

WEST FORK NITROGEN REDUCTION PLAN



PREPARED BY:
THE BLUE WATER TASK FORCE, INC.
JUNE 2014

The Blue Water Task Force is a nonprofit organization with a mission to promote public stewardship of aquatic resources in the Gallatin River Watershed through community education, and citizen involvement in water quality monitoring, scientific data collection, and watershed restoration.

For more information, please visit www.bluewatertaskforce.org.



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EXECUTIVE SUMMARY

West Fork Nitrogen Reduction Plan

The goal of the West Fork Nitrogen Reduction Plan (WFNRP) is to produce a planning document to reduce nitrogen loading from nonpoint sources and improve water quality in the West Fork of the Gallatin River (“West Fork”). The development of the WFNRP and its implementation is the highest prioritized project in the Upper Gallatin Watershed Restoration Plan developed by the Blue Water Task Force and accepted by the Montana Department of Environmental Quality in 2012 [BWTF, 2012]. The nitrogen reduction strategies outlined within this plan were guided by the Upper Gallatin Total Maximum Daily Load [MTDEQ, 2010] and post TMDL assessments [Songline, 2009a; Gardner, 2012] and include the following:

- Advocate for changes in local architectural ordinances (large landowners and Homeowner Associations (HOA’s)) to require builders to take stormwater courses.
- Work with the Gallatin Canyon / Big Sky Zoning District Advisory Committee (BSAC) and the Gallatin and Madison Planning Departments on adding zoning regulations to reduce nitrogen loading from future development.
- Implement a Trout Friendly Landscaping (TFL) Workshop and Program
- Host continuing educational course on water issues for realtors in Big Sky
- Host Stormwater 101 and 201 courses for builders in Big Sky
- Review homeowners association’s landscaping requirements
- Help facilitate improvement to Big Sky Golf Course wastewater management
- Host workshop on nitrogen reduction strategies for the Big Sky Golf Course Maintenance crew
- Enhance riparian buffers, wetlands, and streambanks in the Upper West Fork
- Upgrade the Big Sky Golf Course irrigation and wastewater treatment systems
- Work with septic system companies to promote advanced treatment systems
- Advocate for zoning requiring advanced systems in sensitive areas
- Develop educational brochure on septic systems for distribution
- Follow up on Horse Manure Management workshop for horse owners
- Solicit community partners for additional dog waste stations
- Organize a dog poop cleanup day in the spring
- Disseminate all the above information through news and social media, newsletters, and public meetings.

The BWTF will work with watershed stakeholders to begin implementation or planning of all the above strategies by 2020. In addition, as part of the WFNRP, water quality data will be collected to refine nitrogen sources in the Lower South (“Lower South Fork”) and Upper

Middle Forks (“Middle Fork”) of the West Fork and to gauge success of future restoration activities associated with the WFNRP [Gardner and O’Hare, 2014].



1.0 Introduction

Waters in Montana are protected from excessive nutrient concentrations by numeric and narrative standards, which stipulate: “State surface waters must be free from substances attributable to municipal, industrial, agricultural practices or other discharges that will create conditions which produce undesirable aquatic life” [ARM 17.30.637 (1)(e)].

Montana base numeric nutrient standards for the Middle Rockies are listed in **Table 1**.

Table 1: Montana base numeric nutrient standards [Suplee et al. 2009; Suplee and Sada de Suplee, 2011; Suplee and Watson, 2012.]

Parameter	Criteria
Total Nitrogen	0.3 mg/L-N
Total Phosphorous	0.03 mg/L
Chlorophyll a	135 mg/m ²
Benthic Biomass	35 g/m ²

The goal of the West Fork Nitrogen Reduction Plan (WFNRP) is to produce a planning document to reduce nitrogen loading from nonpoint sources and improve water quality in the West Fork of the Gallatin River (“West Fork”). The development of the WFNRP and its implementation is the highest prioritized project in the Upper Gallatin Watershed Restoration Plan [BWTF, 2012]. The strategies outlined within this plan were guided by the Upper Gallatin TMDL [MTDEQ, 2010] and post TMDL assessments [Songline, 2009a; Gardner, 2012]. As part of the WFNRP, data collection efforts include surface water monitoring to refine nitrogen sources in the Lower South (“Lower South Fork”) and Upper Middle Forks (“Middle Fork”) of the West Fork and to gauge success of future restoration activities associated with the WFNRP [Gardner and O’Hare, 2014].

2.0 Watershed Description

The West Fork drains the Big Sky community in Southwestern Montana (**Figure 1**). Elevation ranges from ~ 1800 to 3400 meters and average annual precipitation exceeds 1270 mm at higher elevations and is less than 500 mm near the watershed outlet. Sixty percent of precipitation falls during the winter and spring months [USDA NRCS, 2008]. The West Fork watershed (212 km²) is characterized by well-defined steep topography and shallow soils with high hydraulic conductivities [USDA SCS, 1978; USDA SCS, 1982]. Shallowest soil depths are in alpine areas, where soil depth can range from zero to less than one meter. Deeper soils up to two meters exist near the watershed outlet.

2.1 Surface Water

Annual hydrographs of the West Fork exhibit peak flows during spring snowmelt typically occurring in late May/early June followed by a general recession throughout the summer, autumn, and winter months. Streams in the West Fork watershed range from first-order, high gradient, boulder dominated mountain streams in the upper elevations to a fourth-order, alluvial stream at the watershed outlet.

Stream productivity across the watershed is expected to be low due to cold temperatures and short growing seasons [USDA FS, 2004], however in recent years, increased algal growth has been noted in the South Fork, Middle Fork, and West Fork [PBS&], 2005 & 2008; Covino et al., 2012; Gardner, 2014].

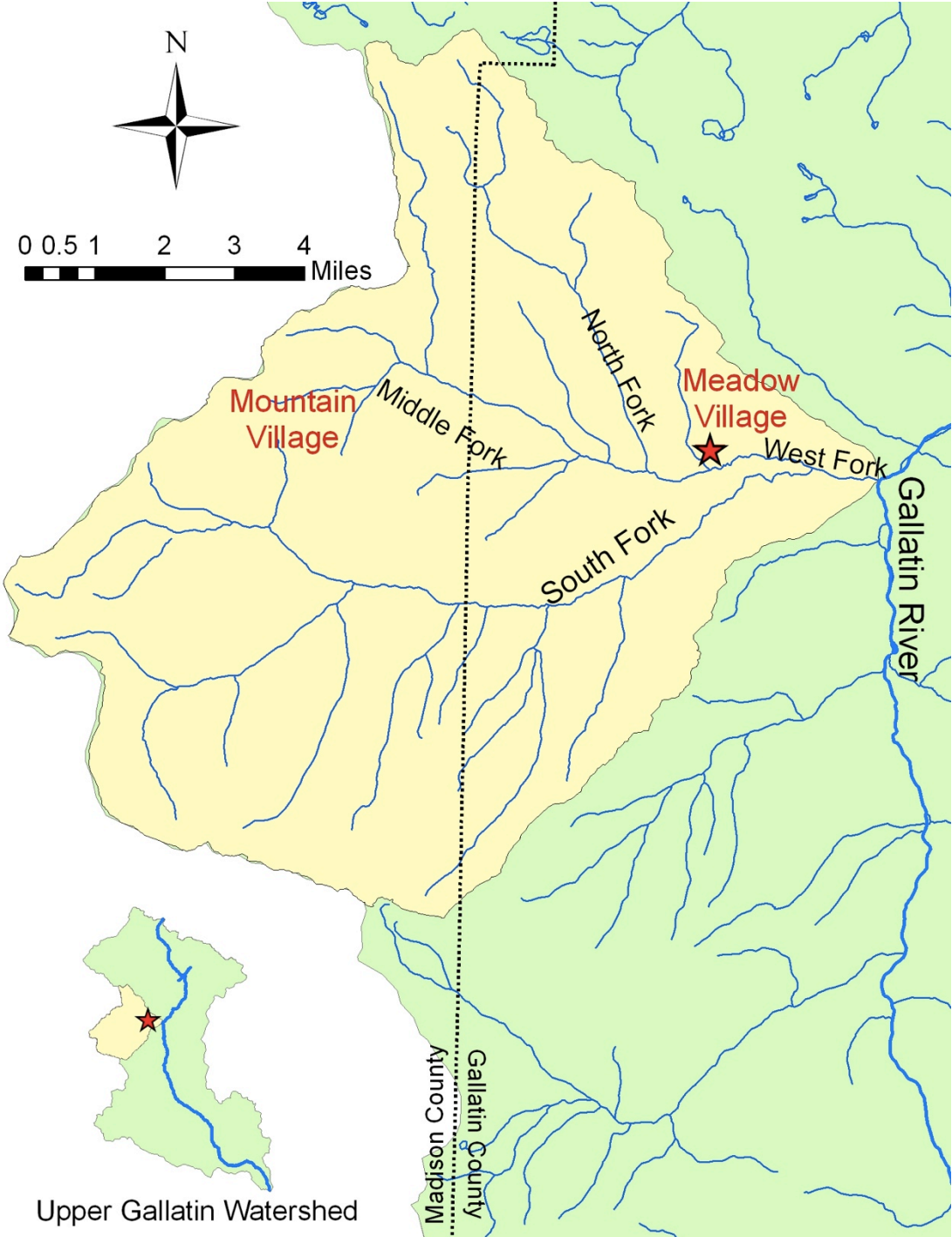


Figure 1: Location of the West Fork Watershed within the Upper Gallatin Watershed.

2.2 Ground Water

Ground water occurs in both shallow alluvial and bedrock aquifers. Natural recharge occurs from infiltration of precipitation, stream loss, and flow out of the adjacent bedrock aquifers. The average ground water flow velocity in the bedrock is likely several orders of magnitude lower than in the valley fill sediments. Bedrock ground water flow is complicated by variability in lithology and geologic structures.

In general, groundwater flows from the margins of the West Fork valley towards the center, where flow is along the axis of the valley. The Middle Fork is a gaining stream to its confluence with the North Fork where it forms the West Fork of the Gallatin and infiltration into the alluvial aquifer beneath the Meadow Village area results in a losing reach [Baldwin, 1996] for approximately three-quarters of a mile and then the West Fork is strongly connected again until its confluence with the Gallatin mainstem.

2.3 Vegetation

Vegetation below tree line consists of coniferous forest (lodgepole pine, Sub-alpine fir, Engelmann spruce, and Douglas-fir), grasslands, shrublands, and willow and aspen groves in the riparian areas. The watershed has a brief growing season from mid-June through mid-September (75 – 90 frost free days), decreasing with elevation [USDA FS, 1994].

2.4 Aquatic Life

Native fish species present in the West Fork Watershed include westslope cutthroat trout, mountain whitefish, longnose dace, longnose sucker, mountain sucker, white sucker, and mottled scuplin. Westslope cutthroat trout are designated “Species of Concern” by Montana Department of Fish, Wildlife and Parks (FWP). Introduced species present in streams include brook, brown, golden and rainbow trout. In addition, hybrids are reported in streams. Data on fish species distribution are collected, maintained and provided by FWP.

2.5 Population

An estimated 2,308 persons lived within the Big Sky Community [US Census Bureau, 2010] and the majority of the population is located within the West Fork Watershed.

2.6 Land Use/ Land Cover

Land cover within both the West Fork Watershed is dominated by evergreen forest. Information on land use is based on the USGS National Land Cover Dataset. **Table 2** and **Figure 2** show land use/ land cover within the West Fork Watershed. **Figure 3** illustrates land ownership within the West Fork watershed.

Big Sky Water and Sewer District (BSWSD) services the two high dense residential areas, Mountain and Meadow Village, with public water supply and sewer. Public wastewater receives secondary treatment and is released into three lined wastewater detention ponds and stored until mid-spring when it is released as irrigation water onto the Big Sky Golf Course. Golf course irrigation begins in mid-spring when the ground thaws and continues through mid-fall, when the ground again freezes. Areas outside of the sewer district are on individual or community septic systems and private wells [R. Edwards, personal comm., 2007].

Table 2: Land Use and Land Cover in the West Fork Watershed

Land Use	Acres	% Of Total
Evergreen Forest	26,232	51.08%
Shrub/Scrub	16,473	32.08%
Grassland/Herbaceous	6,602	12.86%
Developed, Open Space	1,159	2.26%
Barren Land	212	0.41%
Emergent Herbaceous Wetlands	188	0.37%
Deciduous Forest	171	0.33%
Developed, Low Intensity	132	0.26%
Woody Wetlands	117	0.23%
Mixed Forest	40	0.08%
Open Water	11	0.02%
Developed, Medium Intensity	8	0.02%
Pasture/Hay	6	0.01%
Cultivated Crops	4	0.01%

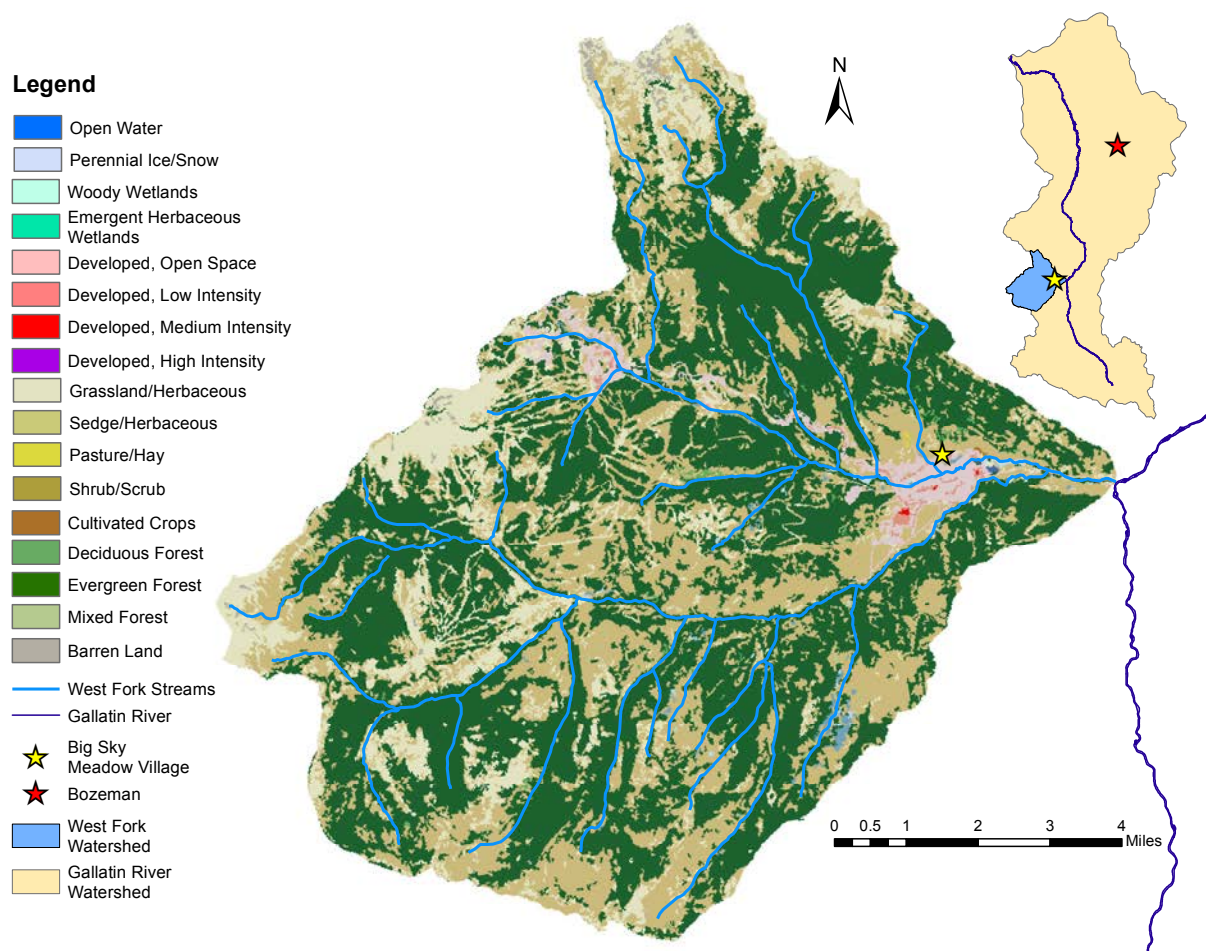


Figure 2: Land Use/ Land Cover within the West Fork Watershed.

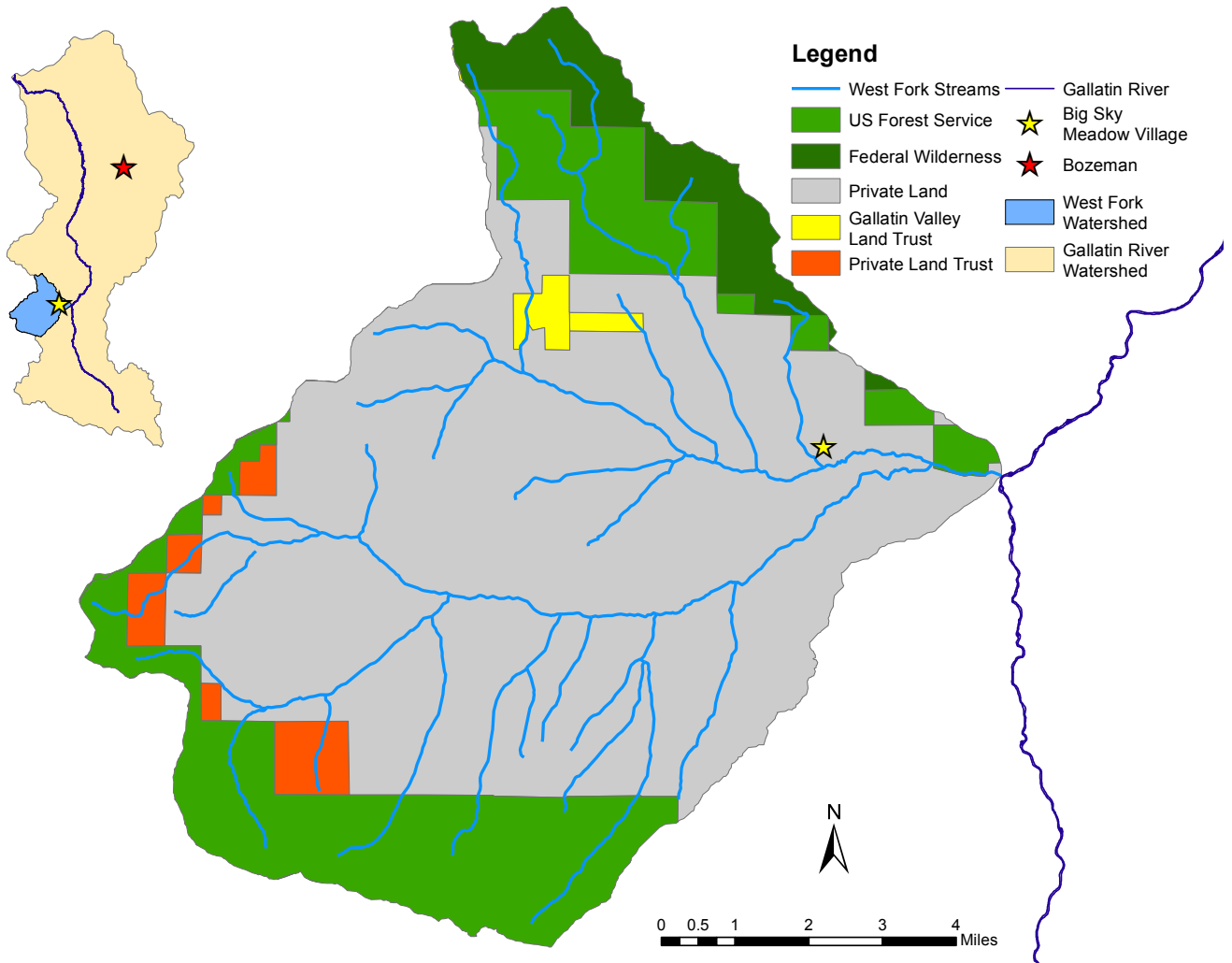


Figure 3: Land Ownership within the West Fork Watershed.

3.0 Water Resource Conditions

This section describes on the nutrient and algal conditions within the West Fork Watershed because it is the primary focus of the WFNRP.

3.1 Nutrients

Extensive nutrient data (nitrogen, phosphorous, chlorophyll *a*, and benthic biomass) has been collected in the West Fork Watershed between 2005 and 2013 as part of the Upper Gallatin TMDL assessments, subsequent studies to refine nutrient sources, and Montana State University research.

3.1.1 Total Nitrogen and Nitrate+Nitrite-N

Total nitrogen and nitrate-nitrogen have exceeded MTDEQ target levels in the Upper Middle Fork and the West Fork [Gardner and McGlynn, 2009; MTDEQ, 2010; Songline, 2009a; Gardner, 2012]. Water quality data collected as part of the BWTF Community

Water Quality Monitoring Program has confirmed the elevated levels of nitrate (www.bluewatertaskforce.org). A detailed assessment of the Upper West Fork found the following [Gardner, 2012]:

- Nitrate+nitrite-N and chloride concentrations increased as the West Fork traveled through the Big Sky Golf Course. This observation suggests an increasing contribution from wastewater to this stretch.
- Spikes in chloride and nitrate concentrations in the West Fork and groundwater on the northern section of the Big Sky Golf Course combined with increasing groundwater levels suggest that wastewater effluent released onto pastures west of northern area of Big Sky Golf Course was impacting the West Fork.
- High levels of nitrate and chloride in groundwater and smaller tributaries suggested contribution of nitrogen from wastewater effluent applied as irrigation. This southeastern region of the Big Sky Golf Course appears to be nitrogen saturated and sensitive to nitrogen loading.
- Increases in $\delta^{15}\text{N}$ values in October suggests impacts from wastewater effluent applied onto the pastures.
- Although the small tributaries to the Upper West Fork have consistently higher nitrogen and chloride concentrations than the mainstem, they do not account for the increased concentrations as the West Fork travels through the Big Sky Golf Course. This observation suggests that there are gaining reaches in this area that contribute a significant nutrient load to the stream.

3.1.2 Phosphorous

Phosphorous levels in the West Fork Watershed have been documented to be well under Montana state criteria and in many cases below detection limit [Montana State University, unpublished data; PBS&J, 2008; Gardner, 2014].

3.1.3 Chlorophyll *a* and Biomass

Chlorophyll-*a* densities were above state recommended densities (135 mg/m³) in the South Fork and the West Fork [PBS&J 2005 & 2008; Covino et al., 2012] and benthic biomass densities were above state recommended criteria in the South Fork and West Fork (35 g/m²) [MTDEQ, 2010; Gardner, 2014].

3.2 Nutrient Sources/Issues

3.2.1 Nonpoint Sources

Nitrogen

The primary sources of anthropogenic nitrogen in the West Fork Watershed are associated with resort and residential development, with wastewater, from both septic systems and public disposal of wastewater effluent on the Big Sky Golf Course, as the largest source [MTDEQ, 2010].

The Big Sky Water and Sewer District releases treated wastewater (2011=187 MGD, 2012=143.69 MGD, 2013 135.2 MGD) into the three storage ponds in Meadow Village. Water is land applied to the Big Sky Golf Course, the Yellowstone Club Golf Course, and the Big Sky Community Park (**Figure 4**). Gallatin County septic system records show 226

septic systems (8 commercial) in the West Fork Watershed (**Figure 4**). Aside from wastewater, other sources of nitrogen associated with resort and residential development include fertilizer, horse manure, pet waste, and stormwater runoff.

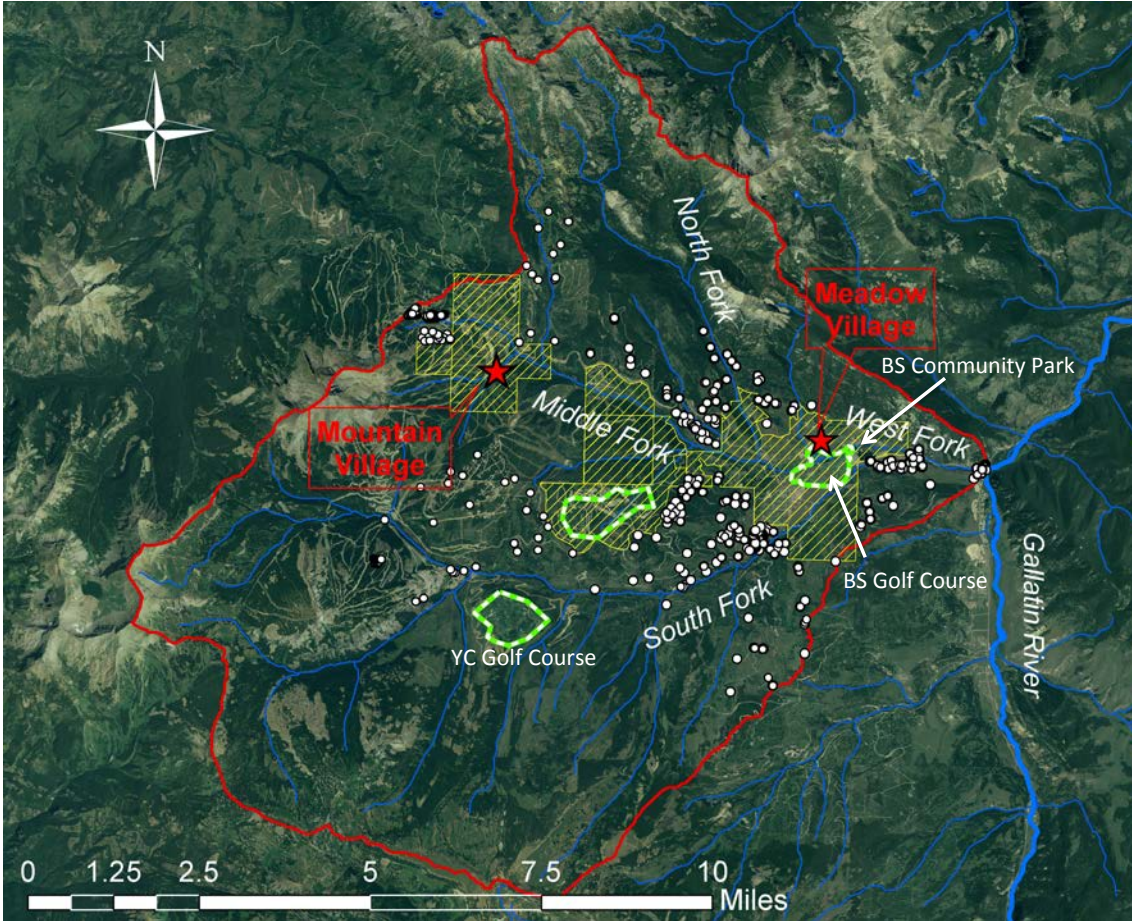


Figure 4: Location of septic systems (white dots), golf courses (green and white outlined circles), and the Big Sky Water and Sewer District boundary (yellow hatched area) in the West Fork Watershed.

3.2.2 Point Sources

There are no point sources of pollution in the West Fork Watershed.

3.2.3 Riparian Health

Riparian health was assessed through aerial photography as part of the Upper Gallatin TMDL assessments [MTDEQ, 2010]. Sections of the Lower West Fork, Upper Middle Fork and Upper South Fork were found to have poor riparian buffering capacity. A detailed field assessment riparian health on the Upper West Fork was conducted in the Fall of 2013, see Appendix D.

4.0 Pollution Reduction Goals

Pollution reductions goals were taken from the Upper Gallatin Watershed Restoration Plan (UGWRP)[BWTF, 2012]. Loading estimates can be found in Appendix A.

4.1 Nitrogen

Anthropogenic sources of nitrogen accounted for in the TMDL assessments were residential and resort sources, septic system effluent, and wastewater irrigation. Residential and resort nitrogen sources were defined “as a variety of variable and diffuse nitrogen sources associated with widespread land clearing and development that may include nitrogen derived from: 1) vegetative decay of detritus derived from land clearing or land maintenance activities, 2) residential landscape and/or golf course fertilizer application, and 3) general refuse inherent in residential development (animal waste, garbage etc.)”. The Upper Gallatin TMDL combined the residential and resort and septic sources to determine the percent reduction goals and therefore, these two sources were combined for the UGWRP and WFNRP (**Table 3**).

Table 3: Nitrogen Reduction Goals for the West Fork Watershed [MTDEQ, 2010; BWTF, 2012].

Stream Segment	Source	Percent Reduction	Restoration Strategies
Upper Middle Fork	Residential/Resort Septic	44%	Development and Implementation of West Fork Nitrogen Reduction Plan and associated BMP's
South Fork	Residential/Resort and Septic	44% ¹	
	Wastewater	100%	
West Fork	Residential/Resort Septic	44% ²	Education/ Outreach
	Wastewater	100%	Further Assessment

¹ Although total nitrogen and $\text{NO}_3^- + \text{NO}_2^-$ concentrations did not exceed state water quality targets in the South Fork, high algal densities have been well documented [PBS&], 2005; MTDEQ, 2010; Covino et al., 2012; Gardner, 2014] verifying impairment [MTDEQ, 2010]. To lessen nuisance algal growth, the UGWRP propose to reduce the nitrogen load to the South Fork. The UGWRP suggests a loading reduction from the Residential/Resort source equivalent to that of the West Fork (44%). Depending on groundwater flowpaths, wastewater effluent irrigation applied to the Big Sky Golf Course may also be a source of nitrogen to the South Fork.

² The Upper Gallatin TMDL did not recommended reduction in the residential/resort and septic source from the West Fork; however, recognizing that the TMDL's are rough

estimates, 44% reduction goal in the Residential/Resort/Septic source was set to be consistent with the Upper Middle Fork and the South Fork.

5.0 Nitrogen Reduction Strategies (3-5 year outlook)

The BWTF has produced the following list of strategies to reduce nitrogen loading to the West Fork Watershed and subsequently lower nitrogen concentrations and algal densities in the West Fork, Middle Fork, and South Fork. For the implementation schedule of these restoration strategies, see **Appendix B**.

5.1 Residential and Resort Development Strategies

5.1.1 Advocate for changes in local architectural ordinances (large landowners and Homeowner Associations (HOA's)) to require builders to take Stormwater 101 and 201 courses (See Strategy 5.1.5).

BWTF Action Items:

- Meet with large landowners and HOA's to discuss
- Work with interested parties to adopt requirement

Nitrogen Source/Issue Addressed: Stormwater

5.1.2 Work with Gallatin County Planner and the Gallatin Canyon / Big Sky Zoning District Advisory Committee (BSAC) on adding zoning regulations to reduce nitrogen loading from future development.

BWTF Action Items:

- Meet with Gallatin County Planner, Tim Skop, to discuss potential changes to zoning regulations
- Work with Tim to develop language for potential zoning changes and present to the BSAC for potential adoption

Nitrogen Sources/Issue Addressed: Stormwater, wastewater, riparian health

5.1.3 Trout Friendly Landscaping (TFL) Workshop and Program

BWTF Action Items:

- Plan and implement an educational workshop for local landscapers about using organic fertilizers, appropriate timing of fertilizer and water applications, the benefits of native vegetation, etc.
- Develop TFL brochure
- Promote TFL program in the Big Sky area through local landscapers
- Complete the Community Stormwater Conservation Garden at Ophir School and promote the TFL program through the garden/school

Nitrogen Sources/Issue Addressed: fertilizer, stormwater runoff

5.1.4 Continuing Educational Course for Realtors

BWTF Action Items:

- Pursue potential partners to develop a certified realtor continuing education class on water quality/natural resource topics in Big Sky
- Implement educational course
- Develop educational brochure to distribute to realtors and their clients

Nitrogen Sources/Issues Addressed: wastewater, stormwater, fertilizer, riparian health

5.1.5 Stormwater 101 and 201 Course

BWTF Action Items:

- Work with Rich Chandler from the Yellowstone Club to bring certified Stormwater 101 and 102 courses to Big Sky
- Develop educational brochure for developers/builders

Nitrogen Sources/Issues Addressed: Stormwater runoff

5.1.6 Review Homeowners Association's Landscaping Requirements

BWTF Action Items:

- Meet with HOA's to examine landscaping requirements and suggest changes to reduce nitrogen leaching and water use

Nitrogen Sources/Issues Addressed: Stormwater runoff, fertilizer

5.2 Land-applied Wastewater Management Improvement Strategies

5.2.1 Big Sky Golf Course Wastewater Management Improvements

BWTF Action Items:

- Work with the Big Sky Water and Sewer District to further explore feasibility of wastewater management options presented by AE2S (Appendix C)
- Collaborate with the Big Sky Water and Sewer District to obtain funding for future projects for wastewater management improvements.

Nitrogen Sources Addressed: wastewater

5.2.2 Big Sky Golf Course Maintenance Crew Workshop

BWTF Action Items:

- Coordinate workshop for the maintenance crew at the Big Sky Golf Course on irrigation and fertilizer management to reduce nitrogen loading to the Upper West Fork (completed May 2013)

- Coordinate additional workshops with changes in Golf Course Management.
- Develop brochure corresponding to workshop topics

Nitrogen Sources/Issues Addressed: land-applied wastewater, fertilizer, stormwater runoff, and riparian health

5.2.3 Enhancement of Near Stream Vegetation along the Upper West Fork

BWTF Action Items:

- Obtain funding to support stream restoration projects identified by RESPEC, see Appendix D
- Oversee and coordinate funded restoration projects

Nitrogen Sources/Issues Addressed: wastewater, fertilizer, runoff, riparian health

5.2.4 Upper West Fork: Irrigation and Wastewater Treatment Upgrades

BWTF Action Items:

- Review project options suggested by HKM study funded by the Big Sky Water and Sewer District to upgrade and improve wastewater effluent irrigation system and wastewater treatment
- Collaborate with Big Sky Water and Sewer District and Big Sky Golf Course to obtain funding for projects

Nitrogen Sources/Issues Addressed: wastewater

5.3 Septic System Strategies

5.3.1 Work with septic system companies to promote advanced treatment systems

BWTF Action Items:

- Meet with companies to discuss promoting advanced systems and septic system maintenance schedules for clients

Nitrogen Sources/Issues Addressed: wastewater

5.3.2 Advocate for zoning area requiring advanced systems in sensitive areas

BWTF Action Items:

- Work with Tim Skop of the Big Sky/Gallatin Canyon Zoning Advisory Committee and Gallatin Planning Department to develop language for zoning change to present to the BSAC for potential adoption

Nitrogen Sources/Issues Addressed: wastewater

5.3.3 Develop educational brochure for distribution

BWTF Action Items:

- Develop educational brochure on septic system maintenance for residents and for septic system companies to distribute to their clients

Nitrogen Sources/Issues Addressed: wastewater

5.4 Animal Waste Strategies

5.4.1 Horse Manure Management Workshop for Horse Owners

BWTF Action Items:

- Coordinate a workshop on manure management for horse owners (Completed November, 2103)
- Follow up with attendees on changes they have implemented
- Follow up with non-attendees to distribute MSU extension educational brochure and discuss points discussed at workshop

Nitrogen Sources Addressed/Issues: animal wastewater, stormwater runoff

5.4.2 Solicit Community Partners for additional dog waste stations

BWTF Action Items:

- Approach Town Center, Big Sky Community Corporation and other potential partners to install additional dog waste stations across the community

Nitrogen Sources/Issues Addressed: animal waste, stormwater runoff

5.4.3 Organize a dog poop cleanup day in the spring

BWTF Action Items:

- Organize a community dog poop cleanup day in the spring

Nitrogen Sources/Issues Addressed: animal waste, stormwater runoff

5.5 General Public Outreach and Education Strategies

- ### **5.5.1 Disseminate all the above information through news and social media, newsletters, and public meetings.**

6.0 Water Quality and Water Quantity Monitoring

6.1 Water Quality

Water quality monitoring will occur as part of the WFNRP to determine whether restoration strategies listed in Section 5.0 are reducing nitrogen loads to the West Fork. The objectives of water quality monitoring associated with the WFNRP are to:

- Quantify nitrate+nitrite-N (NO₃⁻ + NO₂⁻), total nitrogen (TN), chlorophyll *a*, benthic biomass, chloride and boron levels in the Lower South Fork and the Upper Middle Fork.
- Identify sources of nitrogen loading to the Lower South Fork and Upper Middle Fork.
- Quantify levels of NO₃⁻ + NO₂⁻, TN, chlorophyll *a*, total phosphorous and benthic biomass in streams with listed nitrogen TMDLs to assess the success of future restoration strategies.

More information on the water quality monitoring can be found in the Sampling Analysis Plans for the West Fork Nitrogen Reduction Project [Gardner, 2013] and the BWTF Community Water Quality Monitoring Program [Gardner and O'Hare, 2014].

6.2 Water Quantity

Streamflow will be determined for the West Fork and its three main tributaries (**Figure 2**) [Songline, 2009b] by employing continuous stage data and measured discharge to develop a rating curve for each site. Stream discharge will be calculated in July, August, and September with a Marsh McBirney Flo-Mate 2000™ current velocity meter and standard USGS area-velocity method [USGS, 2008].

7.0 Criteria to Determine Achievement of Load Reductions

Water quality monitoring targets set by the MTDEQ determine whether water bodies are achieving pollutant load reduction goals; however, we do not expect water bodies to meet water quality criteria/standards immediately. Instead, we anticipate a lag time in creating instream conditions that will meet water quality monitoring targets/standards due to historical N loading and travel times from N source areas to stream.

8.0 Implementation Schedule and Measurable Milestones

The intent is for the WFNRP to be fully implemented by 2020. At that time, BWTF will review the UGWRP and revise/make additions as necessary. For a detailed implementation schedule, see Appendix B, Table B-1. The interim measurable milestones are described in Appendix B, Table B-2.

9.0 Public Information and Educational Component

Stakeholder involvement and input will be a key component to restoration planning implementation. Stakeholders will be informed of all restoration planning and implementation activities through email, newsletters, website, press releases, and public events.

10.0 Technical and Financial Assistance

10.1 Technical Assistance

Technical assistance will be requested routinely from the appropriate state agencies and regional scientists (Montana Fish, Wildlife and Parks, US Forest Service, Natural Resources Conservation Service, Montana DEQ, Gallatin Local Water Quality District, Gallatin Conservation District, Montana State University). These folks are part of the Technical Advisory Committee organized during the Upper Gallatin TMDL assessments.

10.2 Financial Assistance

We expect that a wide range of funding sources will be used to implement the WRNRP. Each management measure or restoration project will generally call for a different funding approach. A partial list of potential funding sources includes:

1. 319 Grant funding from MTDEQ
2. Big Sky Resort Tax District
3. Montana Fish Wildlife and Parks - Future Fisheries Improvement Program
4. Various types of funding from the USFS including: RAC (Secure Rural Schools and Community Self-Determination Act of 2000) and USFS Partnership Grant
5. National Fish and Wildlife Foundation
6. Department of Natural Resources and Conservation Grants (Watershed Planning Assistance Grant Program, Renewable Resource Grant and Loan Program, Reclamation and Development Grant Program)
7. Soil and Water Conservation Districts of Montana's mini-grants for education and outreach focused projects
8. Individual and business donations

Cost estimates for the restoration strategies defined in Section 5 are listed in **Table 4**.

Table 4: Cost estimates for restoration strategies described in Section 5.0.

Restoration Strategy	Expected Cost Range
5.1.1 Advocate ordinance for Stormwater class requirement for builders	staff time
5.1.2 Zoning changes to reduce nitrogen footprint	staff time
5.1.3 Trout Friendly Landscaping Workshop/Program	\$2,500
5.1.4 Realtor Continuing Education Course/Materials	< \$4,000
5.1.5 Stormwater 101 & 102 Course/Educational materials	<\$4,000
5.2.1 Big Sky Golf Course Wastewater Management	< 100K to > 500K
5.2.2 Big Sky Golf Course Maintenance Workshop/Brochure	\$2,500
5.2.3 Upper West Fork Vegetation Enhancement Projects	\$271K
5.2.4 Upper West Fork Irrigation and Plant Improvements	600K+
5.3.1 Partner with companies to promote advanced septic systems/ brochure	\$2,000 + staff time
5.3.2 Zoning change to require advanced septic systems in sensitive areas	staff time
5.3.3 Septic maintenance brochures	\$1,000
5.4.1 Horse manure management workshop	\$300
5.4.2 Dog waste stations	\$1,500
5.5.1 Dissemination of all information related to strategies 5.1 - 5.4 through the BWTF website, flyers, newsletters, and social media	\$1,000/yr + staff time

References

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APPENDIX A
Existing Pollutant Load Estimates

Table A-1: Existing Nitrogen Load Estimates for the West Fork Watershed.

Stream Segment	Source	Existing Load
Upper Middle Fork	Residential/Resort	0.589 lbs/day
	Septic	0.015 lbs/day
South Fork	Residential/Resort and Septic	6.8 lbs/day
	Wastewater	0.2 lbs/day
West Fork	Residential/Resort	11.2 lb/day
	Septic	negligible
	Wastewater	9.0 lb/day

APPENDIX B
Implementation Schedule and Measureable Milestones

Table B-1: West Fork Nitrogen Reduction Plan Implementation Schedule

Restoration Strategy	2014	2015	2016	2017	2018	2019
5.1.1 Advocate Ordinance for Stormwater Class Requirement for Builders						
5.1.2 Zoning changes to Reduce Nitrogen Footprint						
5.1.3 Trout Friendly Landscaping Workshop/Program						
5.1.4 Realtor Continuing Education Course						
5.1.5 Stormwater 101 & 102 Course						
5.2.1 Big Sky Golf Course Wastewater Management						
5.2.2 Big Sky Golf Course Maintenance Workshop	as	needed				
5.2.3 Upper West Fork Vegetation Enhancement						
5.2.4 Irrigation and wastewater Plant Improvements						
5.3.1 Partner With Companies to Promote Advanced Septic Systems						
5.3.2 Zoning Change Requiring Advanced Septic Systems in Sensitive Areas						
5.3.3 Septic maintenance brochures						
5.4.1 Horse Manure Management Workshop Follow Up						
5.4.2 Dog Waste Stations and Clean Up Day						
5.5.1 Dissemination of all information related to strategies 5.1 - 5.4 through the BWTF website, public meetings/events, newsletters, and social media						

Table B-2: Upper Gallatin Watershed Restoration Plan Measureable Milestones

Measureable Milestones	2014	2015	2016	2017	2018	2019
5.1.1 New ordinances requiring Stormwater classes						
5.1.2 Zoning aimed at reducing nitrogen footprint						
5.1.3 Trout Friendly Landscaping Workshop & Brochure						
5.1.4 Realtor Continuing Education Course						
5.1.5 Stormwater 101 & 102 Course in Big Sky						
5.2.1 Big Sky Golf Course Wastewater Management						
5.2.2 Big Sky Golf Course Maintenance Workshop	As	needed				
5.2.3 Upper West Fork Vegetation Enhancement						
5.2.4 Irrigation/wastewater plant improvements						
5.3.1 Partnerships Septic System Companies						
5.3.2 Zoning Requiring Advanced Septic Systems in Sensitive areas						
5.3.3 Septic Maintenance Brochure						
5.4.1 Horse Manure Management Workshop Follow Up						
5.4.2 New Dog Waste Stations and Spring Cleanup						
5.5.1 Dissemination of all related plan information						
- Public meeting presentation						
- Email, newsletters, website, Facebook						
- Press release in local newspaper						

APPENDIX C
Land Application Strategy Enhancement

APPENDIX D
West Fork Gallatin Nutrient and Sediment Reduction Project
Design Plans

APPENDIX E
Wastewater System Master Plan Update