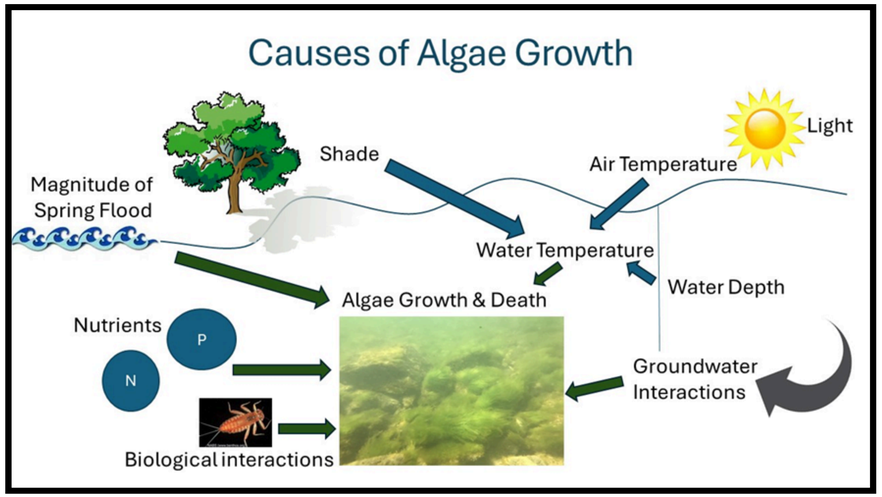
GALLATIN RIVER ALGAE GROWTH: MODEL WORK

DEQ is developing a nutrient-algae model which uses data and mathematical equations to represent how algae grows in the Gallatin River.

DEQ will use this model to better understand how nutrient sources and other environmental factors interact to cause excessive algae to grow on the Gallatin River.

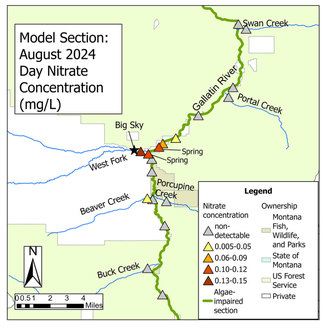
- To develop this model, DEQ is collecting data related to nutrient concentrations, pH, dissolved oxygen, water temperature, weather conditions, stream flow, algae biomass, algae diversity, macroinvertebrates, shade, and more.
- DEQ began intensive data collection in 2023, and this will continue through at least 2025.

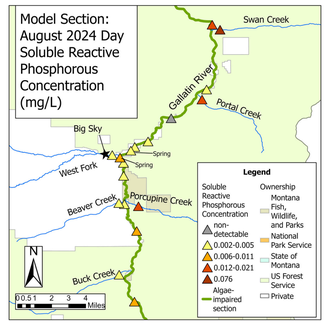


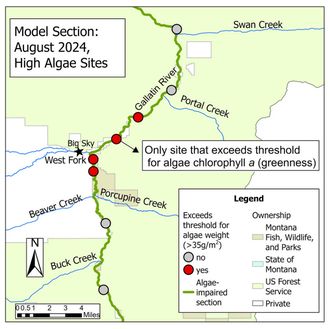
Nitrate and soluble reactive phosphorous are the main forms of nutrients that algae use to grow.

Intensive summer sampling identified patterns of nutrient change on the Gallatin River.

- Nitrate increased downstream of West Fork. Concentrations increased at night when algae growth was less.
- Soluble reactive phosphorous was highest downstream of tributaries with phosphorous-rich geology.
- Availability of both nitrate and soluble reactive phosphorous increased during storms.
- Possible nutrient sources include natural geology and soils, and human inputs.



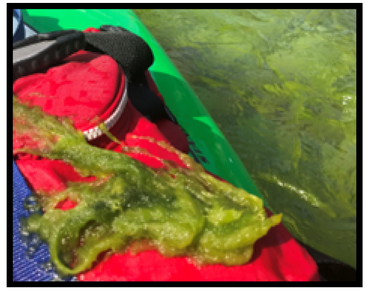




Preliminary results suggest algae type and amount change in response to nutrient availability.

- *Didymo*, which has a snot-like appearance, was the most common type of algae type on the mainstem Gallatin upstream of West Fork.
- *Cladophora*, the algae identified to be growing excessively in recent years, increased downstream of West Fork where nitrate concentrations also increased. The highest amounts of *Cladophora* (covering approximately 75% of the riverbed) were observed 3.5 miles downstream of West Fork.
- Sites above and below West Fork exceeded the threshold amount of algae that indicates possible impairment (>35 g/m$_2$), but because *Cladophora* algae length was shorter, it was less noticeable to recreationists.

Short Cladophora *algae at site downstream of West Fork (photo by DEQ, 2024)*



Long Cladophora *algae at site downstream of West Fork (photo by Upper Missouri Waterkeeper, 2018)*

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GALLATIN RIVER

What are we doing and why?

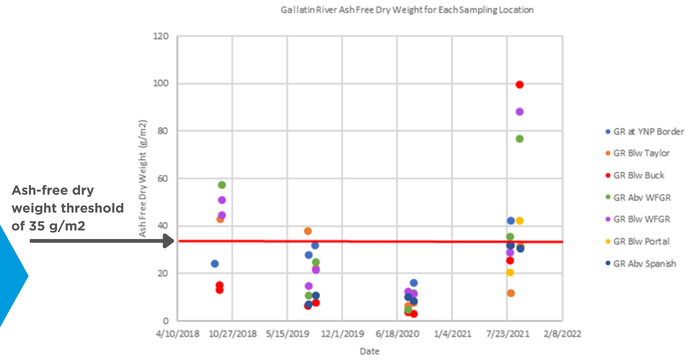
ASSESSMENT WORK

DEQ's Water Quality Act programs develop water quality standards to monitor water quality conditions, protect beneficial uses, and assess whether waterbodies are supporting those beneficial uses.

- Water quality standards define the water quality goals of a waterbody. Waterbodies that fail to meet one or more water quality standard are considered impaired waters and are included in Montana's Water Quality Integrated Report.
- Waterbodies that do not meet water quality standards are often prioritized for water quality improvement plans and funding to resolve the issues.
- DEQ partnered with the Gallatin River Task Force to expand water quality monitoring after reports of excess algae growth.

The EPA approved DEQ's decision to list the Gallatin River, from Yellowstone National Park Boundary to Spanish Creek, as impaired for excessive algae growth on May 9th, 2023.

Ash-free dry weight threshold of 35 g/m2



- Ten years of nutrient, algae, and aquatic insect data were analyzed by DEQ.
- Testimonials of recreationalists and businesses that derive income based on recreation along with photos and videos of algae growth were used in assessment.
- Ash free dry weight, a measurement of the weight of dried algae collected from the riverbed, exceeded the established threshold considered to support aquatic life and recreation.
- DEQ submitted an addendum to the 2020 Integrated Report to show that the Gallatin River is impaired for excess algal growth.

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Nutrient (nitrogen and phosphorus) levels didn't exceed the thresholds expected to limit algae growth, but excessive algae growth was still observed on the Gallatin River in some recent years.

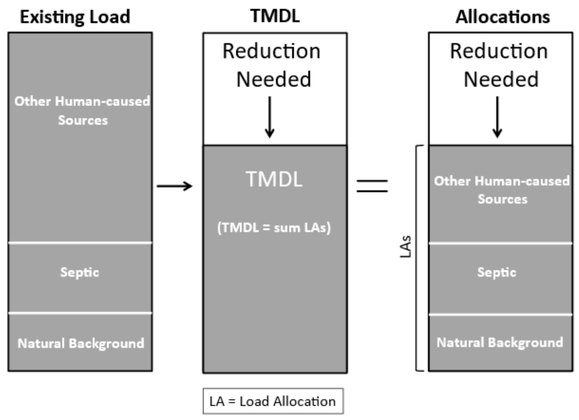
- DEQ is conducting a more in-depth study, including additional monitoring, to understand the drivers of algae growth in the Gallatin River.
- DEQ continues to collaborate with the Gallatin River Task Force to expand tributary sampling efforts used for the in-depth study.
- DEQ will update impairment parameters, meaning the pollutants or conditions that show the river is impaired, based on study results. See **Gallatin River Algae Growth: Model Work** poster for in-depth study details.

GALLATIN RIVER PROJECT NEXT STEPS

1

DEQ uses Total Maximum Daily Loads (TMDLs) to address the pollutants that cause water quality impairments.

- TMDLs establish guidelines to lower pollutant concentrations to acceptable levels that protect beneficial uses.
- TMDL development follows the standard process diagramed on the right.
- The TMDL document provides recommended practices to reduce pollutant contributions causing excessive algae growth.



2

DEQ will identify levels of pollutants that will limit algal growth.

- Upon completion of a nutrient-algae model, DEQ will establish numerical thresholds for the pollutants that control algal growth.
- Stakeholder groups can use this information to identify specific areas and practices that have the greatest potential to restore stream health.

3

DEQ provides technical and financial support for projects that improve water quality.

- DEQ can help local watershed groups develop long-term strategies to reduce nonpoint source pollution from sources such as runoff, leaky septic systems, and other contributors within the watershed.
- Over $450,000 has been committed from DEQ to support restoration and outreach projects within the Gallatin River Watershed.
- Businesses, landowners, and community members are encouraged to implement best management practices at any time.

During and post-implementation photos from the Upper West Fork Nitrogen and Sediment Reduction Project, DEQ Contract #216001 (Photos by GRTF)

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