

# Water Quality in the Upper Gallatin Watershed

## What It Means to You



# Upper Gallatin Watershed



The cold, clear waters of the upper Gallatin watershed pour from the high elevations of the Gallatin and Madison ranges, nourishing a world-class fishery, the community of Big Sky and the surrounding area. Tourism contributed over \$26 million to the local economy in 2005. As an amenity and recreation based community, the state of the natural resources directly influences economic prosperity.

The estimated full-time population is approximately 2,500 and seasonal population can exceed 15,000 on peak days.

## Is the Water Clean?

Three streams in the West Fork of the Gallatin watershed (West Fork watershed) are on Montana's Department of Environmental Quality's (DEQ) list of impaired waters (303(d) list). They are the South Fork and Middle Fork of the West Fork and the West Fork of the Gallatin. Elevated levels of nutrients, sediment and pathogens including the *e. coli* bacterium have been found. This flagged them for further investigation through Total Maximum Daily Load (TMDL) studies.

In 2005, the Blue Water Task Force (BWTF) began a partnership with the DEQ to further investigate water quality and sources of impairment of the streams in the upper Gallatin watershed. The TMDL studies identify water quality issues, major contributor sources of nutrients, sediment and pathogens, and set reductions needed to improve water quality. The BWTF hopes to use the results of these studies to help the community determine the best way to balance growth and land use needs while protecting the water uses that are fundamental to its identity and economy.

Currently, the overall health of the watershed is good. However, elevated levels of nutrients, *e. coli* and sediment were observed in some areas. As development pressures on local water resources (ground water and surface waters) increase, care must be taken to remedy existing problems and ensure that waters are not further degraded.



**Above** Stream insects can be an indicator of stream water quality

**Opposite Page**

**Top** Construction can be a major contributor of sediment

**Opposite Page Bottom** Algal growth can indicate elevated

levels of nutrients

# Clean Water Indicators and Sources of Pollutants

Six major indicators of water quality were studied in the upper Gallatin: nutrients, algae (chlorophyll *a*), stream insects (macroinvertebrates), sediment, *e. coli* bacteria and flow. These indicators are used to identify stream conditions which can affect human health and aquatic life.

## Nutrients, Algae and Stream Insects

High levels of the nutrients nitrogen and phosphorus typically result in excess algae in streams. Excess algae affect both recreation and aquatic life. Recreational impacts result from excessive amounts of algae on stream bottoms which can affect fishing, swimming boating and general aesthetics. Initially, increased levels of algae may be beneficial to aquatic life, but too much algae lowers oxygen levels, harming fish and their main food source, stream insects.

Sources of nutrients include excess fertilizer used for landscaping, human and animal waste, and alteration or removal of streamside vegetation.

## Sediment

Increased sediment (excess dirt and sand) can decrease water clarity and cover up stream bottoms which can affect fish and stream insect survival and reproduction.

Activities contributing to increased sediment include road building and maintenance, construction activities, undersized culverts, improper landscaping, and streamside vegetation removal. Road sand applied each winter to Highway 64 between 191 and Big Sky resort would be three-quarters of an inch deep for the entire distance, if applied all at once. Without proper management this sand can end up in the river.

## *E. Coli* Bacteria and Pathogens

*E. coli* is a bacterium associated with both human and animal fecal matter and can be dangerous to human health. It also serves as an indicator of the probable presence of other pathogens.

Possible sources of *e. coli* include septic systems, wastewater, stormwater runoff and domestic and wild animal waste.

## Flow

Flow, or the amount of water in the stream, can affect water temperature and the concentration of pollutants in the water. Flow varies by time of year and depends on snowpack, temperature and precipitation.



# Results of the Water Quality Studies

In-depth water quality studies were conducted between 2005 and 2009, primarily in the West Fork of the Gallatin watershed. Overall, water quality is still good in the Big Sky area. However, water quality is degraded in some areas; the general trend showed lower water quality as the streams travelled through more intensely developed areas.

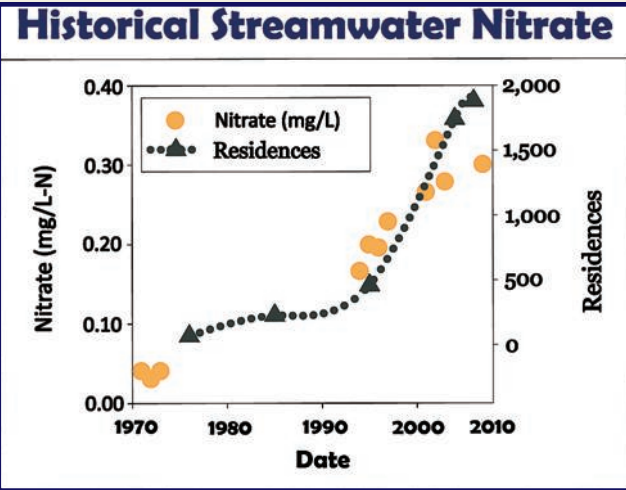
## Nutrients, Algae, and Stream Insects

Though the highest nitrogen levels measured were recorded during the low-flows of winter, the levels are less likely to affect recreation or aquatic life, since algal growth almost stops during winter.

DEQ's recommended nitrogen concentrations apply from July 1 to September 30, when streams are most likely to be affected by nuisance algal growth due to excessive nutrients. Recent measurements



**Top** Higher levels of algae in the West Fork of the Gallatin  
**Above** Excess sediment on the stream bed  
**Below Top** Stream monitoring  
**Below Bottom** Streamside development  
**Right** Volunteer testing water samples for nitrogen



Since 1970, the nutrient nitrate has increased in direct relationship to the increased number of residences in the watershed.

(Data are courtesy of the National Science Foundation "Research Applied to National Needs" study, MSU Watershed Hydrology Lab, Blue Water Task Force, Big Sky Water and Sewer, and Gill Geesey)



have shown that the West Fork of the Gallatin exceeds the state's recommended concentration for nitrogen during the summer time-period.

Excessive amounts of algae were found in the lower sections of the South and West Fork during the summer. Algae growth within the West Fork increased in a downstream direction as the stream runs through Meadow Village.

Stream insects have been tracked since 2000. Stream insects indicated excellent water quality at headwaters sites and exhibited mild impairment in the lower portion of the watershed. Increased numbers of shredders and grazers (algae eating stream insects) were found in the lower reaches of the West Fork.

### **Sediment**

Several sources of concern for sediment were noted, including instances of severe bank erosion, undersized culverts, limited use of management practices to minimize construction sediment, and road sanding practices that promote sediment transport to rivers and streams. Excess fine sediment was observed in some riffles and pools at sites in the Middle Fork and West Fork of the Gallatin.

### ***E. Coli* Bacteria**

*E. coli* levels exceeded state standards on sections of the Middle Fork and West Fork during late summer. Streams in the watershed are more susceptible to impact of *e. coli* in the late summer because warm water temperatures can promote bacterial growth and low water levels can increase concentrations.

*E. coli* was reported in 18 public wells near the Gallatin River, suggesting contamination from septic systems. This can be a health threat to well users and can eventually reach the river.



### **Determining Water Quality**

The Department of Environmental Quality (DEQ) and the Blue Water Task Force (BWTF) have conducted detailed water quality studies between 2005 and 2009.

The BWTF has sampled and analyzed stream insects since 2000 and conducted volunteer water quality monitoring on the Gallatin and its tributaries.

Public well sampling results for *e. coli* are from Source Water Delineation and Assessment Reports.

### **Further Information**

Detailed water quality studies and results can be found on the Blue Water Task Force site under "Document Libraries."

[www.bluewatertaskforce.org](http://www.bluewatertaskforce.org)

More information on the State DEQ Total Maximum Daily Load (TMDL) program is available at:

[deq.mt.gov/wqinfo/TMDL/default.mcp](http://deq.mt.gov/wqinfo/TMDL/default.mcp)

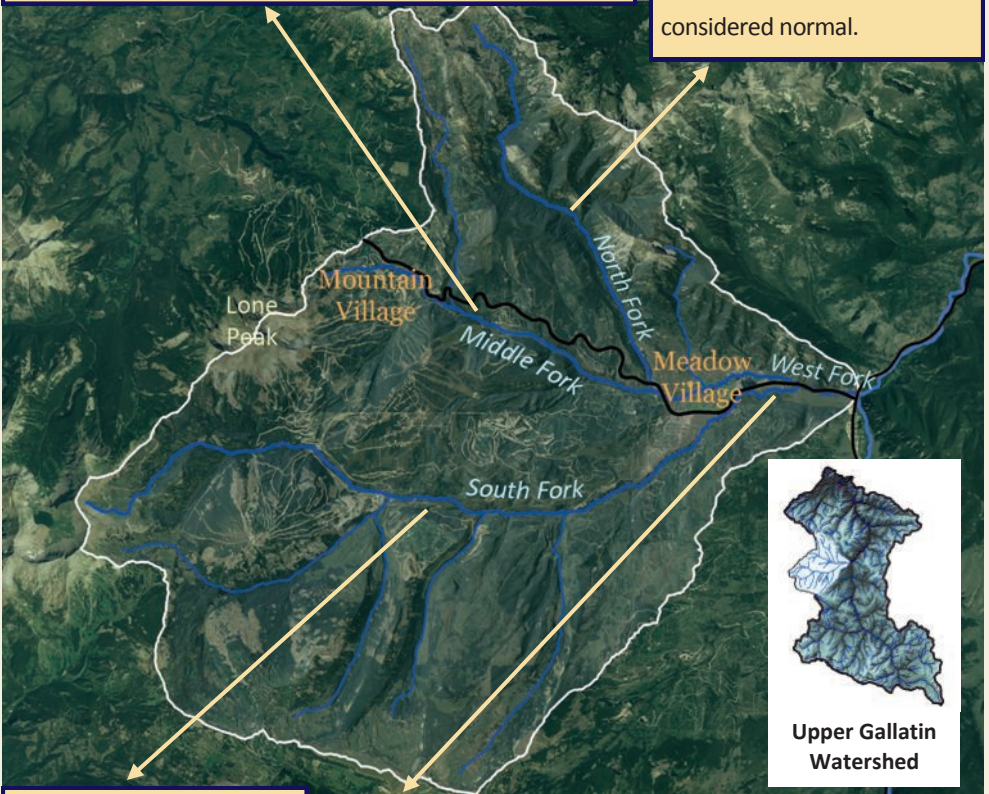
# West Fork Watershed Summary

## Middle Fork

*E. coli* counts generally increased going downstream along this tributary, although two unnamed tributaries also showed high *e. coli* levels. *E. coli* quantities exceeded state standards at four sites. At an upper site, stream insects were somewhat impaired, possibly due to the presence of Lake Levinsky dam. Nutrient levels met state recommended concentrations.

## North Fork

Nitrogen, phosphorus and algae levels were quite low. Stream insect populations were healthy. Most sediment was from natural sources and considered normal.



Upper Gallatin Watershed

## South Fork

Nutrient concentrations were low and stream insect populations were healthy. However, algae growth was above state recommended concentrations. It is likely that the algal growth took up most of the available nutrients.

## West Fork below the North Fork confluence

*E. coli* counts were highest at a site here, above state standards. Nutrients and algae were generally found in highest concentrations, and nitrogen levels exceeded state recommended concentrations. Stream insects were found to be mildly impaired, possibly due to the increases in nutrients and algae. About one-third of the sediment was from residential or ski area development, in excess of the natural stream conditions. This area is furthest downstream and appears to be affected by a number of cumulative impacts.

# Protecting and Improving Water Quality: What You Can Do

Most pollution in the upper Gallatin watershed can be attributed to many small sources of human activity, which collectively create a larger impact. Land owners and managers have many options to improve water quality, even if they do not live or work next to a stream. Individuals can:

- Use appropriate amounts of fertilizer, timed to avoid applications before storms.
- Inspect and maintain septic tanks regularly.
- Move horse corals or feed lots away from streams, rivers or water sources.
- Keep pet waste picked up and disposed of in trash receptacles.
- Plant native vegetation, which requires less fertilizer and water application.
- Leave streamside vegetation alone or restore it.



**Top** A poorly maintained sediment fence (top) allows runoff, while a well designed and maintained fence (bottom) keeps streams clean **Below Left** Extending the natural vegetative buffer next to the water minimizes nutrient and sediment runoff **Bottom** Community water quality monitoring



- Use Streamside Management Zone Law requirements during timber harvest.
- Follow best construction practices, such as those illustrated at [stormwater.montana.edu](http://stormwater.montana.edu).

The Blue Water Task Force has access to information to help landowners address these problems. In addition, people can also work together to advocate the improvement of management practices in public areas such as roads and common areas.

## Community Participation

BWTF helps individuals learn more about the watershed, and provides focused, effective opportunities to work to improve and protect the Gallatin watershed. Learn more by visiting:

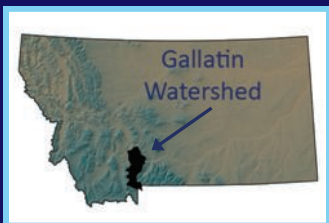
[www.bluewatertaskforce.org](http://www.bluewatertaskforce.org)



# How Clean Is Our Water?

The rivers and streams of the upper Gallatin watershed and the Big Sky area are relatively clean, but water quality studies point to areas of concern that could affect aquatic life and recreation:

- Excess nutrients and sediment exist in some streams.
- *E. coli* levels exceeded state standards in some locations of the Middle Fork and the West Fork during late summer when stream flow is lowest and water temperatures are highest.
- The variety of stream insects (macroinvertebrates) has changed due to degraded water conditions in certain areas.



## Blue Water Task Force

The Blue Water Task Force (BWTF) is a community-based nonprofit watershed group that promotes nonpartisan, scientifically based approaches to protect the health of the Gallatin watershed.

### Contact

Kristin Gardner, Executive Director  
50 Meadow Village Drive, Suite #201  
PO Box 160513  
Big Sky, MT 59716  
(406) 993-2519  
[bluewatertaskforce@gmail.com](mailto:bluewatertaskforce@gmail.com)

[www.bluewatertaskforce.org](http://www.bluewatertaskforce.org)

**Board** Sue Barton, Eric Becker, Jack Crowther, Ron Edwards, Jon Holtzman, Mindy Nowakowski, Mike Richter.

**Reviewers** Sue Barton, Eric Becker, Jack Crowther, Ron Edwards, Kristin Gardner, Jeremy Harder, Jon Holtzman, Sharon Holtzman, Lisa Kusnierz, Mindy Nowakowski, Mike Richter, Pete Schade.

**Sponsors** Montana DEQ 319 Program, Big Sky Resort Area Tax District, The Dream Catcher Foundation, Big Sky Resort, The Big EZ, Highline Partners.

Published 2010

