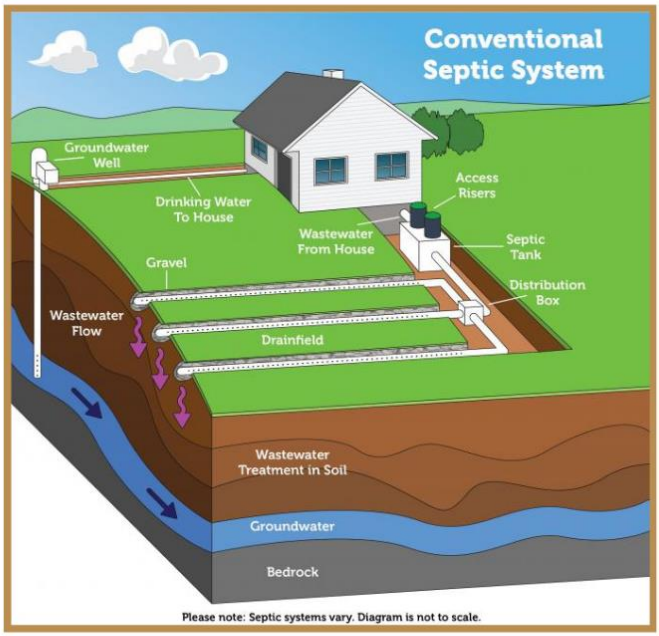
Unlocking the Secrets of Septic Pollution in Flathead Basin

Septic systems are underground wastewater treatment systems commonly used in areas without centralized sewer systems. Septic tanks separate out the solid waste, while the liquid, known as leachate, is slowly released into the ground through the drainfield to be treated by organisms in the soil. Septic systems can be effective forms of wastewater treatment. However, when septic systems malfunction or are poorly maintained, harmful pathogens, bacteria, and nutrients that can cause harmful algal blooms can seep into our groundwater, lakes, and rivers, causing harm to aquatic life and endangering our water supply. To complicate this issue further, pollution from septic systems is difficult to source track, and homeowners may not know if their septic system is underperforming.



Septic Risk Assessment

Over the years, studies have confirmed the presence of septic-related pollutants in Flathead Basin waters. However, the severity and spatial extent of the problem remained unknown. In 2020, the Flathead Basin Commission (FBC), now the Western Montana Conservation Commission (WMCC), partnered with the Whitefish Lake Institute and contracted the River Design Group, Inc. (RDG) to map the risk of septic systems in the Flathead Basin. The two primary goals were to show where existing septic systems may pose a risk to water resources and develop a tool to predict the effectiveness of future systems across the basin. This project allows the public, planners, and policymakers to engage in science-based decision-making to protect the Flathead Basin's unique and iconic water resources.

Nonpoint Source Pollution:
Pollution that comes from all across the landscape. We can all reduce nonpoint source pollution in our water by being mindful of what we leave on the landscape.

Synthetic DNA

The problem of distinguishing between septic leachate pollution sources remained. In collaboration with researchers from Cornell University, FBC was at the forefront with a groundbreaking solution – synthetic DNA tracers. These tracers are engineered DNA strands that mimic natural DNA. Each tracer acts as a unique barcode that can be easily distinguished from each other and read in water samples. They can be used to trace the sources of pollution in water bodies with exceptional precision, even in very low concentrations.

Septic Leachate:
The liquid that remains after the wastewater drains through septic solids. Septic leachate can pollute our local surface and groundwater.

Synthetic DNA:
Lab-created strands of DNA that can be picked up in water samples and tell us from which septic system they came.

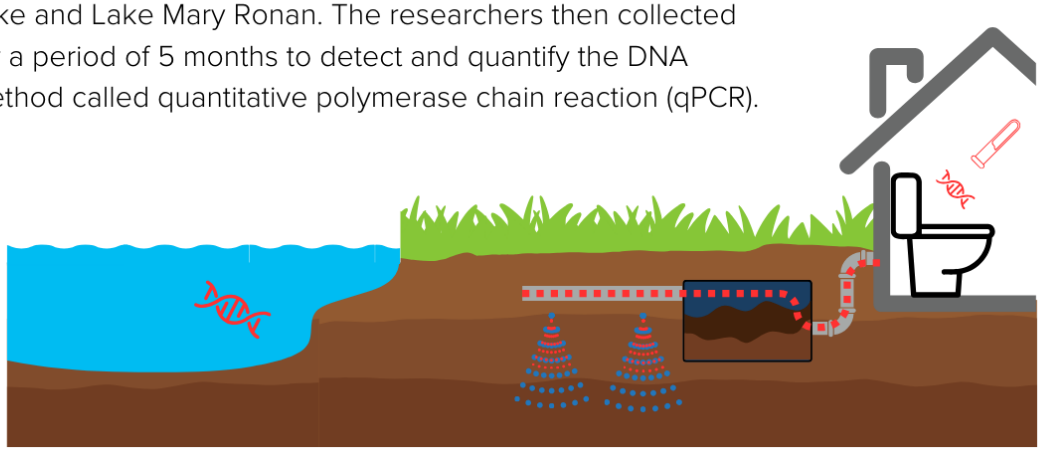
The Research

The primary goal of this project is to validate the septic risk assessment using synthetic DNA tracers, ensuring the accuracy of pollution source identification, while testing this type of research in our climate and on lake systems. Additionally, the project aims to understand how different factors, including septic system age and soil type, affect pollution travel time and concentration.

The synthetic DNA tracers were flushed down toilets to introduce them into different septic systems surrounding Whitefish Lake and Lake Mary Ronan. The researchers then collected water samples in these lakes over a period of 5 months to detect and quantify the DNA tracers using a highly sensitive method called quantitative polymerase chain reaction (qPCR).

The Results

Whitefish Lake exhibited high concentrations of the synthetic DNA tracers shortly after their introduction with levels declining over time.



Whitefish Lake exhibited high concentrations of the synthetic DNA tracers shortly after their introduction with levels declining over time. The researchers identified multiple locations as potentially more problematic because the tracers appeared in the lake rapidly after injection and at relatively high concentrations. Lake Mary Ronan exhibited a similar pattern with all the chosen tracers appearing relatively quickly after injection into the septic systems and maintaining concentrations in the samples throughout the study period.

The results of this study have significant implications for water quality management. This study shows connectivity between the toilets the tracers were flushed down, the septic systems, and the adjacent waterbody. The DNA tracers act as a model to show that pollutants from septic systems can reach nearby lakes. Some septic systems appear to be more problematic than others, releasing tracers more rapidly and at higher concentrations. This information can help identify the septic systems that contribute the most to water pollution, allowing for targeted interventions to improve these systems and protect our water resources.

This study further highlights that this novel technology performs in our ecoregion and within lake environments. This research provides another tool for better understanding septic systems and their potential impacts on our local water resources.

Better Septic Practices

- All the water a household uses ends up in its septic system. Using less water improves the operation of a septic system and reduces the risk of malfunctions.
- Never flush chemicals down the drain. Septic systems contain a collection of beneficial living organisms that digest and treat household waste. Harsh chemicals can kill these organisms.
- Inspect and pump frequently. The average household septic system should be inspected and pumped every 3-5 years.
- Avoid parking or driving on your drainfield. Compacting the soil can prevent your septic leachate from being effectively treated and can cause system backups.