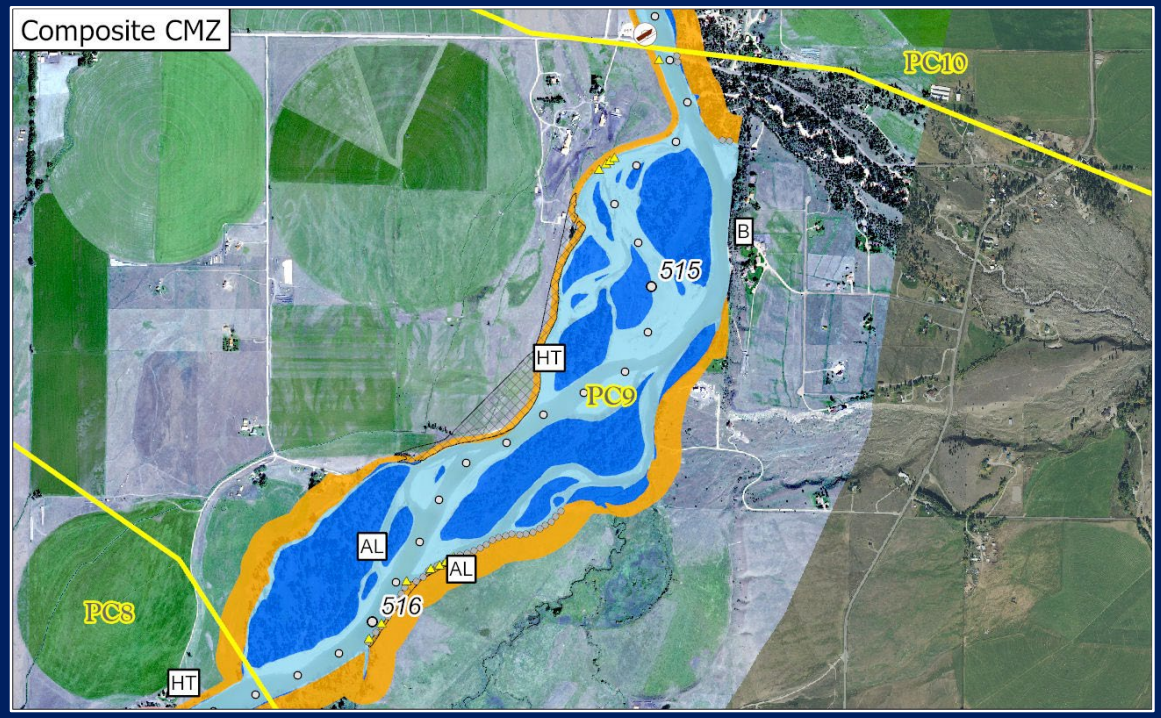
2024 Yellowstone River Channel Migration Mapping

Update to 2009 Mapping



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Acknowledgements

- This project is based on work supported by the Department of Natural Resources and Conservation under Agreement No RITP-23-0194.
- Park County
- City of Livingston
- Other Public Interests

Channel Migration Mapping Concepts

- Defines a Specific Type of River Hazard – Channel Migration
- **Non-Regulatory** in Montana
- Different than floodplain mapping
- Based on mapping and measuring from historic imagery
- Cost-effective
- Used to help make management decisions = Best Available Information
- Based on well-established methodology

Channel Migration Mapping vs. Floodplain Mapping

Floodplain –
Flooded out

Channel Migration –
Wiped out

Channel Migration 101

The Natural Movement of a Channel Across its Floodplain

Yellowstone River Near Miles City 1950-2001

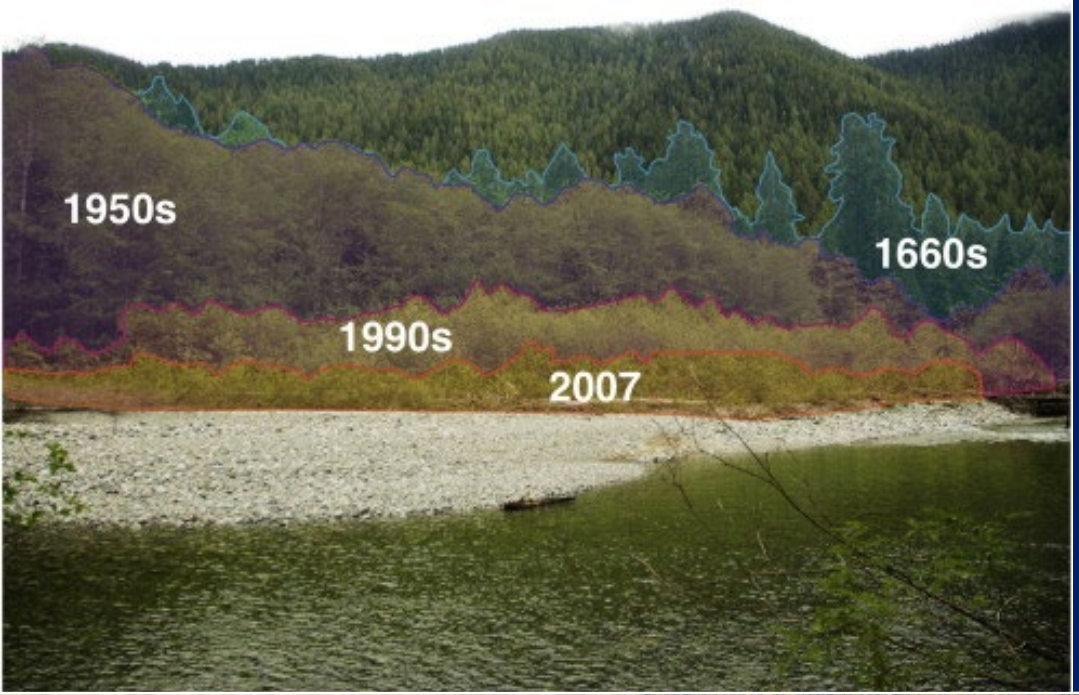
What are the risks?

Homes
Roads/Bridges
Utilities
Diversion Structure
Loss of Property

So, Migration is a Hazard

and yet…

Unimpeded Channel Movement is Critical to the Health and Stability of Dynamic Rivers



Migration Creates Open Bars that are Colonized by Streamside Vegetation

Gravel Recruitment
Woody Debris Recruitment
Fish Habitat
Riparian Turnover

Can We Strike a Balance?

Rivers can be Managed as either Channels or Corridors

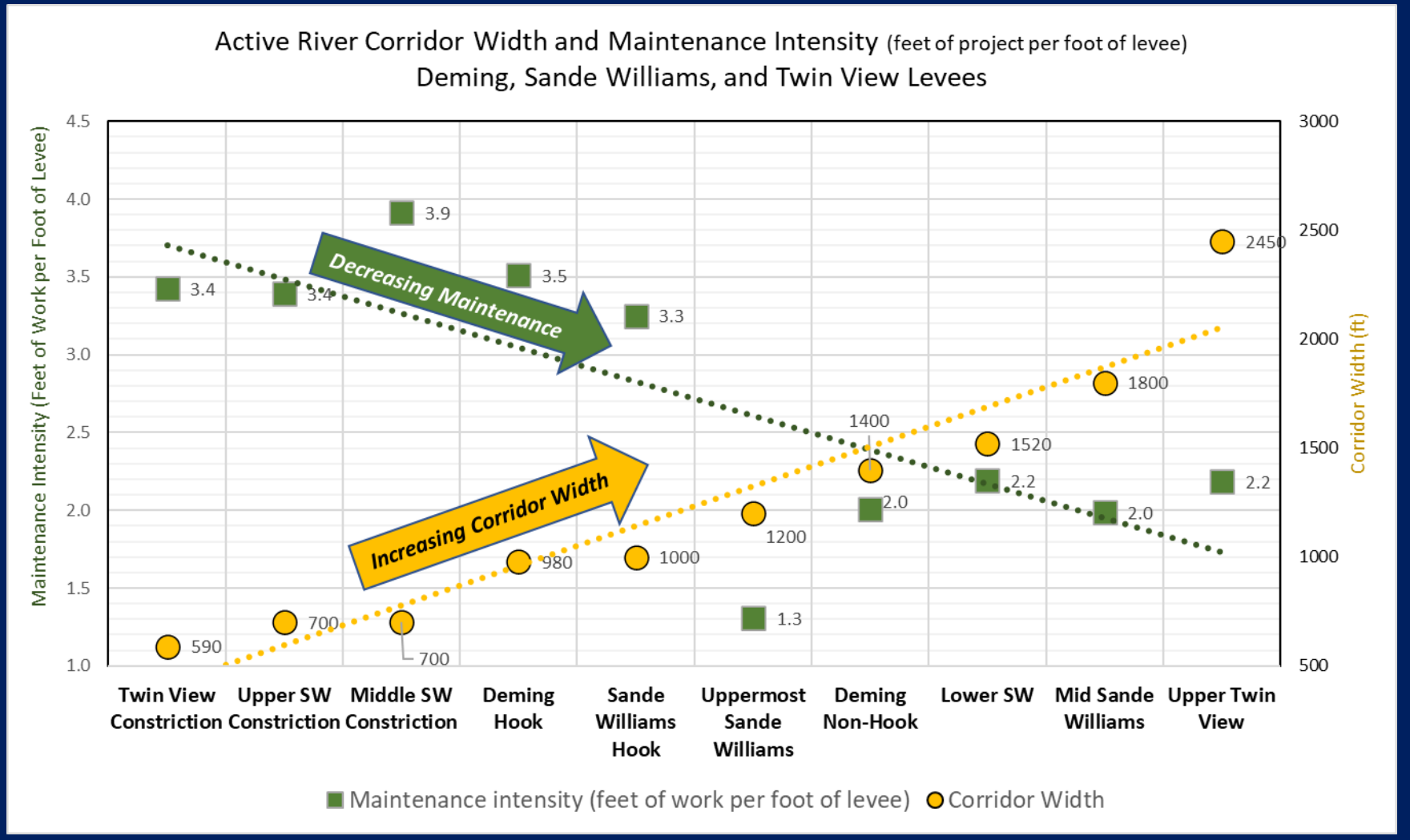
Sacramento River, California

~95% armored

Gallatin River, Montana

~10% armored

Nooksack River WA
Relationship Between Migration Corridor Width and Levee Maintenance



Yellowstone River Cumulative Effects Assessment

- Bank Armor
  - 2001: 23.1 miles of armor
  - 2011: 28.9 miles of armor
  - 2023: 31.5 miles of armor
  - ~18% of the bankline is currently armored, not including levees
  - Some reaches had over 25% of bankline armor
- Highest concentration of dikes/levees on the Yellowstone River

That Brings Us to Channel Migration Mapping

CMZ Mapping Process

1. Identify Where the River has Been
   ⇨ Historic Migration Zone (HMZ)

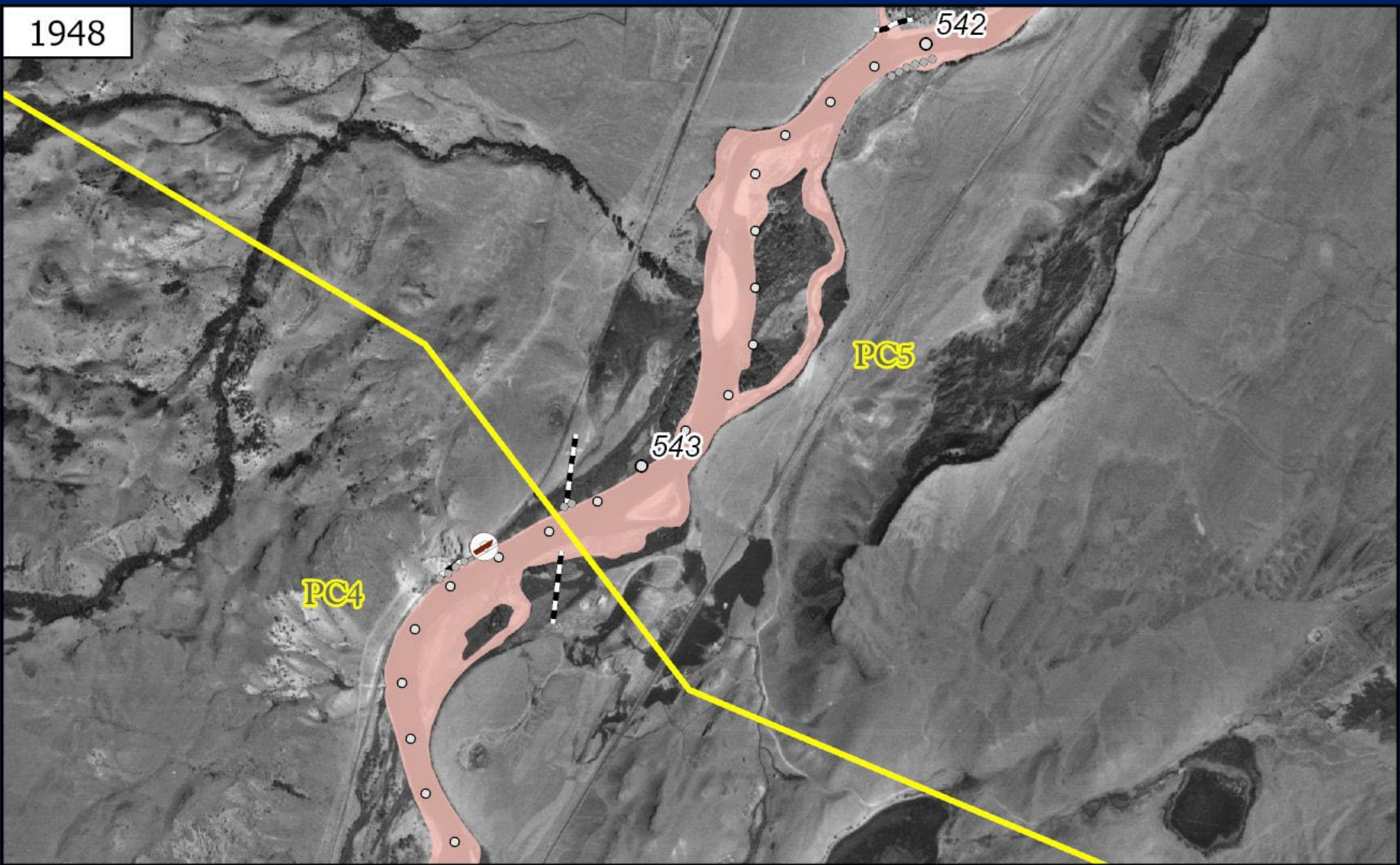
2. Anticipate Future Erosion Potential
   ⇨ Erosion Hazard Area (100-yr)

3. Map Avulsion Potential
   ⇨ Avulsion Hazard Zone

4. Map Geotechnical Hazards – Slope Layback
   ⇨ Geotech Hazard Overlay

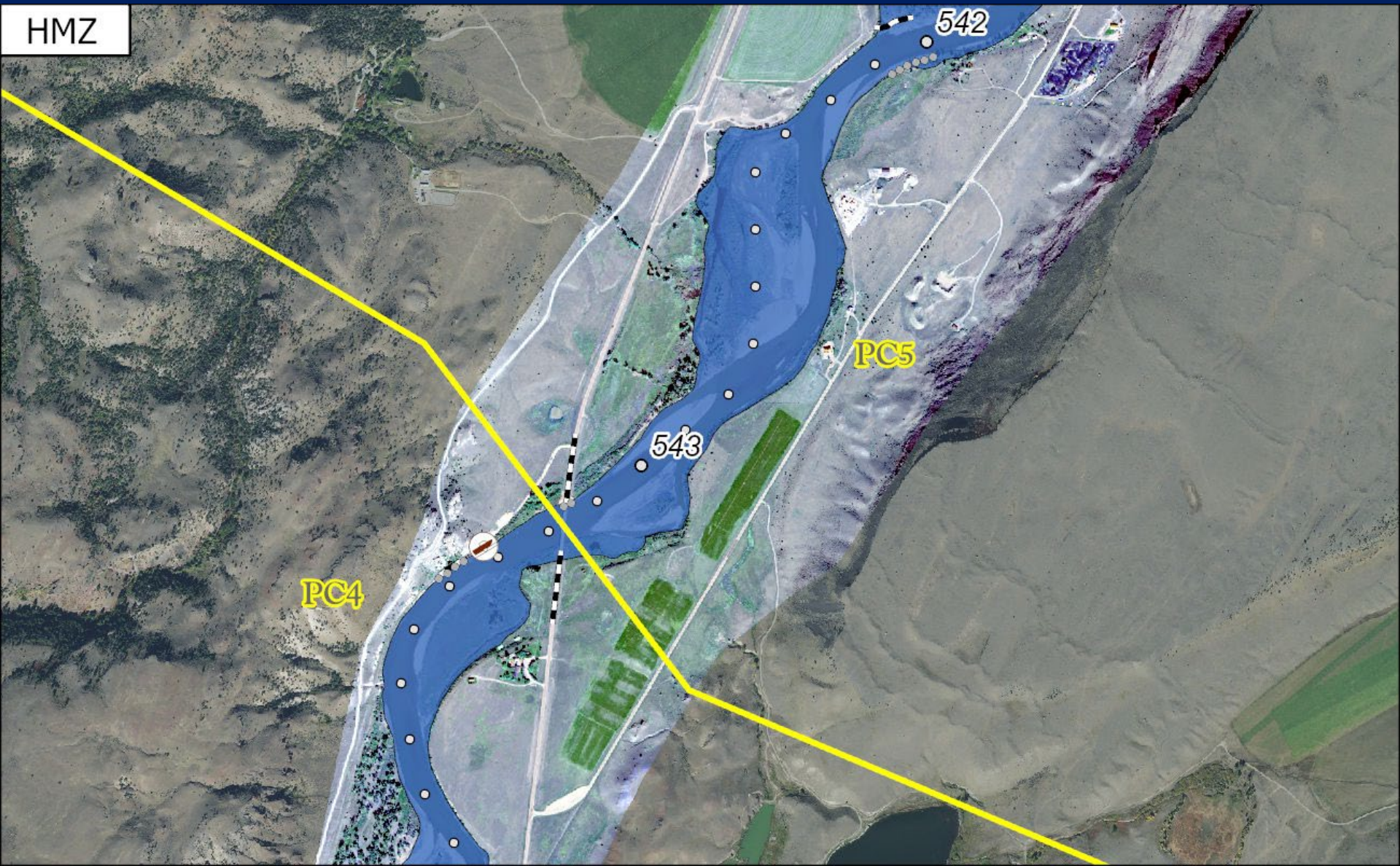
5. Map Restricted Migration Areas
   ⇨Restricted Migration Area

1948 USDA – Point of Rocks

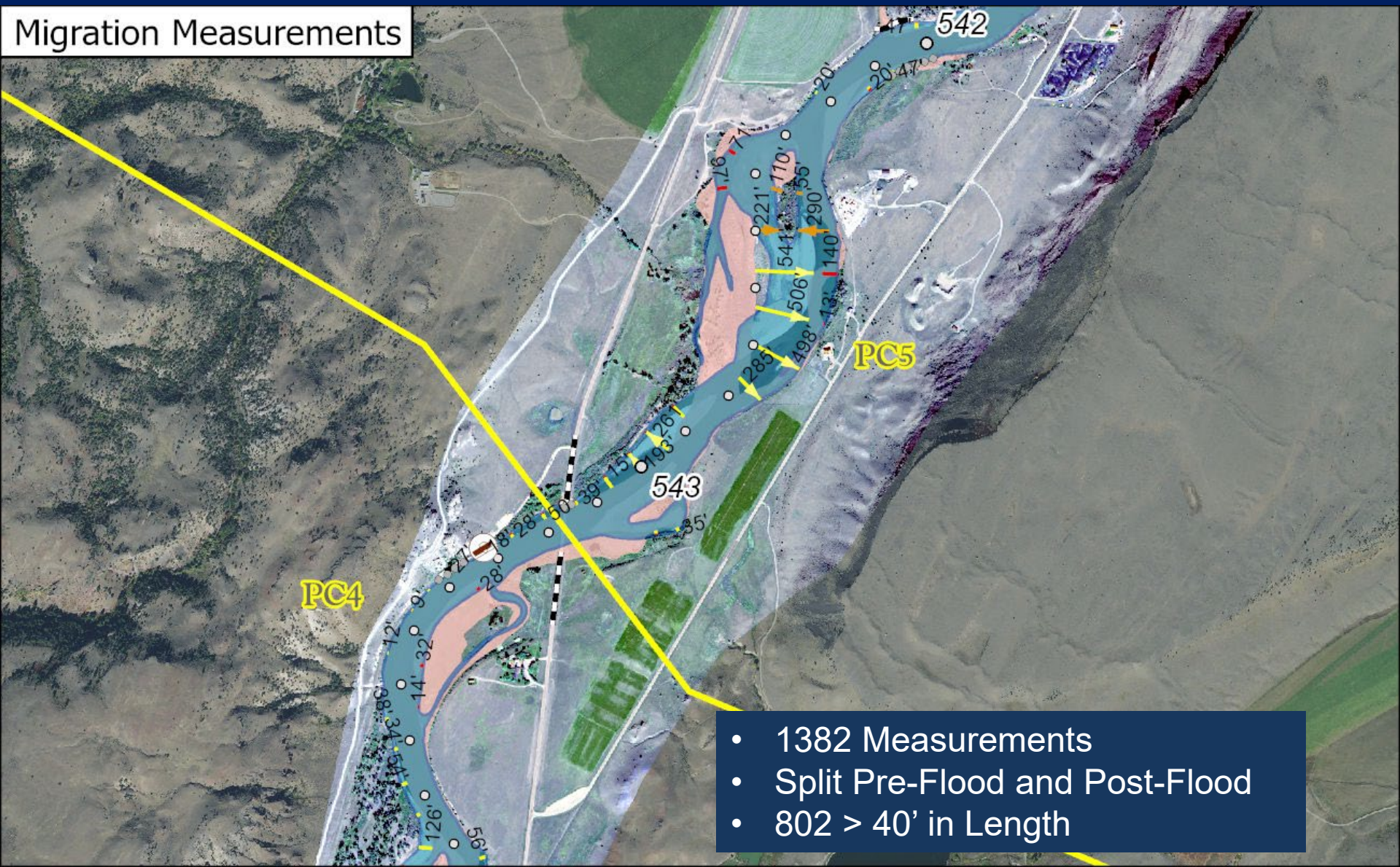


2023 50cm Satellite Imagery

Historic Migration Zone (HMZ)



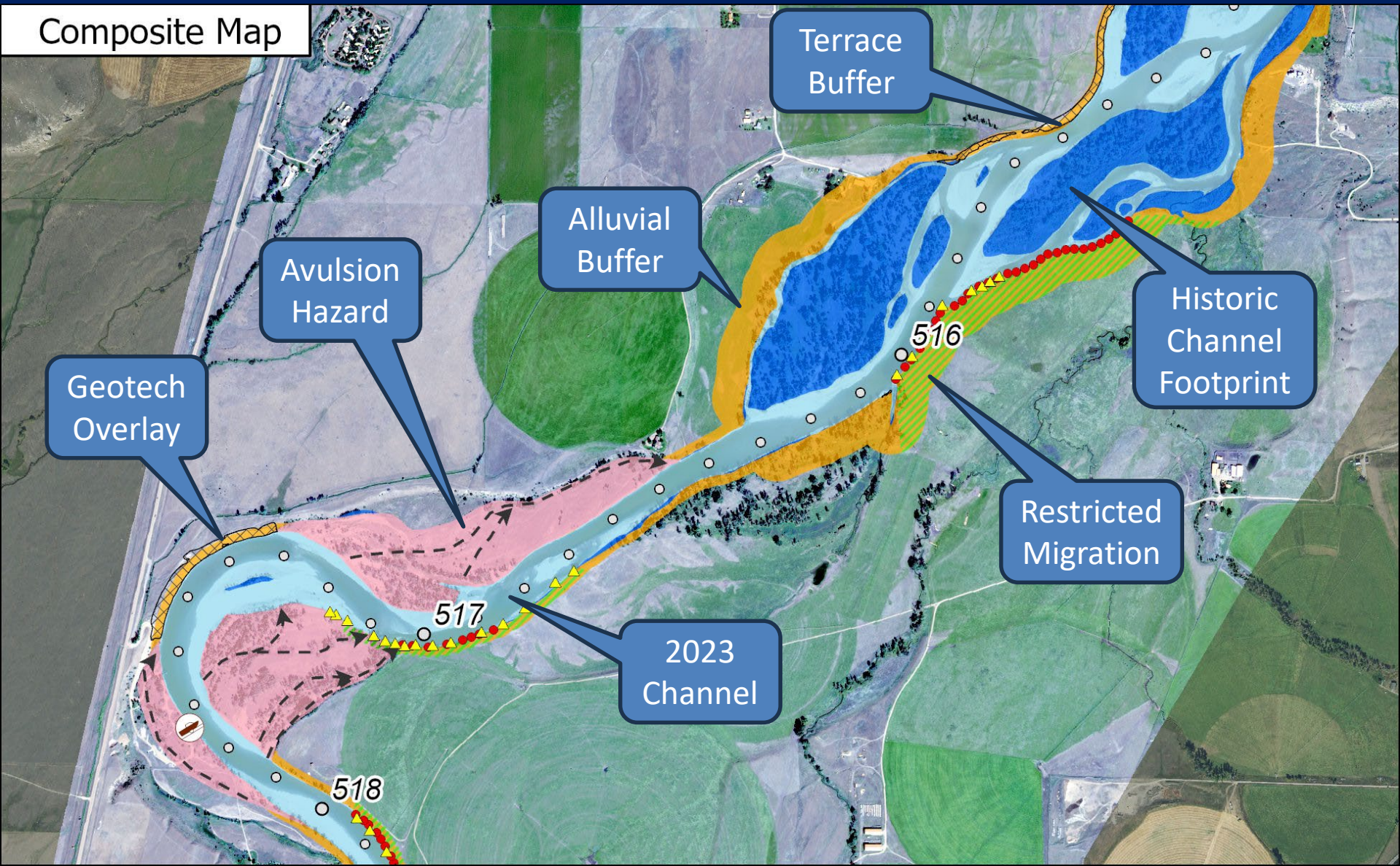
Migration Measurements



Different Bank Materials

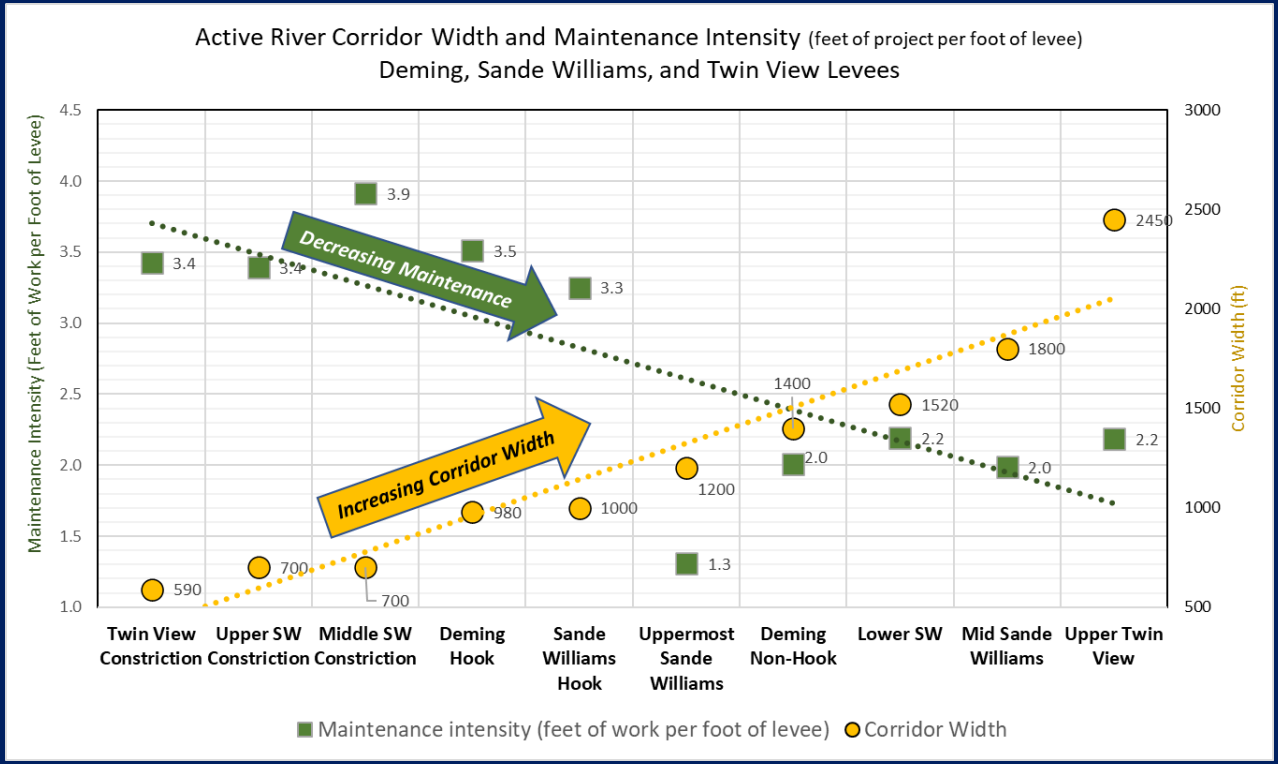
- Materials:
  - Bedrock
  - Glacial Outwash Terrace (Qg)
    - Upper river only
  - Terraces (Qt1/Qt2)
    - Rates were essentially the same
  - Alluvium
    - Reach Based using mean of 71 years of record

Composite Map



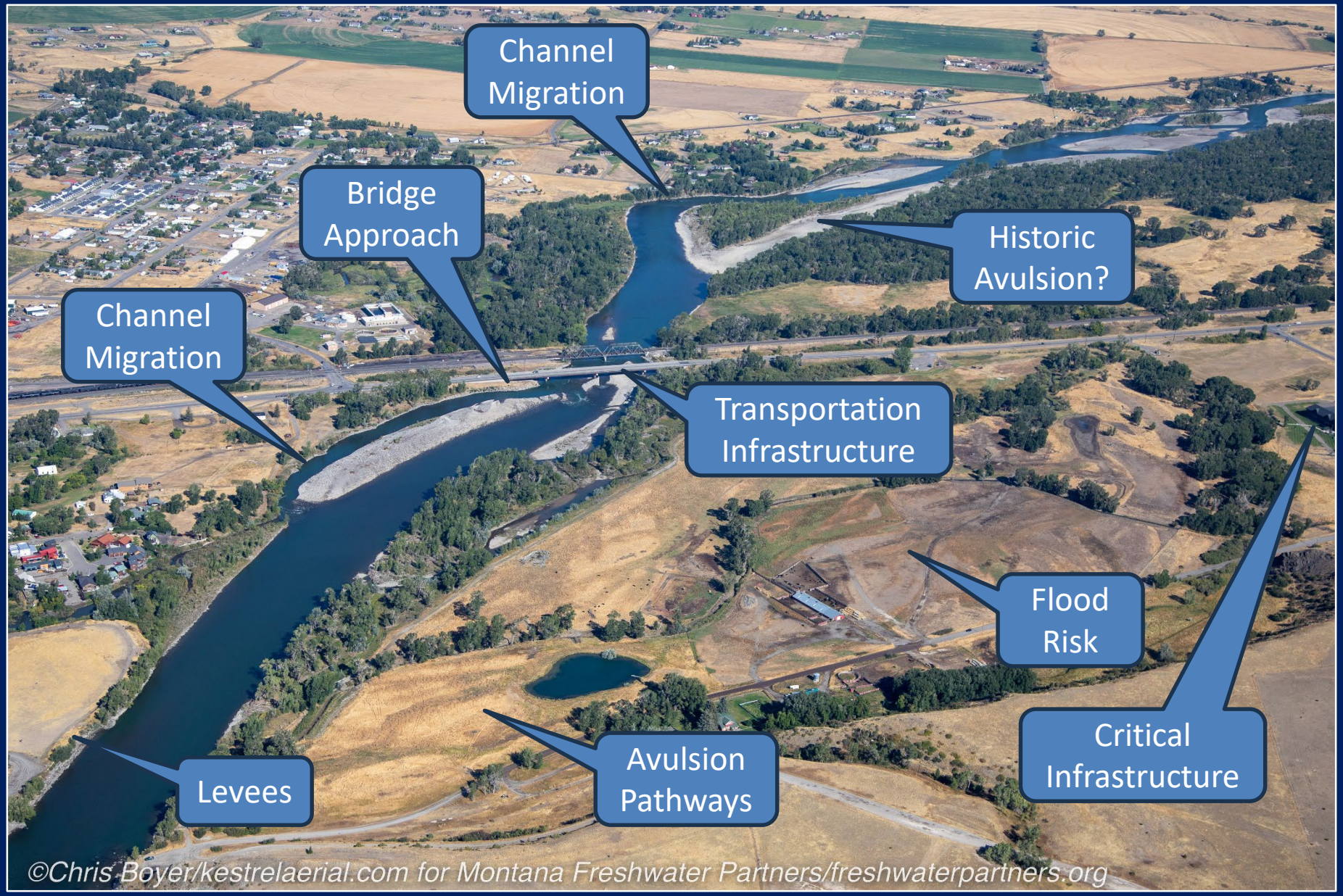
What Can You Do With This Map?

- Assess your risk
- Make informed decisions



Bank Armor Failure/Flanking

Yellowstone River near Park City


Channel Migration
Bridge Approach
Historic Avulsion?
Channel Migration
Transportation Infrastructure
Flood Risk
Critical Infrastructure
Avulsion Pathways
Levees
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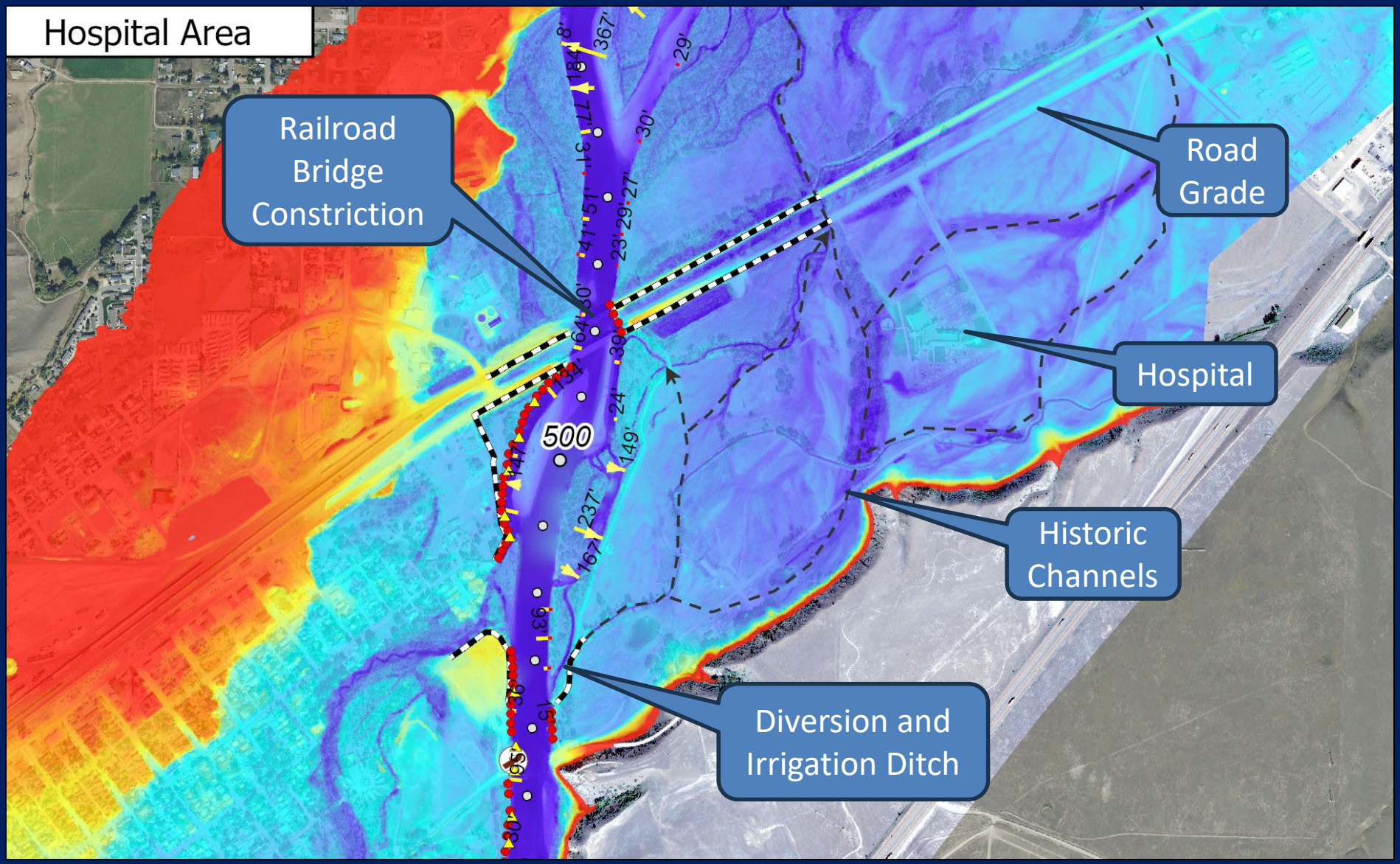
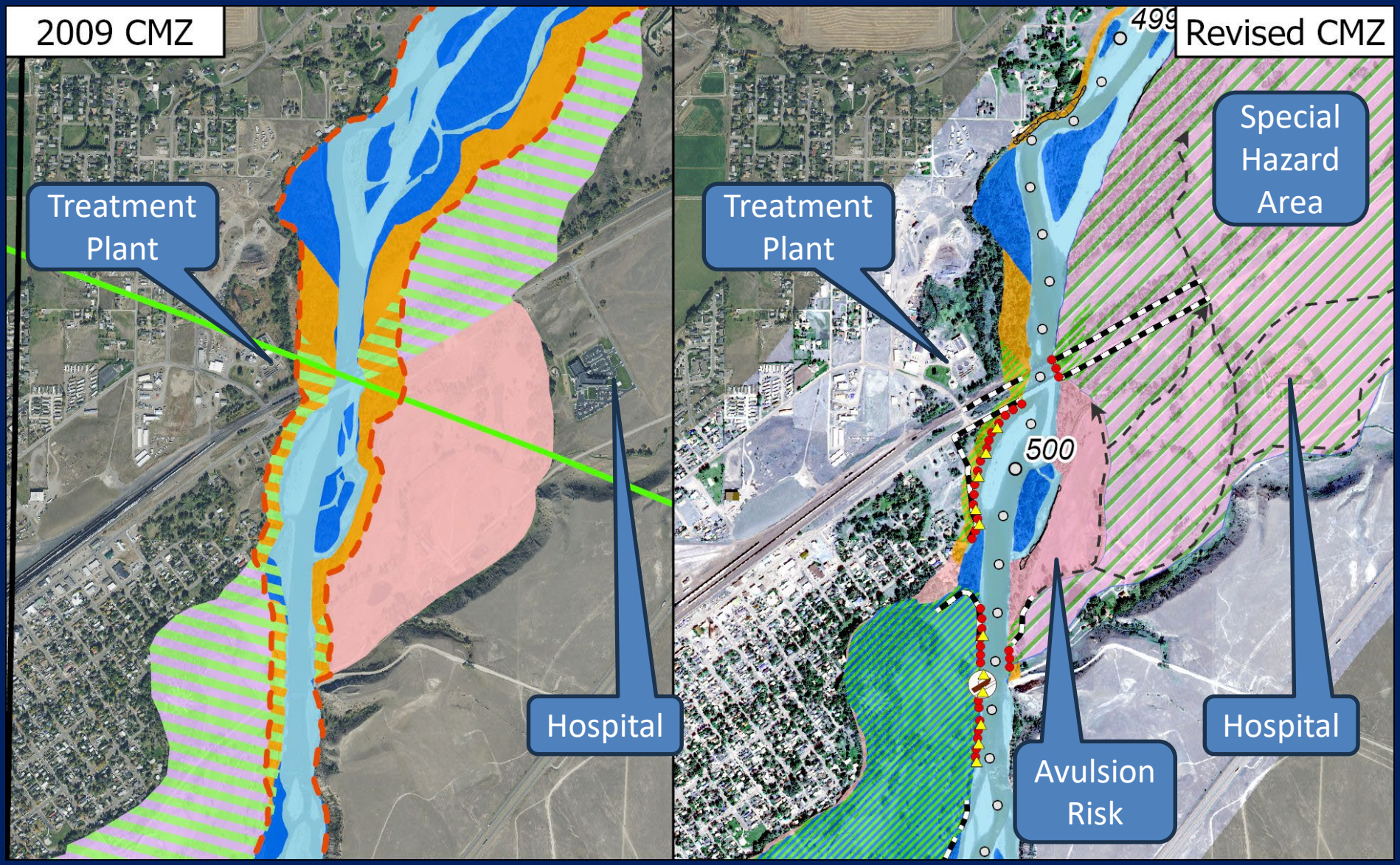
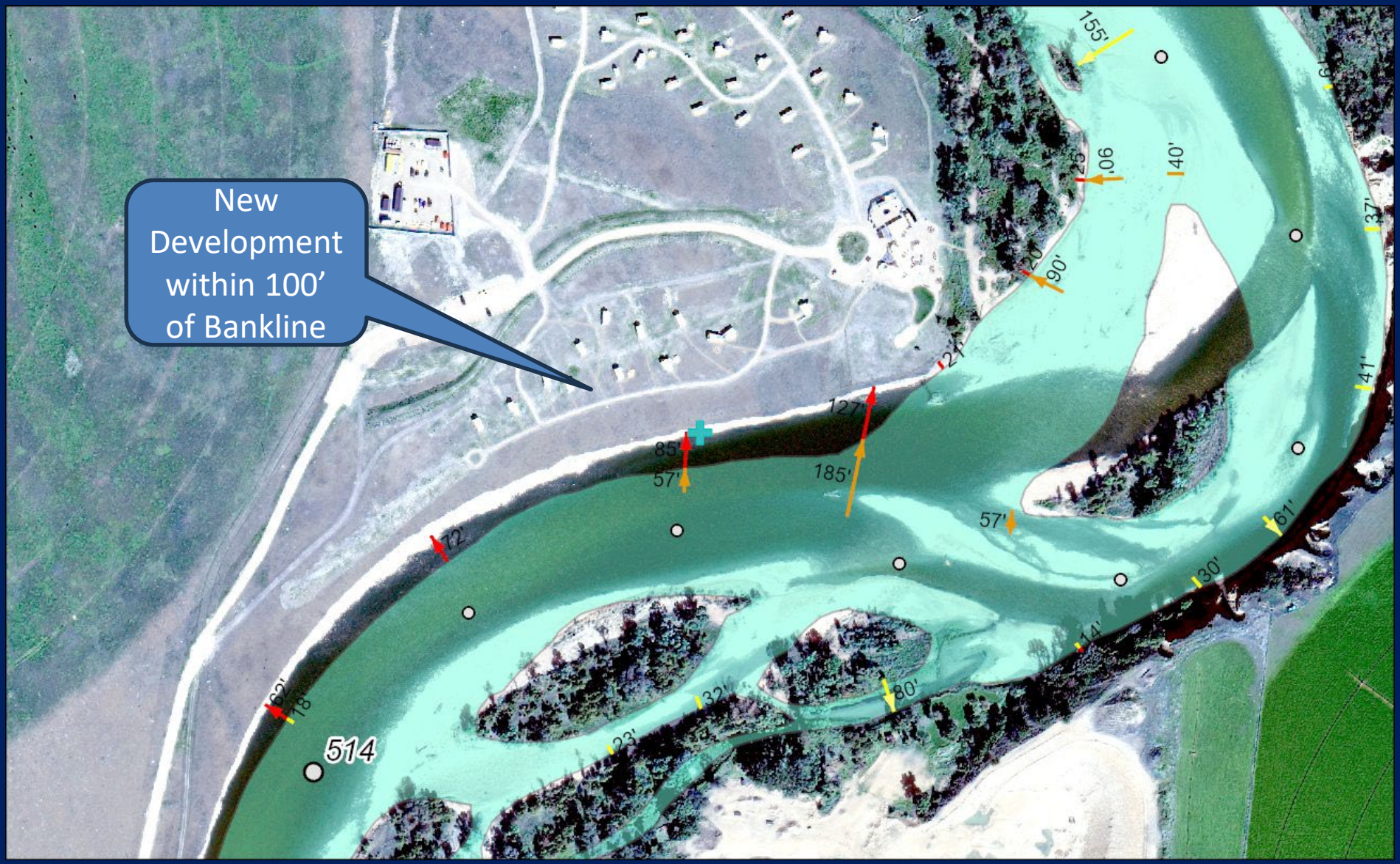
Hospital Area – Relative Elevations



Comparison – Hospital Avulsion Risk

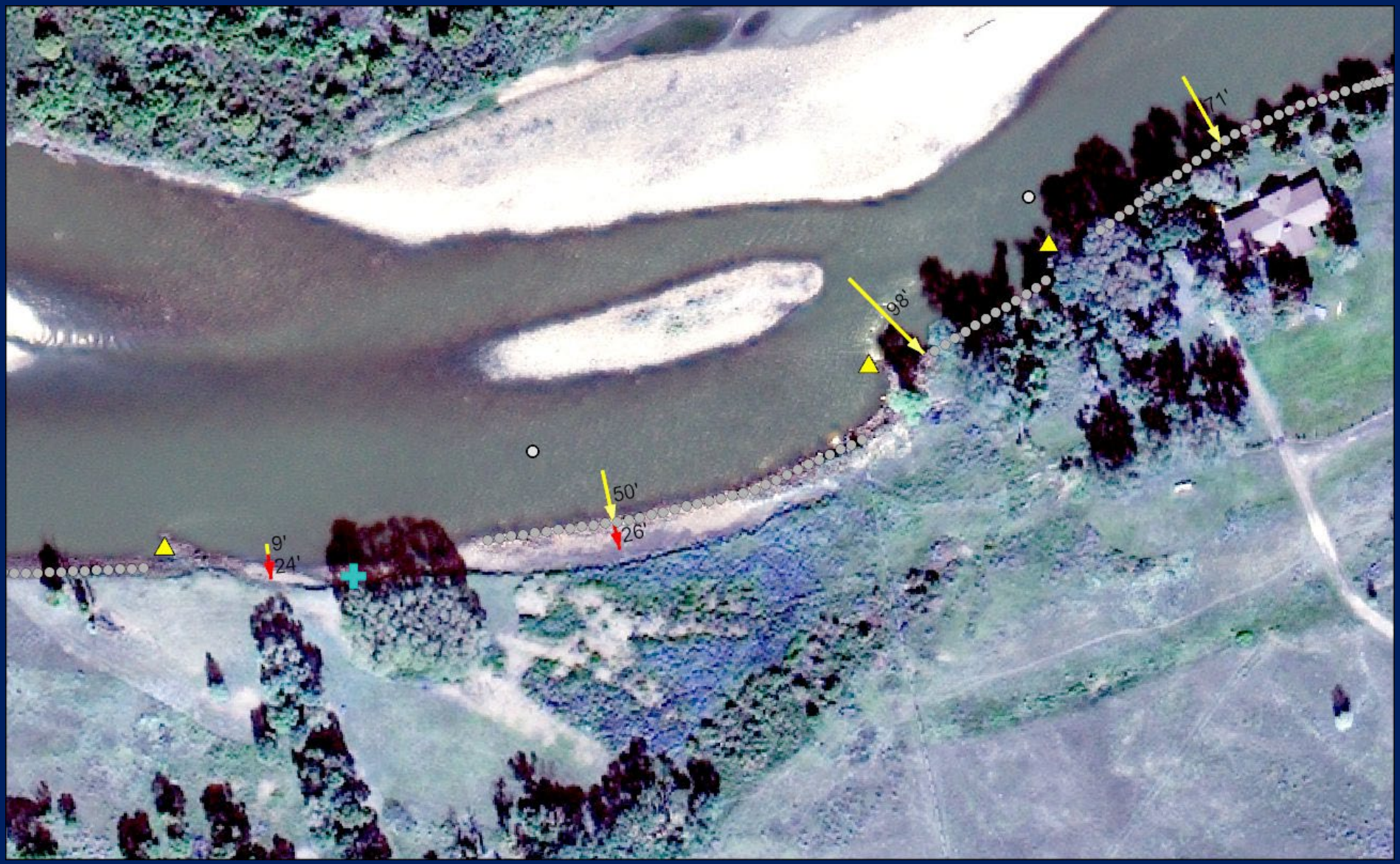


100+ Ft Erosion Example



Riprap Flanking Risk

Failed Riprap - ~30 Ft Erosion Post-Flood



Available Online

- Google “2024 Yellowstone Channel Migration Map” (Montana State Library link)

https://msl.mt.gov/geoinfo/data/montana_channel_migration_zones/projects/yellowstone_river

- Report
- All of the Maps
- GIS Data
- Interactive Web Mapper

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