TMDL Projects

- Aerial assessment – ongoing
- Streamflow study – ongoing
- Biological monitoring in 2005
- Pathogen monitoring in 2006-2007
- Sediment assessment planned for 2008
  - Unpaved roads
  - Eroding streambanks
  - Upland sediment sources

Pathogen Assessment 2006-2007

Middle Fork West Fork Gallatin River

- Considered ***partially supporting*** the primary contact ("recreation") beneficial use by the State of Montana

Montana Standard for Pathogen Impairments

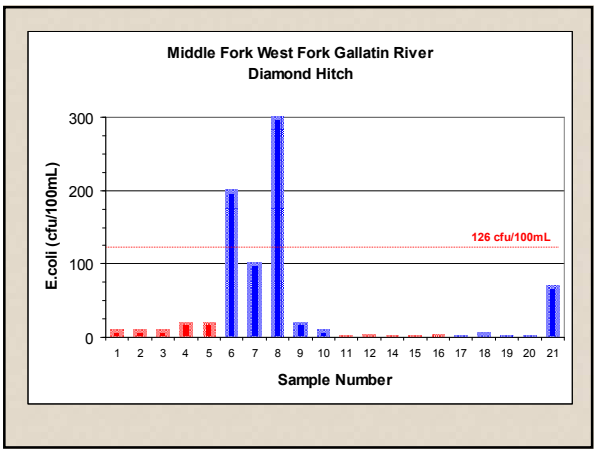
- *E. coli* is a non-pathogenic bacteria usually associated with pathogens transmitted by fecal contamination
- The presence of *E. coli* indicates the presence of human pathogens
- Referred to as an "indicator organism"
- Measured in "colony forming units" (cfu) per 100mL

Potential sources of pathogens:

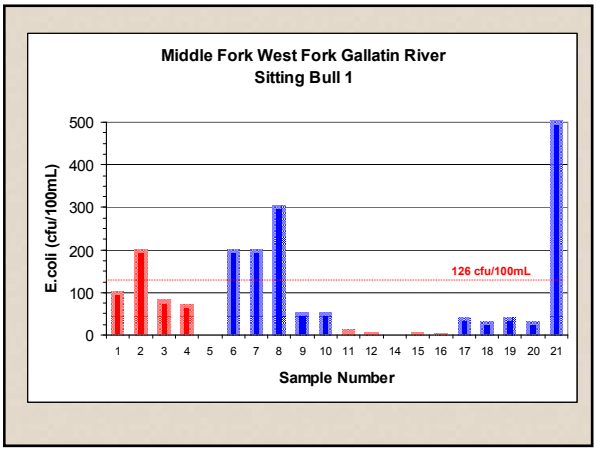
- Septic systems and wastewater
  - individual septic systems
  - failing wastewater treatment ponds and sewer lines
  - land application of sewage effluent
- Animal sources
  - wildlife/stormwater runoff
  - animal feeding operations
  - domestic pets/stormwater runoff

Applicable Period	Geometric mean of 5 samples collected over a 30-day time period	No more than 10% of the samples during a 30-day time period shall exceed:
April 1 – October 31 "summer"	< 126 cfu/100mL	252 cfu/100mL
November 1 - March 31 "winter"	< 630 cfu/100mL	1,260 cfu/100mL

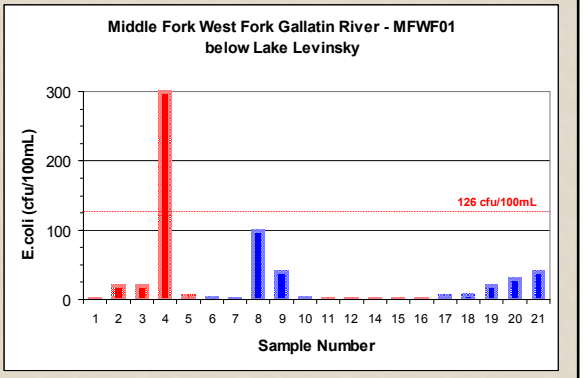
Middle Fork West Fork Gallatin River
Diamond Hitch



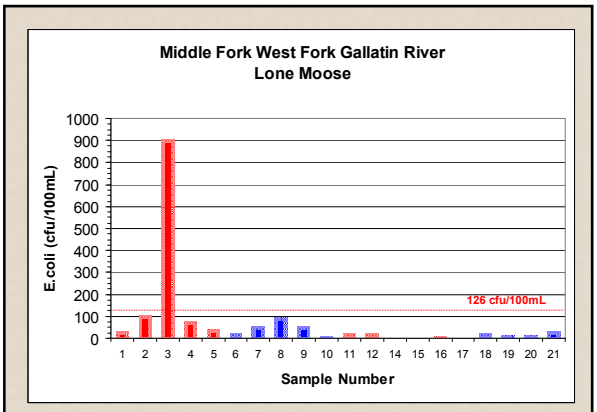
Middle Fork West Fork Gallatin River
Sitting Bull 1



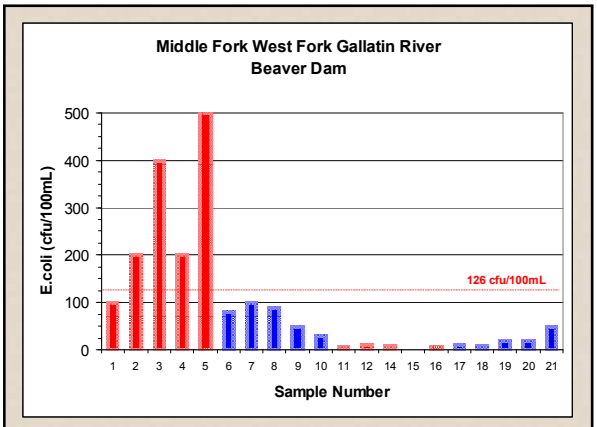
Middle Fork West Fork Gallatin River
below Lake Levinsky



Middle Fork West Fork Gallatin River
Lone Moose



Middle Fork West Fork Gallatin River
Beaver Dam

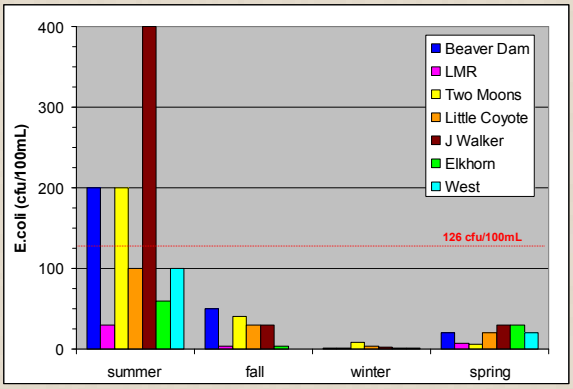


Geometric Mean *E. Coli* Concentrations (cfu/100mL)

Sample Timeframe	Sample Site				
	Diamond Hitch	Sitting Bull 1	below Lake Levinsky	Lone Moose	Beaver Dam
August	13	103	15	95	**240**
November	65	**125**	8	28	64
February/March	2	4	1	5	5
May/June	4	59	16	10	17

"Summer" standard: <126 cfu/100mL

"Winter" standard: <630 cfu/100mL



Conclusions

- No pathogen impairments during winter
- Elevated pathogen concentrations in summer indicate impairment
  - Low streamflow
  - Warm water temperatures
- Future assessment work should focus on the June through October timeframe
- Expand to include West Fork through the Meadow Village to the mouth

2005 Biological Monitoring

- Streams considered impaired by nutrients:
  - Middle Fork West Fork Gallatin River
  - South Fork West Fork Gallatin River
  - West Fork Gallatin River
- Benthic algae chlorophyll *a* concentrations
  - algal density often increases as nutrient loads increase
  - pigment in algae, indicator of excessive algae growth
  - naturally variable, 5 replicates per site

- **The State of Montana's narrative standard for nutrients states:**

  "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"

  excessive algae = undesirable aquatic life

- **Chlorophyll *a* standards for the Clark Fork River:**
  100 mg/m² summer mean
  150 mg/m² summer peak

Middle Fork West Fork Gallatin River below Lake Levinsky

Mean Chlorophyll *a* concentration = 81 mg/m²

Middle Fork West Fork Gallatin River Beaver Dam

Mean Chlorophyll *a* concentration = 23 mg/m²

Beaver Dam

Chlorophyll *a* concentration = 20 mg/m²

Beaver Dam

South Fork West Fork Gallatin River
Site 01

Mean Chlorophyll *a* concentration = 15 mg/m²

South Fork West Fork Gallatin River
Site 02

Mean Chlorophyll *a* concentration = 136 mg/m²

South Fork West Fork Gallatin River
Elkhorn

Mean Chlorophyll *a* concentration = 468 mg/m²

Elkhorn

West Fork Gallatin River
Two Moons

Mean Chlorophyll *a* concentration = 23 mg/m²

West Fork Gallatin River Site
J Walker

Mean Chlorophyll *a* concentration = 318 mg/m²

J Walker

Chlorophyll *a* concentration = 313 mg/m²

West Fork Gallatin River
West

Mean Chlorophyll *a* concentration = 443 mg/m²

North Fork West Fork Gallatin River
WOW

Mean Chlorophyll *a* concentration = 4 mg/m²

Swan Creek
Site 01

Mean Chlorophyll *a* concentration = 2 mg/m²

Dudley Creek
Site 01

Mean Chlorophyll *a* concentration = 19 mg/m²

Hell Roaring Creek
Site 01

Mean Chlorophyll *a* concentration = 30 mg/m²

Conclusions

- Excessive algae growth due to nutrient impairments in:
  - South Fork West Fork Gallatin River
  - West Fork Gallatin River
- Recommend additional chlorophyll *a* monitoring during mid-late summer in both streams
  - Starting upstream of the Meadow Village