Developing Process-Based Restoration in the NEK…

….using lessons from elsewhere

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What is Low-tech, Process-Based Restoration?

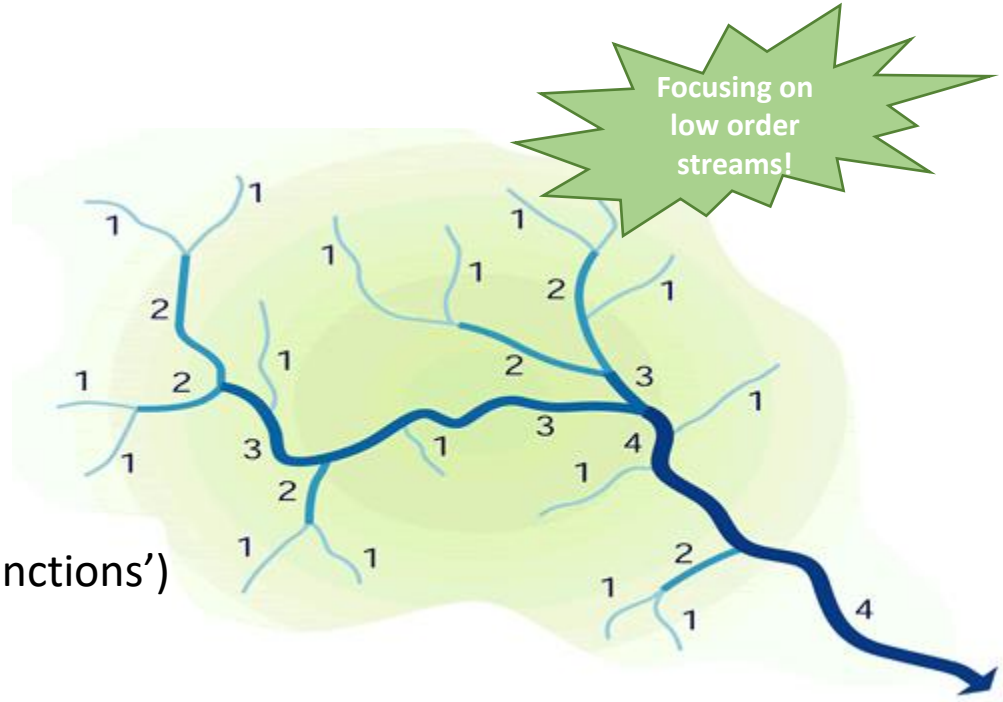
…the use of simple, low cost, **structural additions** (e.g., wood and beaver dams) to riverscapes to **mimic functions** and **promote specific processes**…

Add structural diversity and complexity (i.e., 'habitat')…

- Fine woody material
- Large woody material
- Sediment
- Organic matter
- Riffles, runs, pools, glides
- Bed scour, cascades/waterfalls, point bars, bars

….to encourage, promote, and enhance riverine processes (i.e., 'better functions')

- Hyporheic (shallow groundwater) exchange
- Groundwater recharge
- Nitrogen uptake & denitrification
- Phosphorus retention
- Sediment sorting
- Temperature buffering



Low-order streams (Strahler, 1952)

Employing the Channel Evolution Model in Process-Based Restoration

Stream channels ***evolve*** in response to:

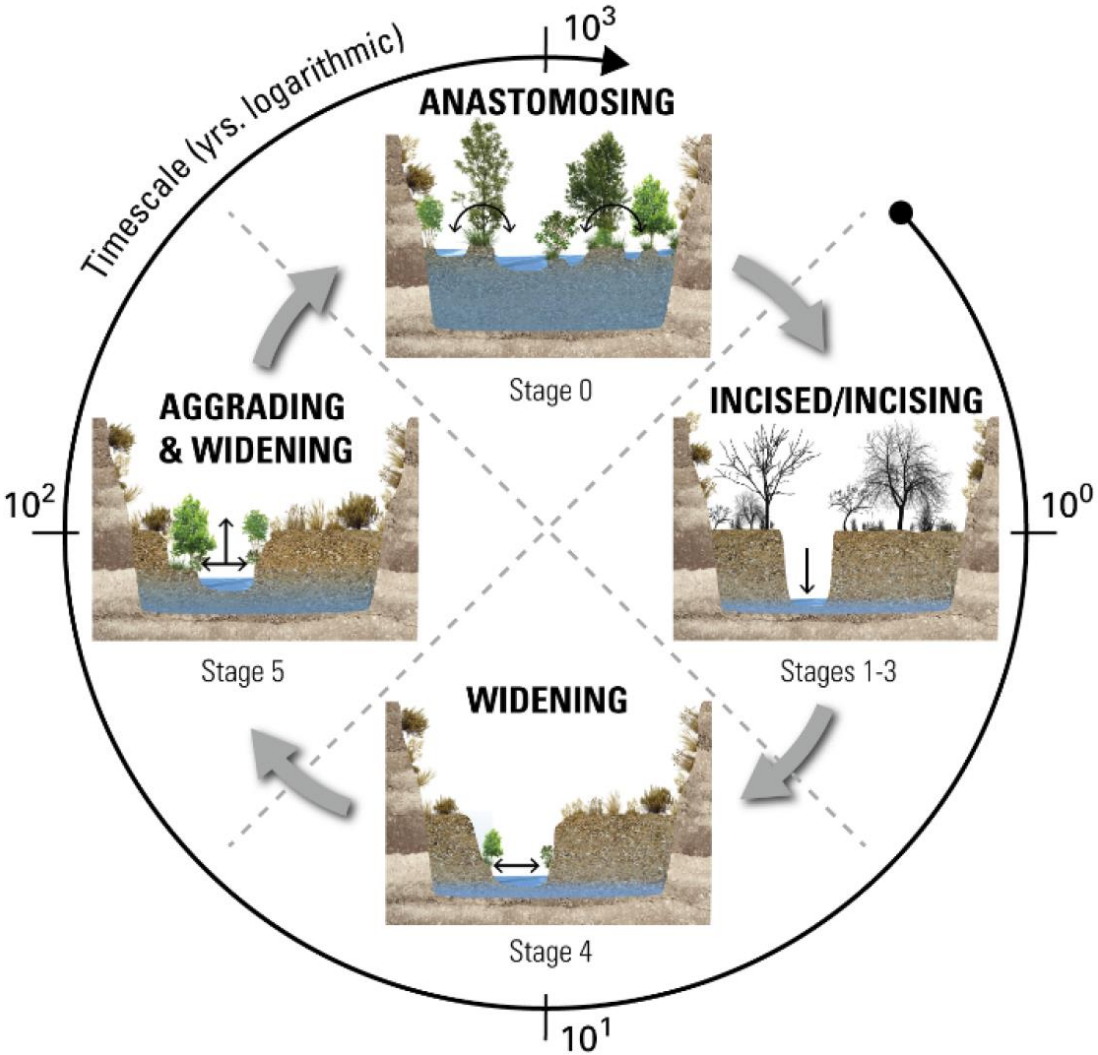
- Changes in sediment supply (erosion-deposition)
- Changes in hydrograph (precipitation-runoff)
- Floodplain connectivity
- Beaver activity
- Large wood inputs
- Riparian vegetation
- Natural or anthropogenic disturbances

Stream channels go through different ***stages*** over time:

- Stage 0→1 = Stable, single & multi-threaded channels

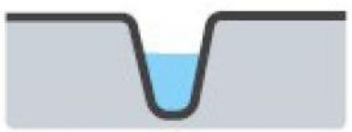
-------DISTRURBANCE------

- Stages 2→3 = Incising, downcutting, vertical erosion
- Stage 4 = Widening, horizontal erosion
- Stage 5 = Aggrading, sediment deposition, new floodplain
- Stage 6→0 = Re-establishing quasi equilibrium



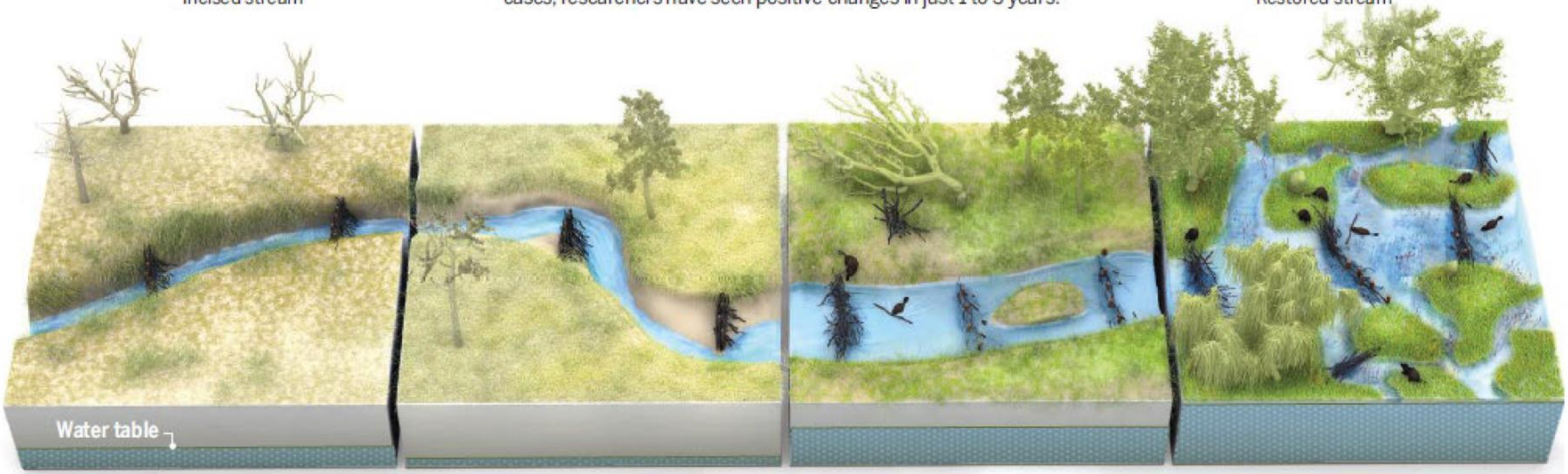
A stream comes back to life

Across the U.S. West, scientists and land managers are using beaver dam analogs (BDAs) to heal damaged streams, re-establish beaver populations, and aid wildlife. In some cases, researchers have seen positive changes in just 1 to 3 years.



Incised stream

Restored stream



Adding dams
Beaver trapping and overgrazing have caused countless creeks to cut deep trenches and water tables to drop, drying floodplains. Installing BDAs can help.

Widening the trench
BDAs divert flows, causing streams to cut into banks, widening the incised channel, and creating a supply of sediment that helps raise the stream bed.

Beavers return
As BDAs trap sediment, the stream bed rebuilds and forces water onto the floodplain, recharging groundwater. Slower flows allow beavers to recolonize.

A complex haven
Re-established beavers raise water tables, irrigate new stands of willow and alder, and create a maze of pools and side channels for fish and wildlife.

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What does Low-tech, Process-Based Restoration Look Like?

More like this…

***Beaver Dam Analogue (BDA)**, East Fork Divide Creek, MT*

And less like this…

***Engineered Log Jams (ELJ)**, Entiat River, WA*

Beaver Dam Analogue (BDA), *Willow Creek, MT*

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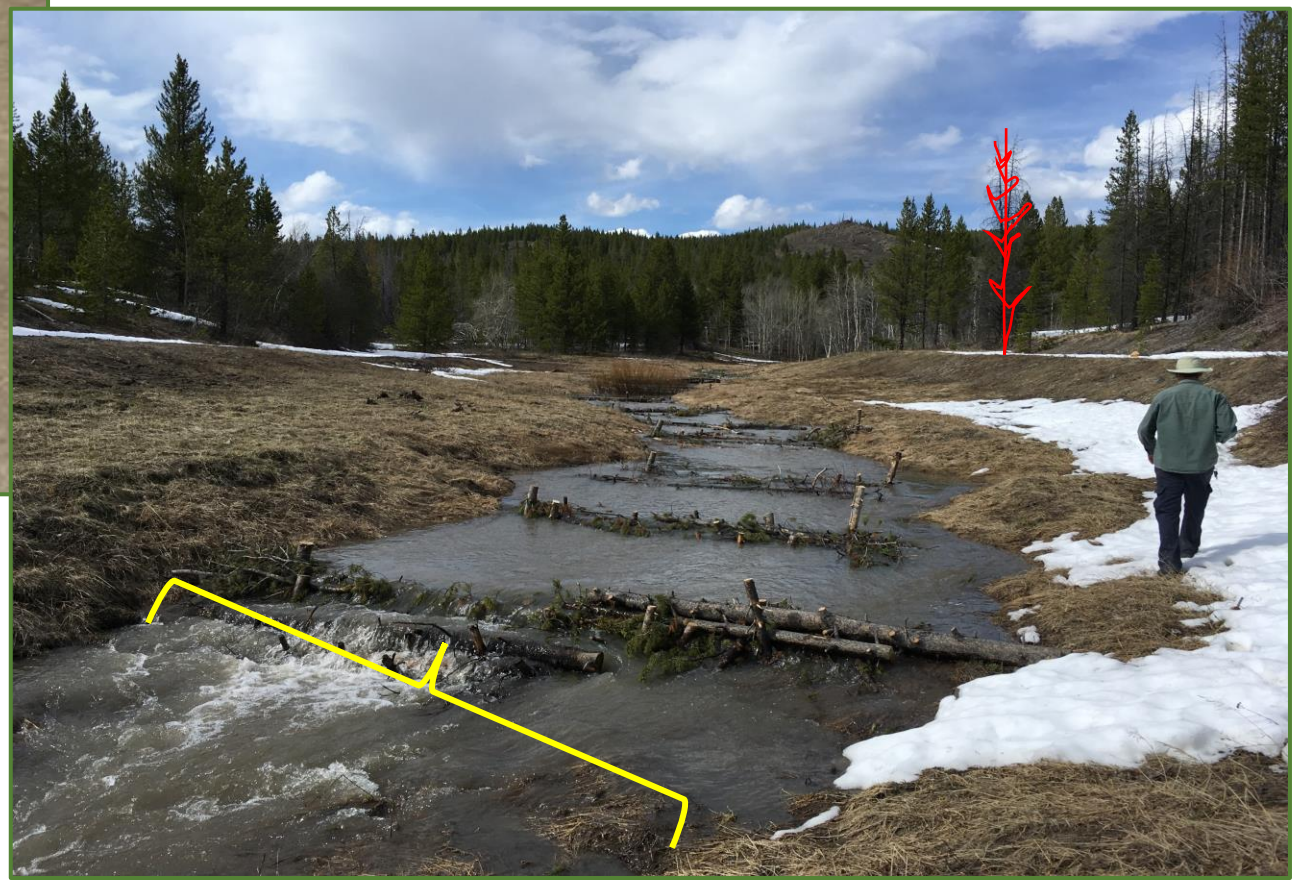
May 2015

May 2019



Beaver Dam Analogues,
California Creek, MT

Beaver Dam Analogues, East Fork Divide Creek, MT

Beaver Dam Analogues, California Creek, MT

*Beaver Dam Analogues & **Rock Check Dams**, California Creek, MT*

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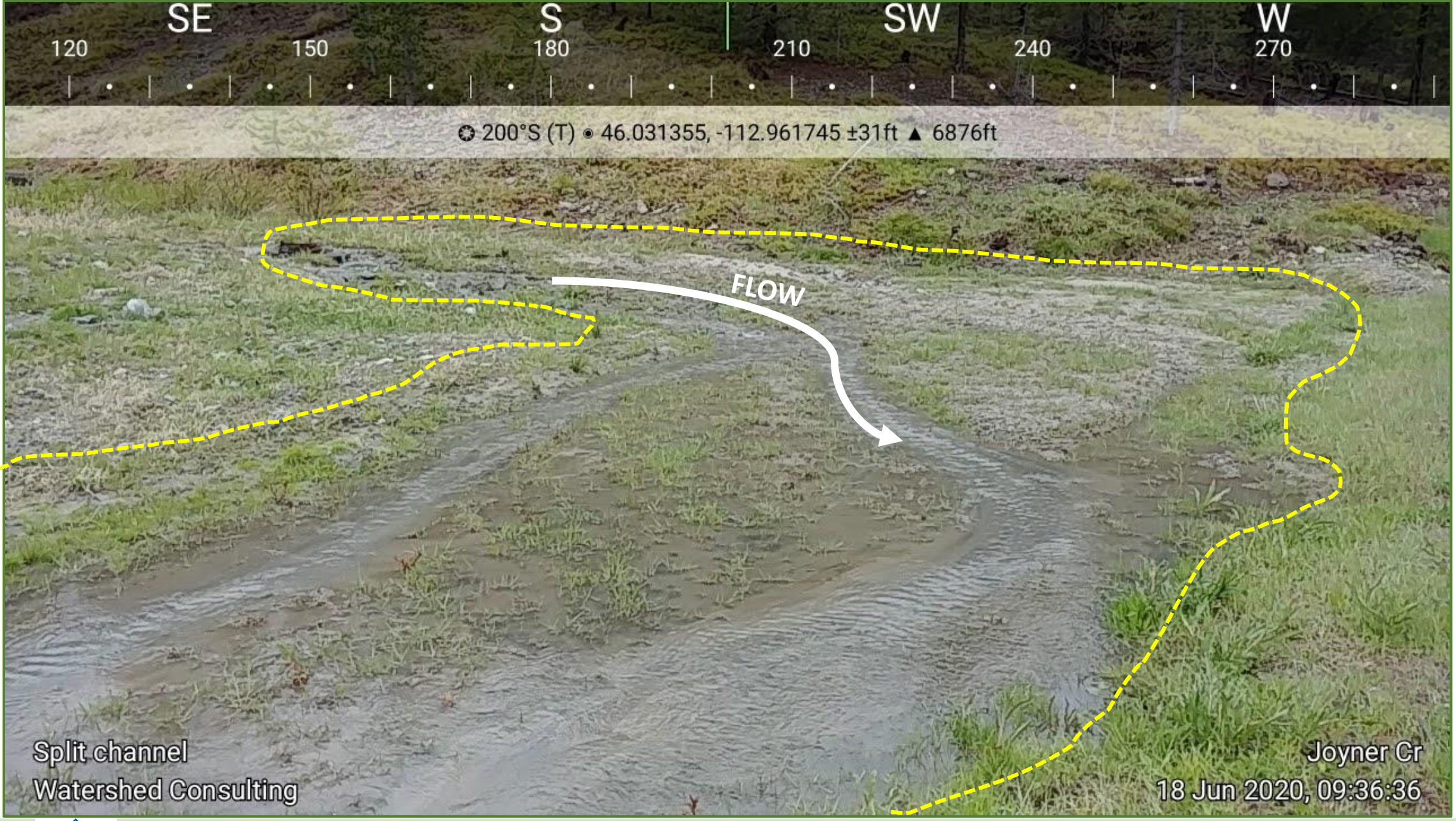


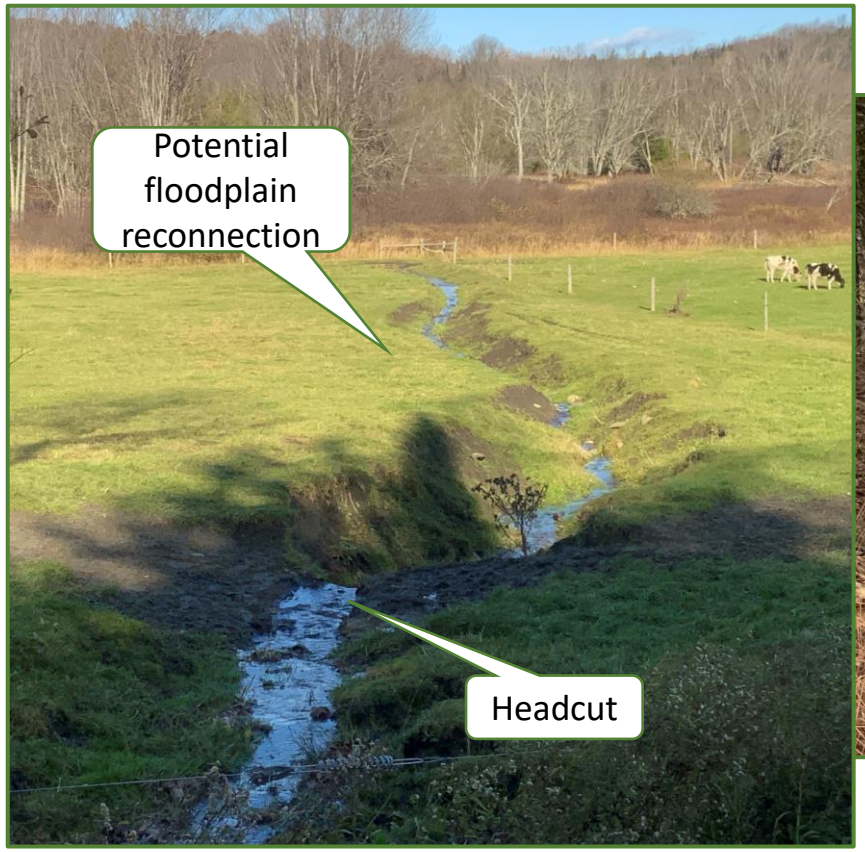
Floodplain Sediment Deposition, *Joyner Creek, MT*

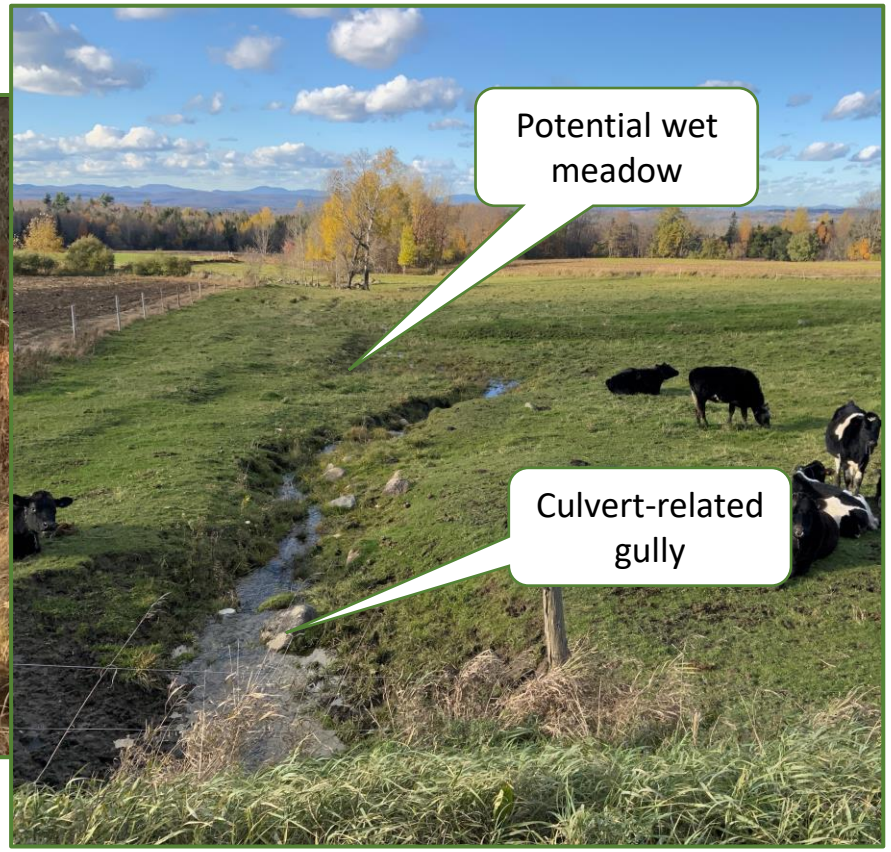
Post-Assisted Log Structures (PALS), *Entiat River, WA*

***Earth & Log Beaver Dams**, Post Creek, MT*

***Gully Plugs**, Joyner Creek, MT*

Identifying Potential PBR Projects in Basin 17

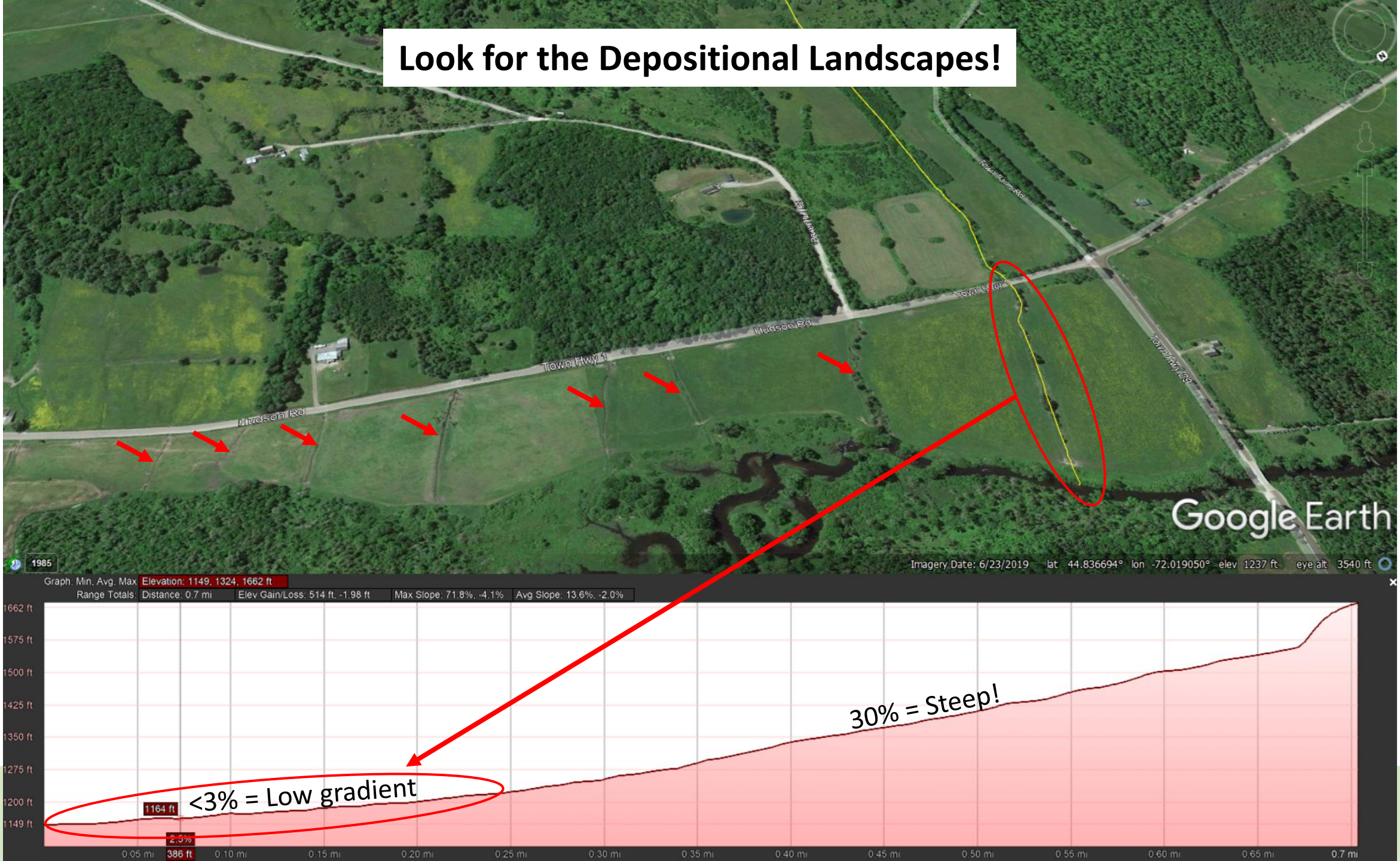




Things we're looking for:

- Sediment loading or deposition
- Ditching & berming
- Channelization & straightening
- Livestock impacts
- Historic beaver dams and meadows
- Culvert plunge pools
- Alluvial fans & toe slopes
- Off-channel wetlands
- Oxbows & confluence areas
- Gullies & headcuts

Look for the Depositional Landscapes!



Take-Away Lessons

Do's:

- Work with an expert to identify potential reaches, locate structures, and select methods appropriately
- Consult with your district fisheries biologist, river scientist, and floodplain manager
- Focus on 1st – 3rd order streams
- Design & build with redundancy
- Plan on 3-5 years monitoring & maintenance
- Add in-fill structures as channel evolves
- Use locally-sourced natural materials
    - Logs, stumps, rocks, sedge mats, etc.
- Use experienced work crews & sawyers

Don'ts:

- Put these in big rivers if you want them to work
- Apply an inappropriate structure in the wrong setting
- Put them where landowners don't want flooding
- Locate structures near vulnerable buildings or infrastructure
- Rely on volunteers to do more than a handful of structures
- Assume this is a 'set-it-and-forget-it' project

Resources & Acknowledgements

Additional Resources

Low-tech, Process-Based Restoration Manual

Let the Water do the Work

Hold Back the Snow Pack

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Photo & Project Acknowledgements

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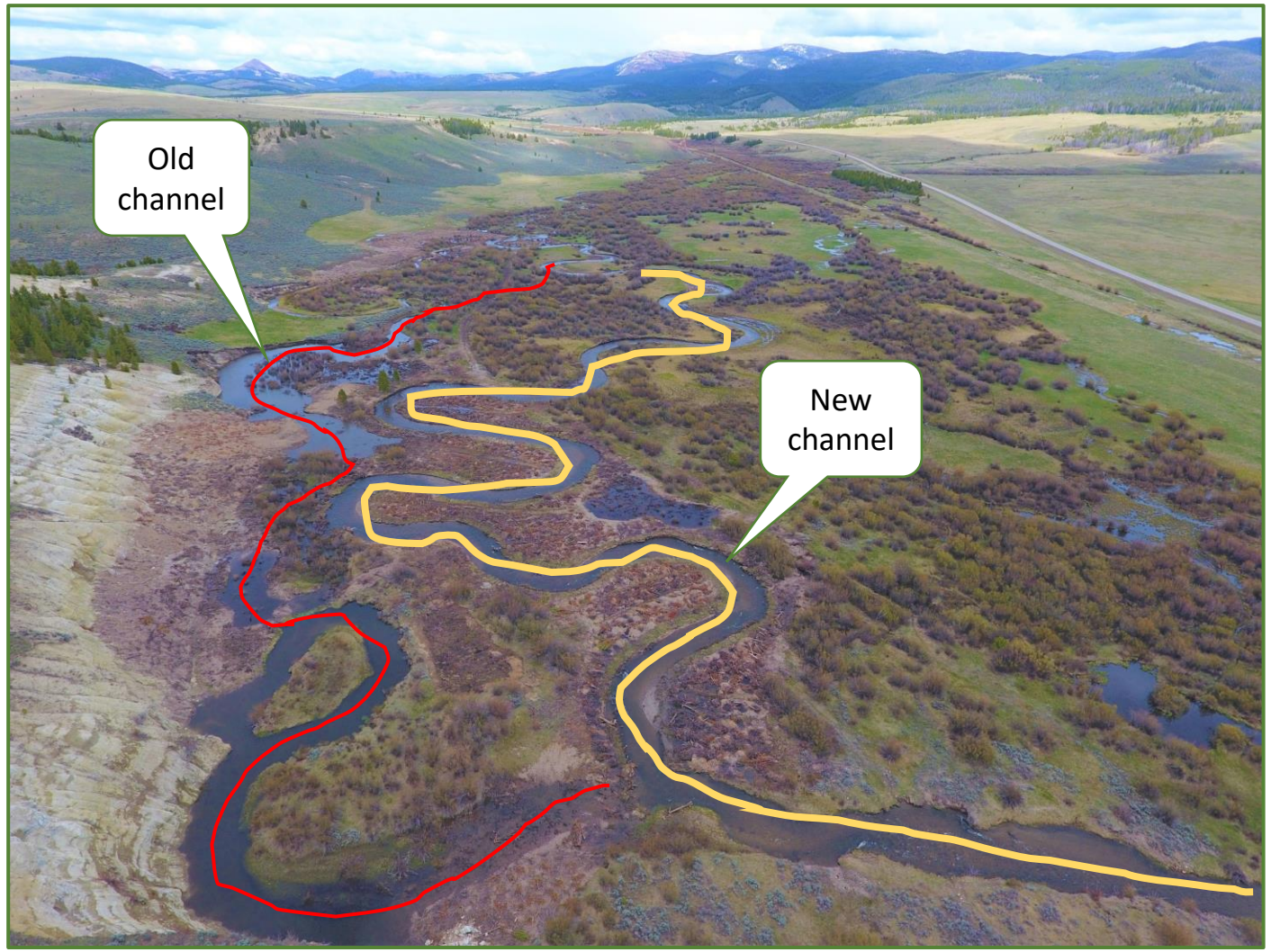
Different in Ways from Form Based Restoration



Channel re-alignment, French Creek, MT

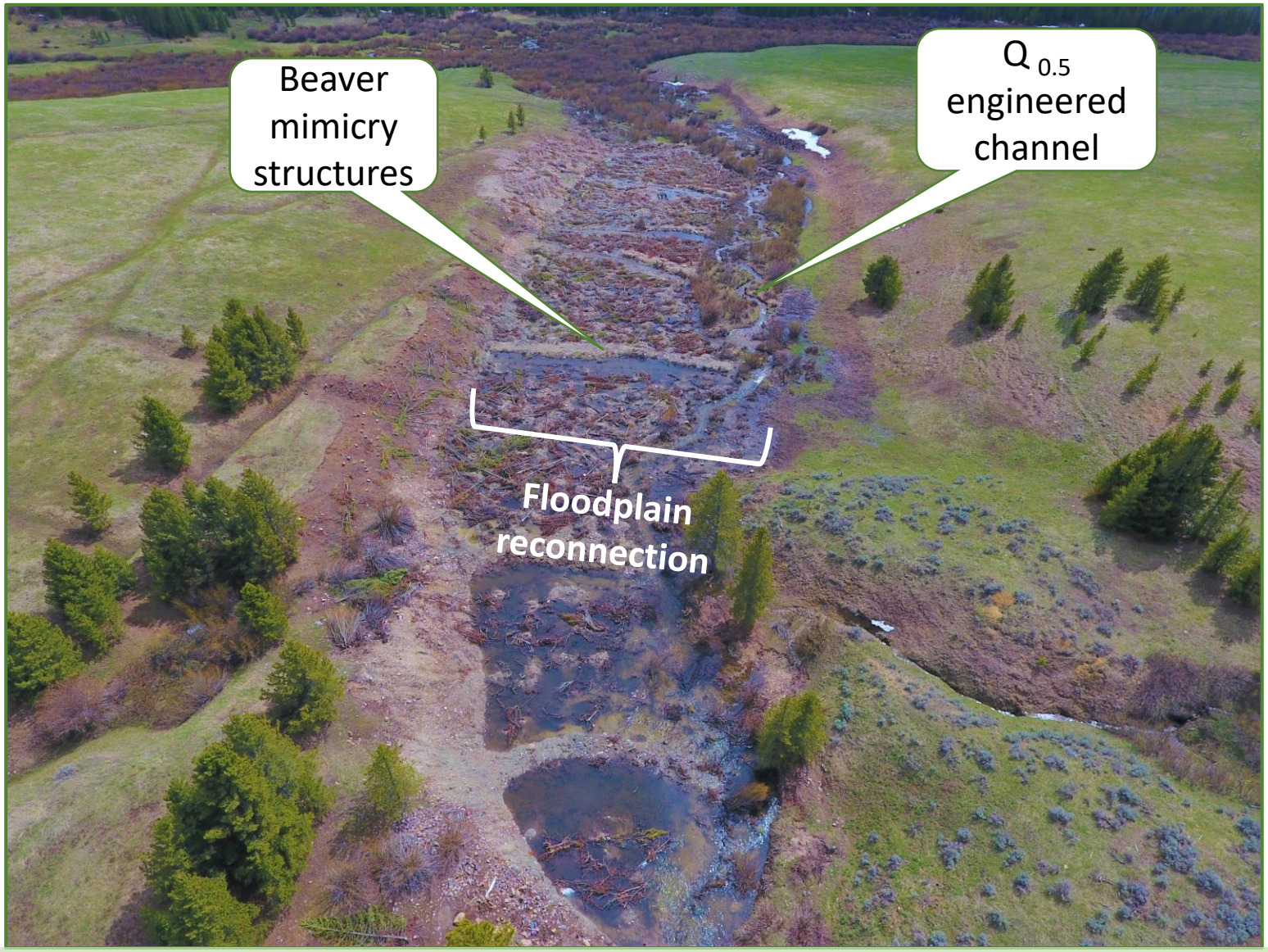
Focuses more on the shape of a river as it relates to:

- Channel alignment
- Channel bed form
- Bank stability
- Flood flow conveyance
- Floodplain connectivity
- In-stream habitat

Often manifests as:

- Stream channel re-construction
- Floodplain excavation & grading
- Streambank bioengineering
- Engineered log jams
- Dam removals
- And more…

Designing for Form & Process-Based Restoration



Stage 0 Restoration,
Oregon Creek, MT

Beaver Dam Analogues, California Creek, MT

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Brush fascines for bank stabilization, Mill Creek, MT

Beaver meadow restoration, East Fork Divide Creek, MT