Wetlands Restoration and Basin Resilience

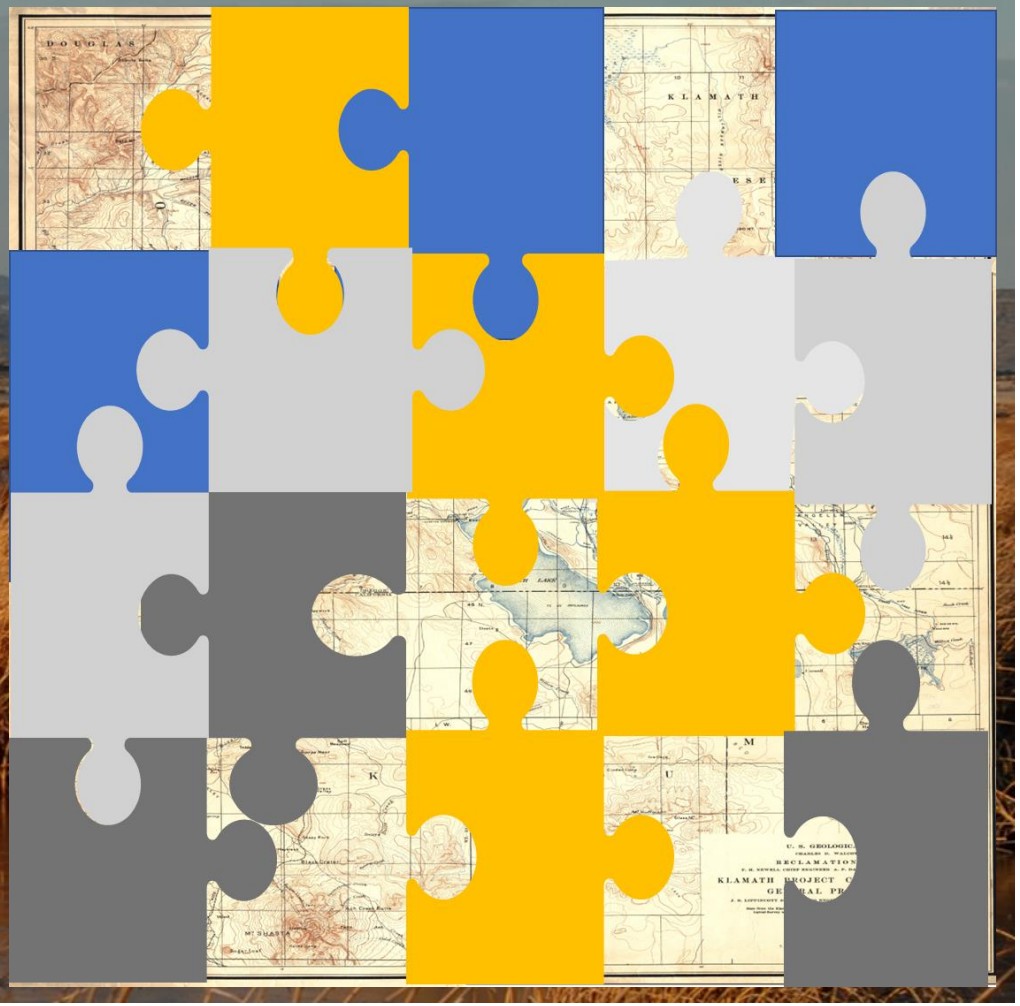
- John Vradenburg – USFWS KBNWRC: Putting the Puzzle Back Together
- Mark Buettner – The Klamath Tribes: The Klamath Tribes Perspective
- Damon Brosnan – Natural Resource Conservation Service: Watershed Top to Bottom
- Moss Driscoll – Klamath Basin Water Users Association: Opportunities within the Project Area

The Road to Ecological Resiliency

Putting the Klamath Basin Puzzle Back Together

John Vradenburg

Supervisory Biologist – Klamath Basin National Wildlife Refuge Complex



We need to recognize and accept

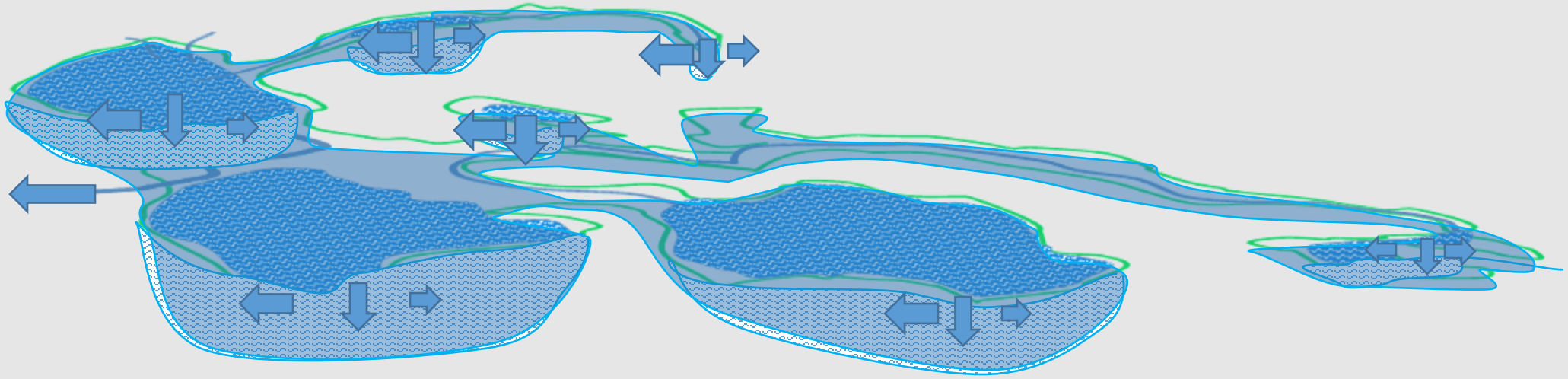
- The issues we are dealing with today are the culmination of decades of a lack of placing the ecosystem in the proper context related to watershed planning
- The problems of the past are **exacerbated by** an annually reactive water management approach across the Basin **rather than** proactive planning for a sustainable (resilient) future
- We can restore the entire Klamath Basin Ecosystem (watershed)
- BUT we need a watershed wide cohesive vision of what the future will be

  (WATER, FISH, WETLANDS, WILDLIFE, FORESTS, UPLANDS, PEOPLE…….?)

CURRENTLY **POSSIBLE FUTURE**

DESERTIFYING AND LOSING RESILIENCY RE-WETTING AND BUILDING RESILIENCY

Hydrologic Processes of Pre-Altered Klamath Basin

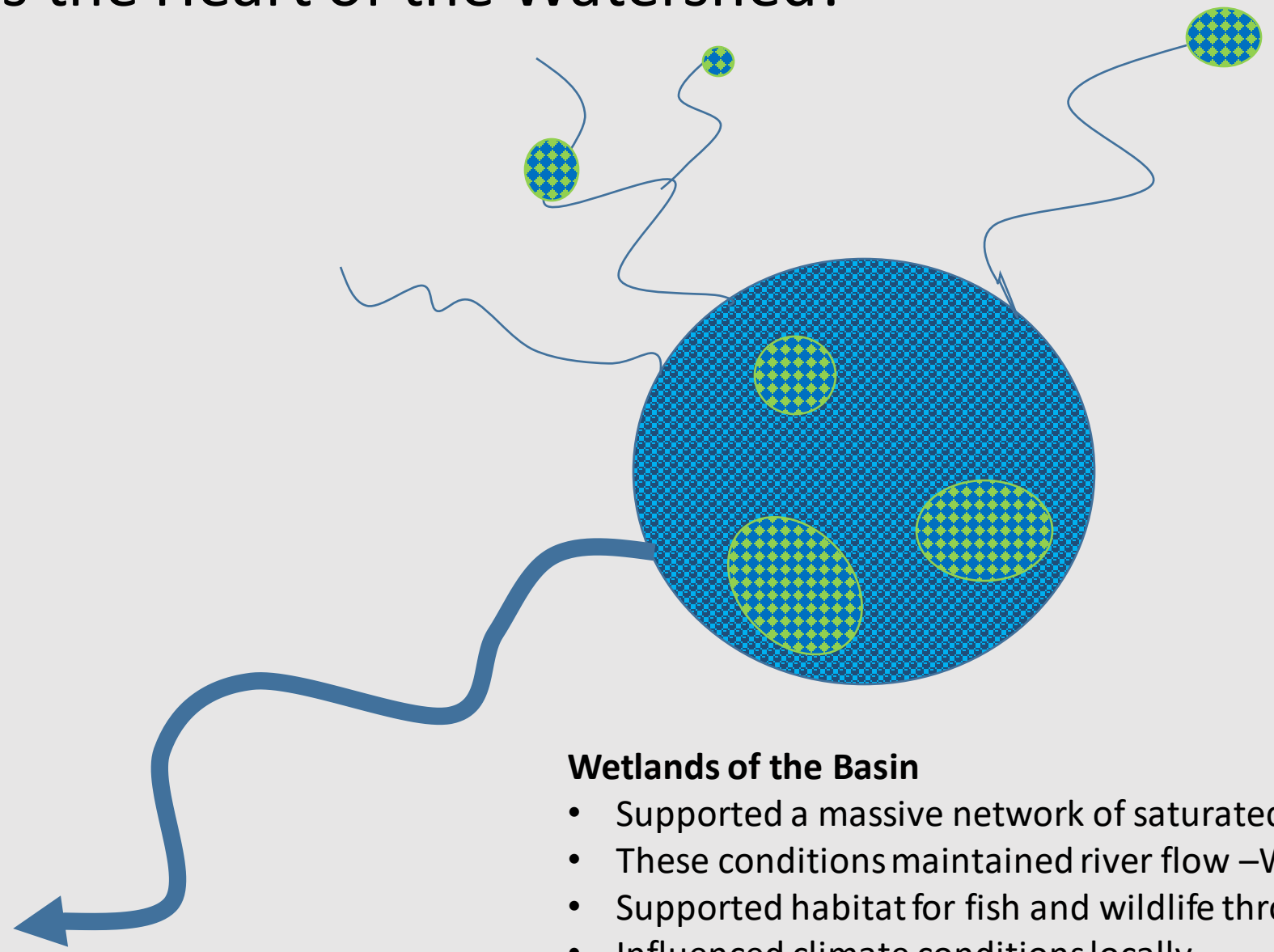


The natural functioning system could:

- Capture and absorb flood water
- Store water
- Attenuate stream and river flows through a slow release of captured water
- The size of these wetlands basins could persist through prolonged dry periods

= **Ecological Resiliency**

This is the Heart of the Watershed!

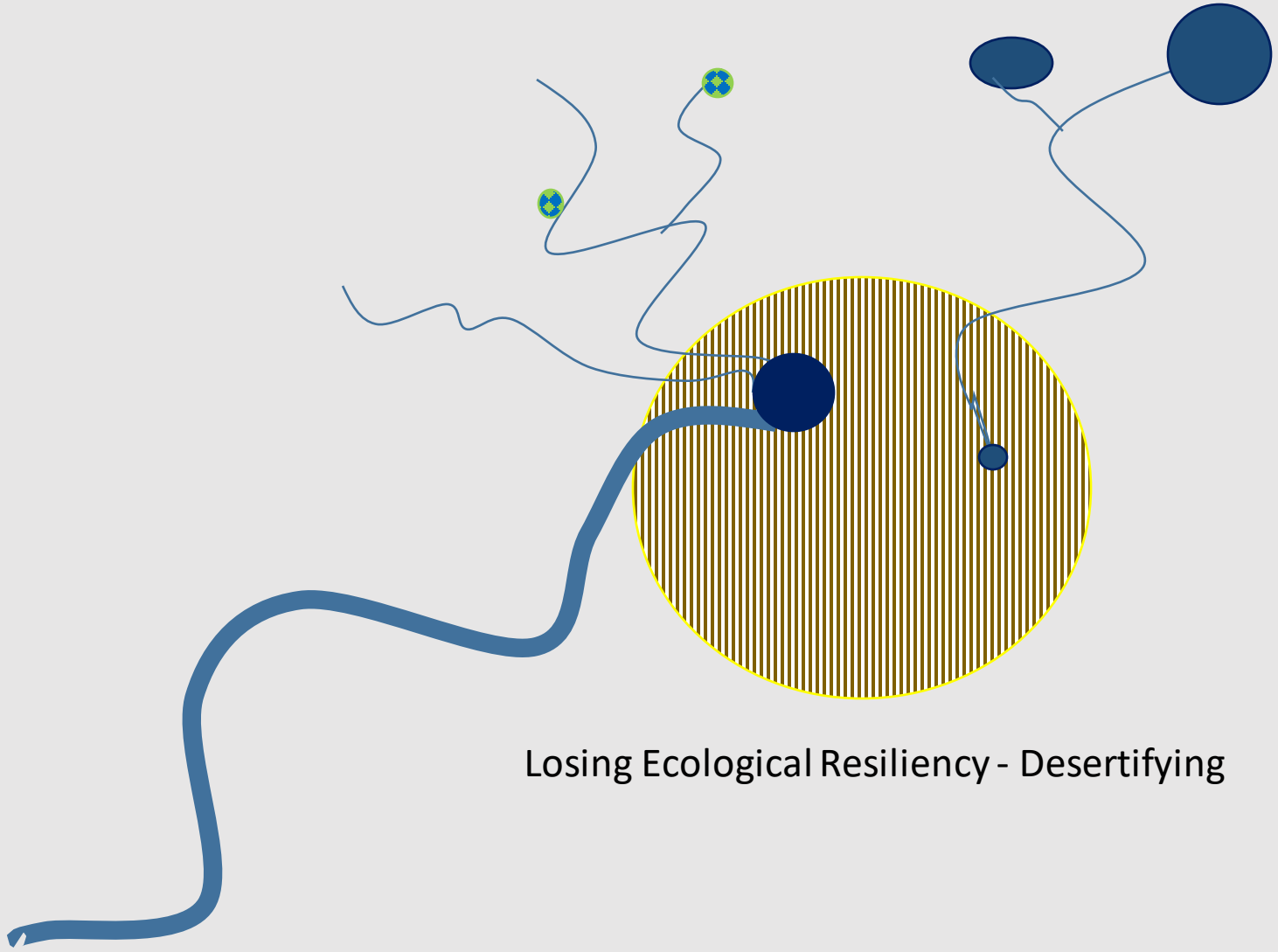


Wetlands of the Basin

- Supported a massive network of saturated conditions
- These conditions maintained river flow –Within and beyond the upper Basin
- Supported habitat for fish and wildlife throughout the year
- Influenced climate conditions locally
- Maintained the watershed water balance

Through our actions or decisions

- Curtailments
- Prescriptive flow regimes
- Disproportionate allocations
- Lack of ecosystem approach to water management



Losing Ecological Resiliency - Desertifying

Wetlands of the Basin Today

- Physically or functionally gone
- The historically wet Basin is desertifying
- This has an impact on the hydrology and the climate locally
- As the Basin dries – the watershed is drying
- As the watershed dries the successful recovery of species, cultures, communities and economies is increasingly unlikely

Water has well defined uses but they don't always complement each other

Flow Requirements of Klamath River
Anadromous fish

Water Supply

Project Supply
Irrigation

This pushes the system towards water consumption rather than water sustainability

Surface Elevation of Upper Klamath Lake
Resident (endemic) Fish

Tribal Trust Responsibilities
Upper Klamath Basin/Lower Klamath Basin

Hydroelectric

This causes within year water supply constraints and promotes across year shortages

"Hoping for a big water year"

BECAUSE

Everything is Part of the Larger Ecosystem that Depends on Water

However

Water Policy Does not Account for Ecosystem Complexity

Klamath Watershed Ecosystem

Image credit Clipart - Evergreen Mountains - Cliparts.co

Case Example :
Impact of wetland function on Klamath River hydrograph

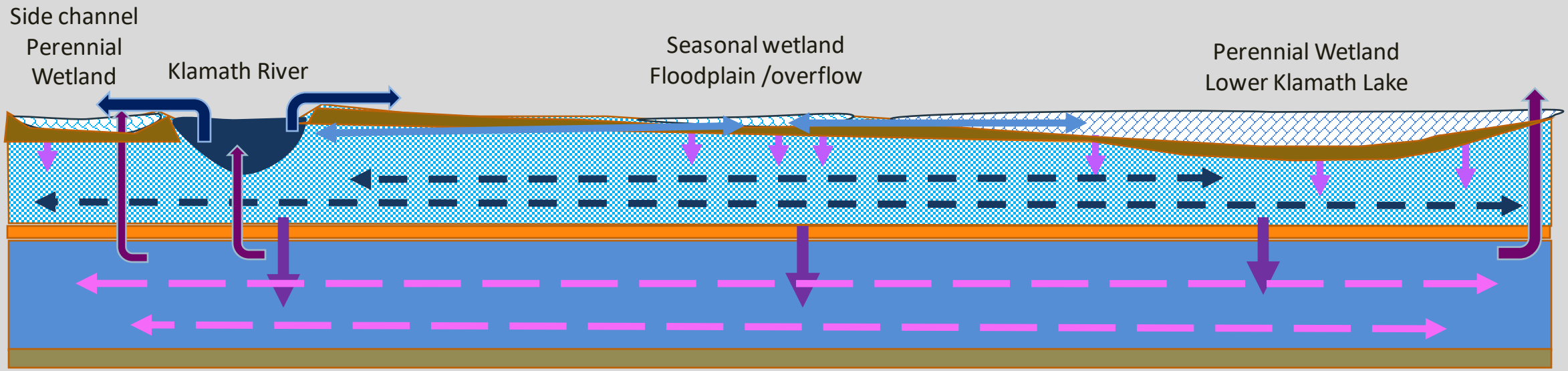
<u>Caveats</u>

- This is an ecological perspective – Not statistical
- It is showing a pattern
- We need more information to evaluate this further
- But it does provide some interesting insights

The Klamath River Keno Reach and its Floodplain

Floodplain Hydrologic Cycle

Surface water is just a fraction of the water underneath it



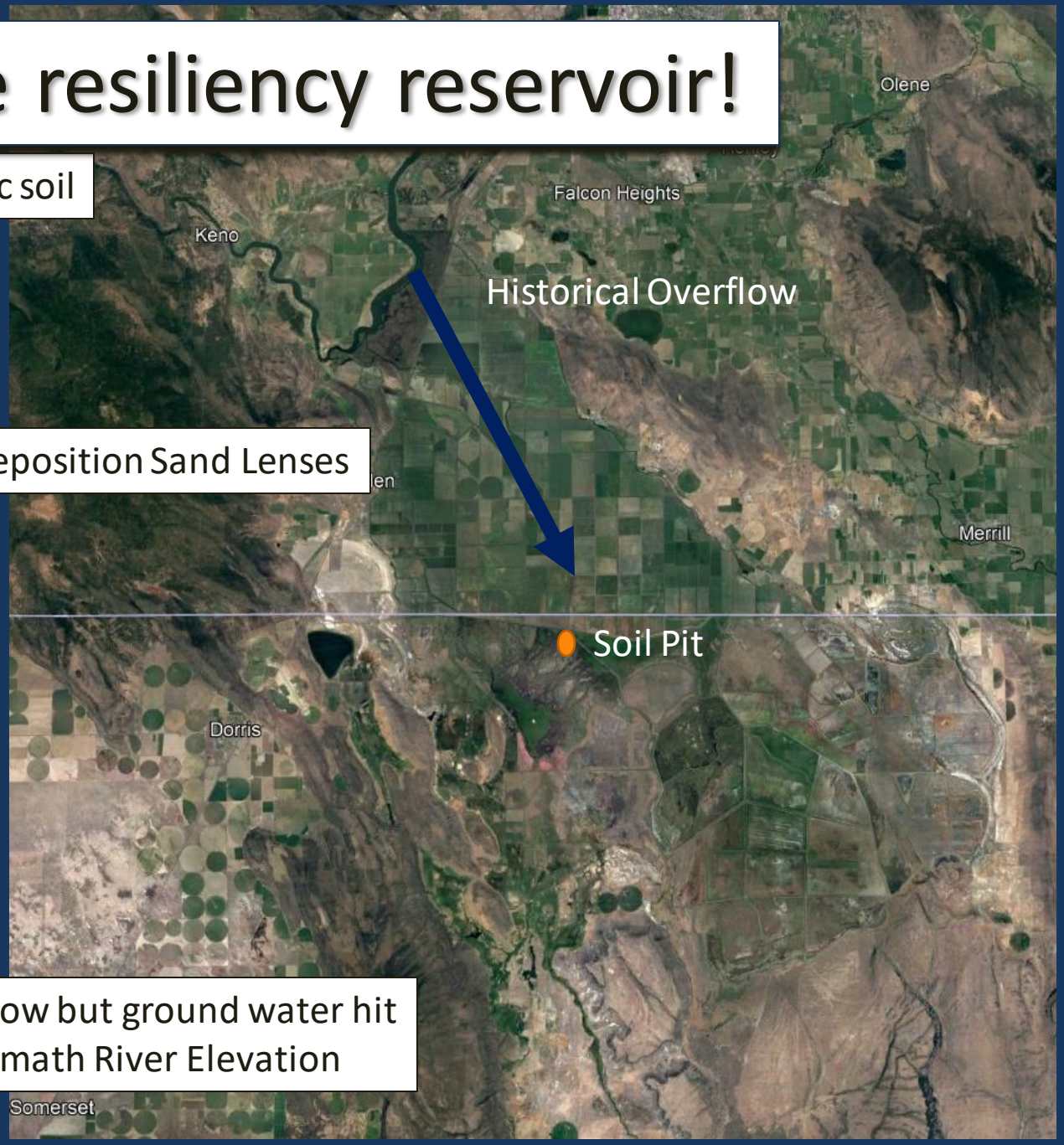
- Overbank floodplain inundation
- Flow through wetlands
- Wetland shallow groundwater recharge
- Shallow groundwater lateral flow
- Shallow groundwater discharge to deep groundwater
- Lateral groundwater flow
- Groundwater discharge (within and outside of Basin) as instream, wetland, and spring discharge

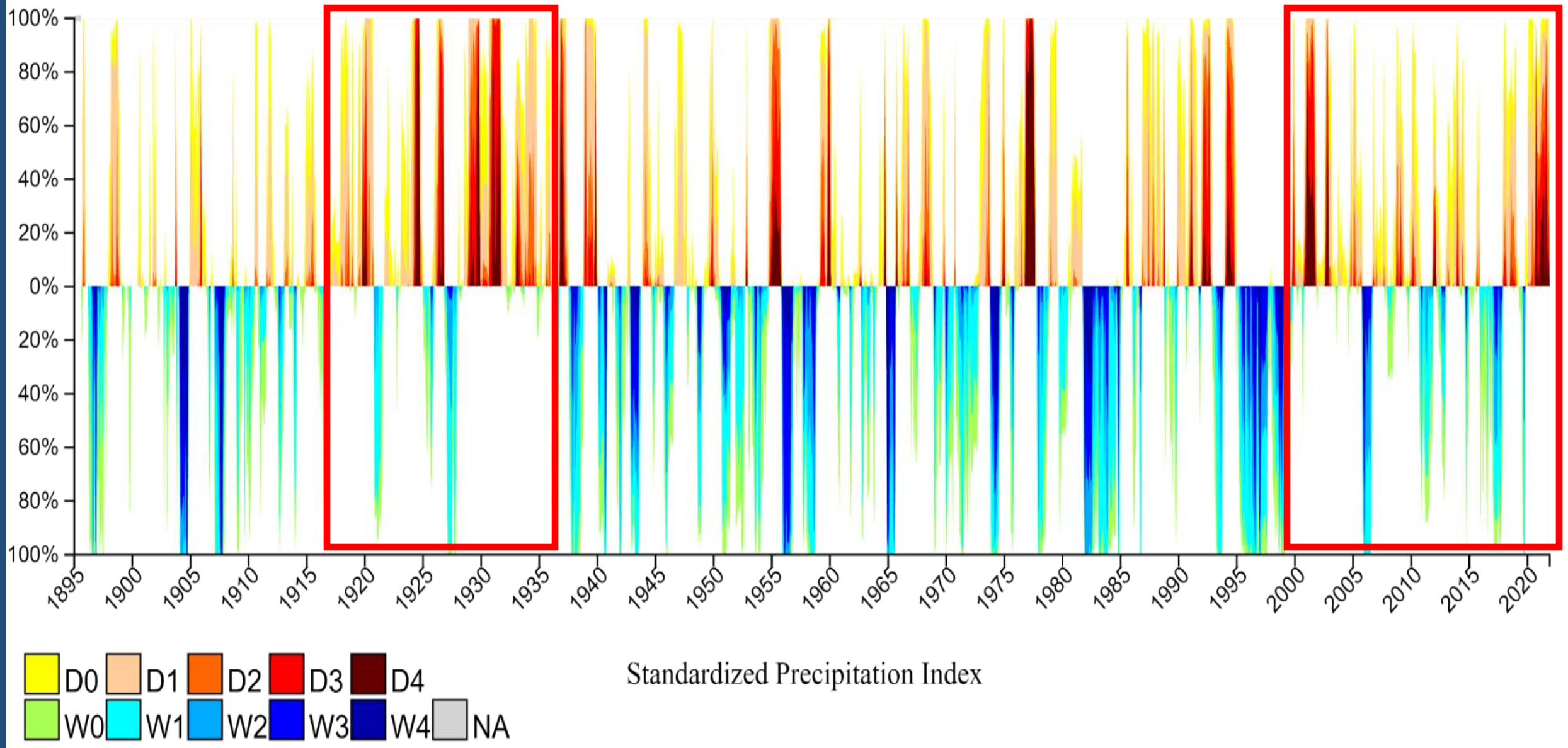
This is your climate resiliency reservoir!

Organic soil

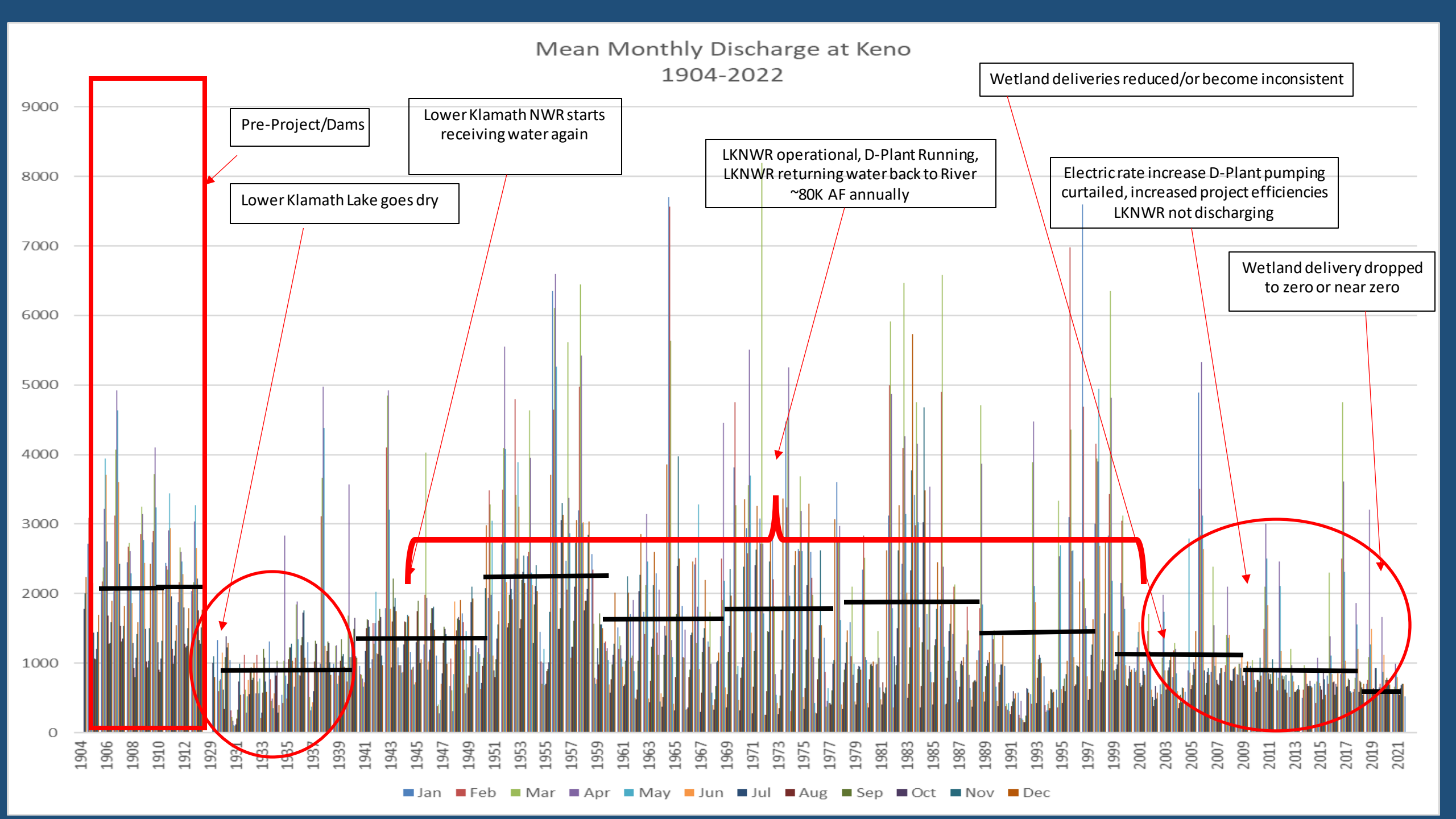
Deposition Sand Lenses

More below but ground water hit
Likely Klamath River Elevation





Long Term Record of Wet and Dry Cycles in the Klamath Basin


Mean Monthly Discharge at Keno
1904-2022
Pre-Project/Dams
Lower Klamath Lake goes dry
Lower Klamath NWR starts receiving water again
LKNWR operational, D-Plant Running, LKNWR returning water back to River ~80K AF annually
Wetland deliveries reduced/or become inconsistent
Electric rate increase D-Plant pumping curtailed, increased project efficiencies LKNWR not discharging
Wetland delivery dropped to zero or near zero
9000
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7000
6000
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1000
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The Hydrograph Illustrates

- Some of this is climate, but it is also water policy and management
- The Lower Lake area plays an integral role in the flow of the Klamath River
  - timing, volume, attenuation, etc.
- The post modification hydrograph was more variable and may not have matched species or ecosystem need
- The increased impact post 2001 suggests that basin drying is having a bigger effect than the 1930's drought
  - wetland/floodplain/Basin drying both above and below the lake
- Re-engaging wetland systems has contributed to more resilient flows in the river before and could do so again

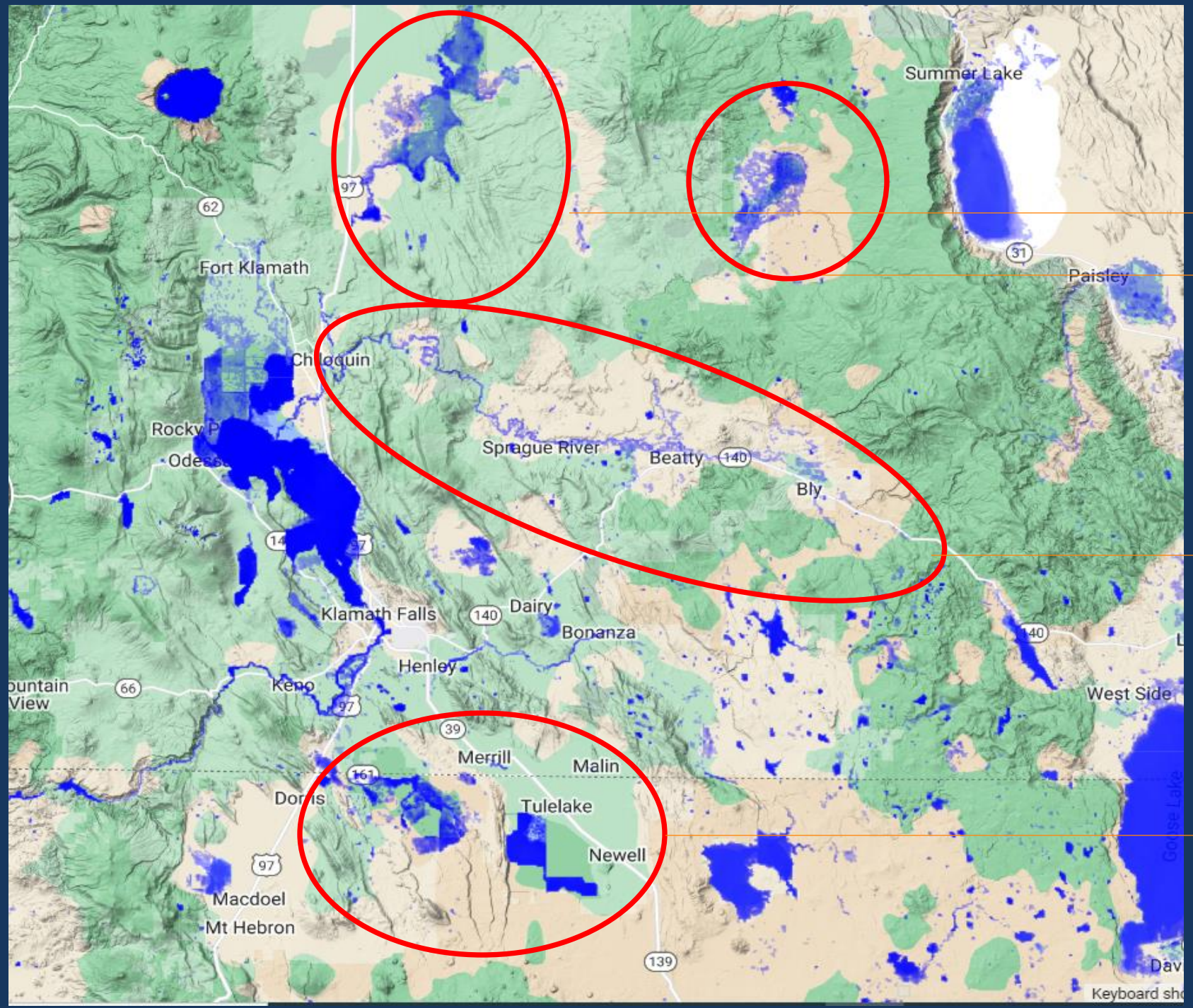
More Recent Example Looking at the Larger Landscape

Intermountain West Joint Venture WET Model
https://pdonnelly.users.earthengine.app/view/wetresiliencev23

https://pdonnelly.users.earthengine.app/view/wethydroperiodv23

https://pdonnelly.users.earthengine.app/view/wetsurfacewaterv23

Average Spring snow melt response 1984 - 1994



Klamath Marsh - Full

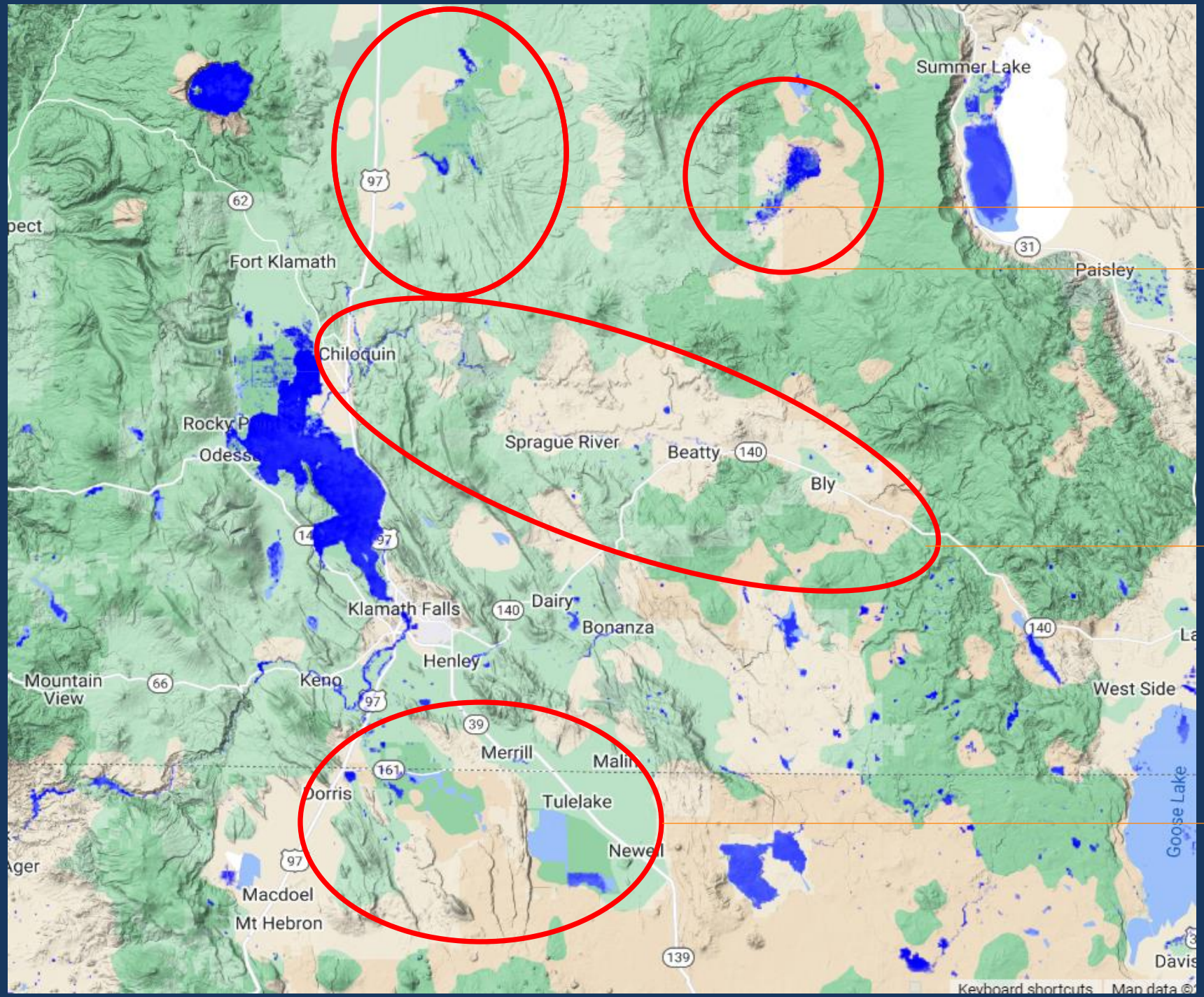
Sycan Marsh - Full

Sprague River floodplain
Charged and flooded

NWR Wetlands -
Full

https://pdonnelly.users.earthengine.app/view/wetsurfacewaterv23

Spring snow melt response 2022



Klamath Marsh – Nearly dry

Sycan Marsh – Partial fill

Sprague River floodplain -Low flow no flooding/bank storage

NWR Wetlands – 95% dry

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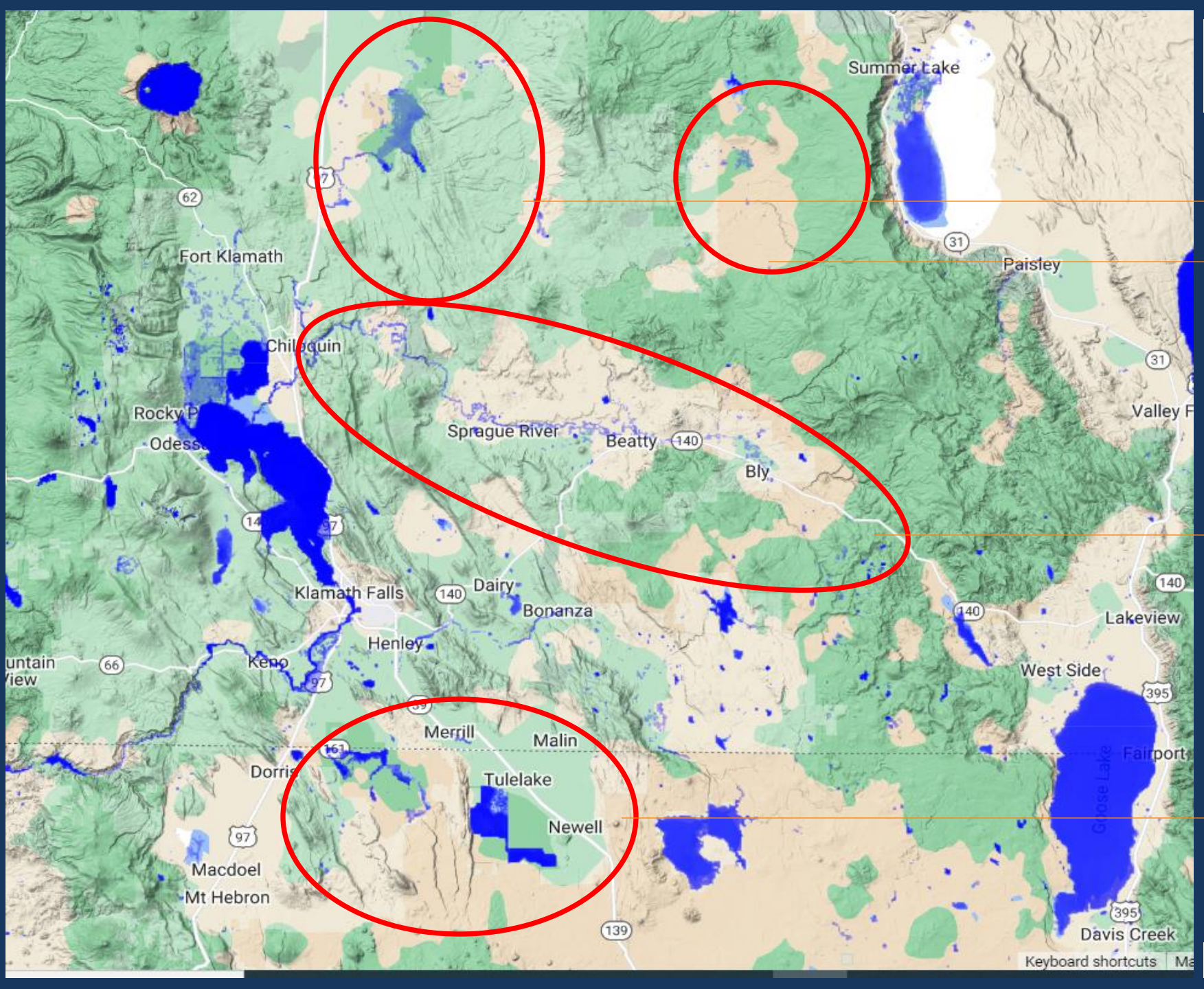

Average August conditions
1984 - 1994

Klamath Marsh – Partial fill

Sycan Marsh - drying

Sprague River floodplain - Some floodplain flooding, higher stream flow

NWR Wetlands – AVG summer conditions

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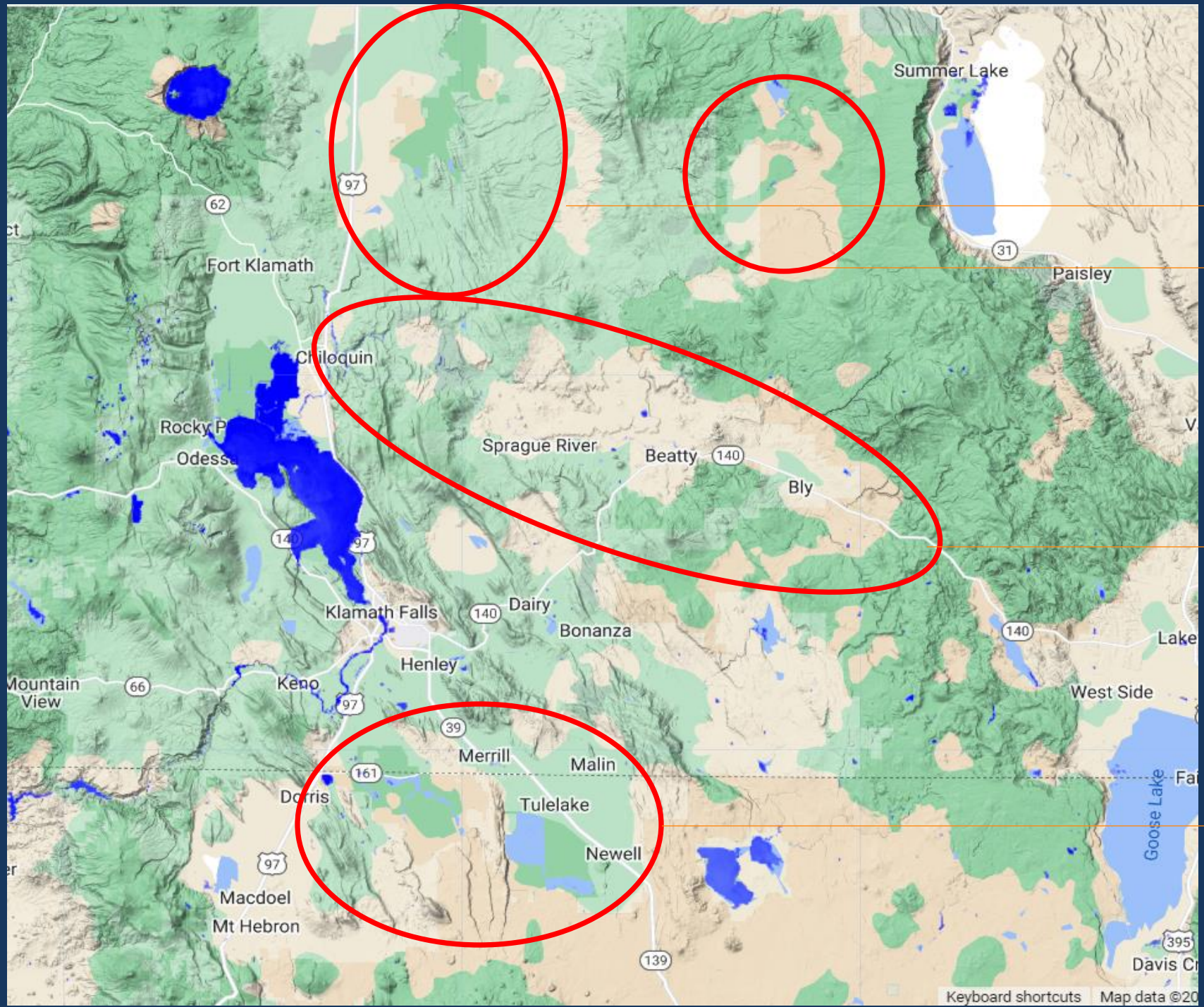
August conditions - 2022



Klamath Marsh – nearly dry

Sycan Marsh - nearly dry

Sprague River floodplain - poor flow / floodplain dry

NWR Wetlands – 100% dry

https://pdonnelly.users.earthengine.app/view/wetsurfacewaterv23

These Examples Illustrate

- Again climate is influencing this but water management decisions are a driver
- The drier the watershed gets, the less water is stored and attenuated through the system (decreased climate resiliency)
- This impacts seasonal flow in creeks, streams and rivers
- Decreased resiliency compounds across time
  - less water in the system results in drier conditions throughout and across years
- These drier conditions influence the success of restoration and recovery efforts across the watershed
- When the system is wet it is extremely resilient and when dry it has limited resiliency to hydrologic and climatic variability

The Math is Simple

A Klamath Basin with functioning wetlands systems = A wet Klamath Basin (A)

+

A wet Klamath Basin = An ecologically resilient Klamath Basin (B)

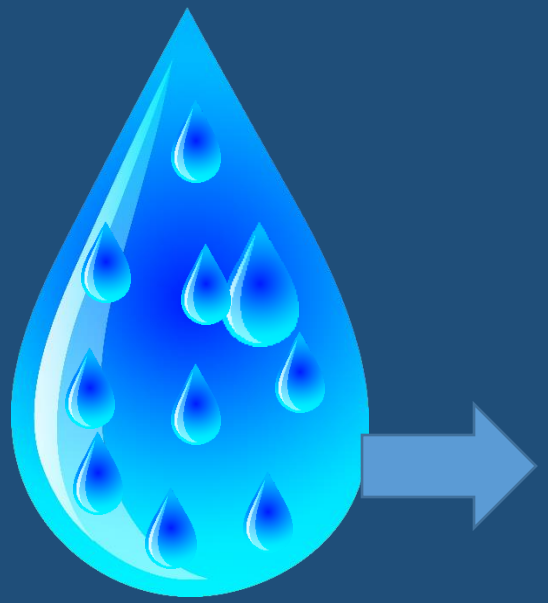
=

An Ecologically Resilient Klamath Basin = A Klamath Basin that can drive the recovery of fish, wildlife, water and our communities (C)

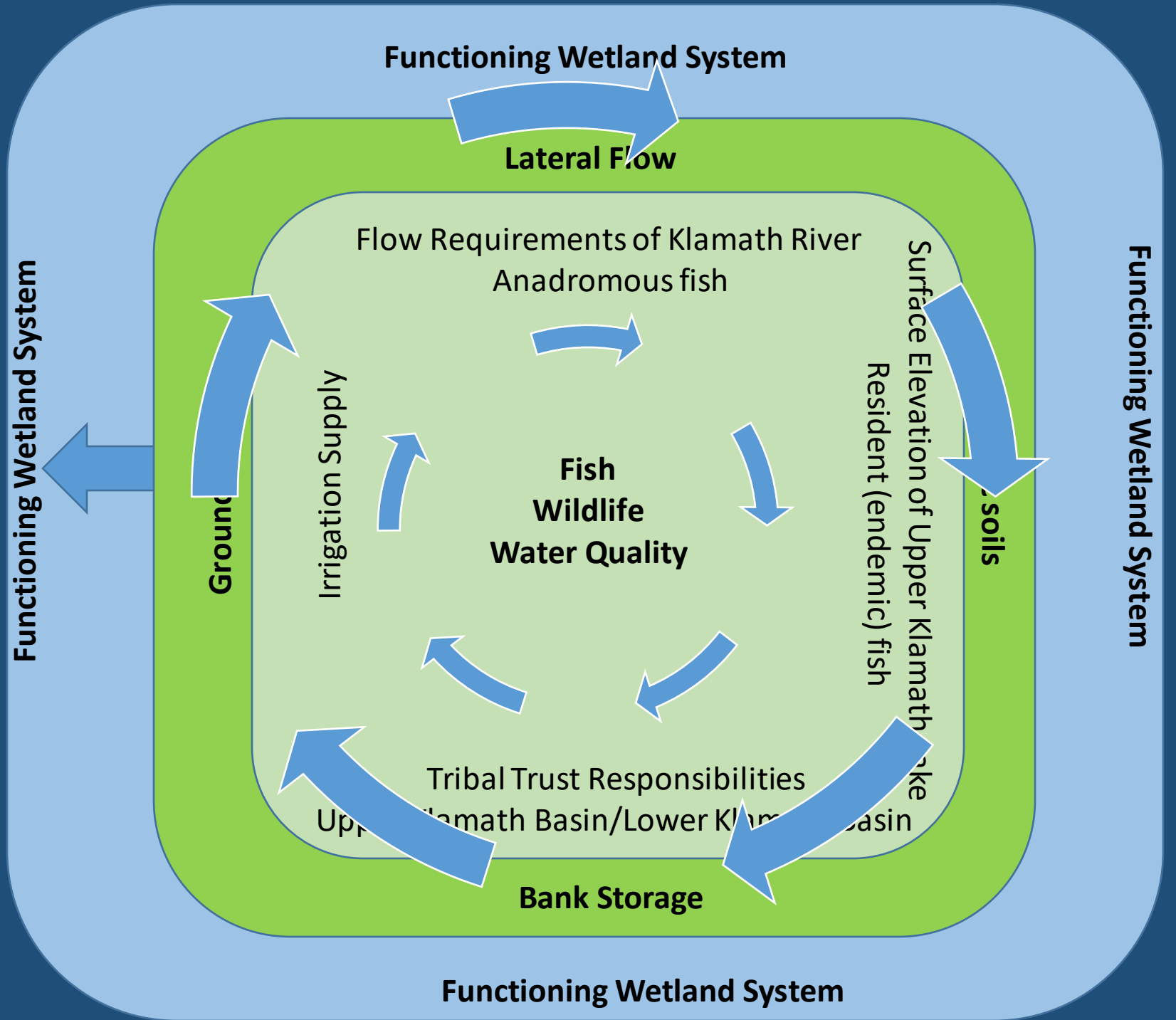
A New Approach to Water Management Across the Watershed

Klamath Basin Watershed Ecosystem

Water Supply

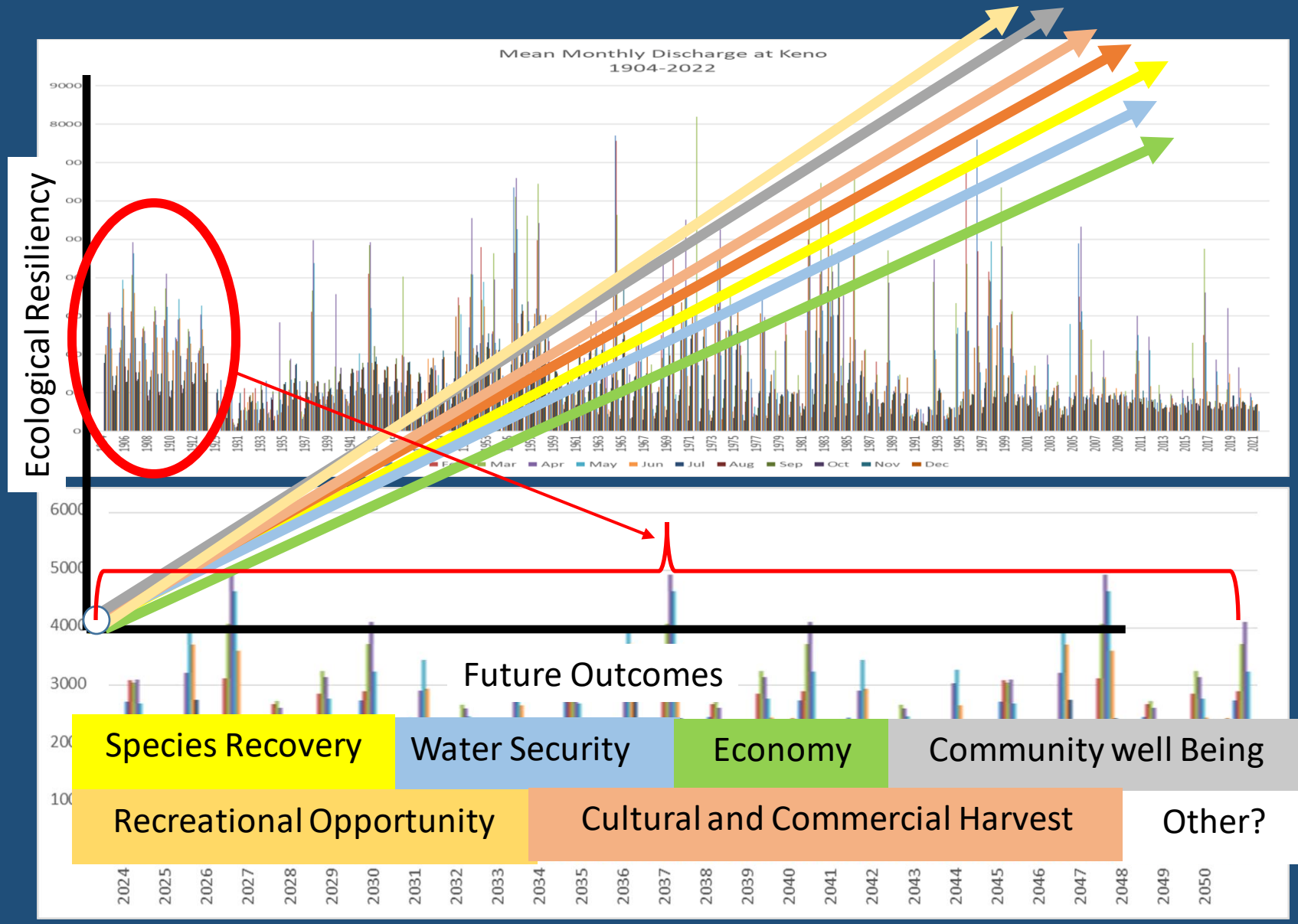


Water Management built on the foundation and processes of the ecosystem



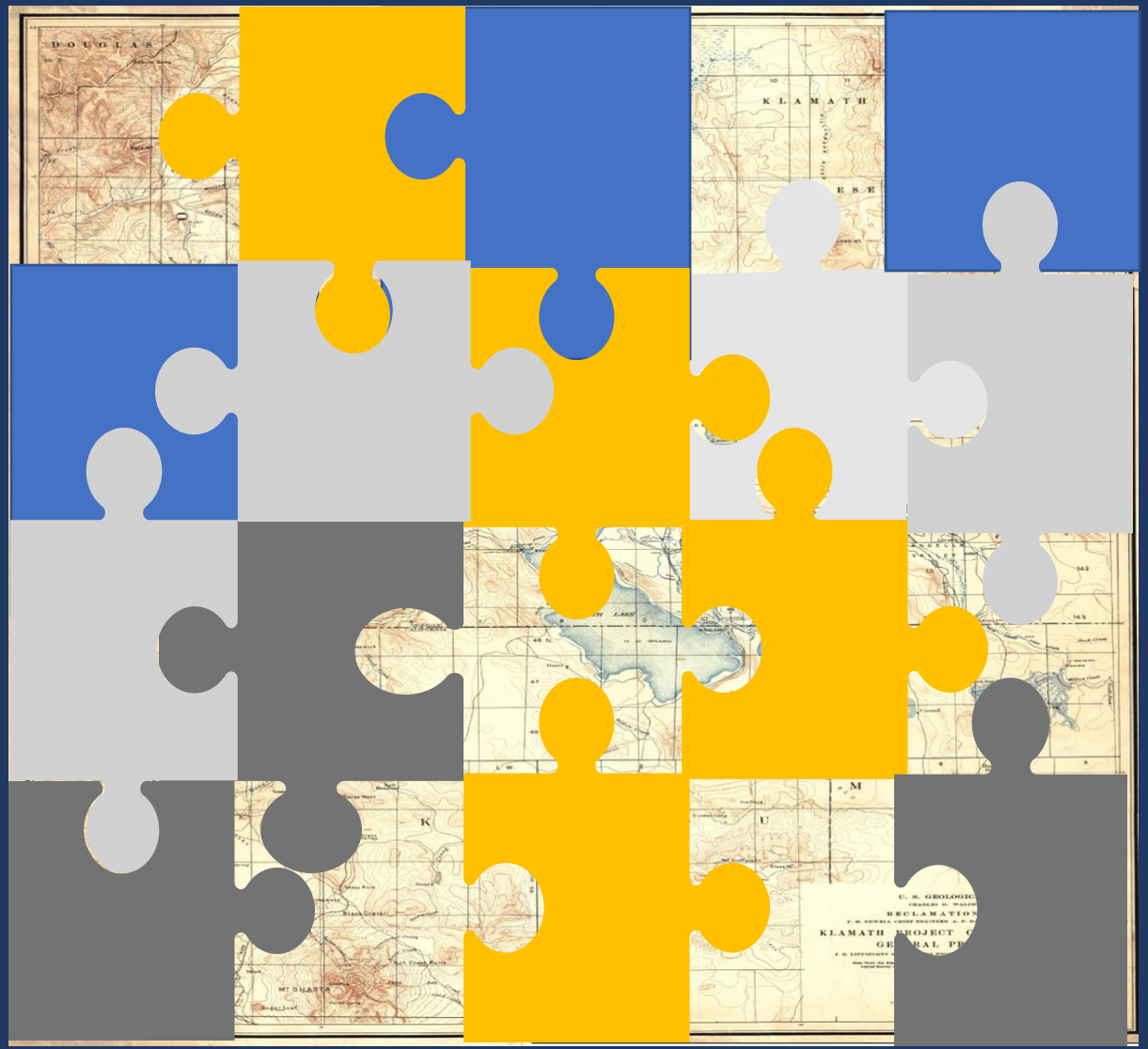
This Ecosystem Based Water Management Could

- Build back and sustain resiliency
- Promote species recovery throughout the watershed
- Increase habitat availability within and among years
- Increase reliability of lake elevations and river hydrology
- Provide assurance of water for all users
- Increase water security in the face of climatic variability
- Increase collaboration, trust, communication throughout the watershed



The Time and Opportunity to Start Putting the Puzzle Back Together is Now!

Thank you for your time and interest



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