

# Manning Creek Improvements as part of the Kuhla'Napo Wetland Preserve Restoration Project on Clear Lake, CA

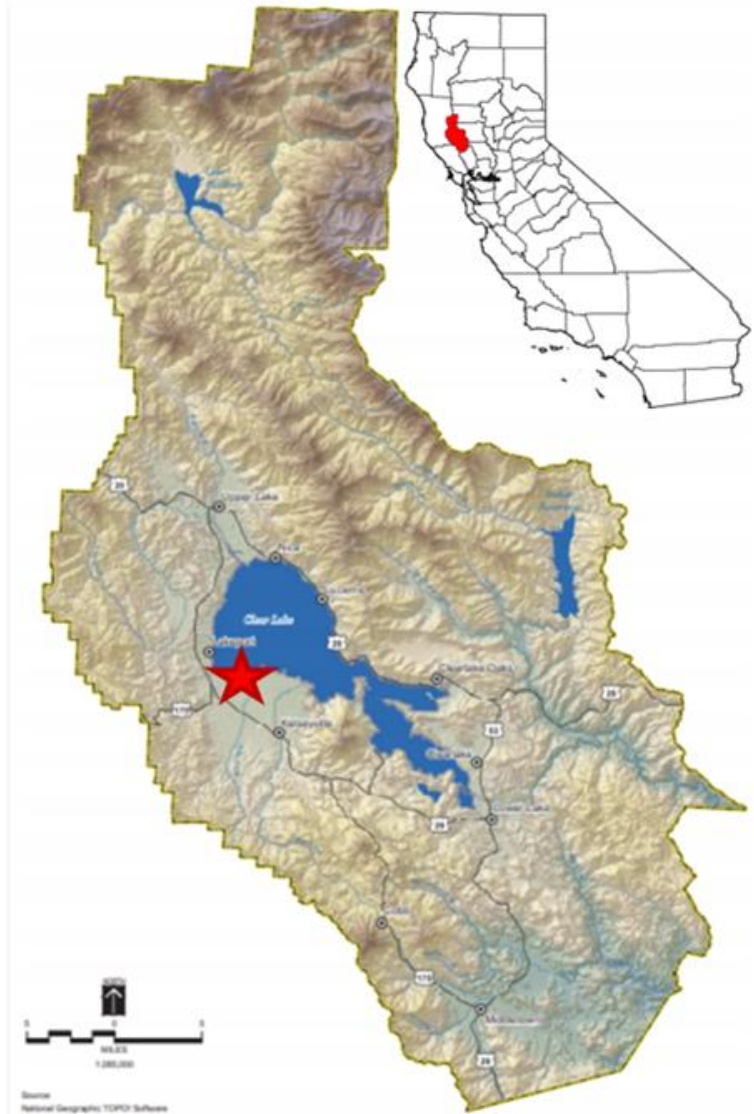


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Lake County Land Trust  
**Skyler Lewis & Anthony Falzone,** FlowWest  
**Sarah Ryan & Alfred Balletto,** Big Valley Rancheria



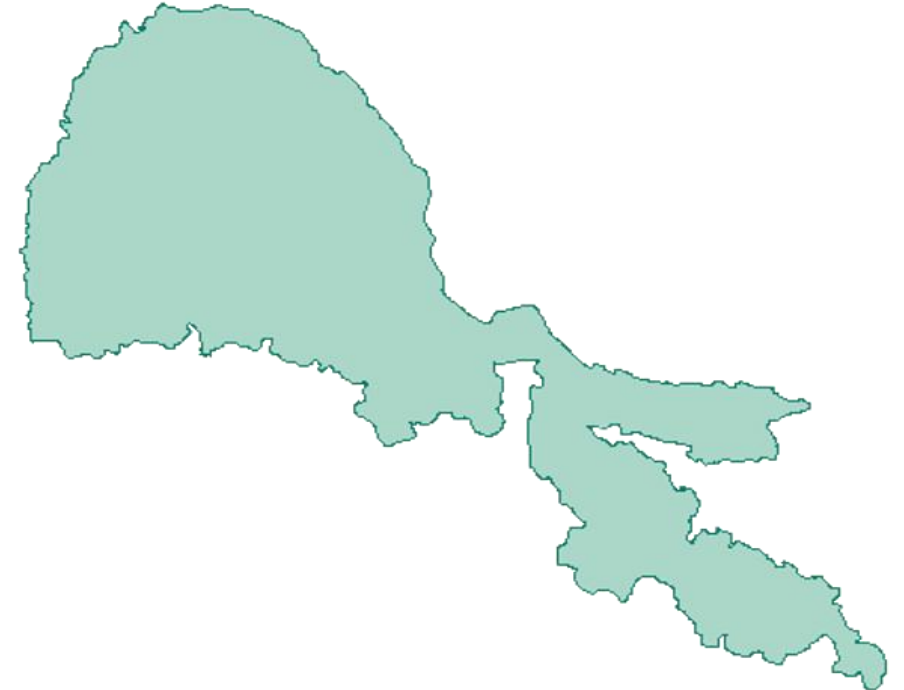
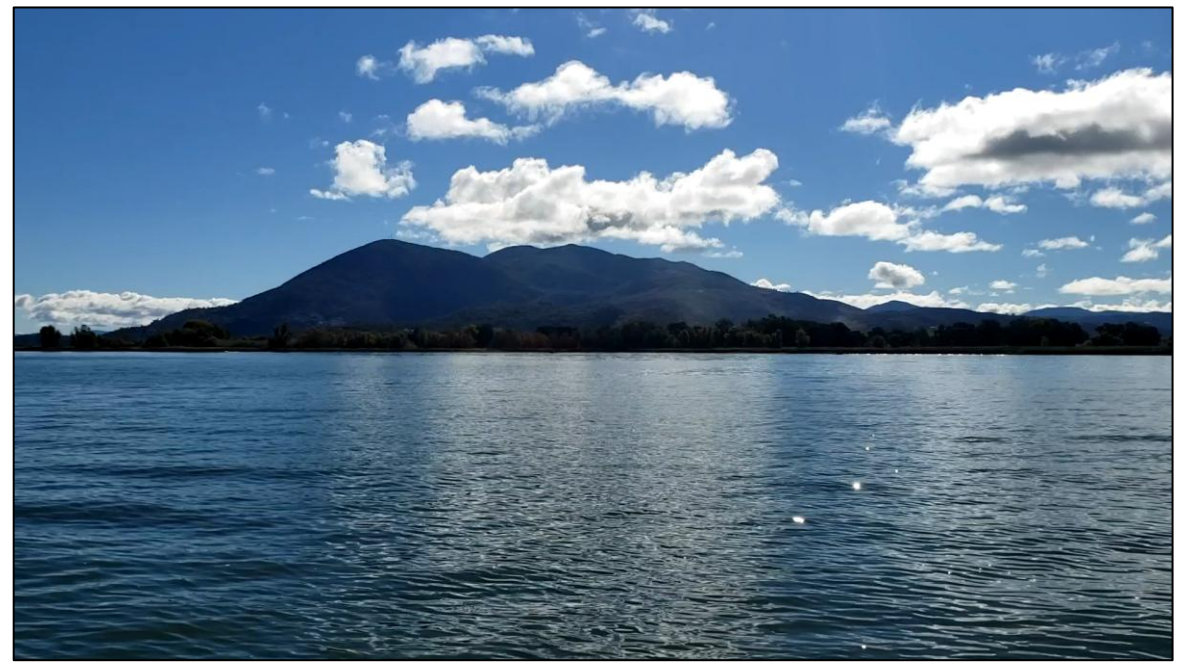
# Conservation Priority on lands around Clear Lake

*Shorelines, wetlands, tributaries, Clear Lake Hitch habitats*



# Clear Lake, CA

- Largest freshwater lake in California
  - 120 miles of shoreline
  - ~70 square miles
  - Shallow (mean depth = 27 ft.)
- Very old
  - ~480,000 years in current shape
- Water Quality Issues
  - Lost about 85% wetlands and natural shoreline habitat
  - Currently 303d listed
  - TMDL sediment phosphorus
- Regional Importance
  - Vital to local fishing economy and ecology
  - Provided year-round drinking water to 66% county population





# Today: Planning Project 292-acre Kuhla'Napō Preserve in Big Valley Wetland Complex on Manning Creek

**Kuhlanapo Wetland Preserve**

**Big Valley Tribal Lands**



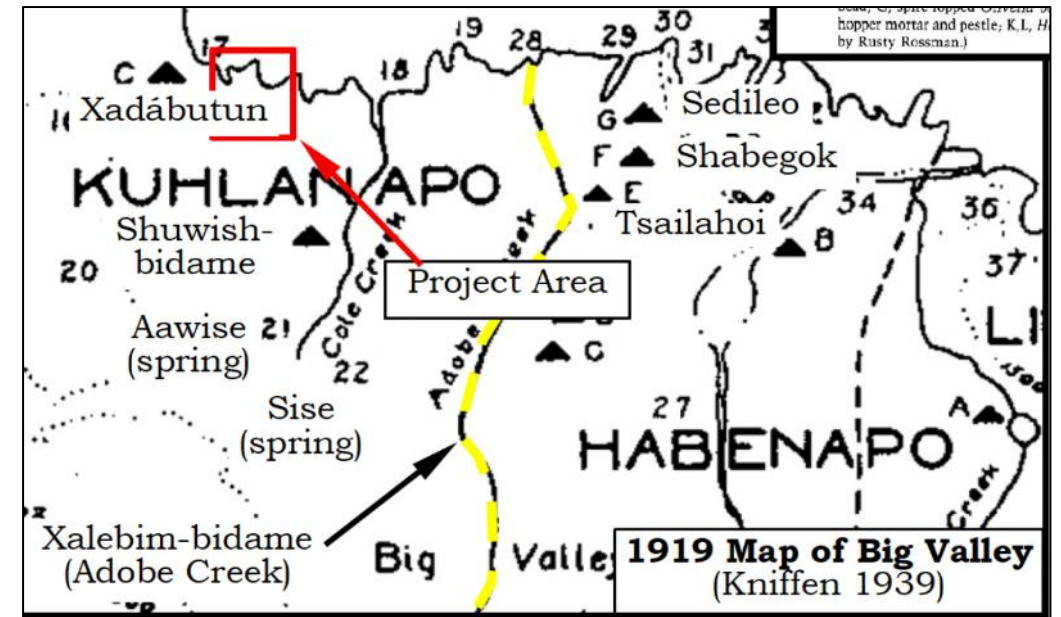
**CDFW \$1.2 M  
restoration  
planning grant**

# Important Indigenous Cultural Site

Kuhla'Napo = Water Lily People

Current Site of Big Valley Band of Pomo Indians

- MOU for Access and Planning
- Co-Management / Stewardship Plan drafted
- Full partners / decision makers
  - Access & Gathering
  - Design & Use Decisions
  - Site Security
  - Grant Planning



# Manning Creek Delta 1942

- Manning Creek flows through east branch riparian corridor
- Connects to lake at Manning Creek Delta tule wetland complex



# Manning Creek Delta 1952

- Poof! Manning Creek east branch riparian corridor is gone
- Flow redirected through west branch agricultural canal



# Manning Creek Delta 2022

- Steep head cut on west branch creates hitch passage barrier
- East branch continues to flow as a secondary channel
- Tule wetlands are partly disconnected from the rest of the floodplain by levees



# Current Issues on Site

- Delta, wetland, and creek alteration and disconnection
- Creek modification
  - Erosion & Sedimentation
  - Flooding
  - Fish Barriers
- Wetland Removal
  - Reduced natural shoreline
  - Reduced native vegetation



# Fish barriers and Flooding at site

*Contribute to fish strandings, sediment and nutrient leaching – wetland & floodplain disconnection*



West Channel Manning Creek straightened,  
deepened, native vegetation removed and  
previous wetland drained



Remnant secondary Manning Creek  
Channel, blocked, debris accumulation,  
contributes to erosion and blow outs



# Data for Design

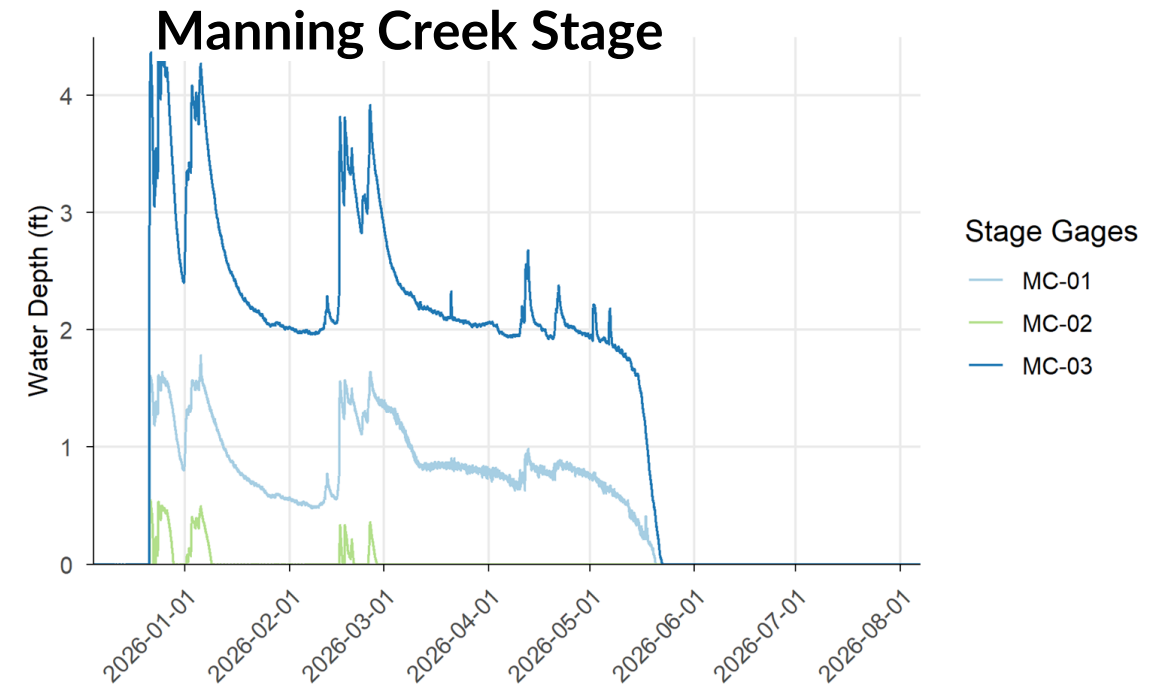
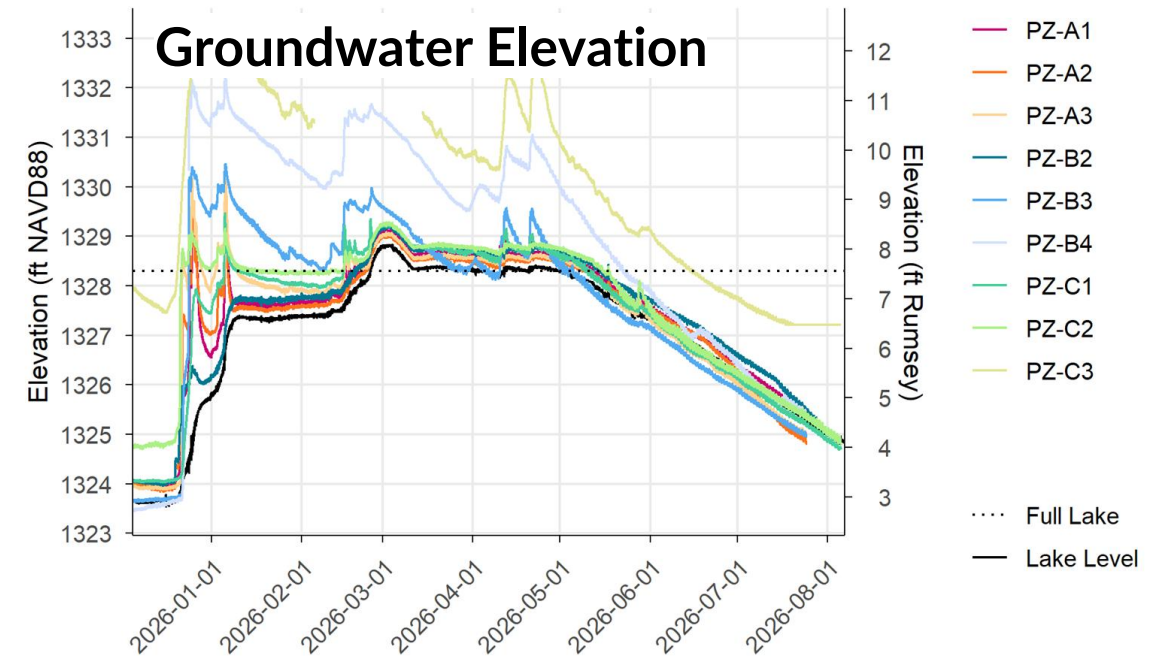
- Shallow Groundwater Elevation
- Creek Stage and Temperature
- Real Time Data on our Restoration Website:

[lakecountylandtrust.org/lands/kuhlanapo-wetland-restoration](http://lakecountylandtrust.org/lands/kuhlanapo-wetland-restoration)



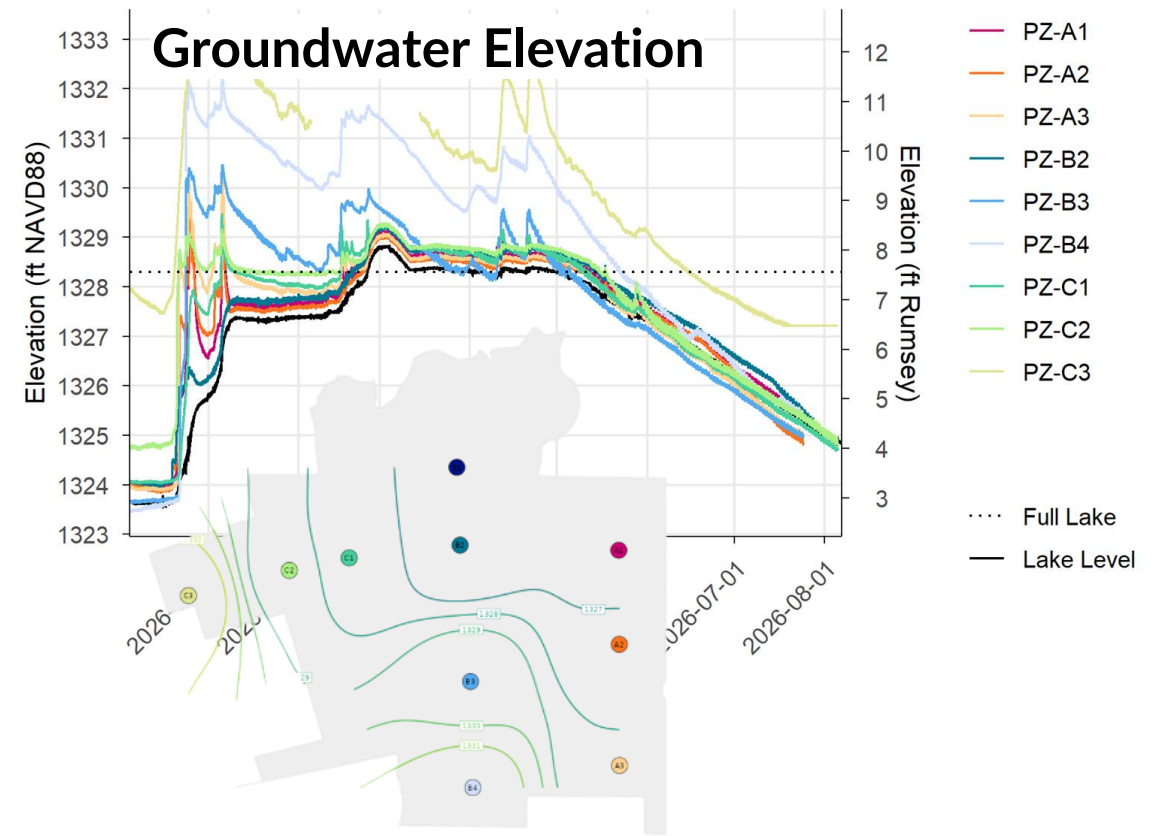
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## MONITORING LOCATIONS



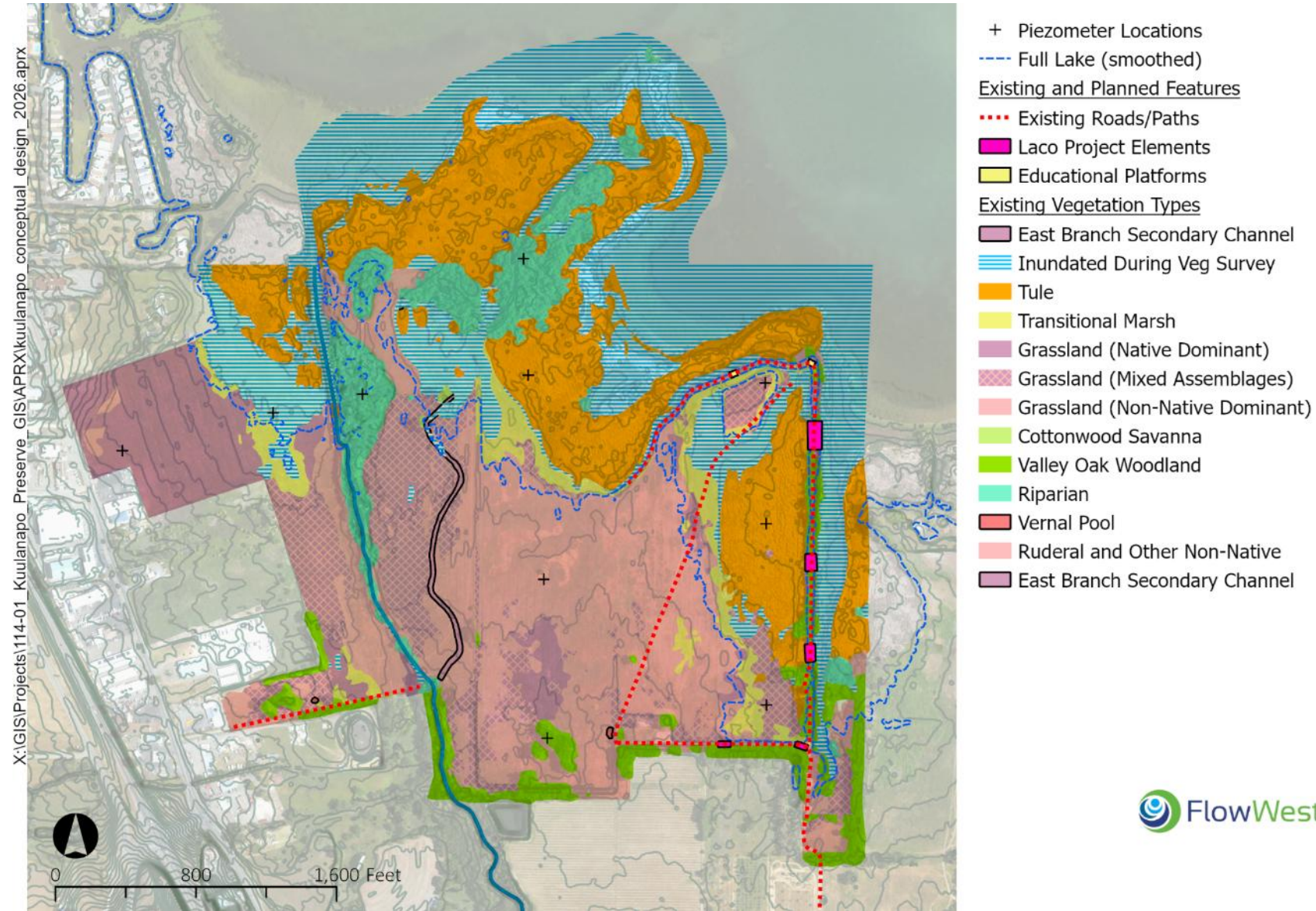
# Data for Design

- Shallow Groundwater Elevation
  - Hand augered 10 shallow groundwater monitoring wells
  - Tribal monitor
  - Installed in transects to capture different
    - soil types
    - vegetation communities
    - distance from the lake



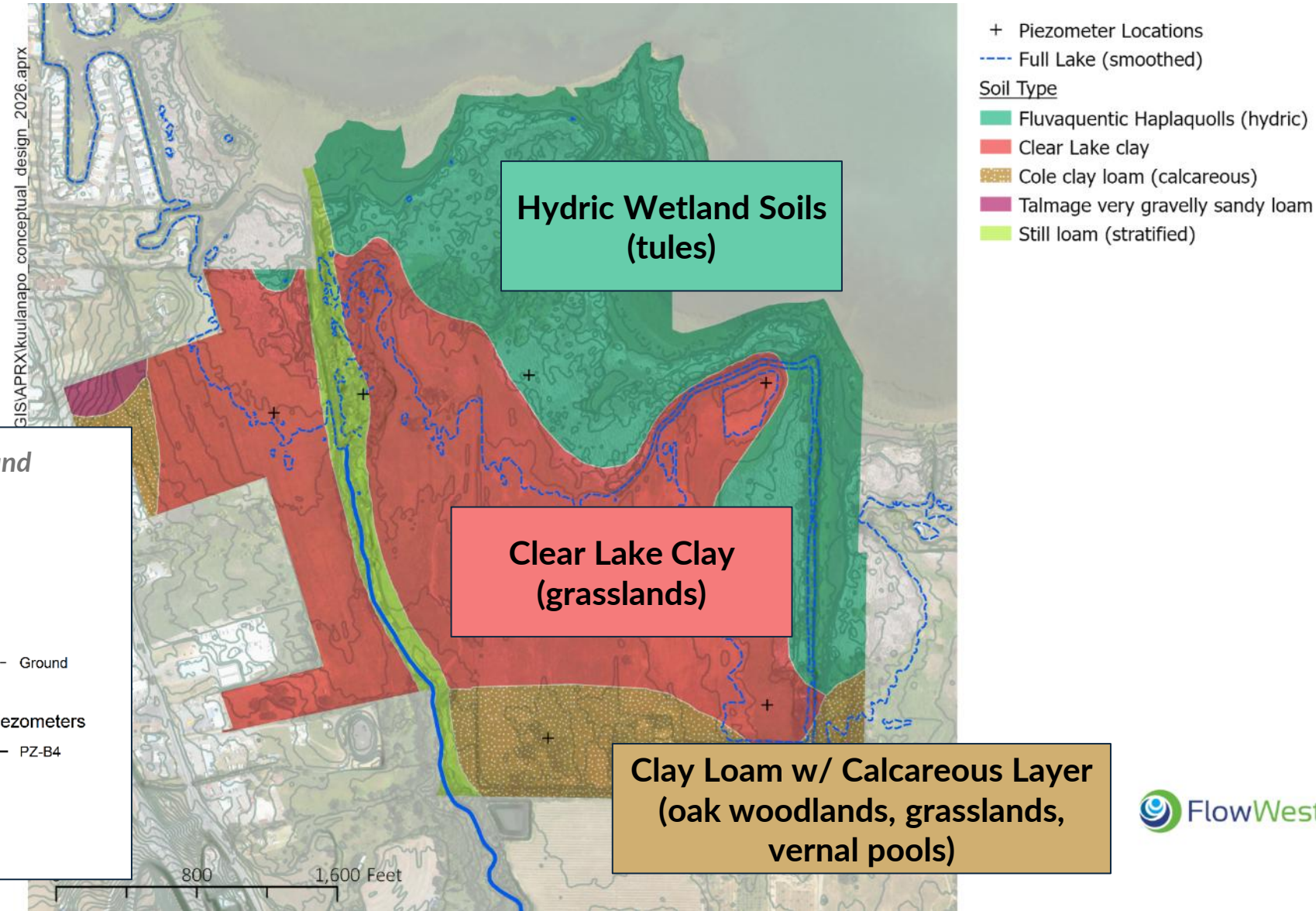
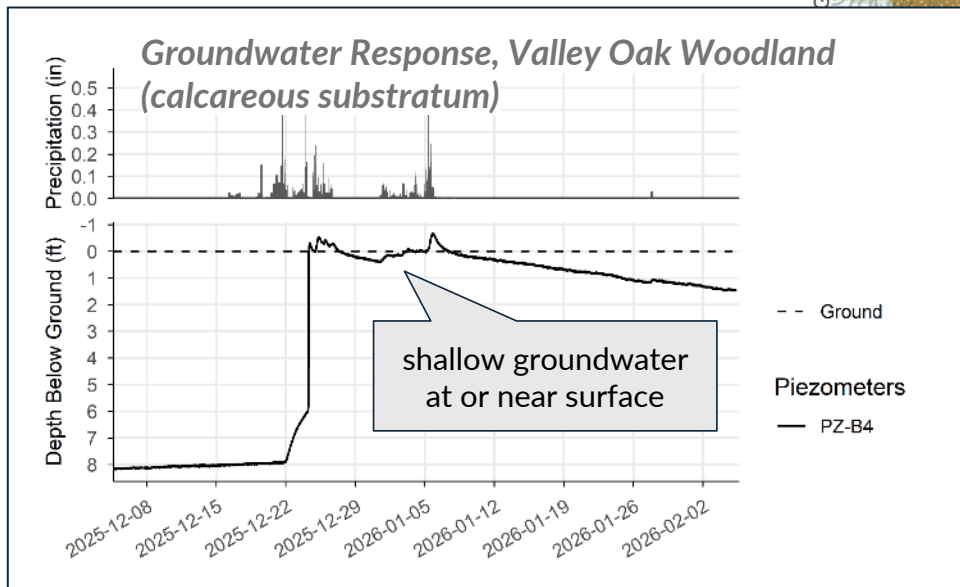
# Vegetation Mapping

- Current conditions:
  - established tule beds
  - non-native invasives
  - oak woodlands
- Change in wetland extent between the last drought and now (61% to 87% of area)
- Vernal pool protection



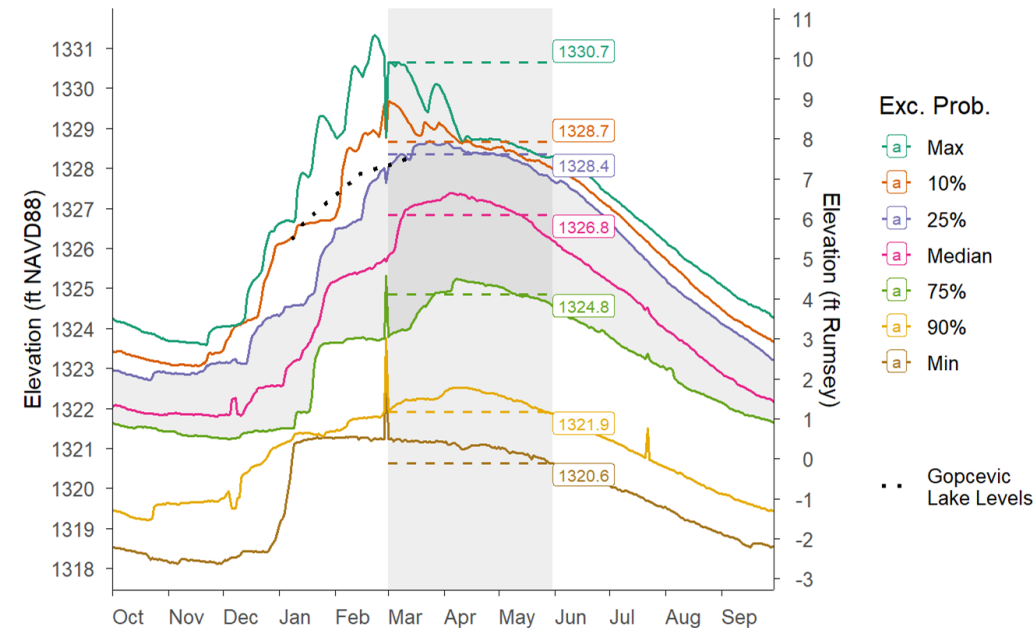
# Soils Mapping

- Match proposed vegetation with appropriate soils
- Understand shallow groundwater and overland flow dynamics for different soil types

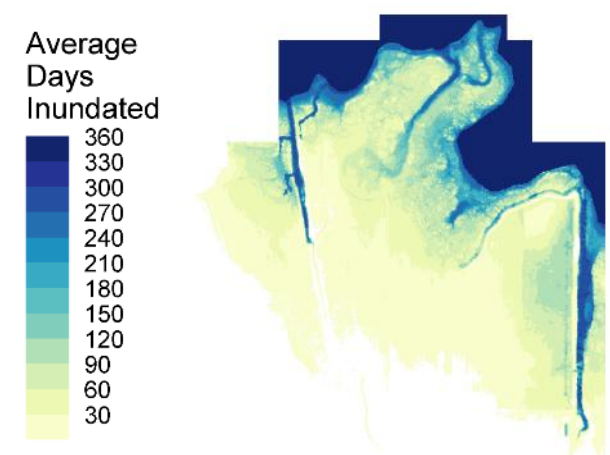


# Elevation and groundwater analysis to determine target elevations for tule wetland and transitional wetland communities

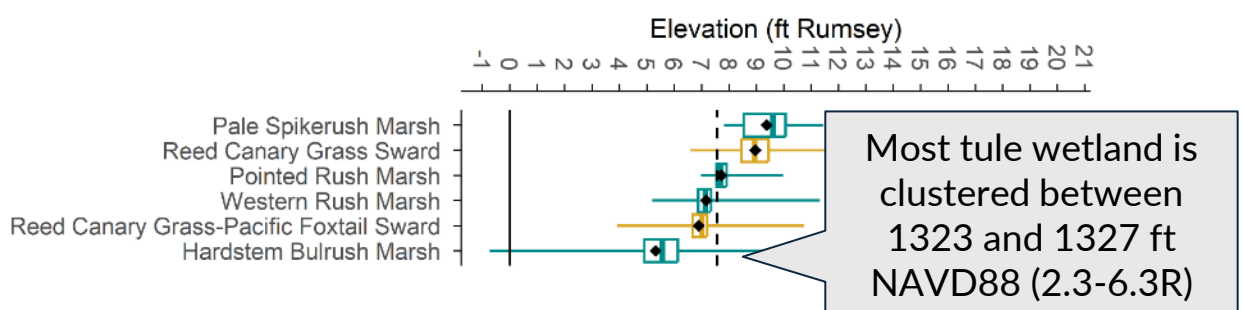
## Lake Elevation Statistics



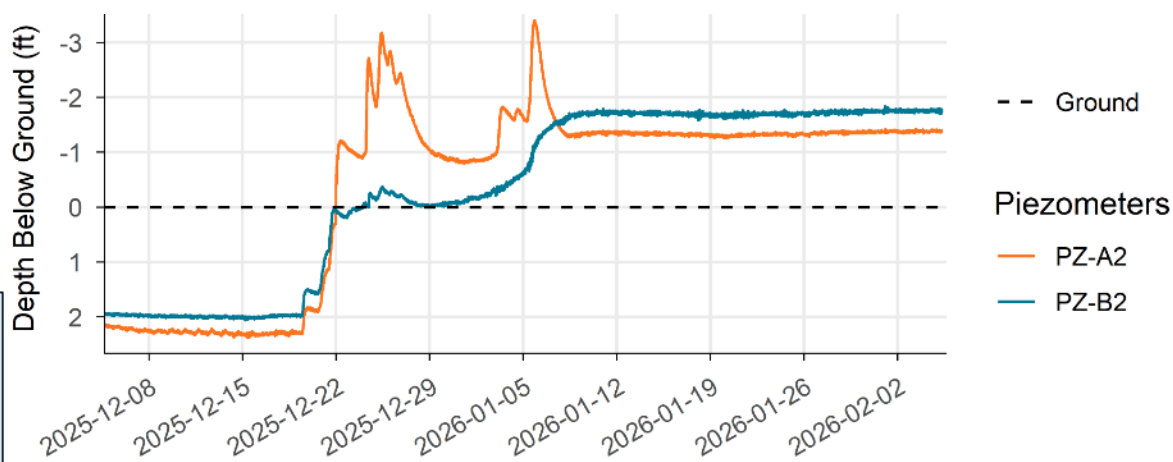
## Inundation Frequency via LiDAR DEM



## Elevation Ranges of Existing Vegetation



## Groundwater Trends in Existing Wetlands



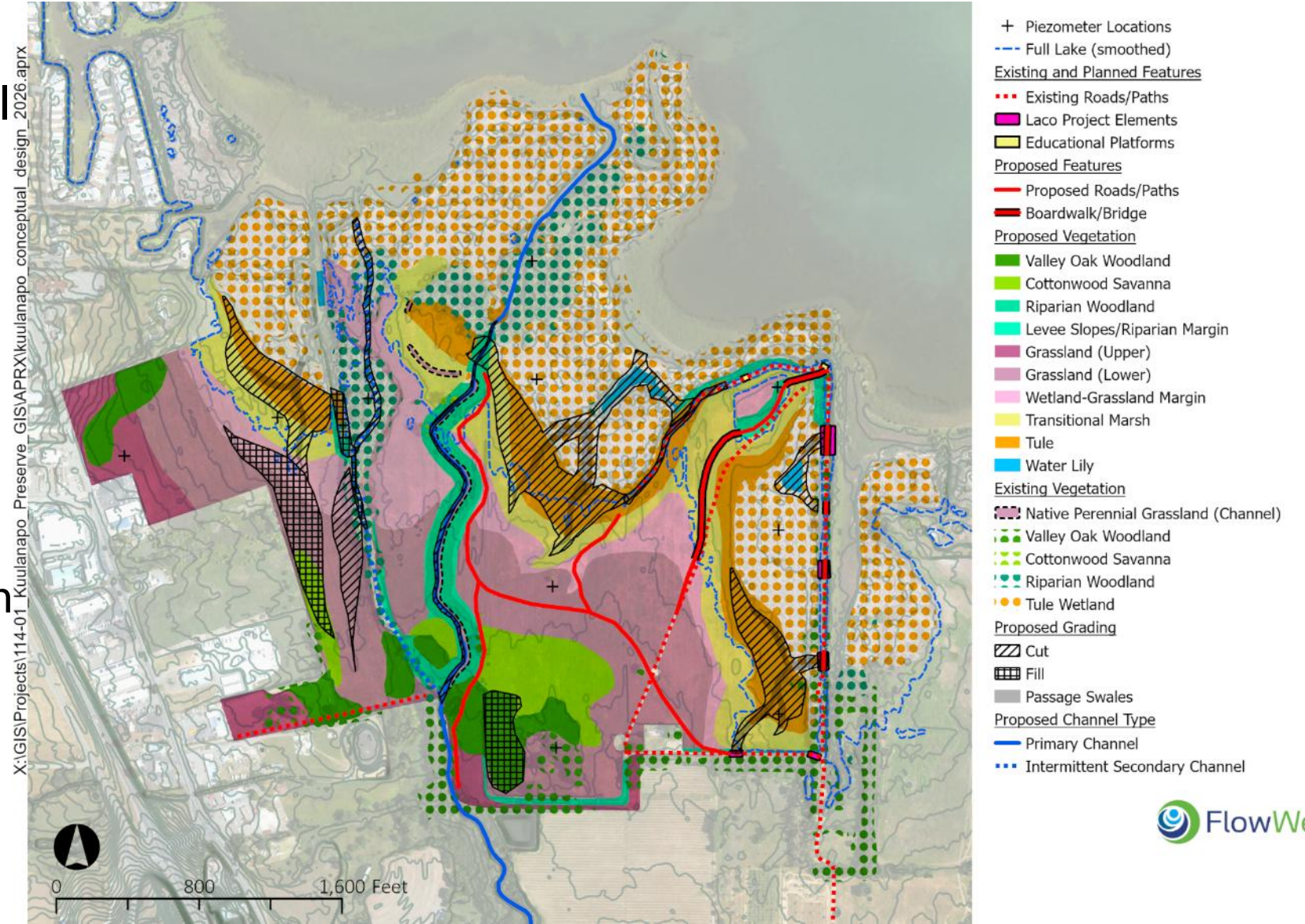
# Restoration Plan

## *Planting and Wetlands :*

- Expand tule and transitional wetland habitat
- Replace invasive species with native plants
- Incorporate culturally significant plants for gathering
- Implement cultural burning

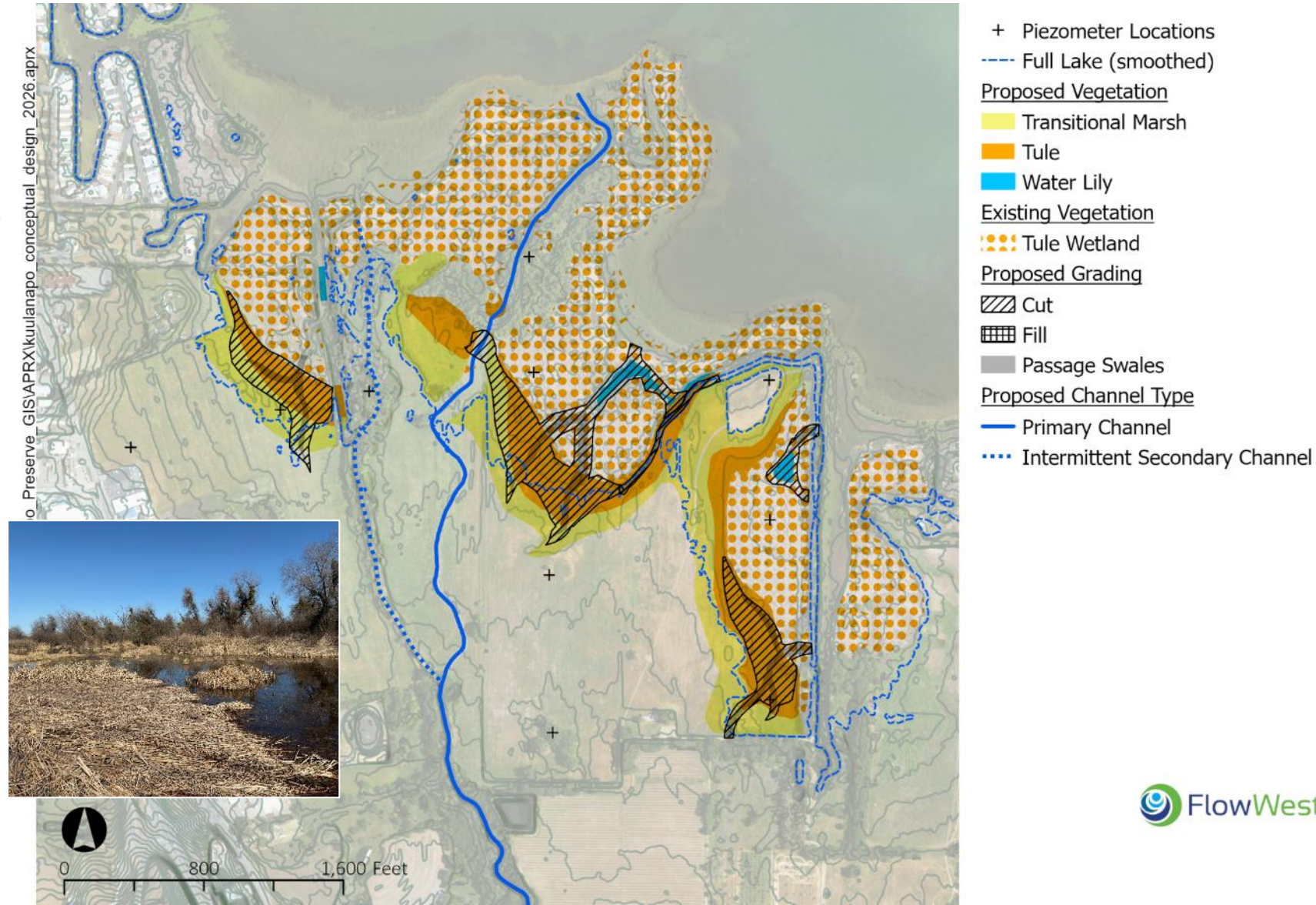
## *Manning Creek:*

- Restore the creek to its historical alignment through the tules of the Manning Creek delta
- Improve hitch passage and prevent stranding



# Restoration Plan: Wetland Expansion

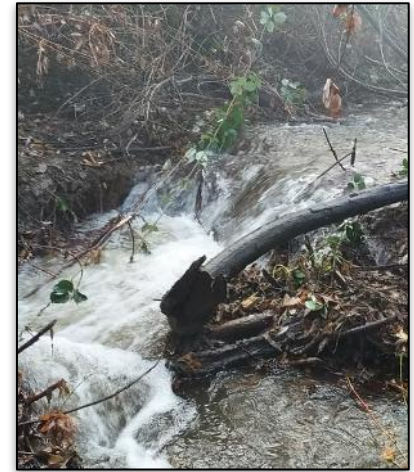
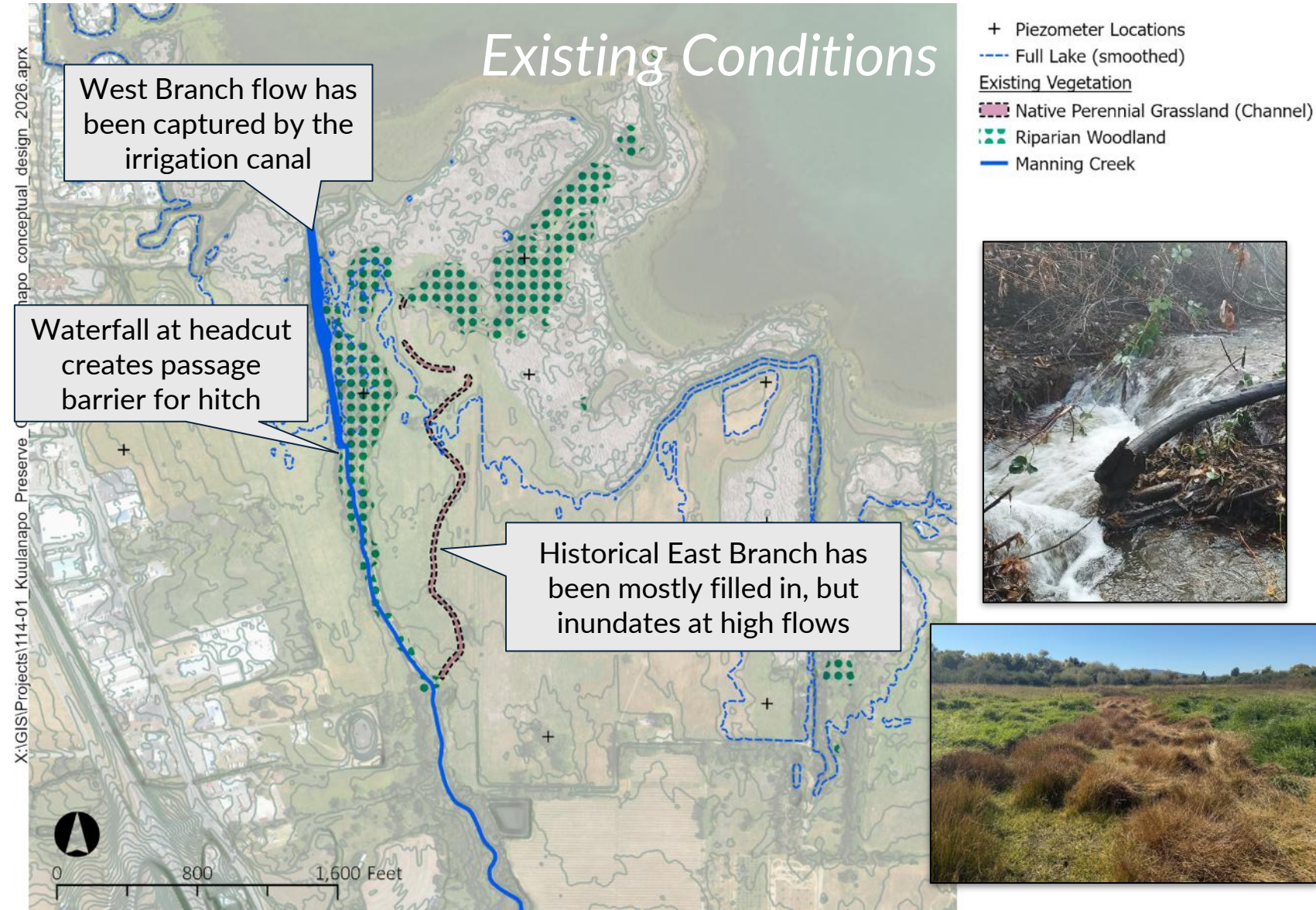
- Shallow grading at margins of existing wetlands to create suitable hydrology for expanding wetland
- Dendritic passage swales to guide hitch from floodplain through wetland back to the lake
- Deeper inlets for restoration of yellow pond-lily



# Restoration Plan: Manning Creek

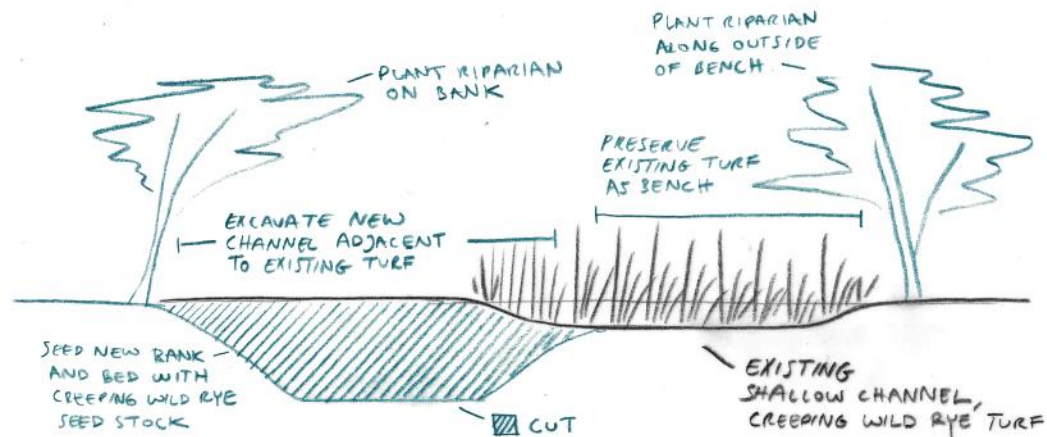
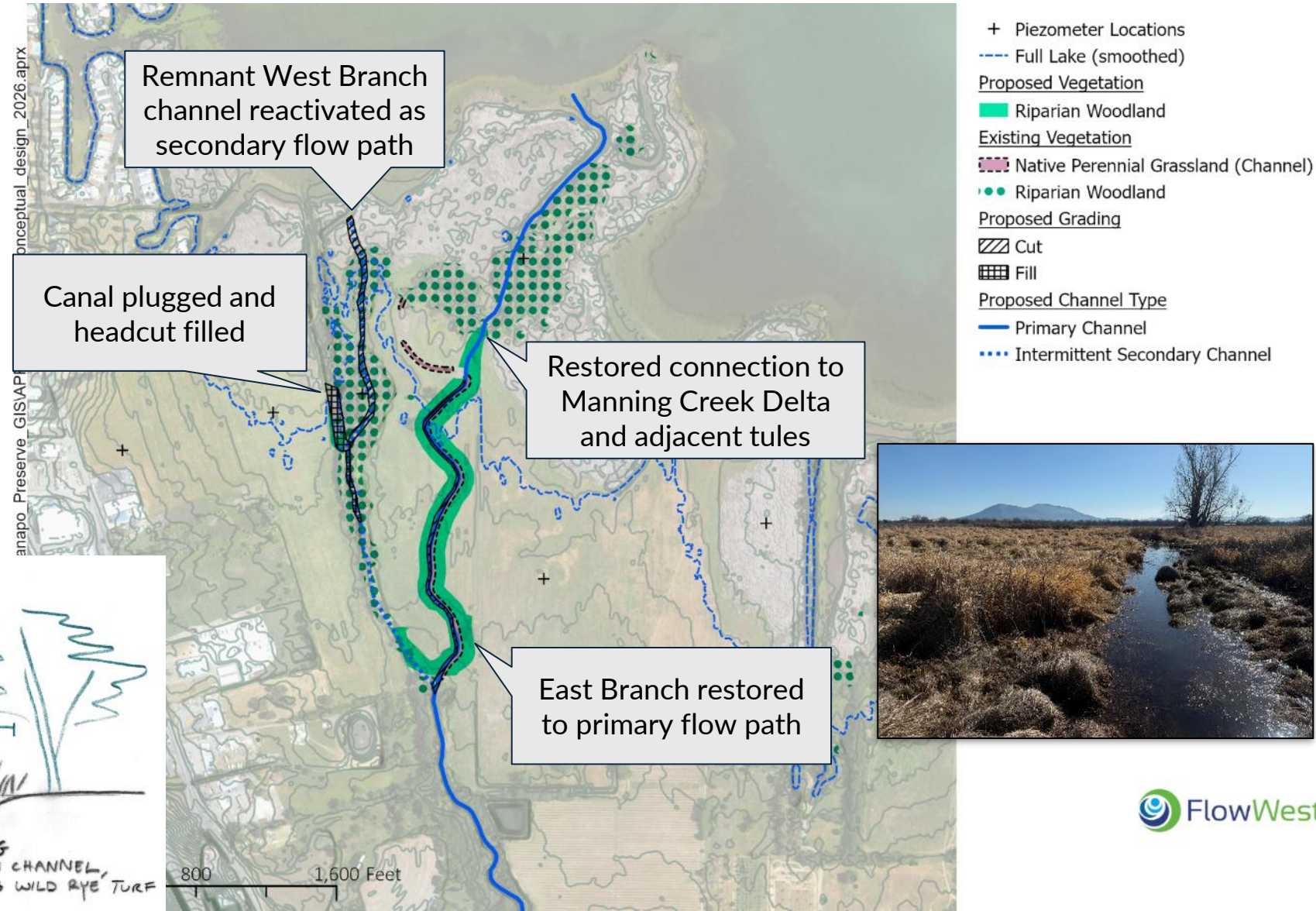
## Design goals:

- Keep more flow in the channel to reduce stranding and maintain passage
- Eliminate headcut barrier that is present when lake levels are low
- Restore historical channel alignments



# Restoration Plan: Manning Creek

- Considered 5 different design alternatives
- Preferred alternative restores the main flow path through the historical meandering east branch



# Restoration Plan by the numbers



**3,860 feet**

*restored creek  
channel connecting  
to delta*



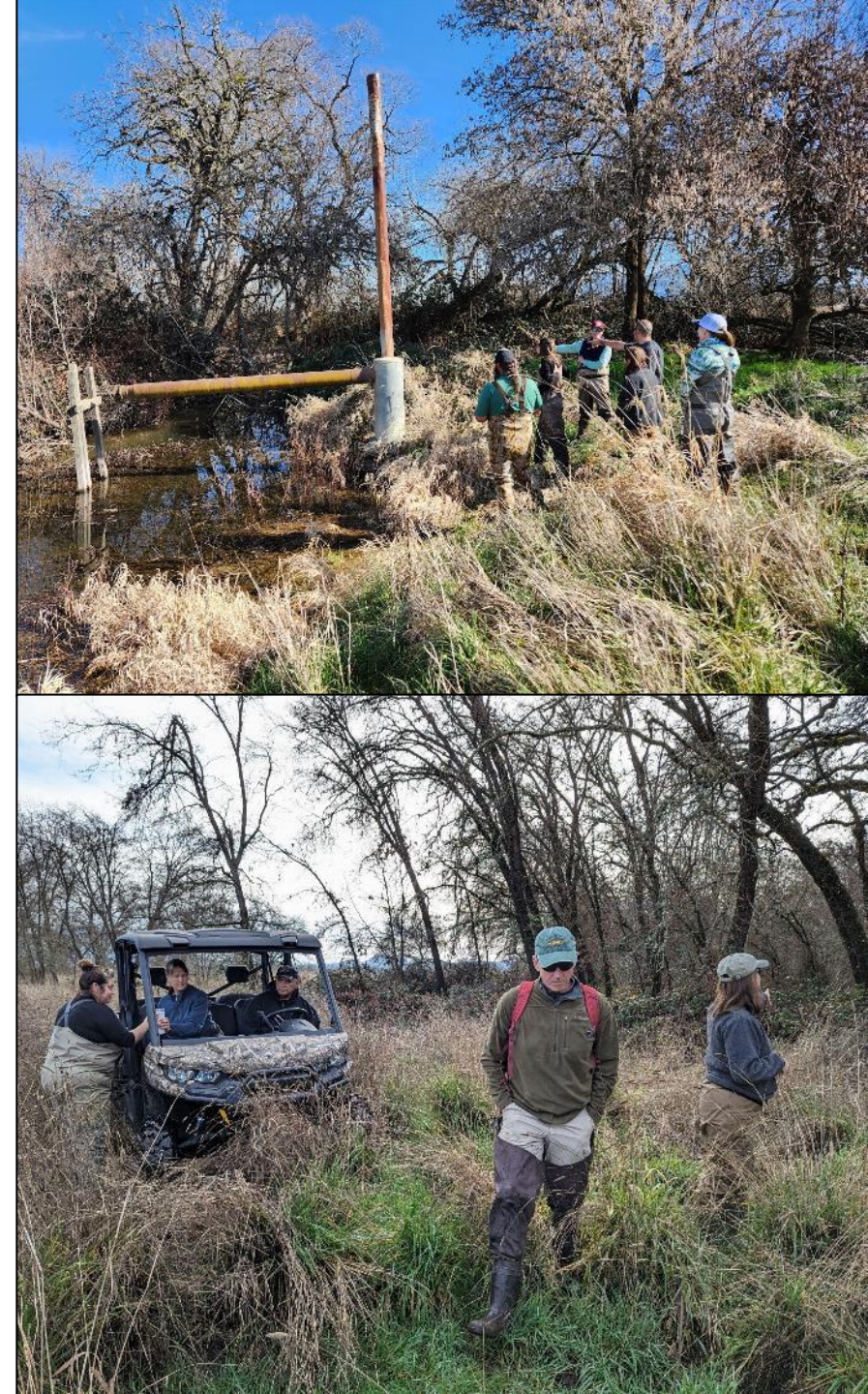
**18 acres**



*tule wetland created  
on lakeshore  
(+26%)*

# Conclusion

- Research is essential!
  - Historical information maximizes restoration potential
    - maps & aerial imagery
  - Integrate site data: groundwater monitoring, vegetation mapping, and elevation analysis
- Wetland / floodplain reconnection improves Clear Lake
  - reduce nutrient sources
  - increase size & function shoreline communities
- Collaboration with Tribal partners
  - Historical ecology and land use
  - Stewardship planning
    - Access for fishing, gathering, ceremony
    - Village protection
    - Good Beneficial Fire & indigenous practices





# Questions?

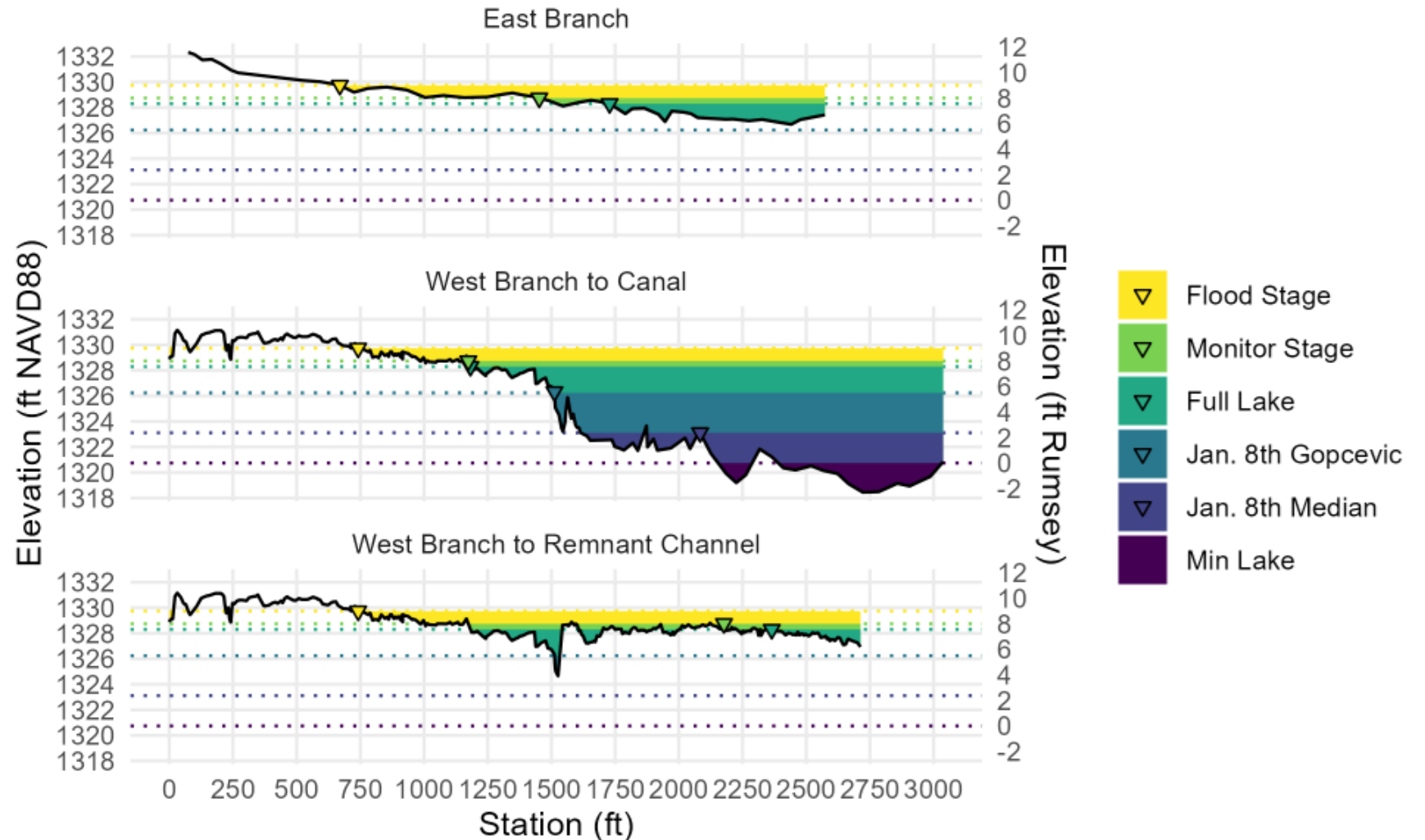
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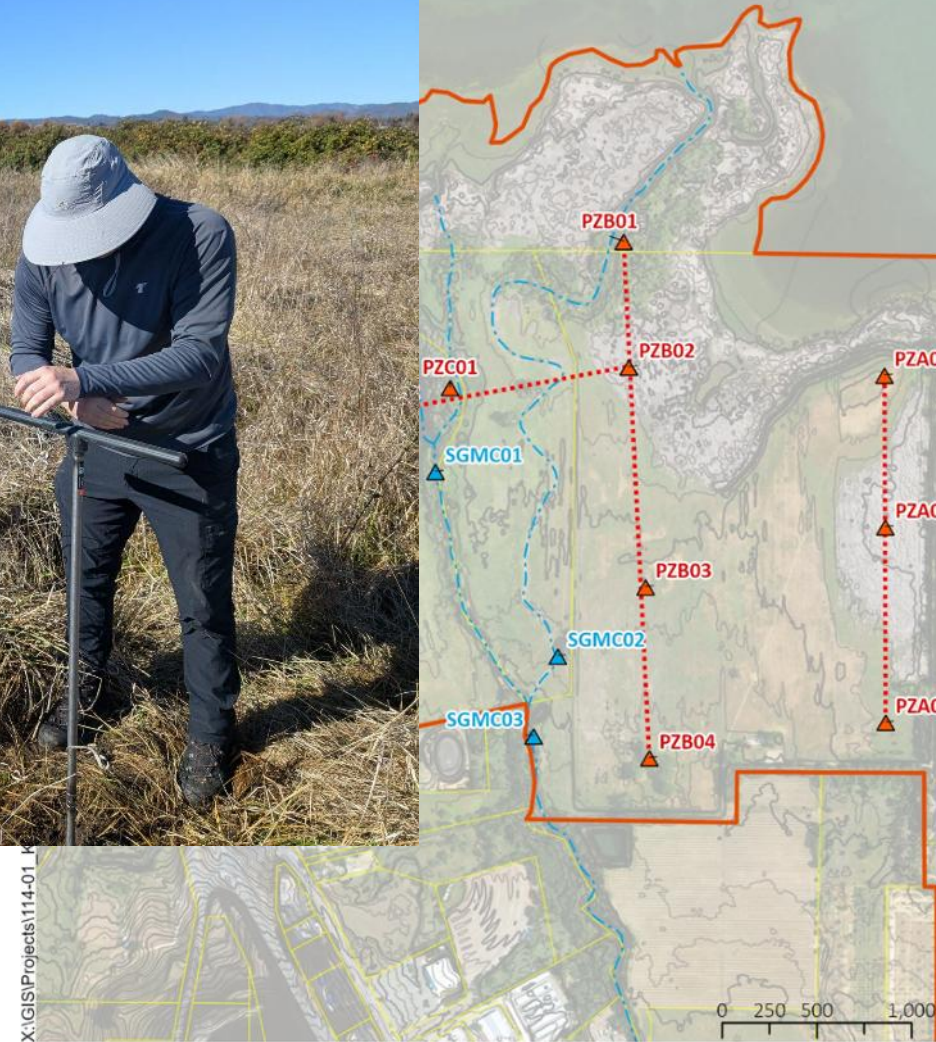
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# Appendix

# Channel Profiles

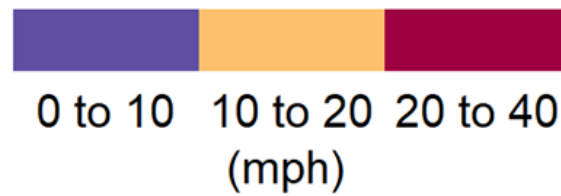
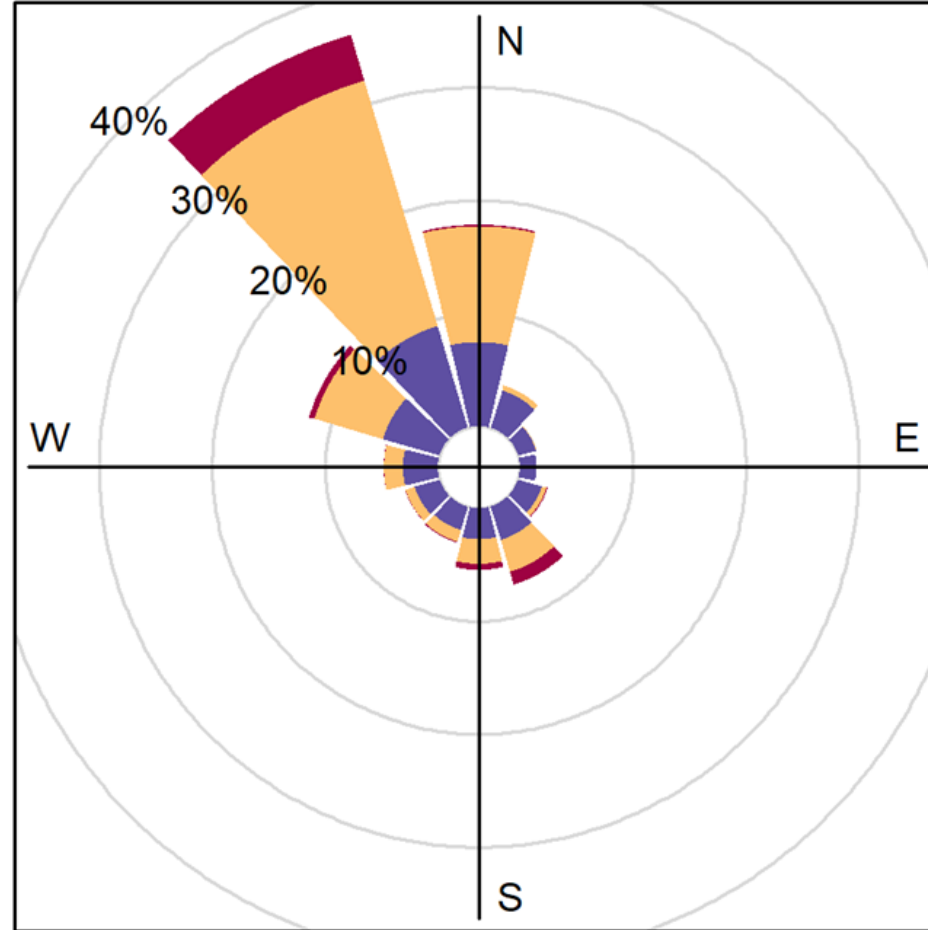
- Will require excavation to restore the East Branch
- Material can be used on site to plug the West Branch and create upland surfaces





- ▲ Stage Gages
- ▲ Piezometers
- ..... Piezometer Transects
- ▭ Project Boundary
- ▭ Parcels
- 3 ft contours
- 1 ft contours
- - - Manning Creek West and East Branches

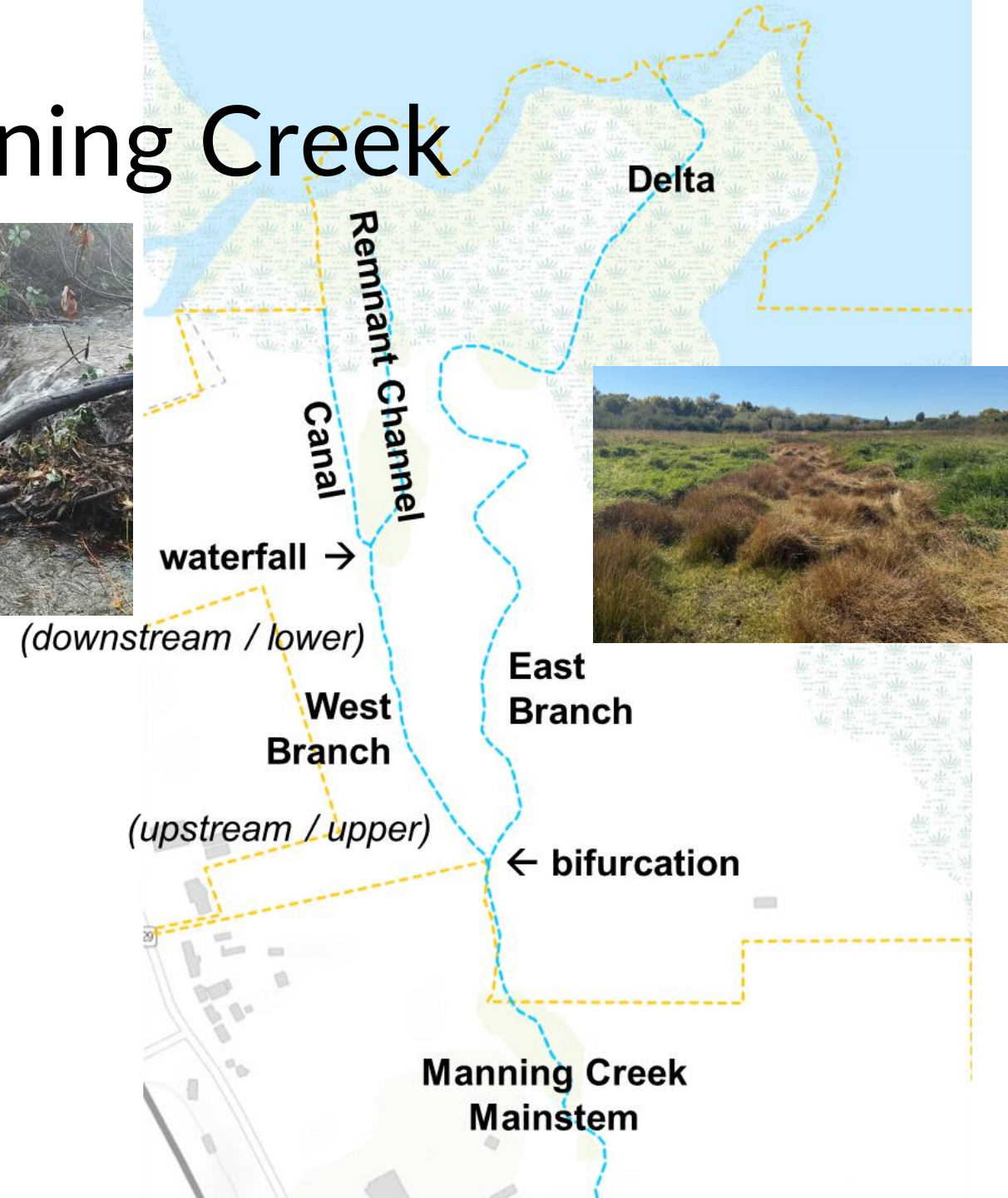
# Kuhlanapo Wetland Preserve Wind Rose



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