Flathead Basin Commission

Onsite Wastewater Treatment Risk Model

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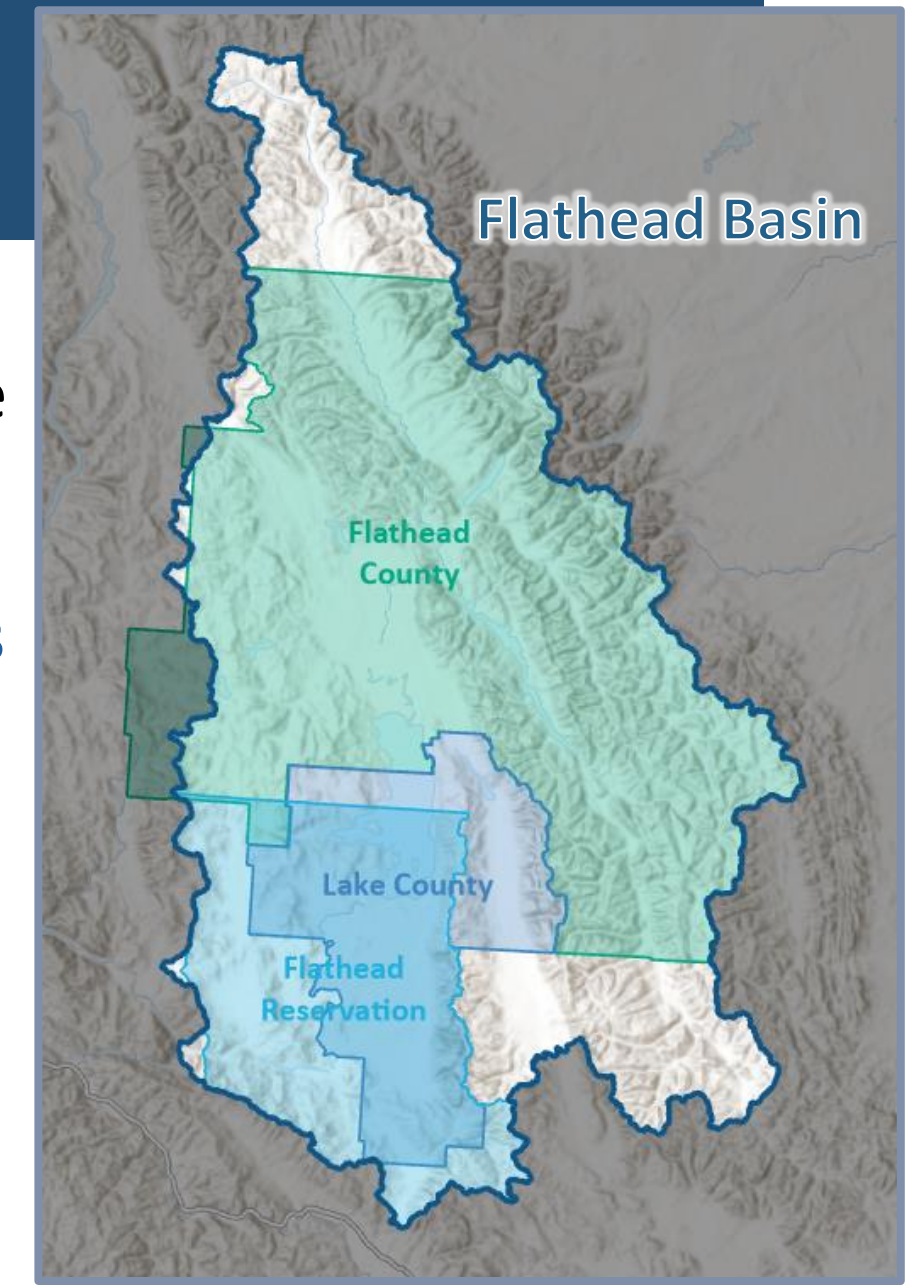
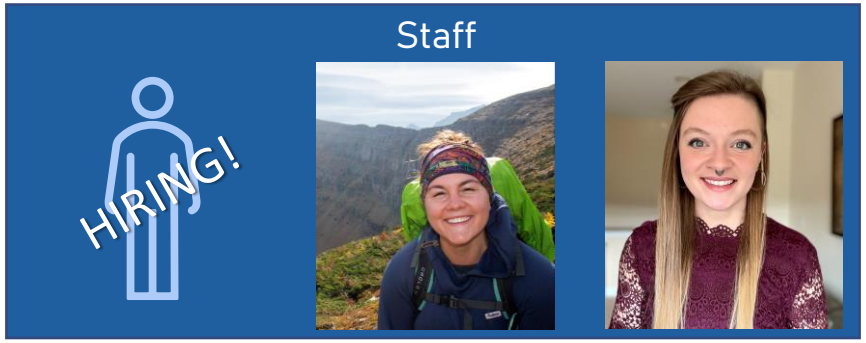
About the FBC

The Flathead Basin Commission was established in 1983 by the Montana Legislature to **protect the existing high quality of the Flathead Lake aquatic environment; the waters that flow into, out of, or are tributaries to the Lake and; the natural resources and environment** of the Flathead Basin.



Staff



Commission Administrator

Cassidy Bender
Coordinator

Emilie Henry
NPS Coordinator

Statutory Duties

(1) to **monitor the existing condition of natural resources** in the basin and coordinate development of an annual monitoring plan. This plan must involve a cooperative strategy among all land and water management agencies within the Flathead basin and identify proposed and needed monitoring which emphasizes but is not limited to the aquatic resources of the Flathead basin.

(2) to **encourage close cooperation and coordination** between federal, state, provincial, tribal, and local resource managers for establishment of compatible resource development standards, comprehensive monitoring, and data collection and interpretation;

(3) to **encourage and work for international cooperation and coordination between the state of Montana and the Province of British Columbia** concerning the undertaking of natural resource monitoring and use of consistent standards for management of resource development activities throughout the North Fork Flathead River drainage portion of the Flathead basin;

(4) to **encourage economic development and use of the basin's resources** to their fullest extent without compromising the present high quality of the Flathead basin's aquatic environment;

(5) to, in the discretion of the commission, **undertake investigations of resource utilization and hold public hearings** concerning the condition of Flathead Lake and Flathead basin;

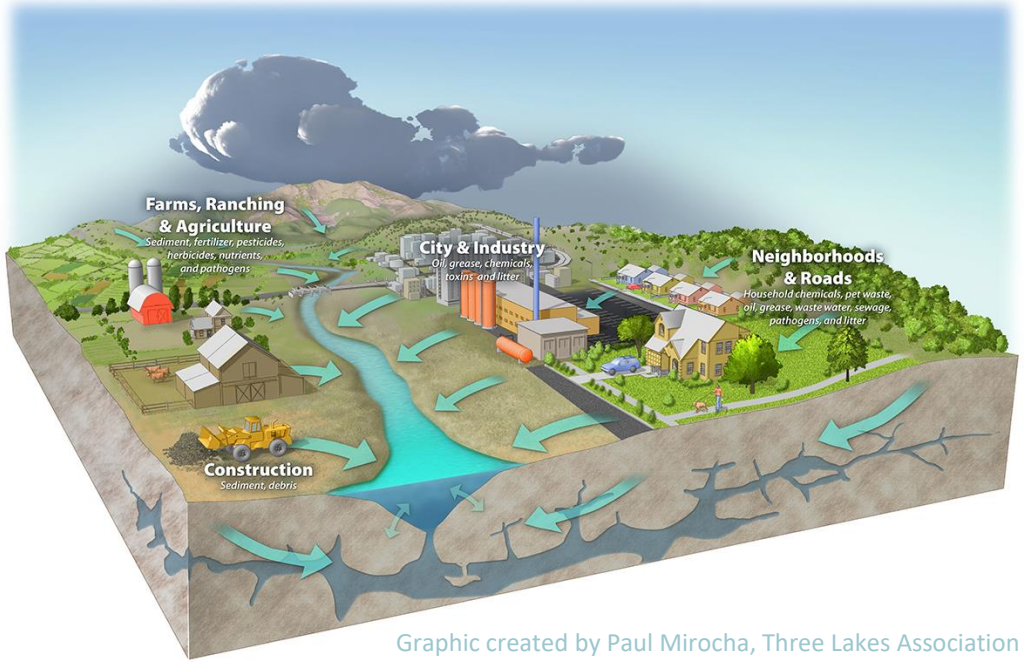
(6) to submit to the governor and, as provided in **5-11-210**, to the legislature a **biennial report**

(7) to **meet at least semi-annually within the Flathead Basin**, alternating the meeting site between the cities of Kalispell and Polson.

Current Priorities

Nonpoint Source Pollution

- Pollutants that come from many undiscernible, unconfined, and indiscrete land use activities – you can't directly point to the source of it
- Transported via runoff or subsurface flow to waterbodies or groundwater
- Common nonpoint pollutants include sediment, nutrients, pathogens, temperature changes, metals, salinity, etc.

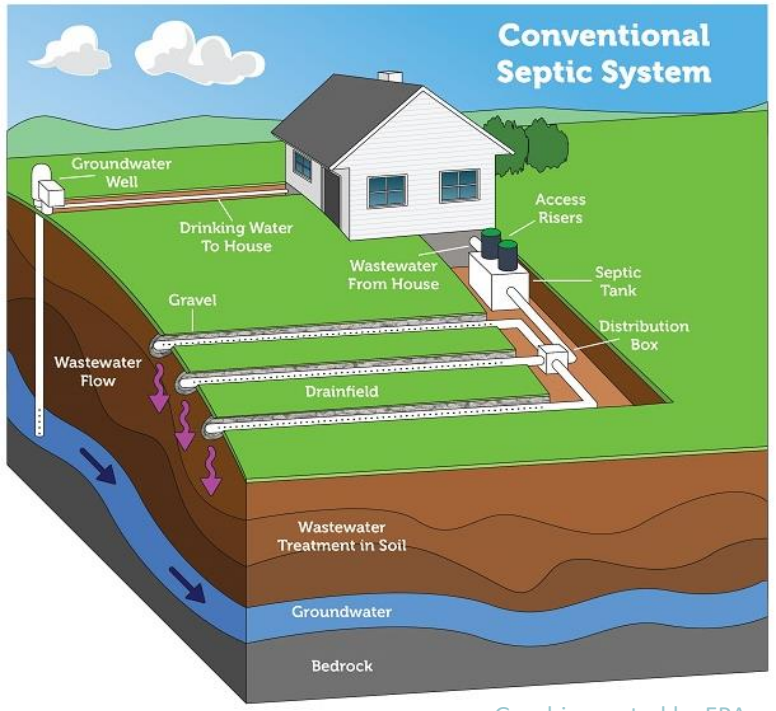


Graphic created by Paul Mirocha, Three Lakes Association

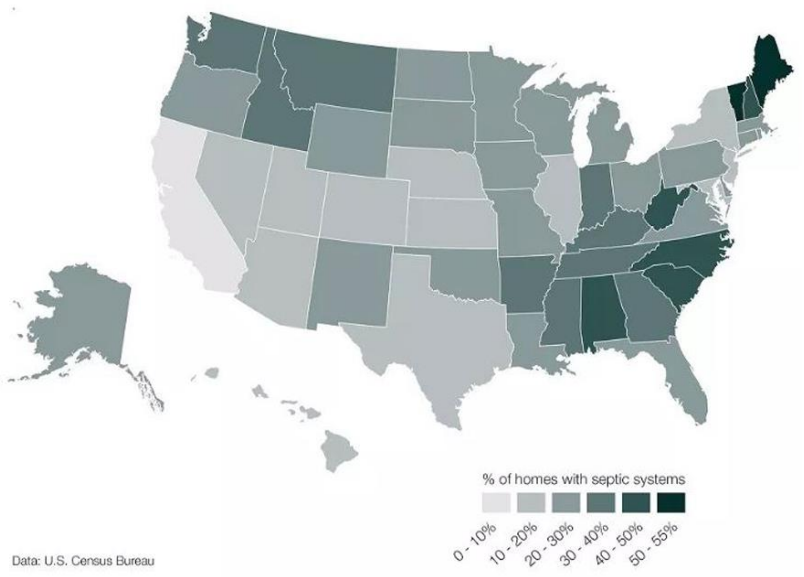
*"Nonpoint source pollution is the **largest contributor of water quality problems on a statewide basis** when compared to point sources of pollution." – MT DEQ, 2017*

Septic Leachate Overview

- Septic leachate – the liquid that remains after wastewater drains through septic solids
- Can be one form of nonpoint source pollution if septic systems are:
  - →Sited in densities that exceed the treatment capacity of regional soils
  - →Poorly designed, installed, operated, or maintained
- Studies of septic leachate in MT date back to 1977 – little movement in ~50 years
- On a state level, MT has "passing grade" for new systems, but only handful of counties have gone above and beyond minimum design & installation standards
- Cumulative impacts of existing, aging systems not addressed
- Homeowner knowledge of maintenance BMPs suspected to be low – Education is not enough to change behavior

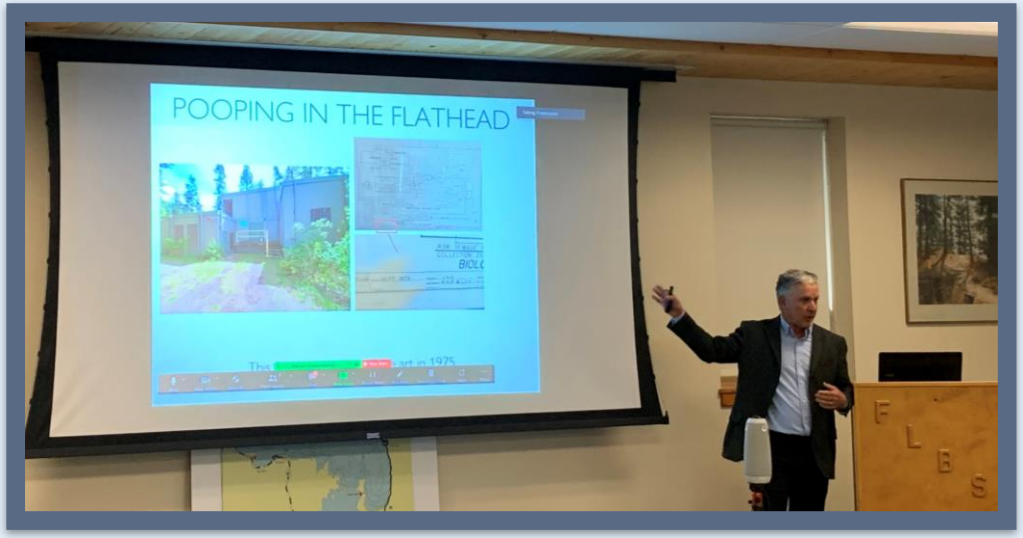


Graphic created by EPA.



FBC's Septic Leachate Work

- **Onsite Wastewater Treatment Committee**
  - Groups of diverse stakeholders including regulators, counties, MACO, League of Cities & Towns, tribes, NGOs, conservation groups, real estate reps, etc.
  - Goal: Identify and implement actionable measures to reduce water quality impacts from septic leachate
- **Flathead Basin Wastewater Partnership**
  - Septic maintenance reimbursement program
- **UM/FLBS National Science Foundation Grant**
  - Collaboration to study all aspects of septic issue
  - Workshop hosted June 8-10 at FLBS – invited experts + decision makers to hear presentations and discuss
- **Basin-Wide GIS Risk Model + SDNA Study**
  - Broad-brush, watershed-wide analysis to better understand septic leachate threat



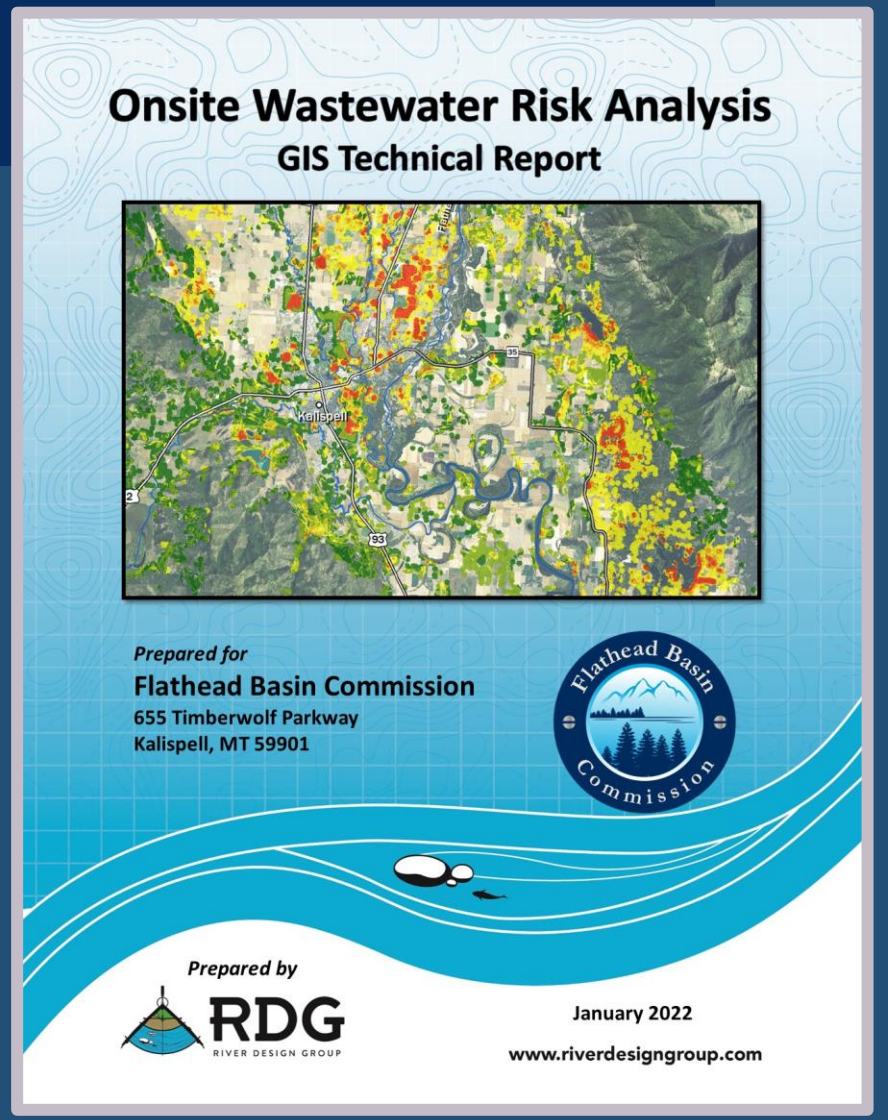
Risk Model Overview

Goals:

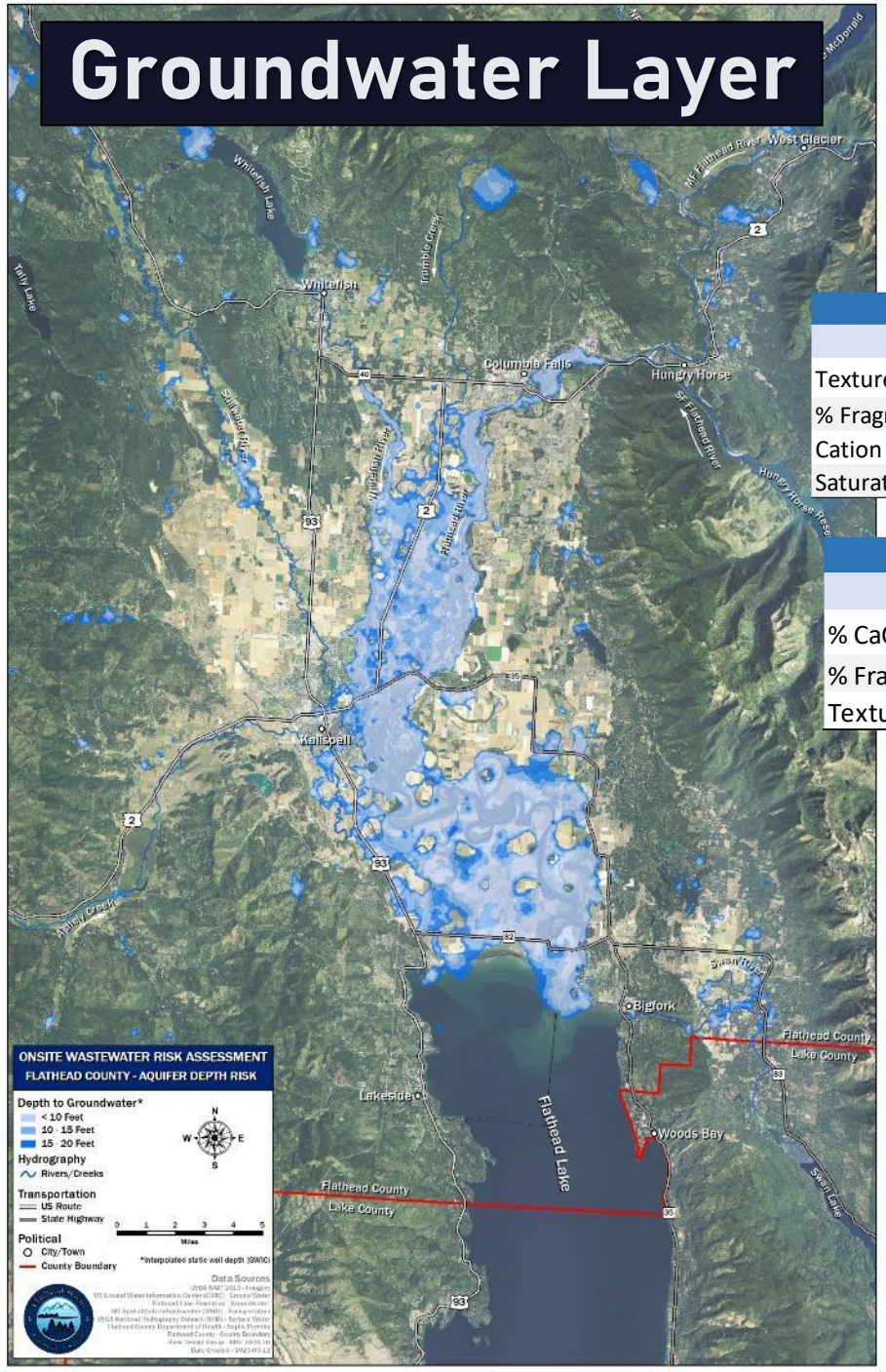
1) Identify existing septic system distribution and age of population
2) Increase the Committee's spatial understanding of septic system pollution risk

Methods:

- Create maps for known risk factors for septic system failure or poor performance for both Flathead & Lake Counties
  - Soil Suitability (N/P)
  - Groundwater Depth
  - Slope
  - Distance to Surface Water
- Create model of existing septic system risk for Flathead County



Groundwater Layer

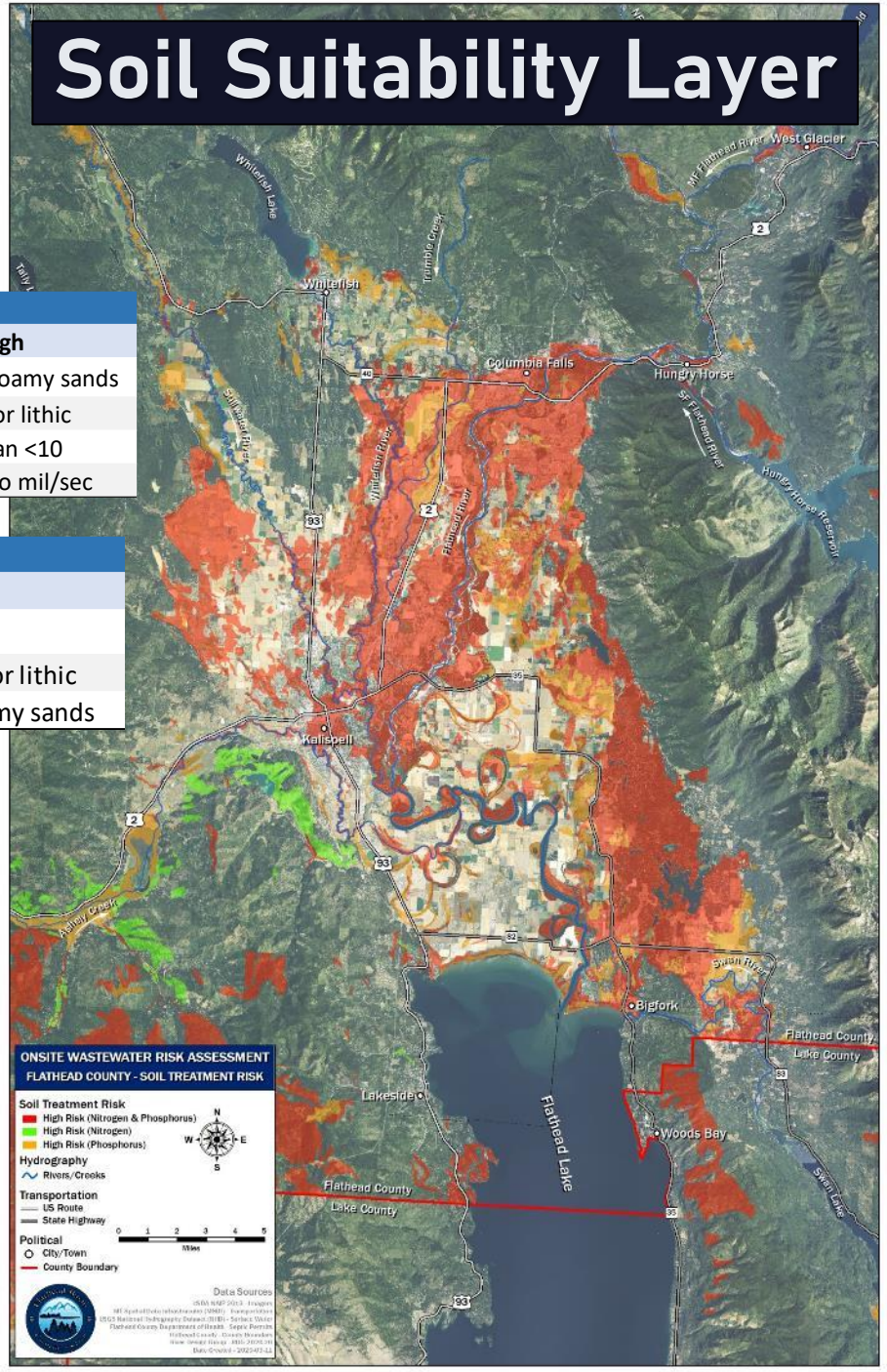


Soil Suitability: Nitrogen		
Risk	**Low**	**High**
Texture	Finer than loamy sands	sands and loamy sands
% Fragments	<30%	>30% or lithic
Cation Exchange Capacity (CEC)	Median >10	Median <10
Saturated Hydraulic Conductivity	<42 micro mil/sec	>42 micro mil/sec

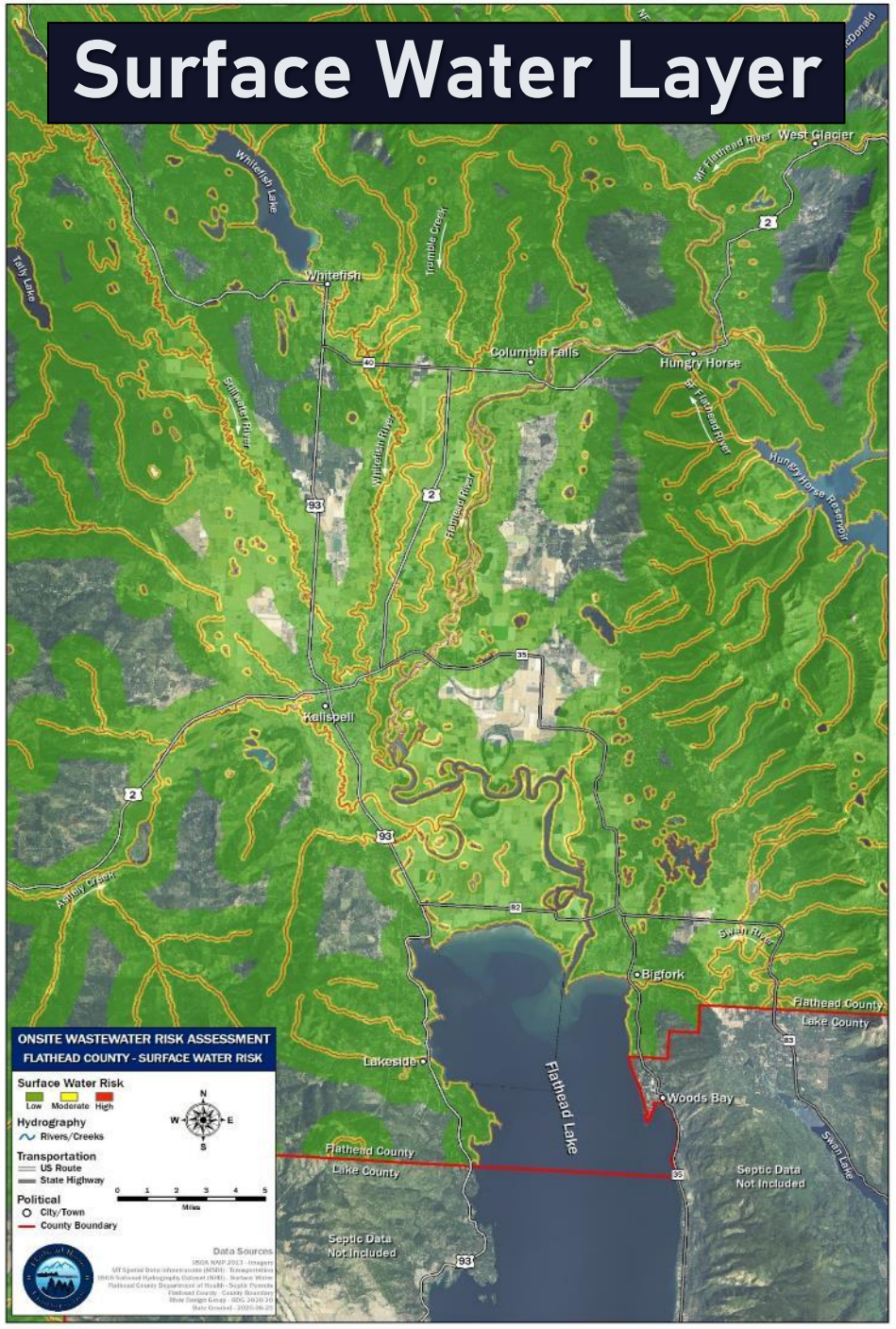
Soil Suitability: Phosphorus		
Risk	**Low**	**High**
% $CaCO_3$	>10% in subsoil	<10% in subsoil
% Fragments	<60% in subsoil	>60% in subsoil or lithic
Texture	Finer than loamy sands	Sands and loamy sands

Groundwater Depth Risk	
Depth (ft)	**Risk Category**
< 10	High
10 - 15	Moderate
15 - 20	Low
> 20	-

Soil Suitability Layer



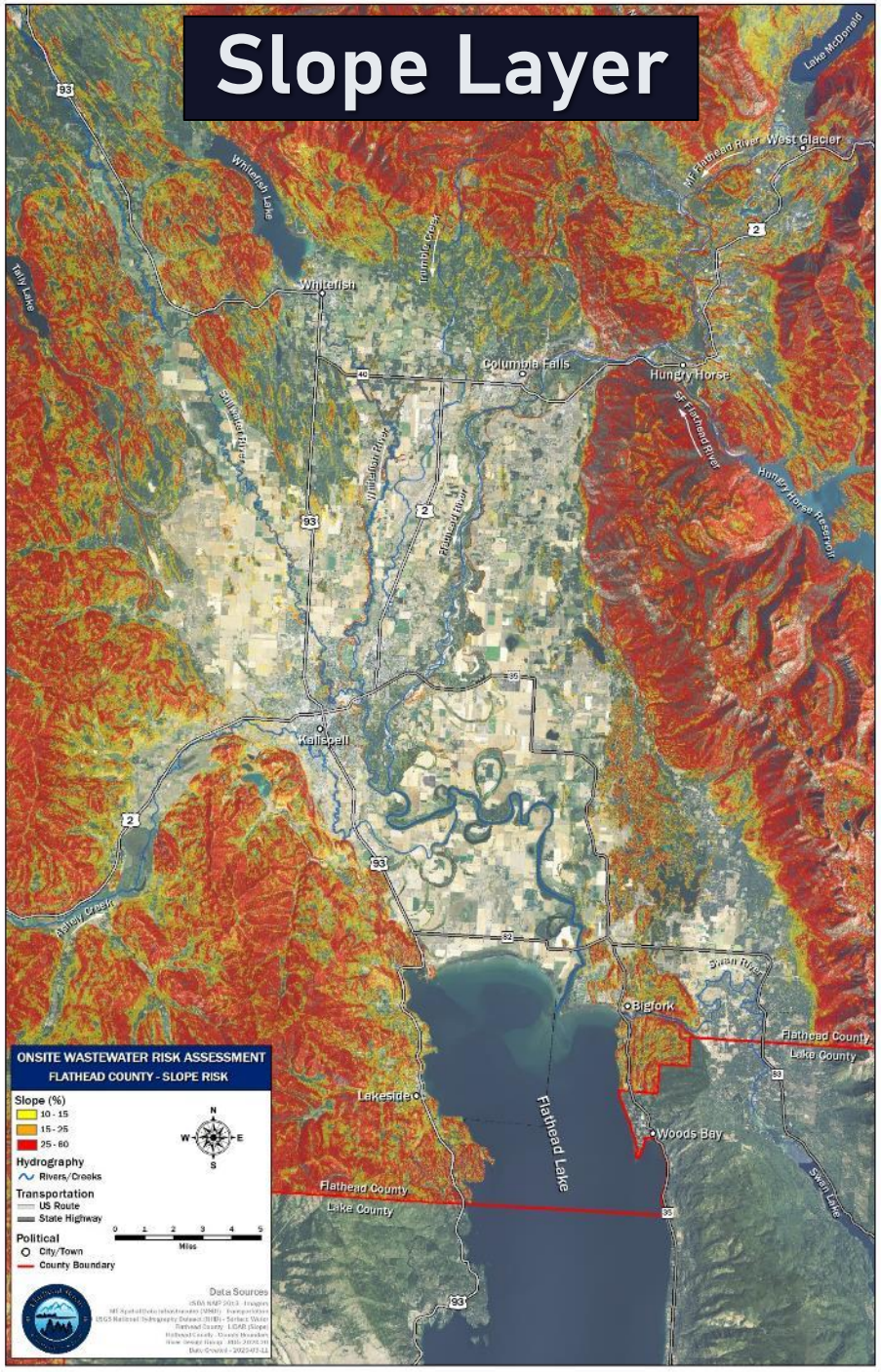
Surface Water Layer

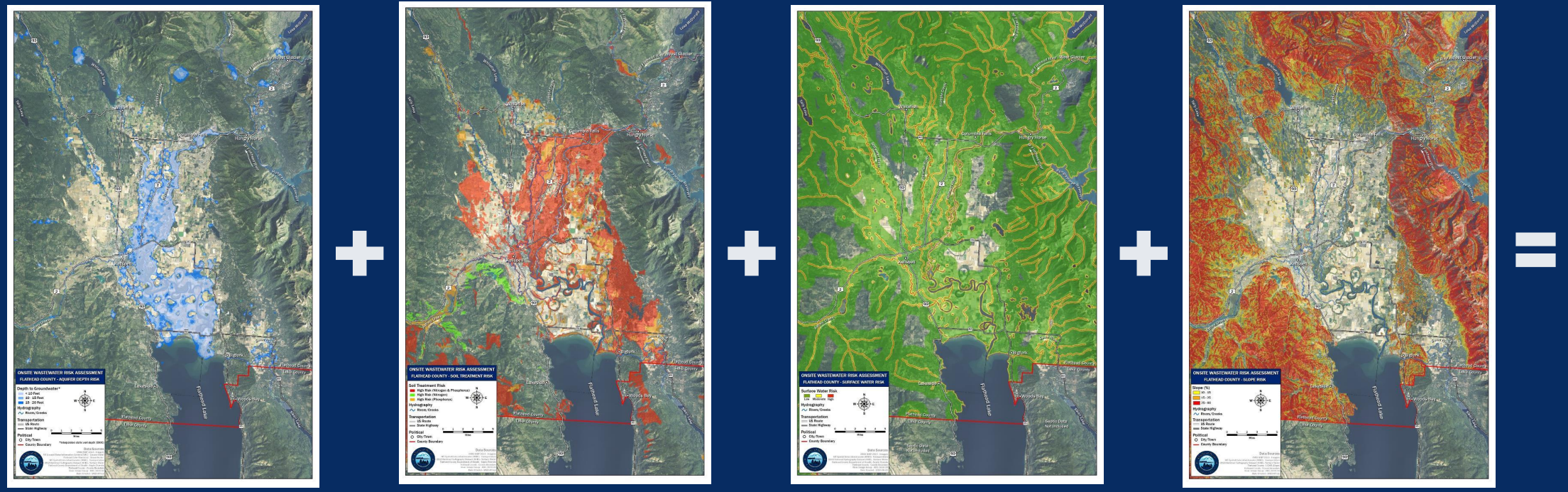


Slope Risk	
Slope (%)	**Risk Category**
0 - 10	-
10 - 15	Low
15 - 25	Moderate
25 - 60	High
> 60	-

Surface Water Risk	
Distance to Surface Water (ft)	**Risk Category**
0 – 100	High
100 – 500	Moderate
500 - 5000	Low

Slope Layer





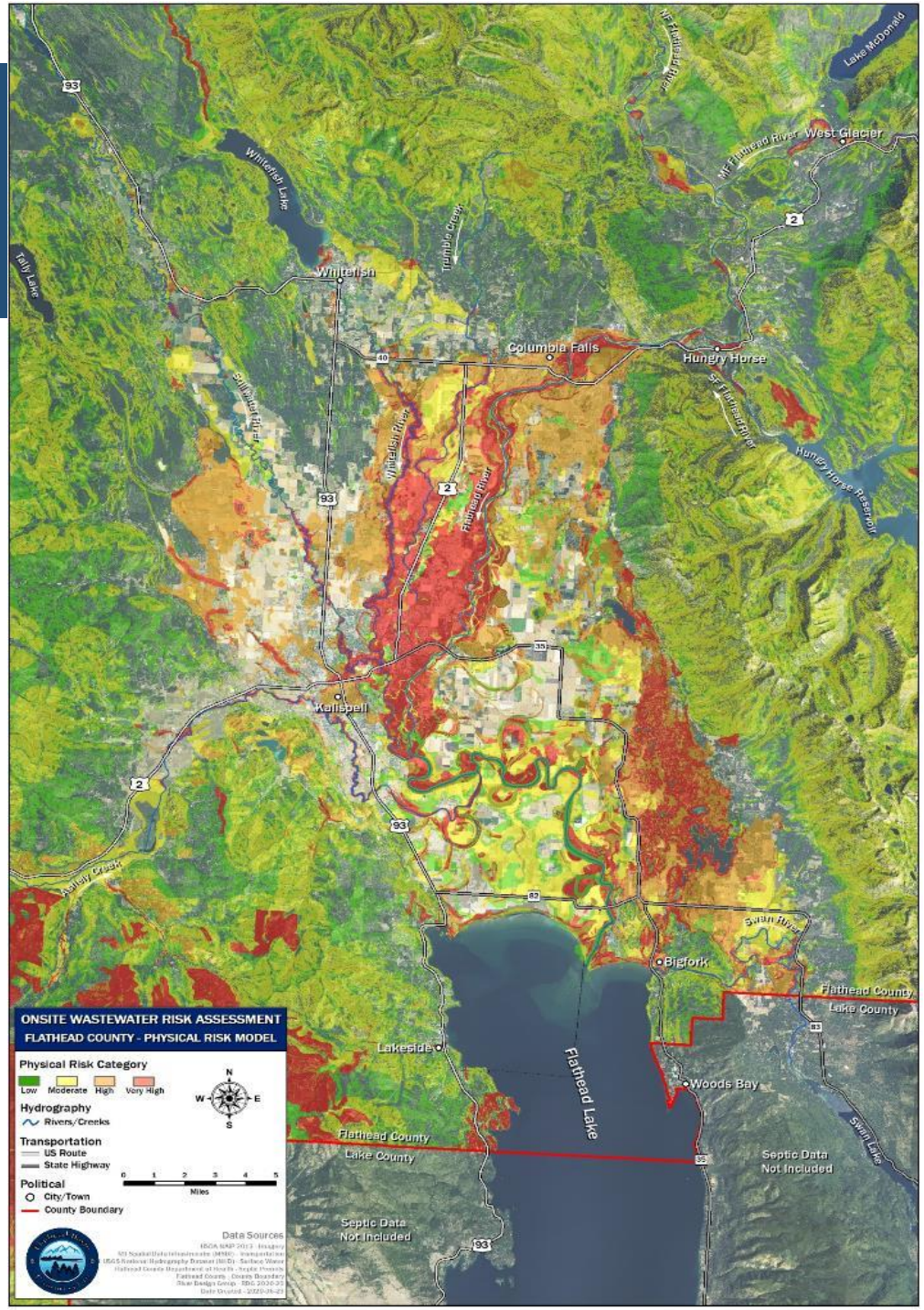
Physical Septic Risk

Physical Risk Model

- Developed for both Flathead and Lake Counties
- Shows the potential for septic treatment failure based on the geophysical conditions
- Spatial generalization

Physical Risk Model (Cumulative)	
Risk Category	**Value**
Very Low	0 – 2
Low	2 – 3
Moderate	3 – 5
High	5 – 7
Very High	7 – 15

Existing Septic Risk Model (Components)		
Feature	**Category**	**Value**
Nitrogen Risk (Soil)	Low	0
Nitrogen Risk (Soil)	High	3
Phosphorus Risk (Soil)	Low	0
Phosphorus Risk (Soil)	High	3
Groundwater < 10'	High	3
Groundwater 10' - 15'	Moderate	2
Groundwater 15' - 20'	Low	1
Groundwater > 20'	-	0
Slope (%) 0 - 10	-	0
Slope (%) 10 - 15	Low	1
Slope (%) 15 - 25	Moderate	2
Slope (%) 25 - 60	High	3
Slope (%) 60 - 90	-	0
Surface Water 500’ – 5000’	Low	1
Surface Water 100’ – 500’	Moderate	2
Surface Water 0’ – 100’	High	3



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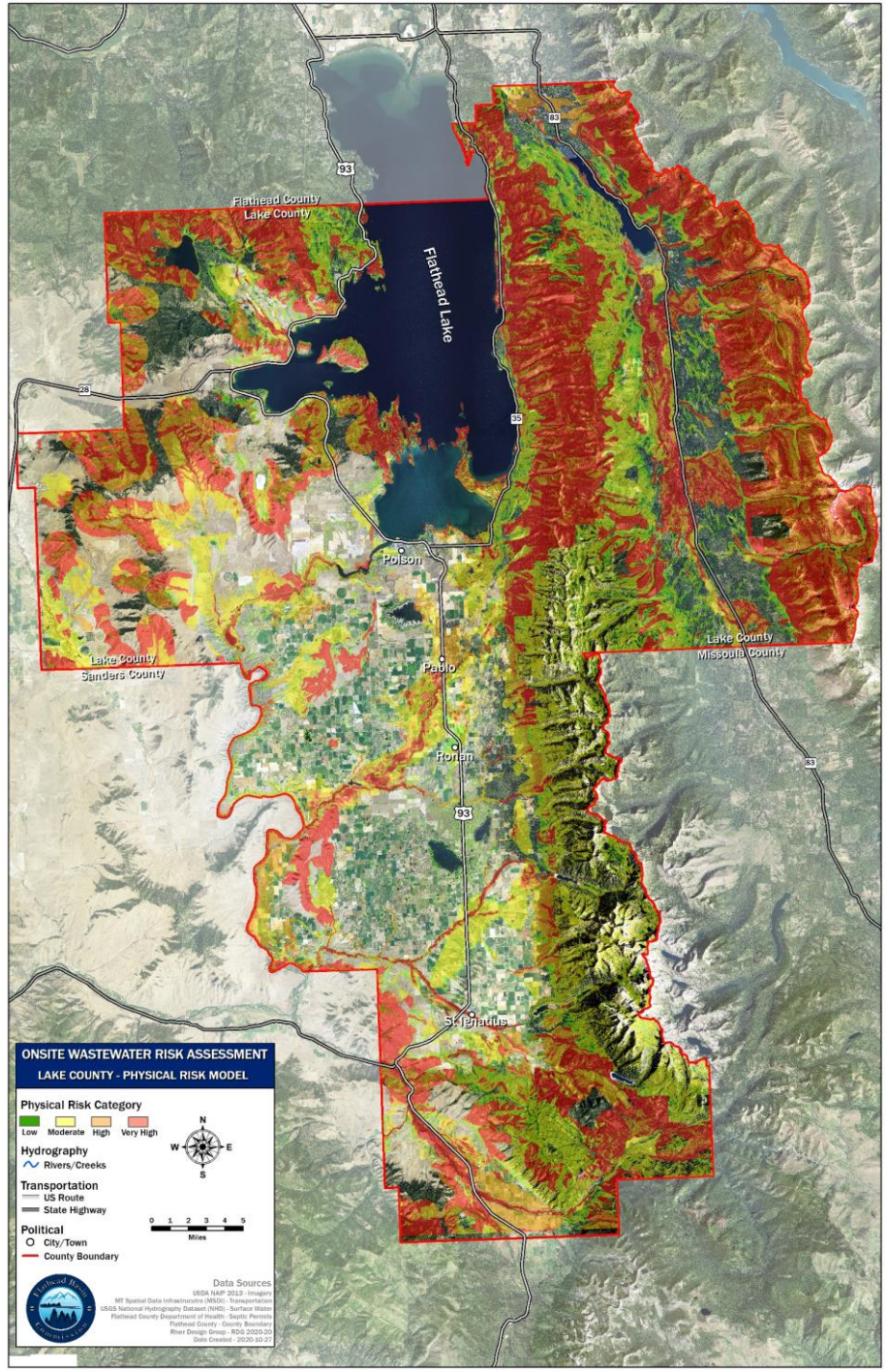
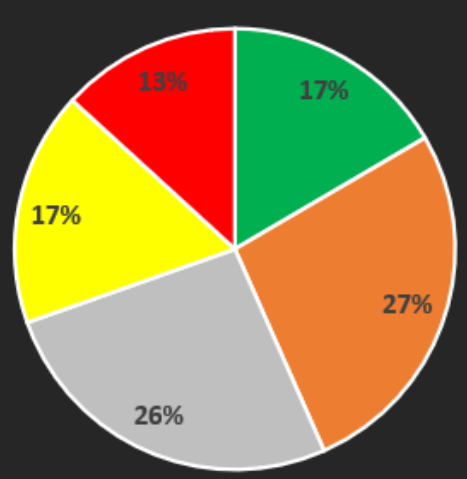


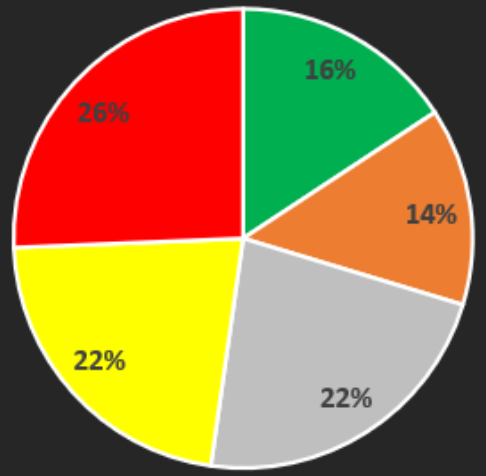
Septic Age Analysis

- Age: key factor in a system's likelihood to underperform
- Data only available for Flathead County

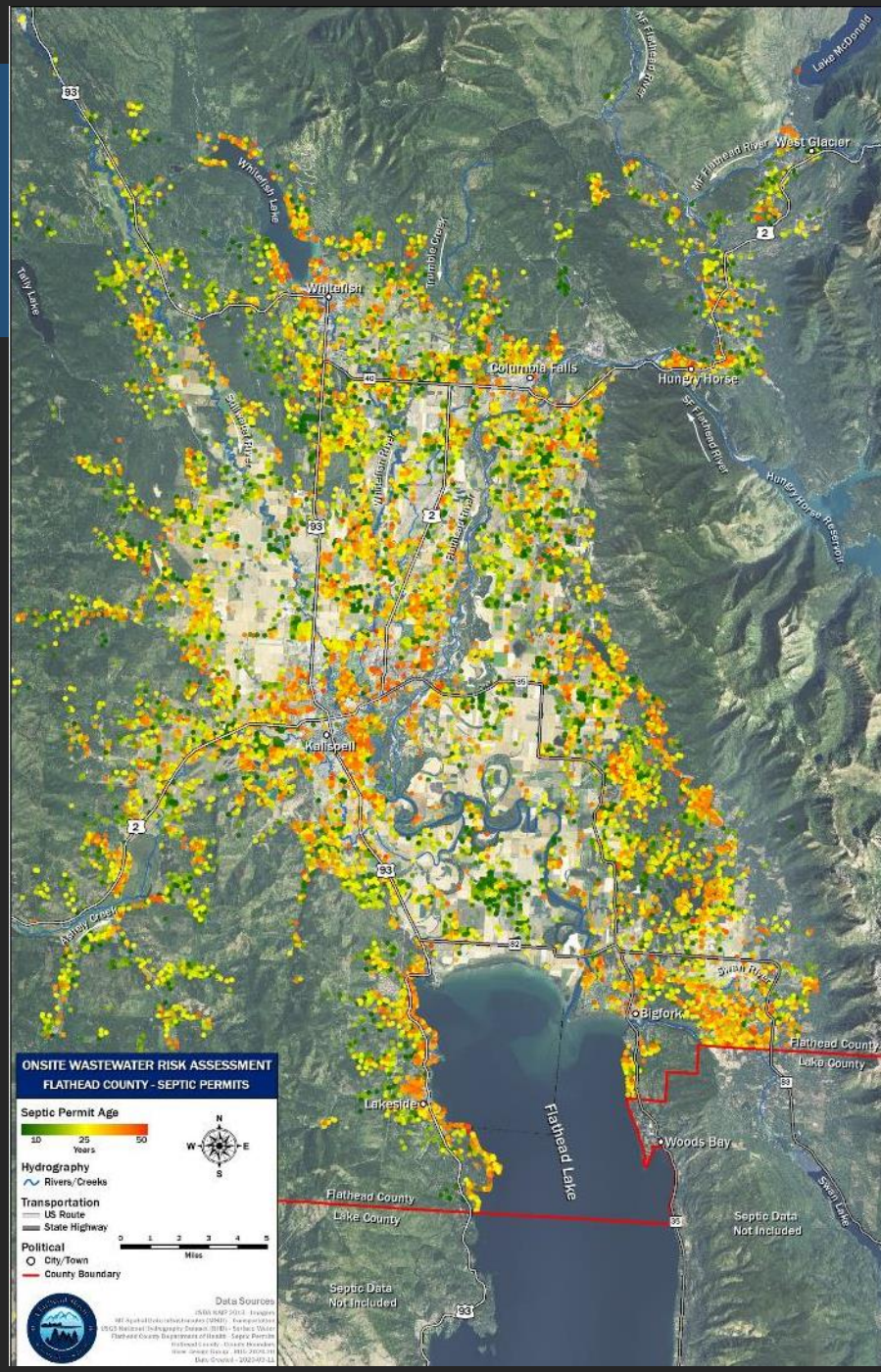
2020--Current Age
Proportion of Septic Systems in Each Risk Class
Flathead County (Permitted) TN= 21,415



2030--Projection
Proportion of Septic Systems in Each Risk Class
Flathead County (Permitted) TN= 25,415

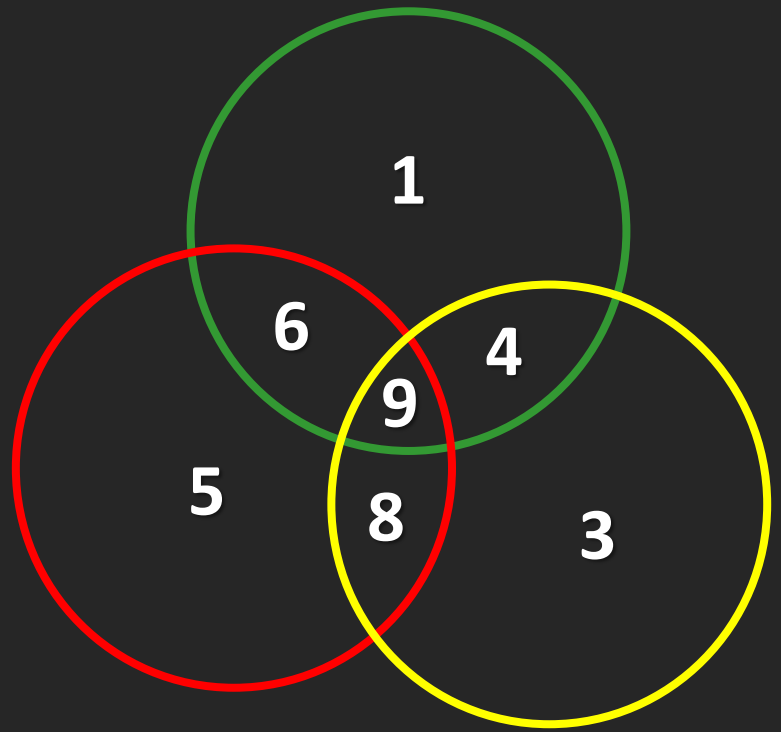


- Low (0 - 10 years)
- Mild (11 - 20 years)
- Moderate (21 - 30 years)
- High (31 - 40 years)
- Extreme (40+ years)



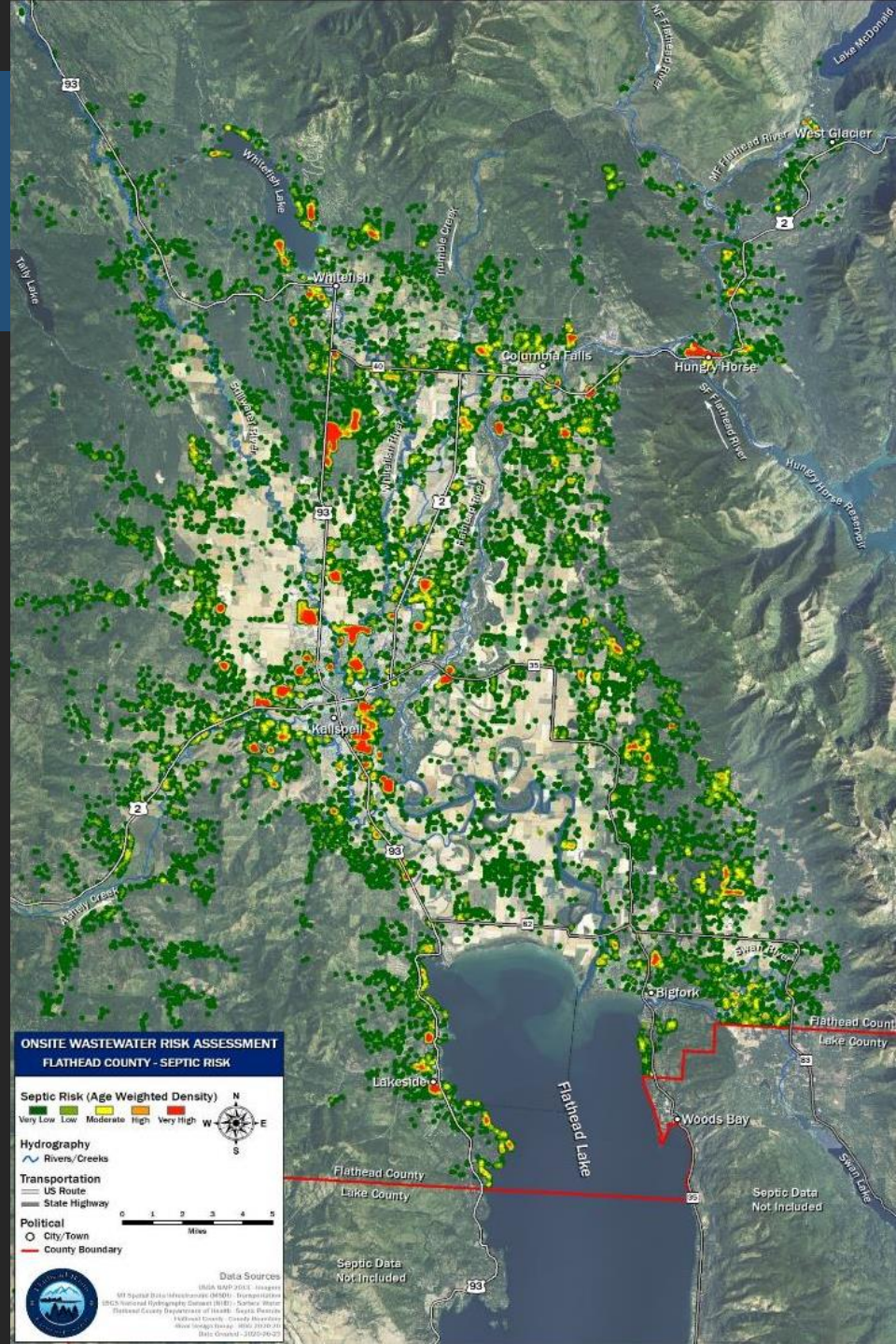
Age-Weighted Density

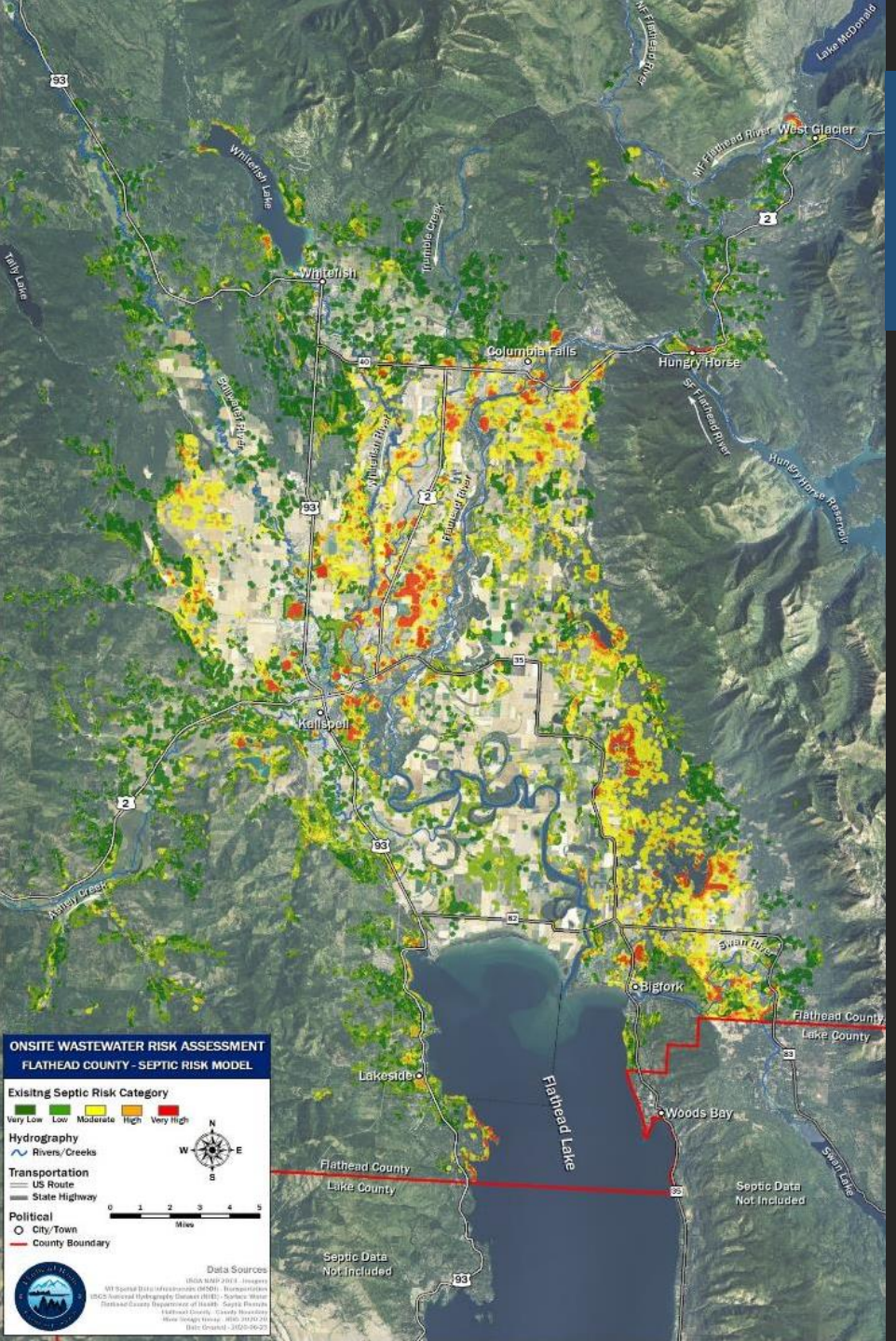
- 500-ft buffer surrounding septic permit location
- Age risk value assigned to each buffer
- Overlapping buffers added together



Individual Septic Age Risk Value		
Permit Age	**Risk Category**	**Value**
0 – 10	Low	1
11 – 20	Mild	2
21 – 30	Moderate	3
31 – 40	High	4
>40	Extreme	5

Septic Weighted Age Density Risk Value		
Cumulative Age Value	**Risk Category**	**Value**
1 – 5	Very Low	1
6 – 10	Low	2
11 – 20	Moderate	3
21 – 40	High	4
41 - 300	Very High	5





Existing Septic Risk Model

Physical Risk					Age-Weighted Density					Existing Septic Risk Model		
3	4		X		3	1		=		9	4
4	9				5	3				20	27

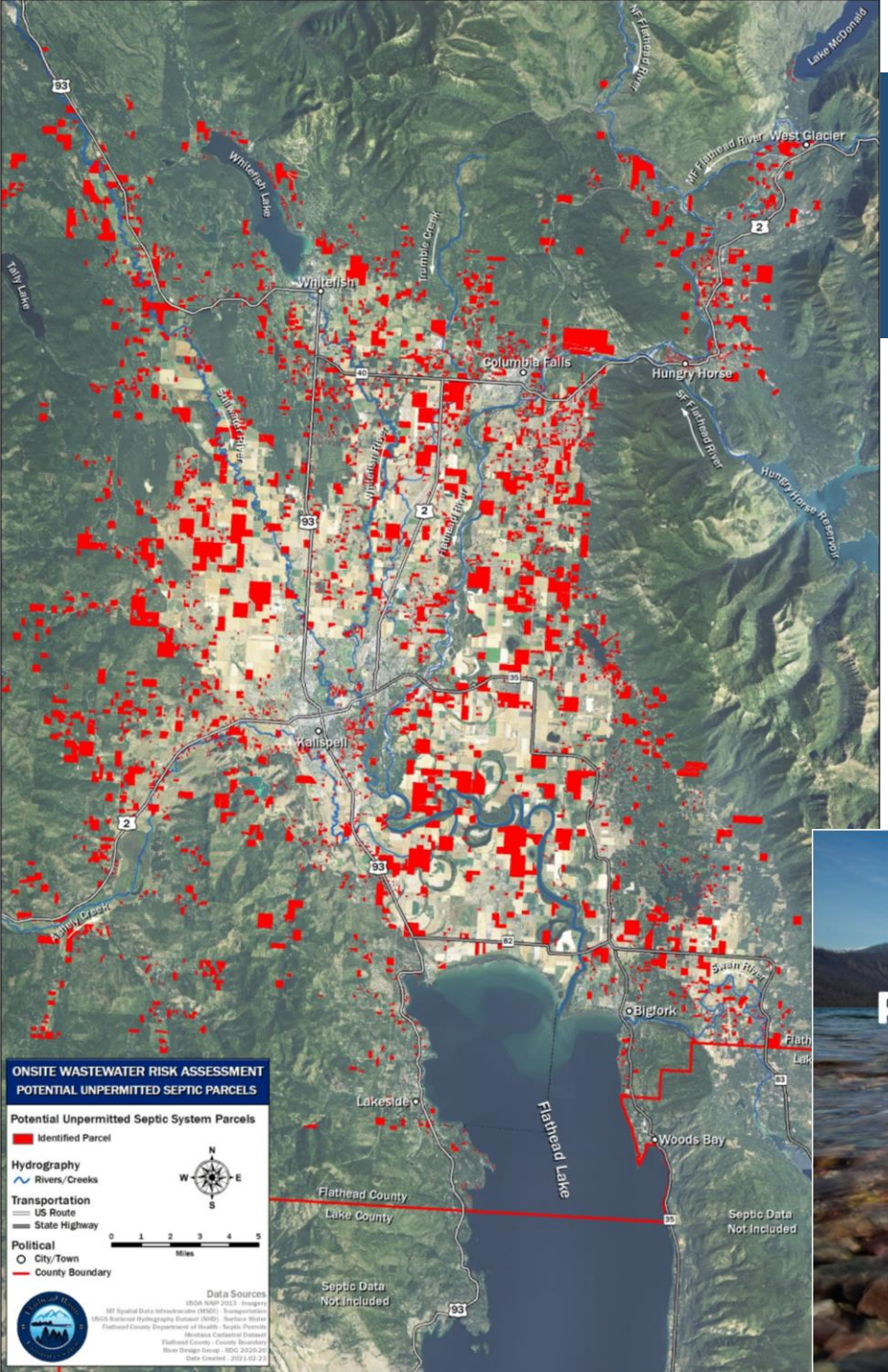
$$(G_w + S_w + M + N_r + P_r) \times S_r = E_r$$

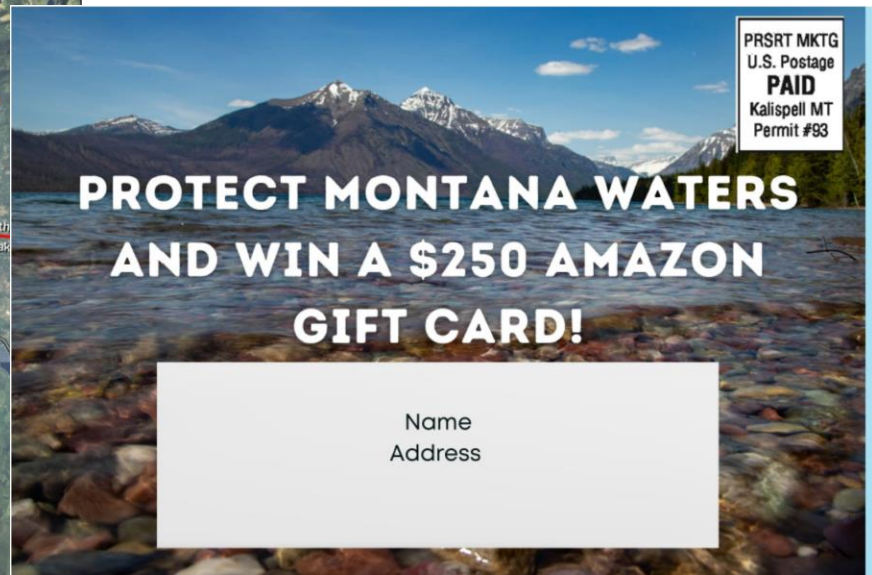
G_w – Groundwater Depth Risk Value
S_w – Surface Water Risk Value
M – Topographic Slope Risk Value
N_r – Nitrogen Translocation Risk Value
P_r – Phosphorous Translocation Risk Value
S_r – Septic Age Weighted Density Risk Value
E_r – Existing Septic Risk Value

Existing Septic Risk Model	
Risk Category	**Value**
Very Low	0 – 2
Low	2 – 5
Moderate	5 – 10
High	10 – 15
Very High	15 – 65

Unpermitted Analysis

- Using cadastral data to identify parcels that likely have a septic system but no permit
  - ~8,000 parcels identified
- Postcard survey to ground-truth
  - 72% of respondents confirmed presence of septic system - ~5,000 unpermitted systems





Synthetic DNA Tracer Study

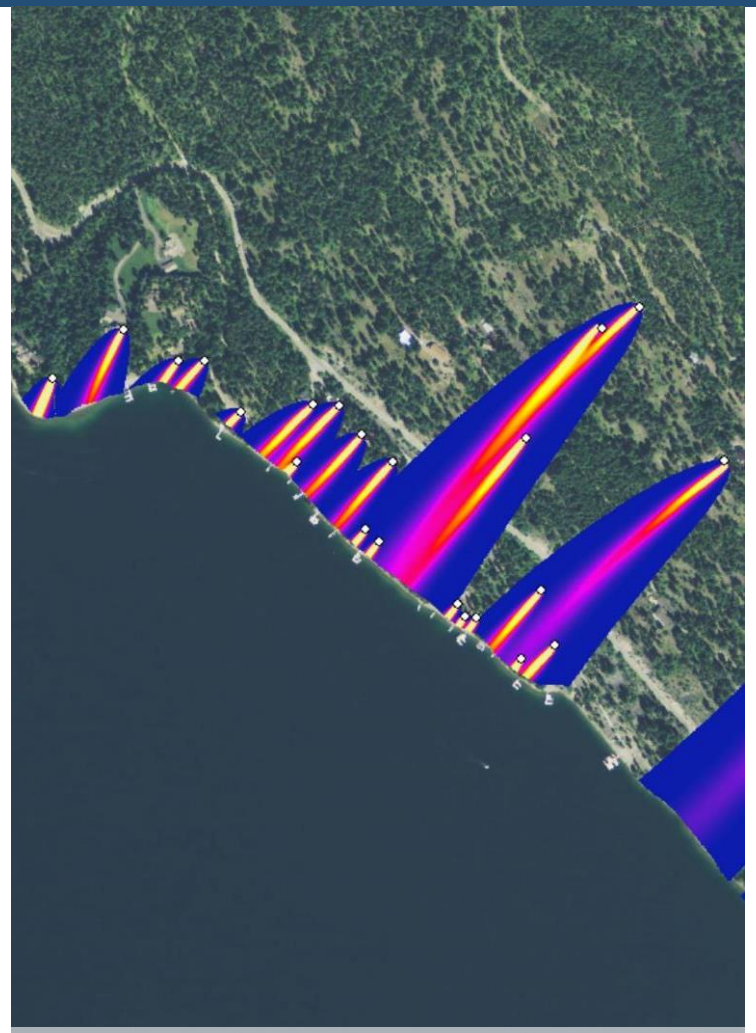
- Short, unique strands of DNA used to trace septic leachate from specific septic systems
- Pilot study being conducted on Whitefish Lake and Lake Mary Ronan – sampling complete
- Would give us another tool in the toolbox to understand septic leachate pollution in the basin

Flathead Basin Commission

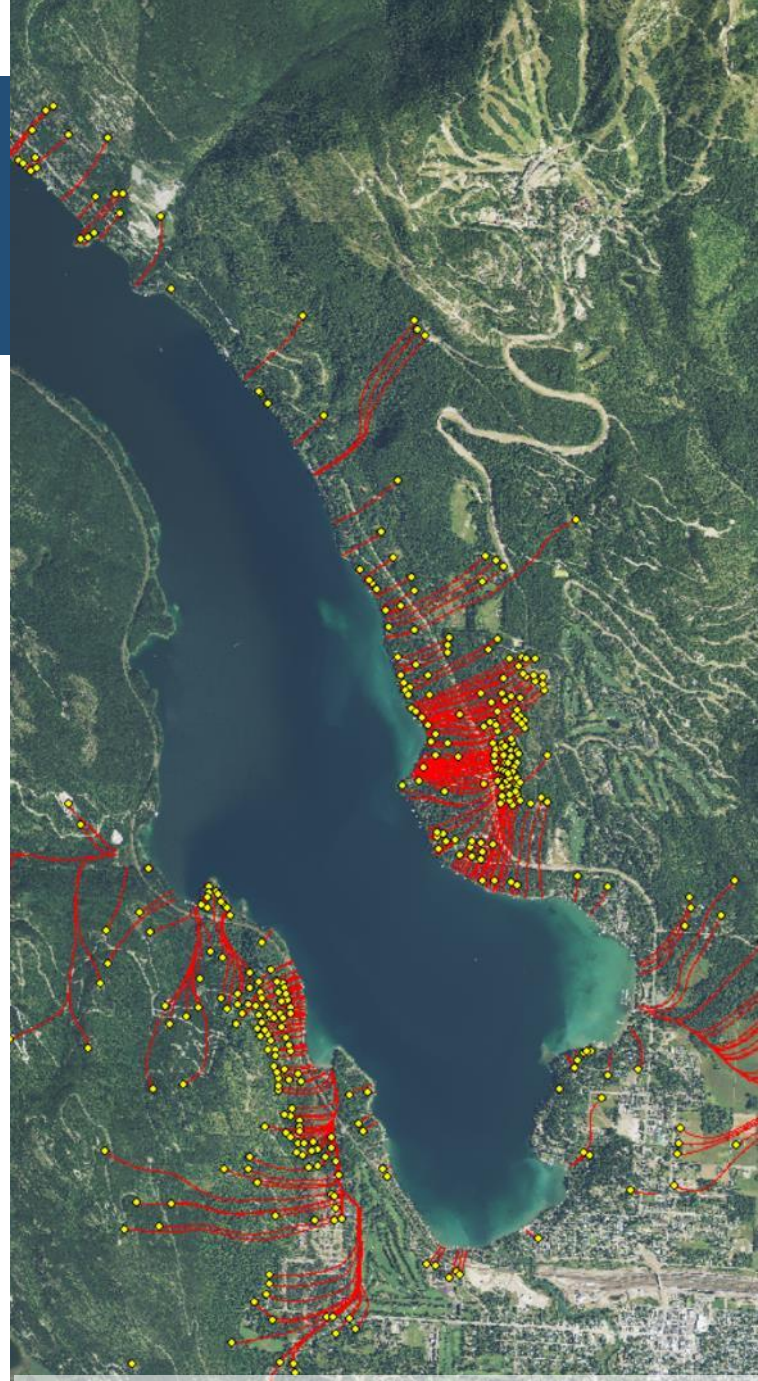
Whitefish Lake INSTITUTE

CORNELL UNIVERSITY FOUNDED A.D. 1865

RDG RIVER DESIGN GROUP



Simulation of nitrogen contamination plume



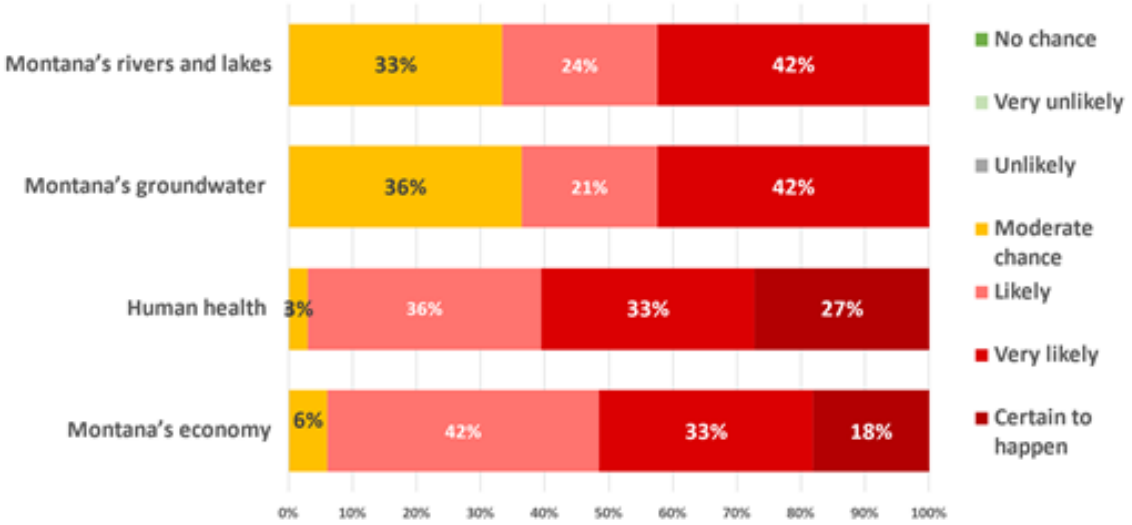
Groundwater flow model

National Science Foundation Grant

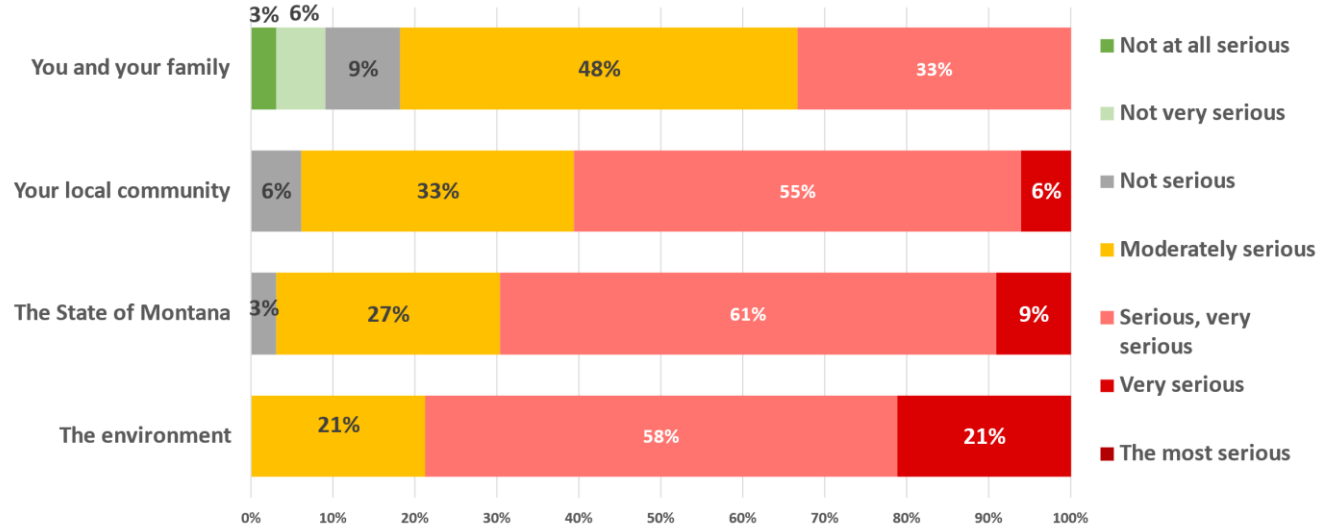
Goal: Solidify emerging collaborations between researchers, basin stakeholders, government agencies, and communities committed to maintaining water quality in the Flathead River Basin by:

- Hosting a three-day Septic & Water Quality Workshop composed of natural resource scientists, social scientists, and the public to scope strategies and solutions to address the issue.
- Evaluating the use of scientific and social data to motivate homeowners to adopt septic system best practices.
- Completing a pilot shoreline microbial study to identify areas receiving septic leachate in Flathead Lake.
- Incorporating the results of a synthetic DNA study on Whitefish Lake and Lake Mary Ronan by our community partner, the Flathead Basin Commission.
- Assessing policies and governance frameworks that address the risks from failing sep systems to public health and surface water and groundwater contamination.

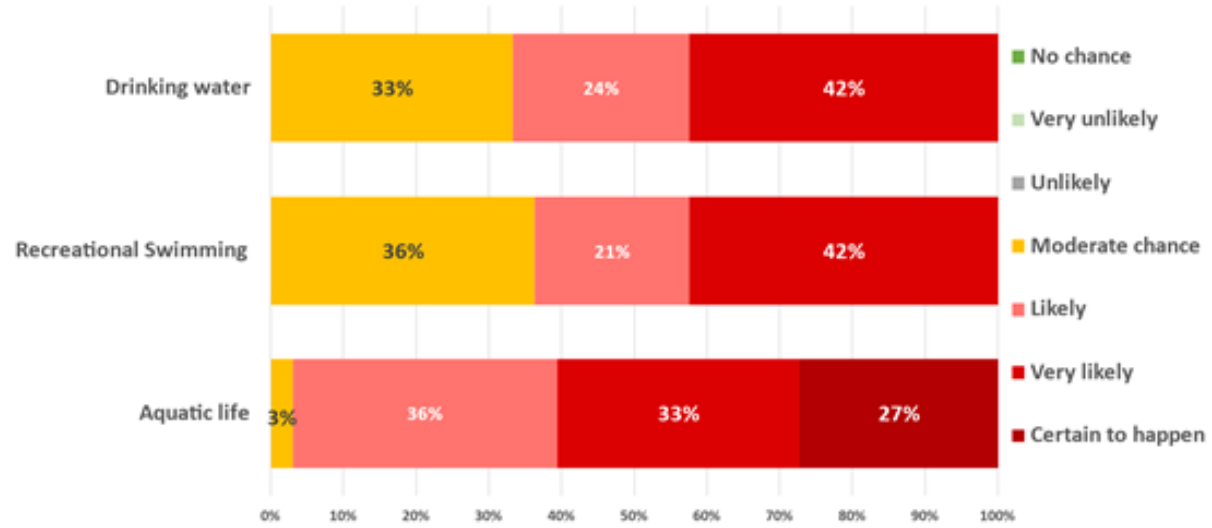
Septic leachate Perceived Impacts



Aging Septic systems Perceived Impacts



Septic leachate - Perceived Impacts in Flathead Lake



Future Work – Septic Leachate

→Final edits to septic risk map report – FBC website

→Explore/implement recommendations from NSF workshop

→Analyze results of synthetic DNA study

→Assess and explore data gaps in the Flathead Basin

→Analysis of options: Legislation, ordinances, outreach/education, financial incentives, etc.

→Enhance funding mechanisms for maintenance + replacement

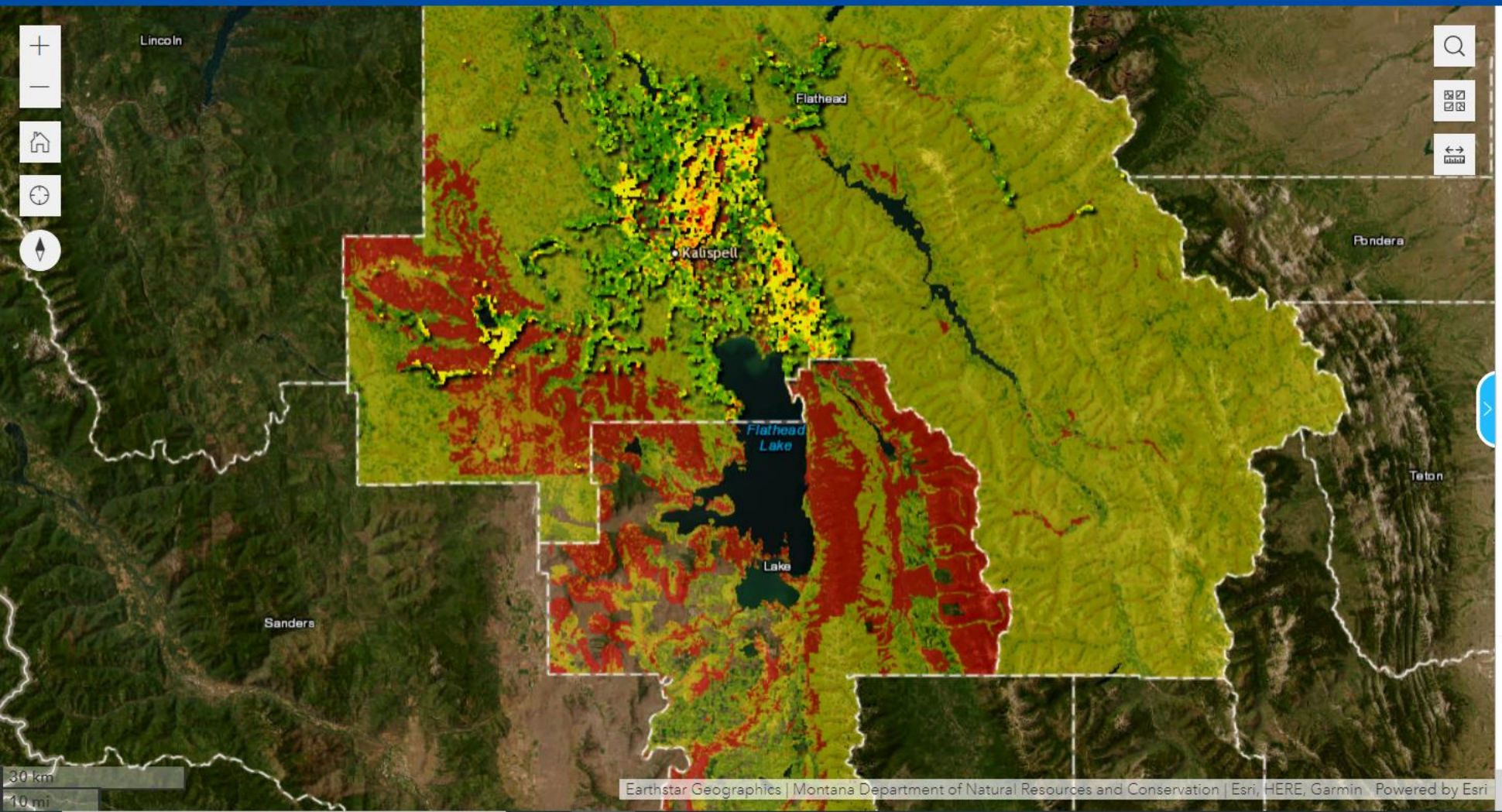
→Development and growth awareness + use of tool (counties, municipalities)

→Publish online, publicly-available, interactive GIS risk tool

Online Tool

Flathead Basin Septic Risk Model

New User Guide | Project Summary

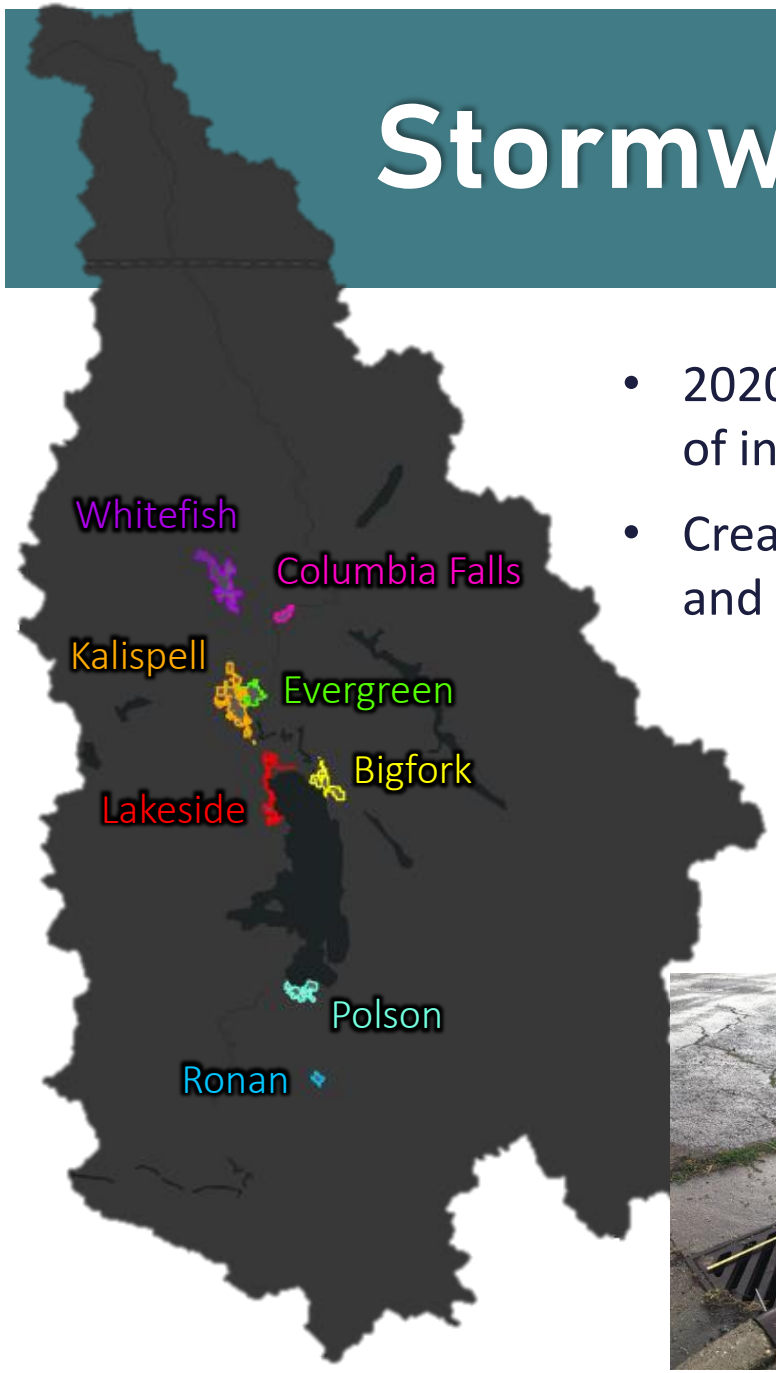


- Flathead County Existing Septic Risk
- Flathead County Septic Age-Weighted Density
- Flathead County Geophysical Septic Risk
- Flathead County Depth to Groundwater
- Flathead County Distance to Surface Water
- Flathead County Soil Treatment Capacity
- Flathead County Slope
- Lake County Geophysical Septic Risk
- Lake County Depth to Groundwater
- Lake County Distance to Surface

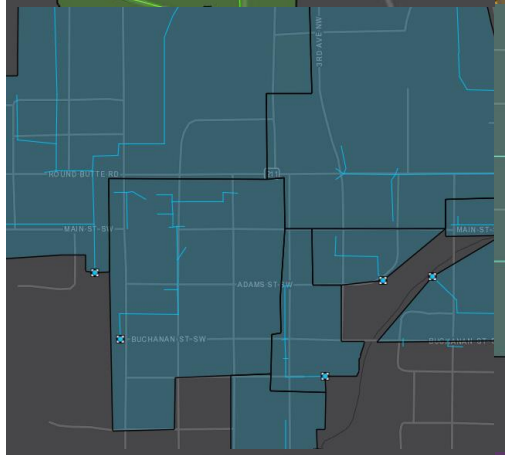
Flathead County Existing Septic Risk

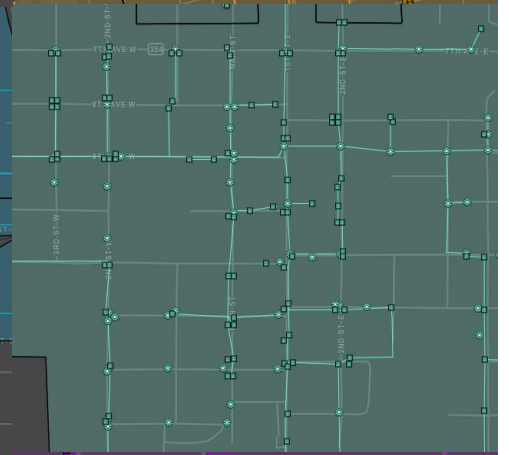
Very High | High | Moderate | Low | Very Low

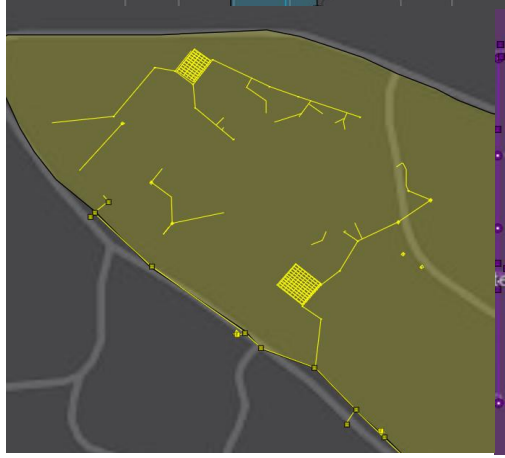
Stormwater Project



- 2020/21: Developed digital inventory of infrastructure in urban areas
- Created through data access requests and citizen science mapping events



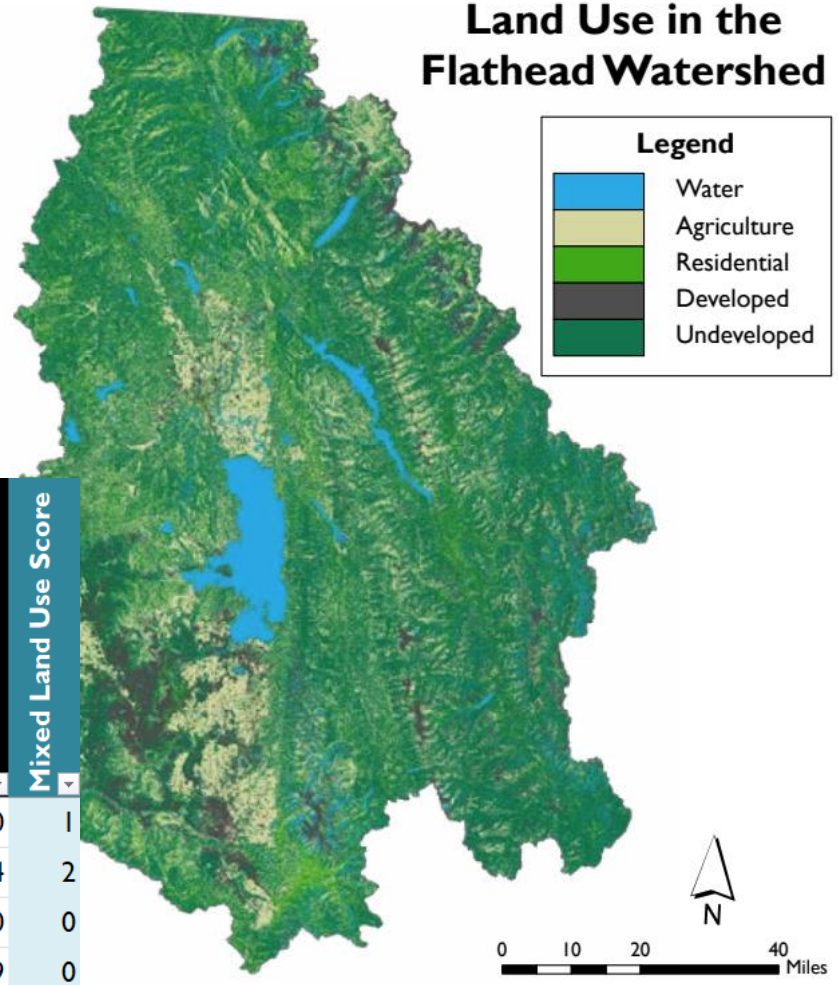




Sub-basin Prioritization Model

- 212 sub-basins in watershed
- Rankings based on four sub-basin characteristics:
  1) Size
  2) Land use type
  3) Land use pattern
  4) Impairment status of receiving waterbody

Name	Total Area (acres)	Area Score	Receiving Waterbody	Impairment Status	Pollutants of Impairment	Impairment Score	Water (%)	Agriculture (%)	Residential (%)	Developed (%)	Undeveloped (%)	Urbanized Score	Max Land Use Diff (%)	Mixed Land Use Score
KAL_AC11	292	2	Ashley Creek	IMP >1	TN, TP, Sed, DO, and Temp	2	2	23	23	41	11	2	30	1
WHI_WR5	260	2	Whitefish River	IMP >1	Oil & Grease, PCBs, and Temp	2	6	28	16	31	18	1	14	2
KAL_AC1	28	0	Ashley Creek	IMP >1	TN, TP, Sed, DO, and Temp	2	0	7	4	83	6	4	80	0
KAL_AC18	9	0	Ashley Creek	IMP >1	TN, TP, Sed, DO, and Temp	2	0	7	4	83	6	4	79	0
KAL_AC6	547	2	Ashley Creek	IMP >1	TN, TP, Sed, DO, and Temp	2	2	22	18	47	11	2	35	0



Future Work - Stormwater

Determine future goals of monitoring and outfall model

1

Increase capacity for management & maintenance

2

Develop retrofit guidance in high-priority sub-basins

3

Campaign incentivizing green stormwater infrastructure

4

Addressing the issue through Education & Outreach

"The three main goals of an outreach program are to **improve learning, promote civic engagement**, and **strengthen communities through addressing their societal needs**. Such programs create a partnership with communities, strengthening and improving public knowledge, personal responsibility, and the overall health of communities."

–Journal of Education and Health

MONTANA WATERS

Clearly Connected.

Montana Waters: Clearly Connected

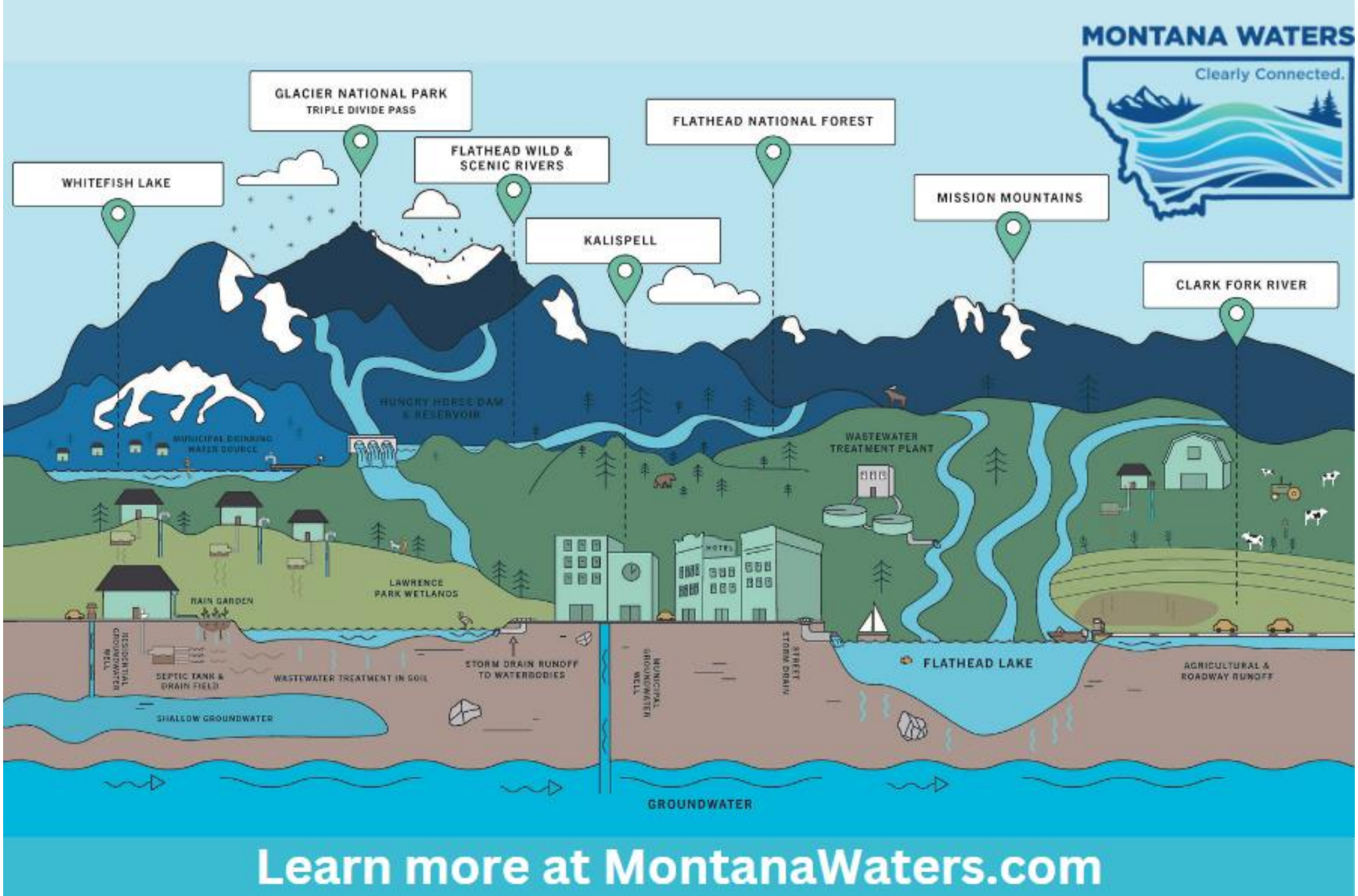
Campaign Goals:

- Provide information and education on **several water quality issues**:
  - Nonpoint source pollution
  - Septic leachate
  - Harmful algal blooms
  - Stormwater pollution
  - And more!
- Increase consistency and effectiveness of messaging among partners.

*Montana Waters makes talking about water quality **easy** and **understandable!***

Collaboration Efforts & Projects

- Septic Maintenance Reimbursement Program
- Flathead Living Guide
- Events: NSF septic workshop, community septic seminar ‘Pump Party’, Stormwater Conference, Flathead Waters cleanup, etc.


MONTANA WATERS
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GLACIER NATIONAL PARK
TRIPLE DIVIDE PASS
WHITEFISH LAKE
FLATHEAD WILD & SCENIC RIVERS
FLATHEAD NATIONAL FOREST
KALISPELL
MISSION MOUNTAINS
CLARK FORK RIVER
HUNGRY HORSE DAM & RESERVOIR
MUNICIPAL DRINKING WATER SOURCE
WASTEWATER TREATMENT PLANT
RAIN GARDEN
LAWRENCE PARK WETLANDS
RESIDENTIAL GROUNDWATER WELL
SEPTIC TANK & DRAIN FIELD
WASTEWATER TREATMENT IN SOIL
STORM DRAIN RUNOFF TO WATERBODIES
SHALLOW GROUNDWATER
MUNICIPAL GROUNDWATER WELL
STREET STORM DRAIN
FLATHEAD LAKE
AGRICULTURAL & ROADWAY RUNOFF
GROUNDWATER
Learn more at MontanaWaters.com

Collaborative Programs

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Flathead Rain Garden Initiative

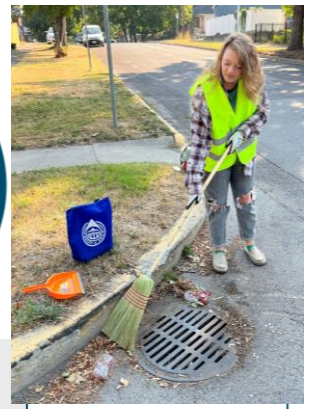
- Empowers residents of Flathead County to build rain gardens

Flathead
Rain Garden Initiative

Adopt-a-Drain

- Encourages residents to clear debris off storm drains in their neighborhood

ADOPT-A-DRAIN



Annual Flathead Waters Cleanup

- Recruits volunteers to pick up trash in and around waterbodies of the Flathead Watershed

FLATHEAD WATERS CLEANUP
HELPING KEEP OUR FAVORITE PLACES CLEAN

Questions?

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Flathead Basin Commission