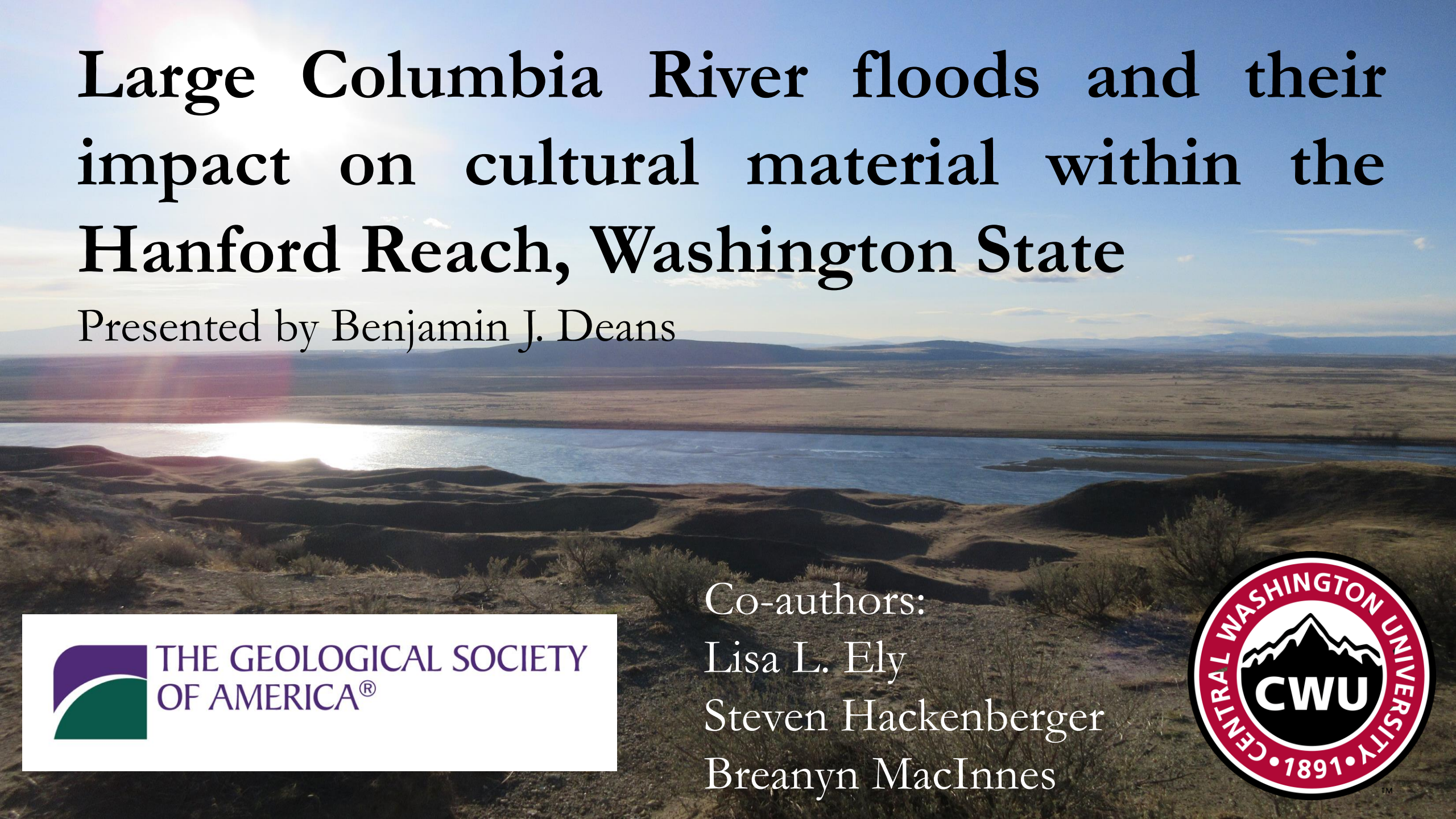
Large Columbia River floods and their impact on cultural material within the Hanford Reach, Washington State

Presented by Benjamin J. Deans

Co-authors:
Lisa L. Ely
Steven Hackenberger
Breanyn MacInnes



This work was partially supported by:

- NSF/GSA Graduate Student Geoscience Grant #13204-21, which is funded by NSF Award #1949901;
- GSA Geoarchaeology Division's Claude C. Albritton, Jr. Award; and
- School of Graduate Studies and Research, Central Washington University, Ellensburg, WA

THE GEOLOGICAL SOCIETY OF AMERICA®

THE GEOLOGICAL SOCIETY OF AMERICA®

GEOARCHAEOLOGY DIVISION

CENTRAL WASHINGTON UNIVERSITY • 1891 •

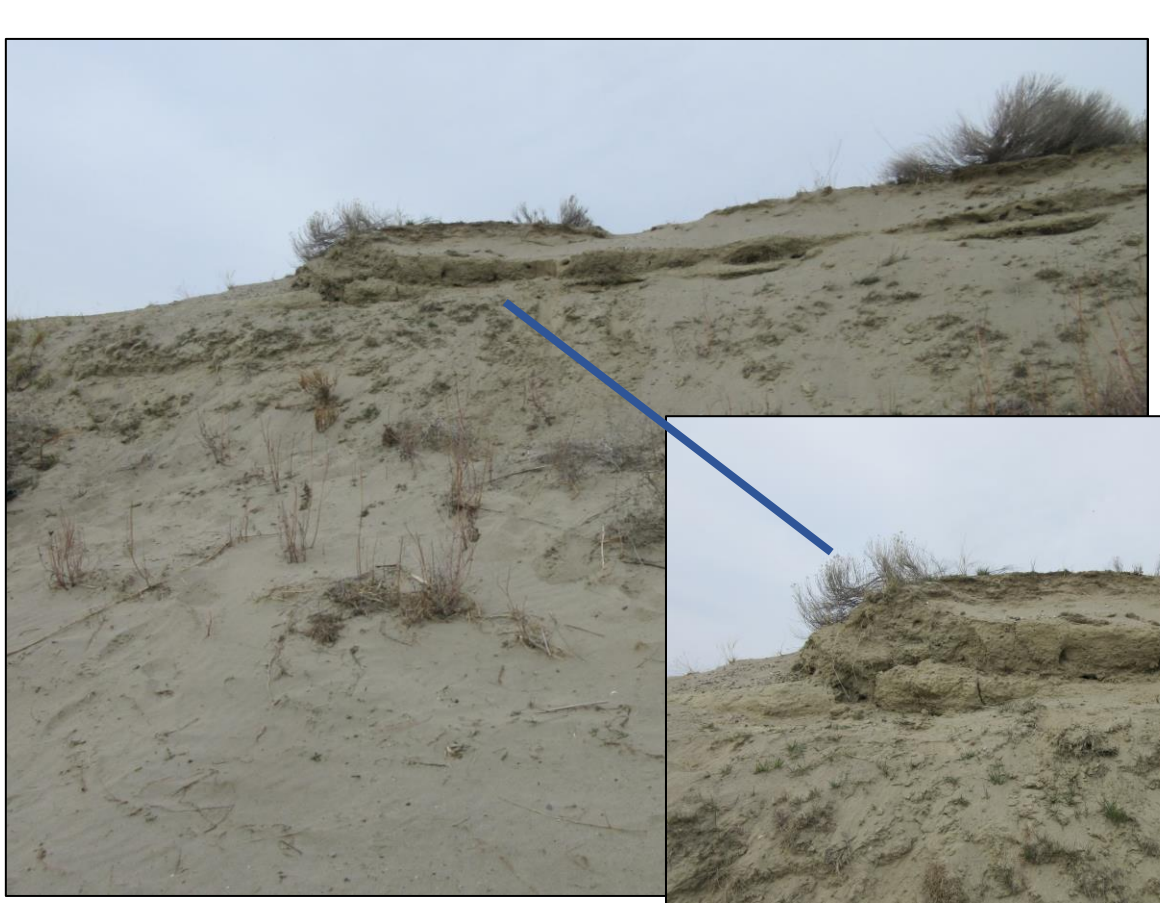
CWU

What to expect...

- Research question
- Stewards of the land
- The Hanford Reach
- Hydrologic Engineering Center River Analysis System (HEC-RAS)
- Locke Island
- Slackwater Deposits
- Conclusion

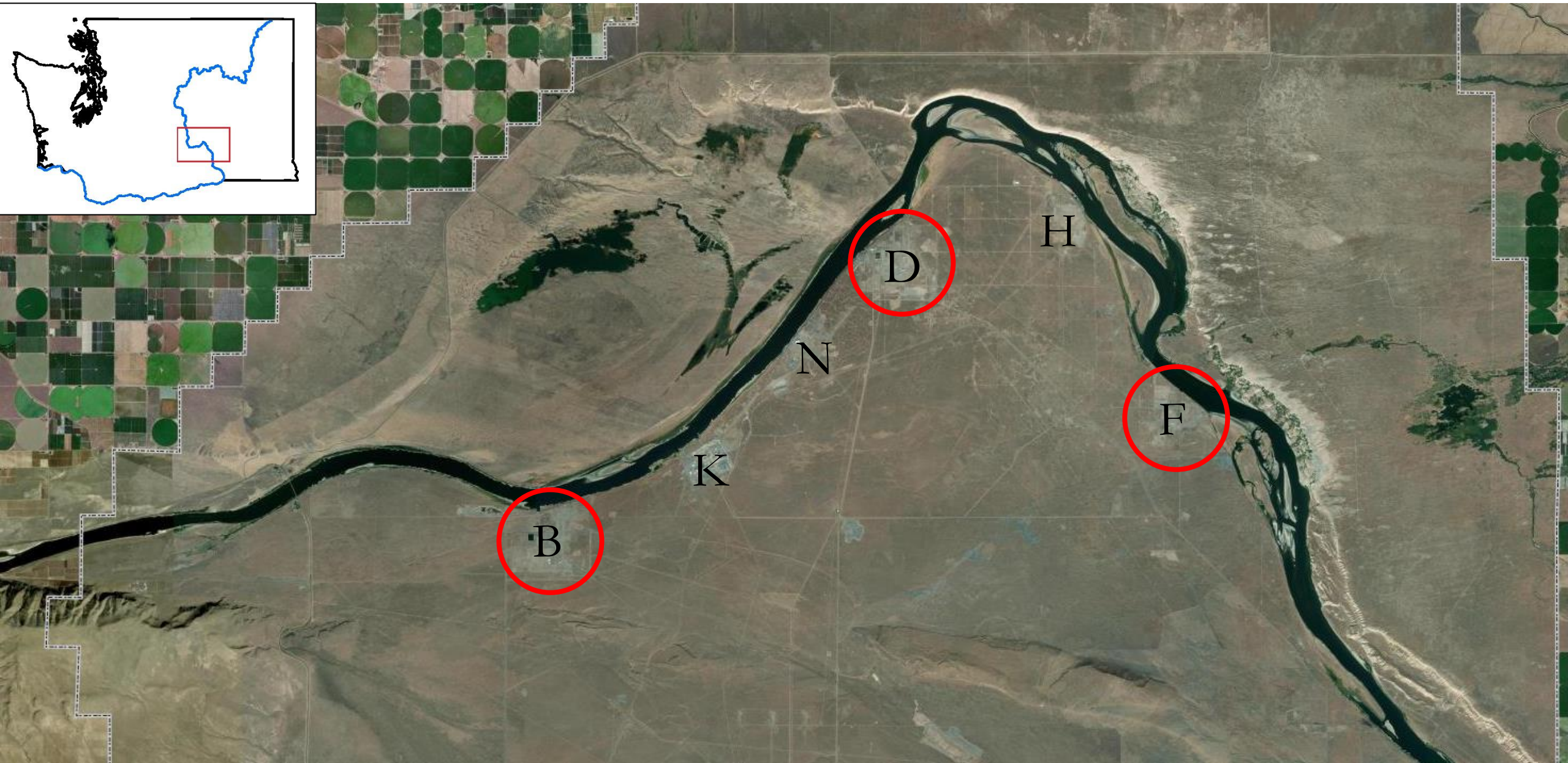
Research question

How do Columbia River floods affect archaeological site preservation and erosion?

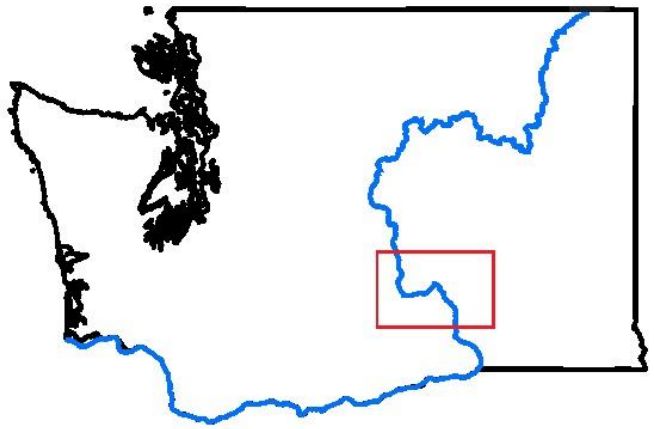


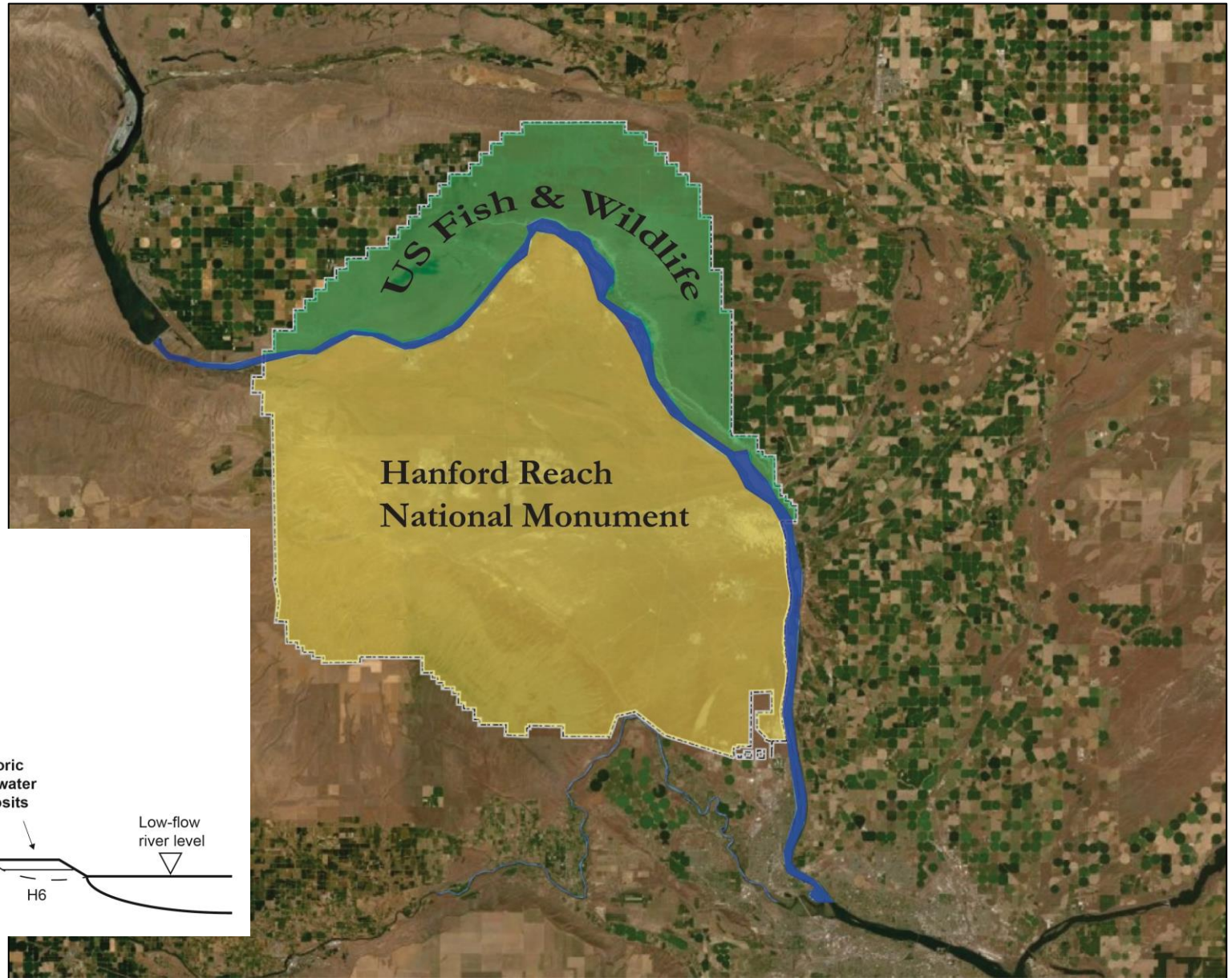
Stewards of the land

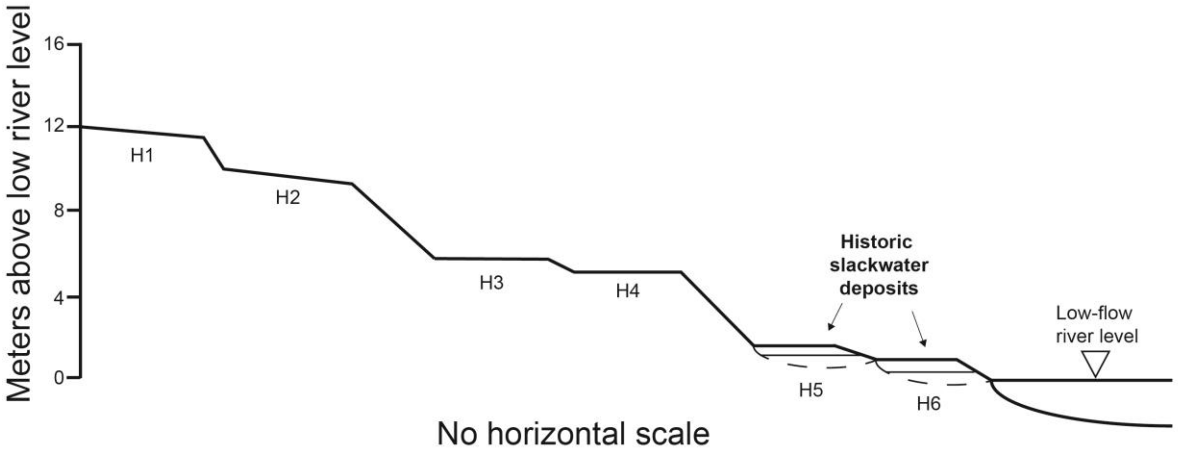
The Hanford Reach



The Hanford Reach



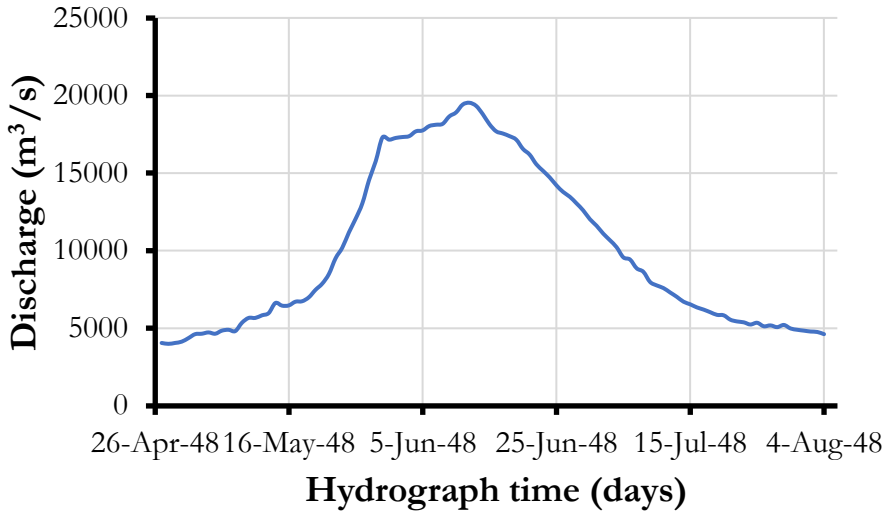




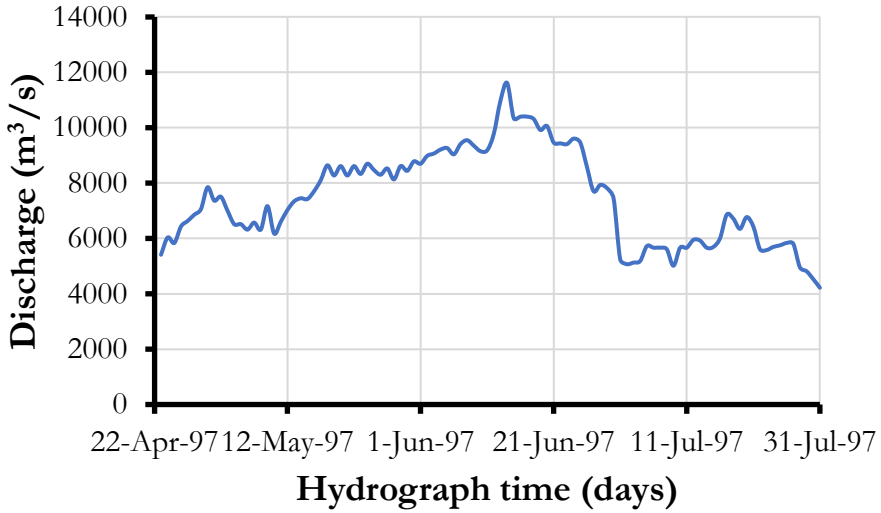
Hydrologic Engineering Center River Analysis System (HEC-RAS)

- HEC-RAS two-dimensional hydraulic modeling
- 1948/1997 flood hydrograph used to simulate a 100-day period prior/during/after flooding
- Simulations were run using full momentum equations
- Skaggs & Walters, 1981 and Waichler et al., 2017, appraised the reach for areas inundated, water surface elevation, and peak discharge for historic and probable maximum

1948 flood hydrograph

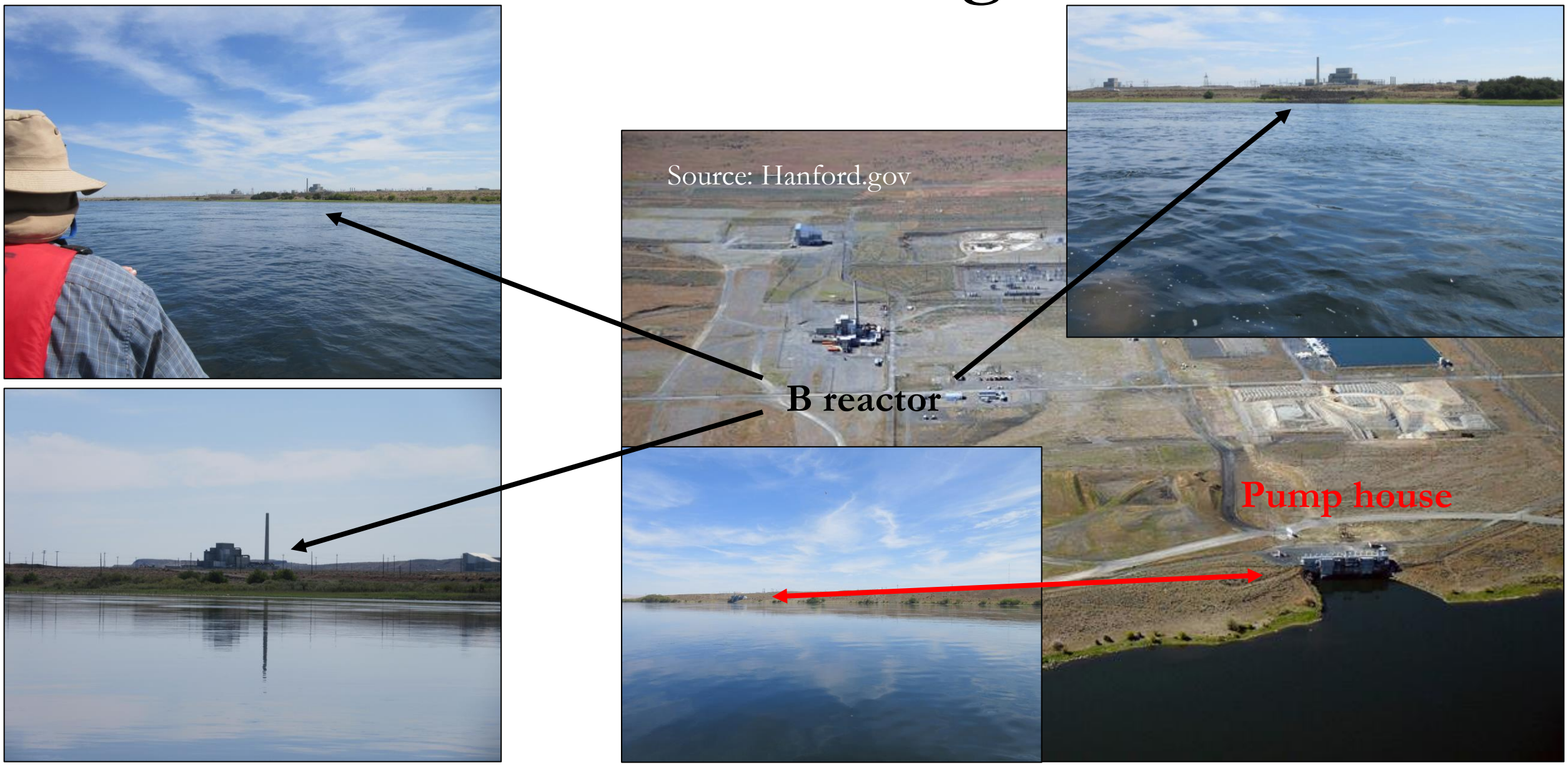


1997 Flood hydrograph



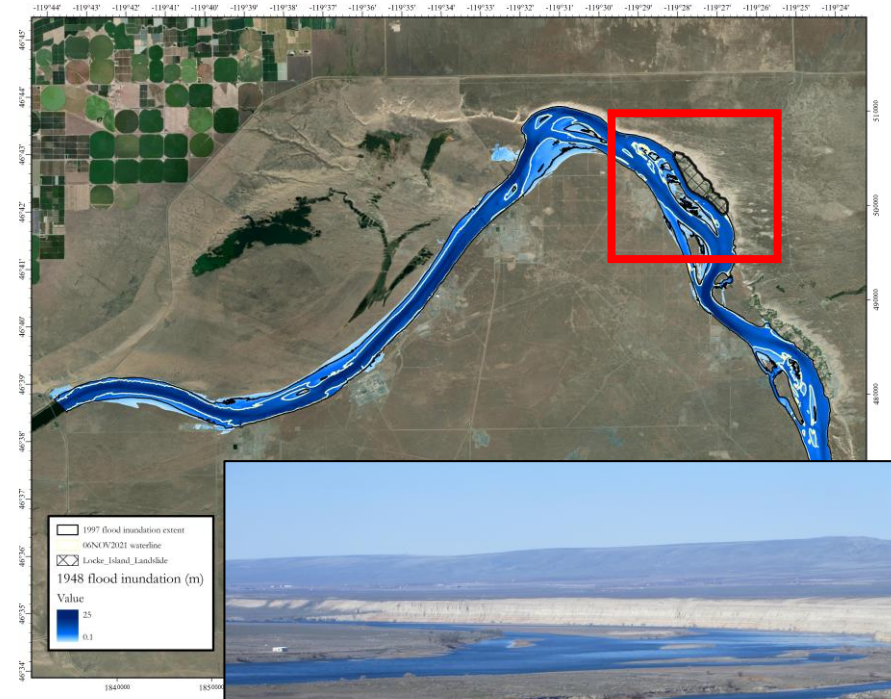
Calibration: Present-day river conditions

Calibration: 1948 flood high water mark

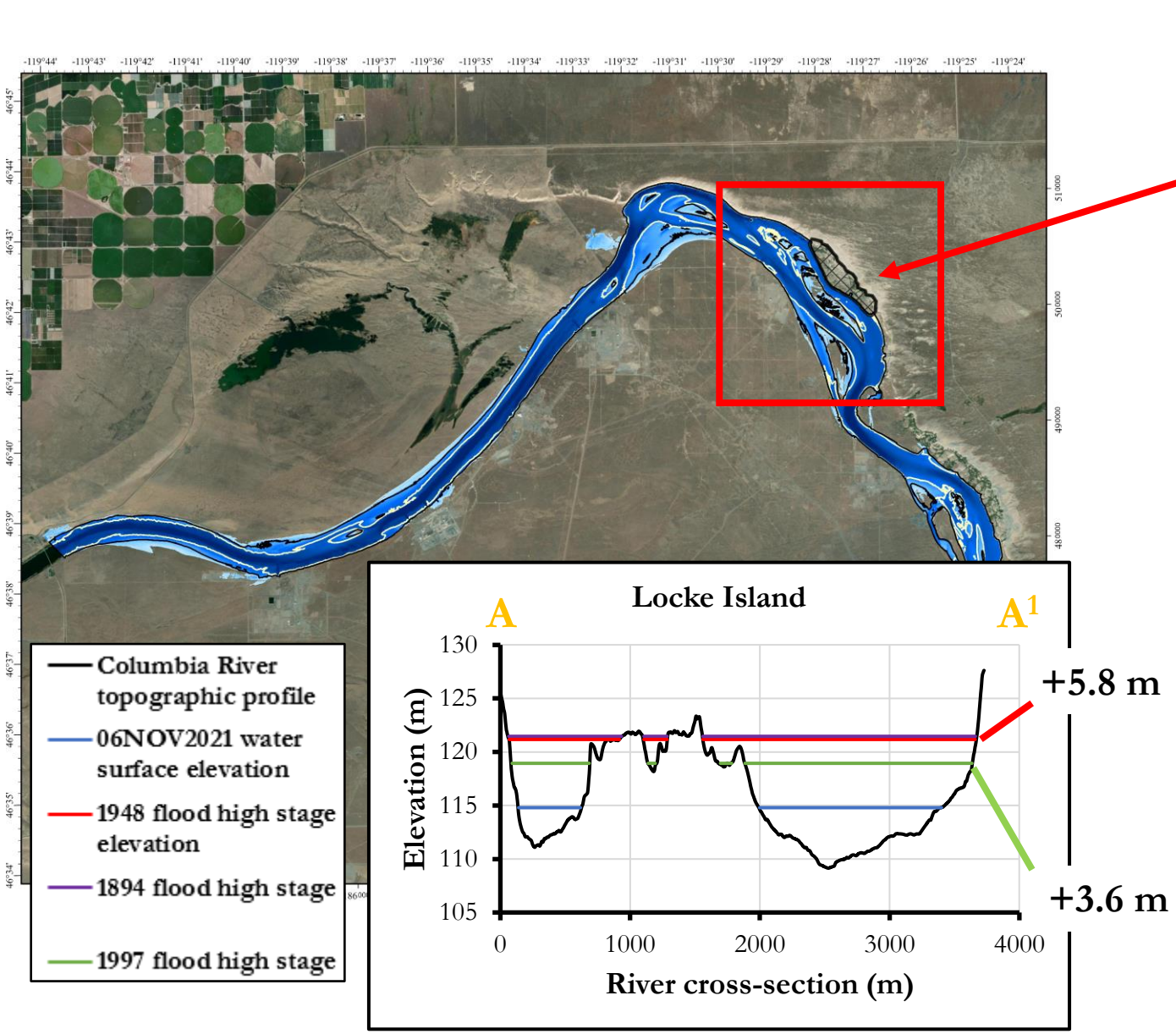


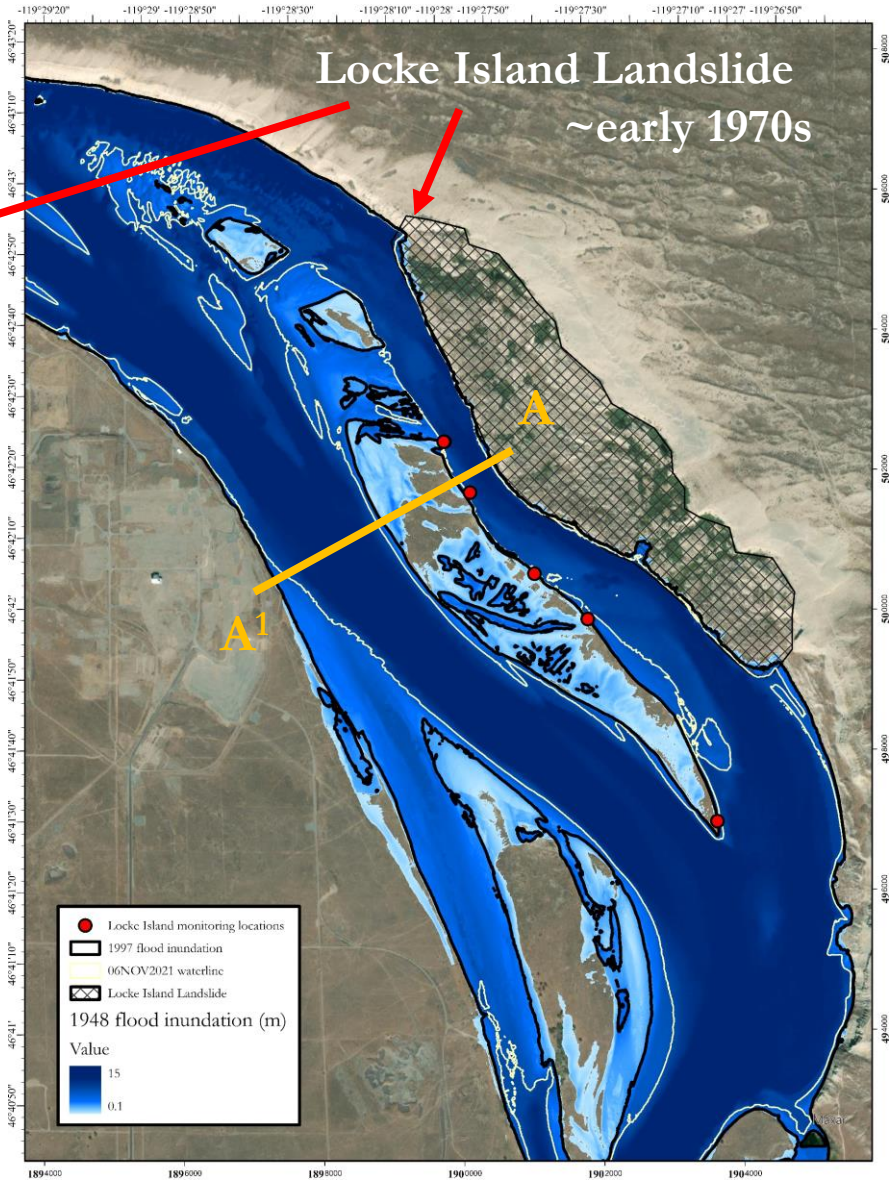
Locke Island

- Placed in the National Register of Historic Places (National Register) in 1976
- “the best preserved and largest known remaining housepit site in the entire Columbia Basin” (Rice, 1968)
- Supervised by the Confederated Tribes of the Umatilla



Locke Island

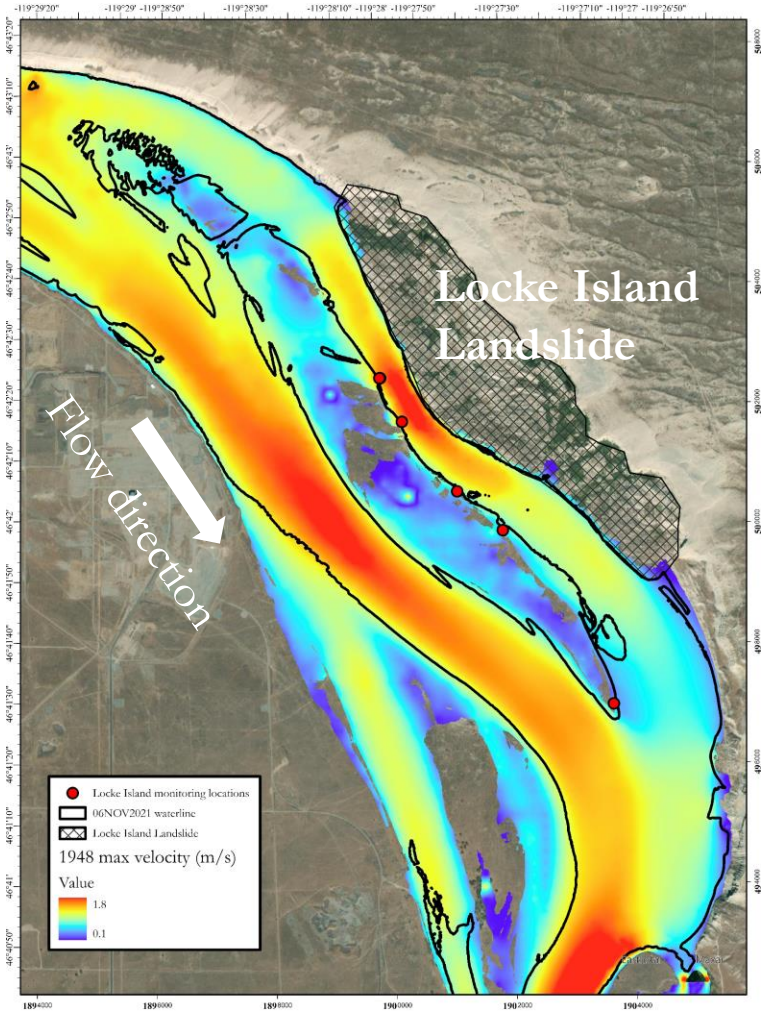




Locke Island

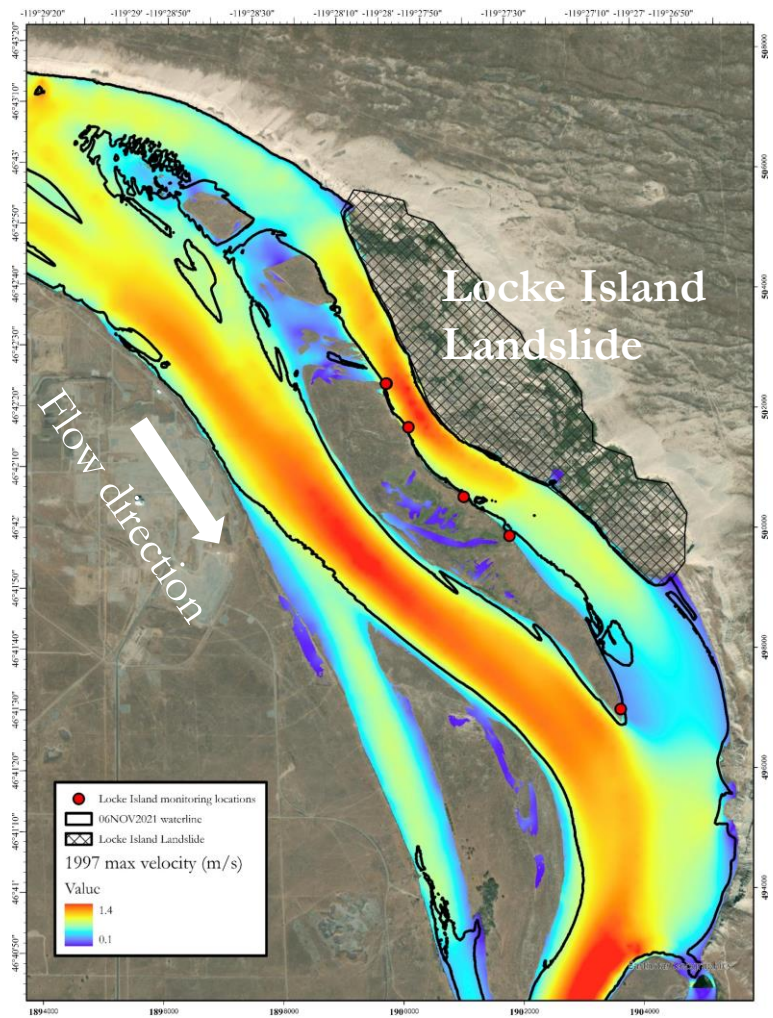
1948 Flood

- Max velocity
  - LC
    - 1.8 m/s
  - RC
    - 1.6 m/s
- Average velocity
  - LC
    - 1.4 m/s
  - RC
    - 1.2 m/s
- Specific stream power
  - LC
    - 761 W/m^2
  - RC
    - 269 W/m^2

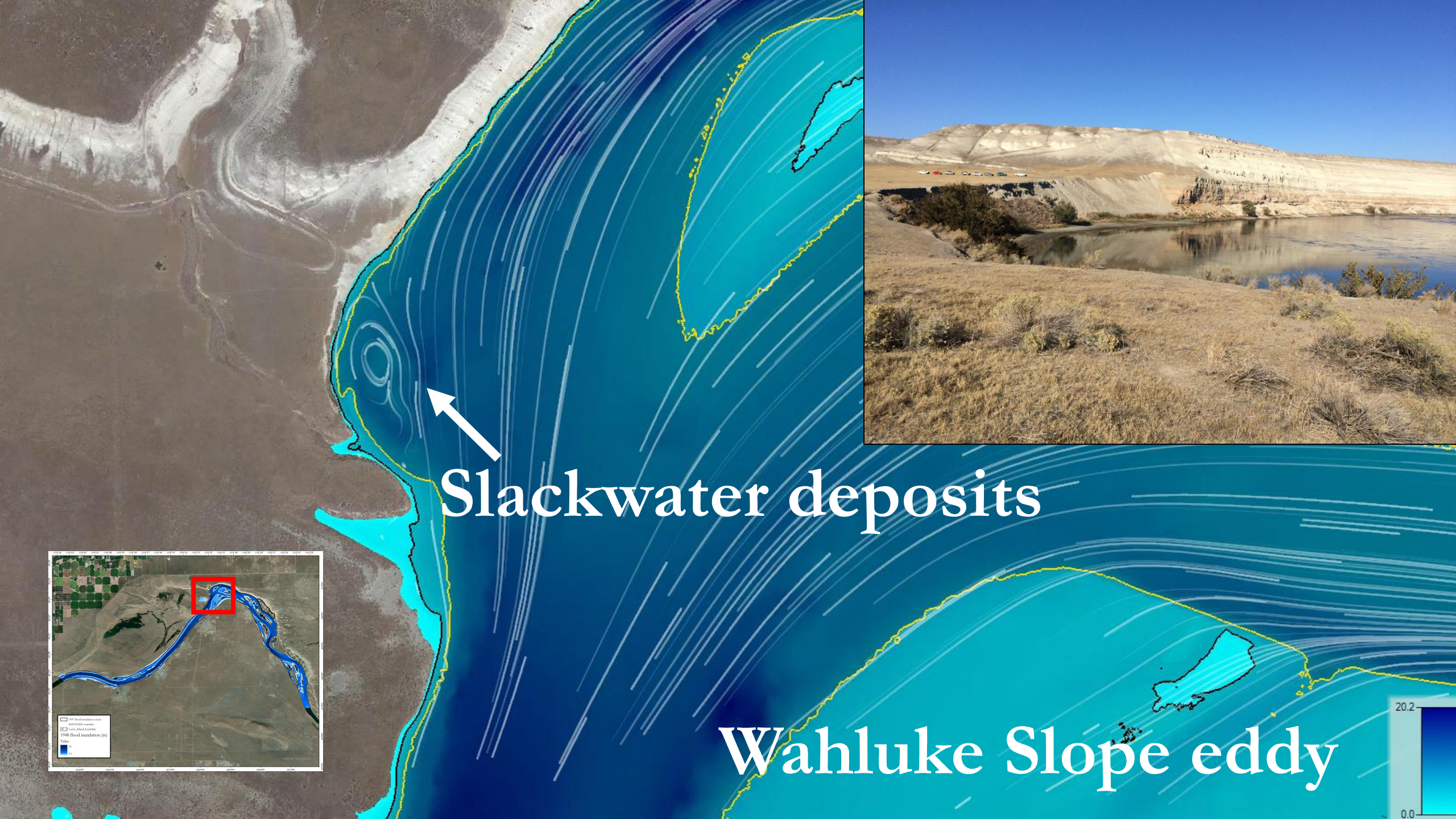


1997 Flood

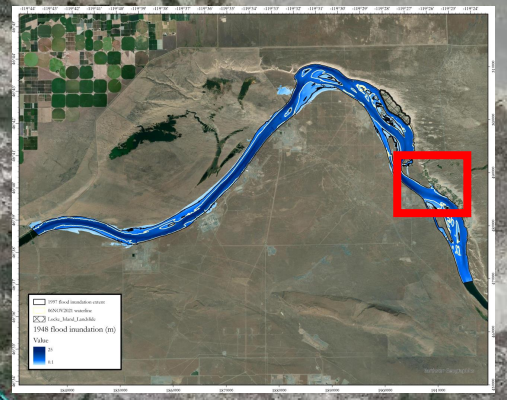
- Max velocity
  - LC
    - 1.4 m/s
  - RC
    - 1.3 m/s
- Average velocity
  - LC
    - 1.3 m/s
  - RC
    - 1.1 m/s
- Specific stream power
  - LC
    - 566 W/m^2
  - RC
    - 196 W/m^2



LC = Left channel; **RC** = Right channel


Slackwater deposits
Wahluke Slope eddy
20.2
0.0

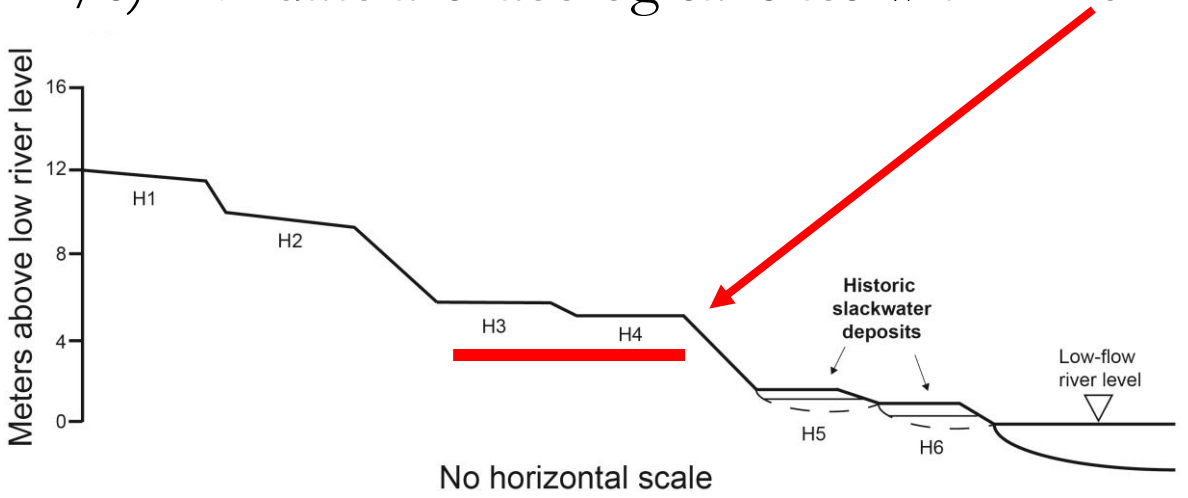
White Bluffs Boat Launch eddy



Slackwater deposits

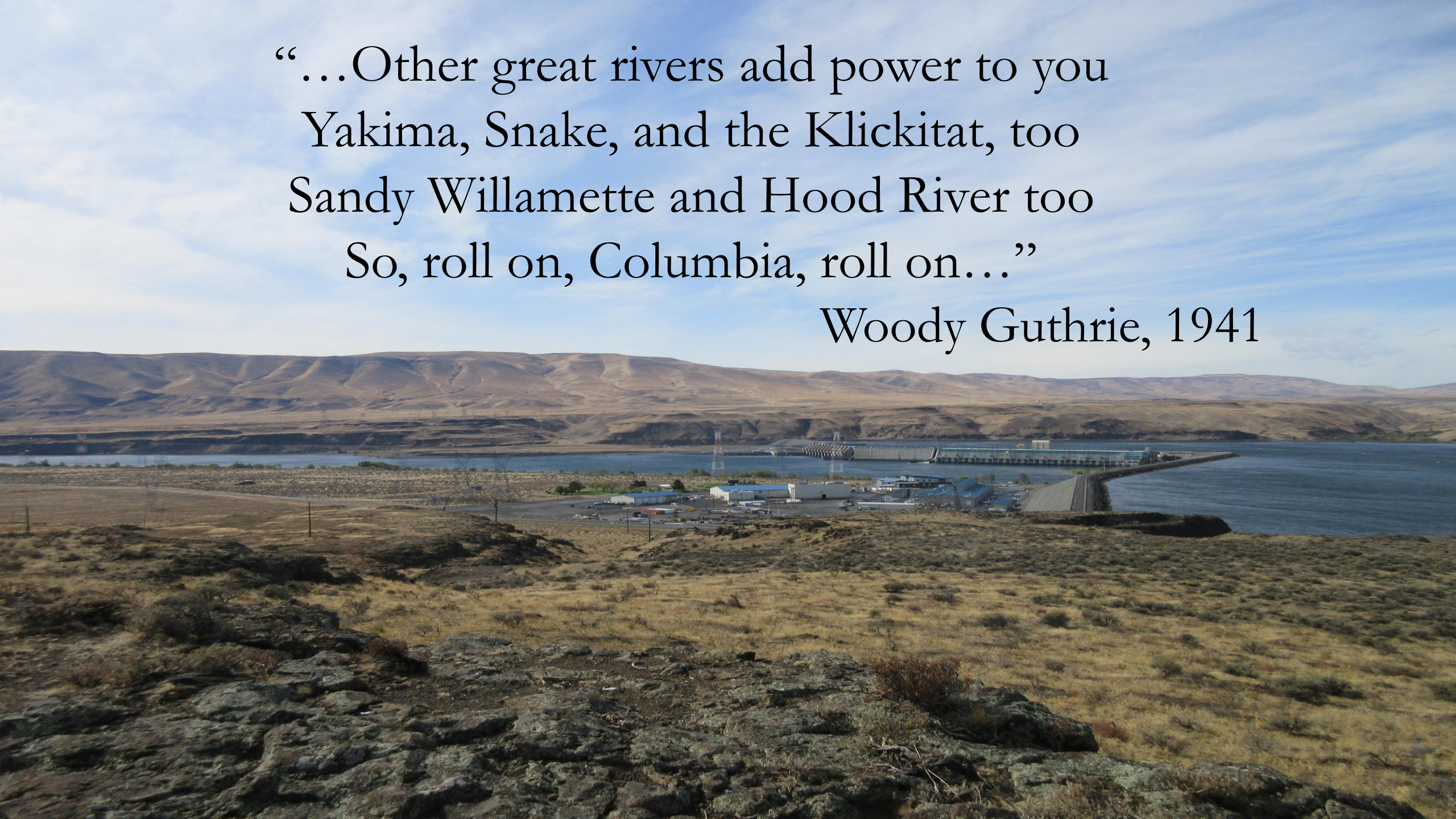
Conclusions

- Large Columbia River Floods (Q>19,000 m^3/s) inundate archaeological sites within ~6 m of river low, terraces H3-H6
- Floods Q>10,000 m^3/s double velocity (max & average) and specific stream power, from normal flow
- Corroboration of slackwater flood deposit by eddy formation



Future work

- Complete flood deposit elevation surveys
- Reinterpret stratigraphic columns and samples, from a CWU archaeological field school, to identify the agent of preservation (fluvial or eolian)


"…Other great rivers add power to you
Yakima, Snake, and the Klickitat, too
Sandy Willamette and Hood River too
So, roll on, Columbia, roll on…"
Woody Guthrie, 1941

References cited

Skaggs, R.L., and Walters, W.H., 1981, Flood risk analysis of Cold Creek near the Hanford Site: RHO-BWI-C-120/PNL-4219, Pacific Northwest Laboratory.

Waichler, S., Serkowski, J., Perkins, W., and Richmond, M., 2017, Simulation of Columbia River Floods in the Hanford Reach.

Wood, V.W., 1954, A summary of Columbia River hydrographic information pertinent to Hanford Works 1894 to 1954, HW-30347, General Electric Company, Richland, Washington.

Bjornstad, B.N., Nickens, P.R., Cadoret, N.A., and Wright, M.K., 1998, Monitoring bank erosion at the Locke Island archaeological national register district Summary of 1996 1997 field activities: