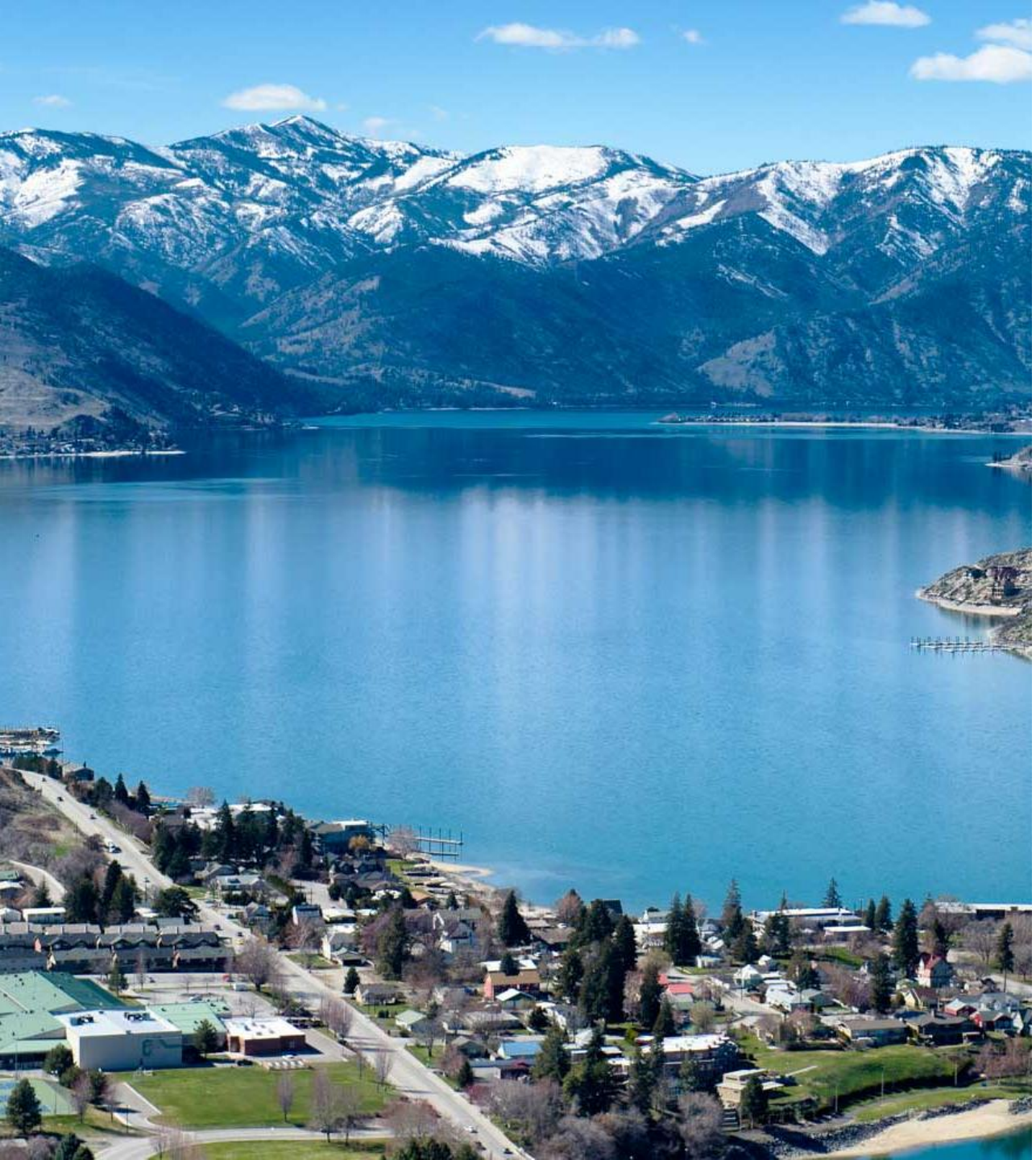
LAKE CHELAN COLLABORATIVE

MEETING 2 – LAKE CHELAN WATERSHED RESTORATION PLAN

DECEMBER 3, 2025



Welcome and Overview

GRETCHEN MULLER,
CASCADIA

Meeting Objectives

- **Provide additional context for the planning goals, and how it ties into the previous watershed planning effort.**
- **Discuss and prioritize issues list.**
- **Walk through minor edits to the LCC Operating Principles and formally adopt.**
- **Share a technical presentation on water quality issues.**

Meeting Agenda

Agenda Item
Welcome and Agenda Overview
Watershed Planning Approach
Group Activity: Issue List and Prioritization
BREAK
Group Discussion: Results of Issue Prioritization
Group Action: Adopt Operating Principles
Technical Presentation: Water Quality (Anchor QEA)
Wrap Up & Timely Topics

Introductions and Icebreaker

Share:

- **Name and affiliation**
- **Favorite winter activity in basin**

Online Resources

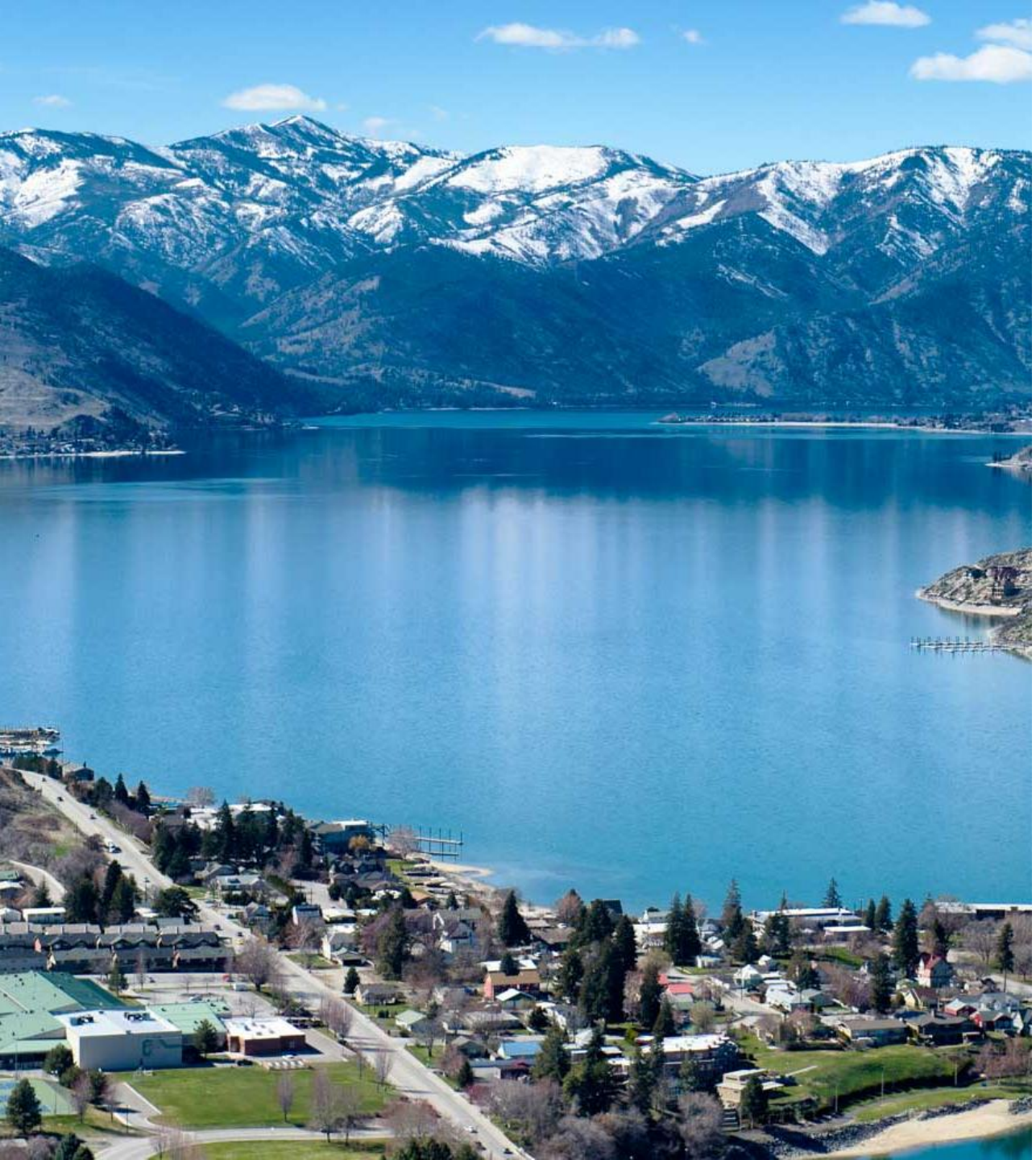
County website with meeting materials and schedule.

https://www.co.chelan.wa.us/natural-resources/pages/watershed-plan-lake-chelan

Online SharePoint folder for saving background resources

Lake Chelan Collaborative Resources folder

- Please reach out if you have resources you would like to share with the group.



Watershed Planning Approach

KELSEY MACH,
ASPECT CONSULTING

2012 Watershed Plan

- Saved in shared resource folder
- Nexus behind plan was RCW 90.082
- Legislature made funding available for Ecology to issue grants and outlined specific requirements for watershed plan development.
- Lake Chelan Watershed Planning Unit was convened to author 2012 Watershed Plan and 2014 Detailed Implementation Plan

The following entities are members of the WRIA 47 LCWPU.

- Chelan County
- City of Chelan
- Lake Chelan Reclamation District
- Chelan County PUD #1
- Chelan-Douglas Health District
- Washington Department of Ecology (Ecology)
- Washington Department of Fish and Wildlife
- Washington Department of Health
- Washington Department of Natural Resources
- US Army Corps of Engineers
- US Forest Service
- Interested individuals

2012 Watershed Plan

The development of such plans serves the state's vital interests by ensuring that the state's water resources are used wisely, by protecting existing water rights, by protecting instream flows for fish, and by providing for the economic well-being of the state's citizenry and communities. Therefore, the legislature believes it necessary for units of local government throughout the state to engage in the orderly development of these watershed plans.

- **Recommended actions related to water quantity, water quality (including some AIS) and fish habitat.**
- **The new watershed plan will build off the findings and recommendations from the 2012 plan.**

Why Now—Why a New Plan?

- **Timing** – it's been >10 years, more knowledge related to issues in previous plan, and new emerging issues
- **Group diversification** – this planning effort intends to incorporate additional stakeholder representation
- **Funding availability** – developing a plan under the Bureau of Reclamation WaterSMART program will hopefully lead to implementation funding availability through federal or other programs
  - WaterSMART Environmental Water Resources Projects | Bureau of Reclamation

Background on WaterSMART Program

- Public Land Management Act of 2009, Section 6001-6003 Subtitle A, Cooperative Watershed Management Program
- CWMP Fact Sheet
- Example Restoration Plans | Cooperative Watershed Management Program

The Cooperative Watershed Management Program (CWMP) contributes to the WaterSMART strategy by providing funding to watershed groups to encourage diverse stakeholders to form local solutions to address their water management needs. The purpose of the CWMP is to improve water quality and ecological resilience, conserve water, and reduce conflicts over water through collaborative conservation efforts in the management of local watersheds.

WaterSMART Grant Application Focus

- **Effectively engage broad stakeholder participation in understanding the resource needs in the Lake Chelan Watershed and then working together to identify priority issues and strategies to address those issues.**
- **Identify and prioritize major challenges to water supply, water quality, and other resource concerns in Lake Chelan.**
- **Identify and develop restoration project ideas and critical data gaps.**
- **Develop a schedule and milestones, likely funding sources, priority projects, outreach and monitoring components as part of the implementation matrix.**

What Will This Watershed Plan Look Like?

- **Describe Lake Chelan issues and prioritization approach**
- **For each issue**
  - Problem statement
  - Desired outcome/goals
  - Current understanding/background
  - Data gaps/emerging issues
  - Projects to address issue and/or data gaps
  - Funding needs and opportunities
- **Detailed and prioritized project implementation matrix**
  - Sponsor, cost, feasibility, schedule, funding opportunities, permitting and operational requirements, administrative requirements, interim milestones

Key Issues from Grant Application

Water Supply/Water Rights

A primary focus of the Lake Chelan Collaborative will be to understand the water supply challenges and develop durable solutions to address future needs in the watershed

Water Quality

Focus on near-shore, DDT, PCBs, nutrient loading/algae growth, benzene, post-fire effects

AIS

Reduce risk of QZ establishment and proactive management of existing AIS

Forest Health

Targeted locations and treatments to reduce risk of catastrophic wildfire

Approach for Watershed Plan Development

- ✓ Technical presentations and group discussions guide content of Watershed Plan
- ✓ Technical subcommittees as needed – ex. AIS subcommittee
- ✓ Consultant team will develop plan content between meetings with support from LCC members
- ✓ LCC reviews and provides input into Watershed Plan outline and draft Watershed Plan
- ✓ LCC adopts Watershed Plan

Meetings Overview

Meetings 1-2

- Operating principles
- Issue identification and prioritization
- LCC goal and vision setting
- Public outreach planning

Meetings 3-5

- Topic specific technical presentations and discussions
- Subcommittee formation/meetings

Meetings 6-7

- Prioritization of projects
- Plan outline
- Additional public outreach planning

Meeting 8-9

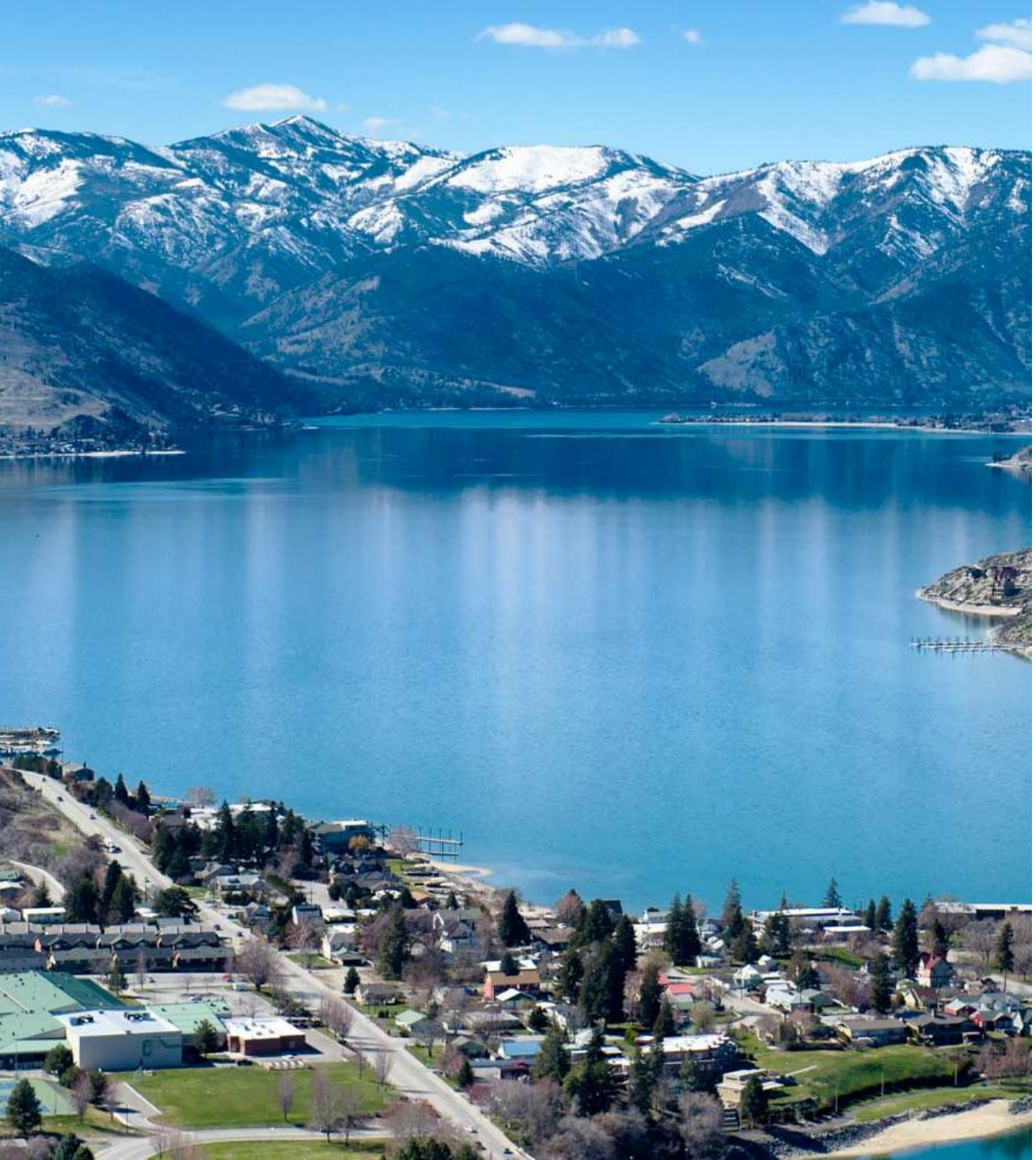
- Refinement and finalizing watershed plan

Proposed Format for Technical Presentations

- **Water quality is first later today**
- **Future topics based on prioritization and group input**
- **Standard presentation outline**
  - Recommendations from previous planning efforts (if relevant)
  - Current understanding/background
  - Data gaps
  - Problem statement
  - Desired outcome/goals
  - Actions to address issue or data gaps

Group Discussion

- **Clarifying questions/reflections?**
- **What planning horizon makes sense for this plan?**
  (5 yrs, 10 yrs, 20 yrs, etc?)



Issues List and Prioritization

Issue List and Prioritization

#	Primary Category	Issue
1	Agriculture	Irrigation district consolidation
2	AIS	Aquatic invasive species proactive management and control
3	Fishery health/management	Fish populations - Bull Trout Reintroduction, Kokanee, land locked Chinook
4	Fishery health/management	Fish habitat restoration
5	Recreation	Recreational impacts (BTEX, wave generation, noise)
6	Recreation	Recreational access
7	Water Quality	Roses Lake nutrient impacts/algal blooms
8	Water Quality	DDT and relic toxics in fish from ongoing agricultural drainage
9	Water Quality	Holden Mine compensatory habitat restoration opportunities (Railroad Creek)
10	Water Quality	Lake stratification/Lake dynamics/Lake water temperature
11	Water Quality	Trash accumulation
12	Water Quality	Microplastics and emerging toxics (e.g. PFAS)
13	Water Quality	Nutrient loading and nearshore algal accumulations
14	Water Quality	Forestry management impacts to lake water quality
15	Water Quality/Recreation	Water fowl populations and pathogens (e.g. swimmers itch)
16	Water Supply	Long term water supply
17	Watershed health	Land use change management
18	Watershed Health/Water Quality	Forest fire prevention and management
19	Watershed health	ESA Listed or Other Species/ Reintroduction (Western Gray Squirrels, Beavers)

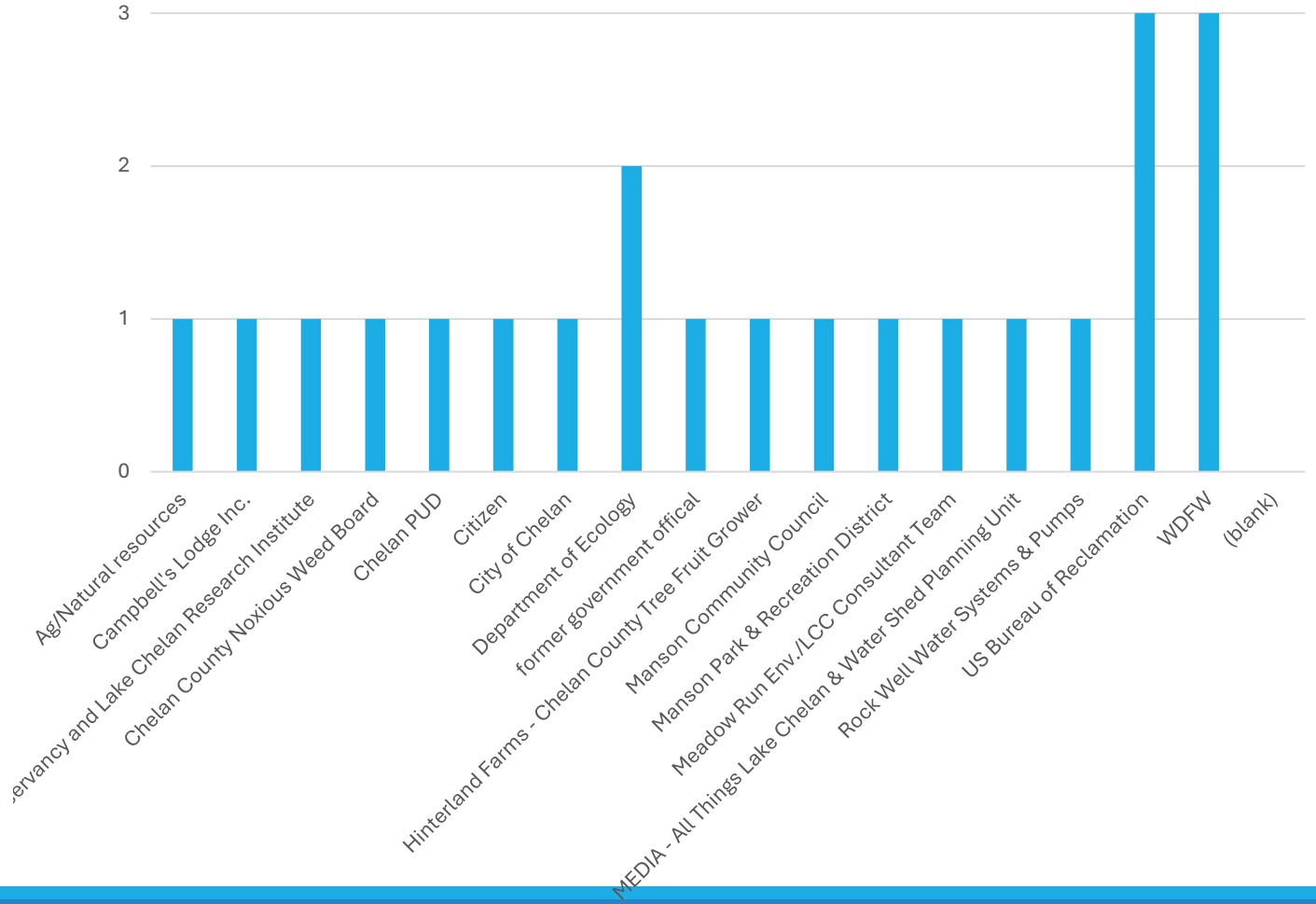
- **59 “issues” distilled into 19 categories**
- **Group Discussion**
  - Missing “issues” or issue categories?

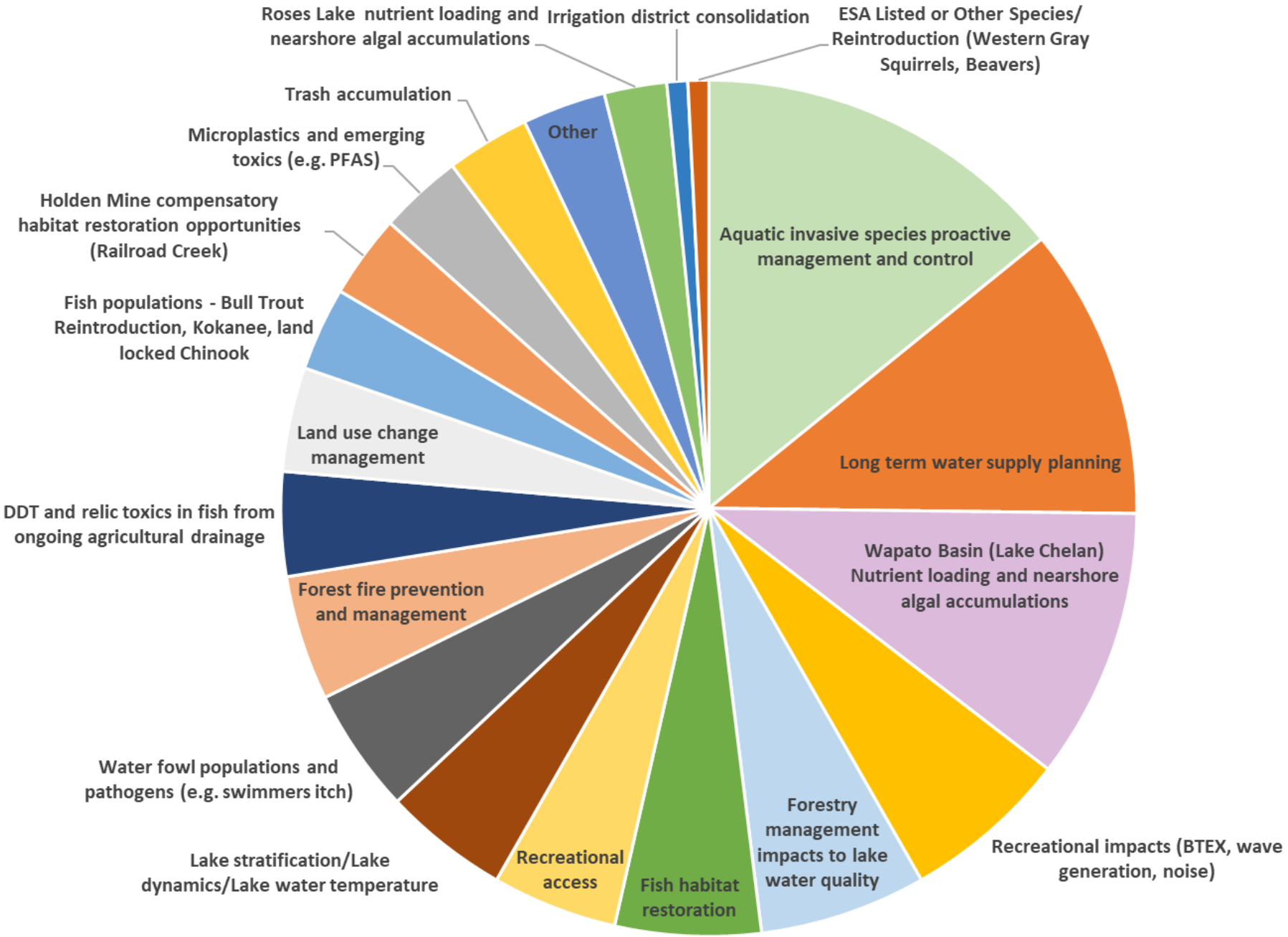
Prioritization Approach

- **Will help guide future technical presentation and discussion topics**
- **Prioritization may evolve throughout the planning process**
- **Meetings 1-5 to focus on issues deep-dives and Meetings 6-7 to focus on project identification/prioritization**

Results from Online Survey

- **22 responses**




Roses Lake nutrient loading and nearshore algal accumulations
Irrigation district consolidation
ESA Listed or Other Species/ Reintroduction (Western Gray Squirrels, Beavers)
Trash accumulation
Other
Microplastics and emerging toxics (e.g. PFAS)
Holden Mine compensatory habitat restoration opportunities (Railroad Creek)
Fish populations - Bull Trout Reintroduction, Kokanee, land locked Chinook
Land use change management
DDT and relic toxics in fish from ongoing agricultural drainage
Forest fire prevention and management
Water fowl populations and pathogens (e.g. swimmers itch)
Lake stratification/Lake dynamics/Lake water temperature
Recreational access
Fish habitat restoration
Forestry management impacts to lake water quality
Recreational impacts (BTEX, wave generation, noise)
Wapato Basin (Lake Chelan) Nutrient loading and nearshore algal accumulations
Long term water supply planning
Aquatic invasive species proactive management and control

Group Activity on Prioritization (In-Person and Online)

Key considerations for prioritization

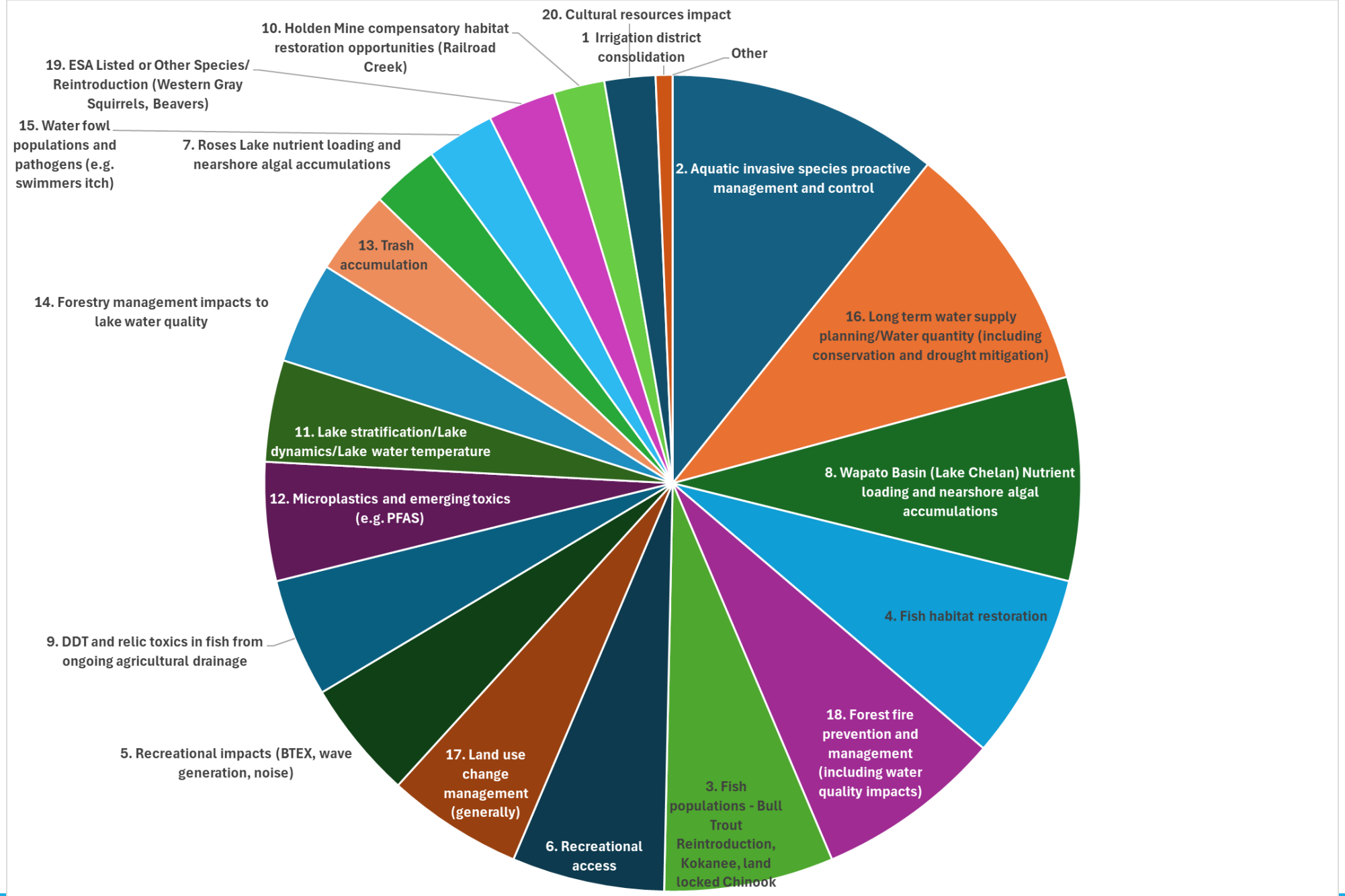
- **Time sensitive/critical path**
  Potential for negative impact to human health or environment in short term (<5 years) if not addressed
- **Co-benefits**
  Benefitting multiple categories: fish, recreation, health and safety, tribal interests, etc.
- **Community support**
  Clear public consensus/generally easy to communicate to the public
- **Local benefit**
  Potential for positive impact on recreation, local economy, human health/generally benefits population centers or major recreation hubs
- **Need for support**
  Currently not being addressed by other groups or regulatory framework
- **Known funding opportunities**

#	Issue
1	Irrigation district consolidation
2	Aquatic invasive species proactive management and control
3	Fish populations - Bull Trout Reintroduction, Kokanee, land locked Chinook
4	Fish habitat restoration
5	Recreational impacts (BTEX, wave generation, noise)
6	Recreational access
7	Roses Lake nutrient impacts/algal blooms
8	DDT and relic toxics in fish from ongoing agricultural drainage
9	Holden Mine compensatory habitat restoration opportunities (Railroad Creek)
10	Lake stratification/Lake dynamics/Lake water temperature
11	Trash accumulation
12	Microplastics and emerging toxics (e.g. PFAS)
13	Nutrient loading and nearshore algal accumulations (Lake Chelan)
14	Forestry management impacts to lake water quality
15	Waterfowl populations and pathogens (e.g. swimmers itch)
16	Long term water supply (water quantity, conservation and drought mitigation)
17	Land use change management
18	Forest fire prevention and management
19	ESA Listed or Other Species/ Reintroduction (Western Gray Squirrels, Beavers)
20	Cultural resource impact

Break

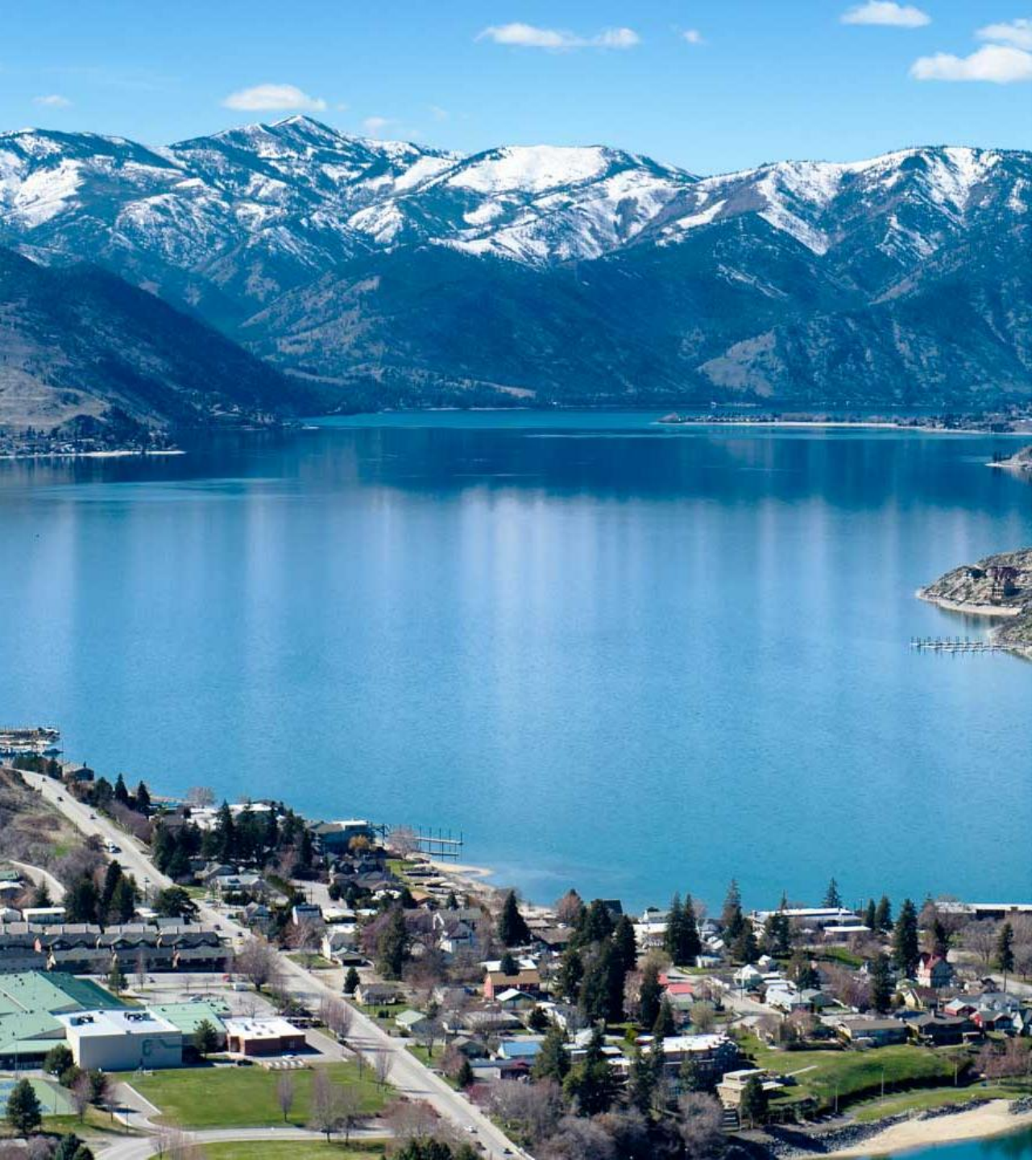
Group Discussion – Results of Issue Prioritization

- Group feedback/thoughts?


20. Cultural resources impact
10. Holden Mine compensatory habitat restoration opportunities (Railroad Creek)
1 Irrigation district consolidation
Other
19. ESA Listed or Other Species/ Reintroduction (Western Gray Squirrels, Beavers)
15. Water fowl populations and pathogens (e.g. swimmers itch)
7. Roses Lake nutrient loading and nearshore algal accumulations
2. Aquatic invasive species proactive management and control
13. Trash accumulation
16. Long term water supply planning/Water quantity (including conservation and drought mitigation)
14. Forestry management impacts to lake water quality
11. Lake stratification/Lake dynamics/Lake water temperature
8. Wapato Basin (Lake Chelan) Nutrient loading and nearshore algal accumulations
12. Microplastics and emerging toxics (e.g. PFAS)
4. Fish habitat restoration
9. DDT and relic toxics in fish from ongoing agricultural drainage
18. Forest fire prevention and management (including water quality impacts)
5. Recreational impacts (BTEX, wave generation, noise)
17. Land use change management (generally)
3. Fish populations - Bull Trout Reintroduction, Kokanee, land locked Chinook
6. Recreational access

Group Action: Adopt Operating Principles

- **Walk through of changes made**
  - Addressed comment to add reference development of Spanish speaking materials for outreach.
  - Added LCC member roster
- **Clarifying questions?**



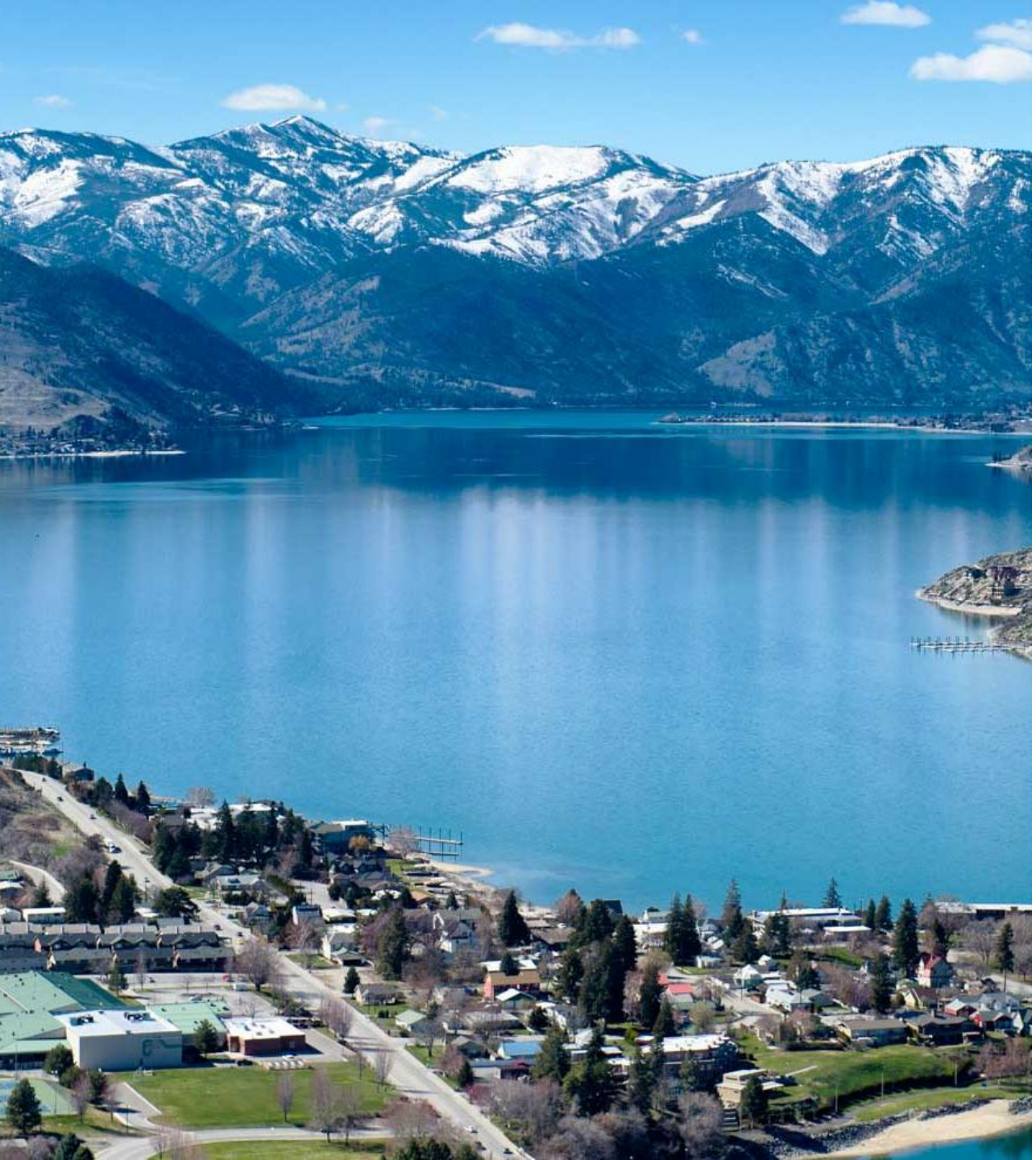
Technical Presentation

LAKE CHELAN WATER QUALITY

CLAY PATMONT, ANCHOR QEA

Water Quality Issues: September 2025 LCC Meeting

- DDT and relic toxics in fish from ongoing agricultural drainage
- Lake stratification/lake dynamics/lake water temperature
- Trash accumulation
- Microplastics and emerging toxics (e.g., PFAS)
- Nutrient loading and nearshore algal accumulations
- Forestry management impacts to lake water quality
- Waterfowl populations and pathogens (e.g., swimmers itch)
- Roses Lake nutrient impacts/algal blooms
- Holden Mine compensatory habitat restoration opportunity



2012 Watershed Plan

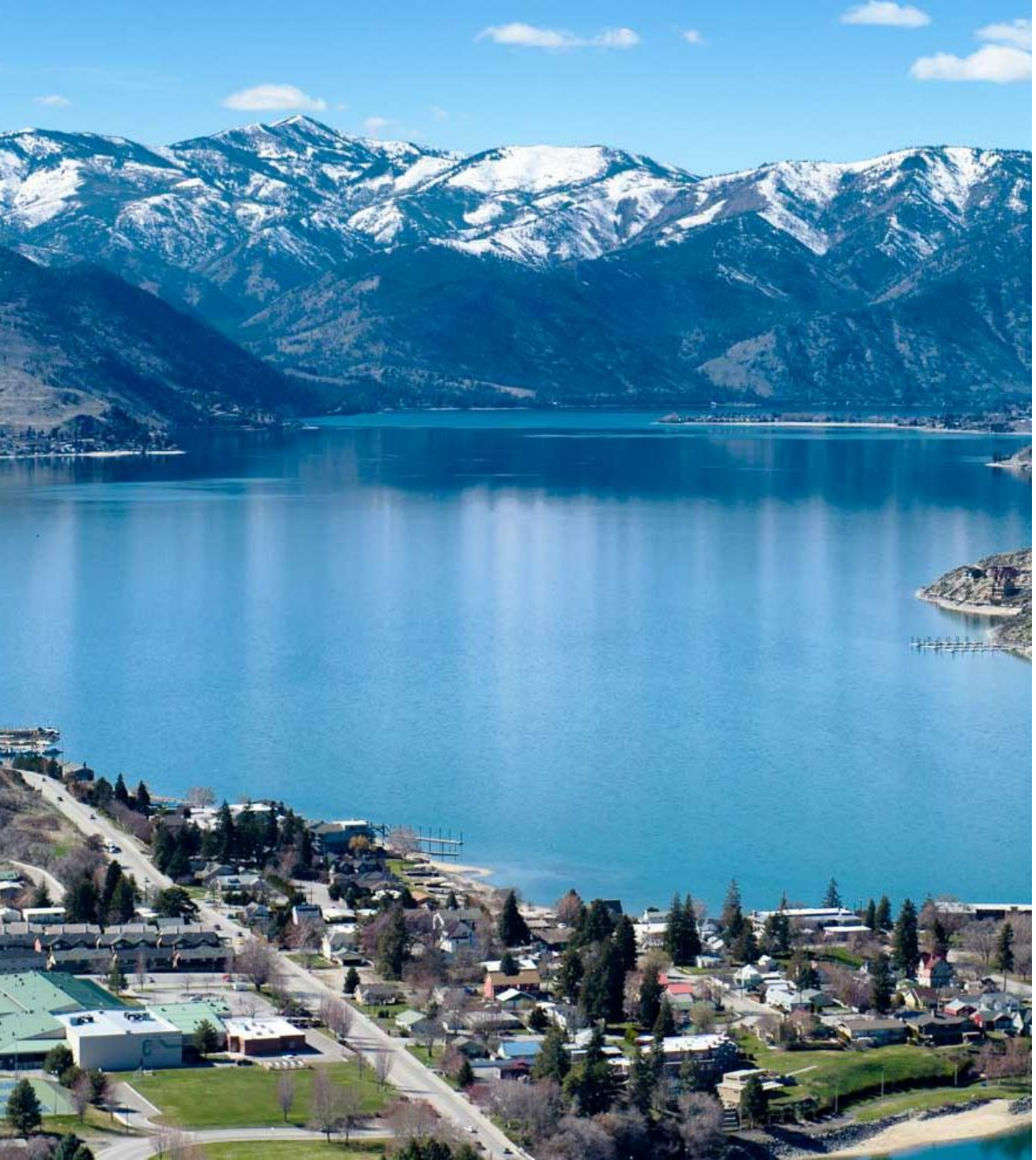
PREVIOUS RECOMMENDED ACTIONS

2012 Plan - Recommended Actions

- Implement comprehensive, long-term water quality monitoring
- Inform and educate communities about water quality protection
- Promote regulations to reduce unmanaged stormwater and sediment discharge
- Evaluate wastewater treatment improvements to reduce pathogens and nutrients
- Evaluate irrigation drain treatment to reduce nutrients and DDT (e.g., constructed wetlands)

Actions Following 2012 Plan

- **2013** - State-wide ban of phosphorus fertilizers
- **2016** - Lake Chelan Research Institute (LCRI) reinitiated routine lake monitoring
- **2016 to 2021** - Shoreline Management Act updates
- **2021** - Washington State Department of Ecology (Ecology) continued fish tissue DDT monitoring
- **2025** - Nearshore algae investigation (LCRI and Chelan PUD)
- **2025** - DDT investigation (LCRI, Chelan County, and Ecology)

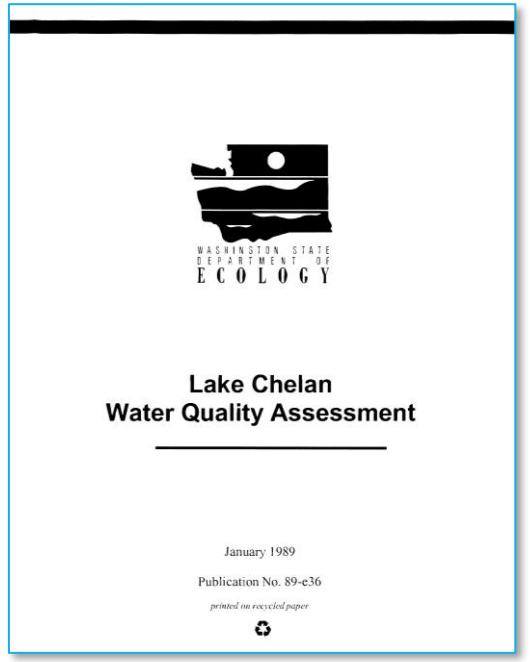


Current Understanding

KEY STUDIES AND REPORTS

Key Water Quality Studies and Reports

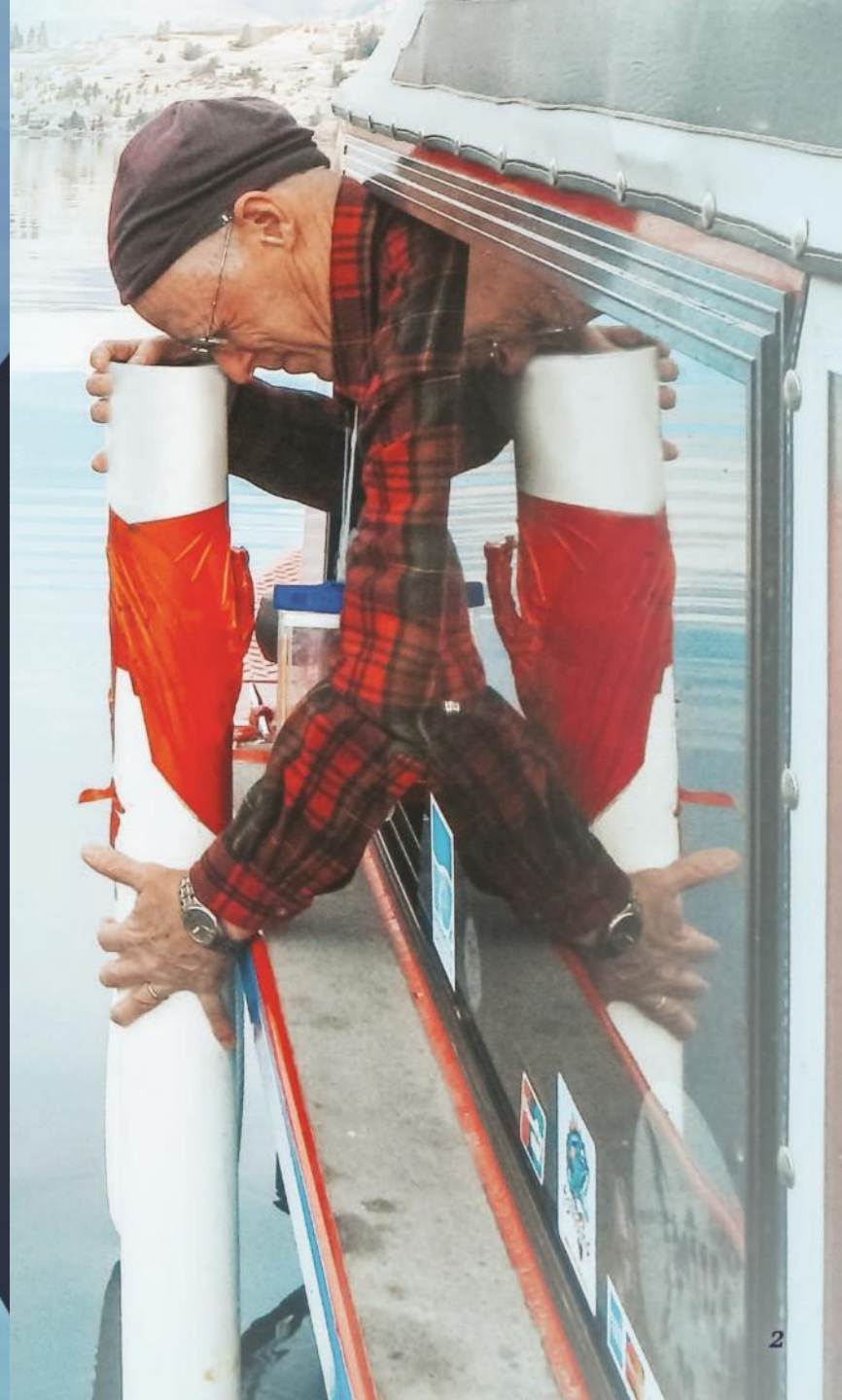
- **1989** - Lake Chelan Water Quality Assessment (Ecology)
- **1991** - Lake Chelan Phosphorus Total Maximum Daily Load (Ecology)
- **2004** - Manson Lakes Water Quality Assessment: Phosphorus and DDT (LCRD and Ecology)
- **2005** - Lake Chelan DDT/PCB Total Maximum Daily Load (Ecology)
- **2021** - Lake Chelan State of the Lake (LCRI)
- **2026 (*pending*)** - Lake Chelan Nearshore Algae (LCRI and Chelan PUD)
- **2026 (*pending*)** - Lake Chelan DDT (LCRI, Chelan County, and Ecology)



2021 State of The Lake Report

LAKE CHELAN, WASHINGTON USA

OCT
2021

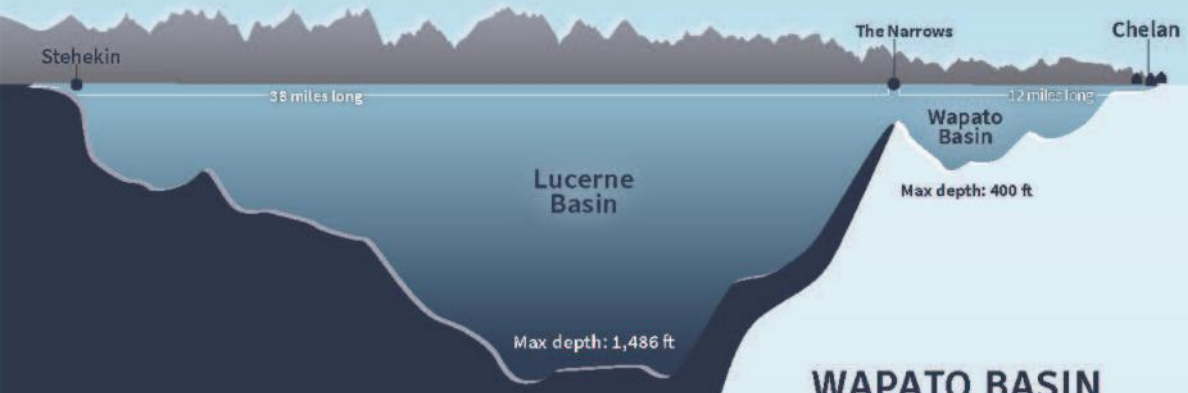


1st
Largest Natural Lake in Washington State

3rd
Third Deepest Lake in the United States

52
52 Square Miles of Total Surface Area

920
Entire Watershed Encompasses 920 Square Miles

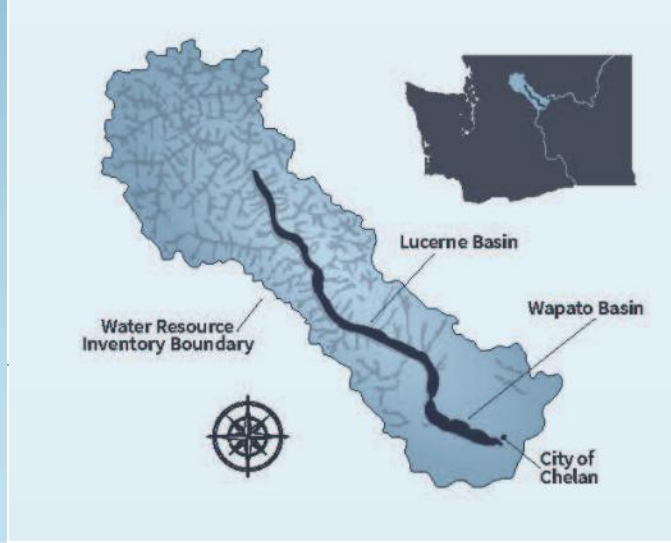


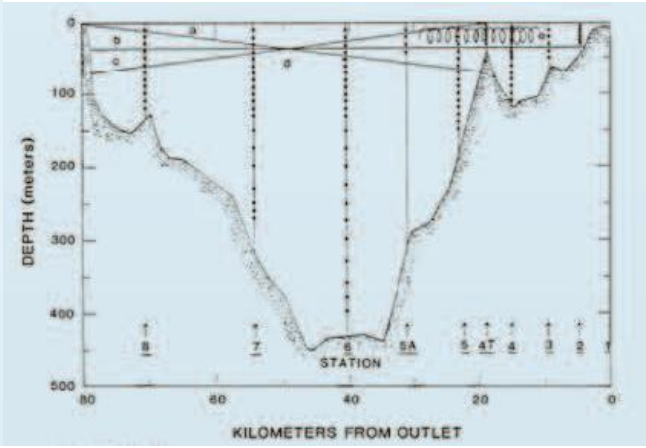
LUCERNE BASIN

- Three times longer than the Wapato Basin and almost four times deeper
- Constitutes 92% of Lake Chelan's total volume
- Water originates from forested and glacial fed tributaries
- Largely undisturbed by human activity
- Water resides in the Lucerne Basin for 10 years on average

WAPATO BASIN

- Surface temperatures are considerably warmer during the summer months than the Lucerne Basin
- Contains most of developed land within the watershed
- Contributes much of the total nutrient and bacterial loading
- Water quality characteristics here are a principal concern for lake use





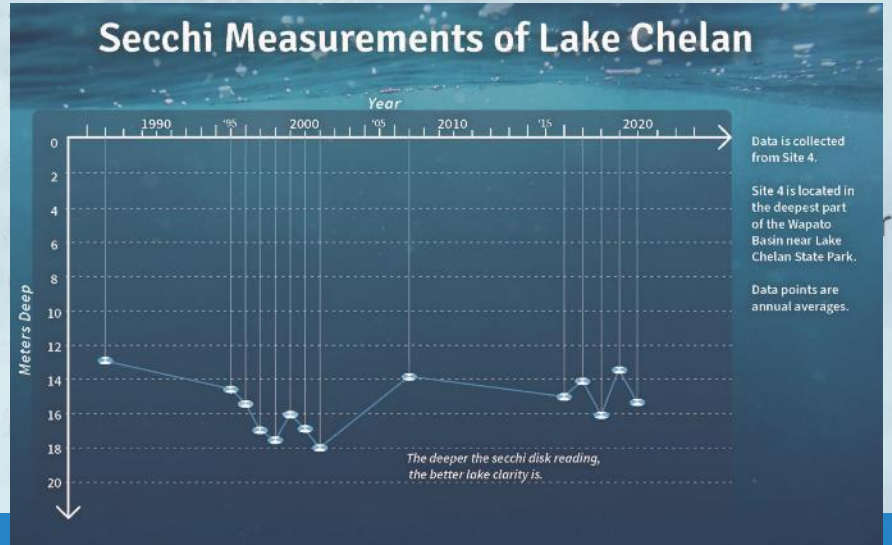
- "Internal seiche" one of the largest in world
- Lucerne Basin surface current oscillation
- Mixing at the Narrows

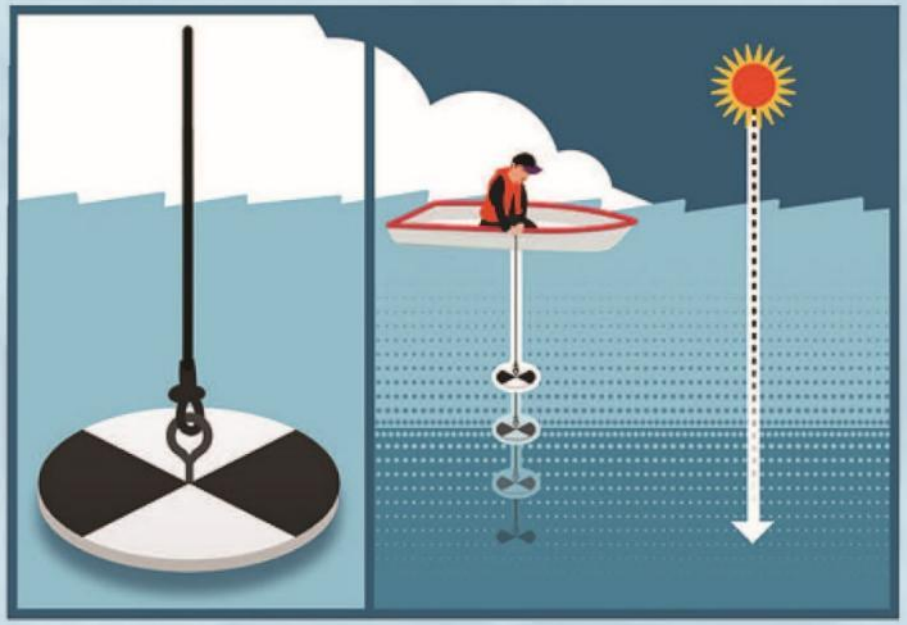
Wapato Basin Water Quality Status

Key water quality metrics for the Wapato Basin include water clarity, total phosphorus concentrations, chlorophyll concentrations, and dissolved oxygen depletion rates. Discussed below, these metrics have been remarkably stable for the past several decades.

1 Water Clarity

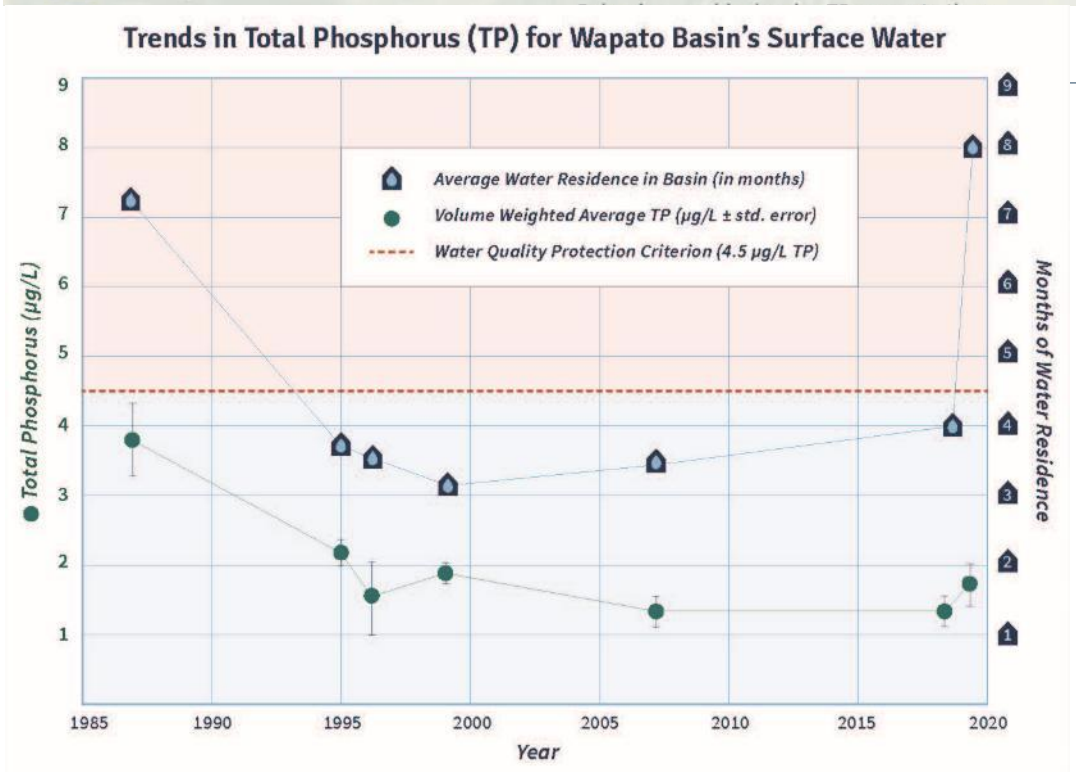
Water clarity is measured by using a "Secchi" disk that is mounted on a line and lowered slowly into the lake until it can no longer be seen from the surface.





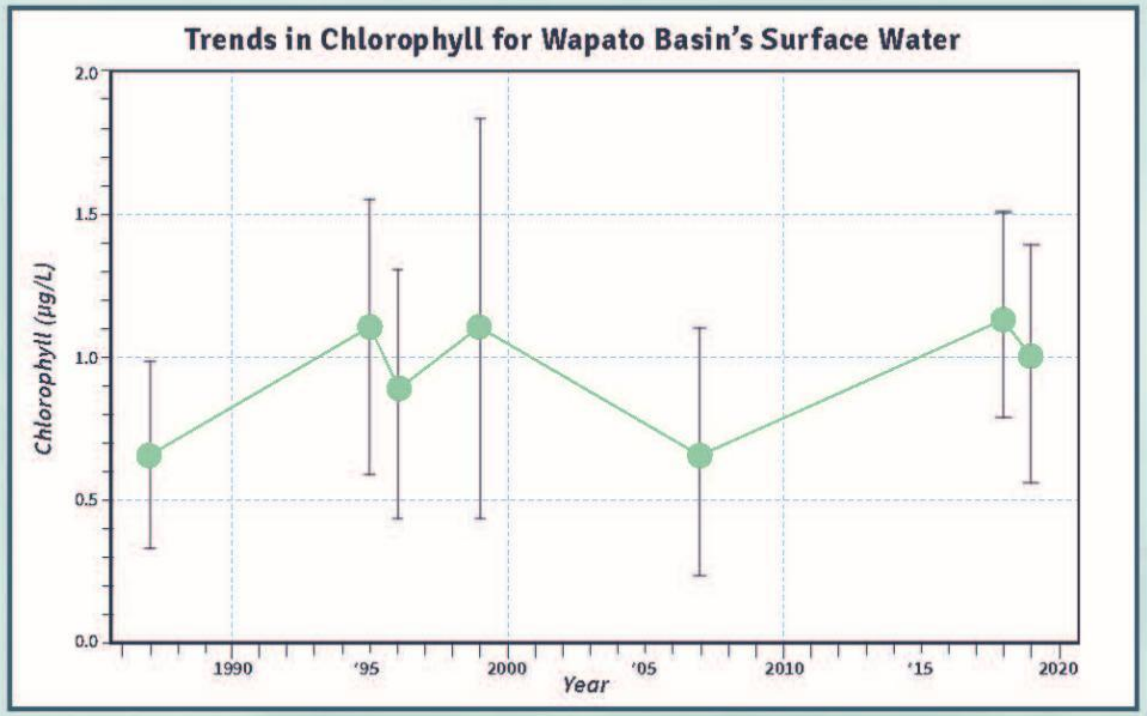
Wapato Basin Water Quality Status

2 Total Phosphorus



3 Chlorophyll

Measured concentrations of chlorophyll provide a direct estimate of the abundance of algae in surface waters of the Wapato Basin.



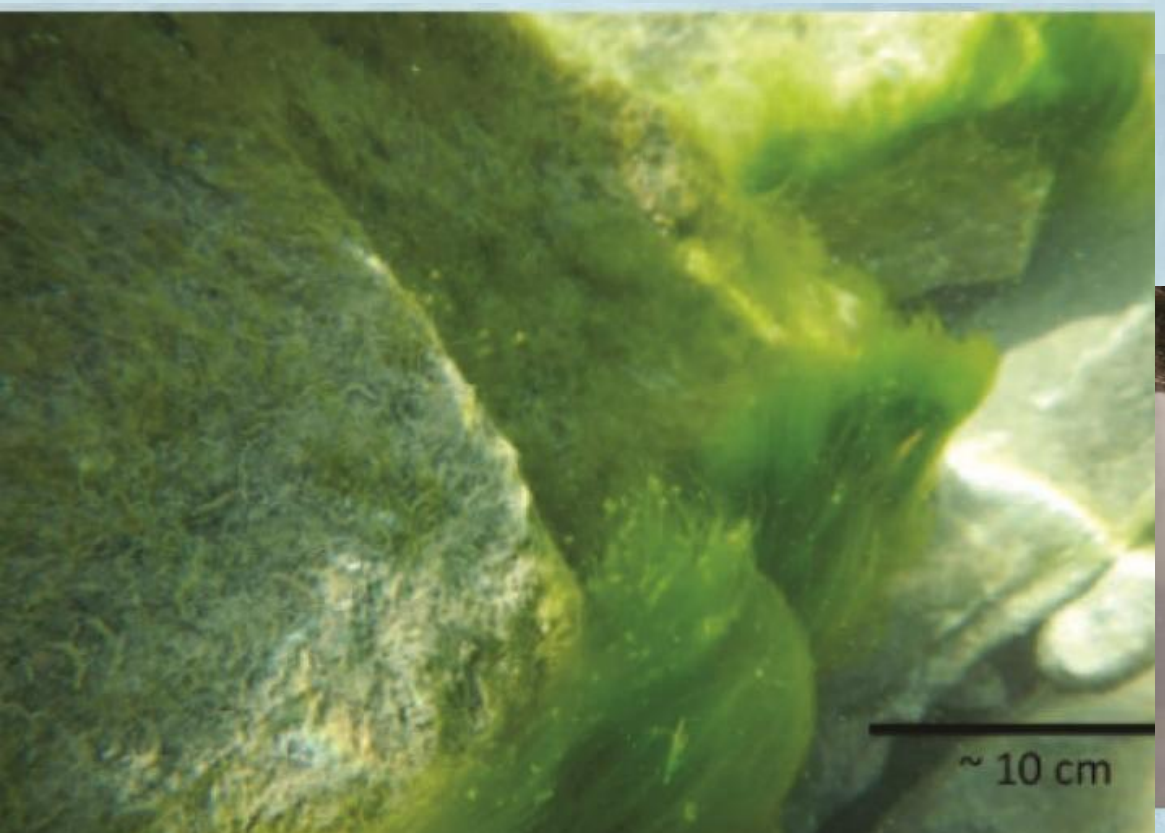
Nutrient (esp. phosphorus) loading into Lake Chelan is primarily (75 - 90%) from natural sources

- Orchard drainage is largest non-natural source of phosphorus; Manson Lakes are nutrient "sinks"

Nearshore Water Quality

Offshore Wapato Basin has mainly maintained its pristine status in water clarity. Unfortunately, this is not the case within nearshore ("littoral") areas of the lake.

1 Nearshore Algae



2 Pathogen Indicators

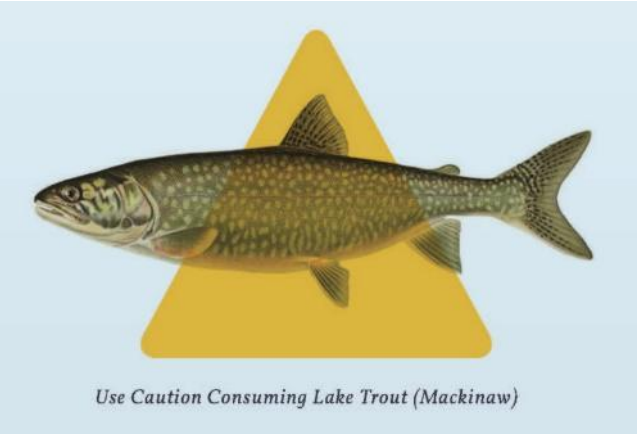
3 Aquatic Invasive Species

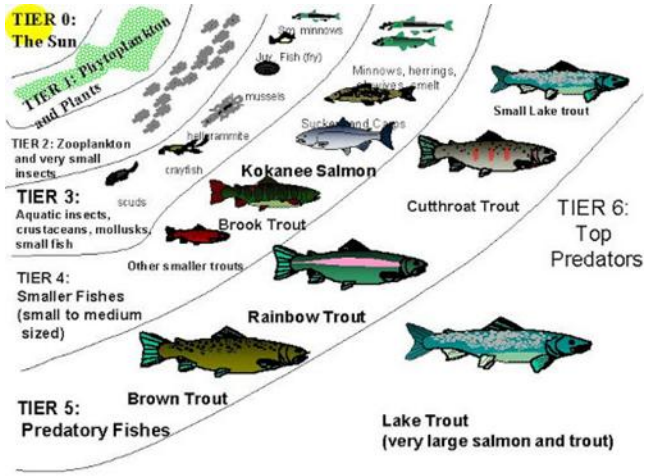
Eurasian watermilfoil needs to be removed

Lake Chelan is also at risk from:

- **Invasive zebra mussels** *(Dreissena polymorpha)*
- **Quagga mussels** *(D. rostriformis bugensis)*
- **Flowering rush** *(Butomus umbellatus)*

Contaminants in Lake Chelan

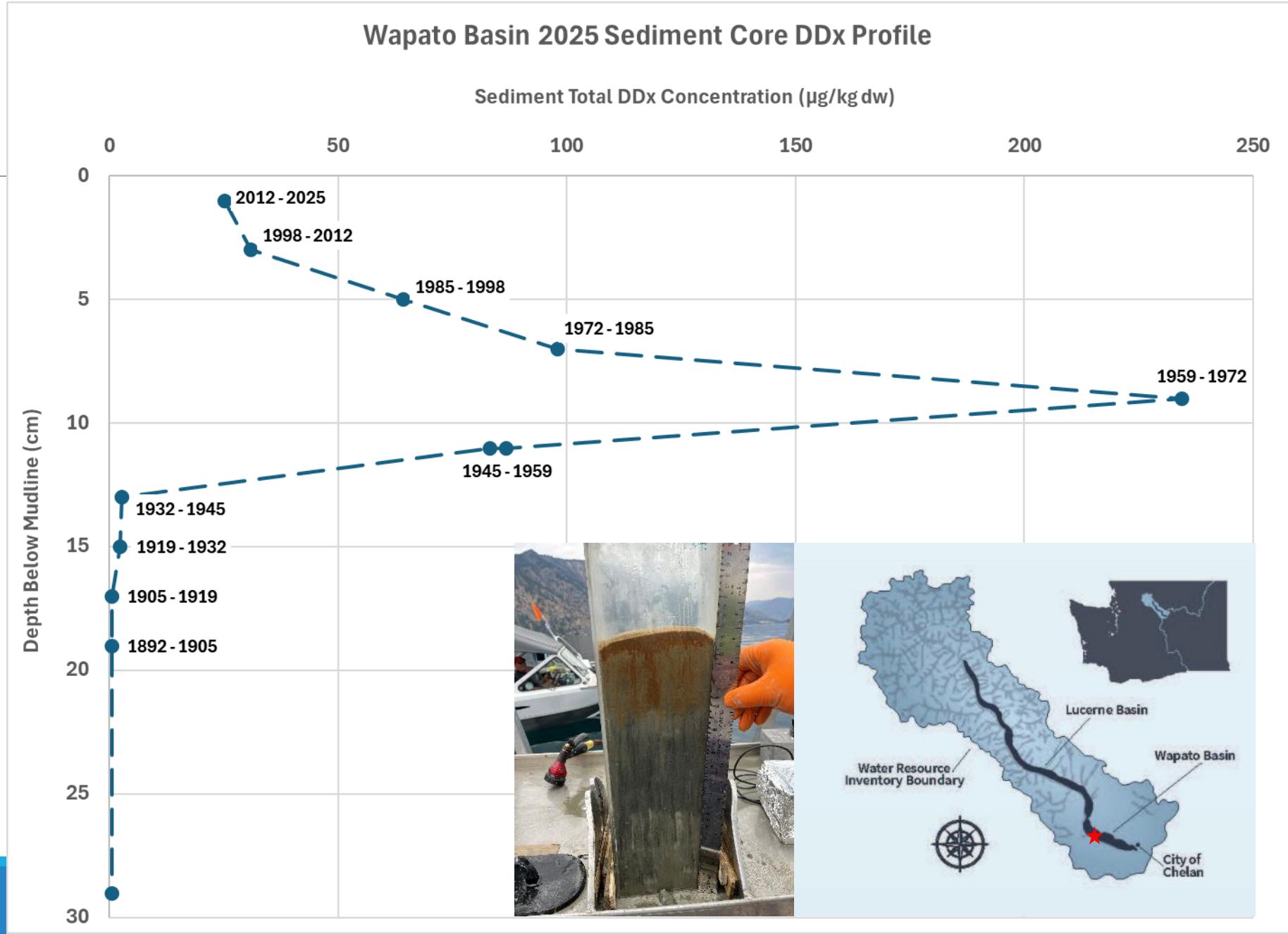


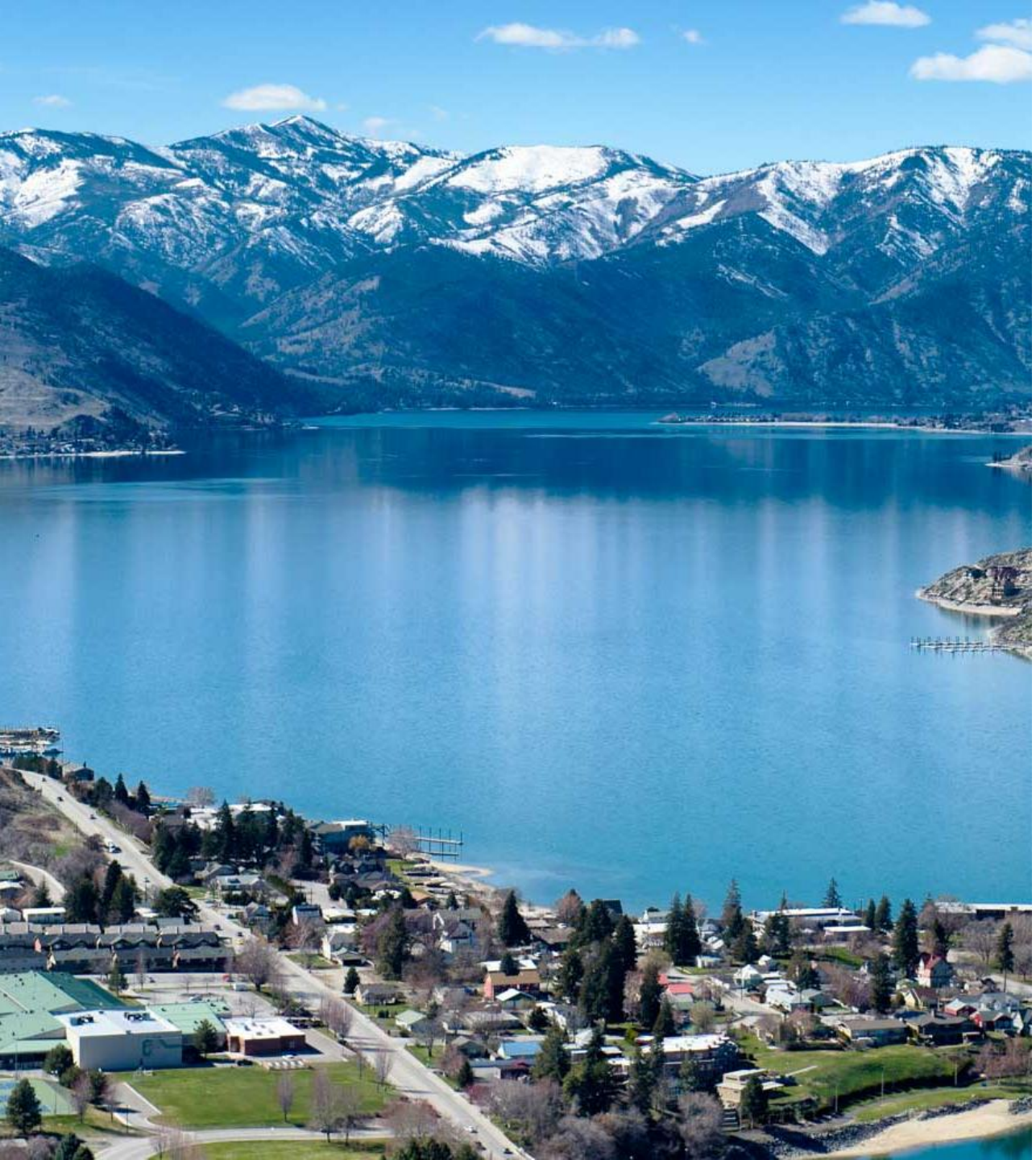


- **DDT (organochlorine pesticide developed in 1940s; banned in 1972)**
  - **Human health risk from consuming Wapato Basin Lake trout (Mackinaw)**
    - Among the highest fish tissue DDT levels in North America
    - Lake water DDT (4,4'-DDE) concentration is currently more than 100X above Ecology surface water quality criterion to protect fish tissue
    - Department of Health recommends no more than one meal per week of Lake trout (Mackinaw) consumption
      - No restriction on Burbot, Kokanee, and Rainbow trout consumption
  - **Low drinking water risk (below Ecology drinking water criterion)**
  - **Low wildlife risk (e.g., to fish-eating birds)**
  - **Low human health direct contact risk (e.g., to water, sediment, or soil)**
- **Low risk from other contaminants (e.g., mercury and PCBs)**

History of DDT Levels in Lake Chelan

- No change in Lake trout DDT levels over the last two decades
- Ongoing orchard drainage is primary DDT source to fish



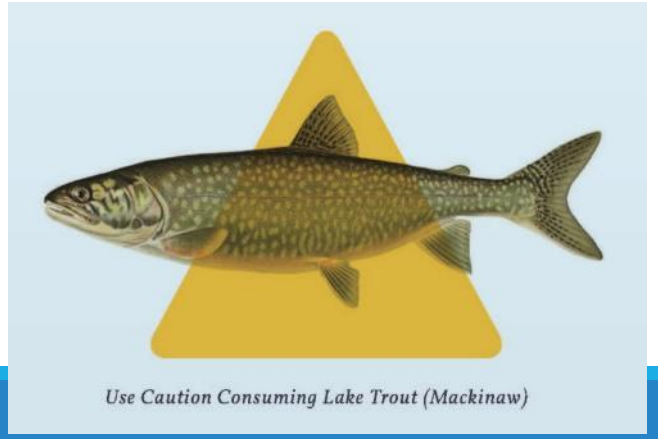


Problem Statements

DEFINE WATER QUALITY ISSUES

Water Quality Issues

- **Reduce nutrient loading**
  - **Continued phosphorus loading could lead to degradation of water quality**
    - Potential future reductions in Wapato Basin water clarity and bottom water dissolved oxygen levels
    - Continued harmful algal blooms in Manson Lakes
    - Nearshore algae provide an early indicator of potential offshore water quality degradation
- **Reduce DDT loading**
  - **Continued DDT input into Lake Chelan is degrading lake water quality and leading to elevated concentrations in fish tissue that limit safe human consumption**
    - Primary risk is from consuming Wapato Basin Lake trout
    - Ongoing orchard drainage is primary DDT source to fish
    - DDT levels in fish unlikely to naturally decline for many decades



Water Quality Data Gaps and Actions

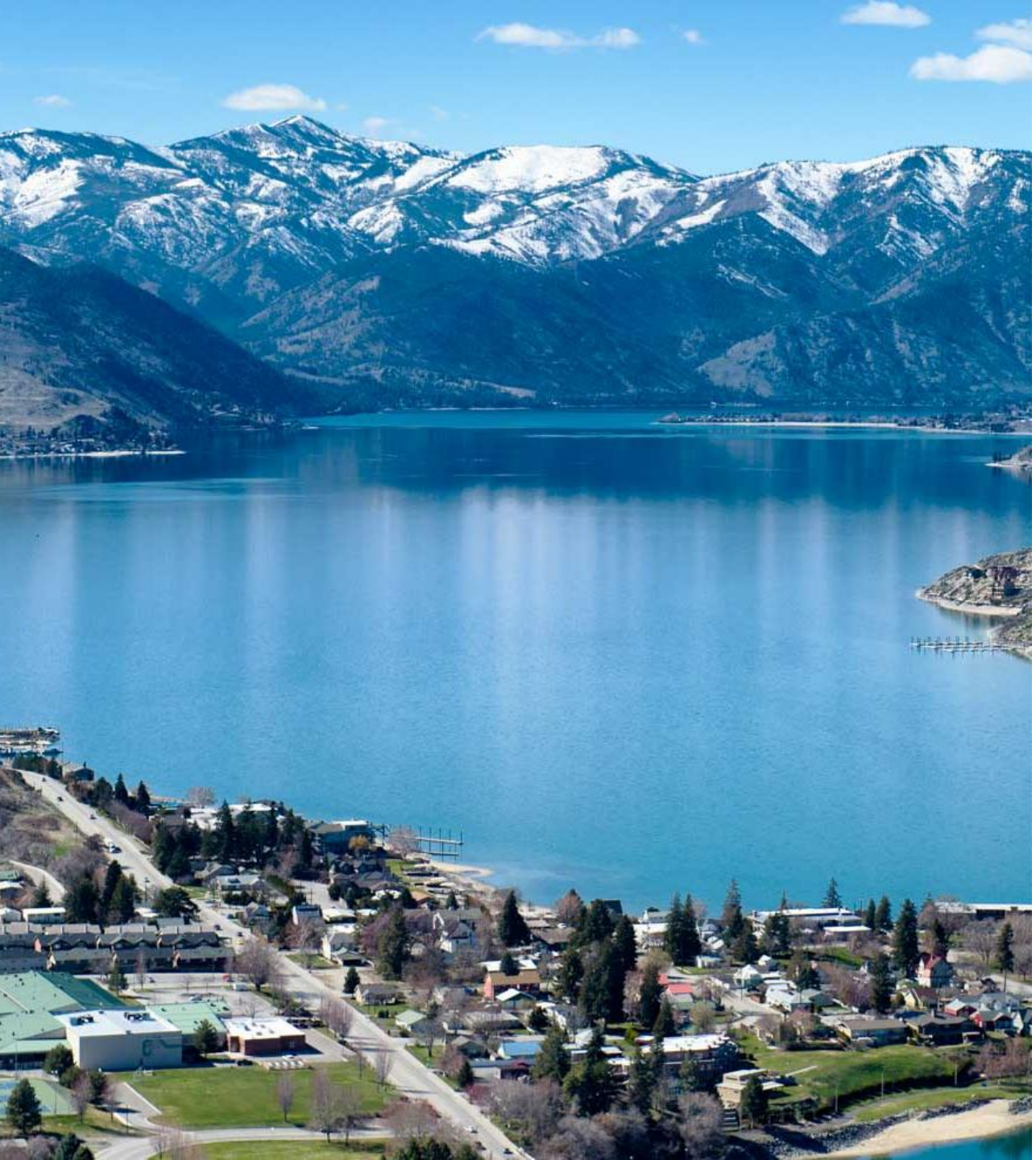
- **Ongoing investigations**
  - **Nearshore algae sampling presentation in spring 2026 (LCRI and Chelan PUD)**
  - **Lake Chelan DDT sampling presentation in spring/summer 2026 (LCRI, Chelan County, and Ecology)**
    - Watershed load reductions necessary to reduce fish tissue DDT concentrations
- **Data gaps**
  - **Confirm effectiveness of wetland treatment systems in reducing loading of phosphorus and DDT**
    - Build on promising results from earlier studies
    - Construct and monitor pilot wetland treatment system
    - 1 to 2-acre upland area needed in orchard drainage pathway
    - ~$1 million, 3-year effort (2026 to 2028); not currently funded
    - 2029 and beyond – expand wetland treatment in watershed

Group Discussion

- Feedback on issue definition and data gaps

Desired Outcomes/Goals

- Develop in 2026 based on ongoing investigations



Potential Actions

Potential Actions

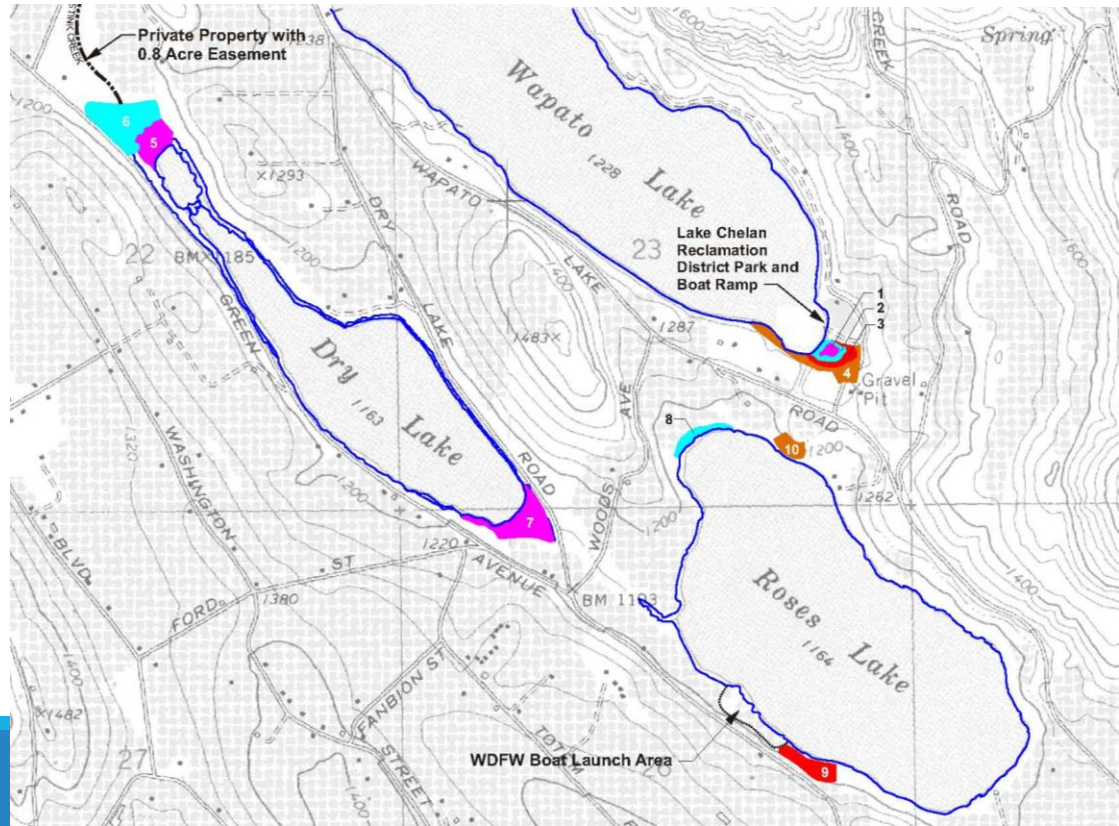
- **No action**
- **Reduce phosphorus and DDT inputs**
  - **Improve irrigation efficiencies**
  - **Construct wetland treatment systems**
    - Mitigation options for future developments
    - Holden Mine compensatory habitat restoration opportunity

Wapato Lake:
1 Wetland Enhancement: 0.29 A
2 New Wetlands: 1.10 A
3 Riparian to Upland Transitional Lands: 0.98 A
4 New Uplands: 2.46 A

Dry Lake (North):
5 Wetland Enhancement: 2.59 A
6 New Wetlands: 5.26 A

Dry Lake (South):
7 Wetland Enhancement (Private): 4.03 A

Roses Lake:
8 New Wetlands: 1.04 A
9 Riparian to Upland Transitional Lands (WDFW Property): 1.79 A
10 New Uplands: 1.00 A



Wrap Up and Timely Topics

- Updates from the field
- LCRI Monitoring Updates/2026 Plan
- Recap of decisions made and next steps

- Next meeting: March 11, 202**6** – 1PM-4PM

Review of Lake Chelan Long-Term Monitoring Program 2025 and Plan for 2026

Lake Chelan Long-Term Monitoring Team:

Matt Holland[1], Jeremiah Rath[1], Anna Galipeau[2], Joe Heinlen[3], Tim Sullivan[4], Craig Breuer[5], Elle Robinson[1], Phil Long[2]

[1]Chelan County Natural Resources Department

[2]Lake Chelan Research Institute

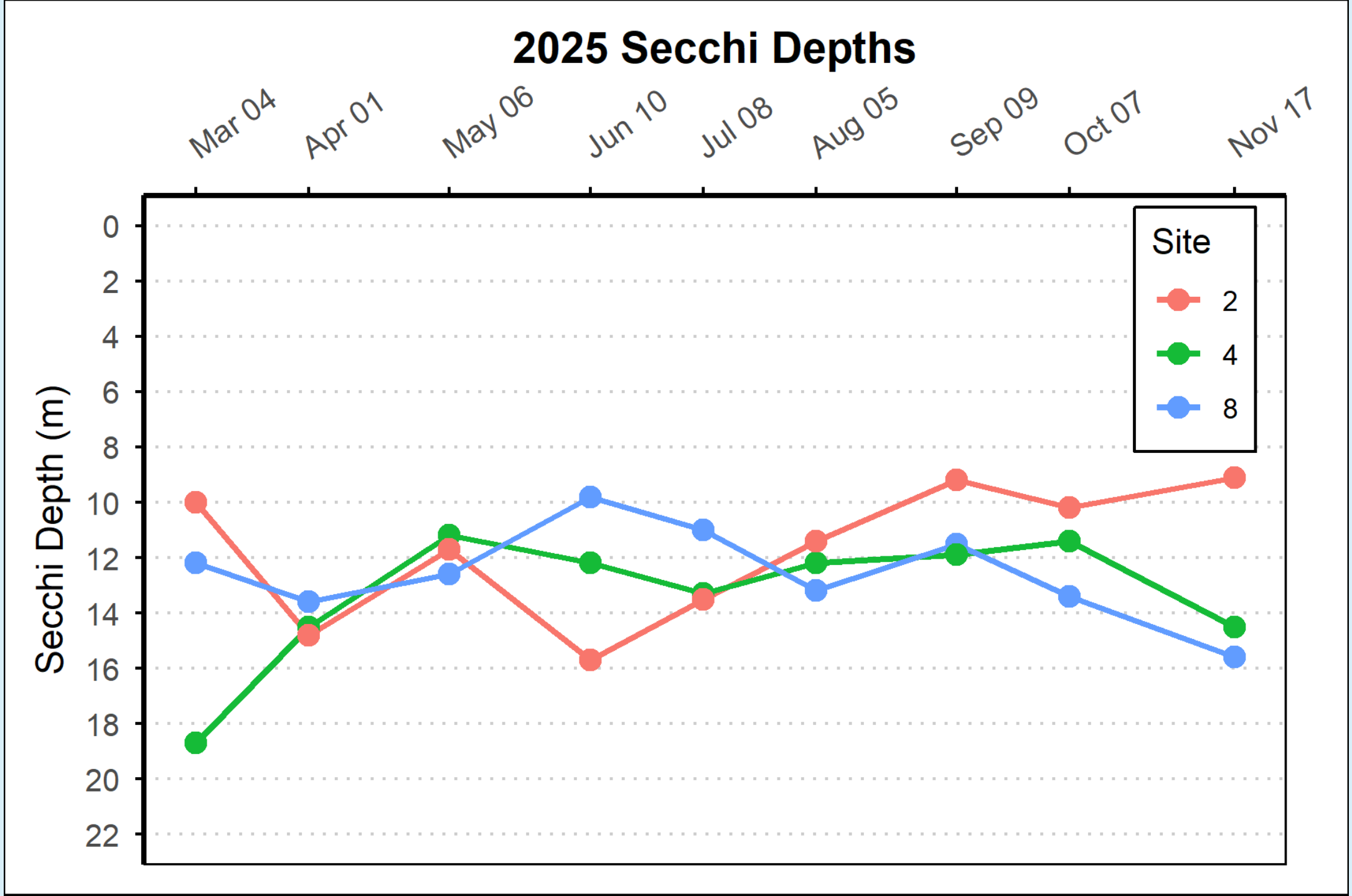
[3]Lake Chelan Adventures

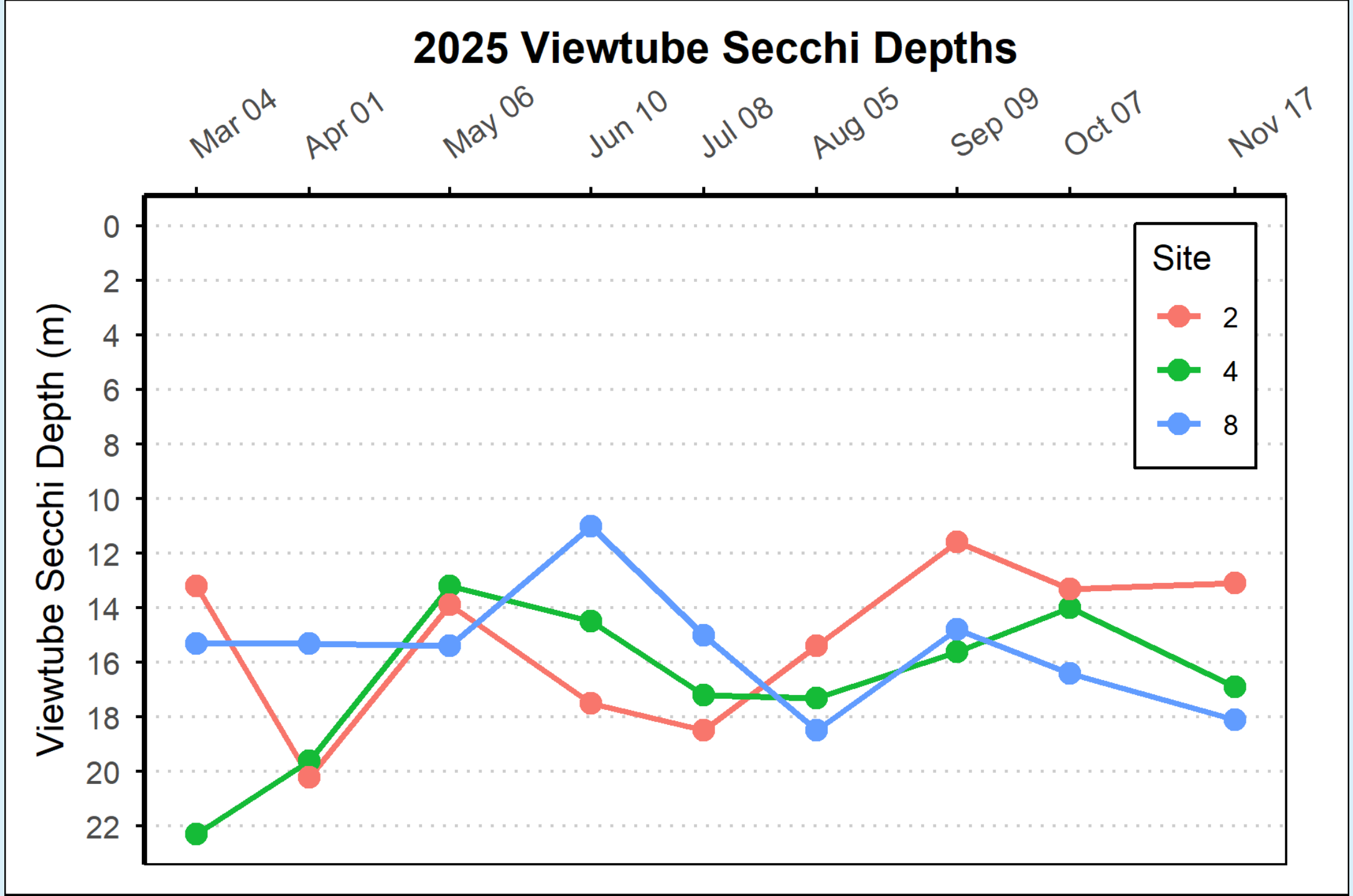
[4]Sullivan Maritime LLC

[5]Breuer Guide Service

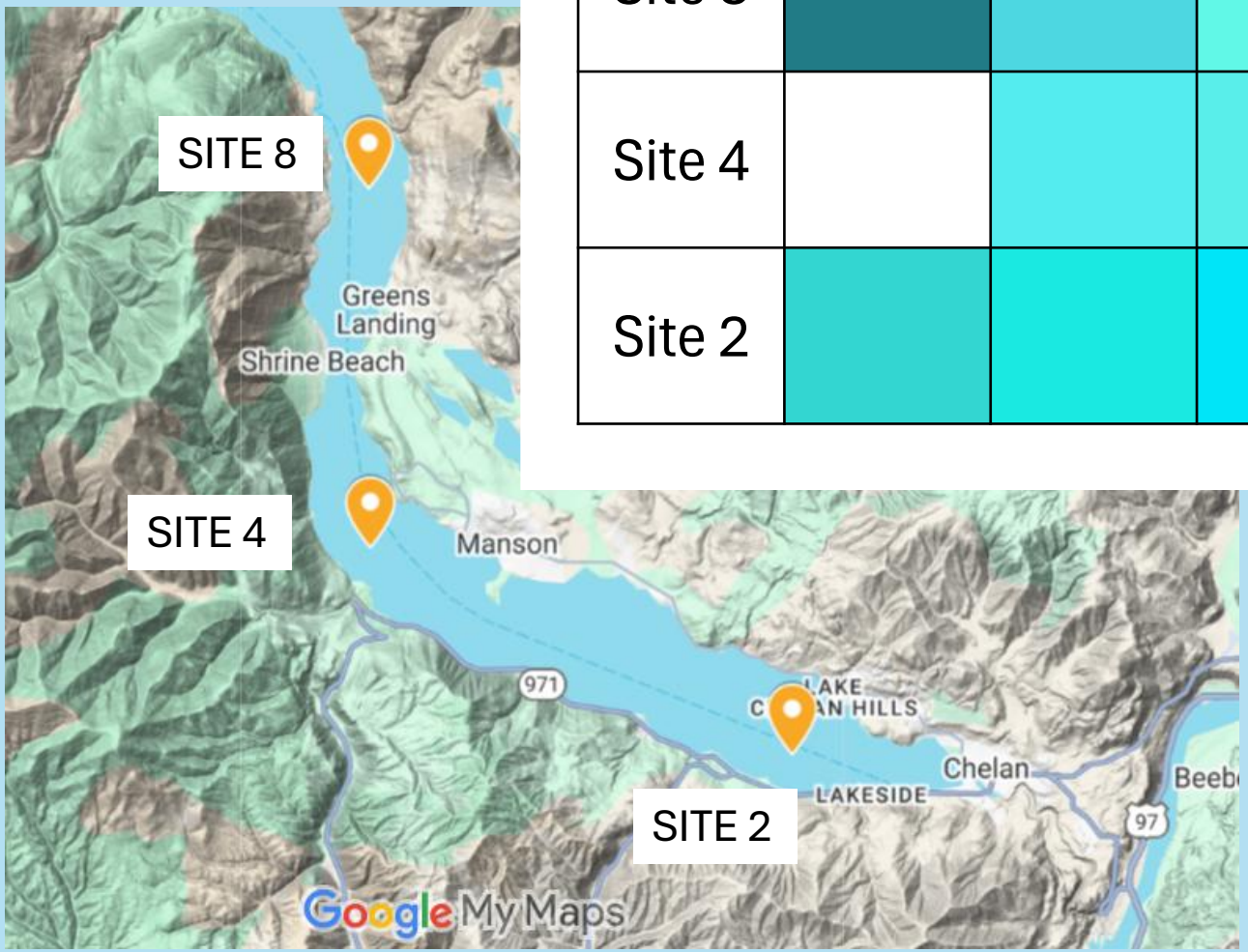
Lake Chelan Long-Term Monitoring 2025 Overview

- Monitored Lake Chelan for nutrients, temperature, specific conductivity, Secchi depth, color, dissolved oxygen, blue green algae, turbidity, pH and chlorophyll (9 sampling events)
  - Three locations include collection of water samples for nutrients, Secchi depth, weather,
  - Eight locations included profiles for the full depth of the lake
  - Monitoring color started this year when we noticed an unusual color in the lake this spring
- Monitored selected tributaries, mostly in the Wapato Basin (8 sampling events)
- Continuing data analysis (e.g. next slide)
- Emerging long-term water quality issue: Will Lake Chelan become permanently stratified?
- 2025 qualitative observation: More aquatic plants floating on the lake than in previous years


2025 Secchi Depths
Mar 04
Apr 01
May 06
Jun 10
Jul 08
Aug 05
Sep 09
Oct 07
Nov 17
Secchi Depth (m)
0
2
4
6
8
10
12
14
16
18
20
22
Site
2
4
8


2025 Viewtube Secchi Depths
Mar 04
Apr 01
May 06
Jun 10
Jul 08
Aug 05
Sep 09
Oct 07
Nov 17
Viewtube Secchi Depth (m)
0
2
4
6
8
10
12
14
16
18
20
22
Site
2
4
8

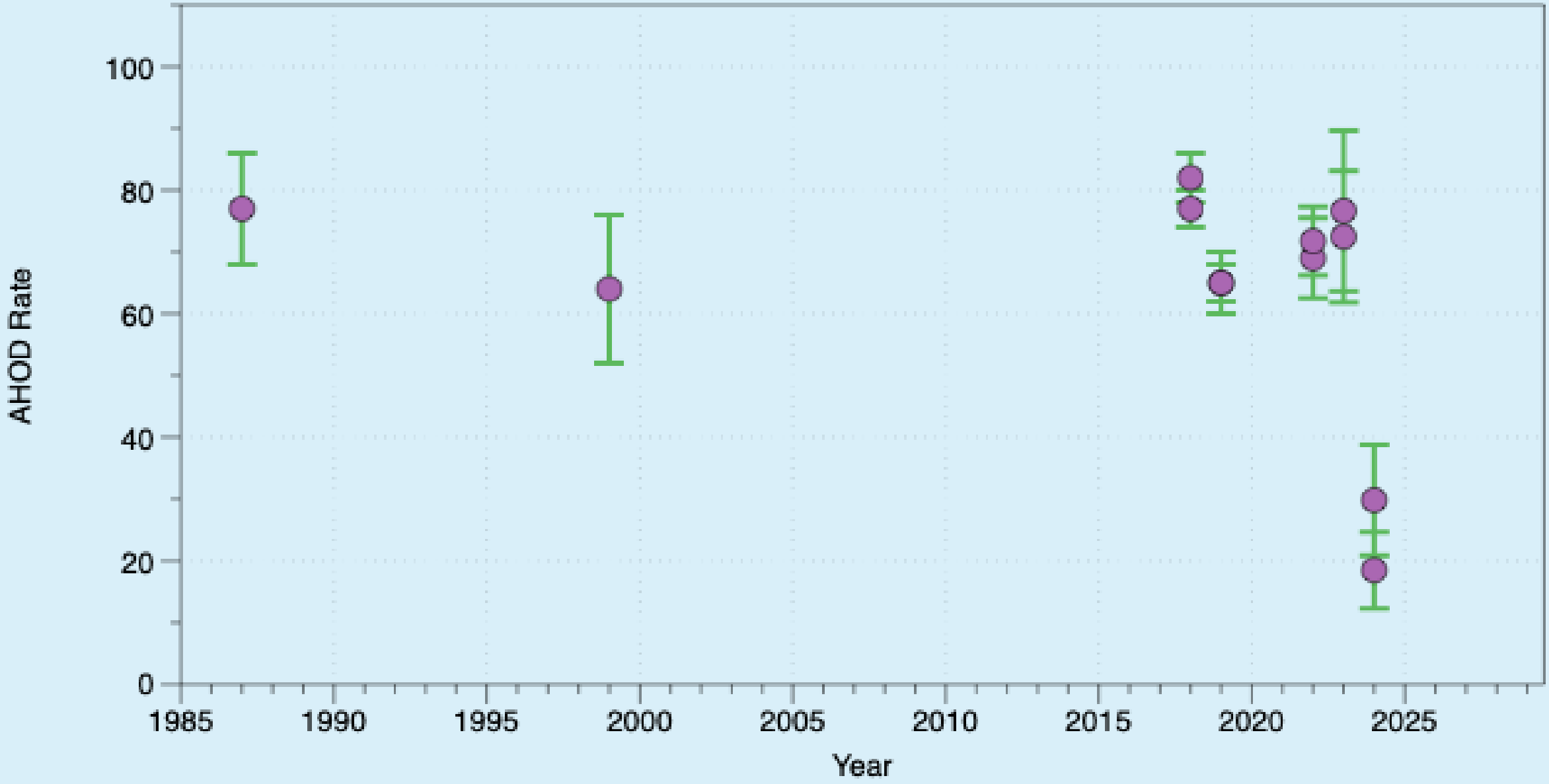
	4-Mar	1-Apr	10-Jun	8-Jul	9-Sep	7-Oct	17-Nov
Site 8							
Site 4							
Site 2							



Is Lake Chelan's color changing?

(viewtube color)

Deep water oxygen deficit in the Wapato Basin

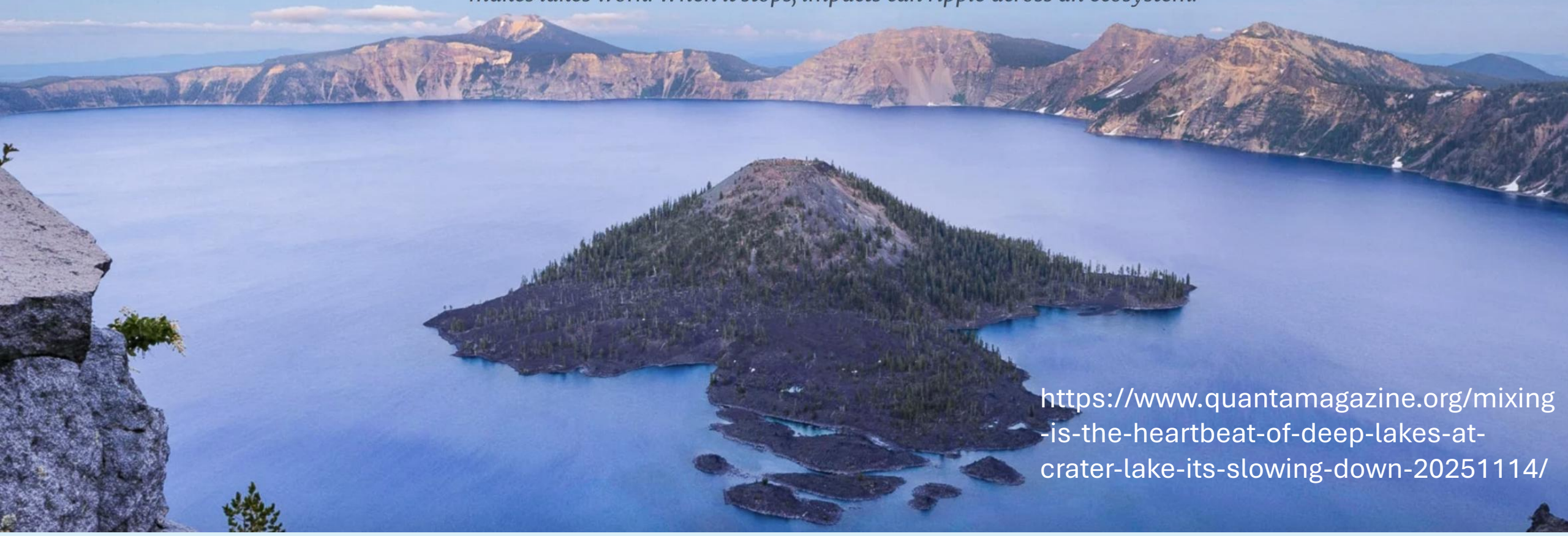


CLIMATE SCIENCE

Mixing Is the Heartbeat of Deep Lakes. At Crater Lake, It's Slowing Down.

5

The physics of mixing water layers — an interplay of wind, climate and more — makes lakes work. When it stops, impacts can ripple across an ecosystem.



https://www.quantamagazine.org/mixing-is-the-heartbeat-of-deep-lakes-at-crater-lake-its-slowing-down-20251114/

Plan for 2026

- Preliminary sampling dates for 2026 set including both lake and tributary sampling
- Includes options for winter sampling
- Continue color monitoring
- 2026 will complete our transition to Sullivan Maritime LLC and Breuer Guide Service for boat transport for lake sampling and downrigger deployment for profiles
- Scope question: Should we be monitoring the upper Lucerne Basin? If so, where and with what sampling frequency?
- Data analysis will continue enabling publication of a ***2026 State of the Lake Report***
- We are also planning frequent updates of plots on CCNRD and LCRI webpages depending on data availability