will be critical to generating support for conservation easements and land stewardship.</i></p>		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
		Name:
		Phone:
<p>57. Do any land trusts exist in the area? <i>Protection of remaining wetlands, contiguous forests, steep slopes and special habitats is integral to overall watershed management. Whether governments have the capacity to manage conservation easements, consider land trusts as a viable alternative.</i></p>		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
		Group:
		Name:
		Phone:
<p>58. Do any state or federal agencies have gauges or monitoring stations in the watershed? <i>Unlike local or academic monitoring, the USGS and many state agencies have the ability to provide long-term monitoring. If monitoring stations exist, take advantage of the information to establish baseline conditions and track watershed changes over time. If not, consider building a case for gauge installation.</i></p>		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
		Agency:
		Name:
		Phone:
	<p>59. Do you know any private-sector environmental consultants? <i>These folks may be tapped for conducting functional wetland assessments, updating local GIS databases, designing restoration projects, or identifying conservation and restoration opportunities.</i></p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
		Company:
		Name:
		Phone:

<p>60. Do you know who covers the environmental beat? <i>Get to know one or two local reporters who you can call to cover watershed related issues and events.</i></p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
<div style="text-align: right;">Paper/News:</div> <div style="text-align: right;">Name:</div> <div style="text-align: right;">Phone:</div>	
<p>61. Are any GIS mapping layers available from non-local sources? <i>Don't assume that the data is not available just because your local government does not have a well-developed or accessible system. A variety of internet sites (www.datadepot.com, USGS, etc.) where you can download data for a small fee.</i></p> <p><i>List these and their locations if known:</i></p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
<div style="display: flex; align-items: flex-start;"> <div> <p>62. Do you know who is in charge of Section 404 permitting for jurisdictional wetlands in your watershed? <i>The Army Corp of Engineers is generally responsible for granting permits and approving wetland delineations for federally protected wetlands. The EPA has veto authority over the USACE decisions.</i></p> <p><i>Some states or localities also require permits for impacts to wetlands, so another thing you should consider is the working relationship between local or state reviewers and federal permitters.</i></p> </div> </div>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
<div style="text-align: right;">Agency:</div> <div style="text-align: right;">Name:</div> <div style="text-align: right;">Phone:</div>	
<div style="display: flex; align-items: flex-start;"> <div> <p>63. Are there any roadway construction projects in your watershed? <i>State DOTs generally have the greatest impacts on wetland and riparian resources. As a result, they may have money for wetland mitigation projects.</i></p> </div> </div>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
<div style="text-align: right;">Name:</div> <div style="text-align: right;">Phone:</div>	
<p>► Who else is missing from your rolodex? (Try listing at least 2)</p> <p>1.</p> <p>2.</p>	

Part 5. Community Attitudes


64. What are the primary water resource concerns in your communities? *Successful planning requires input from diverse interests and the integration of seemingly disparate objectives within watershed goals (flooding, air quality, economic growth, historic preservation, etc.).*
Please list:

65. Is your watershed a popular recreational destination? *There is no better way to generate public support for watershed activities than to link them to recreational amenities. Enlist fishing, hiking, biking, canoeing, duck hunting, and other recreational groups to your cause.* ☐ Yes ☐ No ☐ Don't Know

 **66. Is the general public's basic level of watershed awareness relatively high in your watershed?** *Stakeholder involvement must be targeted at many levels ranging from local government staff to neighborhoods to individual homeowners. Each step in watershed planning should contain a public component designed to engage and inform local communities.* ☐ Yes ☐ No ☐ Don't Know

67. Are elected officials or senior agency staff aware of the term watershed management? *If framed in the right way, watershed management can be politically popular because it provides services to constituents in the neighborhoods and public areas.* ☐ Yes ☐ No ☐ Don't Know

68. Has the local press/media covered your watershed in the past 3 months? *If not, why not? Call up your local reporters and have them come out with you in the field or advertise a big event. This is a great way to begin educating the public and giving recognition to supportive local officials and staff.* ☐ Yes ☐ No ☐ Don't Know

 **69. What are the local attitudes towards wetlands?** *Are wetlands viewed as an amenity or as a nuisance (e.g., mosquito sources)? You'll want to start making a list of the specific services your wetlands provide (fish habitat, drinking water filters, nutrient processing, flood prevention, etc.)—particularly the economic benefits.* ☐ Amenity ☐ Nuisance ☐ Don't Know

Comments/Notes:

Appendix E:

The Eight Tools Audit

The Eight Tools Audit is designed to identify regulatory and programmatic tools and gaps in your watershed protection arsenal. The self-assessment is organized by the eight categories of protection tools available in most communities. These tools roughly correspond to the stages of the development cycle from initial land use planning, site design, and construction through home ownership. As a result, a watershed manager will generally need to apply some form of all eight tools in every watershed to provide comprehensive watershed protection. The eight tools include:

- *Land Use Planning*—identify which regulatory measures and/or planning techniques are in use in your community to manage growth, redirect development where appropriate, and protect sensitive areas (i.e., zoning, overlay districts, growth boundaries).
- *Land Conservation*—outline programs or efforts to conserve undeveloped, sensitive areas or areas of particular historical or cultural value (i.e., PDR, land trusts, agricultural preservation, tax incentives).
- *Aquatic Buffers*—evaluate criteria for the protection, restoration, creation, or reforestation of stream, wetland, and urban lake buffers (i.e., width, vegetative standards, and incentives).
- *Better Site Design*—assess flexibility of local codes and ordinances to reduce impervious cover, integrate stormwater management, and conserve natural areas in the design of new and redevelopment projects.
- *Erosion and Sediment Control*—examine criteria for the use of erosion prevention, sediment control, and dewatering practices at all new development and redevelopment sites.
- *Stormwater Management*—assess criteria for design of structural practices in new development, redevelopment, or the existing landscape to help mitigate the impacts of stormwater runoff on receiving waters.
- *Non-stormwater discharges*—evaluate operations and maintenance programs for locating, quantifying, and controlling non-stormwater pollutant sources in the watershed.
- *Watershed Stewardship Program*—identify extent of existing stormwater and watershed education or outreach programs; restoration efforts, and monitoring activities.

► Please complete the following self-assessment for your watershed. This assessment work best in a watershed of 100 sq. miles or less in size. It will still work in a larger watershed to identify regulatory and programmatic tools and gaps. If you represent a watershed with multiple jurisdictions, then choose one (maybe the one with the most area in the watershed) to base your answers on.

Background

Organization Name:

Jurisdiction: _____

Department/Group: _____

Address: _____

Phone: _____ Fax: _____

Email: _____

1. What is the form of government in the communities you represent?
(Check all that apply)

- ☐ City
- ☐ County
- ☐ Township
- ☐ Other

2. What is the approximate area of your watershed?

Square miles


3. What is the approximate population within your watershed?

4. What is the approximate percentage of each of the following land uses in your watershed?

- ☐ Ultra-Urban: _____ %
- ☐ Urban: _____ %
- ☐ Suburban: _____ %
- ☐ Rural: _____ %
- ☐ Undeveloped: _____ %

5. Are the communities in your watershed growing?	<input type="checkbox"/> Quickly and facing a lot of development pressure <input type="checkbox"/> Slowly, facing moderate development pressure <input type="checkbox"/> Not at all, this isn't really a concern
6. The best description of our communities' stormwater drainage system is:	<input type="checkbox"/> Storm drains (usually pipes leading to a receiving stream) <input type="checkbox"/> Open channels or ditches <input type="checkbox"/> Combination of storm drains and open channels <input type="checkbox"/> Combined sewers (stormwater and wastewater flow in the same pipe) <input type="checkbox"/> Don't know
7. What is the primary method your communities use to treat wastewater (<i>check all that apply</i>)?	<input type="checkbox"/> Wastewater treatment plants <input type="checkbox"/> Individual septic systems <input type="checkbox"/> Community septic systems <input type="checkbox"/> Straight pipes <input type="checkbox"/> Other
8. Do you know the departments in your counties that are primarily responsible for mapping and GIS?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
9. What are the primary concerns driving local watershed protection in your communities (<i>check all that apply and describe the most import</i>)?	<input type="checkbox"/> Maintain stream quality <input type="checkbox"/> Sustain fishery (trout, salmon, warm water) <input type="checkbox"/> Protect lake quality (eutrophication) <input type="checkbox"/> Protect quality of drinking water sources <input type="checkbox"/> Protect coastal waters <input type="checkbox"/> Protect groundwater and maintain recharge <input type="checkbox"/> Conserve wetlands and/or forests <input type="checkbox"/> Maintain rural character (i.e. farm conservation) <input type="checkbox"/> (other)

10. What are your communities' prior local experience in watershed planning in the last five years?	<input type="checkbox"/> Watershed plans completed <input type="checkbox"/> Some internal planning and studies <input type="checkbox"/> None
11. What is the regulatory status of your watershed?	<input type="checkbox"/> Not meeting water quality standards, subject to TMDL <input type="checkbox"/> Designated as special waters, under antidegradation <input type="checkbox"/> Don't know
12. What is the approximate percentage of each of the following resources in your watershed?	<input type="checkbox"/> Forest: _____ % <input type="checkbox"/> Wetlands and Open Water: _____ % <input type="checkbox"/> Impervious Cover: _____ % <input type="checkbox"/> Turf: _____ % <input type="checkbox"/> Other: _____ %
13. Does your watershed have watershed-based GIS data layers?	<input type="checkbox"/> Watershed GIS system is operational <input type="checkbox"/> Community has GIS, but it is not watershed-based <input type="checkbox"/> Only have paper maps
14. What is your watershed's political receptivity to watershed planning?	<input type="checkbox"/> Elected officials support or even champion watershed plans <input type="checkbox"/> Agency staff are supportive <input type="checkbox"/> Have not heard of watershed planning <input type="checkbox"/> Unsure and wary of watershed planning <input type="checkbox"/> Hostile toward idea of watershed planning

15. What are your communities' awareness about watersheds?	<input type="checkbox"/> High degree of concern about watershed issues <input type="checkbox"/> Mixed level of concern, some awareness <input type="checkbox"/> Low level of concern and awareness
 16. What is your watershed's awareness about wetlands and how they function within a watershed?	<input type="checkbox"/> High degree of concern about wetland issues <input type="checkbox"/> Mixed level of concern, some awareness <input type="checkbox"/> Low level of concern and awareness
17. What are some of your communities' other issues relating to watersheds?	<input type="checkbox"/> Growth vs. no growth <input type="checkbox"/> Farmland conservation <input type="checkbox"/> Protection of rural character <input type="checkbox"/> Desire for greenways, parks, or recreation <input type="checkbox"/> Newcomers vs. old timers
18. What are the key pollutants of concern in your watershed?	<input type="checkbox"/> Nutrients <input type="checkbox"/> Heavy metals <input type="checkbox"/> Sediment <input type="checkbox"/> Bacteria <input type="checkbox"/> Others: <input type="checkbox"/> Don't know
19. What are the key habitat impairments in your watershed?	<input type="checkbox"/> Stream degradation <input type="checkbox"/> Wetland disturbance <input type="checkbox"/> Fish barriers <input type="checkbox"/> Rare and endangered species <input type="checkbox"/> Riparian condition <input type="checkbox"/> Others: <input type="checkbox"/> Don't know
<i>What are the main sources/causes of these impairments? Please list.</i>	

Tool #1. Land Use Planning

What land use planning techniques do your communities' employ that can be used to maintain or limit future impervious cover, redirect development where appropriate, and protect sensitive areas? Watershed recommendations that build upon existing planning techniques (i.e. overlay districts, PDR, zoning) are often easier to implement than untested tools.

Who are the local agencies in charge of land use planning?

List agency(ies) and contact information:

1.1	Do your communities have comprehensive plans or growth policies?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
-----	--	--

If so when were they last revised?

☐ Don't know

How often are your comprehensive plans updated?

Comprehensive plans reflect the vision communities have to guide development decisions over the next 10-20 years. If your plans are scheduled to be updated, this will be the opportune time to make sure watershed management goals are incorporated.

☐ Every 5 years
☐ Every 10 years
☐ We don't
☐ Other:
☐ Don't know

1.2	Do your comprehensive plans address the most important watershed or water resource goals for your communities?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
-----	--	--

If so, which goals and how?

Flood control, water quality, groundwater protection, and instream habitat are common water resource goals that should be incorporated into the comprehensive planning process. Check your plans to see if these goals are clearly outlined. Your watershed plans should specifically target goals of the comprehensive plans.



	Do your comprehensive plans address specifically wetlands?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
--	--	--

Do your plans evaluate and take into account impacts of future land use on water resources?

☐ Yes ☐ No ☐ Don't know

In what way?

Check to see if long-term transportation and development planning jives with water resource goals. If not, then you may have identified a serious gap in your comprehensive planning process.

1.3 Do your communities have zoning authority? ☐ Yes ☐ No ☐ Don't know

If yes, please list the different zoning districts that are included in your zoning (include abbreviation):

Zoning is the local authority to regulate the type and density of future land use. If your jurisdiction has land use authority, then there are many opportunities to provide incentives and establish development criteria to protect water resources.

In addition, zoning information helps you predict future build-out conditions and impervious cover estimates for your watershed.

1.4 Do you have access to zoning maps for the other jurisdictions in your watershed? ☐ Yes ☐ No ☐ Don't know

Inevitably, when multiple jurisdictions exist within a watershed, some have digital zoning information and others do not. It's hard to estimate future impervious cover without all the zoning information for the watershed.

1.5 Have you used land use, zoning, and other techniques to estimate current and future impervious cover in your (sub)watersheds? ☐ Yes ☐ No ☐ Don't know
☐ Not applicable



Percent impervious cover is a quick and easy indicator of water resource conditions (CWP 1998, 2003). A lot of communities have estimated current impervious cover, but few have estimate future imperviousness!

1.6 Do your communities employ any of the following planning tools to direct growth, manage impervious cover, and protect natural resources (check those that apply)?

Other techniques?

- ☐ Overlay districts¹
- ☐ Watershed-based zoning²
- ☐ Purchase or Transfer of development rights³
- ☐ Limiting infrastructure extension⁴
- ☐ Infill / community redevelopment⁵
- ☐ Agricultural zoning/preservation
- ☐ Compensatory mitigation
- ☐ None of the above
- ☐ Don't know

1.7	Are there local regulations governing the protection of wetlands during development?	<input type="checkbox"/> Yes, we refer to state/federal regs
	If so, describe the key elements:	<input type="checkbox"/> Yes, we have our own ordinance
	▶ If so, please attach copy of regulation:	<input type="checkbox"/> No
	If so, is compensatory mitigation allowed for impacts to wetlands?	<input type="checkbox"/> Don't know
	Are there a local wetland permitting procedures?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
	Do regulations distinguish between wetlands with different functional values or quality?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
	Which of the following wetland types/activities are regulated in your communities?	<input type="checkbox"/> Small wetlands that do not appear on NWI maps (e.g., less than 3 acres) <input type="checkbox"/> Headwater, ephemeral, and isolated wetlands <input type="checkbox"/> Draining or ditching a wetland <input type="checkbox"/> Clearing a wetland <input type="checkbox"/> Development and land use activities within wetland drainage areas (e.g., storm water inputs, site design)
	Do you require functional assessment of wetlands in addition to delineation in non-mitigation permitting?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
	Which functional assessment protocol do you use?	
	Is local enforcement of wetland protection adequate?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
	If not, why not?	
1.8	Are floodplains mapped and managed based on FEMA requirements?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know <input type="checkbox"/> Not applicable
	Are there additional local development restrictions within floodplains?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know <input type="checkbox"/> Not applicable
	Describe:	
	▶ If so, please attach copy of requirements:	

	1.9 Do your communities have detailed local wetland inventories that are more accurate than NWI and have they been updated within the past 3 years?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
	If so, do these inventories contain information about wetland function?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
	1.10 Are there development restrictions pertaining to stream channel modification?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know Not applicable
	If yes, describe key components of restrictions	
<p>► If so, please attach copy of requirements:</p>		
	1.11 Do your communities have reservoir protection ordinances or other special water quality area protection ordinances?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know <input type="checkbox"/> We have no special areas
	If yes, describe:	
<p>► If so, please attach copy of ordinance:</p>		
	1.12 Are there development restrictions pertaining to steep slopes?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
	If yes, describe key components of restrictions (what constitutes a steep slope?):	<input type="checkbox"/> Not applicable
<p>► If so, please attach copy of requirements:</p>		
	1.13 Do your communities have recharge or groundwater protections ordinances?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know <input type="checkbox"/> Not applicable
	If so, describe key elements:	
<p>► If so, please attach copy of requirements:</p>		

► Summarize existing regulatory or programmatic land use planning tools currently available to apply towards watershed protection:

► Summarize gaps in land use planning tool box:

Notes:

Tool #2. Land Conservation

Take a look at what programs or efforts exist within your communities to conserve undeveloped, sensitive areas or areas of particular historical or cultural value.

What local agencies are involved in conserving land?

List agency(ies) and contact information:

2.1 Do you know the locations of rare, threatened, or endangered (RTE) species in your watershed? ☐ Yes ☐ No ☐ Don't know

2.2 Have critical habitat areas for plant and animal species been mapped in your watershed? ☐ Yes ☐ No ☐ Don't know

2.3 Have groundwater recharge areas and wetland contributing drainage areas been mapped in your watershed? ☐ Yes ☐ No ☐ Don't know



These areas are critical for maintaining hydrologic watershed functions and should not be overlooked by conservationists.

2.4 Do locations of RTE species and sensitive areas trigger additional review by local planners prior to site plan approval? ☐ Yes ☐ No ☐ Don't know

In some cases, the location of sensitive habitats that may be impacted by a particular development may not be known by plan review staff, thereby limiting the level of protection that could potentially be afforded these areas.

2.5 Other than what is required by state and federal laws, is the preservation of critical habitat areas for plant and animal species: ☐ Required ☐ Encouraged ☐ Neither ☐ Don't know ☐ Other:

If applicable, describe key components of the program (i.e. regulations, incentives, enforcement):

► *If so, please attach copy of requirements:*

2.6 Are there any local requirements for forest conservation? ☐ Yes ☐ No ☐ Don't know

If so, what are they?

► *If so, please attach copy of ordinance(s).*

2.7 Is the preservation of active agricultural areas:

If required or encouraged, describe the key components of your program:

- ☐ Required
- ☐ Encouraged
- ☐ Too late
- ☐ None of the above
- ☐ Don't know

► If so, please attach copy of ordinance(s). Often, ag preservation can be a leading driver for growth management. Consider prioritizing preservation areas with water recharge, buffer protection, and wildlife corridors goals.

2.8 Other than what is required by state and federal laws, is the preservation of cultural or historical areas:

If required or encouraged, describe the key components of your program:

- ☐ Required
- ☐ Encouraged
- ☐ Neither
- ☐ Other:
- ☐ Don't know

► If so, please attach copy of ordinance(s). These sites are often adjacent to or within natural resource protection areas.

2.9 Is the preservation of forests, fields, and wetlands for hunting, fishing, hiking, or other active recreation:



- ☐ Required
- ☐ Encouraged
- ☐ Neither
- ☐ Other:
- ☐ Don't know

2.10 Do your communities permit or encourage any of the following techniques to conserve land?

- ☐ Conservation easements
 - ☐ Land acquisition programs
 - ☐ Purchase of development rights (PDRs)
 - ☐ Landowner stewardship programs
 - ☐ Other:
 - ☐ None of the above
-

2.11 Can local governments in your watershed administer conservation easements? ☐ Yes ☐ No ☐ Don't know

If so, please describe key components of the program:

Are maintenance, ownership responsibilities, and enforcement parts of the program? ☐ Yes ☐ No ☐ Don't know

2.12 Do any local or regional private land trusts that accept conservation easements exist in the watershed? ☐ Yes ☐ No ☐ Don't know

If so, who? *List group and contact information:*

2.13 Have conservation opportunities been identified in the watershed (i.e. wetlands, forests, recharge areas, etc.)? ☐ Yes ☐ No ☐ Don't know



► *Can you get a map of these locations? If so please attach.*

2.14 Have potential conservation areas which are most vulnerable to development impacts been determined? ☐ Yes ☐ No ☐ Don't know

2.15 Have you established a process for prioritizing conservation opportunities? ☐ Yes ☐ No ☐ Don't know

If so, describe your ranking factors (i.e., connectivity; contiguousness; RTE species; willing land owner):

► *You should check program ranking criteria to make sure they include factors that meet watershed protection goals and objectives.*

2.16 Is there federal, state, regional, or local funding source available for purchasing easements or acquiring land? ☐ Yes ☐ No ☐ Don't know

2.17 What are the required ratios for restoration, enhancement, or protection of wetlands as part of the wetland compensatory mitigation program? ☐ Not applicable ☐ Don't know



Depending on your local guidelines, you may be able to use mitigation requirements to acquire priority wetlands for conservation.

► Summarize existing regulatory or programmatic land conservation tools currently available to apply towards watershed protection:

► Summarize gaps in land conservation tool box:

Notes:



Tool #3. Aquatic Buffers

Evaluate your communities' ability to protect and restore vegetated riparian, wetland, and shoreline buffers.

Who are the local agencies in charge of enforcing buffer requirements?

List agency(ies) and contact information:

3.1	Are stream, wetland, or shoreline buffers required in your communities? (<i>check all that apply</i>)	<input type="checkbox"/> Yes, on perennial streams <input type="checkbox"/> Yes, on intermittent streams <input type="checkbox"/> Yes, on ephemeral streams <input type="checkbox"/> Yes, on most wetlands <input type="checkbox"/> Yes, on all wetlands <input type="checkbox"/> Yes, on shorelines (lakes) <input type="checkbox"/> Yes, other: <input type="checkbox"/> No <input type="checkbox"/> Don't know
	If so, are there local buffer ordinances?	<input type="checkbox"/> Yes, we refer to the state regs <input type="checkbox"/> Yes, we have developed our own ordinance <input type="checkbox"/> No <input type="checkbox"/> Don't know
	► If so, please attach a copy of your regulations, supporting guidance, enforcement, maintenance information, etc.	<input type="checkbox"/> No <input type="checkbox"/> Don't know
	If so, when were they last updates?	<input type="checkbox"/> Don't know
	If your buffer ordinance has not been updated within the last 5 years, you should evaluate how successful it has been, and how it can be improved (i.e. remove ambiguity, include plant lists, better protection for sensitive streams)	
	Are buffers part of an overlay district ¹ ?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know

3.2	If required, what is the minimum required buffer width (in feet)?	<input type="checkbox"/> Don't know
	<p>► <i>In general, a minimum base width of at least 100 feet is recommended to provide adequate stream habitat and water quality protection. Much larger widths are recommended for wildlife protection and view corridors.</i></p> <p>Are width criteria higher for high quality streams, wetlands, reservoirs, or other sensitive aquatic resources?</p> <p>Widths are commonly measured from (<i>check all those that apply</i>):</p> <p>Can widths be expanded to connect wetlands with their critical upland habitats?</p>	<p><input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know</p> <p><input type="checkbox"/> Centerline of stream <input type="checkbox"/> Stream bank <input type="checkbox"/> Edge of 100-year floodplain <input type="checkbox"/> Delineated edge of wetland <input type="checkbox"/> Top of adjacent steep slope <input type="checkbox"/> High tide/water line <input type="checkbox"/> Other: <input type="checkbox"/> Don't know</p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know</p>
3.3	Do your communities provide flexibility with a variable width buffer system (buffer averaging)?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
	<i>This can be difficult to administer, however, flexible systems can provide additional protection to highly sensitive areas in exchange for minimal buffer application in "high traffic" portions of a site.</i>	
3.4	Are buffers excluded from private property boundaries in new residential subdivisions or commercial development?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
	<i>If buffers are outside of property lines, then there is often less hassle with enforcement (i.e. homeowners requesting permission to build sheds, cut trees).</i>	
3.5	Are methods for determining where buffers are applied/delineated detailed in your buffer ordinances?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
	<i>Is it a stream or is it a ditch? Your ordinance should differentiate between water types.</i>	
3.6	Do your communities rely primarily on mapping data (USGS "blue line" streams or NWI) for applying buffer regulations (or are field verifications also used)?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
		

3.7 Are buffer delineations visibly demarcated on:	<input type="checkbox"/> Pre-construction plan (site plans) <input type="checkbox"/> Construction plans <input type="checkbox"/> As built/final plans <input type="checkbox"/> Homeowners plat <input type="checkbox"/> Other: <input type="checkbox"/> None of the above: <input type="checkbox"/> Don't know
<i>Boundaries should be well defined during each stage of the development process from initial plan review to post-construction. This can prevent encroachment during construction and by homeowners.</i>	
3.8 Is a physical demarcation (flagging or fencing) of buffers required on site during construction to prevent encroachment?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
If so, can site inspectors enforce buffer criteria with stop work orders or fines?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
3.9 Are excluded uses/activities within the buffer clearly established in your buffer ordinance (impervious cover, underground storage tanks, structures, etc.)?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
► <i>If so, please attach a copy of excluded uses.</i>	
What uses/activities are exempt from buffer criteria?	<input type="checkbox"/> Utilities <input type="checkbox"/> Road crossings <input type="checkbox"/> Agriculture/Livestock <input type="checkbox"/> Logging <input type="checkbox"/> Nature trails <input type="checkbox"/> Other: <input type="checkbox"/> None of the above <input type="checkbox"/> Don't know
Are septic drain fields allowed within the buffer?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
If not, what is the setback requirement?	<input type="checkbox"/> Don't know
3.10 Are there specific vegetative targets outlined in ordinance (i.e. native plants)? If so, please describe:	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
► <i>Buffers should have an ultimate vegetative target for a predevelopment native riparian plant community. Do you have a native plants list, if not, consider tracking one down from your local or state natural resources department. You'll want to reference this list in your ordinance for long-term management and restoration projects.</i>	

<p>3.11 Are selective clearing and other management procedures outlined in buffer ordinances (3-zoned buffer, mowing restrictions, tree pruning guidance, etc.)? If so, please describe:</p> <p><i>Urban stream buffers can be designed with a three- zone buffer where each zone performs a different function, and has a different width, vegetative target and management scheme.</i></p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
<p>3.12 Do third parties or homeowners associations have the ability to manage buffers in your communities?</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
<p>3.13 Are any of the following criteria established in buffer ordinance to limit the impacts of stream buffer crossing?</p> <p><i>Ideally a stream buffer network should be maintained as an unbroken corridor; however this is not always possible. When crossings are necessary, such as roads, bridges, utilities, etc. construction methods should be used that will minimize the impact.</i></p>	<input type="checkbox"/> Crossing and clearing width must be minimized <input type="checkbox"/> Crossing angle is perpendicular to stream <input type="checkbox"/> Frequency of crossings is minimized <input type="checkbox"/> Creation of fish barriers is prohibited <input type="checkbox"/> All features designed to handle 100-year floods <input type="checkbox"/> Hydrologic alteration must be minimized (e.g., no constrictions at wetland outlets) <input type="checkbox"/> Other <input type="checkbox"/> None of the Above
<p>3.14 Can storm water management facilities be located in the buffer?</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
<p>3.15 Can buffers be used for sheet flow storm water management?</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
<p>3.16 Are any of the following stream buffer management measures required in your communities? (<i>check those that apply</i>)</p> <p><i>Future integrity of the buffer system requires a long-term management strategy, including a strong education and enforcement program.</i></p>	<input type="checkbox"/> Permanent signage marking the buffer boundary <input type="checkbox"/> Periodic buffer walks to check for encroachment <input type="checkbox"/> Non-compliance enforcement measures <input type="checkbox"/> Landowner education on benefits/responsibilities <input type="checkbox"/> Other: <input type="checkbox"/> None of the above <input type="checkbox"/> Don't know

3.17 Do you have a GIS mapping layer that identifies good and inadequate buffer areas in your watershed?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
3.18 Is there a funding mechanism or program for buffer reforestation/restoration for both rural and urban areas?	<input type="checkbox"/> Yes <input type="checkbox"/> Rural only <input type="checkbox"/> Urban only <input type="checkbox"/> No <input type="checkbox"/> Don't know
What is this funding mechanism or program?	
3.19 Is there a comprehensive invasive plant control strategy for local buffers? If so, who manages the program?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
3.20 Do your communities provide any of the following voluntary and regulatory incentives to encourage buffer protection above and beyond what is required?	<input type="checkbox"/> Buffer averaging <input type="checkbox"/> Conservation easements <input type="checkbox"/> Property tax reduction <input type="checkbox"/> Subsidies <input type="checkbox"/> Stormwater credits <input type="checkbox"/> Cost-share programs <input type="checkbox"/> Other: <input type="checkbox"/> None of the above <input type="checkbox"/> Don't know
<p>If so, please describe:</p> <p>► Summarize existing regulatory or programmatic buffer tools currently available to apply towards watershed protection:</p>	
<p>► Summarize gaps in buffer tool box:</p>	
Notes:	

Tool #4. Better Site Design (BSD)

Residential and commercial site design that reduces impervious cover, protects existing natural areas, and treats stormwater on site. Review development codes and ordinances that encourage or hinder this type of environmentally-sensitive design.

Who are the local agencies in charge of updating development regulations and reviewing site plans?
List agency(ies) and contact information:

4.1 Are there zoning or subdivision codes that outline criteria for new residential and commercial development specifically in regards to wetland and riparian areas? ☐ Yes ☐ No ☐ Don't know



► *If so, please compile relevant sections from your zoning ordinance, road codes, forest conservation, or other regulations guiding site design for new development.*

4.2 If so, when were they last revised? ☐ Don't know

► *If development codes have not been revised in the last five years, consider doing a quick self-assessment to see if your codes impede environmentally sensitive development (many antiquated codes never considered protecting water resources when they were originally crafted).*

4.3 Are open space (conservation design, cluster, low impact, etc.) developments a common form of development in your communities? ☐ Yes ☐ No ☐ Don't know

4.4 Do developers have to go through additional review, obtain variances, or other requirements in order to get an open space design approved? ☐ Yes ☐ No ☐ Don't know

If so, consider making this kind of development by-right in order to encourage BSD application.

4.5 Is there an overlay district¹ or a "red-flag" system that triggers additional level of plan review in sensitive areas? ☐ Yes ☐ No ☐ Don't know



4.6 Do local regulations require open space or conservation design near sensitive streams and wetlands; drinking water reservoirs; recharge areas; special habitats, or other natural resources? ☐ Yes ☐ No ☐ Don't know



If so, please describe:

If you a site adjacent to a sensitive area is going to be developed, then develop it in a way that will minimize the environmental impact.

4.7 Do your communities have authority over local road design? ☐ Yes ☐ No ☐ Don't know

Some communities do not have authority over how roads are designed in new developments; often the authority rests with state DOT.

If so, do your local street standards allow for narrower roads and open channel drainage?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
4.8 Do local parking lots commonly exceed minimum parking ratios and generate excess, unused impervious surface?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
4.9 Are homeowner agreements in place to maintain low impact development practices such as rain gardens?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
<i>As we move towards low impact development practices, it is important to account for the long-term management and maintenance of many backyard stormwater practices.</i>	
4.10 Are open space protection and management criteria specified for new subdivisions and parking lots?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
<i>Effective open space protection requires explicit criteria such as percentage of site, contiguousness, long-term management; stormwater integration; and canopy coverage targets.</i>	
4.11 Are there guidelines for on-site afforestation or reforestation?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
<i>Look for opportunities to not only protect existing trees, but to plant new trees during the development process, particularly in watersheds where agricultural fields are being converted to residential neighborhoods, if applicable.</i>	

Tool #5. Erosion and Sediment Control (ESC)

Take a look at local practices and procedures to prevent erosion and control sediment on construction sites. The clearing of vegetation and the exposure of sediment during the construction process can be one of the most critical periods of the development cycle. ESC often fails due to improper practice installation and maintenance by contractors, and lack of inspection and enforcement by local authorities.

5.1 Who are the local agency(s) in charge of revising and enforcing ESC regulations?

List agency(s) and contact information:

5.2 Are there a local erosion and sediment control ordinances?

☐ Yes, we refer to the state regs

☐ Yes, we have developed our own ordinance

► *If erosion and sediment control is required, please attach a copy of your regulations.*

☐ No

☐ Don't know

If so, when were they last revised?

If more than 5 years, consider revising.

5.3 What is the minimum disturbance area requirement for erosion and sediment control plans?

☐ All disturbances

☐ greater than 1 acre

☐ greater than 2 acres

☐ greater than 5 acres

☐ within a special resource area

Phase II requirements cover disturbances greater than 1 acre, however some communities are requiring ESC for less than 1 acre in highly sensitive watersheds (i.e. drinking water).

☐ Other:

☐ Don't know

5.4 Are ESC plans reviewed during the site plan review process?

☐ Yes ☐ No ☐ Don't know

Check to make sure ESC plans are being reviewed in the context of the overall site development process. The process should be set up to trigger red flags in sensitive areas that may require more inspections or advanced ESC.

5.5 Are ESC criteria more stringent in areas draining to sensitive areas such as wetlands, trout streams, reservoirs, or other resource protection area?




☐ Yes ☐ No ☐ Don't know

If yes, how so?

This is a good link with land use planning tools...if you have overlay districts established for sensitive areas, you may be able to apply more stringent ESC criteria for development within them.

5.6 Are there clearing and grading requirements or incentives to encourage phased clearing and site fingerprinting?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
If so, describe:	
<i>If not, consider instituting! Research shows that lots with mature trees are worth more to homebuyers than non-treed lots. Research also indicates that pervious areas compacted by bulldozers and grading equipment acts a lot like impervious cover.</i>	
5.7 Are there specific ESC requirements for logging operations?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
► If so, attach copy of guidance manual and/or regulations.	<input type="checkbox"/> Not applicable
5.8 Is there guidance available for ESC on hillside roads?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
► If so, attach copy of guidance manual and/or regulations.	<input type="checkbox"/> Not applicable
5.9 Are inspection frequency and enforcement requirements specified in the ESC ordinance?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
<i>If not, this should be spelled out to avoid confusion and provide predictability.</i>	
If so, what is the required inspection frequency for construction sites?	<input type="checkbox"/> Once every 7 days <input type="checkbox"/> Once every 7 days or after <input type="checkbox"/> rainfall event <input type="checkbox"/> Once every 14 days and after <input type="checkbox"/> rainfall event <input type="checkbox"/> Other: <input type="checkbox"/> Don't know
If after rainfall event, describe storm event (0.5 in, 1 in):	
If so, please describe the enforcement measures:	
5.10 How often does the average construction site actually get inspected?	<input type="checkbox"/> Only when there is a complaint <input type="checkbox"/> Less than required <input type="checkbox"/> Per regulations <input type="checkbox"/> More often than required <input type="checkbox"/> Don't know
5.11 Who conducts inspections of construction sites for compliance with erosion and sediment control requirements?	<input type="checkbox"/> Not Applicable <input type="checkbox"/> County / municipal inspector <input type="checkbox"/> Third-party inspector (e.g. private engineer) <input type="checkbox"/> Other:

5.12 If government responsibility, how many FTE are dedicated to ESC inspection and enforcement?	<input type="checkbox"/> <0.5 <input type="checkbox"/> 0.5-1 <input type="checkbox"/> 1.5-3 <input type="checkbox"/> >3 <input type="checkbox"/> Don't Know
<i>If your watershed is expected to develop at a rapid pace, you may need to increase inspection capacity.</i>	
5.13 Describe background/training level for ESC inspectors (state certification, 1 day course, etc.):	
5.14 Do your communities sponsor erosion and sediment control training for:	<input type="checkbox"/> Developers <input type="checkbox"/> Contractors <input type="checkbox"/> Engineers <input type="checkbox"/> Inspectors <input type="checkbox"/> None of the above <input type="checkbox"/> Not Applicable
<i>If not, you should consider providing a course not just for inspectors, but also for the folks designing, installing, and maintaining the practices...</i>	
 5.15 Do training programs cover local buffer, wetland, steep slope, open space, and tree protection regulations?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
<i>Trainers should take this opportunity to remind contractors and inspectors of the water resources ESC is meant to protect. Make sure trainers understand how ESC practices relate to other protection tools.</i>	
5.16 Are ESC enforcement mechanisms (e.g. fines, stop work orders, etc.) generally considered effective deterrents?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know <input type="checkbox"/> Not applicable
5.17 Do monies collected from fines go back into ESC program?	
<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know	
<i>► How many enforcement actions were taken last year and how much \$ generally collected from permits and fines?</i>	
5.18 Do your communities have a guidance manual on erosion and sediment control practices?	<input type="checkbox"/> Yes, we refer the development community to a state document <input type="checkbox"/> Yes, we have our own guidance <input type="checkbox"/> No <input type="checkbox"/> Don't know <input type="checkbox"/> Not applicable
<i>► If your communities have developed guidance and/or requirements, please attach copies.</i>	
If so, when were they last revised?	



5.19 Are perimeter control practices required along stream and wetland buffer boundaries? ☐ Yes ☐ No ☐ Don't know



5.20 Check all erosion and sediment control practices that your communities commonly use. Circle the ones that do not appear in your ESC guidance manual.

Phasing and Procedures:

- ☐ Construction sequencing
- ☐ Construction phasing
- ☐ Non-disturbance of open space (visible flagging)
- ☐ Non-disturbance of stream/ wetland buffers
- ☐ Site fingerprinting/reduced grading
- ☐ Construction during dry season
- ☐ Stockpile stabilization
- ☐ Exit tire wash
- ☐ Wash station (cement trucks)

Erosion Prevention:

- ☐ Surface roughening (tracking)
- ☐ Stair-step grading
- ☐ Temporary seeding and mulching
- ☐ Erosion blankets (biodegradable)
- ☐ Turf reinforcement mats (synthetic)
- ☐ Permanent seeding and mulching
- ☐ Rip rap channels
- ☐ Outlet protection
- ☐ Dust control
- ☐ Polyacrylamide (PAM)

Runoff Controls:

- ☐ Pipe slope drains to bypass erodible soils
- ☐ Construction dewatering operations
- ☐ Dikes / berms as conveyance to ESC structures
- ☐ Silt ditch
- ☐ Temporary stream crossings

Sediment Control:

- ☐ Sediment basin
- ☐ Multipurpose basin
- ☐ Sediment traps (dam)
- ☐ Silt fence
- ☐ Rock check dams
- ☐ Sediment tube check dams
- ☐ Stabilized construction entrance
- ☐ Filter fabric inlet protection
- ☐ Straw bales
- ☐ Block and gravel inlet and curb inlet protection
- ☐ Prefabricated inlet protection
- ☐ Sand / gravel bag barrier

Others:

► Summarize existing regulatory or programmatic ESC tools currently available to apply towards watershed protection:

► Summarize gaps in ESC tool box:

Notes:

Tool #6. Storm Water Management (SMW)

Take a look at the stormwater program in your communities to see how structural practices are incorporated into new development, redevelopment, or the existing landscape to help mitigate the impacts of urbanization and stormwater runoff on receiving waters.

6.1 Who are the local agencies in charge of revising and enforcing SMW regulations?

List agency(s) and contact information:

6.2 Do your communities have a Phase I or Phase II NPDES stormwater permits?

☐ Phase I

☐ Phase II

If so, your communities' stormwater program is expected to meet certain minimum measures, most of which fit nicely with watershed planning efforts...

☐ No

☐ Don't Know

If applicable, which components of the programs (minimum measures) do your communities do well?

Which could use some beefing up?

6.3 Are there local stormwater ordinances?

☐ Yes, we refer to the state regs

☐ Yes, we have developed our own ordinance

► *If stormwater is required on new development sites, please attach a copy of your regulation and additional guidance.*

☐ No

☐ Don't know

If so, when were they last revised?

If it's been a while, you may want to update it to reflect new guidance manuals, refined treatment criteria, and enforcement action, or stormwater utility considerations.

6.4 What are the design criteria for stormwater practices?

☐ Control peak discharge rate (flood control): _____

☐ Treat stormwater runoff for water quality: _____

☐ Recharge (by means of infiltration practices, etc.): _____

☐ Protect downstream channels: _____

☐ Other: _____

6.5 Are design criteria more stringent in areas draining to wetlands, trout streams, reservoirs, recharge areas, sensitive watersheds, or other resource areas?



☐ Yes ☐ No ☐ Don't know

If yes, describe criteria:

6.6 Do stormwater regulations include hydroperiod standards for downstream wetlands?



☐ Yes ☐ No ☐ Don't know

Fluctuations in water level due to changes in hydrology resulting from urbanization can significantly impact wetlands.

6.7 Describe any exemptions to stormwater requirements

6.8 Do your communities provide guidance or set forth requirements on the types of stormwater practices that may be constructed?

- ☐ Yes, we refer the development community to a state document
- ☐ Yes, we have our own guidance
- ☐ No
- ☐ Don't know

► *If your communities have developed guidance and/or requirements, please attach copies.*

If so, when were they last updated?

If it's been over 5 years, you may need to update your guidance manual at a minimum in order to incorporate new practice designs and maintenance techniques.

6.9 What are the top three stormwater practices typically installed in your communities?

If dry ponds make your list, then may not be getting as much water quality benefit as you could (i.e. you will have plenty of retrofit opportunities...)




6.10 Is a stormwater plan or other documentation required during the site plan review process?

☐ Yes ☐ No ☐ Don't know

6.11 Do your communities inspect stormwater practices during their construction?

☐ Yes ☐ No ☐ Don't know

Proper construction/installation of stormwater practices is critical. Frequent inspection is important, particularly when ESC basins are being converted to post-construction stormwater ponds as downstream impacts are frequently observed during this transition.

6.12 Is an as-built or record drawing of the stormwater practice required after construction?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
<i>It is important to keep track of the actual location of underground infrastructure, final design, and maintenance plan for all newly constructed practices.</i>	
6.13 Are stormwater practices inspected for maintenance upkeep or structural integrity on a regular basis?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
6.14 How frequently are stormwater practices inspected?	<input type="checkbox"/> Don't Know <input type="checkbox"/> More than once a year <input type="checkbox"/> Once a year <input type="checkbox"/> Every two years <input type="checkbox"/> In response to complaints <input type="checkbox"/> Never <input type="checkbox"/> Other:
 6.15 Are inspections and maintenance more frequent in areas draining to sensitive areas such as wetlands, trout streams, reservoirs, recharge areas, or other resource areas?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
6.16 Who is typically responsible for maintaining stormwater practices?	<input type="checkbox"/> Private owner <input type="checkbox"/> Builder <input type="checkbox"/> Homeowner's association <input type="checkbox"/> Permitting agency <input type="checkbox"/> Other <input type="checkbox"/> Don't know <input type="checkbox"/> Not applicable
<i>If third party is responsible (not local gov), it is important that local government provide guidance on, enforce, and maintain record of proper maintenance activities.</i>	
6.17 Is there a maintenance agreement or covenant between the permitting agency and the private owner, builder, or homeowner's association in charge of maintenance?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
6.18 Are there penalties for not complying with the maintenance agreement or other applicable regulations applying to maintenance? If yes, please describe penalties.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
6.19 Do your communities track STP locations, basic design information (type, drainage area), and maintenance records using GIS?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
 6.20 Can natural wetlands be used for stormwater treatment?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
 6.21 Are direct discharges of untreated stormwater to natural wetlands prohibited?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know



6.22 Are constrictions on wetland outlets discouraged?

☐ Yes ☐ No ☐ Don't know

► Summarize existing regulatory or programmatic SWM tools currently available to apply towards watershed protection:

► Summarize gaps in SWM tool box:

Notes:

Tool #7. Non-Storm Water Discharges

Locating, quantifying, and controlling non-stormwater pollutant sources in the watershed (i.e. septics, sewer, illicit connections). Operation and maintenance practices that prevent or reduce pollutants entering the municipal or natural drainage system.

Who are the local agency(ies) or utility in charge of wastewater regulations and illicit discharges?

List agency contact information:

List utility contact information:

7.1 How do your communities manage sanitary wastes (check all that apply)?

- ☐ Septic systems
- ☐ Aeration systems
- ☐ Package treatment plants
- ☐ Centralized wastewater treatment plants
- ☐ Other:
- ☐
- ☐ Don't Know

7.2 Do your communities have combined storm/ sewer systems?

- ☐ Yes ☐ No ☐ Don't know

7.3 Do the sanitary sewer trunk mains follow (check all that apply):

- ☐ Shortest distance
- ☐ Stream valley
- ☐ Other
- ☐ Don't Know
- ☐ Not Applicable

Often gravity driven, sewer networks typically run along stream corridors. If this is the case, you will want to field assess pipe conditions, particularly at manhole stacks and along pipe joints exposed at stream crossings.

7.4 Do your local sewer authorities promptly respond to and fix sanitary sewer overflow?

- ☐ Yes ☐ No ☐ Don't know
- ☐ Not applicable

Response within in 24 hours is considered prompt.

7.5 Do your communities require enhanced nutrient removal from on-site waste water treatment systems?

- ☐ Yes ☐ No ☐ Don't know



7.6 Do your communities have regulations pertaining to septic system maintenance?

- ☐ Yes ☐ No ☐ Don't know
- ☐ Not applicable

Some communities, particularly in drinking water watersheds require inspection annually or every 2-3 years.

7.7 Do your communities conduct inspections of privately owned septic systems?

☐ Yes ☐ No ☐ Don't know
☐ Not applicable

Describe programs (who, frequency, enforcement measures, etc.):

If not, find out how your communities keep track of on-site systems. Some communities have programs that provide free septic inspections for homeowners.

7.8 Do your communities prohibit septic systems in sensitive wetland drainages or aquatic buffers?



☐ Yes ☐ No ☐ Don't know
☐ Not applicable

7.9 Do your communities have GIS tracking systems for septic locations, inspection, and maintenance records?

☐ Yes ☐ No ☐ Don't know
☐ Not applicable

7.10 Are there regulations regarding runoff from confined animal feeding lots?

☐ Yes ☐ No ☐ Don't know
☐ Not applicable

7.11 Do you know the locations of all known hazmats (i.e. landfills, super fund sites, underground storage tanks) in your watershed?

☐ Yes ☐ No ☐ Don't know

7.12 Is there a program to detect and remove illicit connections and discharges?

☐ Yes ☐ No ☐ Don't know
☐ Not applicable

If so, describe key elements of program (agency, hotline, procedures, etc.):

You'll want to make sure your community has the legal authority to detect and repair illicit connections on private property.

► Summarize existing regulatory or programmatic non-storm water tools currently available to apply towards watershed protection:

► Summarize gaps in non-storm water tool box:

Notes:

Tool #8. Watershed Stewardship Programs

Stewardship includes watershed education, restoration, and monitoring activities. Take a look at the education or outreach programs targeted towards fostering human behavior that prevents or reduces stormwater impacts and pollution generation over a range of land uses and activities. Many types of stewardship efforts can be applied towards meeting NPDES Phase II requirements.

Who is the local agency(ies) in charge of watershed and stormwater education, monitoring, and restoration?

List agency and contact information for education:

List agency and contact information for monitoring:

List agency and contact information for restoration:

8.1	Do your communities administer or support education or outreach programs targeted towards (check those that apply)?	<input type="checkbox"/> Residents <input type="checkbox"/> Commercial sector <input type="checkbox"/> Industrial sector <input type="checkbox"/> Municipal employees <input type="checkbox"/> Other: <input type="checkbox"/> Don't know <input type="checkbox"/> None of the above
	If so, do these programs include/provide watershed related education materials?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know <input type="checkbox"/> Not applicable
	<i>If not, does it make sense to integrate stormwater education into any of the existing programs? Or do you think you'll have to create a new program?</i>	

8.1 If so, please check the topics/ activities promoted by the program(s)?

Raising Awareness:

- ☐ Stream walks
- ☐ Storm Drain Stenciling
- ☐ Canoe Trips
- ☐ Watershed Map for Distribution
- ☐ Watershed Boundary Signage
- ☐ Stream Buffer Signage
- ☐ Wetlands Protection
- ☐ Other:

Training:

- ☐ Build Your Own Rain barrel
- ☐ Water Quality/ Macroinvertebrate monitoring
- ☐ Stream Assessment
- ☐ Other:

Homeowner Stewardship:

- ☐ Water Conservation
- ☐ Lawn Fertilization
- ☐ Integrated Pest Management (IPM)
- ☐ Lawn Conversion/Lawnscapeing
- ☐ Pet Waste Management
- ☐ Car Washing
- ☐ Automotive Maintenance
- ☐ Septic System Maintenance
- ☐ Other:

Activities:

- ☐ Stream Clean-up
- ☐ Stream Buffer Planting
- ☐ Building a rain garden
- ☐ Other:

8.2 How many watershed stakeholder meetings have been conducted in the last year in your communities?

- ☐ 0
- ☐ 1-3
- ☐ More than 3
- ☐ Don't know

8.3 What activities does your watershed group play a role in (check all that apply):

- ☐ Watershed education
 - ☐ Watershed assessment and Monitoring
 - ☐ Watch dog (discharges, ESC, etc.)
 - ☐ Watershed planning
 - ☐ Managing Conservation Areas
 - ☐ Replanting Stream Buffers
 - ☐ Stream Clean-up
 - ☐ Stormwater Facilities maintenance
 - ☐ Stormwater retrofitting
 - ☐ Wetland restoration
 - ☐ Septic Systems inspections/maintenance
 - ☐ Other:

 - ☐ None of the above
-

8.4 Do communities provide grants or technical assistance to watershed groups to perform these services? ☐ Yes ☐ No ☐ Don't know

If so, list grant/assistance program:

8.5 Are there any stream or wetland stewardship or volunteer monitoring programs within your watershed (i.e. Adopt-a-stream, Adopt-a-wetland)? ☐ Yes ☐ No ☐ Don't know



If so, describe:

8.6 Are there any stream or wetland restoration programs or projects within your watershed? ☐ Yes ☐ No ☐ Don't know



If so, list contact and key elements of program:

8.7 Have any priority areas been identified for wetland protection, conservation, restoration, or creation in the watershed? ☐ Yes ☐ No ☐ Don't know



If you know where these places are, then you can proactively seek mitigation funds for implementation.

8.8 Have you conducted a residential behavior survey to determine homeowner activities and attitudes affecting water quality? ☐ Yes ☐ No ☐ Don't know

This in addition to a quick drive thru of the neighborhoods in the watershed will help you target your educational message. You can also use a survey to establish baseline conditions.

8.9 Do your communities have any restrictions on pet waste management? ☐ Yes ☐ No ☐ Don't know

8.10 Do your communities actively enforce dumping restrictions in stream valleys, wetlands, buffers and other conservation areas? ☐ Yes ☐ No ☐ Don't know



8.11 Do you have restrictions or guidance on proper application/use of fertilizers and pesticides on public lands? ☐ Yes ☐ No ☐ Don't know

8.12 Are there any landowner stewardship programs in your watershed? ☐ Yes ☐ No ☐ Don't know

8.13 Do your communities require or encourage any of the following techniques to protect stream and wetland quality in agricultural areas (check those that apply)?

- ☐ Conservation tillage
- ☐ Nutrient management plans
- ☐ Manure application
- ☐ Rotational Grazing (rotating livestock between several small paddocks rather than allowing continuous grazing of one large pasture)
- ☐ Off-stream Water Sources (alternative water sources that can reduce livestock time in stream; most effective when used in conjunction with exclusionary fencing)
- ☐ Buffer reforestation
- ☐ Exclusionary Fencing (fencing that prevents or limits livestock from entering streams, wetlands, and their buffers)
- ☐ Other:
- ☐ Don't know
- ☐ Not applicable

What types of technical assistance or cost share/incentive programs are available to farmers and ranchers?

8.14 Are the following practices encouraged on vineyards?

- ☐ Integrated pest management (IPM)
- ☐ Buffer strips
- ☐ Erosion prevention (terracing, diversion, ditches, no-till cropping, etc.)
- ☐ Fertilizer reduction based on petiole analysis and/or soil testing
- ☐ Other
- ☐ Not applicable
- ☐ Don't know

What types of technical assistance or cost share/incentive programs are available to grape growers?

8.15 Are there any educational programs geared at golf courses for the following?

- ☐ Buffers
- ☐ Water use
- ☐ Runoff management
- ☐ Pesticide application
- ☐ Fertilizer reduction
- ☐ Spray irrigation
- ☐ Other
- ☐ Don't know
- ☐ Not applicable

What types of technical assistance or cost share/incentive programs are available to golf course managers?

8.16 Do your communities have emergency spill response plans?

- ☐ Yes ☐ No ☐ Don't know

This is important particularly in drinking water watersheds where transportation corridors drain to reservoirs or where groundwater can be easily contaminated.

8.17 Are there local household hazardous waste collection programs?

- ☐ Yes ☐ No ☐ Don't know



8.18 Do local mosquito control programs use alternative approaches that reduce insecticide use?

- ☐ Yes ☐ No ☐ Don't know

8.19 Do your communities operate environmental hotlines for illicit discharges, dumping, wetland fills, ESC failure, etc.?



- ☐ Yes ☐ No ☐ Don't know

If so, list contact information:

8.20 Have all municipal yards submitted a pollution prevention plan?

- ☐ Yes ☐ No ☐ Don't know

► *Attach copy of basic municipal PPP.*

8.21 Do your communities provide training on pollution prevention for (check those that apply):

- ☐ Municipal employees
 - ☐ Contractors
 - ☐ Commercial
 - ☐ Business
 - ☐ Industrial
 - ☐ Recycle Centers
 - ☐ Other:
 - ☐ None of the above
 - ☐ Don't know
-

8.22 Describe the type of watershed monitoring you conduct:



Type: (water quality, macros, wetland function, flow, performance monitoring)

☐ Don't know

Frequency:

Responsible party:

Protocols used:

► Attach copies of baseline data or summary monitoring reports.

8.23 How often is watershed monitoring data compiled and reported?

☐ Don't know

Data on watershed trends, performance monitoring, and project tracking should be reported annually.

8.24 Do local agencies provide training, guidance, and supplies to volunteers for monitoring?

☐ Yes ☐ No ☐ Don't know

8.25 Are there programs to manage the spread of invasive plant species?



☐ Yes ☐ No ☐ Don't know

If so, do these programs target management of invasive wetland plants?

☐ Yes ☐ No ☐ Don't know

► Summarize existing regulatory or programmatic stewardship tools currently available to apply towards watershed protection:

► Summarize gaps in stewardship tool box:

Notes:

Foot Notes:

1. A local zoning jurisdiction that is overlaid on a property's existing zoning. Superimposes additional regulations or specific development criteria within specific areas.
2. An alternative zoning technique, whereby the intensity of development within a watershed or sub-watershed is at least partially based on the ultimate percentage of impervious cover and the desired level of stream protection.
3. Transfers potential development from a designated "sending area" to a designated "receiving area"
4. A conscious decision is made to limit or deny extending infrastructure, such as public sewer, water, or roads, to designated areas to avoid increased development in these areas
5. Encourages new development and redevelopment within existing developed areas

Appendix F: Preliminary Goals and Objectives: GGWC

Developing a framework for Integrating Wetland Considerations into Watershed Restoration Plans

Background

The objective of Task 2 is to develop preliminary watershed goals and objective statements for wetland considerations and how their restoration and/or protection can accomplish water quality objectives for 303d listed streams in the Gallatin Watershed. In the Gallatin Watershed Total Maximum Daily Load (TMDL) Planning Area, there are 24 TMDL contributing areas. See attached map created by Montana Department of Environmental Quality (DEQ).

The Greater Gallatin Watershed Council (GGWC) focus area (the Lower Gallatin Watershed, North of the Mouth of Gallatin Canyon) consists of 16 of these TMDL areas. For the purpose of Task 2, GGWC has developed preliminary wetland specific goals and objectives for each of these 16 TMDL contributing areas. These preliminary goals and objectives were developed using the “Exploring your Aquatic Resources” website (<http://mt.gov/deq/wmaAquaticResources>) developed by DEQ. These will be further revised and prioritized during Task 3.

It is not likely that Level 2 assessments will be completed within each TMDL area due to time and resource constraints. Prior to Task 3, GGWC will prioritize specific focus areas based on the following: previously identified projects, degree of impact, project connectivity, landowner amenability, potential funding sources, and likelihood of success.

GIS ID Gallatin 1: Dry Creek TMDL Contributing Area

Point Source Pollutants: Nitrogen, Phosphorus and Sedimentation/Siltation

Non-Point Source Pollutants: Alteration in stream-side or littoral vegetative cover and physical substrate habitat alterations

Potential Pollutant sources: Agriculture and channelization

Goal: Identify riparian areas, depressional, and slope wetlands for restoration and/or protection in order to stabilize stream banks, retain sediments, reduce siltation, and increase nutrient attenuation in the Dry Creek TMDL contributing area.

- Objective #1: Target slope wetlands because of their capacity to attenuate nutrients (61%) and retain sediments (37%); Target depressional wetlands because of their capacity to attenuate nutrients (20%).
- Objective #2: Target riparian wetlands because of their capacity to stabilize stream banks (26%).
- Objective #3: Target depressional wetlands because of their hydrologic alteration as reported by the NWI database (31 acres).
- Objective #4: Contact landowners and conduct Level 2 assessments on wetlands identified in Objectives 1, 2, and 3.

GIS ID Gallatin 2: East Gallatin River Drainage TMDL Contributing Area Point Source Pollutants: The NWI Database for this TMDL contributing area is incomplete

Non-Point Source Pollutants: The NWI Database for this TMDL contributing area is incomplete

Potential Pollutant sources: The NWI Database for this TMDL contributing area is incomplete

Goal: Identify riparian areas, depressional, and slope wetlands for restoration and/or protection in order to stabilize stream banks, retain sediments, reduce siltation, and increase nutrient attenuation in the Gallatin River Drainage TMDL contributing area.

- Objective #1: Target slope wetlands because of their capacity to retain sediment (51%) and their capacity to attenuate nutrients (48%).
- Objective #2: Target depressional wetlands because of their capacity to retain sediment (43%) and their capacity to attenuate nutrients (61%).
- Target riparian wetlands because of their capacity to stabilize stream banks (43%).
- Objective #3: Contact landowners and conduct Level 2 assessments on wetlands identified in Objectives 1, 2 and 3.

GIS ID Gallatin 3: Reese Creek TMDL Contributing Area Point Source Pollutants: Fecal Coliform, Nitrates, Phosphate, Solids (Suspended/Bedload)

Non-Point Source Pollutants: None identified Potential Pollutant Sources: Agriculture

Goal: Identify riparian areas, depressional, and slope wetlands for restoration and/or protection in order to stabilize stream banks, retain sediments and reduce siltation and increase nutrient attenuation in the Reese Creek TMDL contributing area.

- Objective #1: Target slope wetlands because of their capacity to retain sediments (83%); Target slope and depressional wetlands because of their capacity to attenuate nutrients (16% and 23%, respectively).
- Objective #2: Target riparian areas because of their capacity to stabilize stream banks (54%).
- Objective #3: Target depressional wetlands because of their hydrologic alteration as reported by the NWI database (24 acres).
- Objective #4: Contact landowners and conduct Level 2 assessments on wetlands identified in Objectives 1, 2 and 3.

GIS ID Gallatin 4: Bridger Creek TMDL Contributing Area Point Source Pollutants: Phosphorus and Total Kjeldahl Nitrogen Non-Point Source Pollutants: Chlorophyll-a

Potential Pollutant Sources: Grazing in riparian or shoreline zones, impacts from resort areas and roads or paved trails

Goal: Identify depressional or slope wetlands for restoration and/or protection in order to increase nutrient attenuation in the Bridger Creek TMDL contributing area.

- Objective #1: Target slope wetlands because of their capacity to attenuate nutrients (83%).
- Objective #2: Target depressional wetlands because of their hydrologic alterations as reported by the NWI database (39 acres) and their capacity to retain sediments (36%).
- Objective #3: Target areas where limiting or eliminating grazing in riparian areas would allow for protection or restoration of original hydrologic functions.
- Objective #4: Contact landowners and conduct Level 2 assessments on wetlands identified in Objectives 1, 2 and 3.

GIS ID Gallatin 5: Thompson Creek TMDL Contributing Area

Point Source Pollutants: Nitrogen, Sedimentation/Siltation

Non-Point Source Pollutants: Alteration in stream-side or littoral vegetative covers and Chlorophyll-a

Potential Pollutant Sources: Grazing in riparian or shoreline zones

Goal: Identify riparian areas, depressional, and slope wetlands for restoration and/or protection in order to increase sediment retention, reduce siltation, nutrient attenuation and bank stabilization in the Thompson Creek TMDL contributing area.

- Objective #1: Target slope wetlands because of their capacity to attenuate nutrients (79%).
- Objective #2: Target depressional wetlands because of their hydrologic alteration as reported by the NWI database (31 acres) and their capacity to retain sediments (17%).
- Objective #3: Target areas where limiting or eliminating grazing in riparian areas would allow for protection or restoration of original hydrologic functions.
- Objective #4: Contact landowners and conduct Level 2 assessments on wetlands identified in Objectives 1, 2 and 3.

GIS ID Gallatin 6: Stone Creek TMDL Contributing Area

Point Source Pollutants: Sedimentation/Siltation

Non-Point Source Pollutants: Alteration in stream-side or littoral vegetative covers Potential Pollutant

Sources: Grazing in riparian or shoreline zones and silvicultural harvesting

Goal: Identify riparian areas and depressional wetlands for restoration and/or protection in order to stabilize stream banks and retain sediments in the Stone Creek TMDL contributing area.

- Objective #1: Target depressional wetlands because of their hydrologic alteration as reported by the NWI database (.4 acres) and their capacity to retain sediments.
- Objective #2: Target areas where limiting or eliminating grazing in riparian areas would allow for protection or restoration of original hydrologic functions.
- Objective #3: Contact landowners and conduct Level 2 assessments on wetlands identified in Objective 1.

GIS ID Gallatin 7: Godfrey Creek TMDL Contributing Area

Point Source Pollutants: Fecal Coliform, Nitrogen, Phosphorus, Sedimentation/Siltation

Non-Point Source Pollutants: Alteration in stream-side or littoral vegetative covers and excess algal growth

Potential Pollutant Sources: Grazing in riparian or shoreline zones and animal feeding operations

Goal: Identify riparian areas and depressional wetlands for restoration and/or protection in order to stabilize stream banks, retain sediments, reduce siltation, and increase nutrient attenuation in the Godfrey Creek TMDL contributing area.

- Objective #1: Target riparian areas because of their capacity to stabilize stream banks (72%).
- Objective #2: Target depressional wetlands because of their hydrologic alteration as reported by the NWI database (6.9 acres).

- Objective #3: Target areas where limiting or eliminating grazing in riparian areas would allow for protection or restoration of original hydrologic functions.
- Objective #4: Contact landowners and conduct Level 2 assessments on wetlands identified in Objectives 1, 2 and 3.

GIS ID Gallatin 8: Jackson Creek TMDL Contributing Area

Point Source Pollutants: Phosphorous, sedimentation/siltation

Non-Point Source Pollutants: Alteration in stream-side or littoral vegetative covers, chlorophyll-a

Potential Pollutant Sources: Crop production, grazing in riparian or shoreline zones

Goal: Identify riparian areas, depressional, and slope wetlands for restoration and/or protection in order to stabilize stream banks, retain sediments, reduce siltation, and increase nutrient attenuation in the Jackson Creek TMDL contributing area.

- Objective #1: Target depressional wetlands because of their historic hydrologic alterations as reported by the NWI database (23 acres).
- Objective #2: Target slope and depressional wetlands because of their capacity to retain sediment (30% and 17% respectively) and their ability to attenuate nutrients (69% and 17% respectively).
- Objective #3: Target riparian wetlands because of their ability to stabilize stream banks (30%).
- Objective #4: Target areas where limiting or eliminating grazing in riparian areas would allow for protection or restoration of original hydrologic functions.
- Objective #4: Contact landowners and conduct Level 2 assessments on wetlands identified in Objectives 1, 2, 3 and 4.

GIS ID Gallatin 9: Rocky Creek TMDL Contributing Area

Point Source Pollutants: Sedimentation/siltation

Non-Point Source Pollutants: Alteration in stream-side or littoral vegetative covers, other anthropogenic substrate alterations, other flow regime alterations

Potential Pollutant Sources: Agriculture, channelization, highways, roads, bridges, infrastructure (new construction)

Goal: Identify riparian areas, depressional, and slope wetlands for restoration and/or protection in order to stabilize stream banks, retain sediments, reduce siltation, increase nutrient attenuation, and stream-flow maintenance in the Rocky Creek TMDL contributing area.

- Objective #1: Target depressional wetlands because of their historic hydrologic alterations as reported by the NWI database (4.9 acres).
- Objective #2: Target slope and depressional wetlands because of their capacity to retain sediment (8% and 75% respectively) and their ability to attenuate nutrients (7% and 12% respectively).
- Objective #3: Target riparian wetlands for their capacity to stabilize stream banks (33%).
- Objective #4: Target areas where wetlands will assist with stream flow maintenance possibly using depressional wetlands for their capacity for stream flow maintenance (.3%)
- Objective #5: Contact landowners and conduct Level 2 assessments on wetlands identified in Objectives 1, 2, 3 and 4.

GIS ID Gallatin 10: Smith Creek TMDL Contributing Area

Point Source Pollutants: Fecal coliform, Nitrates, and Sedimentation/Siltation

Non-Point Source Pollutants: Alteration in stream-side or littoral vegetative covers and physical substrate habitat alterations

Potential Pollutant Sources: Agriculture

Goal: Identify riparian areas, riverine, fringe, depressional and slope wetlands for restoration and/or protection in order to stabilize streambanks, retain sediments and reduce siltation, and increase nutrient attenuation in the Smith creek TMDL contributing area.

- Objective #1: Target fringe and slope wetlands because of their capacity to retain sediments (93% and 41%, respectively).
- Objective #2: Target riparian wetlands because of their capacity to stabilize stream banks (33%).
- Objective #3: Target depressional and slope wetlands because of their capacity to Attenuate nutrients (15% and 59% respectively)
- Objective #4: Target depressional wetland because of their hydrological alteration as reported by the NWI database (62 acres).
- Objective #5: Contact landowners and conduct Level 2 assessments on wetlands identified in Objectives 1, 2, 3 and 4.

GIS ID Gallatin 11: Camp Creek TMDL Contributing Area

Point Source Pollutants: Fecal coliform, Sedimentation/Siltation and Nitrogen

Non-Point Source Pollutants: Alteration in stream-side or littoral vegetative covers, low flow alterations, anthropogenic substrate alterations and physical substrate habitat alterations

Potential Pollutant Sources: Agriculture, animal feeding operations, channelization, grazing in riparian or shoreline zones, irrigated crop production, and natural sources

Goal: Identify riparian areas, riverine, slope and depressional wetlands for restoration and/or protection in order to stabilize streambanks, retain sediments and reduce siltation, and increase nutrient attenuation in the Camp Creek TMDL contributing area.

- Objective #1: Target riverine and slope wetlands because of their capacity to retain sediments (87% and 19%, respectively); target slope wetlands because of their capacity to attenuate nutrients (76%).
- Objective #2: Target riparian wetlands because of their capacity to stabilize stream banks (33%).
- Objective #3: Target depressional wetlands because of their hydrologic alteration as reported by the NWI database (344 acres).
- Objective #4: Contact landowners and conduct Level 2 assessments on wetlands identified in Objectives 1, 2 and 3.

GIS ID Gallatin 12: Bear Creek TMDL Contributing Area

Point Source Pollutants: Phosphorus, Sedimentation/Siltation, Solids (Suspended/Bedloads)

Non-Point Source Pollutants: Alteration in stream-side or littoral vegetative covers and excess algal

growth

Potential Pollutant Sources: Grazing in riparian or shoreline zones and unpaved roads or trails

Goal: Identify riparian areas, depressional, and slope wetlands for restoration and/or protection in order to stabilize streambanks, retain sediments and reduce siltation, and increase nutrient attenuation in the Bear Creek TMDL contributing area.

- Objective #1: Target slope and depressional wetlands because of their capacity to attenuate nutrients (32% and 43%, respectively) and retain sediments (66% and 30%, respectively).
- Objective #2: Target riparian areas because of their capacity to stabilize stream banks (29%).
- Objective #3: Target depressional wetlands because of their hydrologic alteration as reported by the NWI database (36 acres).
- Objective #4: Target areas where limiting or eliminating grazing in riparian areas would allow for protection or restoration of original hydrologic functions.
- Objective #5: Target areas where limiting or eliminating grazing in riparian areas would allow for protection or restoration of original hydrologic functions.
- Objective #6: Contact landowners and conduct Level 2 assessments on wetlands identified in Objectives 1, 2, 3, 4 and 5.

GIS ID Gallatin 13: Sourdough (Bozeman) Creek TMDL Contributing Area Point Source Pollutants: Escheria coli, Phosphorus, Sedimentation/Siltation, and Total Kjeldahl Nitrogen

Non-Point Source Pollutants: Alteration in stream-side or littoral vegetative covers and chlorophyll-a

Potential Pollutant Sources: Channelization, grazing in riparian or shoreline zones, irrigated crop production, loss of riparian habitat, septage disposal, and yard maintenance

Goal: Identify riparian areas, depressional, and slope wetlands for restoration and/or protection in order to stabilize streambanks, retain sediments and reduce siltation, and increase nutrient attenuation in the Sourdough TMDL contributing area.

- Objective #1: Target slope and depressional wetlands because of their capacity to attenuate nutrients (65% and 22%, respectively); Target slope wetlands because of their capacity to retain sediments (32%).
- Objective #2: Target depressional wetlands because of their hydrologic alteration as reported by the NWI database (385 acres).
- Objective #3: Target areas where limiting or eliminating grazing in riparian areas would allow for protection or restoration of original hydrologic functions.
- Objective #4: Contact landowners and conduct Level 2 assessments on wetlands identified in Objectives 1, 2, and 3.

GIS ID Gallatin 14: South Cottonwood Creek TMDL Contributing Area

Point Source Pollutants: None identified

Non-Point Source Pollutants: Low flow alterations Potential Pollutant Sources: Irrigated crop production

Goal: Identify riverine and depressional wetlands for restoration and/or protection in order to improve stream temperatures in the South Cottonwood Creek TMDL contributing area.

- Objective #1: Target riverine and depressional wetlands because of their capacity to improve stream temperatures for aquatic life (100% and 2% respectively).
- Objective #2: Target depressional wetlands because of their hydrologic alteration as reported by the NWI database (36 acres).
- Objective #3: Contact landowners and conduct Level 2 assessments on wetlands identified in Objectives 1 and 2.

GIS ID Gallatin 15: Hyalite Creek TMDL Contributing Area

Point Source Pollutants: Phosphorus and Total Kjeldahl Nitrogen Non-Point Source Pollutants: Low flow alterations

Potential Pollutant Sources: Irrigated crop production, rangeland grazing, silviculture harvesting, unpaved roads or trails, rangeland grazing

Goal: Identify fringe areas, depressional, and slope wetlands for restoration and/or protection in order to improve stream flows and increase nutrient attenuation in the Hyalite Creek TMDL contributing area.

- Objective #1: Target depressional wetlands because of their capacity to maintain late season streamflows, attenuate nutrients (19%) and their hydrologic alteration as reported by the National Wetland Inventory (NWI) database (167 acres).
- Objective #2: Target slope wetlands because of their capacity to attenuate nutrients (25%) and their hydrologic alteration as reported by the NWI database (56 acres).
- Objective #3: Contact landowners and conduct Level 2 assessments on wetlands identified in Objectives 1 and 2.

GIS ID Gallatin 16: Squaw Creek TMDL Contributing Area

Point Source Pollutants: Phosphorus

Non-Point Source Pollutants: Alteration in stream-side or littoral vegetative covers and physical substrate habitat alteration

Potential Pollutant Sources: Forest roads (Road construction and use), natural sources, and silviculture activities

Goal: Identify riparian areas, depressional, and slope wetlands for restoration and/or protection in order to stabilize stream banks and increase nutrient attenuation in the Squaw Creek TMDL contributing area.

- Objective #1: Target slope and depressional wetlands because of their capacity to attenuate nutrients (90% and 88% respectively).
- Objective #2: Target riparian areas because of their capacity to stabilize stream banks.
- Objective #3: Contact landowners and conduct Level 2 assessments on wetlands identified in Objectives 1 and 2.

Big Hole Watershed Wetland Prioritization Program DRAFT: October 5, 2011

Purpose

The Big Hole Watershed Committee (BHWC) is one of two demonstration watersheds hosted by the Montana Department of Environmental Quality Wetland Program and Montana Natural Heritage. The goal of the program is to incorporate wetlands into watershed restoration planning for watershed groups. Specifically, wetland priorities will be established to meet water quality goals within the watershed restoration plan.

Background

Middle-Lower Big Hole River TMDL: The Middle-Lower Big Hole River TMDL was completed in 2009. This TMDL listed the Big Hole River mainstem for high water temperature and listed several tributaries for various reasons. The TMDL in its entirety can be viewed at [Montana Department of Environmental Quality](#). The TMDL Improvement Plan provides guidance on improving water quality in listed streams. A map highlighting listed streams is included here. Information provided here is based on the TMDL Improvement Plan.

Watershed Restoration Plan: The Big Hole Watershed Committee is in process of completing the Watershed restoration plan. The results of this report will be meshed with the final watershed restoration plan, expected complete by spring 2012.

Resources

[Montana DEQ's Exploring Your Aquatic Resources Mapping Program](#)

[Middle-Lower Big Hole River TMDL](#)

[PBS Works](#)

Study Area

The study area is the middle and lower Montana Department of Environmental Quality TMDL planning areas. This watershed area stretches from Pintlar Creek entering the Big Hole River to the mouth of the Big Hole River. This includes 95 miles of Big Hole River and 1.02 million acres of watershed (Montana DEQ, 2009).

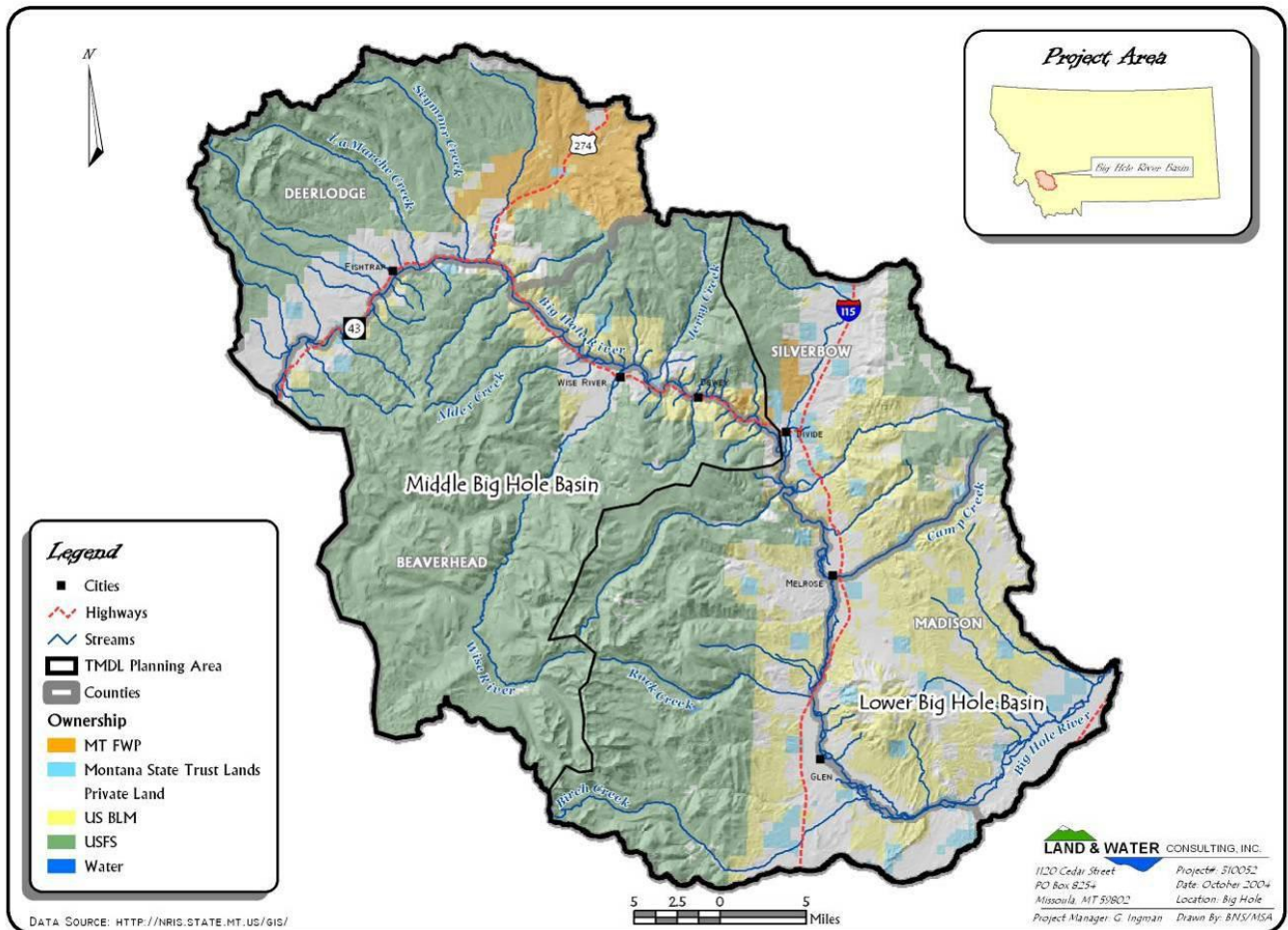


Figure 5: Study area - Middle and Lower Big Hole River TMDL Planning Area. Map Source: Montana DEQ TMDL Appendix A (Montana DEQ, 2009)

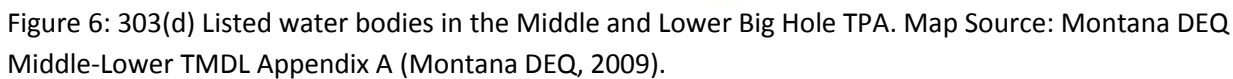


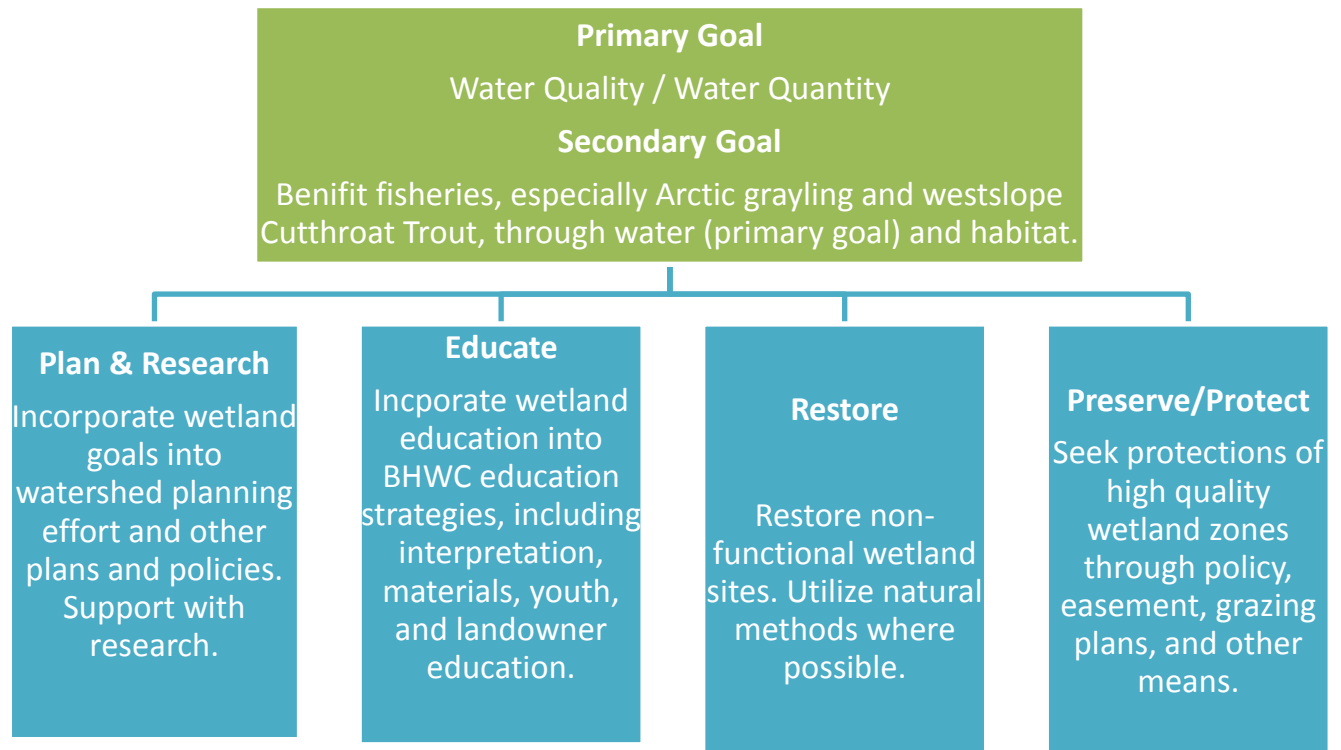
Figure 6: 303(d) Listed water bodies in the Middle and Lower Big Hole TPA. Map Source: Montana DEQ Middle-Lower TMDL Appendix A (Montana DEQ, 2009).

Partners

Currently several groups address wetland and water quality related issues. Our partners most relevant for this project include:

- US Forest Service/Beaverhead-Deer Lodge National Forest
- Bureau of Land Management
- Big Hole Watershed Committee
- Nature Conservancy
- Montana Natural Heritage
- Montana Department of Environmental Quality Wetland Program
- Private Landowners

Goals And Priorities



Priority Reaches:

- **Top Priority:** Big Hole River Mainstem - Pintlar Creek to Mouth
Mitigate for water temperature by seeking wetlands that will have a direct effect on water temperature, and wetlands that will have an indirect on water temperature by improving resiliency through stream flow maintenance, vegetation, and channel shape alteration.
- **Secondary Priority:** 303d Listed Tributaries with listings other than metals
Address tributaries on a case by case basis based on recommendations made by the TMDL, existing and available wetland zones, and sources for water quality improvement. Several tributaries are listed for metals. While metals are a significant negative impact, wetlands are not targeted towards metals reduction. Therefore, tributaries with impacts outside of metals will have a greater priority. Tributaries with the greatest available wetland potential and identified as impacted watersheds are top priority:
Top Priority Tributaries:

<i>Fishtrap Creek</i>	<i>Deep Creek</i>
<i>Wise River</i>	<i>Jerry Creek</i>
<i>Divide Creek</i>	<i>Trapper Creek</i>
<i>Willow Creek</i>	<i>Birch Creek</i>

Objectives

Plan and Research

- Incorporate Wetlands Prioritization into the Middle-Lower Watershed Restoration Plan
- Support the Wetland Prioritization with research and studies.

Education

- Provide wetland interpretation where appropriate, such as within fishing access sites.
- Include wetland function in landowner education efforts

Restore

- Identify and implement high quality wetland restoration projects that will have direct impact on goals.

Preserve & Protect

- Work with four counties to include wetland protection in county Growth Policies.
- Work with three Conservation Districts on wetland permitting, protection and education.
- Include language for wetland role and protection in the Big Hole Watershed Committees Land Use Planning effort - a committee working towards protection of channel migration zones from development.
- Seek support for landowners to protect lands through easement and work. Solicit landowners that own lands with identified high quality wetlands to participate in easement.

Potential Projects by Priority Area

Sites Identified for Restoration

Site	Landowner	WQ Goal	Description	Wetland Type
Wise River Beaver Recolonization	USFS	Sediment Retention Maintain Flows	Document the decolonization of beavers in the Wise River and correlate with improvements with water quality.	Riparian
Big Hole Pasture Land	Zuckers Big Hole Ranch	Maintain Flows Temperature	Alter pasture management and grazing plan to allow rewetting of historic wetland	Riverine
North Fork Pasture Land	Dell Bacon Ranch	Maintain Flows Temperature	Alter pasture management and grazing plan to allow rewetting of historic wetland and improve pond on site.	Riverine
Big Hole River - Pintlar Creek to Fishtrap Creek	Private, BLM - many	Maintain Flows Temperatures	Create long-term plan for targeted micro-restoration to stabilize banks and retain flows/temperature.	Riverine
Jerry Creek	Private - many	Nutrients Bank Stabilization	Work with landowners on grazing management plans for bank stabilization	Riparian
Lower Big Hole River	Pashley	Flows/Temperature	Hydro-modified. Alter pasture management to allow rewetting of historic wetland	Riverine

Sites Identified for Education and Interpretation

Site	Landowner	WQ Goal	Description	Wetland Type
FAS Notchbottom	FWP	Education/Interp.	Restore site and provide interpretive wetlands site.	Riparian/Riverine

Sites Identified for Preservation & Protection

Site	Landowner	WQ Goal	Description	Wetland Type
Divide Creek	Smith	Sediment	Encourage landowner to enter land into easement to preserve high quality section.	Riparian
Deep Creek	Ralston	Sediment	Encourage landowner to enter land into easement to preserve high quality section.	Riparian
Burma Road Pinch Point	Childrey	Flow/Temperature	Encourage landowner to enter land into easement to preserve high quality section.	

Appendix H: Landowner Contacts and Maps: GGWC

Property Owner	Contact	Property Address	Mailing Address	Phone Number	TMDL Contributing Area	Email & Additional information
MSU	EJ Hook, MSU Facilities	16 Graf Street, Bozeman, MT 59715		994-7840	Bozeman Creek	edward.hook1@montana.edu
Emerichip Bozeman	Spring Meadows Retirement Community	3175 Graf Street, Bozeman, MT 59715		587-4570	Bozeman Creek	
Gerald and Marilyn Robertson		3120 Wagonwheel Rd, Bozeman, MT 59715		587-4032	Bozeman Creek	Matthew Bird Creek, livestock on denuded hillside and trammeled creek
West Meadows Subdivision	Kris Merkel - West Meadows H.O.A		West Meadows H.O.A. PO Box 10992 Bozeman, MT 69715-0992	579-6044	Bozeman Creek	krismerkel@gmail.com
Helen M and James R Craig		3312 Sundance Drive, Bozeman, MT 59715	3312 Sundance Drive, Bozeman, MT 59715	586-9042	Bozeman Creek	
James O Jr. and Ronda L Russell		3318 Sundance Drive, Bozeman, MT 59715	3318 Sundance Drive, Bozeman, MT 59715	587-3696	Bozeman Creek	
Leonard and Eugenie Kehl		3320 Sundance Drive, Bozeman, MT 59715	3320 Sundance Drive, Bozeman, MT 59715	586-3002	Bozeman Creek	

Megan F Ross		105 Silverwood Drive, Bozeman, MT 59715	105 Silverwood Drive, Bozeman, MT 59715	585-0529	Bozeman Creek	
Timothy Mark Sr. and Kathryn Haas	Kathryn Haas	102 Silverwood Drive, Bozeman, MT 59715	102 Silverwood Drive, Bozeman, MT 59715	948-0079	Bozeman Creek	Kathryn Haas mobile number
Chris Boyer		10281 Kelly Canyon Road	10281 Kelly Canyon Road	522-8988	East Gallatin	Chris's mobile: 580-1946 chris@kestrelaerial.com
Property Owner	Contact	Property Address	Mailing Address	Phone Number	TMDL Contributing Area	Email & Additional information
Timothy Barnard			PO Box 99, Bozeman, MT 59771		East Gallatin	



GGWC Task III Field Assessment: Mathew Byrd Creek

1 inch = 200 feet

Legend

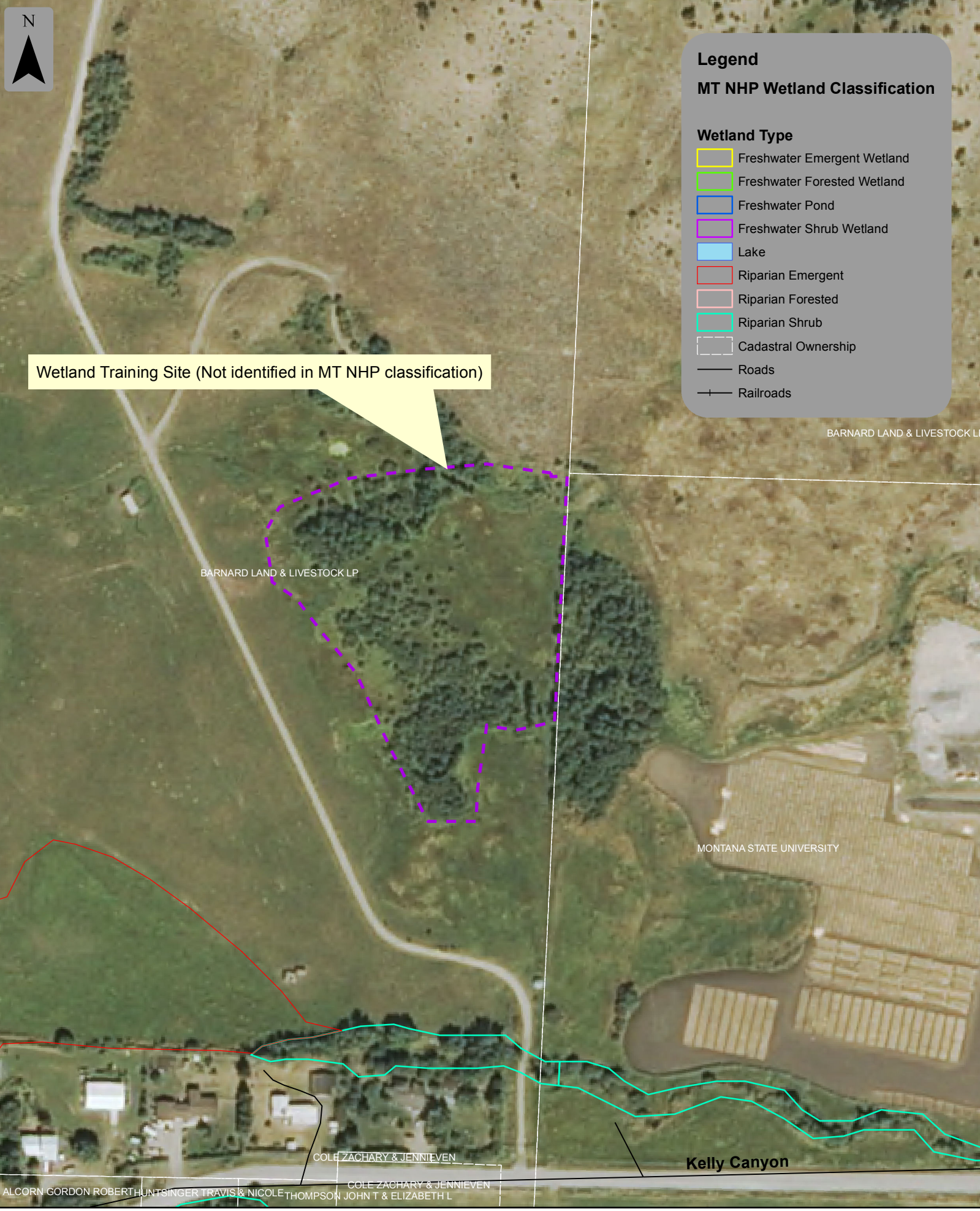
MT NHP Wetland Classification

- Other
- Freshwater Emergent Wetland
- Freshwater Forested Wetland
- Freshwater Pond
- Freshwater Shrub Wetland
- Lake
- Riparian Emergent
- Riparian Forested
- Riparian Shrub
- Cadastral Ownership
- Roads
- Railroads



GGWC Task III Field Assessment: Boyer

1 inch = 300 feet



Legend

MT NHP Wetland Classification

Wetland Type

- Freshwater Emergent Wetland
- Freshwater Forested Wetland
- Freshwater Pond
- Freshwater Shrub Wetland
- Lake
- Riparian Emergent
- Riparian Forested
- Riparian Shrub
- Cadastral Ownership
- Roads
- Railroads

Wetland Training Site (Not identified in MT NHP classification)

GGWC Task III Field Assessment: Barnard (Training Site)

1 inch = 200 feet

Appendix I: Landowner Contacts and Maps: BHWC

Landowner	Site
Montana Fish, Wildlife and Parks Biologists	Mount Haggin Wildlife Refuge (state land)
Jim Olsen, Vanna Boccadori	
US Forest Service	US Forest Service Lands in Wise River drainage
Nate Gassman, Dan Downing, Russ Riebe	Watershed Restoration Planning Priorities on US Forest Service lands
6 Bar S Ranch	Divide Creek
Randy Smith	Big Hole River near Glen
Hagenbarth Livestock	Big Hole River near Glen
Jim Hagenbarth	
Dell Bacon Ranch	Toomey Lake
Hans Humbert	
Zucker Ranch	Zucker Ranch west of Wise River
Corey Lamey, Steve Zucker (several attempts to contact with no response)	
John Lundborg	Jerry Creek
Kamperschroer Ranch	Pond on Kamperschroer Ranch near Jerry Creek
Pete Kamperschroer	Irrigated land south of Wise River
Pioneer Outfitters	Alder Creek bottom lands
Chuck Page	
Sam Stone	
Big Hole Ranch	Big Hole River near Melrose
Sam Stone	
Joe Pizzouli	
Lower Big Hole Corridor	Lower Big Hole Corridor lands

Dave Ashcraft - Landowner	Old Oxbow, Springs and Slews possible water resource development
Jim Olsen - Montana Fish, Wildlife and Parks	Pursued with Lower Big Hole Corridor Report completed 7/2012
Ben Pierce, Hamilton Ranch	
Childrey's	Big Hole River near not bottom
(unable to meet due to illness)	

Appendix J: Prioritized Watershed Recommendations: GGWC

5.2 Task 2 Watershed Goals and Objectives

Mathew Bird Creek converges with Sourdough (Bozeman) Creek approximately two miles downgradient of Graf Street and upgradient of Bogert Park and East Story Street in downtown Bozeman. Restoration and enhancement of the wetland and riparian areas associated with Mathew Bird Creek would be expected to facilitate water quality objectives for Sourdough Creek primarily by reducing sediment and nutrient inputs. The watershed goals and objective statements from Task 2 for the Sourdough Creek contributing area are listed below.

GIS ID Gallatin 13: Sourdough (Bozeman) Creek TMDL Contributing Area

- **Point Source Pollutants:** Escheria coli, Phosphorus, Sedimentation/Siltation, and Total Kjeldahl Nitrogen
- **Non-Point Source Pollutants:** Alteration in stream-side or littoral vegetative covers and chlorophyll-a
- **Potential Pollutant Sources:** Channelization, grazing in riparian or shoreline zones, irrigated crop production, loss of riparian habitat, septic disposal, and yard maintenance.
- **Goal:** Identify riparian areas, depressional, and slope wetlands for restoration and/or protection in order to stabilize streambanks, retain sediments and reduce siltation, and increase nutrient attenuation in the Sourdough TMDL contributing area.
- **Objective #1:** Target slope and depressional wetlands because of their capacity to attenuate nutrients (65% and 22%, respectively); Target slope wetlands because of their capacity to retain sediments (32%).
- **Objective #2:** Target depressional wetlands because of their hydrologic alteration as reported by the NWI database (385 acres).
- **Objective #3:** Target areas where limiting or eliminating grazing in riparian areas would allow for protection or restoration of original hydrologic functions.
- **Objective #4:** Contact landowners and conduct Level 2 assessments on wetlands identified in Objectives 1, 2, and 3.

5.3 Restoration Potential

The parcels reviewed in the Mathew Bird Creek corridor were identified in the NWI database as freshwater shrub wetlands. The corridor is a riparian area that includes an on-stream wetland depression south of Graf Street. There were no slope wetlands identified during the site review. The site poses limited opportunities for increasing wetland acreage. The benefit would be in increasing in the value of wetland functions.

Potential restoration alternatives include removing or restricting livestock access and revegetating denuded streambanks with native herbaceous grasses to stabilize the streambanks with sod-forming wetland species, prevent erosion, restrict the introduction of sediment into the stream, and increase nutrient attenuation. Sediment retention and nutrient transformation and recycling are high on lotic floodplain wetlands with organic-rich soils or seasonally flooded or wetter conditions (Tiner 2002). The restoration methods would meet Objectives 1 and 3. Removing any obstructions (rock dams) and

narrowing the stream channel through the use of sod mats would facilitate sediment transport by increasing stream velocities, which would benefit the aquatic habitat.

Separating the creek channel from the downgradient depression wetlands on MSU property would restore the hydrologic function of the stream by reducing water temperatures and increasing stream velocities through that reach. Enhancing the overstory by planting woody species through this reach would increase shading and provide cooler temperatures, which would benefit the aquatic and fish habitat in the stream. The depression wetland could be preserved once it was separated from the stream to provide a retention basin for sediment and nutrients from the surrounding areas.

Best management practices could be implemented by the landowners to reduce fertilizer usage within 50 feet of the stream channel, maintain the native vegetation cover, and control the spread of noxious and invasive species through manual controls or selected herbicide spraying. Homeowner Association rules or other instruments could be developed to protect the narrow wetland corridor on both sides of the stream.

The success of the restoration and preservation efforts may best be measured by using the 2008 Montana Department of Transportation Montana Wetland Assessment Method developed by Berglund and McEldowney in 2008. Functional assessment forms could be completed before and after restoration measures have been implemented.

5.4 Community Outreach

Restoration and enhancement of the Mathew Bird Creek would provide an excellent opportunity for the GGWC and their partners to work with numerous landowners in a coordinated effort. The cooperation of each landowner will be critical to defining the type, extent, and cost of the restoration efforts. Montana State University is a high-profile landowner with a very visible parcel where construction practices (not necessarily theirs) have directly impacted the stream channel. They have expressed an interest in improving the condition of the natural resources within the Bozeman urban setting. The restoration and enhancement of a high profile creek within the city limits would create an excellent template for educating the public regarding the importance of wetlands in improving the functional value of streams within an urban setting.

Work will need to be done to inform landowners along the creek regarding appropriate management of their land along the creek including management of livestock, removal of riparian vegetation, introduction of non-native plants, and management of invasive plants. Working with a sufficient number of key landowners to effect a change on a narrow stream corridor with small parcels will be critical to the success of the project as a whole.

Potential limitations to the project include the eligibility of USDA program funding for suburban landowners. The urban nature of the site may limit partner interest in funding traditional stream and wetland restoration work. The proximity of potential restoration areas to infrastructure will likely limit the restoration options in the area. Montana State University's participation would provide a strong

partner in obtaining technical and financial assistance, design skills, and influence on the additional landowners south of the MSU property.

5.5 Initial Steps for Restoration Planning

The initial planning steps for restoration measures associated with Mathew Bird Creek were taken from Tom Hinz's summary report (Appendix D):

- Determine whether the owner of the agricultural properties is interested in protecting the streambank and reducing inputs into the stream;
- Determine landowner eligibility for appropriate funding to address the animal feeding operation (AFO) on the stream (e.g. NRCS Environmental Quality Incentives Program [EQIP]).
- Assess project funding sources so that viable options can be suggested to the landowners.
- Work with landowners along the stream to identify yellow flag iris, Canada thistle, common tansy and other noxious plants for mechanical removal and/or biological/chemical treatment.

5.6 Potential Funding Sources

Existing programs to fund restoration/enhancement of the site may include USDA Farm Bill programs such as EQIP. Land owned by MSU could be addressed through partnering with MSU Staff, President Cruzado, and others. Additionally, funding (e.g. landowner cost-share) may need to be pursued through less conventional sources such as private philanthropy.

Big Hole River Middle - Lower Watershed Restoration Plan Final Wetland Prioritization Big Hole Watershed Committee December 2012

Purpose

The Big Hole Watershed Committee (BHWC) is one of two demonstration watersheds hosted by the Montana Department of Environmental Quality Wetland Program and Montana Wetlands Legacy Partnership. The goal of the program is to incorporate wetlands into watershed restoration planning for watershed groups. Specifically, wetland priorities will be established to meet water quality goals within the watershed restoration plan.

Background

Middle-Lower Big Hole River TMDL: The Middle-Lower Big Hole River TMDL was completed in 2009. This TMDL listed the Big Hole River mainstem for high water temperature and listed several tributaries for various reasons. The TMDL in its entirety can be viewed at [Montana Department of Environmental Quality](#). The TMDL Improvement Plan provides guidance on improving water quality in listed streams. A map highlighting listed streams is included here. Information provided here is based on the TMDL Improvement Plan.

Watershed Restoration Plan: The Big Hole Watershed Committee is in process of completing the Watershed restoration plan. The results of this report will be meshed with the final watershed restoration plan, expected complete by spring 2013.

Resources

[Montana DEQ's Exploring Your Aquatic Resources Mapping Program](#)

<http://www.deq.mt.gov/wqinfo/wetlands/exploringaquaticresources.mcp>

[Middle-Lower Big Hole River TMDL](#)

<http://deq.mt.gov/wqinfo/TMDL/finalReports.mcp>

Montana Department of Environmental Quality Wetlands and Watershed Project Files

Study Area

The study area is the middle and lower Montana Department of Environmental Quality TMDL planning areas. This watershed area stretches from Pintlar Creek entering the Big Hole River to the mouth of the Big Hole River. This includes 95 miles of Big Hole River and 1.02 million acres of watershed (Montana DEQ, 2009).

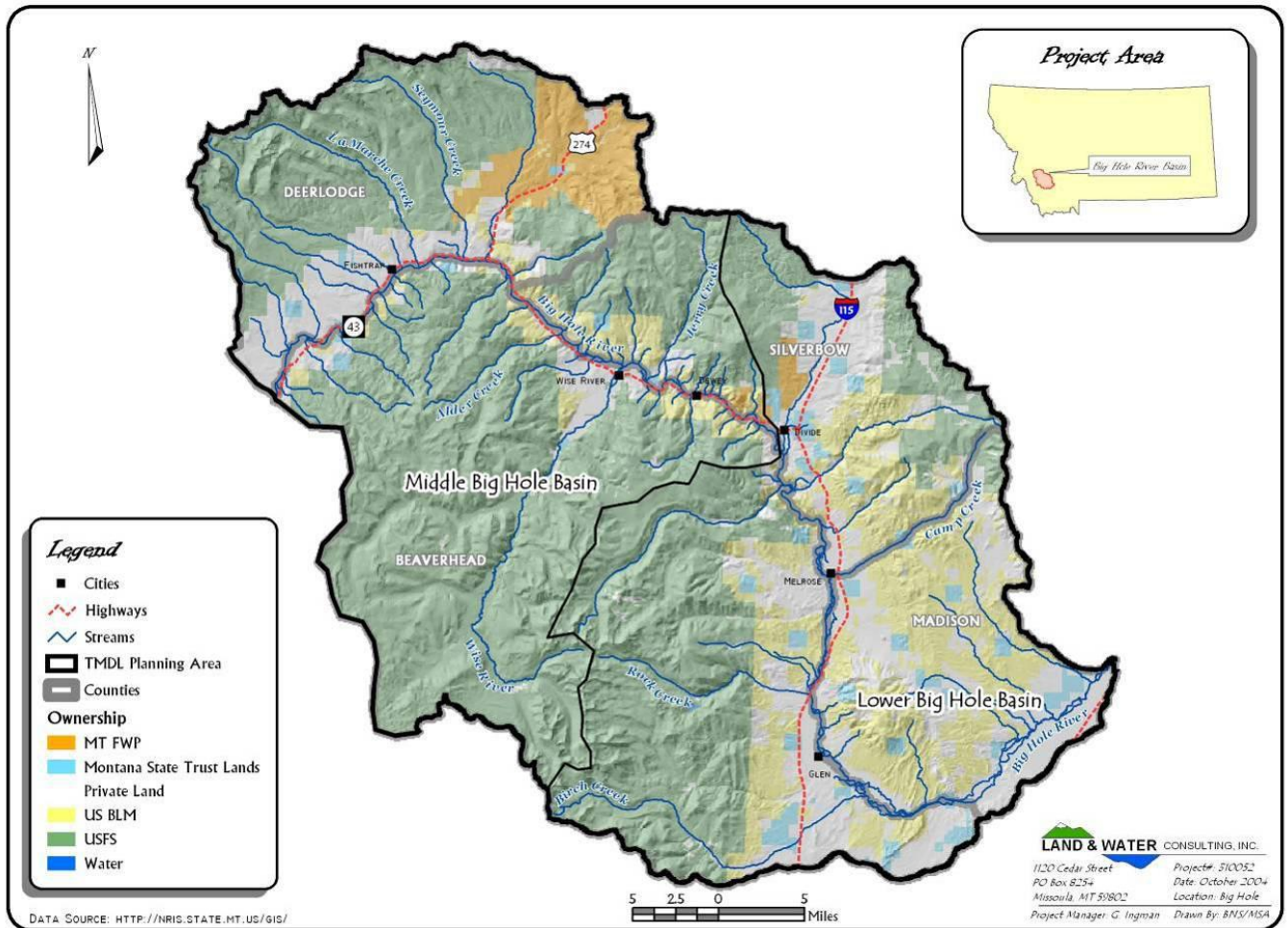


Figure 7: Study area - Middle and Lower Big Hole River TMDL Planning Area. Map Source: Montana DEQ TMDL Appendix A (Montana DEQ, 2009)



Figure 8: 303(d) Listed water bodies in the Middle and Lower Big Hole TPA. Map Source: Montana DEQ Middle-Lower TMDL Appendix A (**Montana DEQ, 2009**).

Middle and Lower Big Hole TMDL Planning Areas: TMDL Contributing Areas Map

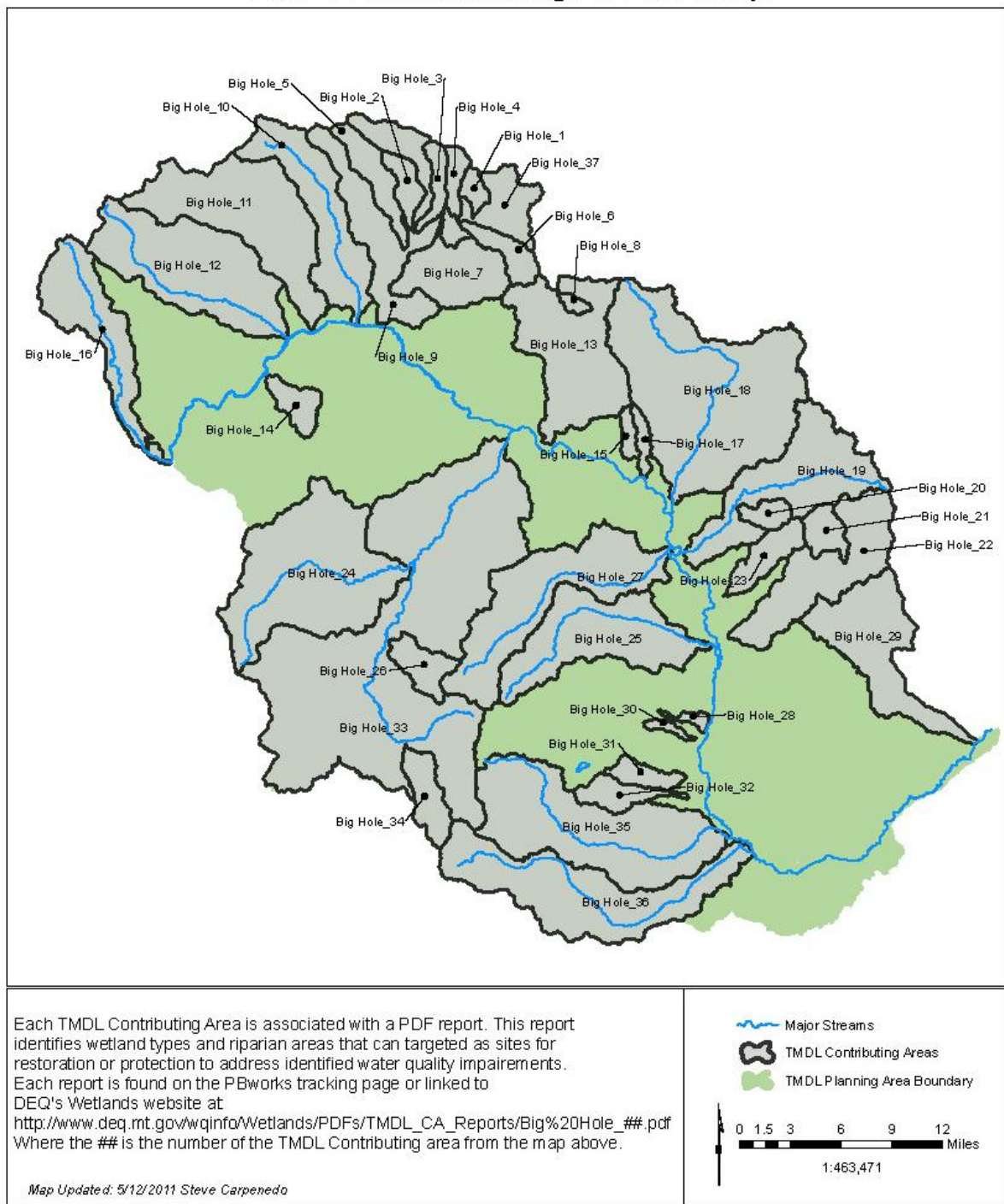


Figure 9: Middle and Lower Big Hole River TMDL Contributing Areas Map. Source: Montana DEQ Wetlands and Watersheds Project.

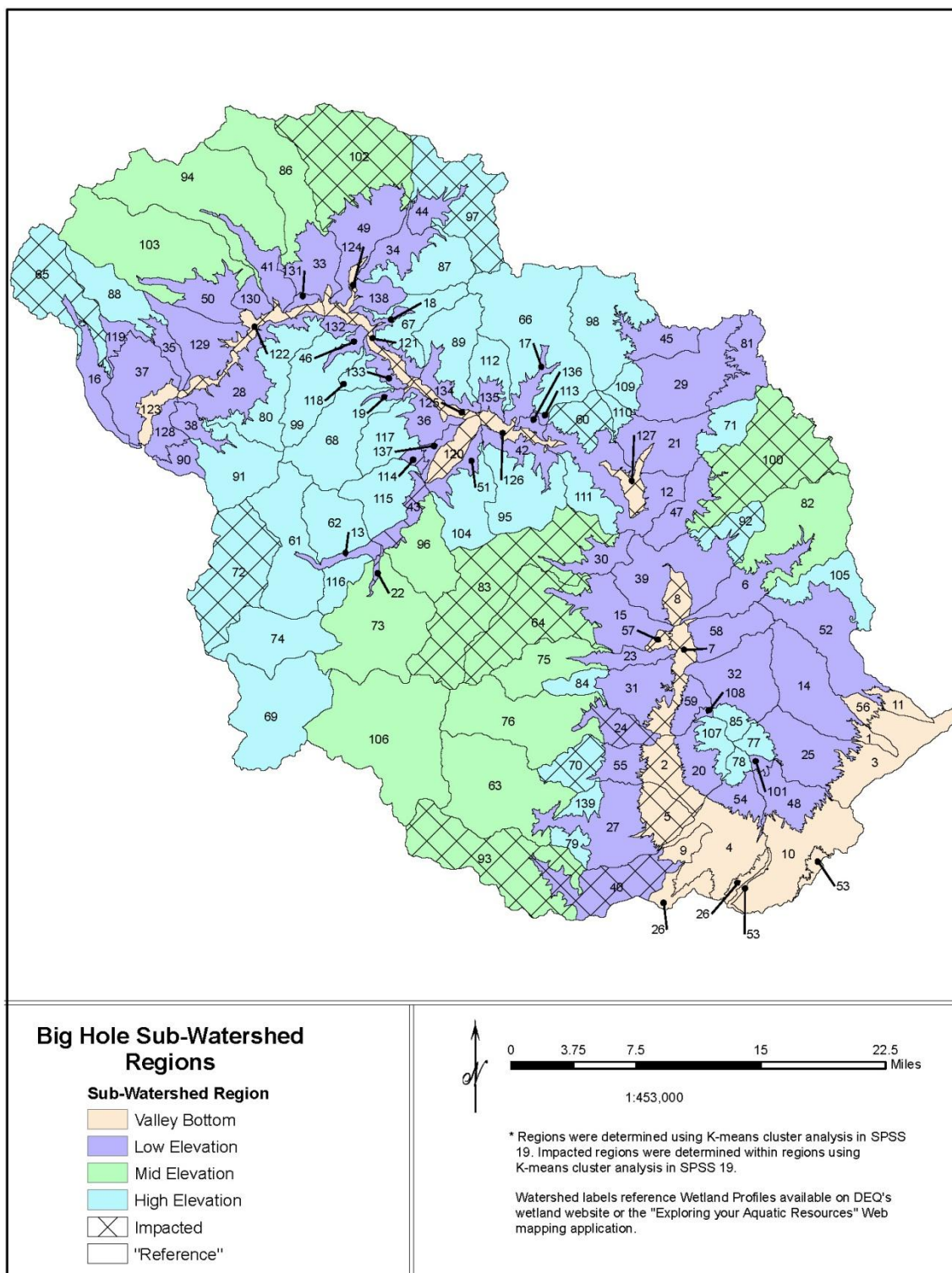


Figure 10: Middle-Lower Big Hole River TMDL Sub-Watershed elevation and condition. Source: Montana DEQ Wetlands and Watershed Project.

Partners

Currently several groups address wetland and water quality related issues. Our partners for this project include:

- Big Hole Watershed Committee
- Montana Department of Environmental Quality Wetland Program
- US Forest Service/Beaverhead-Deer Lodge National Forest
- Montana Wetlands Legacy Partnership
- Montana Fish, Wildlife and Parks
- Montana Natural Heritage
- Private Landowners

Expanded List of Potential Big Hole Watershed Wetlands Partners

Agencies:

- Montana Department of Environmental Quality
- Montana Department of Natural Resources and Conservation
- Montana Fish, Wildlife and Parks
- U.S. Bureau of Land Management
- U.S. Bureau of Reclamation
- U.S. Natural Resources Conservation Service
- U.S. Fish and Wildlife Service
- U.S. Forest Service
- EPA
- Army Corps of Engineers
- Federal Highway Administration
- Intermountain West Joint Venture
- Montana Department of Transportation
- U.S.D.A. Farm Service Agency

Conservation Districts:

- Montana Association of Conservation Districts
- Beaverhead Conservation District
- Mile High Conservation District
- Ruby Valley Conservation District

Organizations:

- Montana Natural Heritage Program
- Trout Unlimited (State and George Grant Chapter)

- Big Hole River Foundation
- Anaconda Sportsmans Club
- Wildlife Conservation Society
- Future West
- American Bird Conservancy
- Montana Native Plant Society - Calypso Chapter
- Missouri Headwaters Partnership
- Montana Watershed Coordination Council
- Rocky Mountain Elk Foundation
- Wise River Community Foundation (outreach resource)
- Divide Grange
- Montana Association of Land Trusts
- Montana Audubon Council
- Montana Fish, Wildlife and Parks Foundation
- Trust for Public Land
- National Center for Appropriate Technology (NCAT)
- Wildlife Conservation Society
- FutureWest
- Ducks Unlimited, Inc.
- Montana Land Reliance
- Montana Natural History Center
- Montana Watercourse
- The Conservation Fund
- The Nature Conservancy

University Programs and Schools

- Avian Science Center - University of Montana
- University of Montana Western
- Montana State University
- Montana Tech
- University of Montana
- Montana Bureau of Mines and Geology
- Big Hole Watershed Rural Schools (Twin Bridges/Sheridan/Wise River/Melrose/Divide/Wisdom/Jackson/Reichle/Grant/Polaris)
- Beaverhead County High School
- Montana State Extension
- Clark Fork Watershed Education Program

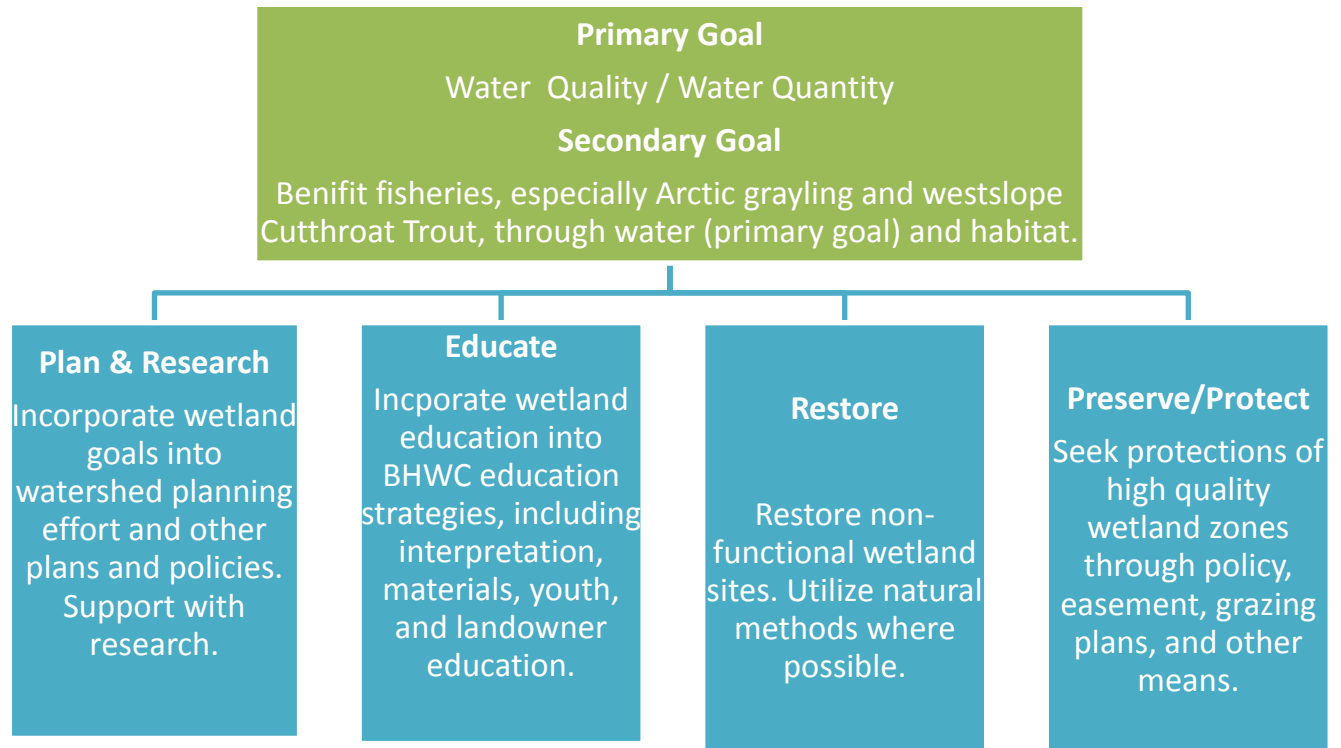
Counties

- Beaverhead County
- Silver Bow County
- Deer Lodge County
- Madison County

Other:

- Guides/Outfitters
- Landowners
- Patagonia (Dillon Store) - Volunteer Support
- PPL Montana

Goals And Priorities



Priority Reaches:

- **Top Priority:** Big Hole River Mainstem - Pintlar Creek to Mouth
Mitigate for water temperature by seeking wetlands that will have a direct effect on water temperature, and wetlands that will have an indirect on water temperature by improving resiliency through stream flow maintenance, vegetation, and channel shape alteration.
- **Secondary Priority:** 303d Listed Tributaries with listings other than metals
Address tributaries on a case by case basis based on recommendations made by the TMDL, existing and available wetland zones, and sources for water quality improvement. Several tributaries are listed for metals. While metals are a significant negative impact, wetlands are not targeted towards metals reduction. Therefore, tributaries with impacts outside of metals will have a greater priority. Tributaries with the greatest available wetland potential and identified as impacted watersheds are top priority:
Top Priority Tributaries:

<i>Fishtrap Creek</i>	<i>Deep Creek</i>
<i>Wise River</i>	<i>Jerry Creek</i>
<i>Divide Creek</i>	<i>Trapper Creek</i>
<i>Willow Creek</i>	<i>Birch Creek</i>

Objectives

Plan and Research

- Incorporate Wetlands Prioritization into the Middle-Lower Watershed Restoration Plan
- Support the Wetland Prioritization with research and studies.

Education

- Provide wetland interpretation where appropriate, such as within fishing access sites.
- Include wetland function in landowner education efforts

Restore

- Identify and implement high quality wetland restoration projects that will have direct impact on goals.

Preserve & Protect

- Work with four counties to include wetland protection in county Growth Policies.
- Work with three Conservation Districts on wetland permitting, protection and education.
- Include language for wetland role and protection in the Big Hole Watershed Committees Land Use Planning effort - a committee working towards protection of channel migration zones from development.
- Seek support for landowners to protect lands through easement and work. Solicit landowners that own lands with identified high quality wetlands to participate in easement.

Wetland Specific Potential Projects by Priority Area

Projects Identified for Restoration

Site	Landowner	WQ Goal	Description	Wetland Type
Wise River Beaver Recolonization	USFS	Sediment Retention Maintain Flows	Wise River is entrenched in several segments near Lacy Creek. Beaver recolonization could repair widespread bank destabilization.	Riparian
Zuckers Big Hole Pasture Land	Zuckers Big Hole Ranch	Maintain Flows Temperature	Alter pasture management and grazing plan to allow rewetting of historic wetland. Presently a ditch drains this pasture.	Riverine
North Fork Pasture Land & Toomey Lake	Dell Bacon Ranch Hans Humbert	Maintain Flows Temperature	Alter pasture management and grazing plan to allow rewetting of historic wetland and improve pond on site.	Riverine
Big Hole River - Pintlar Creek to Fishtrap Creek	Private, BLM - many	Maintain Flows Temperatures	This reach of the Big Hole River suffers from a widespread lack of streamside vegetation and overwidened channel causing high late summer water temperatures. Create long-term plan for targeted micro-restoration to stabilize banks and retain flows/temperature.	Riverine
Jerry Creek	Private - many Lundborg	Nutrients Bank Stabilization	Work with landowners on grazing management plans for bank stabilization. Landowner interested in revegetation of willows.	Riparian Riparian
Lower Big Hole	Pashley	Flows/Temperature	Hydro-modified. Alter	Riverine

River near Twin Bridges			pasture management to allow rewetting of historic wetland	
Lower Big Hole Corridor (High Road Bridge and upstream 3 miles)	Ashcraft/Hamilton Ranch	Flow/Temperature Flood Abatement	Alter existing irrigation system with upgrades to irrigation structures and rewetting of dried lands. See "Lower Big Hole River Corridor Phase I Report, 2012" for specific details. (Confluence Consulting, Inc., 2012)	
Burma Road at Pinch Point	Childrey's	Flows/Temperature	This region is also referred to as the turtle ponds due many water potholes. However, chronic dewatering in the region causes late season water issues. Reduce dewatering impacts. Follow with long term land protection.	Riverine
Bacon Modified Pasture	Ray Bacon Ranch	Flows/Temperature	Need onsite view, but listed as large hydrologically modified wetland.	Depressional
MT Haggin Wildlife Refuge	Montana	Sediment	Alter range management to allow wetland protection	Riparian
French Creek	Montana	Sediment	Restoration work planned with FWP to restore damaged riparian zones in upper French Creek. This includes working with FWP on opportunities that arise with road improvements.	Riparian
Moose Creek Headwaters	Private Inholding	Flow Maintenance	This high elevation pasture land suffers from extreme hummacing. Alter grazing management to	Riparian

allow willow growth				
Pintlar Creek and Christensen Complex	Christiansen, Humbert	Temperature Flood Abatement	The region of the Big Hole River on the east end of the North Fork Road and its intersection with Highway 43 holds many opportunities to alter current land use to allow for water storage and late season temperature buffers.	Riparian and Depressional

Projects Identified for Education and Interpretation

Site	Landowner	WQ Goal	Description	Wetland Type
FAS Notchbottom	FWP	Education/Interp.	Due to the high traffic volume and the poor habitat condition, this site could be restored and used to provide interpretation on the importance of wetlands to the river landscape.	Riparian/Riverine
Conservation Easement Seminar	Many	Education	Provide seminar on methods, resources, and benefits of conservation easements.	All

Projects Identified for Preservation & Protection

Site	Landowner	WQ Goal	Description	Wetland Type
Divide Creek	Smith	Sediment	Encourage landowner to enter land into easement to preserve high quality section.	Riparian
Deep Creek	Ralston	Sediment	Encourage landowner to	Riparian

			enter land into easement to preserve high quality section.
Burma Road Pinch Point	Childrey	Flow/Temperature	Encourage landowner to enter land into easement to preserve high quality section.
Wetland Protection Language	BHWC Land Use Planning		Work with greater Land use planning effort, DEQ Wetlands Program (Linda Saul), and counties to draft

Big Hole Watershed Restoration Projects with Peripheral Benefit to Wetlands

Big Hole River Floodplain Mapping:

In 2012, the Big Hole Watershed Committee (in partnership with DNRC, DEQ, counties and Future West) completed Floodplain Approximate Zone A (100 year floodplain) maps. These maps, combined with two existing map sets, completes floodplain maps for the entire Big Hole River. The maps will be under review for state and county adoption spring 2013. The maps can then be used to refine floodplain regulations to manage development in river corridors. Potential results include protection of human health, life and property in the river corridor in high flows, protection of the river corridor from inappropriate development, and to regulate the kinds of development allowed in the river corridor. Given the dry landscape of the Big Hole Valley, the majority of wetlands are found near streams and rivers. Therefore, floodplain protections will go far in protecting wetlands. Furthermore, the Big Hole Watershed Committee Land Use Planning Committee can suggest wetland protection language as part of the regulatory changes at the county level, if language seems appropriate.

Big Hole Watershed Incentive Program

The Big Hole Watershed Committee Land Use Planning Committee is developing an Incentive Program, or otherwise called Payments for Ecosystem Services. The program is under development. In 2012 the group completed an analysis to assess possible income streams. If launched, this program can serve as a resource to provide compensation to landowners in exchange for wetland protection.

Water Storage Alternatives

The Big Hole River suffers from low flows in dryer months, July - August. Many water storage options have been proposed over the last decades to store early spring flows to be released July-August to augment low flows. Alternatives are often tied to reservoir or dam projects, which are expensive require maintenance. Wetland restoration can be a source of water storage with late season flow release. In contrast to water control projects, wetlands provide a natural water storage and release system that is lower in cost, does not require maintenance, and allows for a natural system to operate.

Big Hole River Irrigation Projects

The Big Hole River is used for irrigation throughout its length. Old irrigation structures often do not completely control water, do not provide water measurement, require in-stream disruption, and cause streambank erosion. The TMDL states for the middle Big Hole that in order to achieve the 15% temperature reduction in the target, "all reasonable irrigation water management practices with water savings applied to instream flow via local, voluntary approach is needed for increasing dissipative capacity of the River." (Montana DEQ, 2009) The Big Hole Watershed Committee, among other groups, have swiftly addressed the issue of headgates by replacing headgates, installing water measurement, and installing permanent instream diversions. The majority of the top priority headgates have been replaced. Some of those headgates were replaced with stockwater wells. Many headgates remain in

need of repair. This project has opened the possibility for options other than stockwater wells and headgates alone.

As an example, two high priority headgates located in the Lower Big Hole River are slated for repair by the Big Hole Watershed Committee. Prior to this project, this would have been strictly the replacement of two headgates alone. However, in 2012 the Big Hole Watershed Committee partnered with Montana Fish, Wildlife and Parks and landowners to review the sites for possible alternatives to headgate replacement alone. Confluence Consulting was hired to investigate possible solutions. The results shows possible alteration of the headgate design for a replacement that will also provide a wetland opportunity that will store water for late season flow release and will provide fish habitat.

Works Cited

Confluence Consulting, Inc. (2012). *Lower Big Hole River Corridor Assessment Phase 1*. Bozeman, Montana: Big Hole Watershed Committee.

Montana DEQ. (2009). *Middle and Lower Big Hole Planning Area TMDLs and Water Quality Improvement Plan. M03-TMDL-02A*. Helena: Montana Department of Environmental Quality.

FRAMEWORK STEPS AND PROCESSES FOR INCORPORATING WETLANDS INTO WATERSHED RESTORATION PLANS

Tom Hinz
Montana Wetlands Legacy Partnership

- and -

Stephen M. Carpenedo
Montana DEQ Wetland Program

DECEMBER 2012



Introduction

In the State of Montana it is estimated that wetlands make up less than one percent of the landscape. Mapped wetlands in Montana average two acres in size ([USFWS 2008](#)). Their small size and landscape coverage percentage belies their importance to the ecological health of the state and its waters. Depending on the landscape position of wetlands, they provide a variety of ecosystem functions including: groundwater recharge/discharge, flood attenuation, flow regulation, nutrient and pollutant removal, and wildlife habitat. Wetlands provide functions that are generally not apparent to the eye and often misunderstood. As a result, while potentially protected at the federal and state level, wetlands are often not the focus of protection at a local level. This is in part due to limited understanding of their importance to environmental quality. This limited understanding leads watershed groups, landowners, local governments, and others to focus more on streams and water quality than the associated wetlands which are a vital part of the aquatic functioning of a watershed. The widespread absence of wetland protection at the local level contributes to indirect impacts to wetlands that cumulatively can greatly affect the health of a watershed. As [Cappiella et al. \(2006\)](#) states, “Watershed [restoration] plans effectively direct the application of regulatory and non-regulatory tools for aquatic resource protection at the local level. Wetland protection, however, has historically been delegated to federal or state permitting authorities who have little control over local land use decisions and as a result wetlands cannot be effectively managed and protected.” Integrating wetlands into watershed restoration plans is one of the most effective means of protecting wetlands from the indirect impacts of urbanization and other land uses and can fill the gaps where wetlands fall outside of state or federal jurisdiction.

The Montana Department of Environmental Quality (MDEQ) Watershed Protection Section (WPS) provides technical and financial assistance to groups developing watershed restoration plans using EPA’s Nine Elements of Watershed Plans (USEPA 2008) and 319 grant funds. In many watershed restoration planning efforts to date, wetlands have been either omitted or not addressed to a degree sufficient to ensure their conservation and ultimate contribution to watershed functions and health. The Wetland Program at MDEQ and the Montana Wetlands Legacy Partnership have been working with the Big Hole Watershed Committee and the Greater Gallatin Watershed Council to develop and demonstrate a replicable process of incorporating wetlands into the watershed restoration planning process. To accomplish this, we integrated the 11 steps the Center for Watershed Protection outlined in *Using Local Watershed Plans to Protect Wetlands* ([Cappiella et al. 2006](#)) into EPA’s Nine Elements of Watershed Plans.

The following table outlines the nine framework steps that we took to integrate wetlands into the watershed restoration planning process. As a pilot project, we found additional time and funding were needed to effectively complete this model approach. Given that time, we were able to demonstrate that incorporating wetlands into the watershed restoration planning process need not be and should not be a separate process. Wetlands should be incorporated as just one of the aquatic resources and the framework steps outlined below can be and do apply to all aquatic resources addressed in any watershed restoration plan.

Framework outlining the steps and processes necessary for incorporating wetlands in watershed restoration

Framework Steps	Step in the Watershed Planning Process	Corresponding U.S. EPA Nine Element (U.S. EPA 2008)	Watershed Planning Principles to Restore and Protect Wetlands (Cappiella et al. 2006)	Purpose and Methods	Pros/Cons
1: Characterize wetlands within the TMDL Planning Area	Step 2		5. Create an Inventory of Wetlands in the Watershed (5.1, 5.2)	<p>Just as the TMDL Implementation Plans characterize the streams and lakes in a watershed, wetlands too need to be rigorously characterized. An accurate characterization of wetlands should be done at the beginning by MDEQ which is the entity overseeing development of the TMDL Implementation Plan that will inform the watershed planning process.</p> <p>To characterize wetlands within a TMDL planning area, it is first necessary to update the National Wetlands Inventory mapping for the area. A characterization of wetlands can be as simple as calculating the number of acres that lie within a contributing area of a 303d listed stream. These can be further broken out using the Cowardin wetland classification system (Cowardin et al. 1979) to characterize wetlands by their type, class, and hydrologic regime. A more in-depth characterization maybe developed using the Hydrogeomorphic method (HGM) that characterizes wetlands by HGM-type, function, and describes their wetland profile.</p>	<p>Pros: Accurate wetland characterizations are imperative for watershed groups to effectively incorporate wetlands into their watershed planning processes.</p> <p>Cons: The time, data, and expertise necessary to develop an in-depth characterization of wetlands within a watershed may be beyond the capability of most watershed groups. As a result, MDEQ would require the time and other resources to fill this role. NWI mapping is still incomplete for Montana which imparts a longer time and greater expense for wetland/watershed integration in those areas where NWI is not yet completed.</p>

2: Relate wetland functions to known water quality impairments	Step 3	Element c	5. Create an Inventory of Wetlands in the Watershed (5.4)	<p>Relating wetland functions to the known water quality and quantity impairments is necessary to ensure wetland restoration and protection are integrated into watershed restoration goals. Demonstrating how specific wetlands can address watershed goals can be accomplished through referencing wetland functions and their ability to address specific impairments; including, pollutants, pollution, and other causes of impairment that MDEQ TMDL Planning Bureau identifies for a water quality impaired stream.</p> <p>To relate wetland function to water quality impairments, a Landscape Position, Landform, Waterflow Path, and Waterbody (LLWW) value added attribution needs to be added to the National Wetlands Inventory. MDEQ has developed a process for relating wetland function to water quality impairments through the Impaired Water Contributing Area Reports. This is a simple methodology that is guided by a series of rules that relate specific wetland functions to the types of pollutants, pollution, and causes of impairment within a TMDL Planning Area.</p>	<p>Pros: Relating wetland functions to known water quality impairments is necessary if a watershed group intends to address water quality impairments through restoration and/or protection of wetlands. The process of showing how wetland functions address water quality impairments, helps inform those involved with watershed restoration plans.</p> <p>Cons: Because the process of adding LLWW value added attribution to the National Wetlands Inventory is not standardized, LLWW attribution lacks sufficient accuracy for several wetland types. While this issue is currently being addressed, LLWW attribution has still not been added to all of the NWI maps for Montana. As a result, data used to relate wetland function to water quality impairments is considered provisional with inadequate QA/QC.</p>
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3: Build Partnerships	Step 1		<ol style="list-style-type: none"> 1. Compile Wetland information on a Watershed basis (1.1, 1.2) 2. Assess Local Wetland Protection Capacity (2.1) 3. Identify Wetland Partners and roles (3.1,3.2,3.3) 	<p>As stated in U.S. EPAs <i>Handbook for Developing Watershed Restoration Plans to Restore and Protect Our Waters</i>, “Watershed planning is often too complex and too expensive for one person or organization to tackle alone. Weaving partners into the process can strengthen the end result by bringing in new ideas and input and by increasing public understanding of the problems and, more important, public commitment to the solutions.” Wetland partners should be involved in the stakeholder process for the watershed restoration plan to ensure that wetland interests are fully integrated into the plan.</p> <p>To build partnership with organizations that have an interest in wetlands, Needs and Capabilities Assessments (NCA) were completed with specific questions that focused on wetland resources. The NCA is designed to give the watershed group a broader view of its strengths and weaknesses and to help identify programs, resources, and partners to engage in developing and implementing an effective watershed restoration plan. This Needs and Capabilities Assessment was developed by the Center for Watershed Protection.</p>	<p>Pros: Conducting the Needs and Capabilities Assessment is a good way to identify groups and individuals interested in participating in the watershed restoration planning process that may not have been identified in a more traditional approach.</p> <p>Cons: Some NCA questions are not relevant for all watersheds in Montana, especially those that are more rural. Additionally, completing the NCA takes time which for some watershed groups is very limiting due to lack of a full-time coordinator or board members who can dedicate the time to complete the NCA.</p>
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4: Assess Local Wetland Protection Capacity	Step 1 & 2	Element d	<p>2. Assess Local Wetland Protection Capacity (2.1, 2.2)</p> <p>3. Identify Wetland Partners and Roles (3.1, 3.2)</p>	<p>Effective watershed restoration planning must include an initial assessment of the local organization's capacity to implement the final watershed restoration plan. This assessment identifies basic watershed and community demographics, key watershed management resources, and helps the watershed group evaluate how well local programs and regulations measure up to specific watershed protection goals and benchmarks. .</p> <p>Two tools were used to collect this information, the NCA from Step 3, and an 8 Tools Audit (8TA) also developed by the Center for Watershed Protection. The NCA is designed to give the watershed group a broader view of its strengths and weaknesses and to help identify programs, resources, and partners to engage in developing and implementing an effective watershed restoration plan. The 8TA is a much more detailed analysis of local environmental regulations and programs related to watershed protection. The results of an 8TA should be used to make recommendations as part of the final watershed restoration plan. Both the NCA and 8TA should be completed to better inform a watershed group regarding local capacity to protect wetlands.</p>	<p>Pros: These tools identify basic watershed and community demographics, key watershed management resources, and help watershed groups evaluate how well local programs and regulations measure up to specific watershed protection goals and benchmarks. They also help to identify gaps where improvements are needed. These tools were designed so that the information gathered can be easily translated into goals and objectives in a watershed restoration plan or other local planning document. These tools also help the watershed group estimate the amount of technical and financial assistance needed, as well as the sources and authorities that may be called upon to assist in implementing the plan.</p> <p>Cons: The 8 Tools Audit (8TA) is comprehensive and will likely take several days of staff time to adequately complete. The required time is even greater when a watershed includes multiple counties and/or municipalities. Given that most Montana watersheds lack full-time watershed coordinators, the time to complete the 8TA is a significant issue.</p>
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<p>5: Develop preliminary watershed goals and objectives that include specific goals and objectives for wetlands</p>	<p>Step 3 & 4</p>	<p>Element c & e</p>	<p>4. Define Wetland Goals and objectives (4.1, 4.2)</p>	<p>Preliminary watershed goals and objectives are defined early in the watershed planning process to help guide the watershed restoration plan. The preliminary watershed goals and objectives should be broad and incorporate all aquatic resources found within the watershed, information collected in the Framework Steps 1-4, and should incorporate an educational component. Goals and objectives should relate back to how they will address water quality and quantity impairments.</p>	<p>Pros: Goals and objectives form the basis of a watershed restoration plan and define the implementation steps needed to successfully address water quality and quantity impairments.</p> <p>Cons: None</p>
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<p>6: Create an inventory of wetlands within the watershed where protection/restoration can accomplish watershed goals and objectives</p>	<p>Step 2 & 3</p>	<p>Element a & c</p>	<p>5. Create an Inventory of Wetlands in the Watershed (5.2, 5.3, 5.4, 5.5, 5.6)</p> <p>6. Screen Wetlands for Further Assessment (6.1, 6.2, 6.3, 6.4)</p>	<p>Creating an inventory of wetlands that can address water quality impairments is important as they represent management measures and practices that can be used to help achieve the goals of the watershed restoration plan.</p> <p>The U.S. EPA's <i>Handbook for Developing Watershed Restoration Plans to Restore and Protect Our Waters</i> outlines six steps for selecting management measures and practices. Wetlands are included in all of these steps and are a solid foundation for starting to identify wetland management measures and protections. Information collected in framework steps 1-3 should be incorporated into this process.</p> <p>To identify wetlands for restoration and protection that can address known water quality and quantity impairments in a watershed, a web application was developed to visually relate wetland functions to pollutants, pollution, and causes of impairment. This web application uses the updated NWI mapping with the value added LLWW attribution to screen wetlands and focus on candidate sites for further assessment. The application also informs some initial decisions about potential sites for conservation, protection, and restoration. This tool can be expanded for use statewide. The web application is found at: Exploring your aquatic resources. A tutorial for use of this tool can be viewed at: Explore your watershed tutorial.</p>	<p>Pros: Using a targeted approach to identifying wetlands for restoration and/or protection is a more cost effective means of using wetlands to address water quality impairments. It also provides a list of potential projects that can be prioritized and maintained for future reference as funds or interest arises.</p> <p>Cons: A targeted approach to identifying wetlands for restoration and/or protection is a time intensive process that does tend to leave out one key component; landowner willingness.</p>
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7: Evaluate wetlands in the field	Step 2 & 3	Element a & c	7. Evaluate wetlands in the Field (7.1, 7.2)	<p>Watershed restoration plans always include some assessment of on-the-ground conditions, in part, to identify potential project opportunities. Field assessments are used to validate assumptions made in the office, evaluate actual wetland conditions, gauge landowner willingness, determine stressors impacting an aquatic site, and to consider potentially beneficial management actions for a site. Evaluating wetlands in the field can vary from a simple walk and talk with a landowner to more systematic and comprehensive EPA Level 2 and 3 wetland assessments that evaluate the functional capacity of a wetland, its condition, and its restoration potential.</p> <p>U.S. EPA Level 2 rapid assessments are good for determining the condition of a wetland in comparison to a “reference network” and can inform the watershed group regarding the need to restore and/or protect a site. Montana Natural Heritage Program’s Ecological Integrity Assessment methodology measures both condition and evaluates site stressors. Montana Department of Transportation’s Montana Wetland Assessment Method allows the user to quantify the functions of a wetland. Both of these as well as other standardized methods could be used to inform a watershed group about a site and its potential to address water quality impairments.</p>	<p>Pros: Evaluating wetlands in the field informs the watershed group regarding the relative need and value in a watershed context of restoring and/or protecting a candidate site. To be reliable and effective, this step cannot be done remotely. On-site evaluations, done systematically, provide a basis for watershed groups to prioritize sites using common and repeatable methodology. These site visits can also quickly identify sites that are not suitable for restoration and/or protection as well as to gauge landowner receptivity to pursuing a potential project.</p> <p>Cons: Wetland assessments are a significant investment in time, travel, and other expenses. To be effective, those participating should have training and experience in aquatic site assessment, experience in developing effective landowner relations, knowledge of potential project partners and programs, and ability to interpret present site conditions relative to apparent history of impacts to the site. Judgment regarding the value of pursuing a project informed by local knowledge and experience in the watershed is necessary. Contacts with landowners may initiate project development which will require significant investment of time to build and maintain a relationship of trust between the landowner and watershed group representative(s). Watershed groups/coordinators should seriously consider this potential time commitment before indicating to the landowner that they may have a good project that will be investigated further for potential implementation.</p>
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<p>8. Refine preliminary goals and objectives with recommendations/ specific projects</p>	<p>Step 3, 4, & 6</p>	<p>Element c, d, e, & f</p>	<p>8. Adapt watershed tools to protect wetlands (8.1, 8.2)</p> <p>9. Prioritize Wetland Recommendations (9.1)</p>	<p>Preliminary goals and objectives to address water quality impairments were identified in framework step 5. Through the previous two steps, information gathered can help a group refine their goals and objectives to become more focused and achievable. More focused goals and objectives will result when the watershed group clearly identifies interested partners, program funding, time required for project implementation to address landowner expectations, and milestones in the project delivery process that will serve as checks to guide timely implementation of the watershed restoration plan.</p> <p>Watershed restoration plans should include much more than a list of potential projects that are expected to fix watershed problems. To be effective they should be developed to enhance local protection of watershed resources from future impacts through changes to land use plans, land protection ordinances, stream and wetland setbacks, and other regulated land use activities. Watershed restoration plans should also highlight best management practices appropriate to the watershed, especially those that could create significant benefits without significant investments or major campaigns to reform land and water use in the watershed. This information, while learned in part in framework step 4, can be refined with the added knowledge gained from compiling a wetland inventory and evaluating wetlands in the field.</p>	<p>Pros: By drafting initial goals and objectives and then refining them as information is gathered, a watershed group becomes better prepared to successfully implement their watershed restoration plan.</p> <p>Cons: This step requires additional time for collaboration between the watershed plan's authors, whether coordinator and/or board members. To be effective, it's imperative that the same individuals that have been involved in the planning process are also leaders in this step of the overall process. Turnover of group members and variation in each person's degree and timing of involvement make consistent involvement in the process a challenge for many watershed groups.</p>
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9. Prioritize recommendations/ specific sites	Step 4	Element c, d, e, & f	9. Prioritize Wetland Recommendations (9.1, 9.2)	<p>Effective watershed plans include specific management measures and recommended actions to change local regulations, adopt new or modify existing programs, and to implement conservation and restoration projects at locations within the watershed that are expected to produce the highest return on investment in terms of watershed health and functioning. This process will likely involve vetting and narrowing consideration of many project ideas to arrive at a comparatively small number of actions worth pursuing. To improve the chances that the watershed restoration plan is successfully implemented, recommended actions and locations for that work to be done should be critically prioritized.</p> <p>The U.S. EPAs <i>Handbook for Developing Watershed Restoration Plans to Restore and Protect Our Waters</i> has a good discussion on how to effectively rank management measures and actions to accomplish the watershed's goals.</p>	<p>Pros: Prioritizing changes in land and water use, policy and programs, and other actions identified in the watershed restoration plans will save time and money by focusing efforts on those projects with an expected high likelihood of successful implementation. Having projects prioritized also clarifies what types of projects and other activities the watershed group intends to focus on, which benefits not only the watershed and its residents but the group itself which is often pulled toward many differing priorities.</p> <p>Cons: Prioritization of specific sites, while informed by the science of watershed restoration planning, is by nature a process that involves many people who may have their biases toward favorite projects. Failure to implement previously identified “good projects” holds the potential to alienate some watershed group members and other potentially influential watershed residents. Those responsible to lead the prioritization process should be prepared for disagreements that may develop and be skilled in consensus building to attempt to minimize feelings that there are “winners and losers” in the prioritization process.</p>
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STORY MILL 25% CONCEPTUAL

Appendix M: Story Mill 25% Concept Design

RESTORATION PLAN DESIGN REPORT



Story Mill Project Site, July 2012

Submitted To:

The Trust for Public Land

Montana and Northern Rockies Office

Emerson Cultural Center

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January 2013

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Introduction

Project Overview

River Design Group, Inc. (RDG) was retained by The Trust for Public Land (TPL) to prepare a conceptual restoration plan for the Story Mill project area located in Gallatin County in the City of Bozeman, Montana (Figure 1). Encompassing approximately 61 acres, the Story Mill site was acquired by TPL in December 2012 for the purposes of developing a new city park, expanding the existing Story Mill Spur Trail, and restoring wetlands and water quality associated with the East Gallatin River and Bozeman Creek.

This report describes a conceptual restoration plan (CRP) for the Story Mill site. The purpose of developing a CRP is to define the restoration vision for the project area so community and park development actions can support a desired restoration outcome.

To support this purpose, this document is organized into the following sections:

- **Section 1. Introduction** provides project background information, a description of the project area setting, a summary of existing reports pertinent to development of the CRP, and presents the draft project goals.
- **Section 2. Existing Conditions** describes the existing conditions of wetland, riparian, and riverine resources within the project area, including the East Gallatin River and Bozeman Creek.
- **Section 3. Restoration Concepts** describes descriptions of general restoration treatments applicable to the Story Mill site.
- **Section 4. Integration with Park Development and Next Steps** describes the general approach for integrating the restoration and community and park development plans, and planning phases necessary to finalize the design and implement the selected restoration actions.

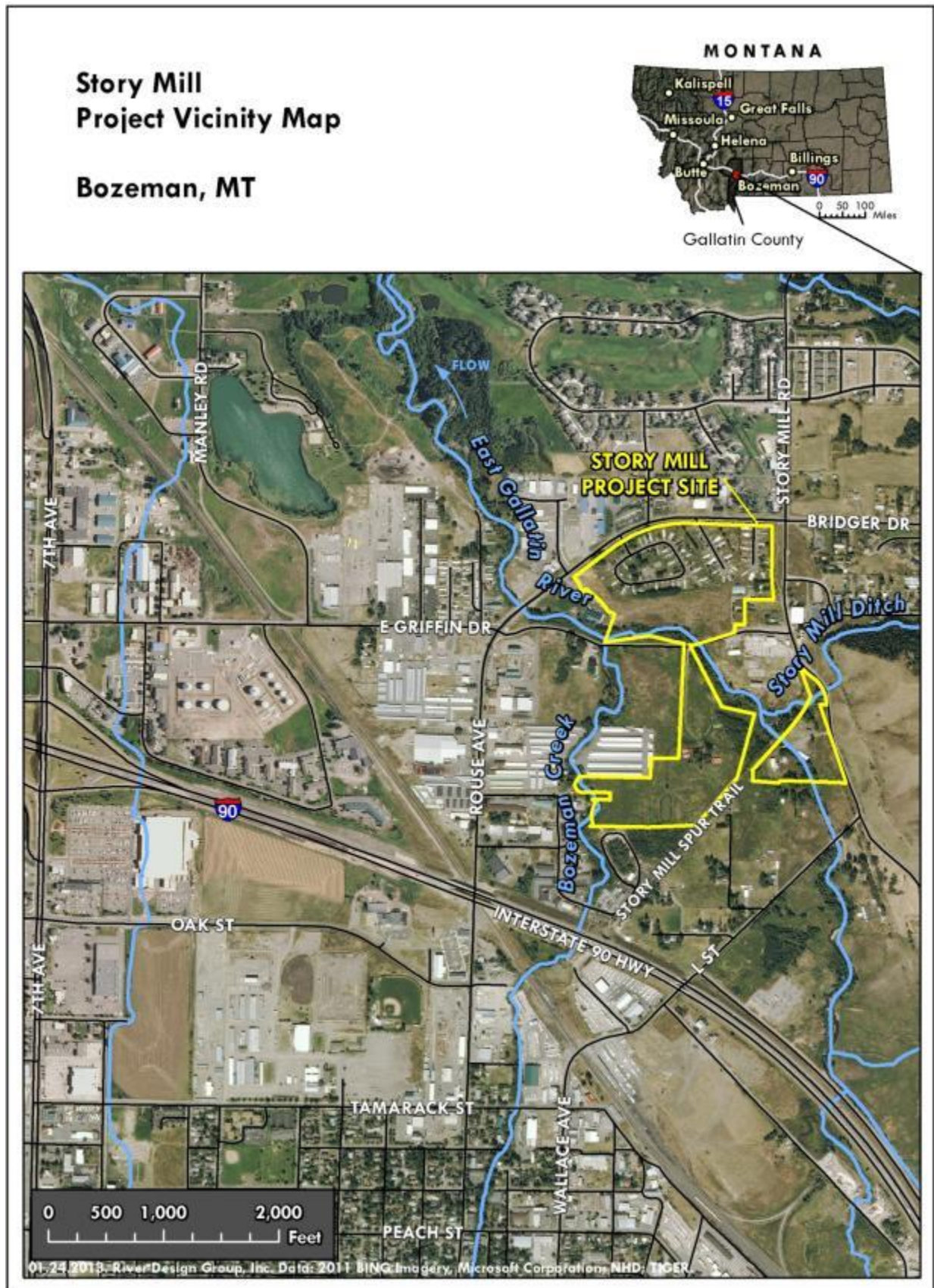


Figure 0-7. The Story Mill project site vicinity map.

1.1 Physical Setting

The Story Mill project site is located in Bozeman, Montana, at approximately 45°41'55" N, 111°1'21" W in Gallatin County (Figure 1). The project area encompasses portions of SE ¼ of Section 31 and SW ¼ of Section 32 in Township 1S, Range 6E, as well as portions of NE ¼ of Section 6 and NW ¼ of Section 5 in Township 2S, Range 6E, P.M.,M. For the period of record of 1981 to 2010, average temperature ranged between 14°F (January) to 83°F (July), with average annual total precipitation of 19.7 inches (WRCC 2012).

Two perennial streams flow through the project area, the East Gallatin River and Bozeman Creek (Figure 1). Bozeman Creek originates approximately 15 miles southeast of the project site in the Gallatin Range, flows south to north and joins the East Gallatin River on the northwest corner of the project site. The East Gallatin River originates at the confluence of Rocky Creek and Bear Creek approximately five miles southeast of the project site. It flows to the northwest for 42 miles before its confluence with the Gallatin River. Annual discharge in the East Gallatin River ranged between 67 and 212 cfs (USGS gage site 06048700, below Bridger Creek), for water years 2002 - 2011 (USGS NWIS 2012). East Gallatin River and Bozeman Creek have been identified as water quality impaired by the Montana Department of Environmental Quality (MDEQ), as further described in Section 2 of this report.

Wetlands present in the Story Mill project area include Freshwater Emergent Wetlands associated with still water or lentic environments and found in depressional settings, Freshwater Emergent Wetlands (including some scrub/shrub wetland components) associated with flowing water or lotic environments and found on floodplains of East Gallatin River and Bozeman Creek, as well as Riverine Wetlands (Bozeman Creek and East Gallatin River) and an Open Water Wetland (small artificial pond).

1.2 Project Goals

TPL in cooperation with project stakeholders developed the following *draft* goals that express the intended results of the project in terms of community benefit, ecological function, and river and wetland stewardship.

Community and Park Development Goals

- Create a north-side destination park for Bozeman that provides for low impact recreation while protecting sensitive riparian, stream and wetland habitats;
- Enhance the Story Mill spur trail connections between downtown Bozeman and other public recreation destinations;

- Provide opportunities for interpretation and ‘living classroom’ education programs for youth and other residents to learn about wetlands, wildlife and the natural history of the area including community engagement in the wetland restoration process;
- Develop a limited network of park pathways to allow visitors to experience the different vegetative communities and restoration process while minimizing the impact to sensitive habitats;
- Revitalize the degraded, semi-industrial area site and the surrounding neighborhood; and
- Develop community garden spaces and an urban agriculture program that interprets and celebrates the agricultural heritage and history of the Gallatin Valley.

Wetland and Riparian Habitat Restoration Goals

- Produce clean water consistent with supporting beneficial uses associated with the East Gallatin River and Bozeman Creek;
- Improve habitat diversity for fish and riparian dependent wildlife species;
- Restore and enhance wetlands to create a more complex matrix of wetlands with increased native, vegetative diversity while working to control invasive species including noxious weeds; and
- Restore site hydrology and riparian and wetland functions.

Restoration objectives are described in Section 3. The CRP acknowledges that several constraints to restoration exist in the project area and will affect the restoration approach. Restoration constraints are generally defined as issues that cannot be modified or changed with restoration or park development activities. Example constraints specific to the Story Mill site include land ownership, site infrastructure and utilities including sewer and water mains, gas lines, existing buildings, neighboring infrastructure, and easements.

2 Existing Conditions

Existing natural resource conditions within the Story Mill project area, including wetland and riparian resources, vegetation, and soils, are adapted from a wetland delineation report completed for the site in July 2012 (RDG 2012). Descriptions for East Gallatin River and Bozeman Creek are based on information obtained from the Lower Gallatin Total Maximum Daily Load (TMDL) Planning Area and field work conducted by RDG in July and November 2012. The Lower Gallatin TMDL Planning Area (LGTPA)

encompasses approximately 996 square miles in Southwestern Montana, and includes both the East Gallatin River and Bozeman Creek within the Story Mill project area.

2.1 Wetland and Riparian Resources

The majority of wetland sites in the Story Mill project area are classified as Freshwater Emergent Wetlands (NWI Code PEMA/PEMC), further distinguished by proximity to either moving water (streambank/lotic type) or to a still water (lentic/depressional type) environment (Figure 2-1). Other wetland types include Riverine (NWI Code R3UBH) encompassing East Gallatin River and Bozeman Creek, and Open Water (NWI Code PABFx) , which describes the pond at the south of the TPL parcel. The U.S. Fish and Wildlife Service (USFWS) published National Wetlands Inventory definitions of the above wetland classifications are listed below, as adapted from USFWS 2012, Branch of Resource and Mapping Support:

1. Code **PEMA**: Palustrine System, Emergent Class, with a Temporary Flooded Water Regime. Surface water in this water regime is present for brief periods during growing season, but the water table usually lies well below the soil surface for most of the growing season.
2. Code **PEMC**: Palustrine System, Emergent Class, with a Seasonally Flooded Water Regime. Surface water here is present for extended periods especially early in the growing season, but is absent by the end of the growing season in most years. The water table after flooding ceases is variable, extending from saturated to the surface to a water table well below the ground surface.
3. Code **R3UBH**: Riverine System, Upper Perennial Subsystem, Unconsolidated Bottom Class, Permanently Flooded Water Regime (water covers the land surface throughout the year in all years).
4. Code **PABFx**: Palustrine System, Aquatic Bed Class, Semi-permanently Flooded Water Regime, **x**: Excavated (artificially created by man). Surface water persists throughout the growing season in most years, and when absent, the water table is usually at or very near the land's surface.

Table 2-1 and Figure 2-3 summarize the wetland delineation results (RDG 2012), parsed by land ownership. Wetland delineation methods complied with the *Corps of Engineers Wetlands Delineation Manual* (1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)* (2010).

Table 0-1. Story Mill wetland delineation results.



Classification	Freshwater Emergent Wetland (Depressional/Lentic)	Freshwater Emergent Wetland (Streambank/Lotic)	Open Water Wetland	Riverine	TOTAL
Parcel	Area (acres)				
TPL	5.60	0.95	0.51	0.93	7.99
Wake Up, Inc.	0.35	0.67	0	0.86	1.88
Total	5.95	1.62	0.51	1.79	9.87



Figure 0-8. The Story Mill project site existing wetland delineation overview.

Of the total 61.5 acres in the TPL parcel, approximately 8 acres (13%) is wetland. Depressional/Lentic Freshwater Emergent Wetland contributes the majority (70%) of the wetlands on the TPL parcel, with Streambank Wetlands at 12% of the total wetland area. The artificial pond is 0.51 acres (6%), and riverine wetlands (East Gallatin River, Bozeman Creek, and a minor inclusion of Story Mill Ditch) comprise 12% of the total wetland area on the parcel owned by TPL. The Wake Up, Inc. parcel includes Depressional and Streambank Emergent Wetland as well as Riverine Wetland, totaling 1.88 acres, or 19% of the total wetland area on both parcels (Table 2-1 and Figure 2-1).

Wetland distribution and functions has been extensively changed by recent human activity. The pond at the south end of the TPL property is artificial. Excavated material was placed around the pond creating bermed upland conditions. A narrow wetland fringe currently defines the pond perimeter. The pond outlet and large ditch to the north which drains the pond contributes to the wetland conditions found around the ditch, which include a swath of wetland dominated by cattail. This ditch extends north to the East Gallatin River. A beaver dam restricts flow close to the outlet and has created ponded water conducive to natural development of wetlands to the south and east of the beaver dam. Two additional drain ditches exist within the project area, one to the west of the artificial pond and one toward the middle of the area (RDG 2012).

A distinct break in riparian forest and wetland exists on the TPL parcel. This line break is indicative of land conversion for agriculture or livestock operations. Other major anthropogenic disturbances include berms created on the north floodplain of the East Gallatin floodplain. Concrete, iron, tires, and riprap is currently slumping into or exposed in the river (RDG 2012).

2.2 Vegetation

Vegetation at the Story Mill project site is classified by location, either in lotic or lentic wetland environments, or uplands. The agricultural and grazing history of the site is well documented in vegetation profiles, with introduced pasture grasses and browse-resistant shrubs common throughout both upland and wetland environments. Wetlands found adjacent to streams exhibited a vegetation community characteristic of succession on mid- to low-elevation floodplain environments in southwest Montana. These lotic wetlands include forested, shrub, and herbaceous communities. Common and dominant tree species are black cottonwood (*Populus trichocarpa*), speckled alder (*Alnus incana*), and both Bebb and Booth's willow (*Salix bebbiana*, *Salix boothii*). In the shrub/sapling stratum, dominant species include a variety of *Salix* species (Bebb willow, crack willow (*Salix fragilis*) and sandbar willow (*Salix exigua*)), as well as speckled alder, red-osier dogwood (*Cornus sericea*), and Woods' rose (*Rosa woodsii*). Reed canarygrass (*Phalaris arundinacea*), smooth brome (*Bromus inermis*), American wild mint (*Mentha arvensis*), tufted hairgrass (*Deschampsia cespitosa*), quackgrass (*Agropyron repens*), as

well as the noxious weed species Canada thistle (*Cirsium arvense*) and common tansy (*Tanacetum vulgare*) are present in dominant cover in the herb stratum throughout this wetland type.

The dominant Bebb willow and reed canarygrass habitat types are characteristic of a grazing/browsing environment often associated with low-gradient floodplains in disturbed environments (Hansen et al. 1995). Bebb willow has evolved to tolerate grazing, and often persists in highly grazed areas where other native species such as Booth's willow are effectively browsed out (Hansen et al. 1995). Similarly, reed canarygrass is highly browse-tolerant, and because of its invasive characteristics including rapid rhizomatous spread, production of abundant small seeds and rapid seed germination, can outcompete native vegetation in streambank wetland areas and persist as a monoculture (Barnes 1999) (Figure 2-2).



Figure 0-13. Reed canarygrass monoculture on two East Gallatin River floodplain wetland areas.

Freshwater emergent wetlands characterized by lentic, or depressional/still-water environments on the TPL parcel are comprised mostly of wetland sedge/rush/cattail vegetation community types. Sandbar willow is the only species in the sapling/shrub stratum, and no trees are present. Sandbar willow is highly adapted to grazing disturbance, however with continued overuse by grazers, can become completely eliminated from a site (Hansen et al. 1995). Its presence in these depressional wetland environments is very limited. Adjacent upland communities exhibit a more common distribution of

sandbar willow, and current encroachment on the lentic wetland type may possibly be attributed to a release from grazing pressure (Fig. 2-3).



Figure 0-14. Upland area dominated by sandbar willow, behind the lentic wetland in the foreground.

Dominant species in the sedge/rush communities on the project site include Northwest Territory/beaked sedge (*Carex utriculata*), and Baltic/arctic rush (*Juncus balticus*), as well as an abundance of grass species such as reed canarygrass, common Timothy grass (*Phleum pratense*), tufted hairgrass, smooth brome, and field meadow-foxtail (*Alopecurus pratensis*). Where present, broad leaf cattail dominates the majority of vegetative cover, with minor inclusions of other herb species such as Northwest Territory sedge, Baltic rush, tufted hairgrass, and western dock (*Rumex occidentalis*).

Upland sites include grassland and well as shrub and forest vegetation communities. Smooth brome and common Timothy grass often occur in monoculture, and other dominant vegetation in upland grassland communities include quackgrass, foxtail barley (*Hordeum jubatum*), redtop (*Agrostis stolonifera*), reed canarygrass, common tansy and Canada thistle. Forested upland communities are dominated by species such as choke cherry (*Prunus virginiana*), Rocky Mountain honeysuckle (*Lonicera utahensis*), quaking aspen (*Populus tremuloides*), black cottonwood, and crack willow. Upland shrub community types are often characterized by common snowberry (*Symphoricarpos albus*), quaking aspen, Woods' rose, as well as sandbar willow.

2.3 Soils

The NRCS Soils Database lists five major soil units in the Story Mill project area (Figure 2-4). The major units within the study site (407A, 512B, 606A, 523A, and 542A) are classified as loams occurring on floodplains and stream terraces. Parent material is alluvium, loamy alluvium, or sandy alluvium, with slope gradients of 0 to 4 percent. Of the major soil units in the project area, only 407A, Sudworth-Nesda loams, does not exhibit hydric soil characteristics. In units 512B and 523A, the Nythar and similar soils are hydric, 542A Blossberg loam is hydric, and in soil unit 606A, Bandy and similar soils as well as Bonebasin and similar soils are listed as hydric. The Riverwash portion of soil unit 606A is unranked (RDG 2012).

Wetland soils documented by RDG during the routine wetland delineation include soils with textures of loam, sandy loam, sandy clay loam, silt loam and silty clay loam. Matrix colors of very dark gray, black, and very dark brown occurred frequently, and dark gray depleted matrices and gleyed matrices were less common. Redoximorphic features within profiles commonly consisted of concentrations of dark yellowish-brown, strong brown and gleyed colors, mostly located within the soil matrix but sometimes occurring along pore linings. All redox features used in hydric soil determinations were distinct or prominent (RDG 2012).

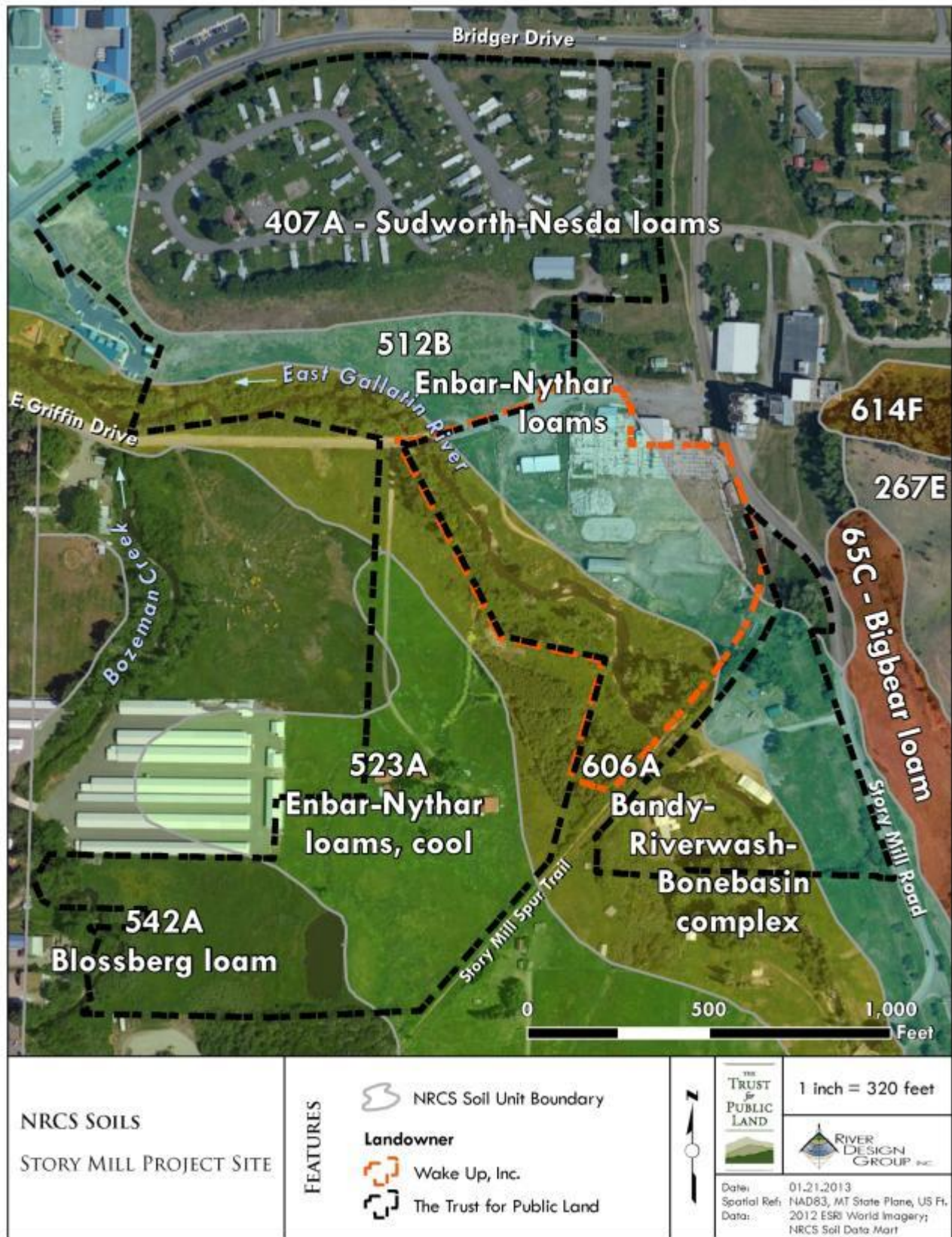


Figure 0-11. NRCS soils overview, Story Mill project site.

2.4 East Gallatin River

Montana Department of Environmental Quality (MT DEQ) lists the East Gallatin River as fully supporting beneficial uses of agriculture, drinking water, and primary contact recreation, and partially supporting aquatic life (MT DEQ 2012). A Total Maximum Daily Load (TMDL) has not been completed nor published, however probable causes of impairment for aquatic life includes total nitrogen and total phosphorous concentrations, resulting from the probable sources of grazing in riparian or shoreline zones, municipal, residential districts, and yard maintenance. Table 2-2 includes 2012 MT DEQ water quality information for the segment of East Gallatin River flowing from the confluence of Rocky and Bear Creeks to Bridger Creek, which includes the segment adjacent to the Story Mill Project Site.

Table 0-2. East Gallatin River MT DEQ water quality information (MT DEQ 2012).

Use Name	Fully Supporting	Partially Supporting	Probable Causes	Probable Sources
Agricultural	X			
Aquatic Life		X	Total Nitrogen, Total Phosphorous	-Grazing in Riparian or Shoreline Zones -Municipal (Urbanized High Density Area) -Residential Districts -Yard Maintenance
Drinking Water	X			
Primary Contact Recreation	X			

Streambanks and riparian areas along the East Gallatin River adjacent to the Story Mill site have been impacted by past bank stabilization and flood protection measures including placement of concrete revetments, riprap, tires, and earthen levees. This has resulted in floodplain disconnection along portions of the reach, and reduced rates of lateral channel migration. Fill has been placed in several locations to elevate land surfaces adjacent to the channel, resulting in floodplain disconnection and a general reduction in the cover of streambank emergent and scrub/shrub vegetation, particularly on the north side of the river. Deposition of earthen fill has also created a seed bed for establishment and expansion of noxious weeds and other invasive plants. Some of these areas likely experience significant additional sediment and seed deposition during high runoff events.

Three bridges cross the East Gallatin River in the upper reach of the project area. The Story Mill Spur Trail bridge is a free-span structure that appears to have adequate hydraulic capacity to convey larger floods without causing adverse impacts to channel stability and sediment and flow routing. The upstream two bridges appear undersized and are structurally supported by multiple in-channel wooden piers. The piers and narrow bridge openings cause flow contraction through the bridge and downstream energy loss resulting in mid-channel sediment deposition and bank erosion downstream of the Story Mill Spur Trail bridge. The streambanks and bridge abutments are armored at the two upper bridge crossings. The multiple sets of piers constrict flow and cause accumulation of woody debris as shown in Figure 2-5 below.



Figure 0-16. Existing bank armoring and bridge impacts on the East Gallatin River.

2.5 Bozeman Creek

Bozeman Creek (also referred to as Sourdough Creek), from the confluence of Limestone Creek and Bozeman Creek to the mouth at East Gallatin River, is listed as water quality impaired for aquatic life and primary contact recreation. It fully supports agricultural use and drinking water. A TMDL has not been completed or published for Bozeman Creek. The creek is surrounded by agricultural, industrial, municipal, and residential land throughout the segment. As it is highly urbanized, straightened and channelized through much of its course through the City of Bozeman, Bozeman Creek has restricted habitat for aquatic species and increased sediment and pollutant transport capacity as well as minimal sediment storage (MT DEQ 2012). Table 2-3 lists the water quality information as extracted on the Clean Water Act Information Center.



Figure 0-17. Bozeman Creek existing conditions (left) and the confluence with the East Gallatin River (right).

Table 0-3. Bozeman Creek MT DEQ water quality information (MT DEQ 2012).

Use Name	Fully Supporting	Partially Supporting	Not Supporting	Probable Causes	Probable Sources
Agricultural	X				
Aquatic Life			X	Alteration in stream-side or littoral vegetative covers	-Channelization -Grazing in riparian or shoreline zones -Irrigated crop production -Loss of riparian habitat
				Total Nitrogen	-Grazing in riparian or shoreline zones -Septage disposal -Yard maintenance
				Total Phosphorus	-Grazing in riparian or shoreline zones -Irrigated crop production
				Sedimentation/ Siltation	-Grazing in riparian or shoreline zones -Yard Maintenance
Drinking Water	X				
Primary Contact Recreation		X		Chlorophyll-a	-Grazing in riparian or shoreline zones -Septage disposal -Yard maintenance

				Escherichia coli	Septage disposal
				Total Nitrogen	-Grazing in riparian or shoreline zones -Septage disposal -Yard maintenance
				Total Phosphorus	-Grazing in riparian or shoreline zones -Irrigated crop production

3 Conceptual Restoration Plan

Restoration concepts for the Story Mill project site highlight the potential for increasing recreation and environmental education opportunities within the City of Bozeman, while restoring ecological integrity to a degraded wetland/stream/riparian complex. Current constraints on natural structure and function include a history of grazing and agricultural land use resulting in wetland ditching and draining and introduction of pasture grasses, noxious weeds, and other invasive plants. Restoration concepts could also include activities that would address historic modifications to the banks and floodplain of the East Gallatin River that have restricted meander migration and limited overbank flooding. While complete re-naturalization may not be attainable due to the urban setting, level of past alterations, and infrastructure constraints, the eventual restoration of ecologically sustainable wetland, stream, and riparian functioning to the project site would not preserve open space within Bozeman but would greatly benefit both human and wildlife uses.

3.1 Wetland Restoration – Emergent and Open Water

Concepts and specific actions for the restoration of Freshwater Emergent Wetlands and anticipated ecological benefits include the following and are depicted in Figure 3-1:

- Fill the main ditch which currently directs water from the artificial pond to East Gallatin River, effectively restoring wetland hydrology and increasing wetland acreage in the vicinity of the pond and to the north and east of the existing ranch buildings;

- Re-shape the pond to a more naturally appearing footprint, create varied depths and irregular shoreline, and develop a small island for nesting birds and other wildlife species;
- Re-grade the existing pond berms to elevations consistent with existing depressional wetlands (excess material to be used in ditch and pond fill), creating an emergent wetland from artificial upland conditions;
- Suppress invasive plant species, especially MT State Category 1 noxious weed species including Canada thistle, common tansy, and leafy spurge. Restore and maintain a diverse native species vegetation community to emergent wetland areas utilizing slightly higher elevations in microtopography to encourage redevelopment of the shrubby component of the system; and
- Allow for a variable open water wetland component in emergent wetland areas that may become seasonally inundated in response to the ditch fill and/or the increase of the pond base elevation. This concept requires an acknowledgement of the dynamic nature of naturally functioning wetland ecosystems.

Project implementation will require an assessment of impacts to existing development adjacent to the project area, mainly the commercial storage units to the northwest of the pond. Flood control structures may be necessary to ensure minimal impact to adjacent properties. This will be further evaluated in subsequent design phases.



Figure 0-14. Overview of wetland restoration concepts on the Story Mill project site.

3.1.1 Open Water

As the ditch is filled and pond bathymetric elevations are modified to restore wetland hydrology, currently marginal upland areas in the vicinity of the pond as well as to the north and east of the existing ranch buildings are anticipated to revert to freshwater emergent wetland conditions (Figures 3-1 and 3-2). The possibility of a seasonal open water component in all of these areas exists, depending on groundwater and precipitation inputs and fluctuations. Analysis of elevation data derived from City of Bozeman Light Detection and Ranging (LiDAR) in conjunction with existing wetland extents suggests an expansion of wetland area. The existing elevations also stress the importance of protecting the adjacent property from wetland encroachment and possible flooding scenarios (Figure 3-2).

The conceptual cross-section illustrated in Figure 3-2 includes both existing and proposed conditions in the vicinity of the artificial pond. Proposed earthwork includes eliminating the berms on all sides of the pond and lowering elevations to mimic existing freshwater emergent wetland conditions. The pond would be partially filled to produce varied depths, striking a balance between restoring wetland hydrology and preventing cattail encroachment. A re-design of the pond footprint and the inclusion of a small island further replicate natural open water wetland conditions, providing increased shoreline perimeter while maintaining a similar surface area as the existing pond.

Along with the restoration of emergent wetland and the associated sedge/rush vegetation community, a native shrub component is proposed as an addition to increase vegetative diversity and habitat cover, utilizing microtopographical high points in the graded and existing ground surfaces. An abundance of sandbar willow can be strategically planted throughout the restored and existing wetland area, transplanted from adjacent areas and thus increasing survival rates as the plants will be acclimated to local conditions. Other shrub species such as swamp redcurrant (*Ribes triste*) and red osier dogwood can also be incorporated into the design. In the emergent vegetation class, we expect natural recruitment of sedges and rushes (mainly arctic/baltic rush, beaked sedge, small-winged sedge) and various herbs and grasses (e.g. smooth scouring-rush (*Equisetum laevigatum*), tufted hairgrass (*Deschampsia caespitosa*)) to colonize the restored wetland environment from surrounding wetland areas. Where large tracts of bare ground will be exposed, mainly the pond berm areas, plugs of emergent wetland vegetation collected on-site can be planted and broadcast seeding techniques can be utilized to jump-start the recruitment process while restricting invasive weed intrusion.

In addition, a fairly aggressive invasive species control effort will likely be necessary to manage noxious weed species, mainly Canada thistle, common tansy, and leafy spurge (*Euphorbia esula*) from the site. A combination of chemical, manual, and biological control methods can be evaluated, and if implemented along with dense plantings and seeding of native wetland grasses, herbs, and shrubs, should reduce invasive species cover. Complete eradication of invasive species is unlikely to occur, however, as seed

sources surround the project site and the noxious weeds produce notoriously prolific and small seeds that are easily dispersed by wind. Conceptual illustrations of existing vs. proposed conditions at the

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pond site (Figure 3-3) are ground-level views from the photo point in Figure 3-2.

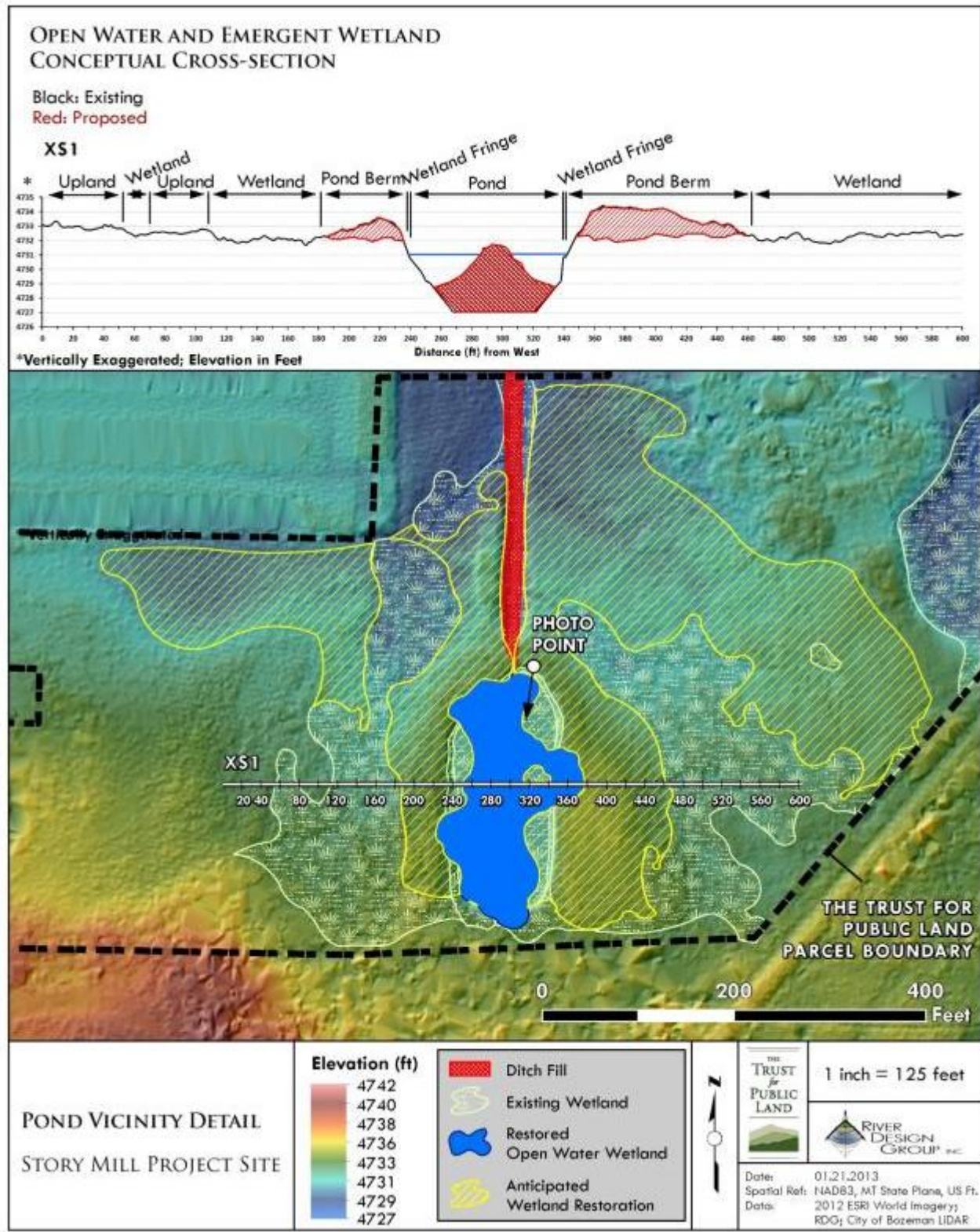


Figure 0-15. Conceptual restoration cross-section across the pond and wetland vicinity.



Figure 0-16. Illustration of open water wetland restoration concepts (Design 5, LLC).

3.2 River and Floodplain Restoration

Restoration concepts for the East Gallatin River and floodplain focus on the area displayed in Figure 3-4. This river reach has been modified by bank armoring to restrict natural meander migration and floodplain connection. River confinement has caused a disconnection from historical floodplain surfaces as well as incision and downcutting of the channel in locations. While acknowledging the upstream and downstream alterations and sources of impairment for aquatic life on East Gallatin River (Table 2-2), channel and floodplain restoration in this ~500-foot reach of river can positively impact local riparian and aquatic habitats. Concepts and specific restoration actions are presented below and in Figure 3-4:

- Remove failing riprap from the streambanks and streambed;
- Install bank restoration structures to encourage the establishment of native riparian vegetation and improve aquatic habitat complexity;
- Remove floodplain fill and establish appropriate elevations to restore natural flooding patterns while reducing flood hazard to adjacent properties within and downstream of the project area;
- Create a small side channel through the south floodplain surface, if feasible, designed to be inundated at high flow conditions; and
- Address the reed canarygrass invasion mainly on the south floodplain surface and streambank. Broadcast seeding native wetland grass species and outplanting native shrub and tree species on bare soil surfaces will both increase vegetative diversity as well as inhibit reed canarygrass and other weedy species invasion.

Implementation of restoration concepts on the East Gallatin River and floodplain areas will depend on adjacent landowner cooperation. If achieved, grading work will be restricted such that existing developments (i.e. the pole barn) are not affected. Restoration design and implementation will require cooperation with City of Bozeman, the U.S. Army Corps of Engineers, MT DEQ, the Gallatin County Conservation District, the Department of Natural Resources and Conservation, and adjacent landowners.

Figure 3-4 depicts a conceptual cross-section of the desired future condition for streambank, riparian and floodplain areas along the East Gallatin River. This concept could be applied at multiple sites depending on landowner cooperation. As shown, the techniques would involve restoring streambank and floodplain site conditions (i.e. elevations, substrate, soil moisture) that support the establishment of herbaceous and woody riparian vegetation including trees and shrubs. The techniques would reduce sediment loading to the East Gallatin River, improve aquatic habitat complexity, and reduce land loss resulting from extreme streambank erosion and geotechnical instability. Figure 3-5 illustrates the restoration concepts from a ground-level view at the photo point in Figure 3-4.

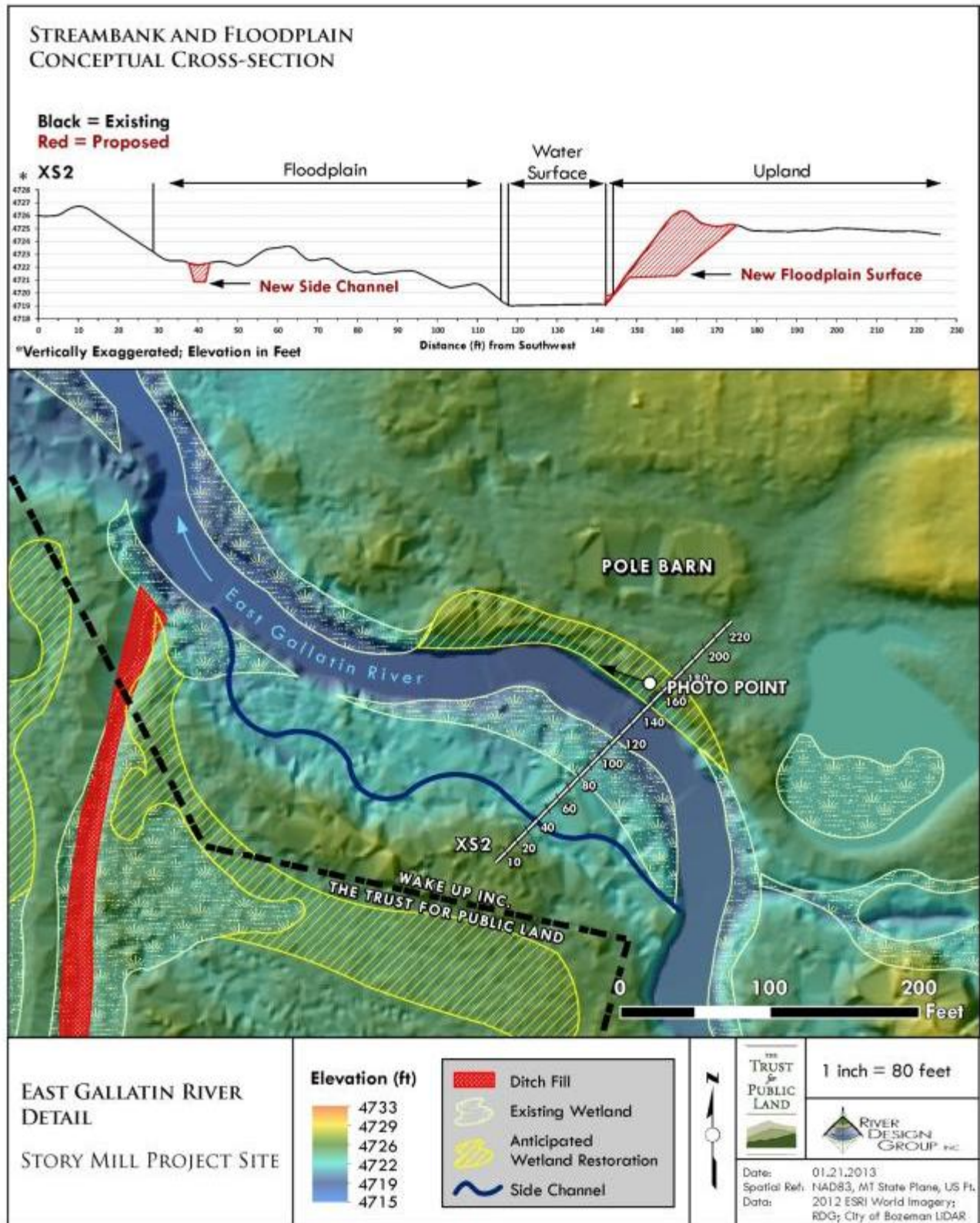


Figure 0-17. Conceptual restoration cross-section of the East Gallatin River project site.



Figure 0-18. Illustration of river and floodplain restoration concepts (Design 5, LLC).

4 Integration with Park Development and Next Steps

The CRP presented in this report is one component of a much larger, more comprehensive project that includes developing a north-side public park for the City of Bozeman. As stated in Section 1, the purpose of developing this CRP is to define the restoration vision for the project area so community and park development actions can support a desired restoration outcome.

This section describes an overview of the planned next steps as they relate to integrating the restoration concepts with park development. In addition, it identifies the critical steps that will be required to develop the concepts presented in this report to final design and implementation. As new information becomes available and design concepts are refined, this section of the report will be updated. Additional next steps not described in this section, but likely to be included in future planning phases, include implementation coordination between park development and restoration actions.

4.1 Project Planning, Coordination and Outreach

TPL in cooperation with the City of Bozeman and project partners will hold a series of design workshops to solicit community input. The workshops will bring together members of the public to share ideas for the site and begin a community dialogue, which includes a proposal for a new public park for the City of Bozeman. The design workshops will focus on reviewing design concepts and ideas, and providing the public the opportunity to help determine the long-term vision for the park, including the overall design, trail connections, wetland and river restoration opportunities, and other park amenities.

4.2 Coordination with Local, State and Federal Agencies

As design plans are further developed and finalized, it will be necessary to coordinate with local, state and federal agencies to identify and confirm environmental compliance needs, identify cooperating agencies, confirm timelines, and initiate appropriate permitting activities. Based on the concepts described in this report, the following permits will be required:

- ***The Montana Natural Streambed and Land Preservation Act***, or 310 Permit, is administered by the Gallatin County Conservation District, and will be required if restoration actions alter or modify the bed or banks of the East Gallatin River. The purpose of the law is to minimize soil erosion and sedimentation, and to protect and preserve streams and rivers in their natural or existing state.
- ***The Montana Stream Protection Act***, or SPA 124 Permit, is equivalent to the 310 Permit, and required in lieu of the 310 Permit if the City of Bozeman or other governmental entity is the applicant. The SPA 124 Permit is administered by Montana Fish, Wildlife and Parks (MFWP).

- ***The Federal Clean Water Act***, or Section 404 Permit, is administered by the U.S. Army Corps of Engineers (COE), and is required when a project will result in the discharge or placement of dredged or fill material into waters of the United States. The purpose of the law is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Waters of the United States in the Story Mill project area include the area below the ordinary high water mark of the East Gallatin River, and wetlands adjacent to the river including the artificial pond. Isolated waters and wetlands including the drainage ditch on the Story Mill property may be waters of the United States; a final determination will be made by COE.
- ***Short-term Water Quality Standard for Turbidity***, or 318 Authorization, is administered by MT DEQ and is required for construction activities that will cause short-term or temporary violations of state surface water quality standards for turbidity. The purposes of the law are to protect water quality and minimize sedimentation to state surface waters. Depending on the nature of the activity, MFWP may waive this requirement during its review under the Natural Streambed and Land Preservation Act.
- ***Water Quality Certification***, or 401 Certification, applies to all activities that do not qualify for COE nationwide permit, and is administered by MT DEQ Water Protection Bureau.
- ***Floodplain Development Permit***, is administered by the City of Bozeman, and would be required if work is proposed along the East Gallatin River within the designated Special Flood Hazard Area. The purpose of the law is to promote the public health, safety and general welfare of the residents and to minimize public and private losses due to flood conditions in Regulated Flood Hazard Areas.
- ***Montana Water Use Act***, or Water Right Permit and Change Authorization, is administered by the Montana Department of Natural Resources and Conservation, and may be required if substantial modifications to the existing pond are proposed. It is likely that the work could be exempt if the total groundwater appropriation is 35 gallons per minute and 10 acre-feet or less.

4.3 Additional Data Needs to Support Analysis and Design

A significant level of information exists to support the concepts presented in this plan. To date, information used to develop this CRP included:

- Light Detection and Ranging (LiDAR) data collected by the City of Bozeman (2007);
- Wetland Delineation Report for the Story Mill project site, prepared by River Design Group, Inc. for TPL (2012);
- FEMA Flood Insurance Rate Map for Gallatin County, Montana. Map Number 30031C0809D, effective date September 2, 2011;
- Phase 1 Environmental Site Assessment, prepared by Tetra Tech for TPL (July 2012);
- Discussions with TPL, MT DEQ, MFWP, Gallatin Valley Land Trust, and Trout Unlimited; and
- Field work and interdisciplinary meetings conducted in July and November, 2012.

Additional data and information will need to be collected, compiled and analyzed to support alternative development and preliminary and final design:

- Assessing existing river morphology including bank erosion investigation;
- Collecting of site-specific geomorphic data in areas proposed for restoration along the East Gallatin River, including channel cross-sections and longitudinal profile;
- Collecting and/or analyzing local groundwater data for existing wells and/or adjacent well logs;
- Collecting pond outflow discharge measurements;
- Analyzing existing gage records to develop bankfull discharge estimates and refined flood frequency analysis for the East Gallatin River; and
- Surveying pond bathymetry and the existing ditch outlet.

4.4 Preliminary and Final Design

The preliminary design stage includes identification of the range of alternatives, development of design plans for the selected restoration alternatives and actions, peer review, public outreach, identification of environmental compliance requirements, preparation of cost estimates, identification of funding sources and other logistics including construction schedules and equipment and materials needs.

Preliminary and final design deliverables will include:

- Refined inventory of existing infrastructure and required mitigation, if any;
- Cost/benefit analysis of alternative treatment approaches;
- Construction sequencing plan;
- Wetland grading plans;
- Wetland and riparian revegetation plans;
- Treatment drawings for the East Gallatin River;
- Construction access, clearwater diversion and Best Management Practices plans;
- Materials quantities and specifications;
- Construction specifications; and
- Regulatory permits.

4.5 Summary

The Story Mill site was acquired by TPL in December 2012 for the purposes of developing a new city park, expanding the existing Story Mill Spur Trail, and restoring wetlands and water quality associated with the East Gallatin River and Bozeman Creek. TPL retained RDG to evaluate wetland and river restoration opportunities and to ensure community and park development actions can support a desired restoration outcome. The proposed restoration concepts presented in this report aim to restore site hydrology, enhance existing riparian and wetland functions, and expand wetlands to the greatest extent practical. Next steps identified in the planning process include additional public outreach including a series of design workshops, evaluating alternatives, and carrying forward the concepts presented in this report to preliminary and final designs.

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