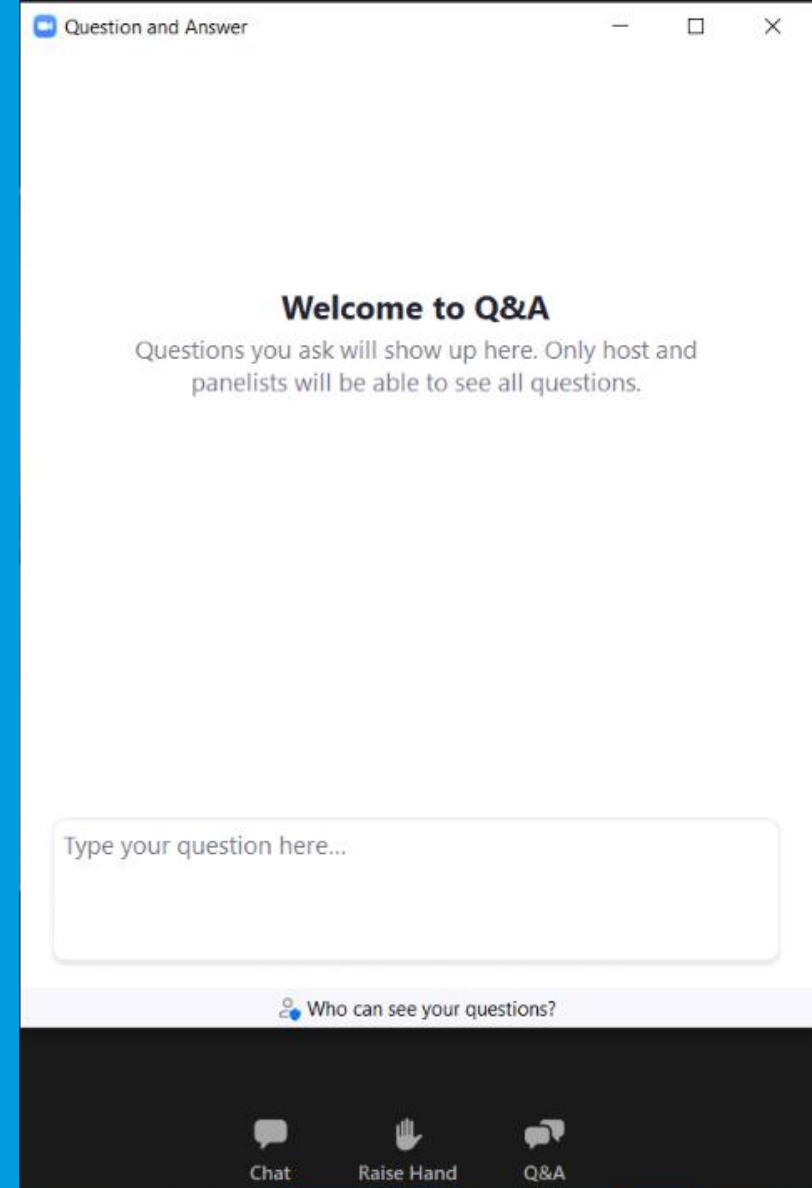


Gallatin River Water Quality Monitoring Project

May 1, 2023

Questions or Comments

- Raise hand (*9 if on the phone) or type questions into the Q&A
- DEQ will unmute you if you wish to provide your comment orally
- If calling by phone, press*6 to unmute
- State your name and affiliation before providing your comment



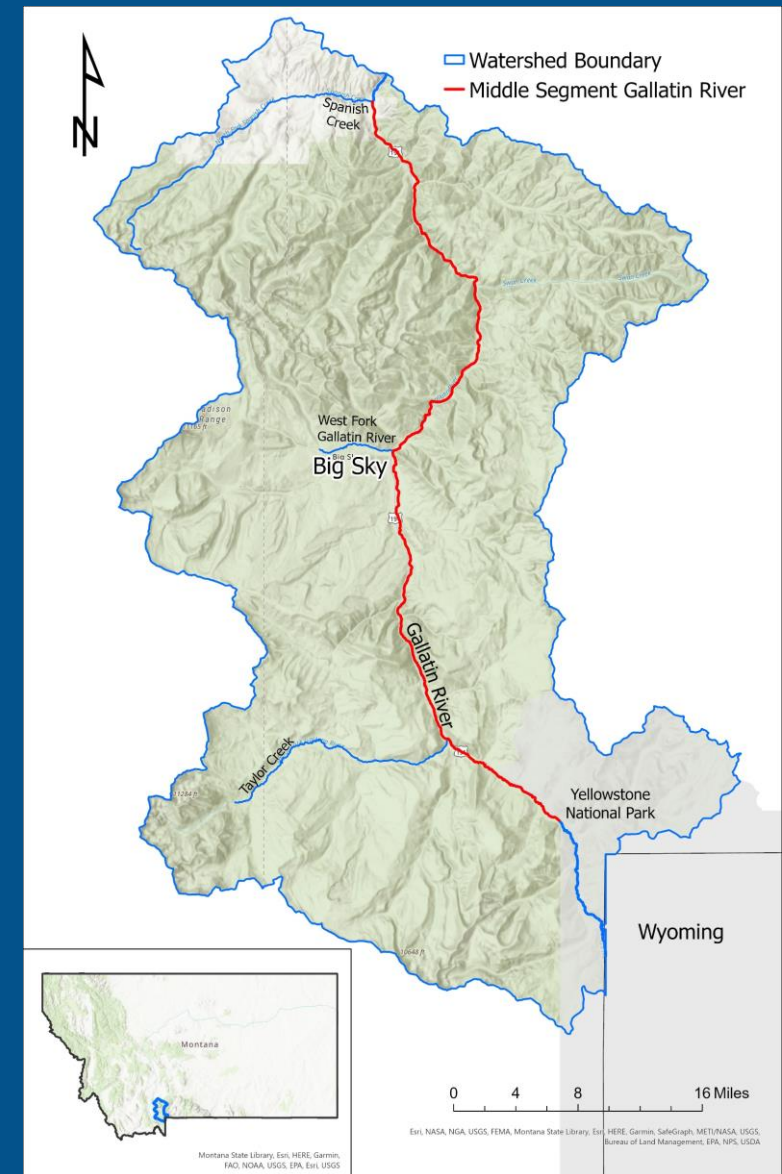
DEQ's Mission: To champion a healthy environment for a thriving Montana.

Water Quality Division Vision: Clean water from peaks to prairies for all Montanans.



Why Are We Here?: Beginning a 5+ Year Study of the Gallatin River

- An important recreational, ecological, and cultural resource
- Experiencing increased development and recreational pressure
- Concern from the community; petition
- More research needed to understand factors driving algal growth
- Momentum from stakeholders to protect and restore water quality



Our Main Goal: Protect Beneficial Uses

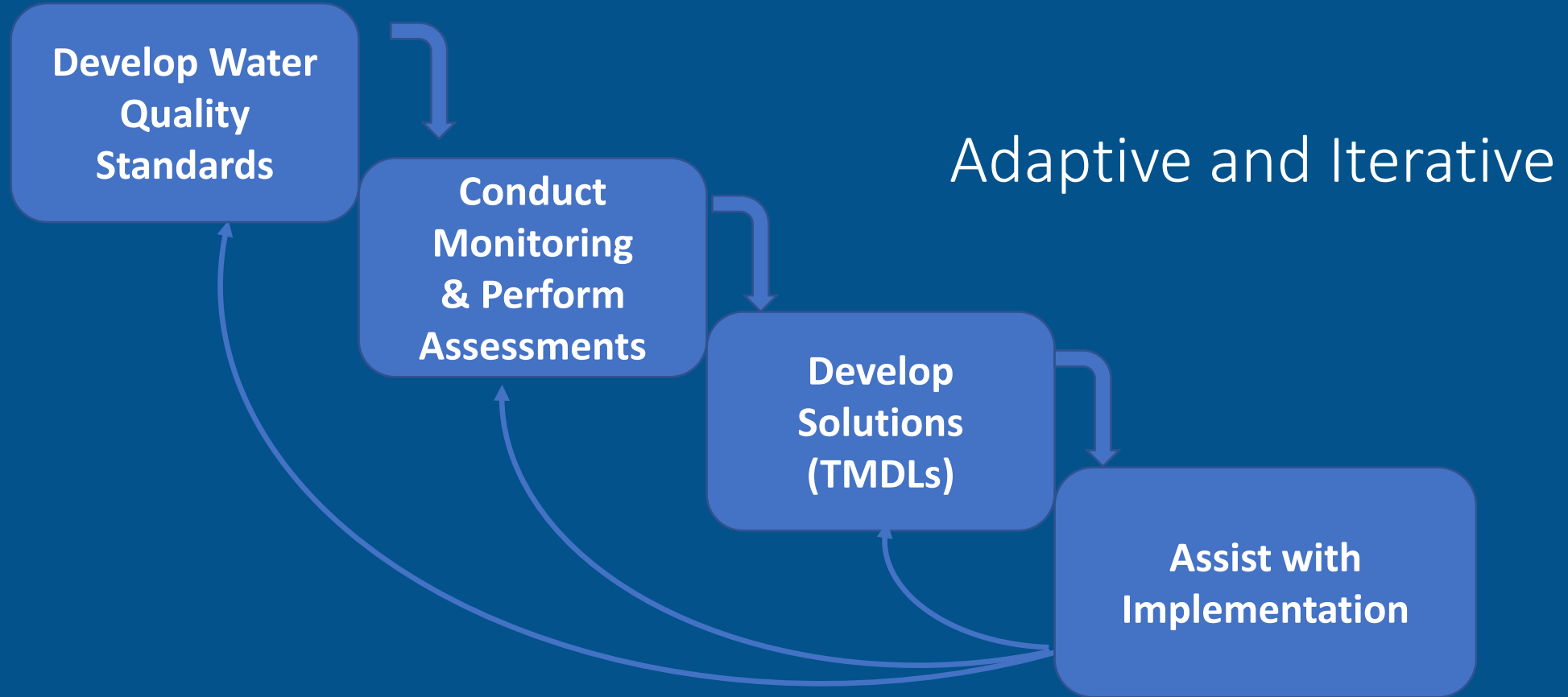
- Beneficial uses are goals and expectations specified in water quality standards for how state water surfaces should be used



Gallatin River Beneficial Uses

- Drinking, culinary, and food processing purposes, after conventional treatment;
- Bathing, swimming, and recreation;
- Growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers;
- Agricultural and industrial water supply.

DEQ's Water Quality Planning Process



Today's Agenda

- Gallatin River Listing Update
- Gallatin Project: Objectives
 - Beneficial use assessment
 - Document temporal and spatial distribution of algae
 - Identify drivers of algae
 - Source assessment and TMDL development
 - Nutrient standards update
 - Stakeholder involvement

Today's Agenda

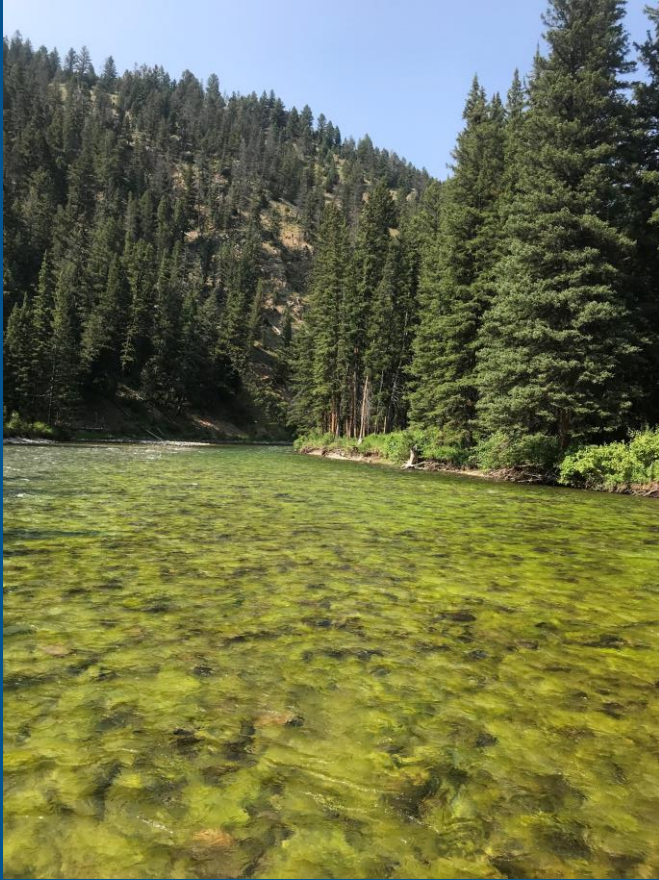
- Gallatin River Listing Update
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History and Petition to List

- Monitoring History
 - Gallatin River Task Force – Monitoring since early 2000s
 - 2010 DEQ West Fork Gallatin River Watershed TMDLS
 - 2013 GRTF volunteer monitoring program funds
 - 2018 Higher algae growth
 - 2019 DEQ Increased funding to study algae and nutrients during growing season
- Petition to list: 3/31/2022
 - Upper Missouri Water Keeper
 - Montana Trout Unlimited
 - Gallatin River Task Force
 - American Rivers
 - Greater Yellowstone Coalition



Algae Photos: Gallatin River



Missouri River Water Keepers



Missouri River Water Keepers



Montana DEQ

Assessment Summary

- Reviewed data collected within the last 10 years (2011-2021)
- All readily available data that meets QA/QC requirements
- Nutrient data
 - July 1 through September 30 of each year
- Metals
 - Insufficient data to assess
- E. coli
 - Insufficient data to assess (all 6 samples collected same day)

Data Review Methods

- Beneficial Use Assessment Method for Montana's Surface Waters (2020)
- Assessment Methodology for Determining Wadeable Stream Impairment Due to Excess Nitrogen and Phosphorus Levels (2016)
- Escherichia coli (E. coli) Assessment Method for State Surface Waters (2020)
- Metals Assessment Method (2012)

Assessment Summary

Evaluated data against numeric standards, recommended criteria, and thresholds

Nutrient Assessment Framework (Middle Rockies)

Level 1 Assessment

- Nutrient Water Chemistry (Total Nitrogen, Nitrite + Nitrate, Total Phosphorus)
 - TN threshold – less than or equal to 0.3 mg/L
 - NO₂₊₃ threshold – less than or equal to 0.1 mg/L
 - TP threshold – less than or equal to 0.03 mg/L
- Benthic Algae (Chlorophyll-*a* and Ash Free Dry Weight)
 - Chl-*a* threshold – less than or equal to 120 mg Chl *a*/m²
 - AFDW threshold – less than or equal to 35 g AFDW/m²
 - Algae photos and videos as supportive information (not in existing framework but used)

Level 2 Assessment

- Macroinvertebrate HBI Score
 - HBI threshold – less than or equal to 4.0

Overwhelming Evidence (if other data is not sufficient)

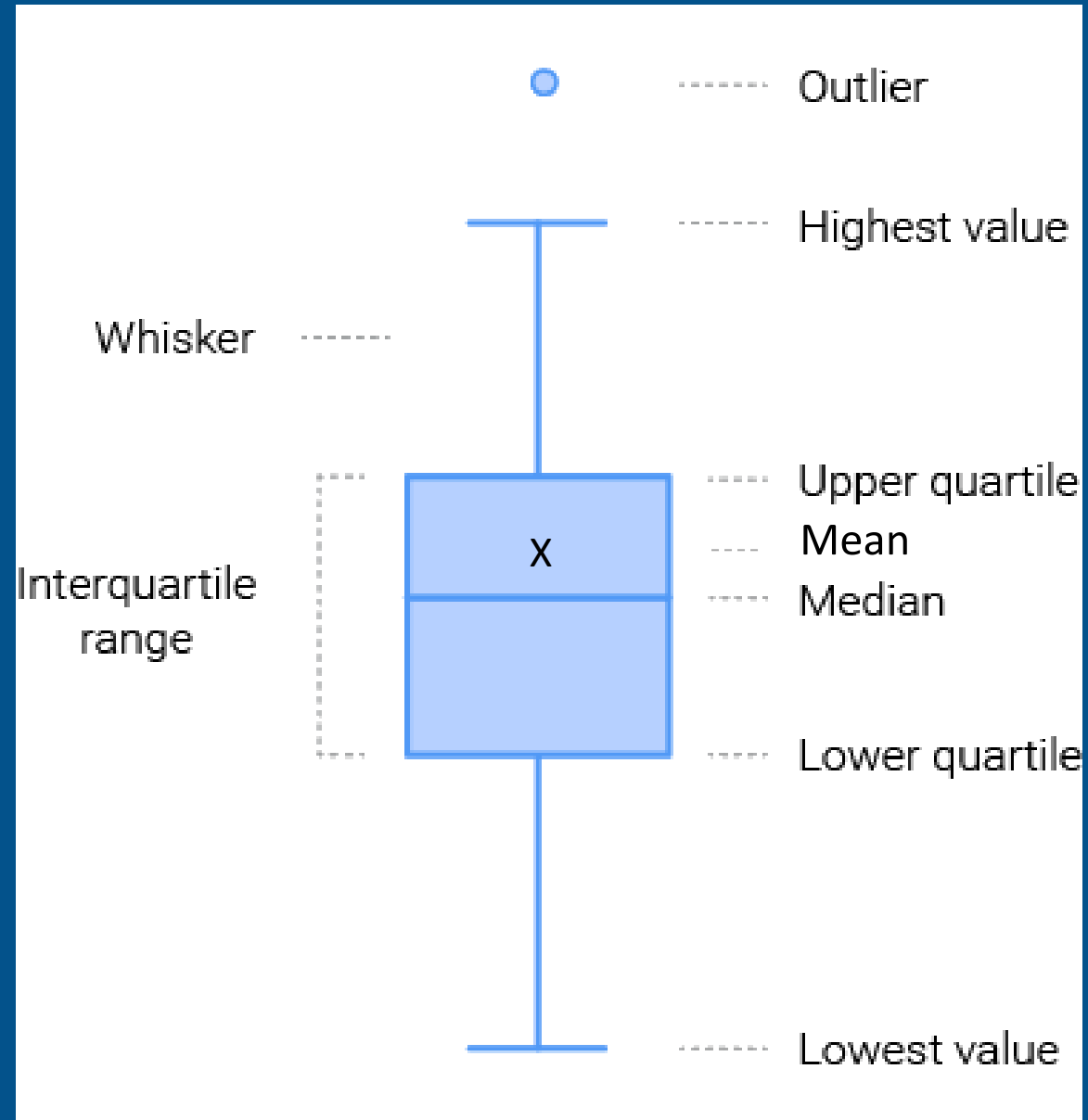
- Algae photos and videos indicate persistent widespread growth

Nutrient Chemistry

- Minimum Sample Size
 - At least 12 samples within the most recent 10 years.
 - Total Nitrogen – 69 samples
 - NO₂+3 – 87 samples
 - Total Phosphorus – 76 samples
- Exact Binomial (PASS)
- Students T-test (PASS)

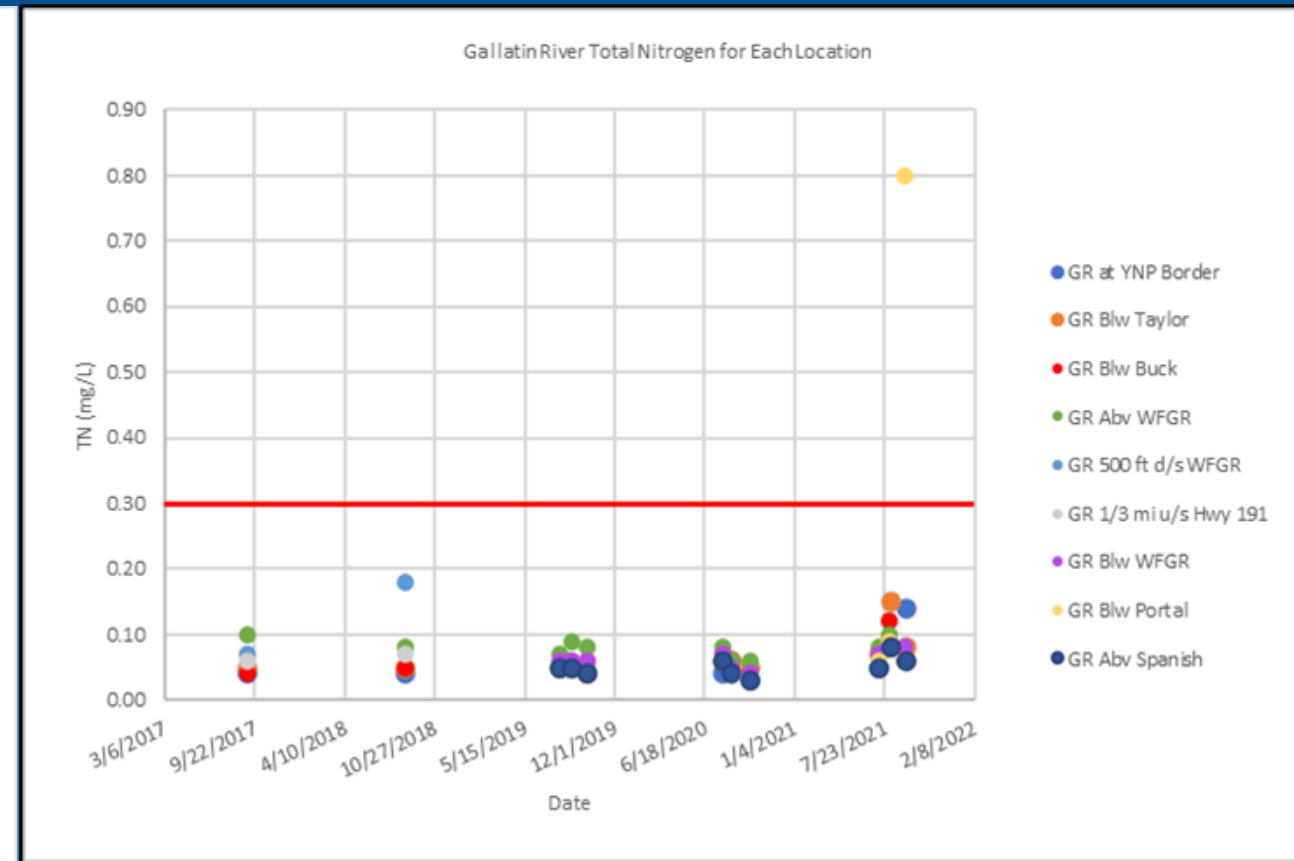
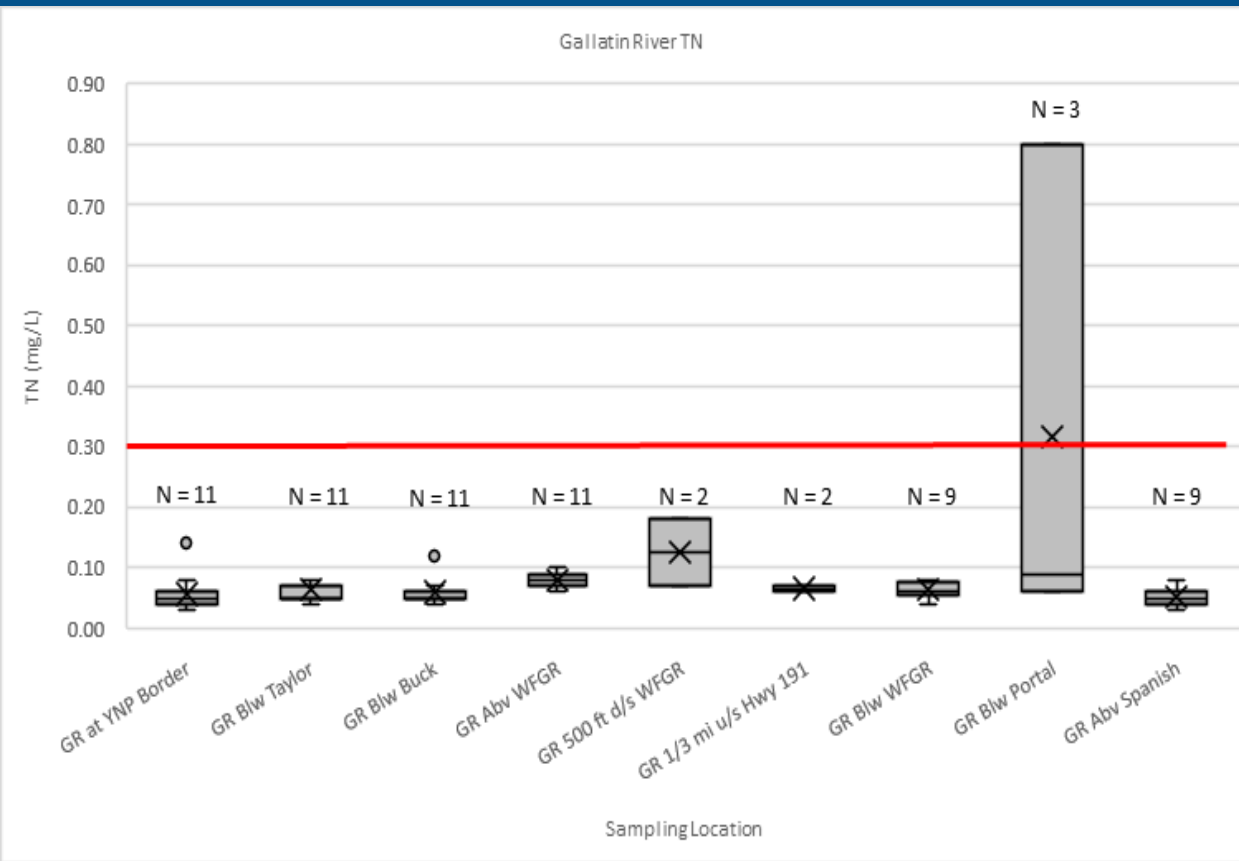


Box and Whisker Plots



Listing Data Review Results: Nutrients

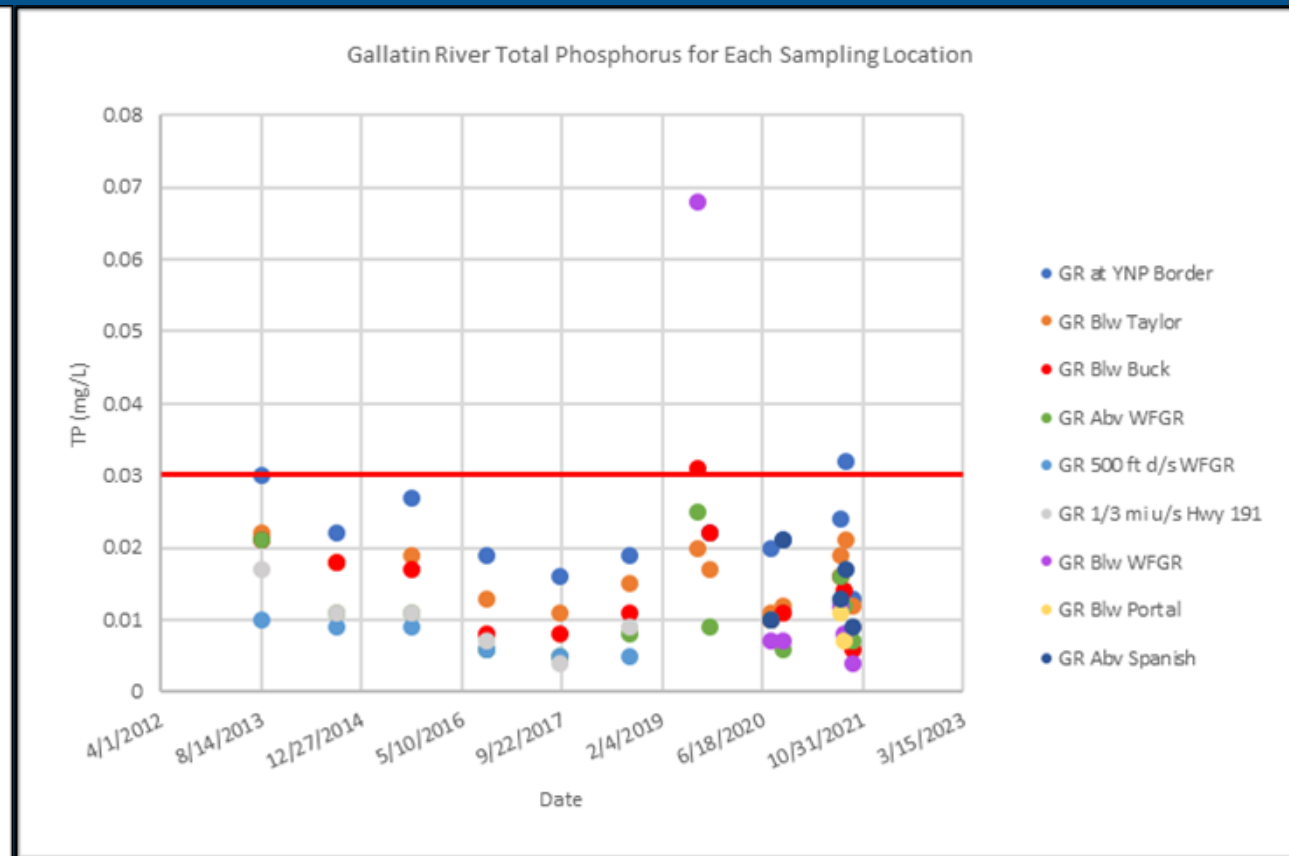
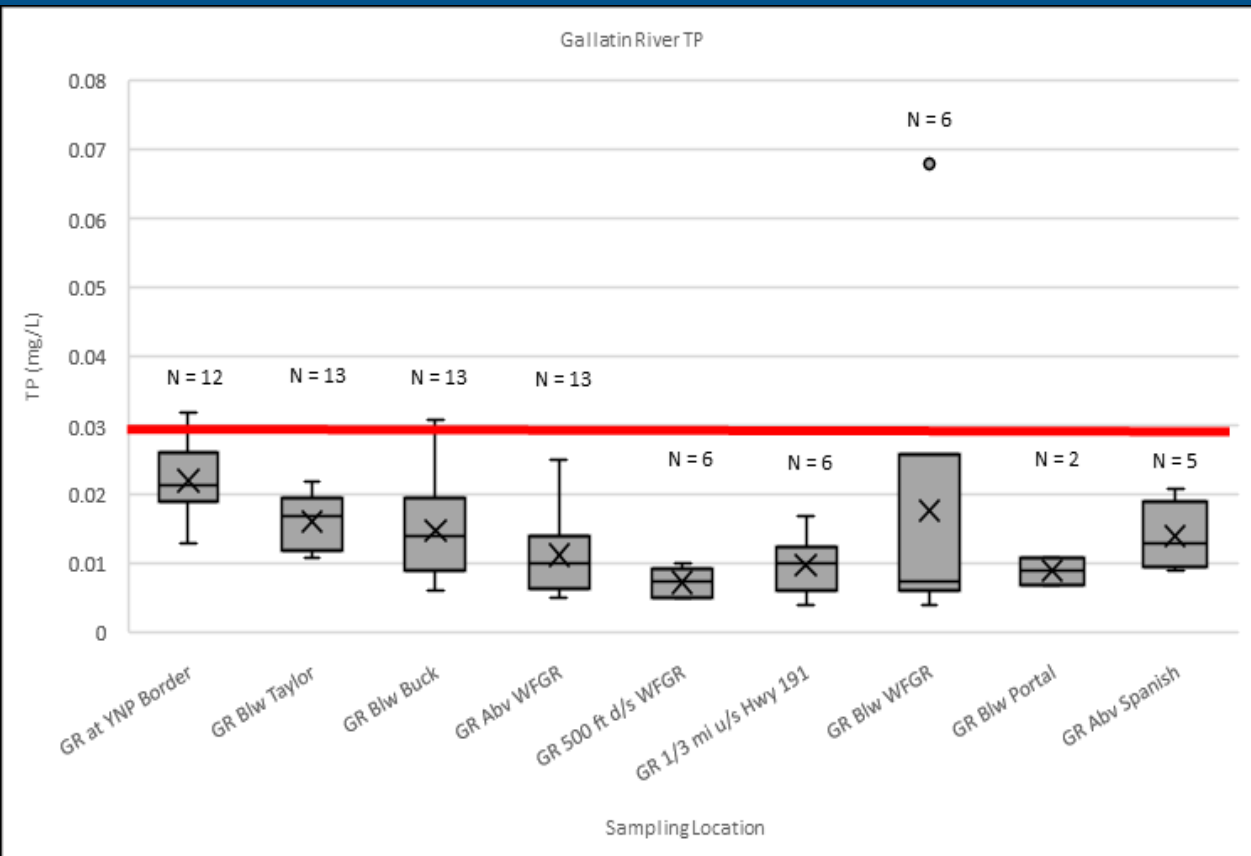
- Total Nitrogen – 1 exceedance



Upstream → Downstream

Listing Data Review Results: Nutrients

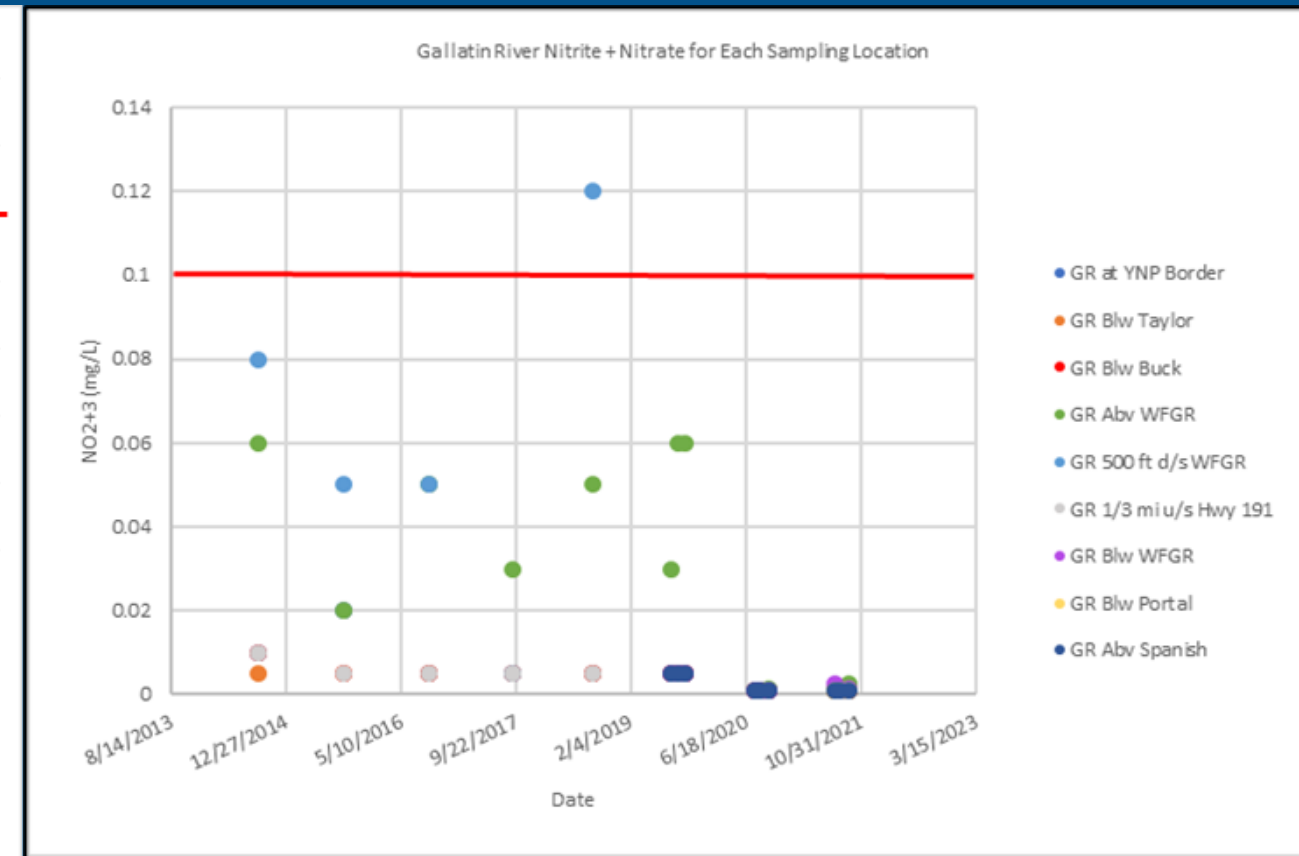
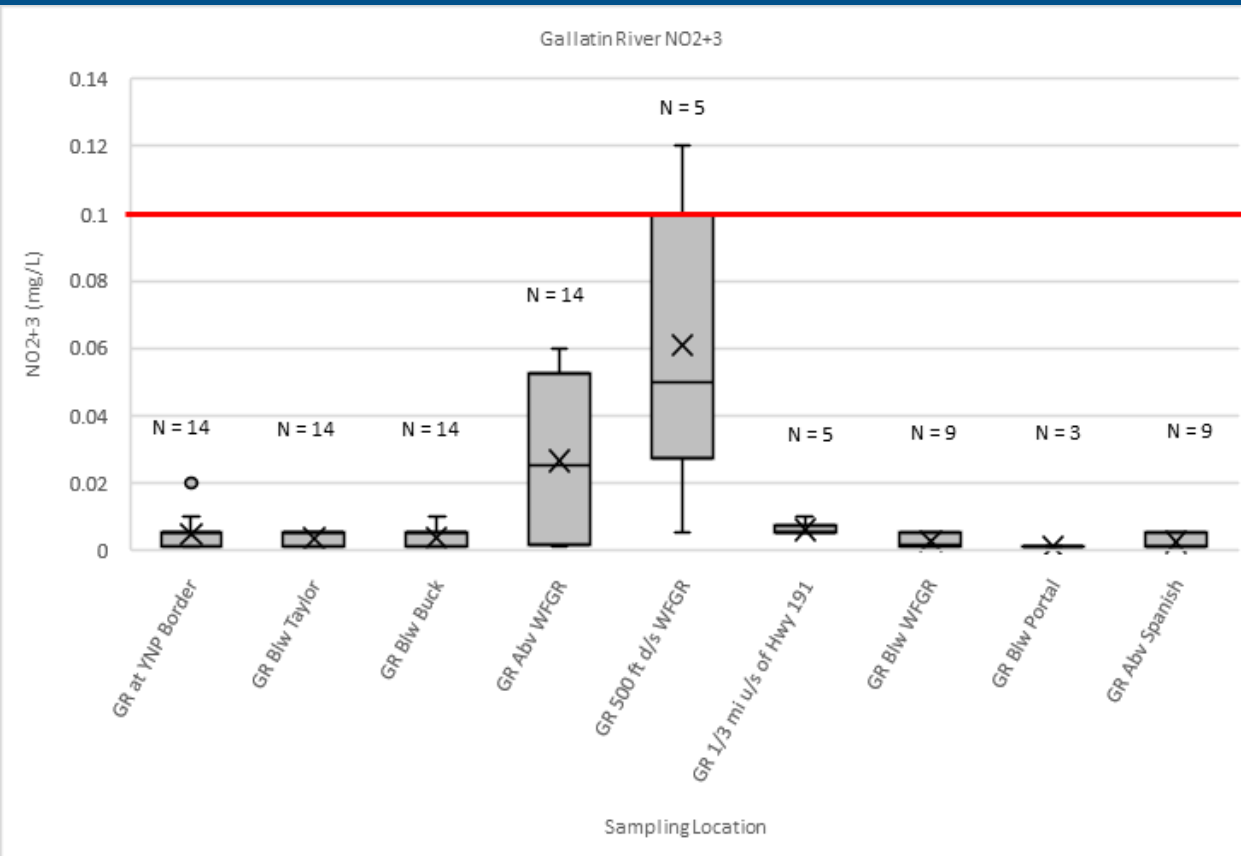
- Total Phosphorus – 3 exceedances



Upstream Downstream

Listing Data Review Results: Nutrients

- Nitrite + Nitrate – 1 exceedance



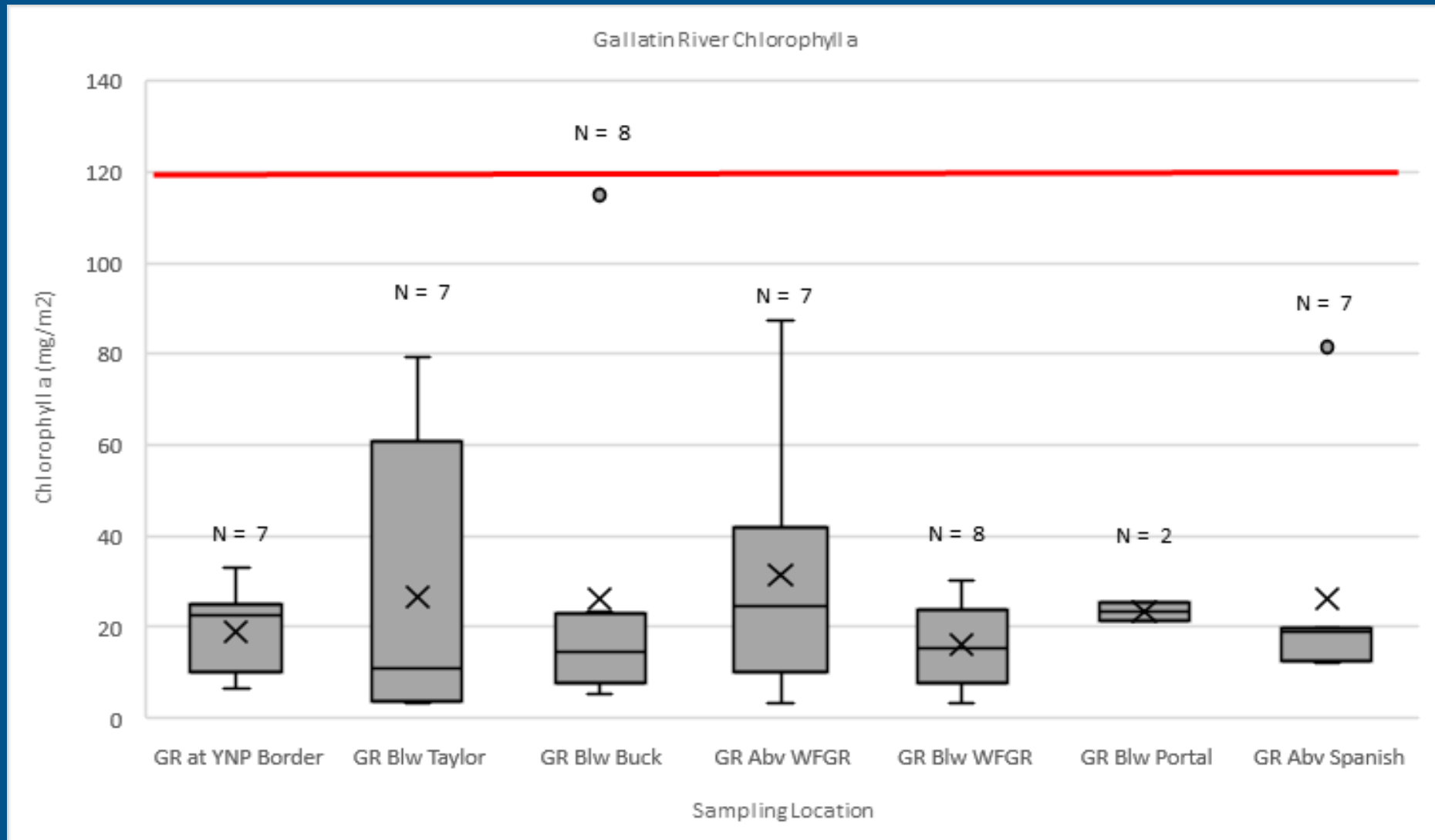
Upstream → Downstream

Benthic Algae

- Minimum Sample Size
 - At least 3 temporally and spatially independent samples within the most recent 10 years.
 - Chlorophyll-*a* = 46
 - Ash Free Dry Weight (AFDW)= 46
- Chlorophyll-*a* and AFDW Exceedances
 - Chl-*a* = 0 samples exceeded threshold
 - AFDW = 11 samples (24%) exceeded threshold

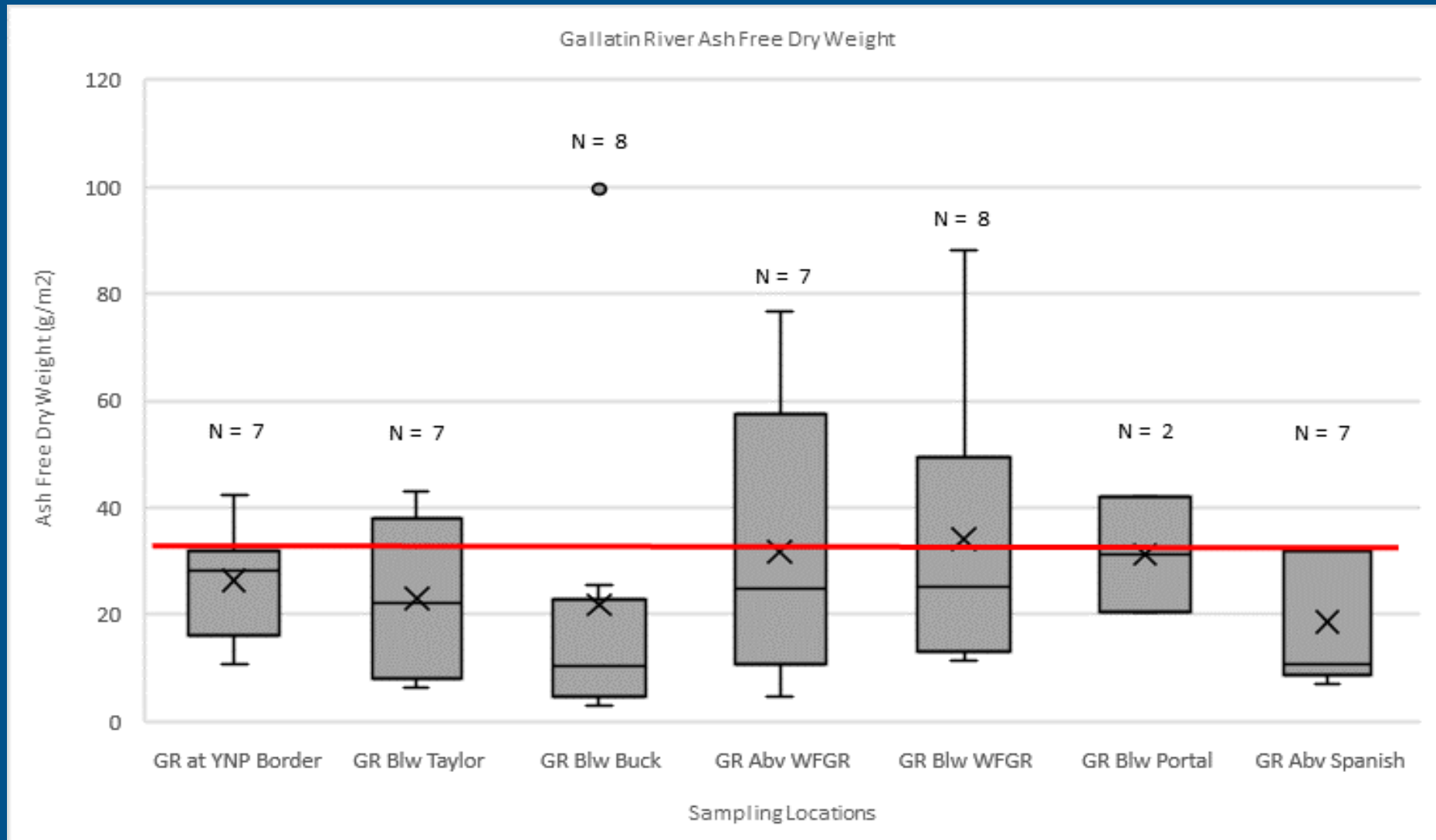
Listing Data Review Summary: Benthic Algae

- Chlorophyll-*a* – No exceedances



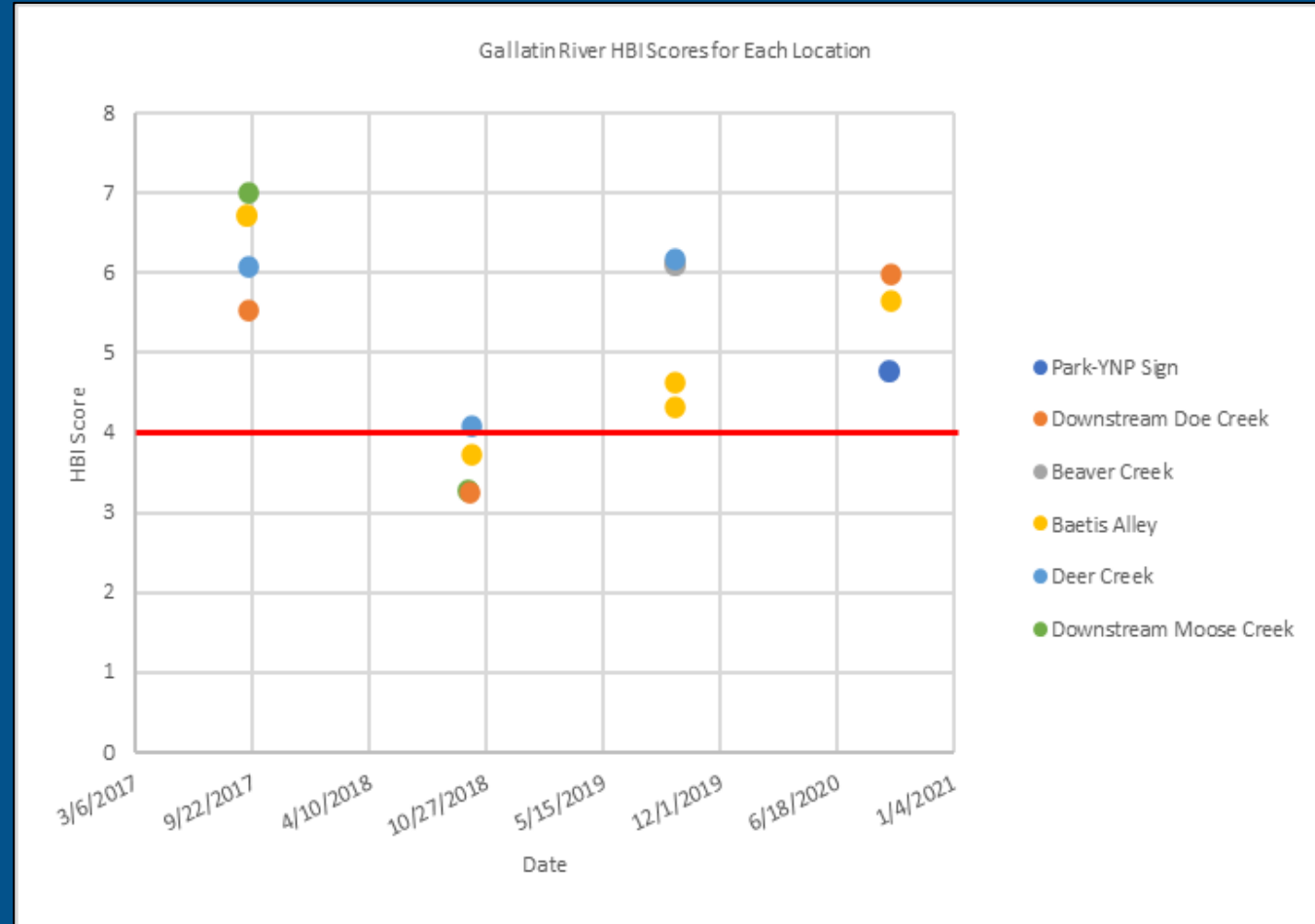
Listing Data Review Summary: Benthic Algae

- Ash Free Dry Weight – 11 exceedances (24%)



Listing Data Review Summary: Macroinvertebrates

- Data from Gallatin River Task Force (2017-2020)
- 13 samples (81%) exceeded HBI threshold of 4.0



Listing Decisions

- Aquatic Life & Fish: (not fully supporting → Excessive Algae Growth)
- Primary Contact Recreation: (not fully supporting → Excessive Algae Growth)
- Excessive Algae Growth: List as pollutant – starts next steps in CWA implementation

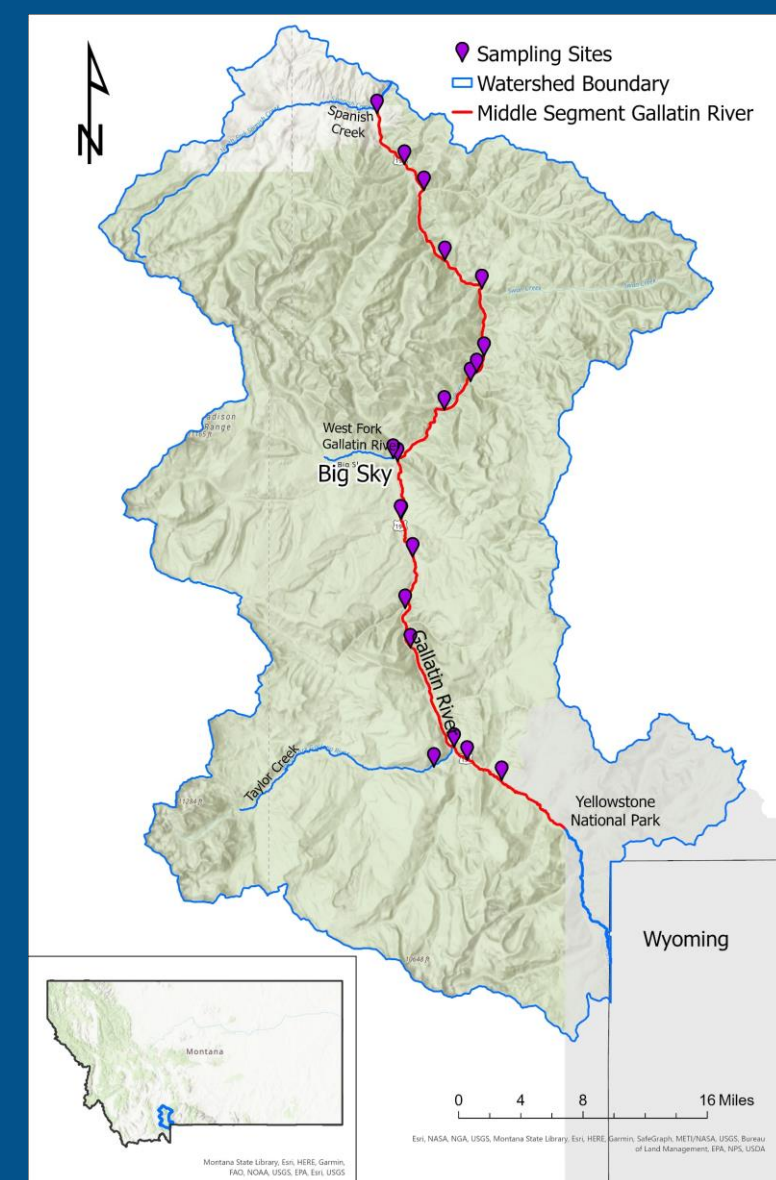
- Proposed to list as impaired for Excessive Algae Growth in an Addendum to the 2020 Integrated Report
 - Sent to EPA on April 13, 2023
- Montana DEQ will increase data collection beginning in 2023

Today's Agenda

- Gallatin River Listing Update
- **Gallatin Project: Objectives**
 - Beneficial use assessment
 - Document temporal and spatial distribution of algae
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Additional Monitoring

- 3+ Year monitoring effort
- 2023 Activities:
 - 5 Monitoring Events
 - 19 Monitoring Sites
 - Nutrients
 - Discharge
 - Temperature
 - Algae
 - (Visual assessment, dry weight, chlorophyll content, drone surveys)
 - Nutrient limitation experiments

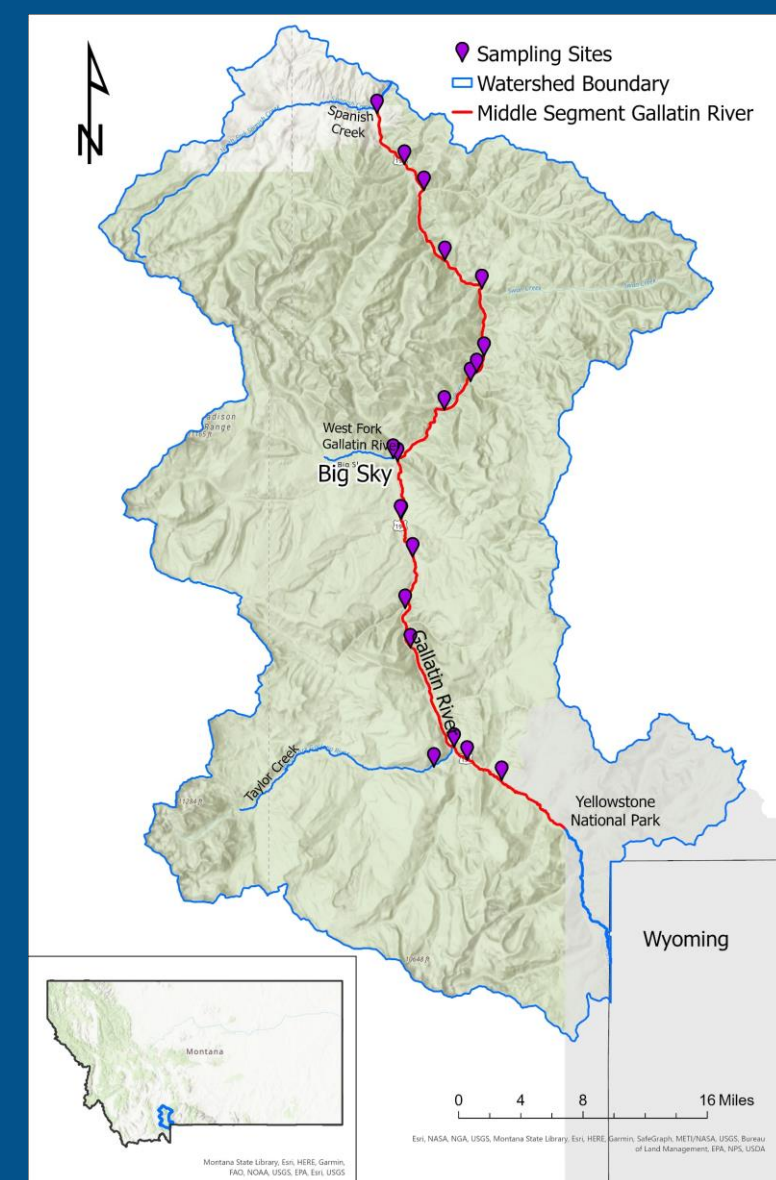


Objectives:

- Objective 1: Conduct beneficial use assessment
- Objective 2: Determine spatial distribution of algae growth
- Objective 3: Determine drivers of algae growth
- Objective 4: Determine sources and develop any needed Total Maximum Daily Loads
- Objective 5: Work with Stakeholders on implementing nutrient reduction strategies

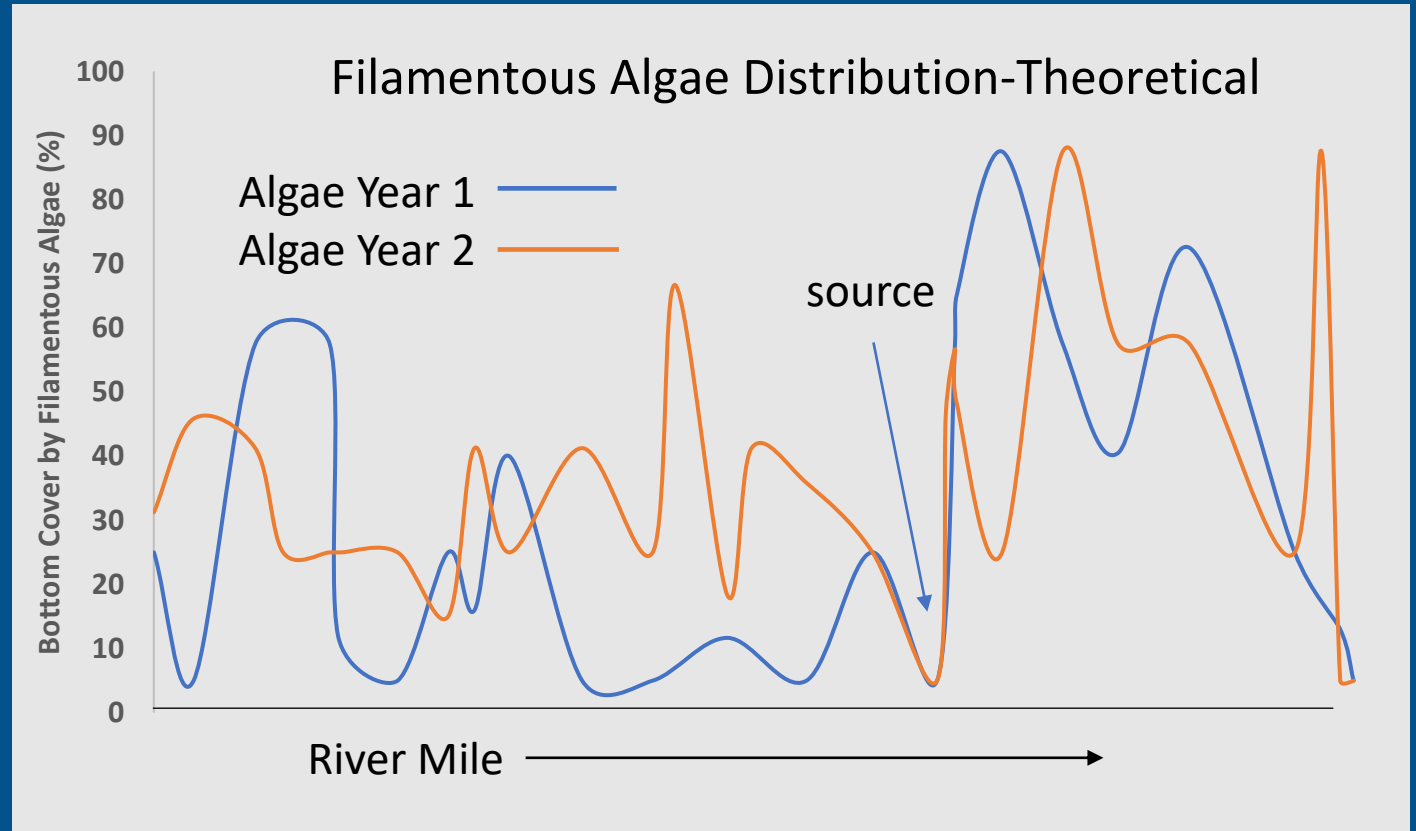
Objective 1: Beneficial Use Assessment

- Incorporate new data collected during this project
- Include evaluating Middle Gallatin, Lower Gallatin, and possible re-evaluation of West Fork
- Use any new assessment methods developed
- Parameters: Nutrients, temperature, dissolved oxygen, macroinvertebrates, AFDW, chlorophyll-*a*



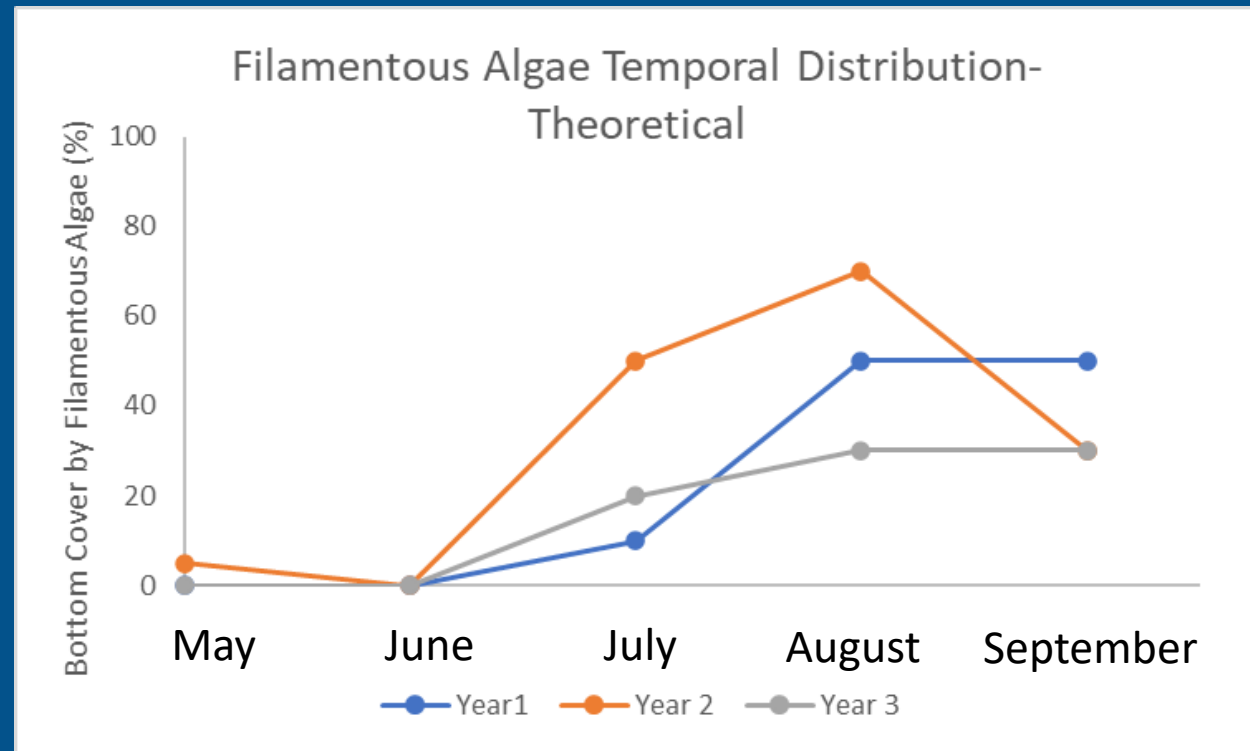
Objective 2: Document Spatial and Temporal Distribution of Algae Growth

- Aerial drone surveys
- Visual assessments
- Chlorophyll and dry weight data

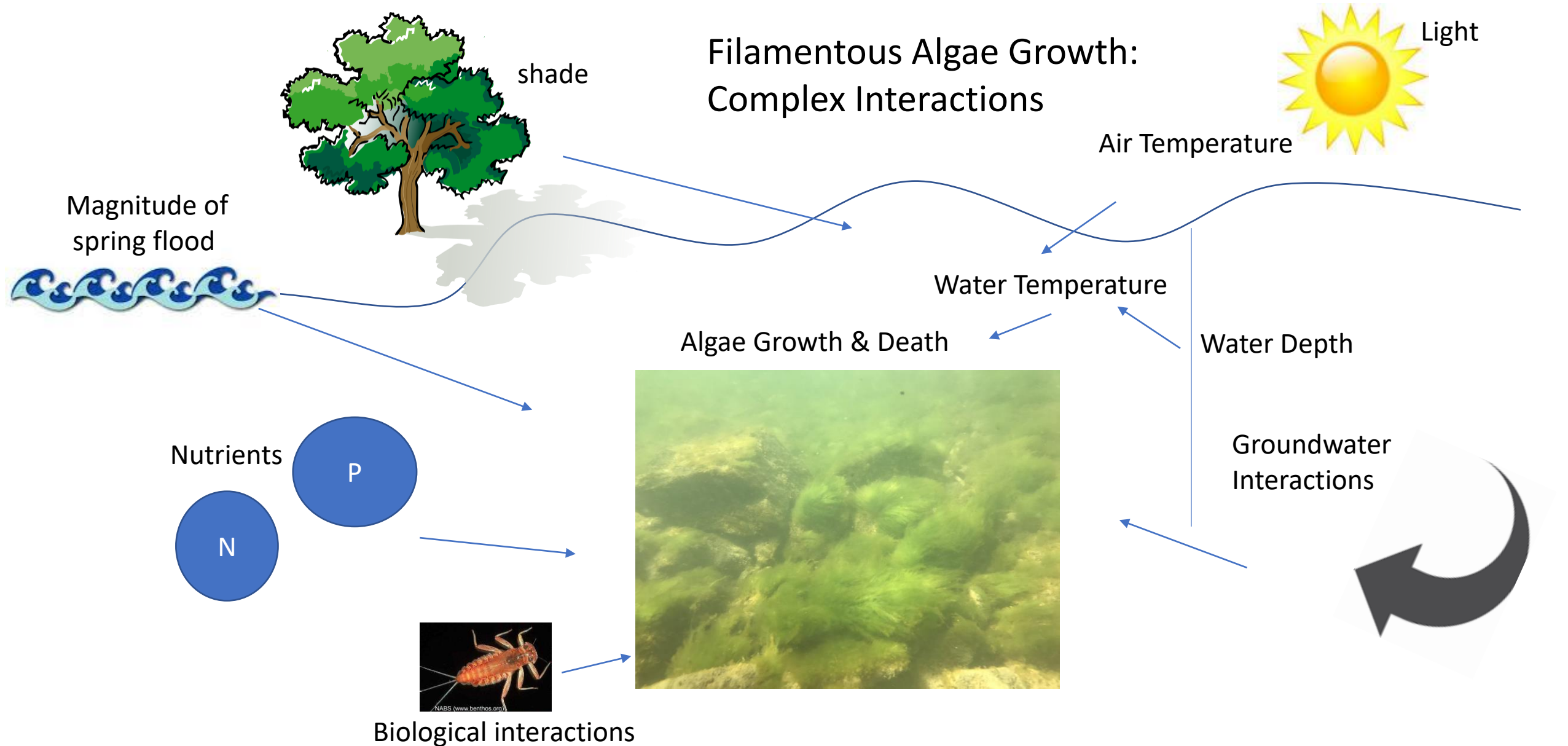


Objective 2: Document Spatial and Temporal Distribution of Algae Growth

- Data collected monthly
- Does the same temporal pattern occur every year?
- If not, why not?
 - stream flow/hydrology
 - temperature
 - nutrient concentrations
 - other?



Objective 3: Determine Drivers of Algae Growth

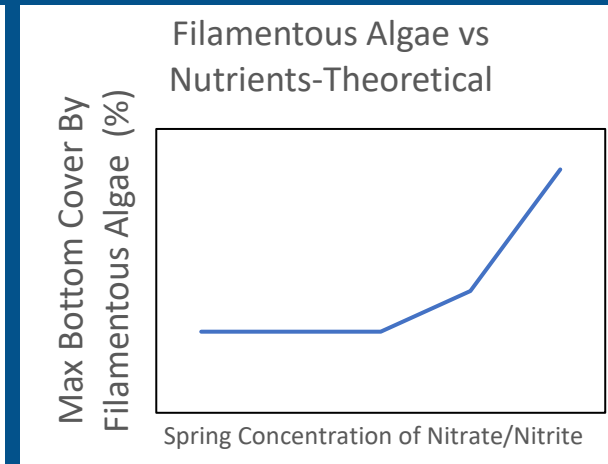
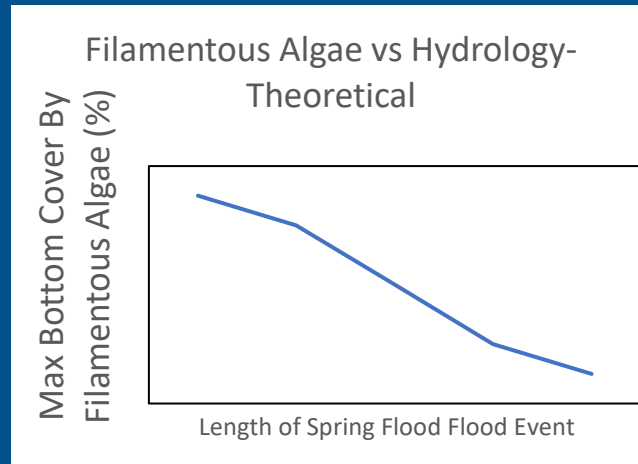


Objective 3: Determine Drivers of Algae Growth

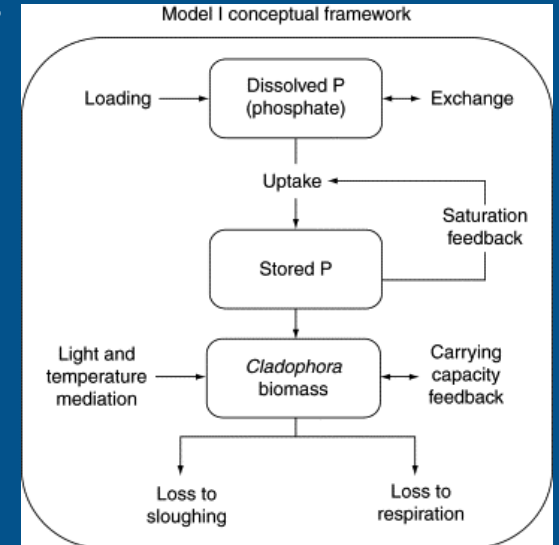
Experiments



Statistical Modeling and Relationships



Mechanistic Modeling

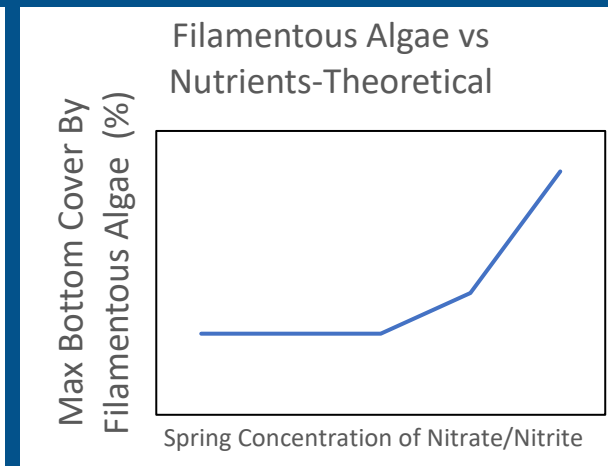
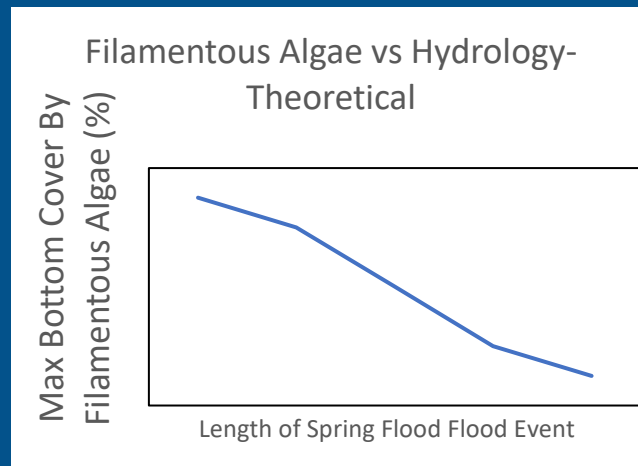


Objective 3: Determine Drivers of Algae Growth

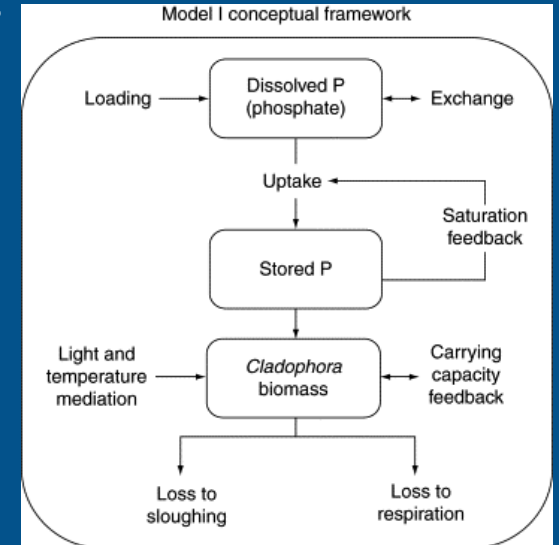
Experiments



Statistical Modeling and Relationships



Mechanistic Modeling



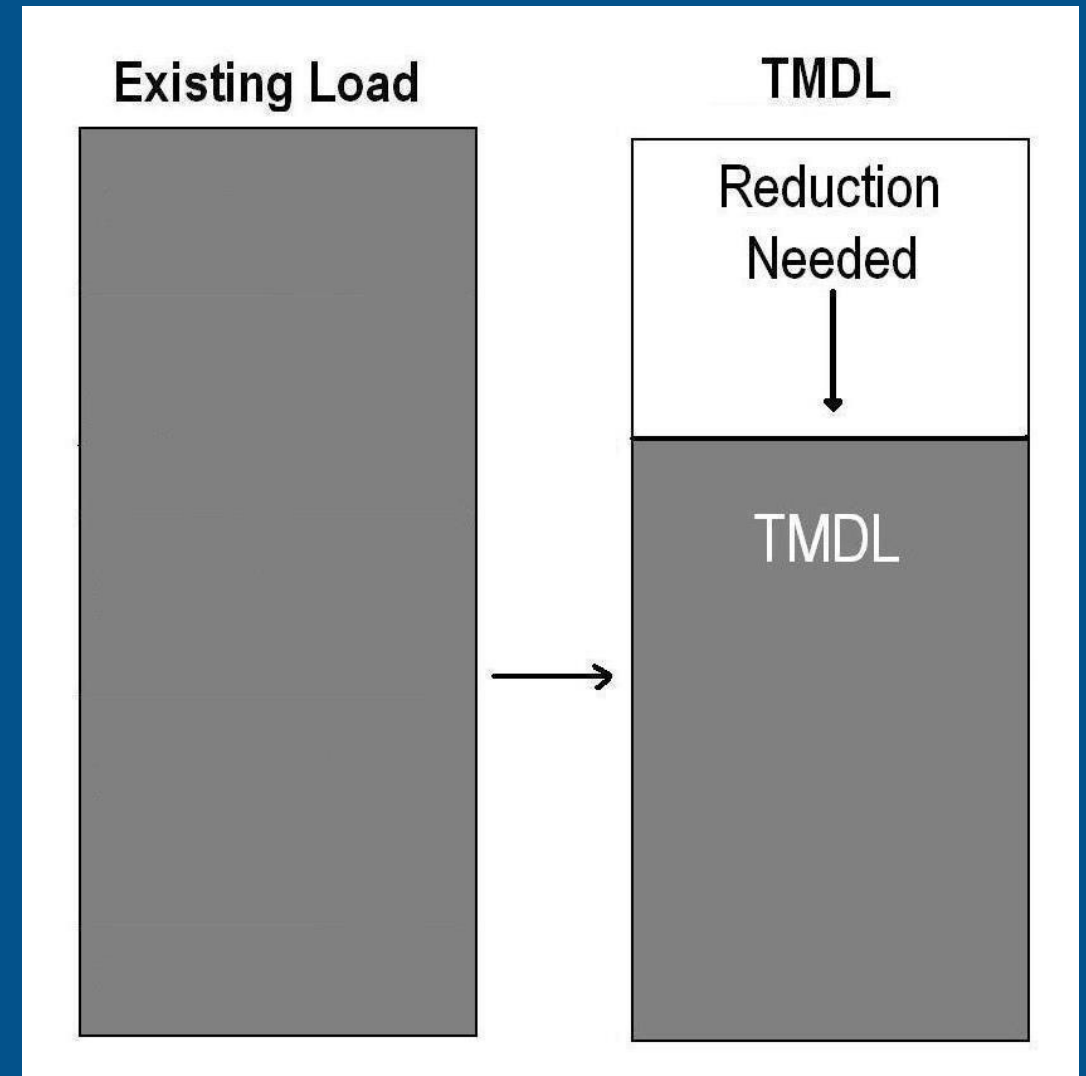
*What factor or combination of factors control algae growth; is there a threshold above which algae growth increases?

Objective 4: TMDL Development and Source Assessment



TMDL Development

Total Maximum Daily Load is the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards



Source Assessment

Point Source



Nonpoint Source



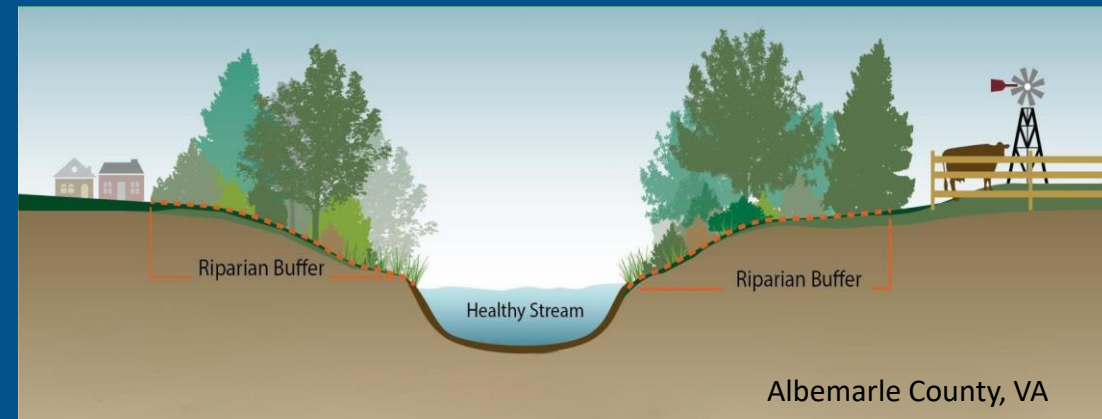
Natural Source



Nonpoint Sources

Load Allocation

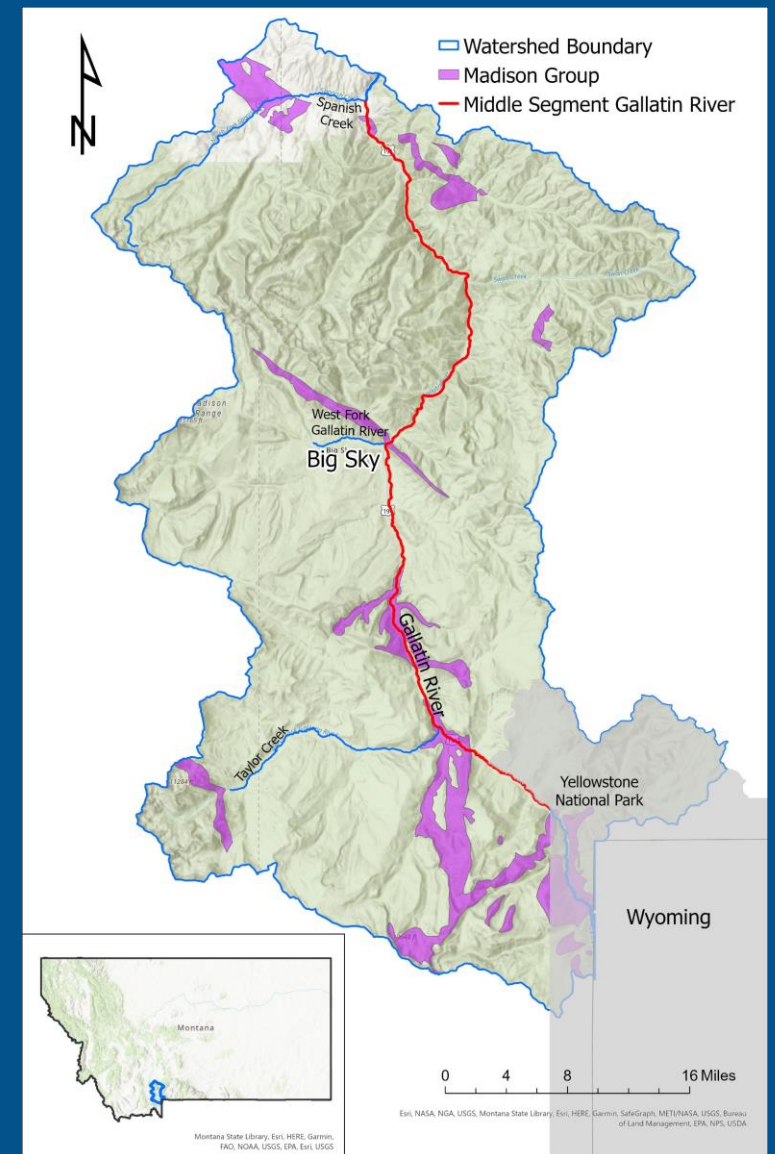
- The portion of a receiving water's loading capacity that is attributed to diffuse sources
- Examples:
 - Runoff from agricultural areas
 - Runoff from roads
 - Contributions from individual septic systems
- TMDL load allocations are implemented through stakeholders via:
 - 319 grants
 - On the ground restoration efforts
 - Education and outreach
 - Cost share programs



Natural Sources

Load Allocation

- The portion of a receiving water's loading capacity that is attributed to natural sources
- Examples:
 - Erosional Areas
 - Taylor Fork
 - Nutrient rich groundwater
 - Madison Limestone



Point Sources

- Wasteload allocations
 - The maximum load of pollutants a permitted discharger is allowed to release into a receiving waterbody
- MPDES permit discharges
 - Wastewater treatment facility
 - Stormwater
 - Construction
 - Concentrated Animal Feeding Operations (CAFO)

Montana, ARM 17.30.637(2), “no wastes may be discharged such that the wastes, either alone or in combination with other wastes, will violate, or can reasonably be expected to violate, any of the standards”.

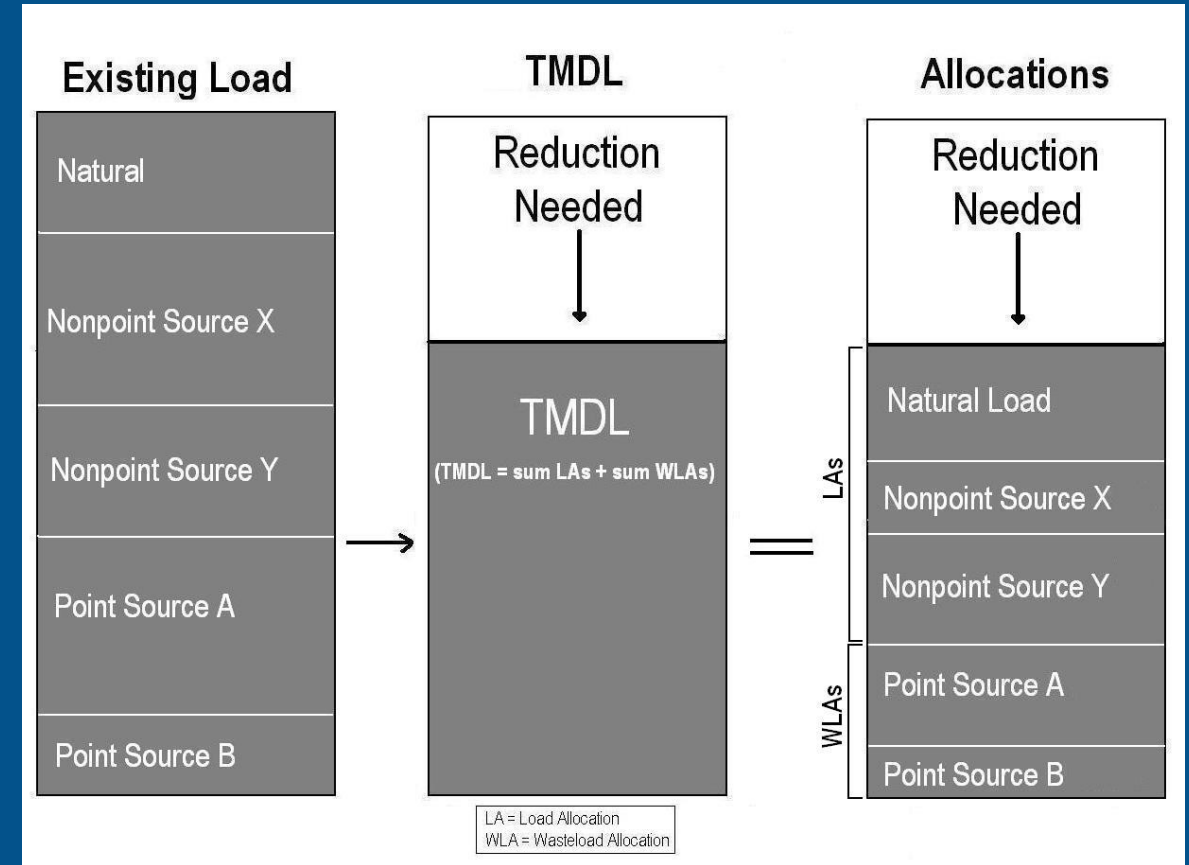


Example TMDL

$$\text{TMDL} = \Sigma \text{WLA} + \Sigma \text{LA} + \text{MOS}$$

Participate on Watershed Advisory Group (WAG)

- Characterize watershed conditions and land management practices
- Help define impacts to water uses
- Provide input on draft TMDL reports
- Landowner site access
- Promote implementation activities



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Draft Nutrient Rule Package

- Impairment designations would evaluate support of beneficial uses through a combination of response and causal variables to “translate” the narrative standard
- Response variables include:
 - Macroinvertebrate community scores
 - Dissolved oxygen delta
 - Algae (visual % cover and ash free dry weight)
 - Chlorophyll a
- Causal variables include:
 - Nutrients (TN and TP)
 - Temperature and sunlight

Draft Nutrient Rule Package

- Adaptive Management Program (AMP) would be an option available to point source dischargers along with variances and compliance schedules
- AMP goal: incremental improvements with milestones incorporated into permits that track progress toward full support of beneficial uses

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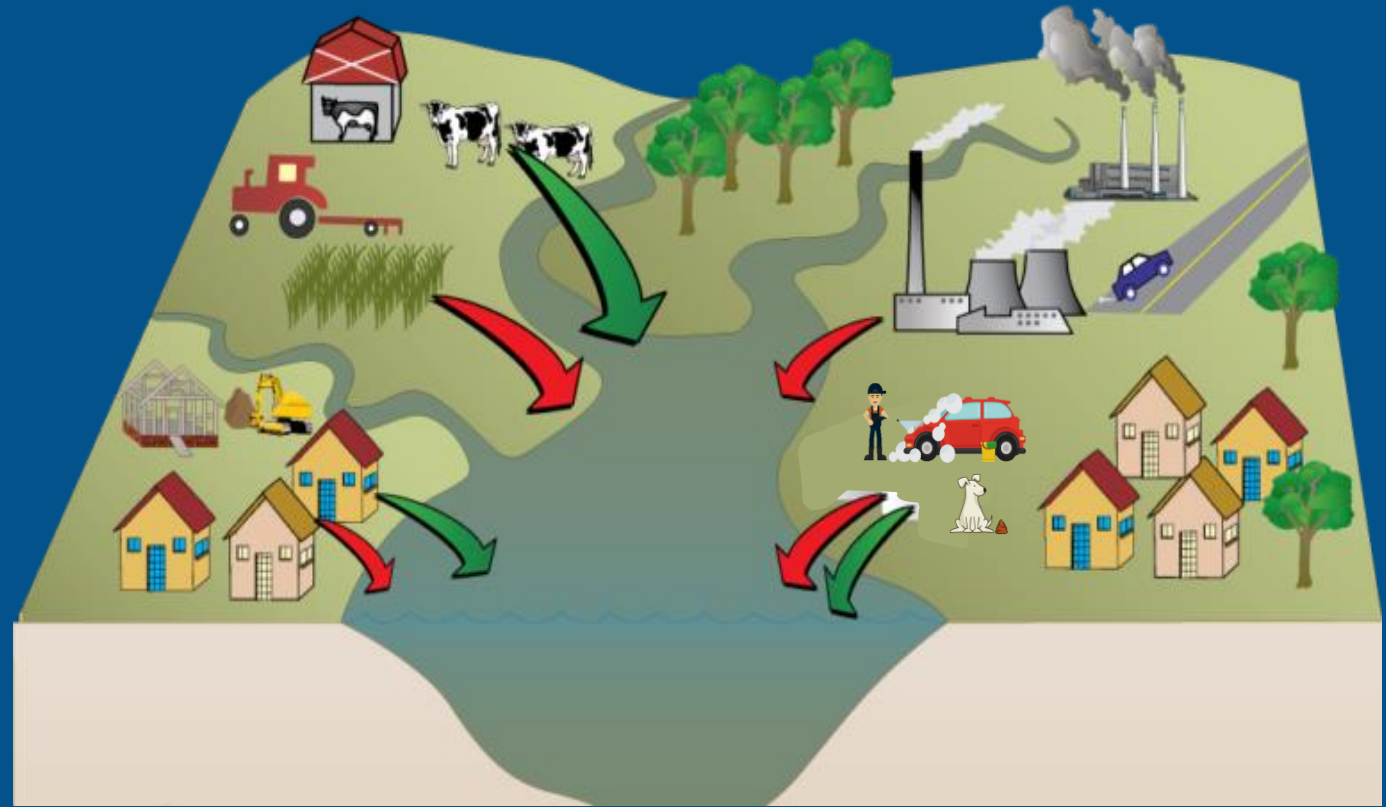
Objective 5: Stakeholder Involvement

- DEQ support for community efforts to address nonpoint source (NPS) pollution
- Gallatin River Task Force (GRTF) initiatives that address NPS pollution



Nonpoint Source Pollution

- Is not from a single, discrete source
- Is smaller amounts of contaminants from many sources accumulating from across a large area



Adapted from Integration and Application Network, U of MD Center for Environmental Sciences

Addressing Nonpoint Source Pollution

voluntary → DEQ's role is to support community-led initiatives (technical and financial)

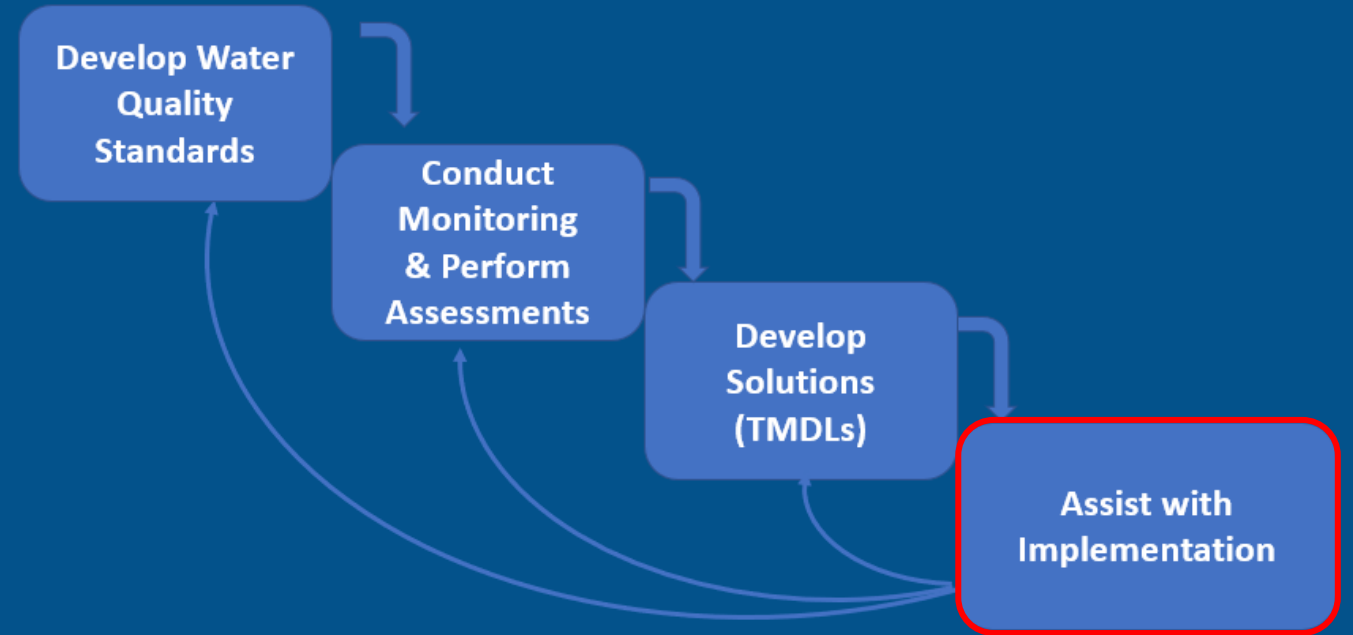
- “319 Projects” (leverage funds allotted to states through §319 of the Clean Water Act)



West Fork Gallatin 319 Project Photos: GRTF

319 Funding & DEQ's Water Quality Planning Process

- A tool that assists with implementation
- Requires an approved Watershed Restoration Plan (WRP)

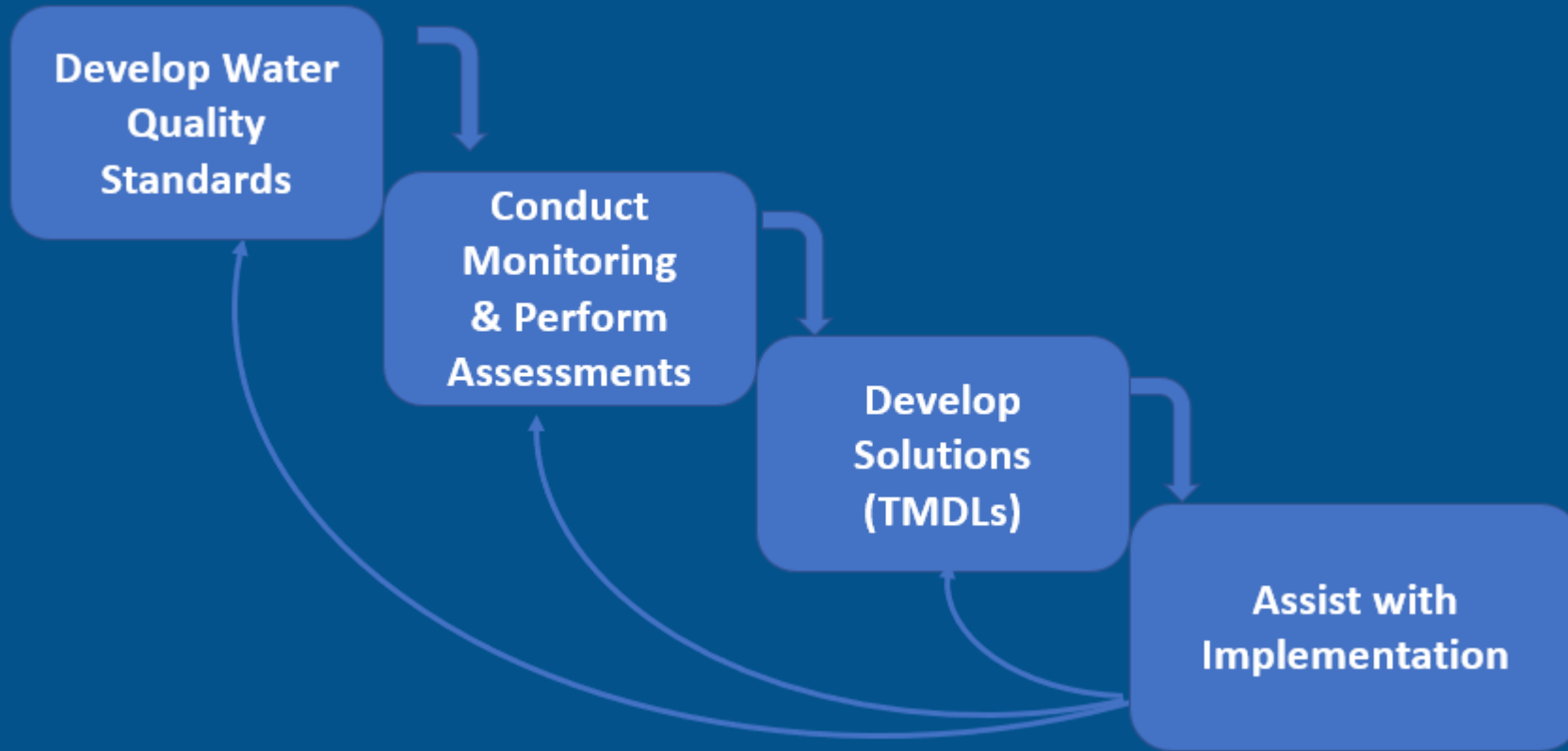


WRPs:

- Are detailed road maps to water quality improvement
- Must include EPA's Nine Minimum Elements:

- DEQ's Assessment
& TMDL work
1. Identification of Pollution Impairment Causes & Sources
 2. Estimates of Necessary Load Reductions
 3. Identification of Management Measures & Critical Locations
 4. Estimates of Technical & Financial Needs to Implement Measures
 5. Public Information, Engagement & Involvement Component
 6. Implementation Schedule for Management Measures
 7. Measurable Milestones for Management Measures
 8. Short-Term Criteria for Evaluating Effectiveness
 9. Monitoring Component to Evaluate Effectiveness

A Multi-Year Process



Opportunities to Address NPS Pollution Now

- Implement BMPs from MT's NPS Management Plan
- Get involved with established community initiatives

Table A.1 BMPs

BMP	Description	References: Guidance documents, internet resources, NRCS Practice Standard(s), other literature	Pollutant									Consultant or Engineer Typically Needed Y/N/?
			Nitrogen	Phosphorus	Sediment	Temperature	pH	Salinity	BOD	Pathogens	Toxic Chemicals	
Wetland Restoration or Creation	Restoration, re-creation or enhancement for the purpose of addressing NPS pollution.	Wetland Restoration (NRCS 657), Wetland Creation (NRCS 658), Wetland Enhancement (NRCS 659)	X	X	X	X			X	X	X	Y
Revegetation	Planting, protecting or reestablishing permanent vegetative cover in riparian or upland areas with the goal of reducing NPS pollution. Practice may include, but is not limited to seeding, sprigging, shrub planting, fencing to protect emerging or fragile vegetation, willow lifts, sod mats, overseeding, non-native plant removal, native plant reintroduction, riparian buffer creation, and replacement of annual plants with perennial vegetation.	Field Border (NRCS 386), Hedgerow Planting (NRCS 422), Pasture and Hay Planting (NRCS 512), Range Planting (NRCS 550), Riparian Forest Buffer (NRCS 391), Riparian Herbaceous Cover (NRCS 390), Tree/Shrub Establishment (NRCS 612)	X	X	X	X			X	X	X	?
Floodplain Reestablishment	Reestablishment of a stream's floodplain or reconnection to an abandoned floodplain, with the purpose of addressing NPS pollution. Practice may also include breaching, removal, or modification of dikes, levees, road bases, or railroad grades to allow streams to access or reestablish a floodplain.		X	X	X	X						Y
Culvert Replacement or Removal	Removal or replacement of culverts to reduce NPS pollution.	Stream Crossing (NRCS 578)		X	X							Y
Dam Removal or Modification	Dam removal or modification to restore the natural hydrograph of a stream in order to facilitate natural stream processes that would reduce NPS pollution.				X	X						Y

Initiatives in Progress

2020 Nutrient Assessment & Reduction Plan

Upper Gallatin Nutrient Assessment
Preliminary Loading Estimate
Page 1 of 39

UPPER GALLATIN NUTRIENT ASSESSMENT & REDUCTION PLAN

TECHNICAL MEMORANDUM:

Preliminary Estimate of Nutrient Loading and Potential Mitigation Projects

DATE: October 17, 2020

FROM: Chris Allen, Ph.D., PE, Sarah Howell, Scientist

Executive Summary

The study area covers select drainages within the Gallatin River drainage from the headwaters in Yellowstone National Park, to USGS Gage Station 06043500 downstream of the confluence of the Gallatin with Spanish Creek. This scenic river and its tributaries are a vital resource notable for its recreational capacity and fisheries. Small increases in instream nutrients can have significant effects on aquatic organisms altering the aquatic food web, changing the ability of the river to support recreational activities, and promoting the growth of algae that can significantly impact fish populations. To maintain stream health in the region the Montana Department of Environmental Quality (DEQ) has set instream standards of 0.3 mg/l total nitrogen as N and 0.03 mg/l total phosphorus as P during summer baseflow within wadable streams. Ongoing water quality monitoring performed by the Gallatin River Task Force (Task Force) indicates that portions of the West Fork of the Gallatin River have exceeded the threshold values for nitrogen (see Figure ES1). On the mainstem Gallatin River, nitrate concentrations downstream of the 'Canyon Area' developed corridor and confluence with the West Fork exceed background concentrations, most notably during base flow. This assessment provides preliminary quantification of nutrient loads and potential mitigation strategies for anthropogenic nutrient sources. Findings are anticipated to be used to prioritize nutrient abatement projects and potentially serve as a framework for establishing a nutrient trading structure with the DEQ to facilitate comprehensive nutrient management and mitigate effects associated with development growth in the Big Sky region.

Creation and Expansion of the Gallatin Canyon Water and Sewer District

[HOME](#)[ABOUT](#)[PROJECTS](#)[DISTRICT LIBRARY](#)[CONTACT US](#)


Committed to providing cost-effective, reliable, and high quality sewer services for the Gallatin Canyon.





1% for Infrastructure

Voter approved 1% addition to Resort Tax

- 27M towards improved wastewater treatment in Big Sky Water and Sewer District
 - 12M for infrastructure of new canyon district
 - Result in 90% less nutrients (N&P), 99% less bacteria
- 

Wetland Treatment Systems



Meadow Village Groundwater Monitoring

Distribution: Sampling Site Locations

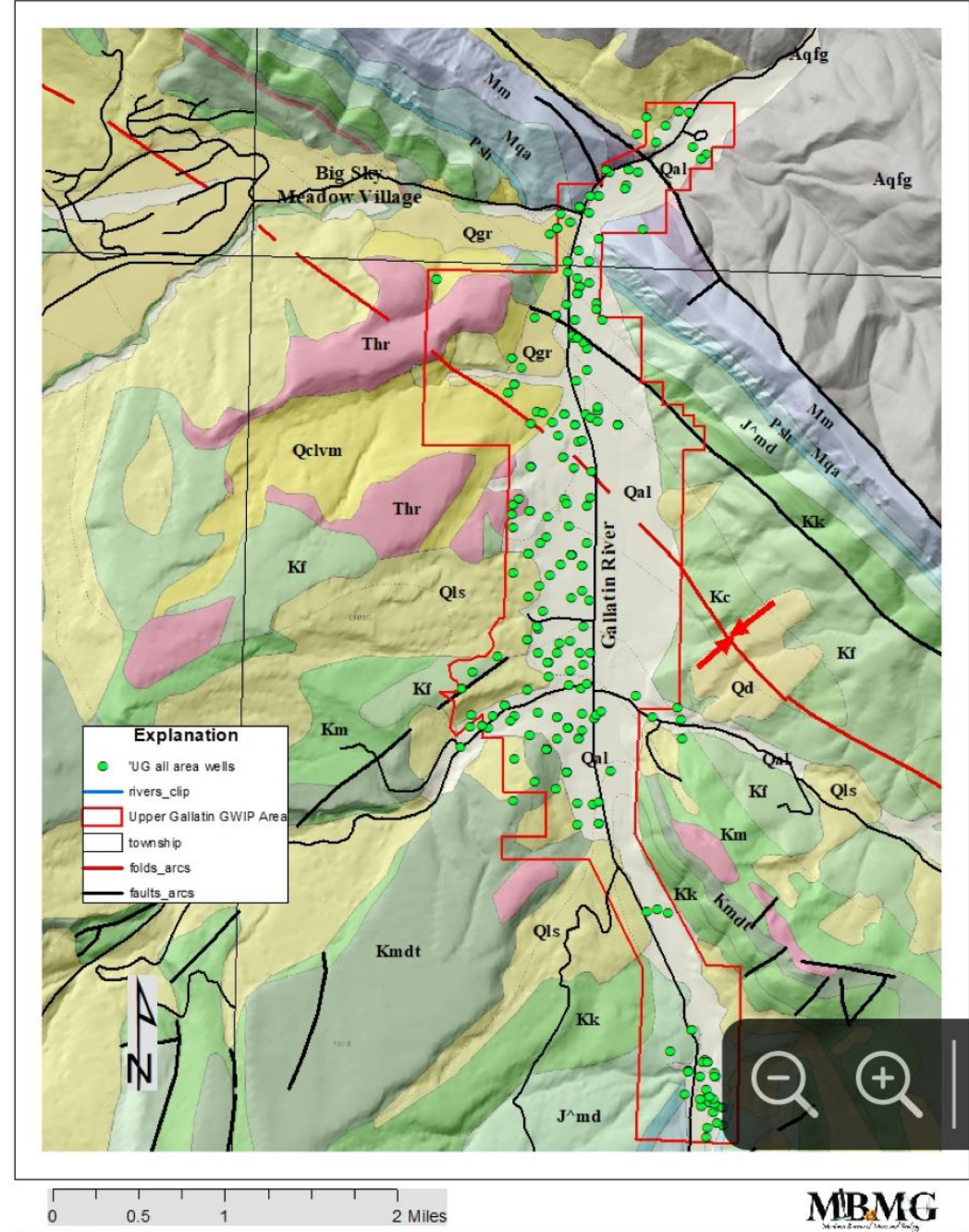
8 wells 1 spring



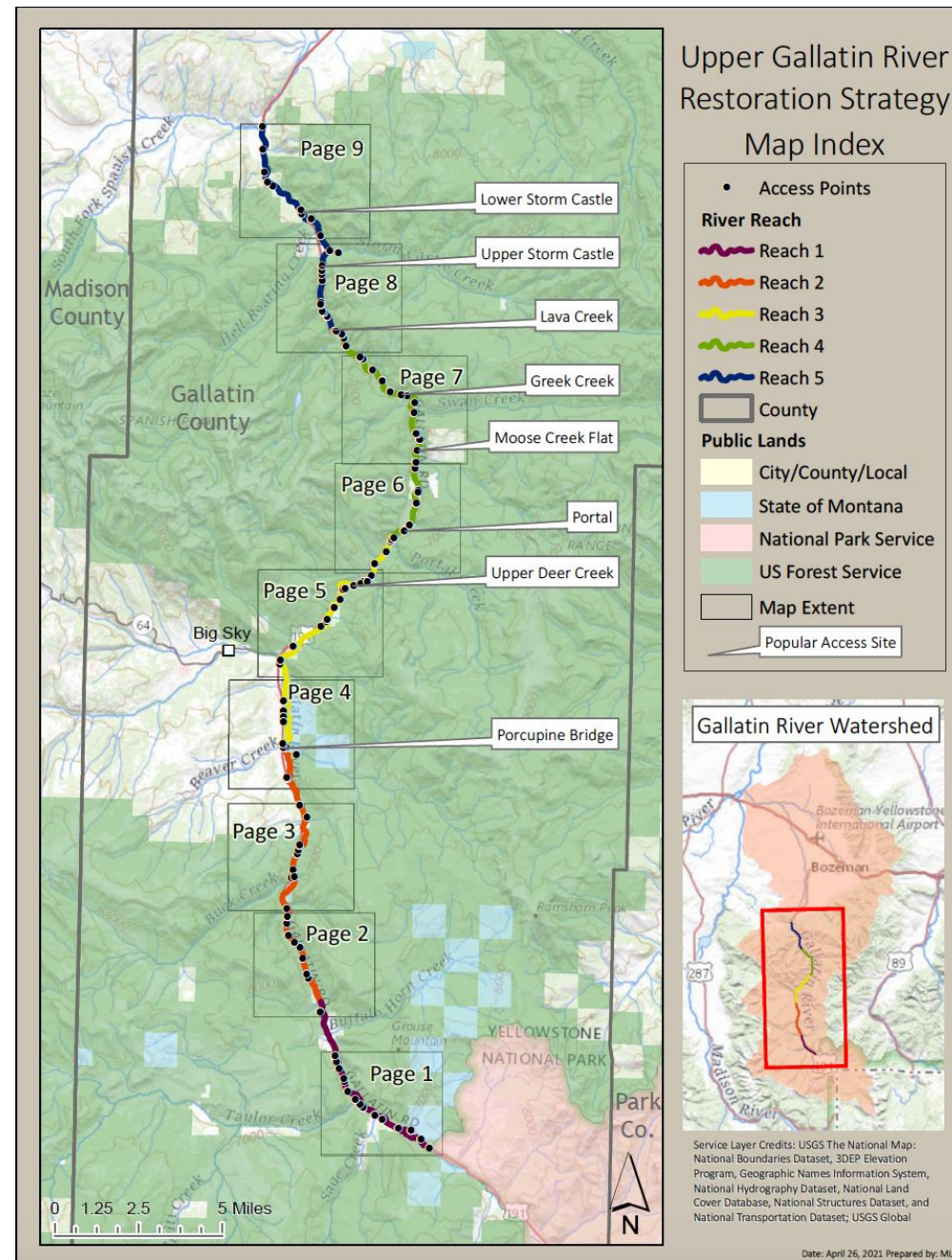
Local Landscaping Partnership



Montana Bureau of Mines and Geology Gallatin Canyon Groundwater Study



Gallatin River Access Restoration Strategy





Montana Headwaters Legacy Act

- Proposed federal protection under Wild and Scenic Rivers Act
 - 385 river miles including 39 miles of Gallatin and 17 miles of the Taylor Fork
- Restricts federally permitted projects

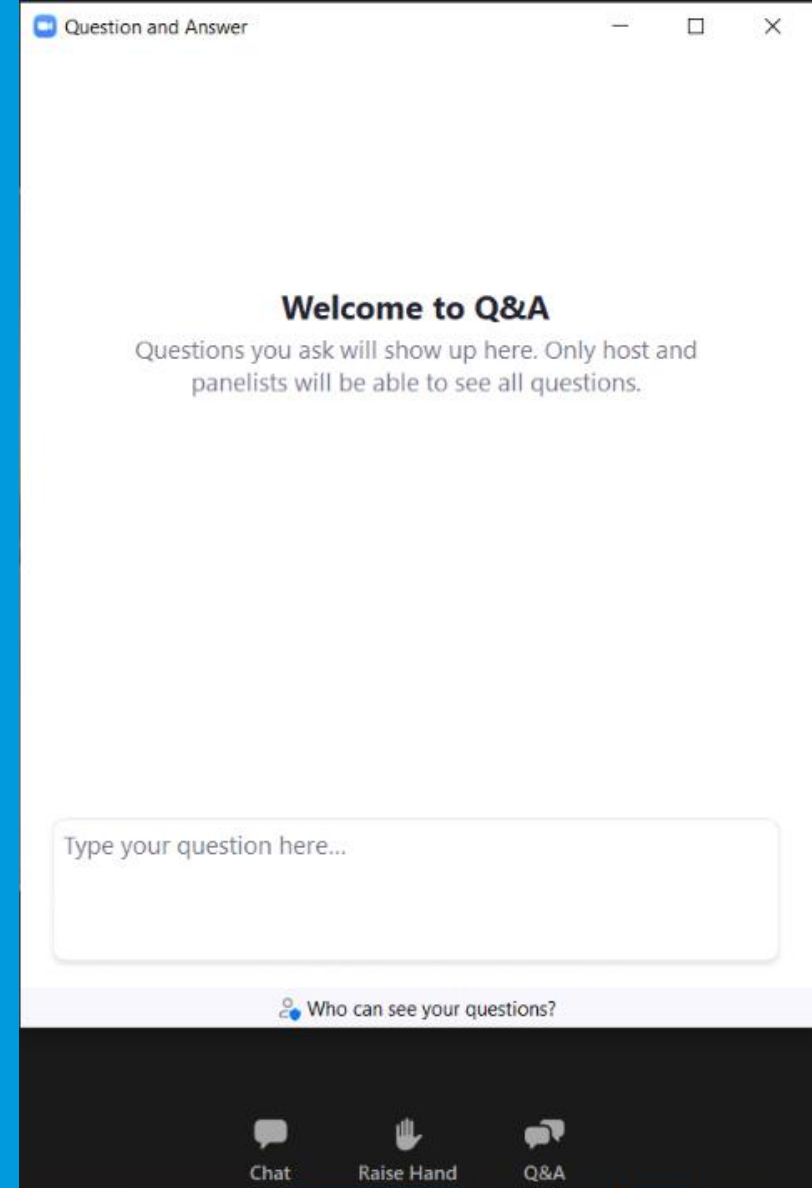
Special Thank You!

- Gallatin River Task Force



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Contacts

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Troy.Clift@mt.gov

Torie Haraldson, Nonpoint Source Section
torie.haraldson@mt.gov

