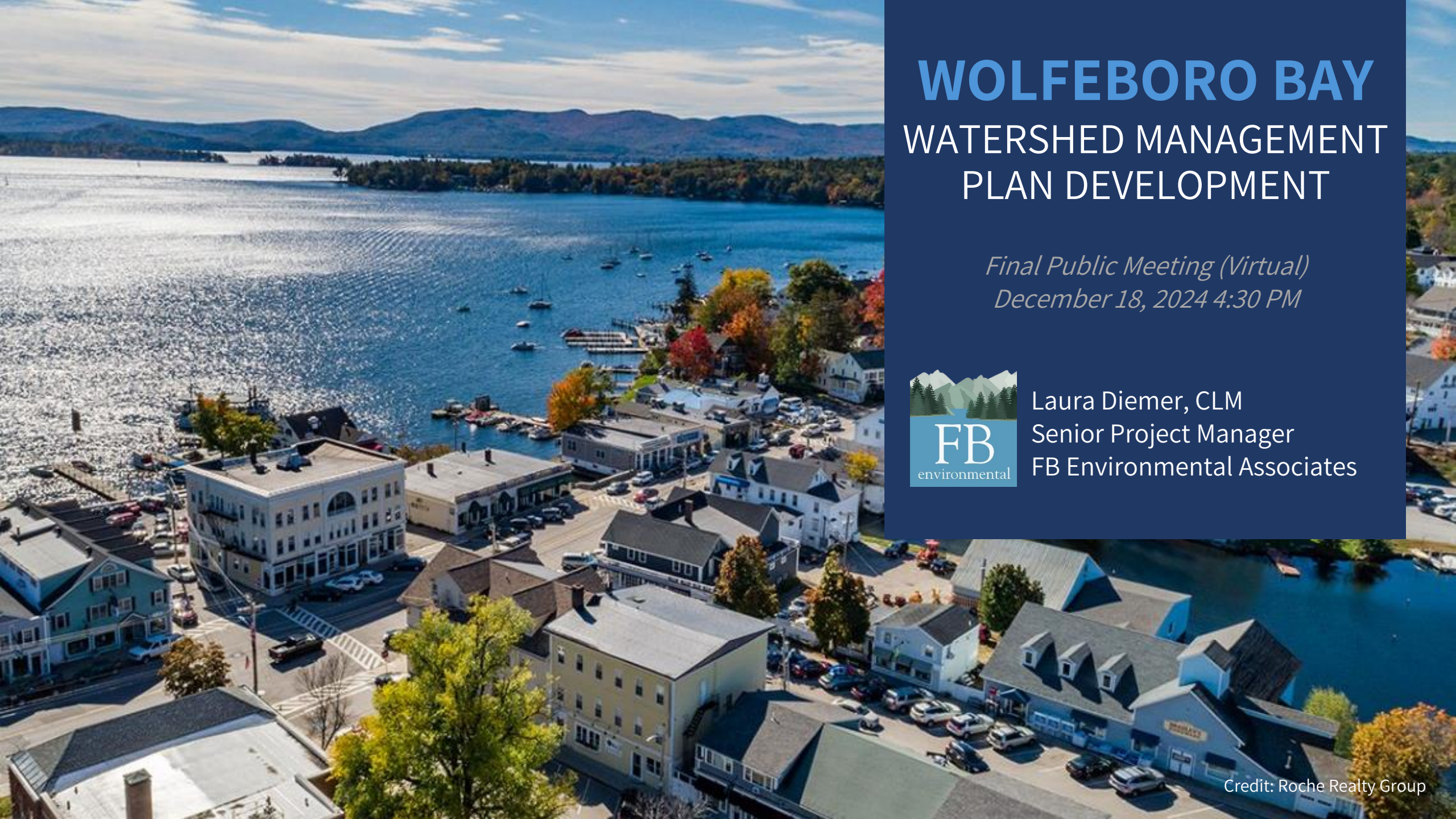


An aerial photograph of Wolfboro Bay, showing the town of Wolfboro, New Hampshire, nestled along the shoreline. The bay is filled with numerous sailboats and motorboats. The town features a mix of historic and modern buildings, including a prominent white building with a large arched window. The surrounding landscape includes rolling hills and mountains in the background, and trees with autumn foliage in the foreground.

WOLFEBORO BAY

WATERSHED MANAGEMENT PLAN DEVELOPMENT

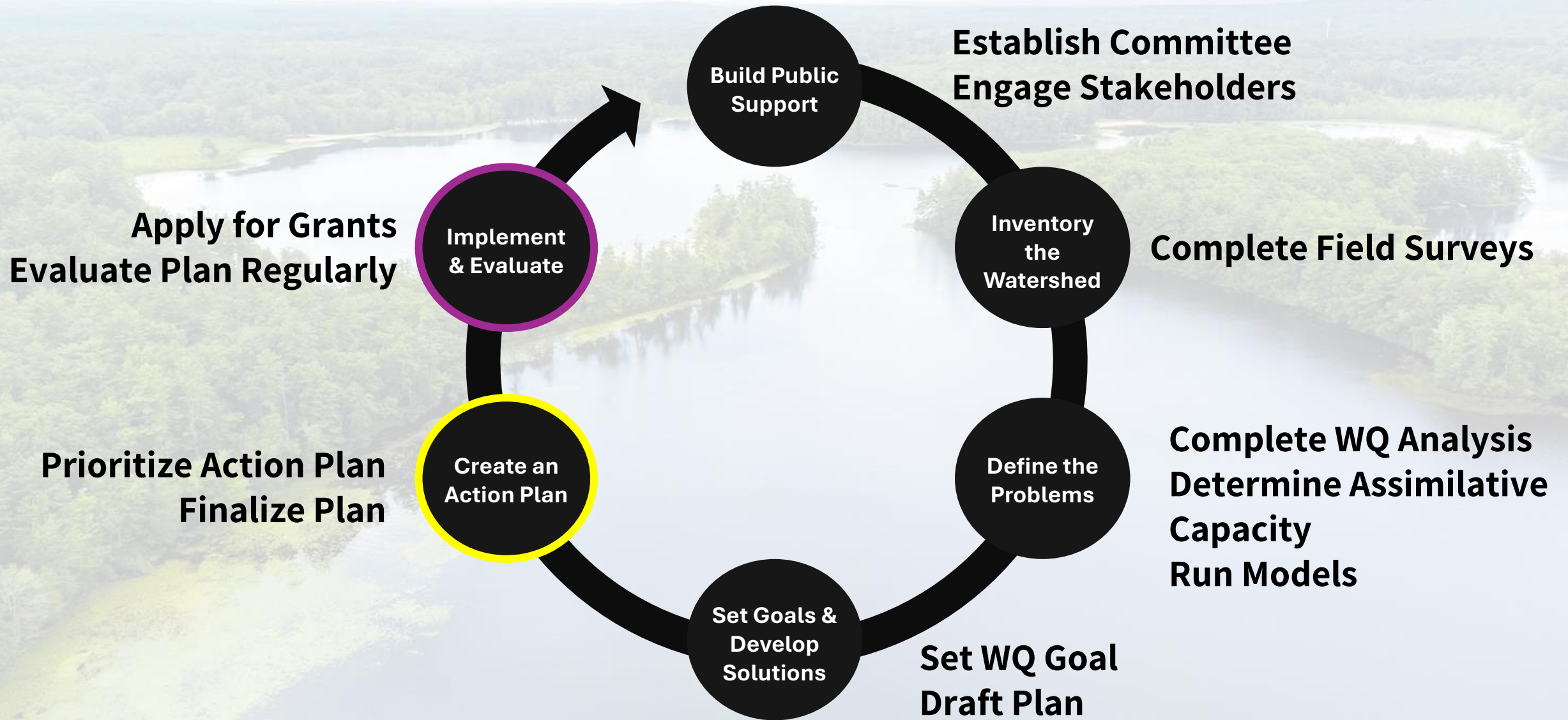
Final Public Meeting (Virtual)
December 18, 2024 4:30 PM



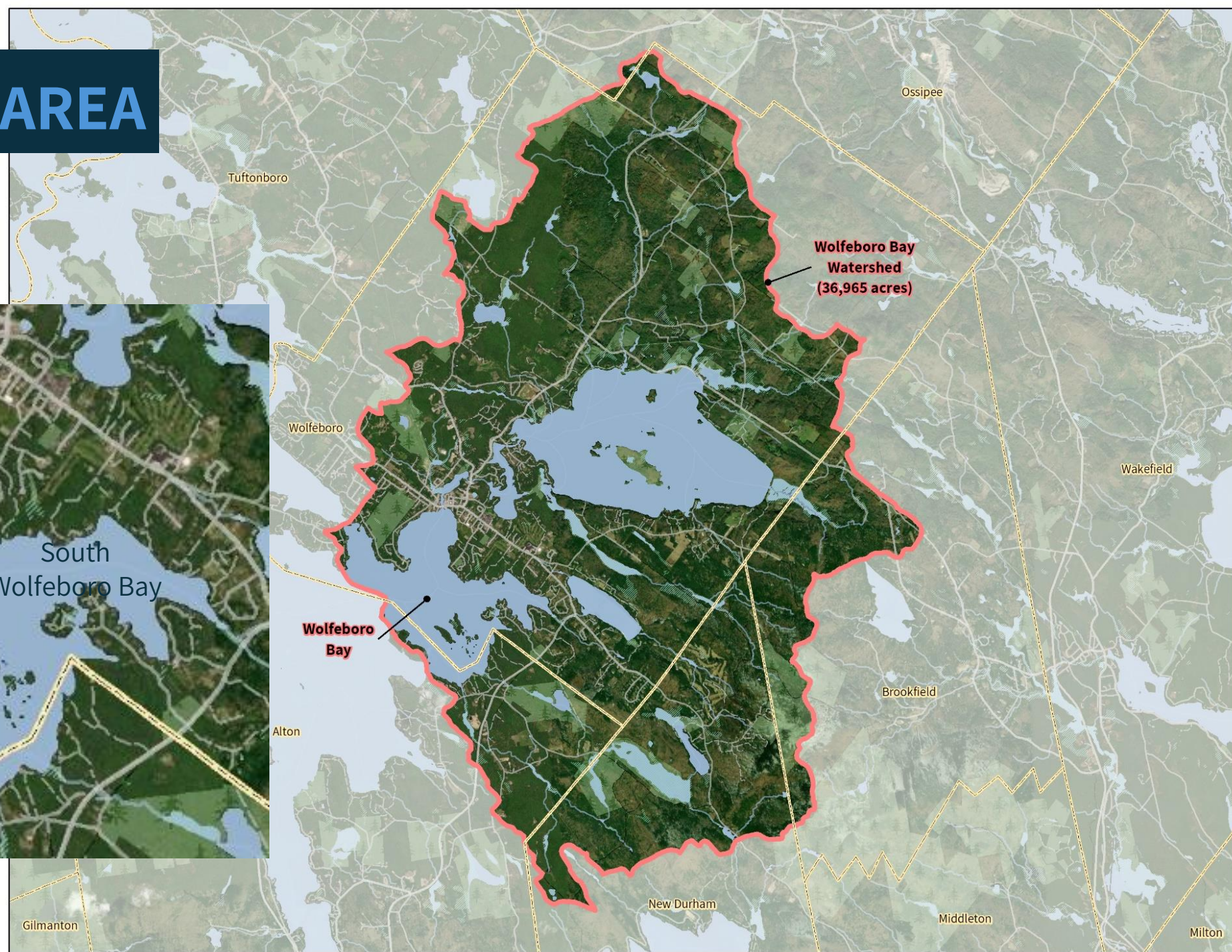
Laura Diemer, CLM
Senior Project Manager
FB Environmental Associates

Credit: Roche Realty Group

WATERSHED PLANNING CYCLE



PLAN STUDY AREA



PLAN STUDY AREA

LAKE WENTWORTH

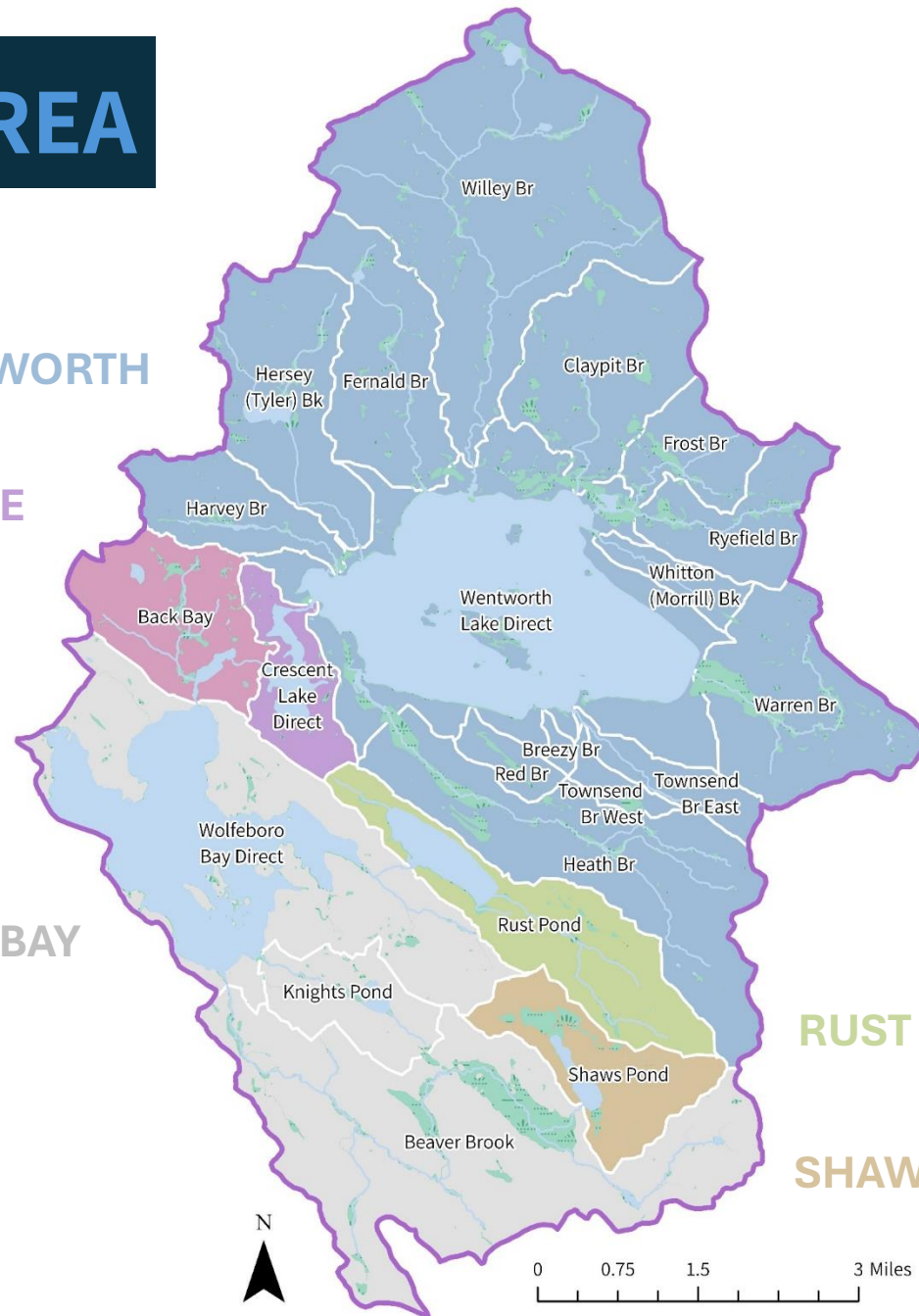
CRESCENT LAKE

BACK BAY

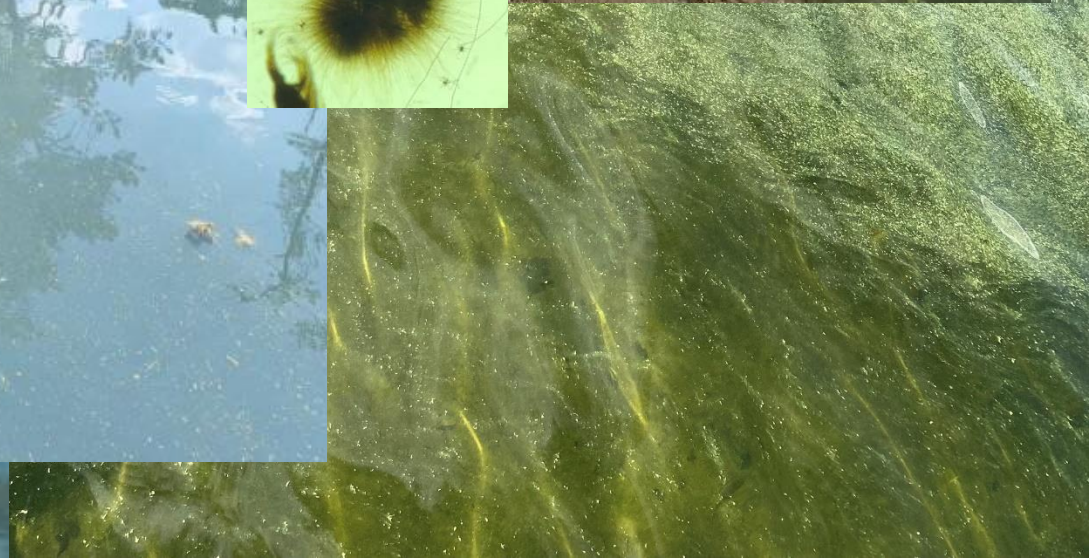
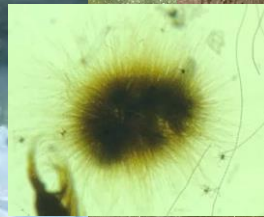
WOLFEBORO BAY

RUST POND

SHAWS POND



THE PROBLEM





WE ARE IN A NEW ERA WITH ENHANCED EFFECTS OF CLIMATE CHANGE

The world has surpassed a heat threshold that scientists have been warning about

How is climate change affecting cyanobacteria in N.H. lakes, ponds and other waters?

New Hampshire Public Radio | By Mara Hoplamazian, Bol Nakdimio
Published July 15, 2022 at 4:50 PM EDT



NOAA says New England's temps are warming, sea levels rising faster than the global rate

Hadley Barndollar USA TODAY NETWORK

CLIMATE CRISIS

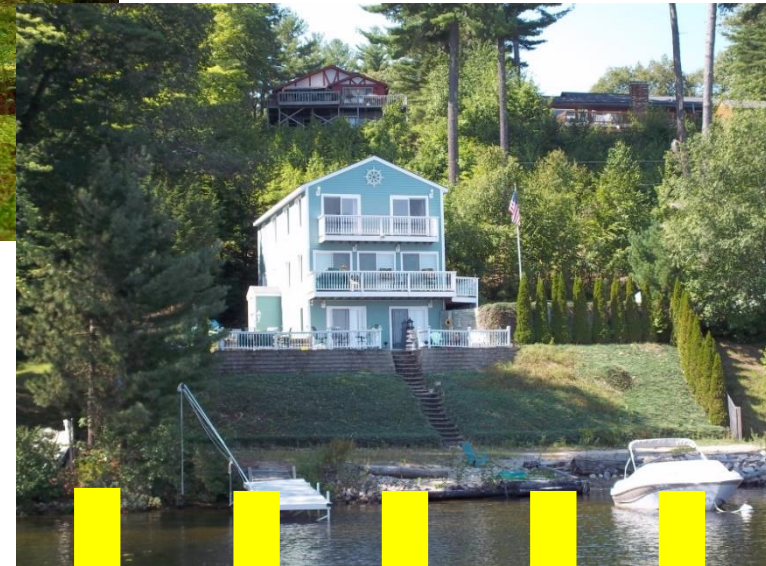
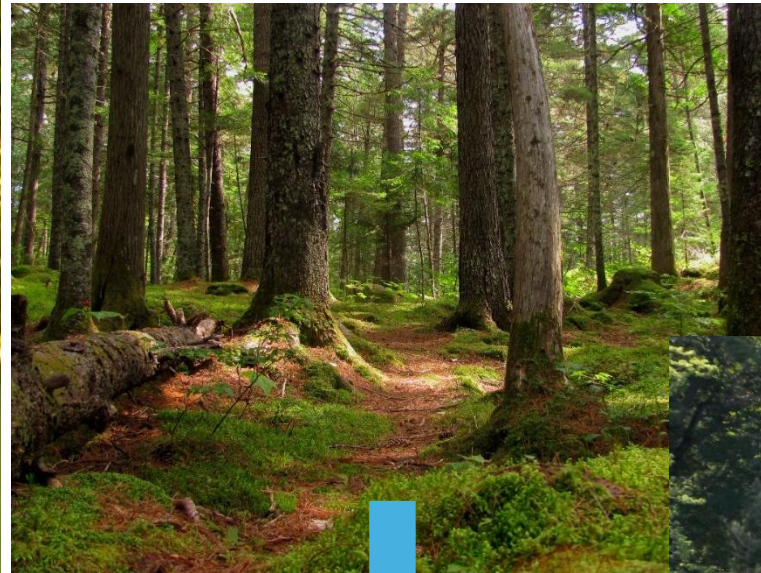
CONNECT THE WORLD

EXPERTS: GLOBAL TEMPERATURES BROKE RECORDS IN JULY
Findings from European Union's Copernicus Climate Change Service

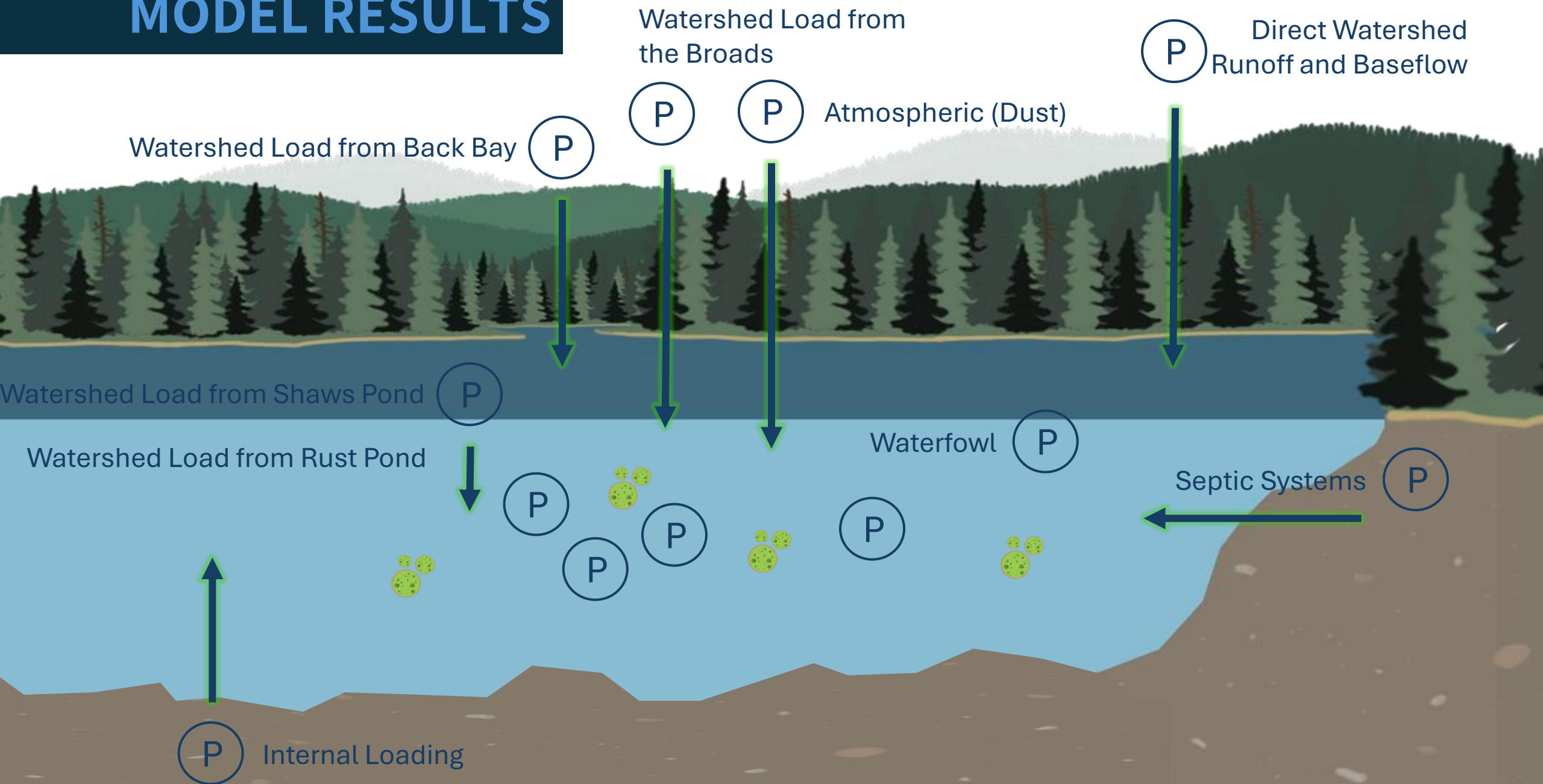


10

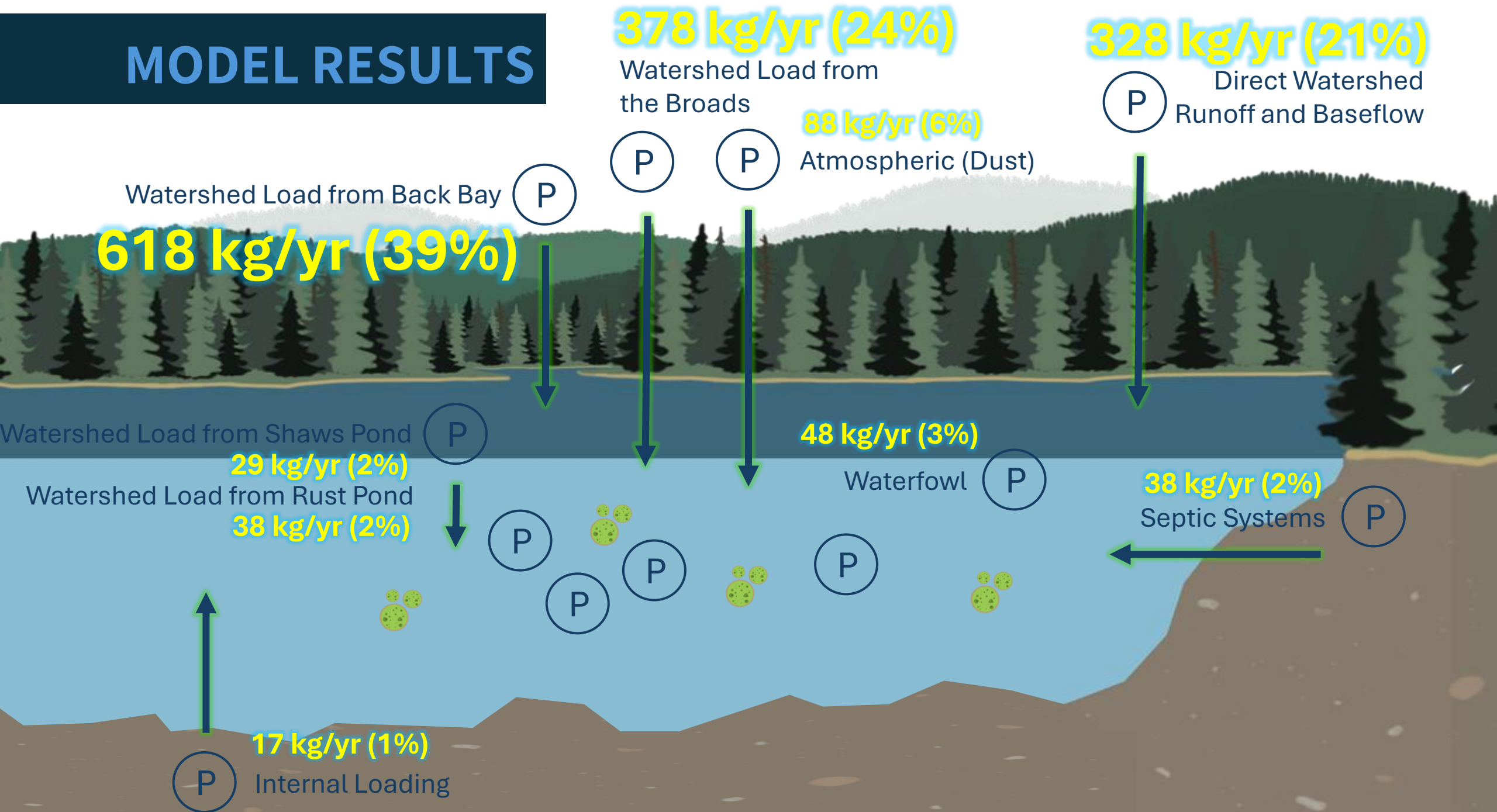
TIMES THE AMOUNT OF
PHOSPHORUS



MODEL RESULTS

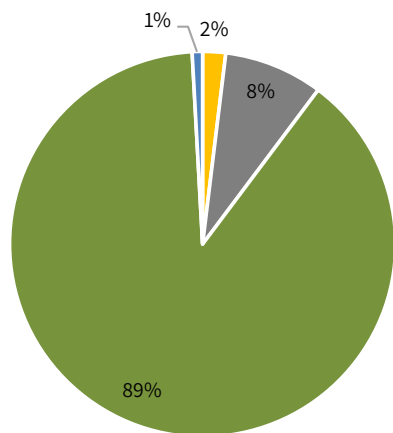


MODEL RESULTS

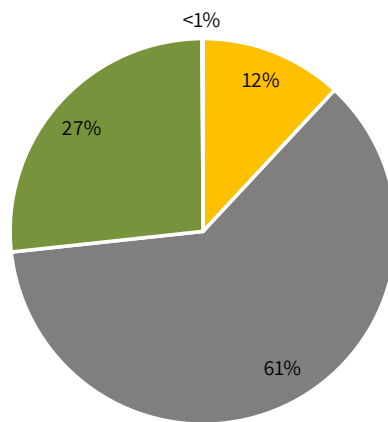


MODEL RESULTS

Watershed Land Cover Area



TP Load By Land Cover Type

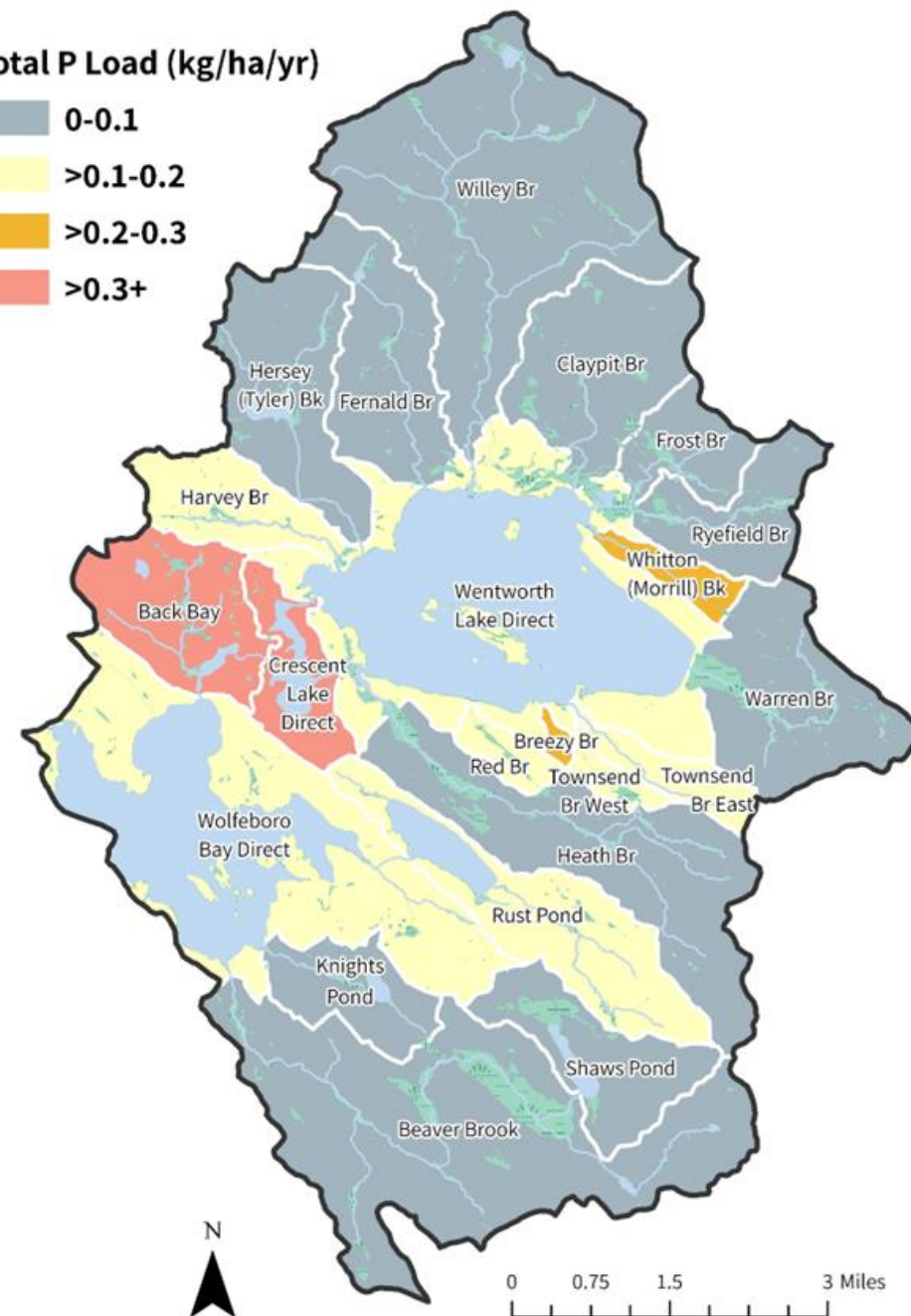
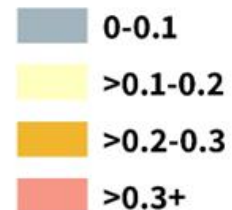


■ Agriculture ■ Developed ■ Forest ■ Water/Wetlands

■ Agriculture ■ Developed ■ Forest ■ Water/Wetlands

Developed land covers 8% of the Wolfeboro Bay watershed but contributes 61% of the TP load to Wolfeboro Bay.

Total P Load (kg/ha/yr)



IDENTIFYING SOURCES OF PHOSPHORUS



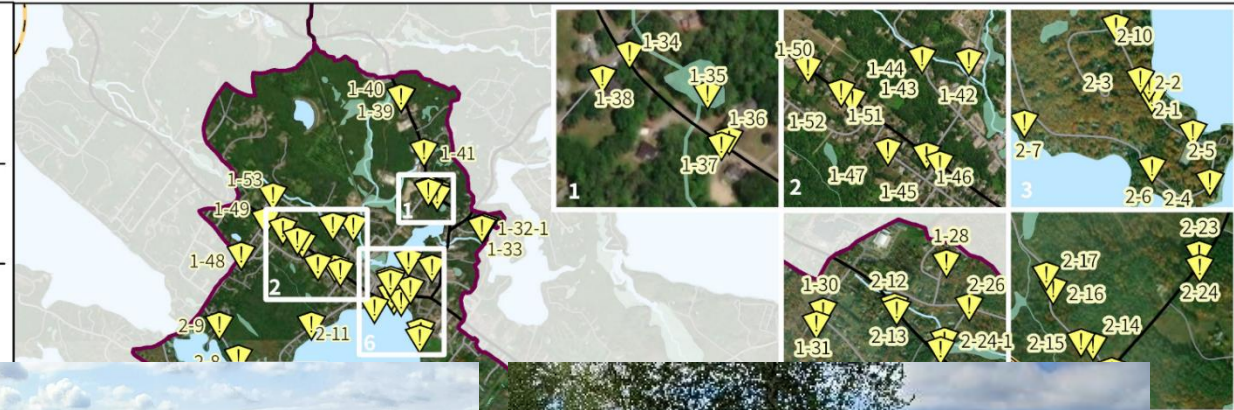
WATERSHED SURVEY

90 problem sites documented

Wolfeboro Bay Watershed Based Management Plan

Watershed Survey Results

-  Lake Wentworth Watershed
-  Wolfeboro Bay Watershed
-  Town Boundary



WATERSHED SURVEY

Figure 3. Wolfeboro Town Docks and Boat Ramp Conceptual Design



HARD EDGE BIORETENTION



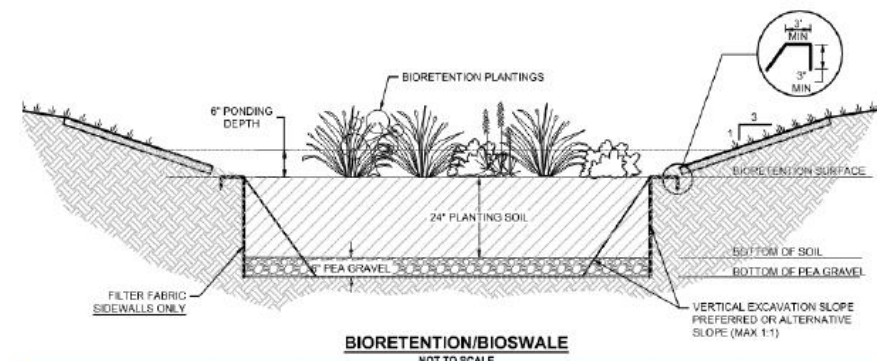
Bioretention (Credit: HW)



Bioretention basin
(Credit: HW)



Volunteer planting day
(Credit: HW)



Bioretention Typical Section
(Credit: HW)

WATERSHED SURVEY

Figure 5. Back Back Boat Launch Conceptual Design



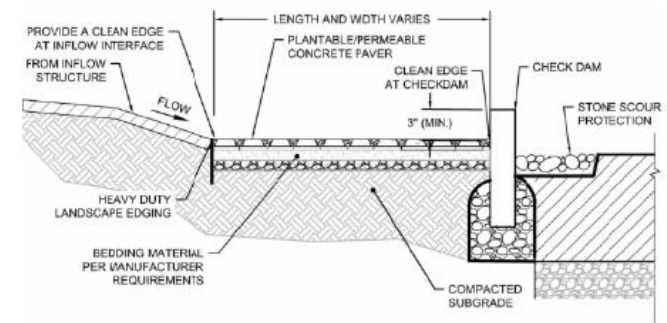
Rain Garden
(Credit: HW)



Sediment forebay with paver mat and level spreader
(Credit: HW)



Boat ramp with concrete dip diverting runoff to bioretention
(Credit: HW)



Sediment Forebay Typical Section
(Credit: HW)

WATERSHED SURVEY

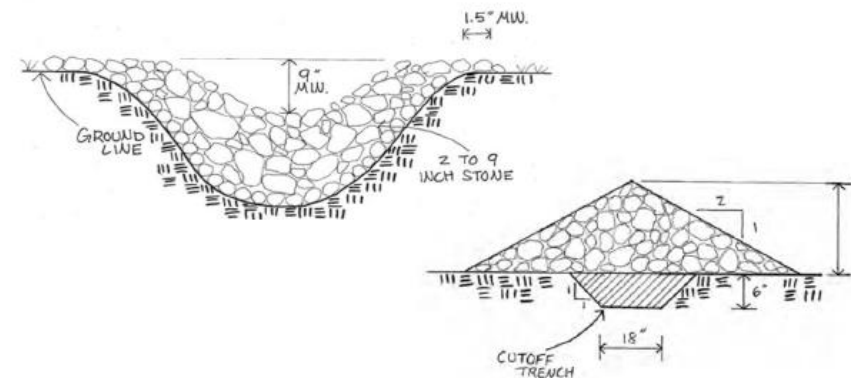
Figure 7. South Main St at Abenauke Dr Conceptual Design



Rock-lined swale
(Source: VT Dept of Environmental Conservation)



Grass swale with stone check dams
(Source: LakeSuperiorStreams.org)



Stone Check Dam Typical Sections
(Source: Vermont Better Roads Manual, January 2024)

SHORELINE SURVEY

- 497 parcels evaluated
- Each parcel assessed for vegetated buffer, presence of bare soil, extent of shoreline erosion, distance of structures to the lake, and slope
- 60% (294) of shoreline parcels showed conditions that may be detrimental to water quality



BUILD-OUT ANALYSIS

“Full Build-out” is a theoretical condition which represents the period when all “developable” land has been developed to the maximum conditions permitted by local ordinances.

Accounts for:

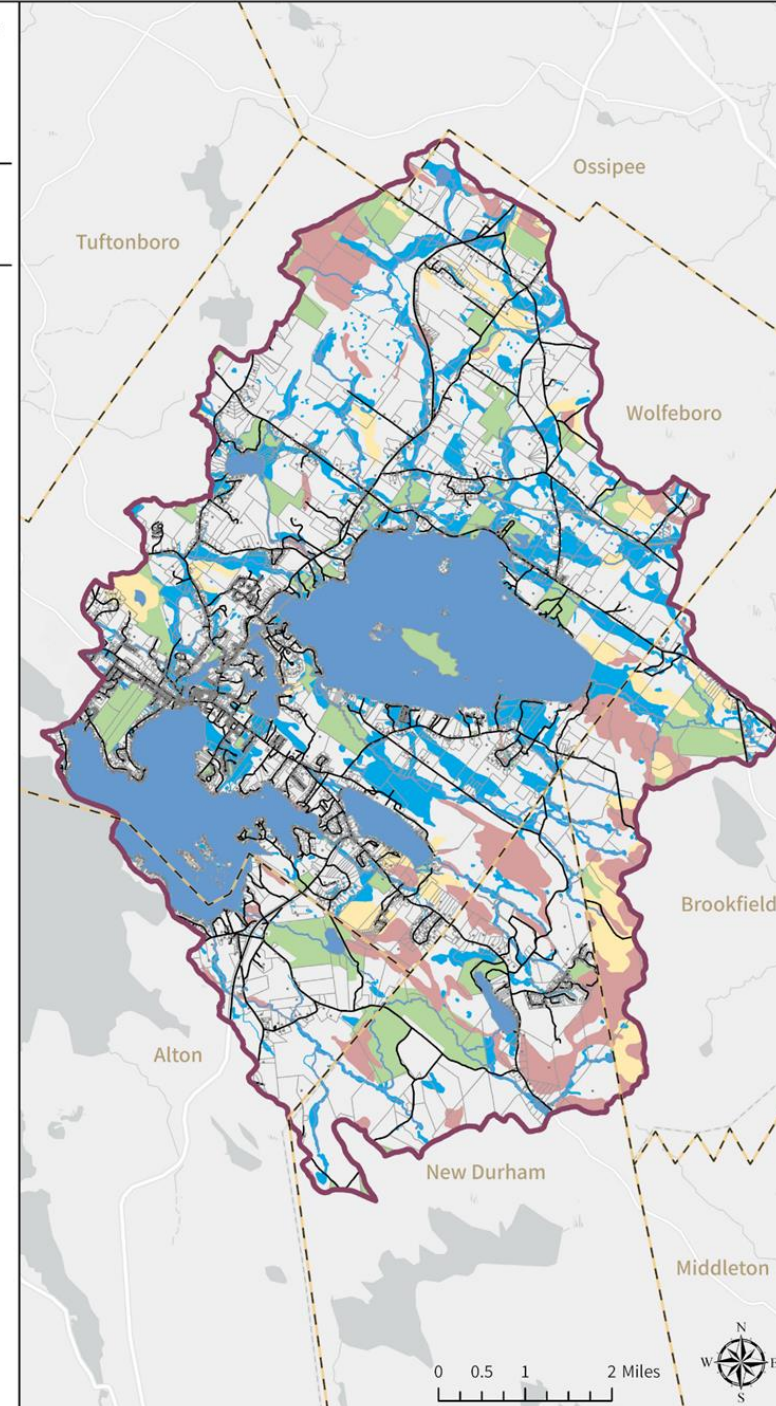
- Existing Buildings
- Conserved Land
- Water, Wetlands
- Hydric Soils
- Steep Slopes
- Current Zoning (minimum lot size, setbacks)

Wolfeboro Bay

Watershed Based
Management Plan

Development Constraints

- Town Boundary
- Watershed
- River/Stream
- Waterbody
- Road
- Parcel Boundary
- Existing Buildings (3,314)
- Conservation Land
- Waterbody/Stream/
Wetland Constraints
- 20-25% Slope
- >25% Slope



Data Source: NH GRANIT, ESRI, NHD, NWI
Coordinate System: NAD 1983 State Plane
NH FIPS 2800 ft
Map Created By: C. Bunyon
FB Environmental
Date Created: November 2023

BUILD-OUT ANALYSIS

57% of the watershed area is buildable:

56% of the direct watershed

58% of Lake Wentworth/Crescent Lake watershed

Wolfeboro Bay

Watershed Based
Management Plan

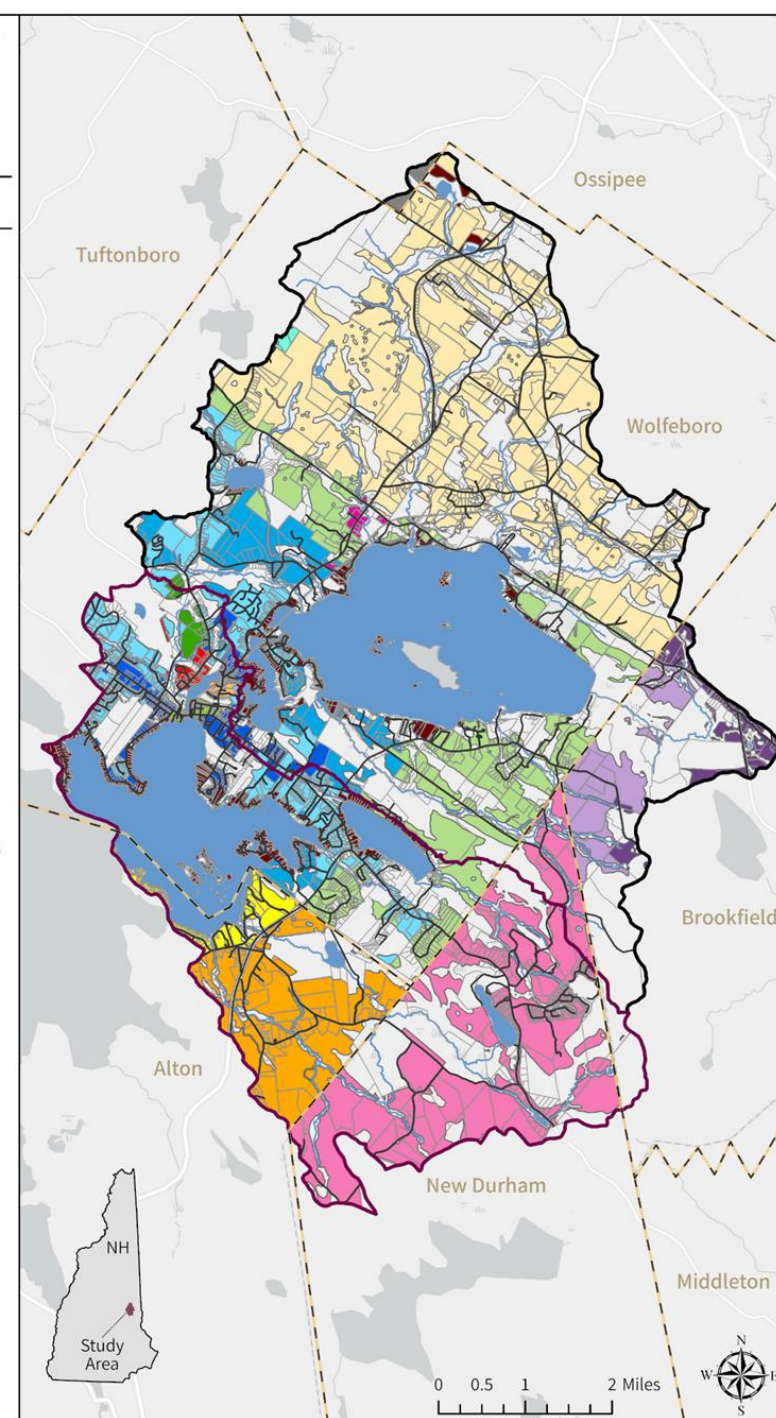
Buildable Area

- Wolfeboro Bay Direct Watershed
- Lake Wentworth Watershed
- Town Boundary
- River/Stream
- Waterbody
- Road
- Parcel Boundary

Buildable Area by Zone (total acres)

- Alton: Lakeshore Residential
- Alton: Rural
- Brookfield: Residential Workforce Housing
- Brookfield: Residential-Agricultural
- New Durham: Residential/Agricultural
- Ossipee: Rural
- Wolfeboro: Bay Street Limited Business
- Wolfeboro: Commercial Business
- Wolfeboro: General Residential
- Wolfeboro: Center Street/Rte. 28 Mixed-Use Business
- Wolfeboro: Municipal Watershed
- Wolfeboro: Pine Hill Road Development
- Wolfeboro: Residential
- Wolfeboro: Residential/Agricultural
- Wolfeboro: Rural Residential
- Wolfeboro: Shore Front Residential
- Wolfeboro: South Wolfeboro Limited Business
- Wolfeboro: Village Residential
- Wolfeboro: Wolfeboro Falls Limited Business

Data Source: NH GRANIT, ESRI, NHD, NWI
Coordinate System: NAD 1983 State Plane
NH FIPS 2800 ft
Map Created By: C. Bunyon
FB Environmental
Date Created: November 2023



BUILD-OUT ANALYSIS

Existing Buildings:

- 3,314

Projected Buildings:

- 5,418
- Most are in New Durham's Residential / Agricultural District and Wolfeboro's Residential District

TimeScope Analysis:

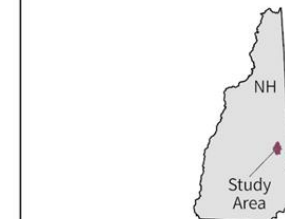
- Full build-out could occur as early as 2070 (based on 50-year compound annual growth rate)

Wolfeboro Bay

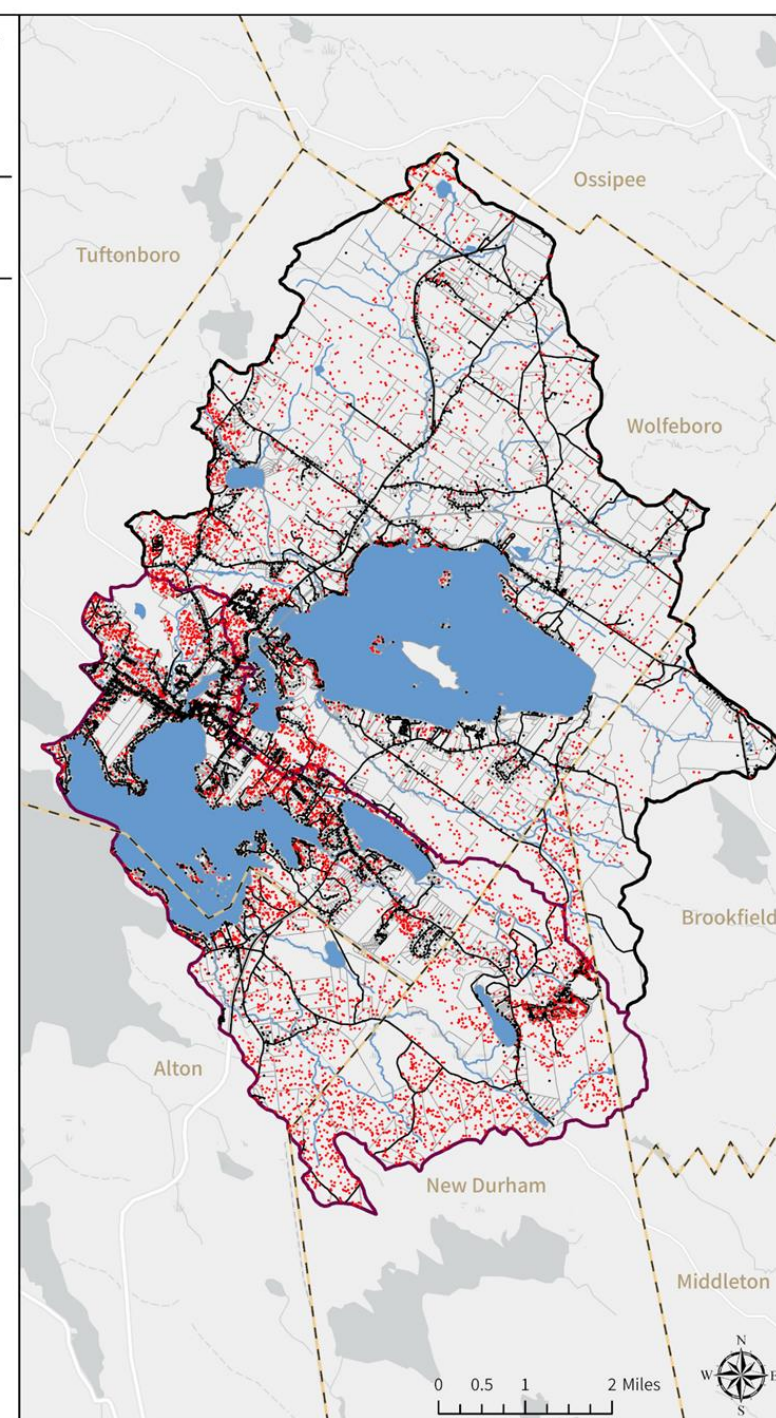
Watershed Based
Management Plan

Projected Buildings

- Wolfeboro Bay Direct Watershed
- Lake Wentworth Watershed
- Town Boundary
- River/Stream
- Waterbody
- Road
- Parcel Boundary
- Existing Buildings (3,314)
- Projected Buildings (5,418)



Data Source: NH GRANIT, ESRI, NHD, NWI
Coordinate System: NAD 1983 State Plane
NH FIPS 2800 ft
Map Created By: C. Banyon
FB Environmental
Date Created: March 2024



WQ GOAL & OBJECTIVES

The goal of the Wolfeboro Bay WMP is **to improve the water quality of Wolfeboro Bay** such that it continues to meet state water quality standards for the protection of Aquatic Life Use and substantially **reduces the likelihood of harmful cyanobacteria blooms** in the lake.

Layman's Terms: No Lake Blooms, Deep Clarity, Healthy Aquatic Life

WQ GOAL & OBJECTIVES

Objective 1: Reduce pollutant loading from existing development by **9.4% (149 kg/yr) to Wolfeboro Bay.**

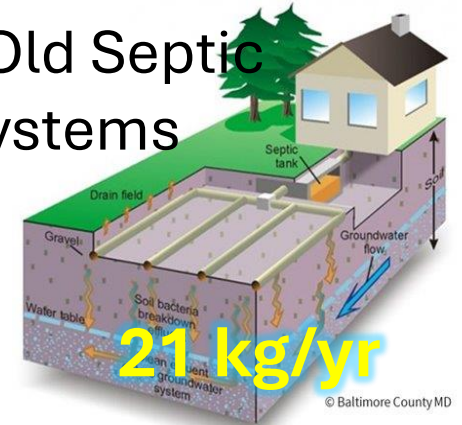


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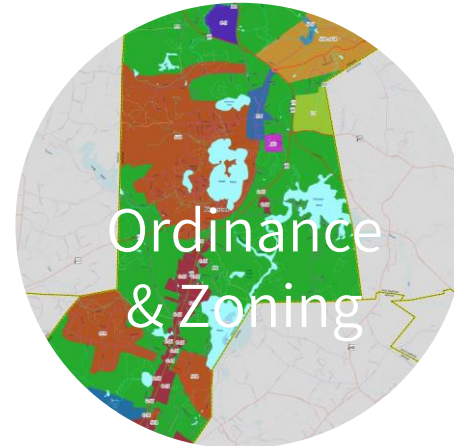
211 Old Septic
Systems



**149.2 kg/yr to
Wolfeboro Bay**

WQ GOAL & OBJECTIVES

Objective 2: Mitigate (prevent or offset) pollutant loading from future development by **203 kg P/yr to Wolfeboro Bay.**



THE ACTION PLAN: MONITORING

- ✓ Continue baseline monitoring
- ✓ Consider expanding lake monitoring frequency in the summer and at turnover periods
- ✓ Consider expanding tributary monitoring
- ✓ Consider collecting winter data under the lake ice



THE ACTION PLAN: STORMWATER

- ✓ Stabilization, infiltration
- ✓ Landscaping, erosion control



Reduce, divert, and infiltrate surface runoff.



Stabilize shoreline access points through vegetation or riprap.



Minimize and define parking areas and pathways.



Maintain shoreline, streamside, and wetland buffers.

Minimize pollutants (e.g., fertilizers, detergents, and other phosphorus-based products).



Photo credit: FBE, AWWA, SOAK UP the Rain, Open Clipart

THE ACTION PLAN: ROADS

- ✓ Municipal best practices
- ✓ Stormwater runoff and erosion control on roads and other town property
- ✓ Low road/driveway salting



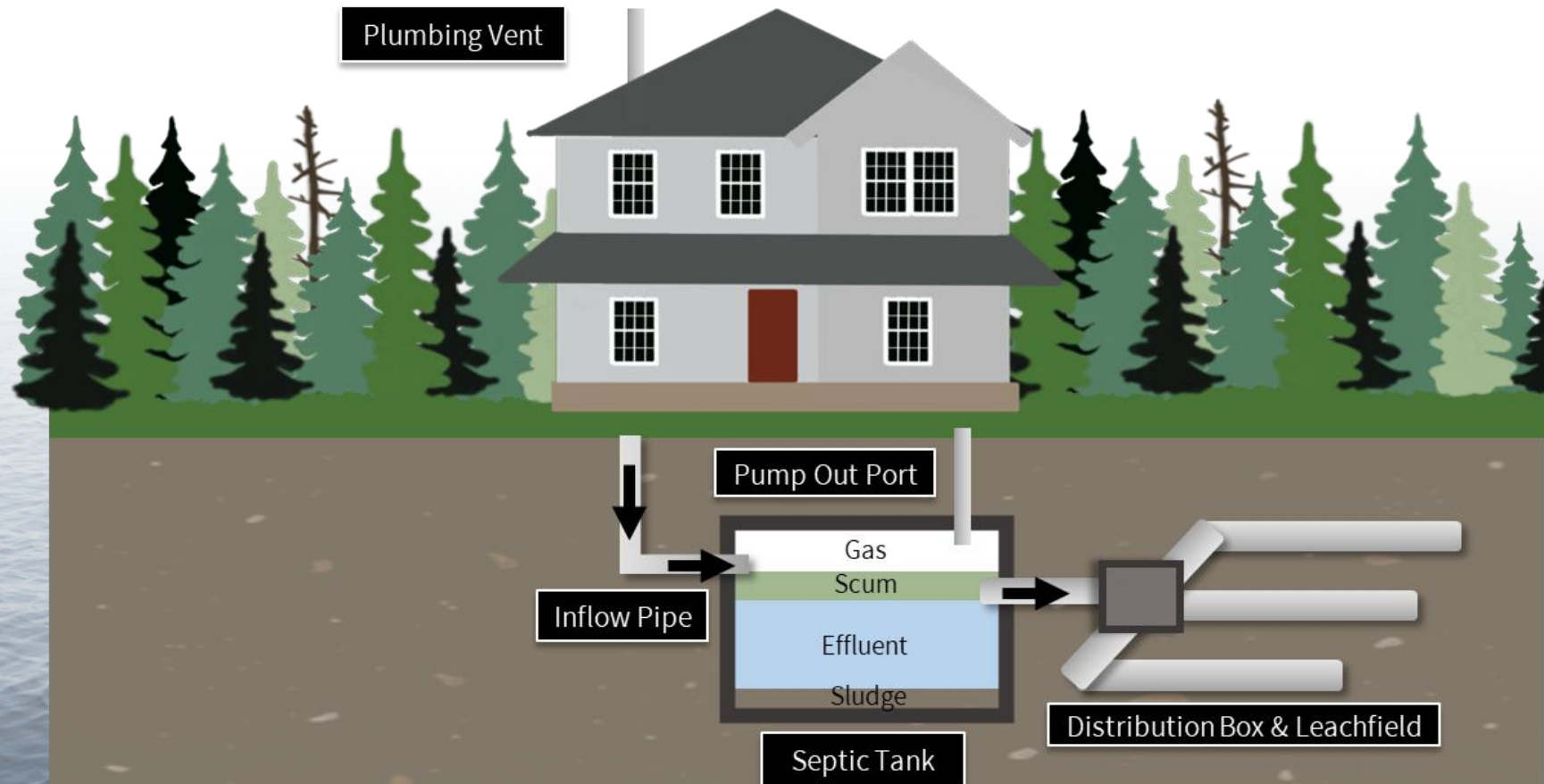
© Water Education Colorado



High Point, SEATTLE, WA
Credit: Seattle Public Utilities

THE ACTION PLAN: SEPTIC SYSTEMS

- ✓ Regular septic system inspections (every 3-5 years)
- ✓ Regular pump outs when the scum layer is as thick as $\frac{1}{3}$ of the effluent layer (~ every 1-3 years)



THE ACTION PLAN: PLANNING & CONSERVATION

- ✓ Update ordinances and setbacks
- ✓ Land conservation



Download from
Dreamstime.com

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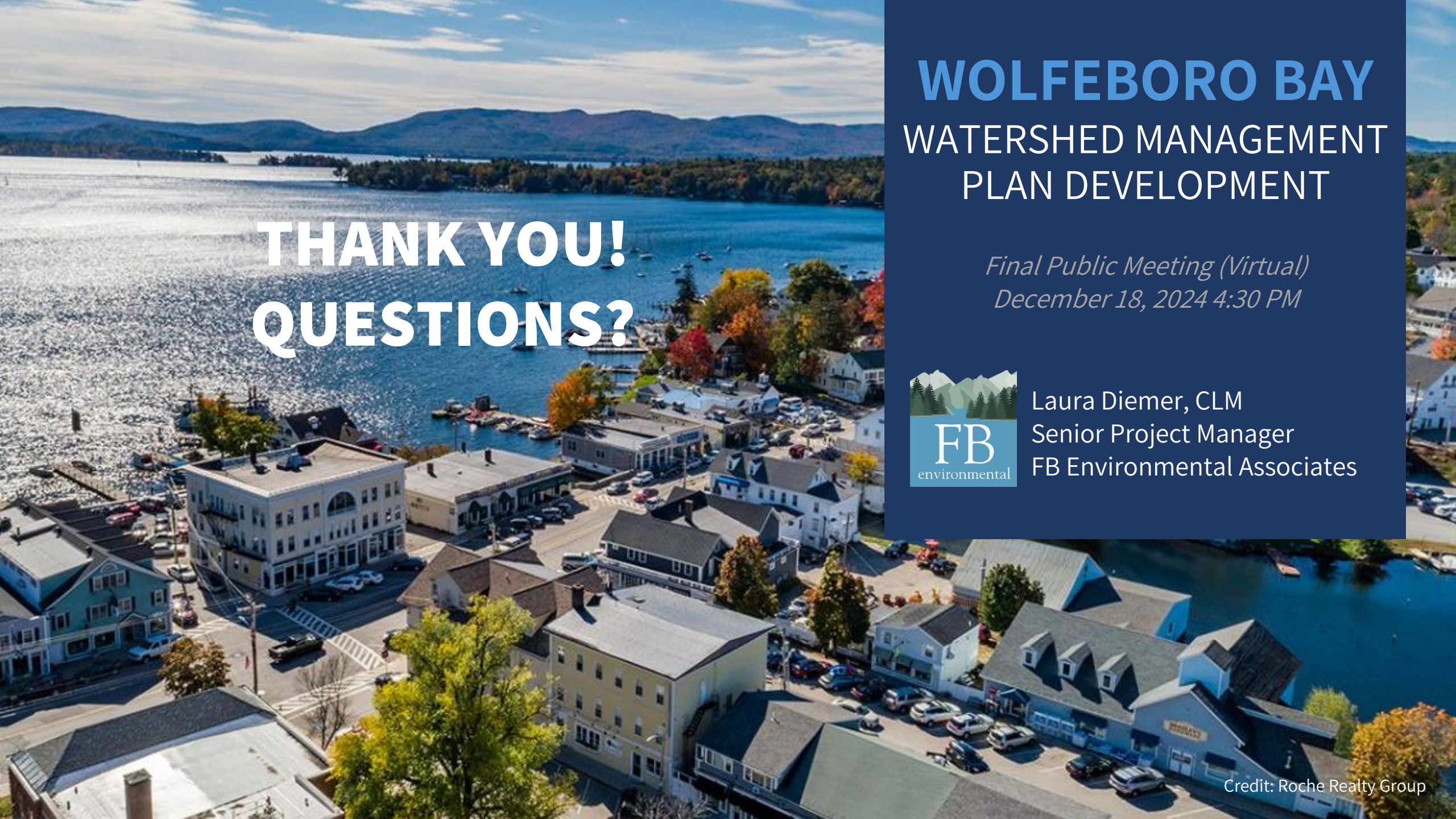
ID 14602918

Annette Boettcher | Dreamstime.com

THE ACTION PLAN: EDUCATION

- ✓ Share what you learn with your neighbors and help each other





**THANK YOU!
QUESTIONS?**

WOLFEBORO BAY WATERSHED MANAGEMENT PLAN DEVELOPMENT

*Final Public Meeting (Virtual)
December 18, 2024 4:30 PM*



Laura Diemer, CLM
Senior Project Manager
FB Environmental Associates

Credit: Roche Realty Group