BEAVER CREEK ECOLOGICAL RESTORATION

A LOW-TECH
PROCESS-BASED
RESTORATION APPROACH

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ecological restoration

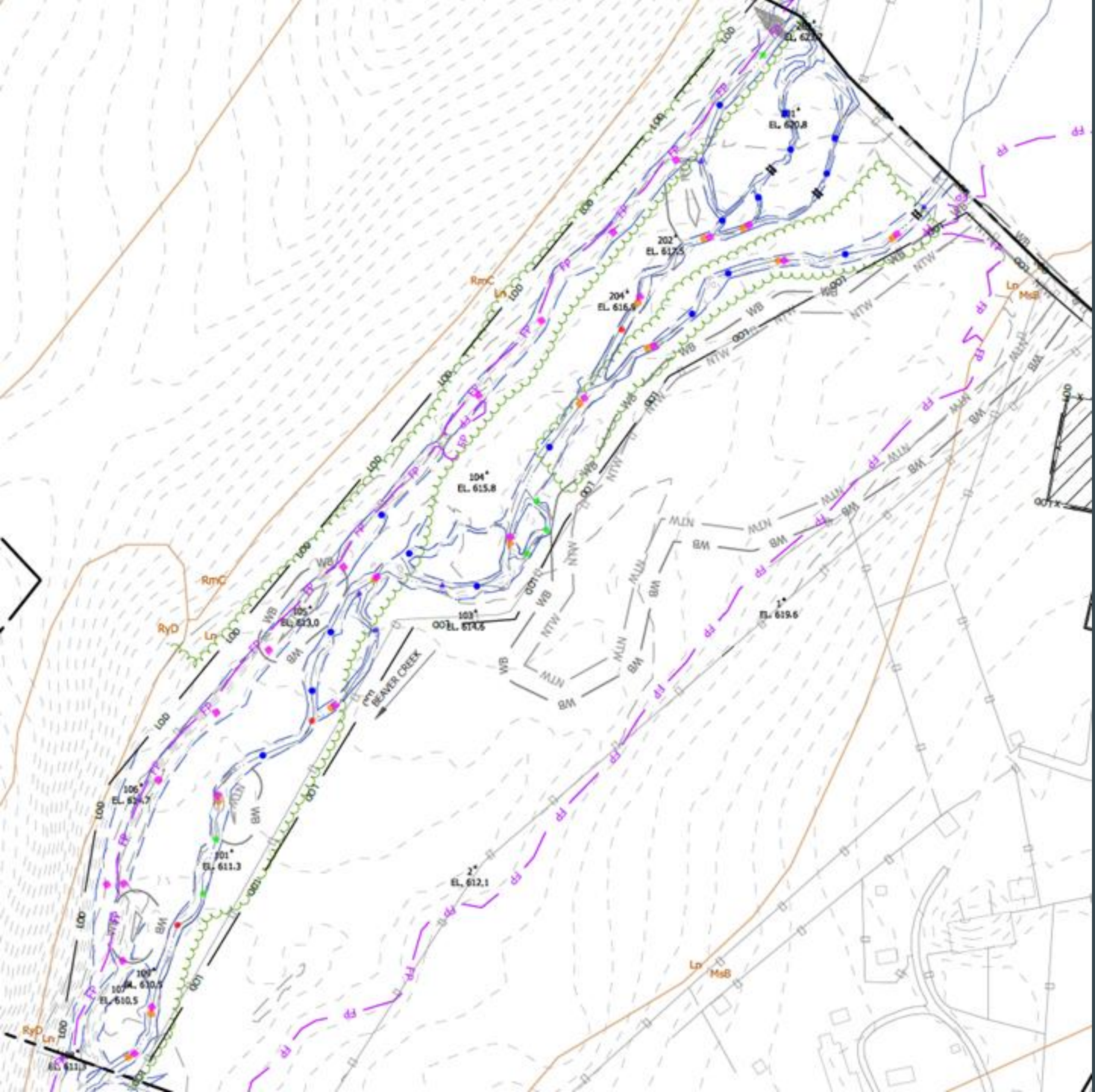
HISTORIC CONDITIONS

- Legacy sediment
- Channel straightened and pushed against valley toe

EXISTING CONDITIONS

BEAVER CREEK DRAINAGE AREA	
DRAINAGE AREA	4.92 SQ. MILES
FORESTED AREA	43.8%
IMPERVIOUS AREA	11.7%
URBAN AREA	22.1%

BEAVER CREEK DISCHARGE			
1.25-YEAR Q	2-YEAR Q	10-YEAR Q	100-YEAR Q
129 CFS	228 CFS	643 CFS	1770 CFS



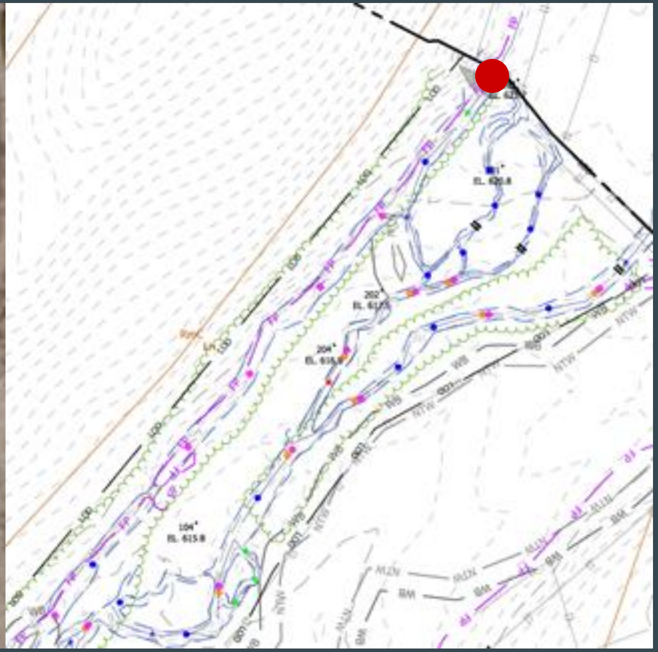
EXISTING CONDITIONS

- Multi-threaded system in the upstream section
- Headcuts
- Incising and abandoning the floodplain
- Eroding banks
- Dominated by reed canary grass
- Dead ash trees
- Structurally starved

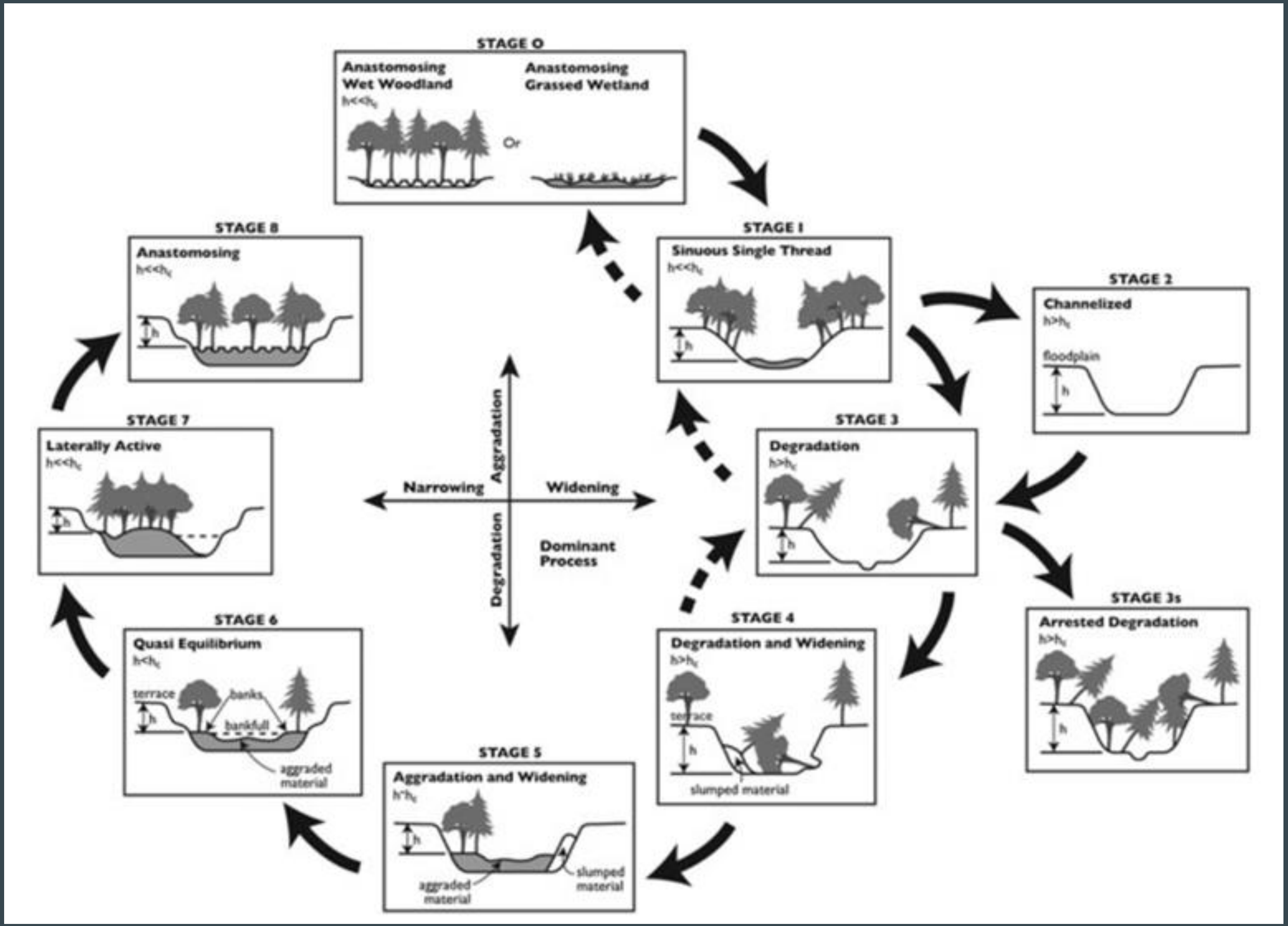
Existing Conditions








EXISTING STREAM STAGE

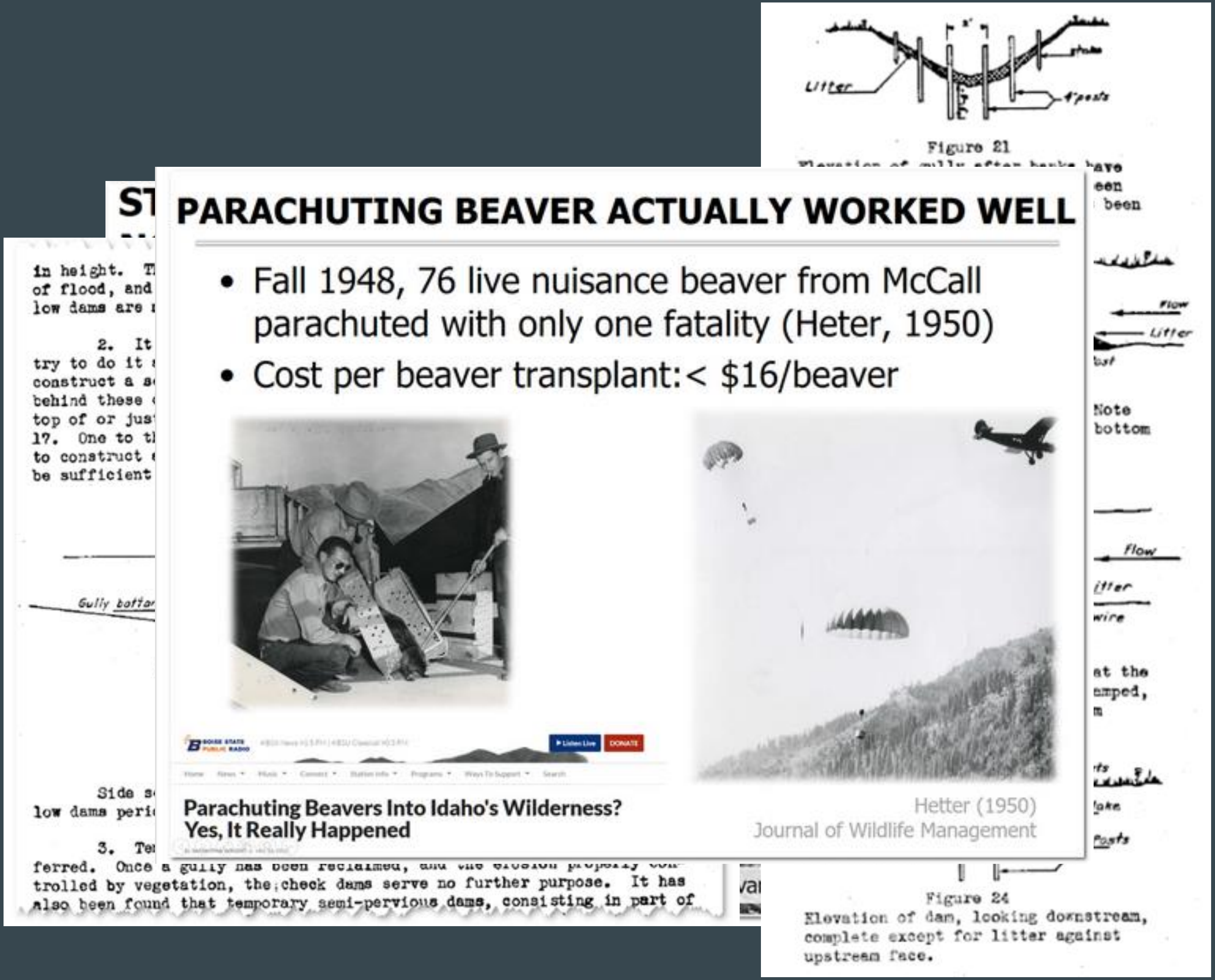


RESTORATION APPROACH

LOW-TECH PROCESS-BASED RESTORATION

LTPBR HISTORY

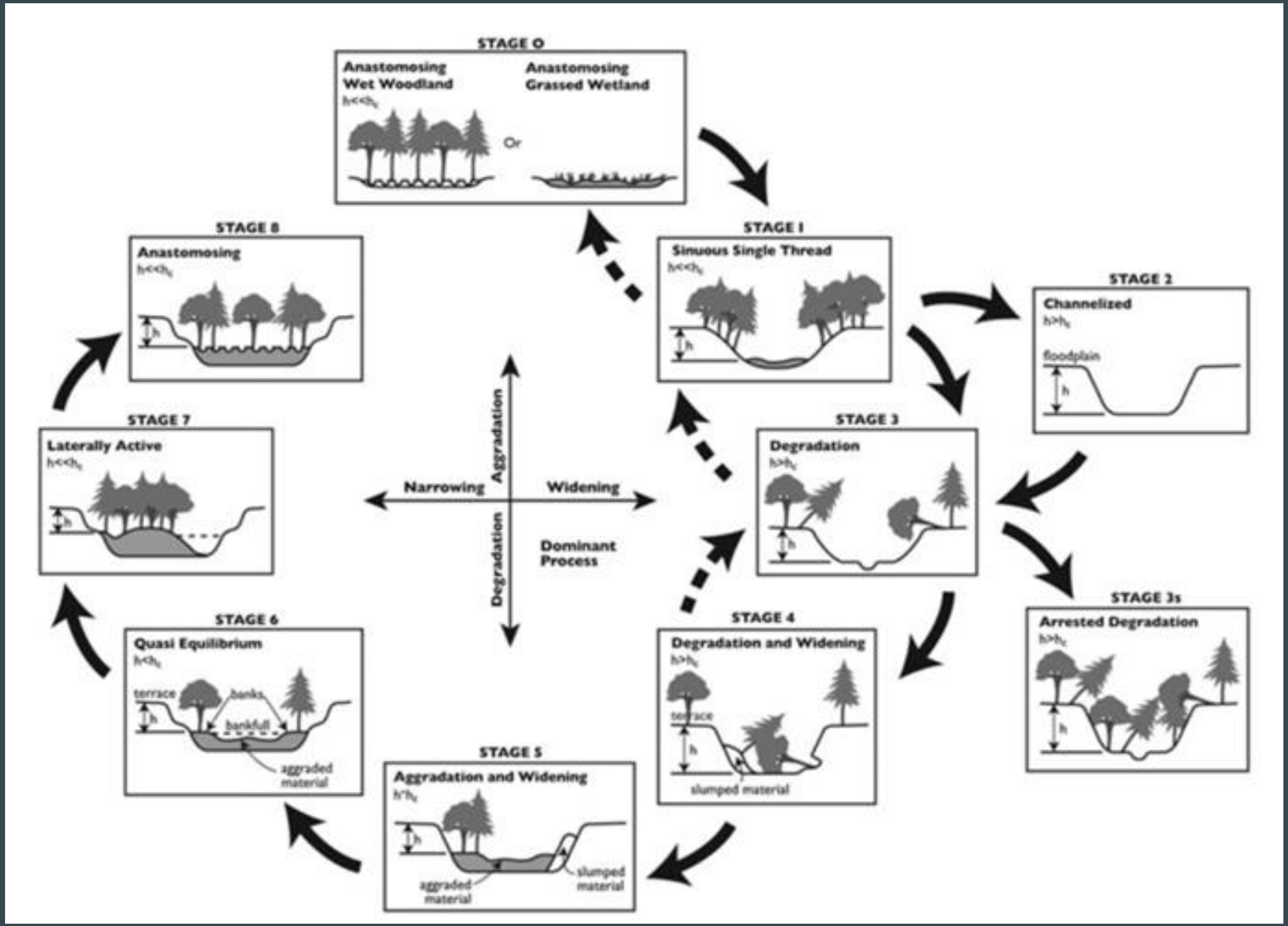
- Not a new technique!
- Structure additions in France in the 1800s
- Erosion control handbook 1934
- *Three Against the Wilderness*
- Parachuting beaver 1940s



- Low-tech: hand-built, non-engineered, short-term design lifespans “Kickstart processes that allow the stream to repair itself”

- Process-based: mimic functions and promote natural geomorphic and fluvial processes “Letting the system do the work”

Low-tech process-based restoration = LTPBR, Low-tech PBR, Cheap and Cheerful, etc.



TARGET STREAM STAGE

- Restore to Stage Zero
- LTPBR is a practice used in the process of achieving a Stage Zero system

LOW-TECH PROCESS-BASED RESTORATION

COMMONLY USED STRUCTURES

COMMON STRUCTURES

- Beaver Dam Analogues (BDAs)
- Post Assisted Log Structures (PALS)
    - Channel Spanning
    - Bank-attached
    - Mid-channel
- Complexes

PALS

- Channel spanning
  - Slow water, create areas of deposition
- Bank attached:
  - Force water against far bank
  - Increase velocity and depth
  - Redistributes sediment and generates space
- Mid channel
  - Split flow
  - Generates space and creates complexity in the flow regime

Messy is good!

PALs act as velcro


A
Bank-Attached
B
Mid-Channel


G
Bank-Attached
UtahStateUniversity
ECOGEOMORPHOLOGY & TOPOGRAPHIC ANALYSIS LABORATORY
H
Channel-Spanning

PALS

- Flow complexity creates deposition and erosion of different substrate sizes
- Slow water = resting areas above and behind PALS
- Fast water created where convergent jets scour bottom substrate creating pools or undercut banks
- Wood and undercut banks provide shelter from predators

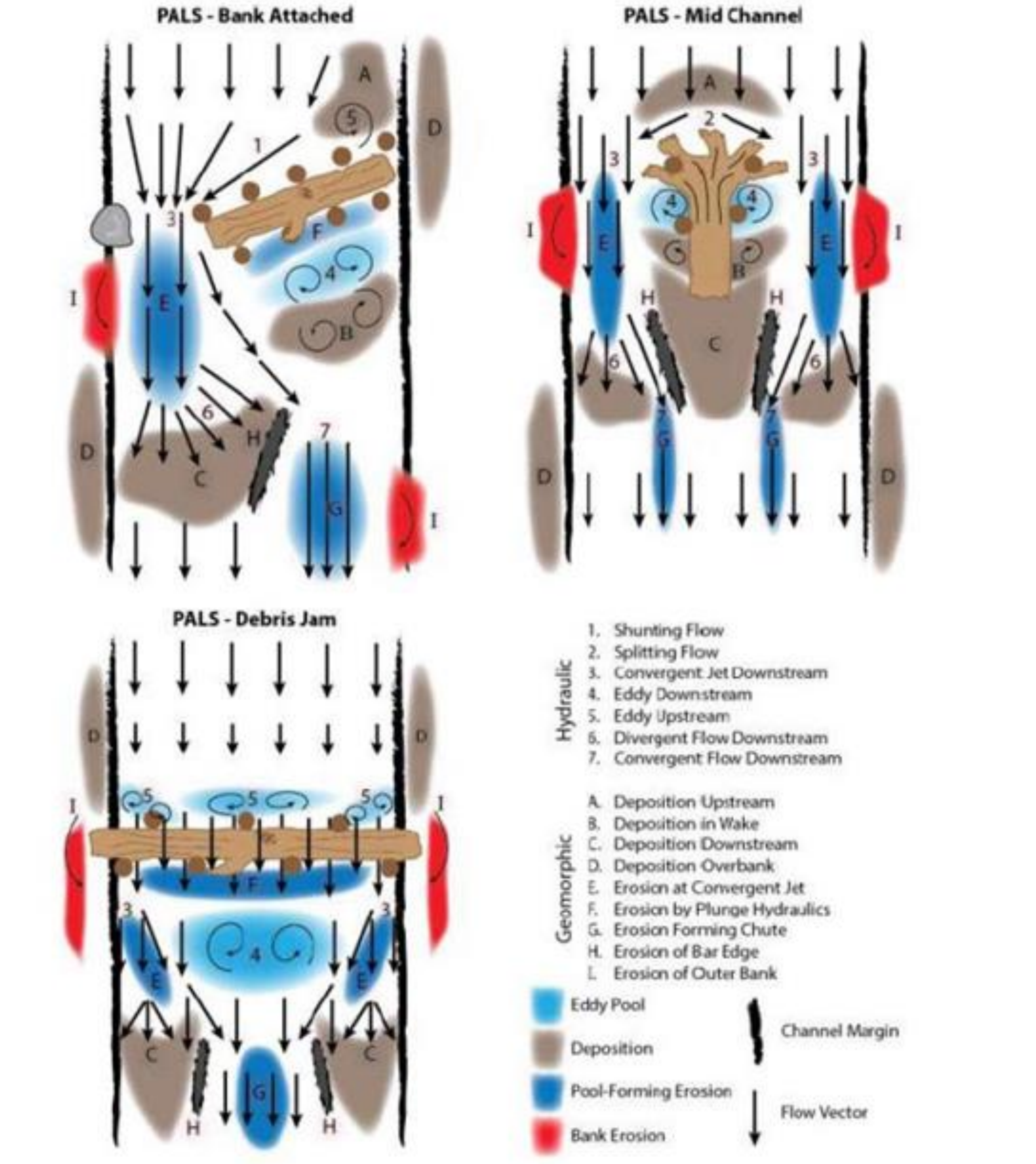
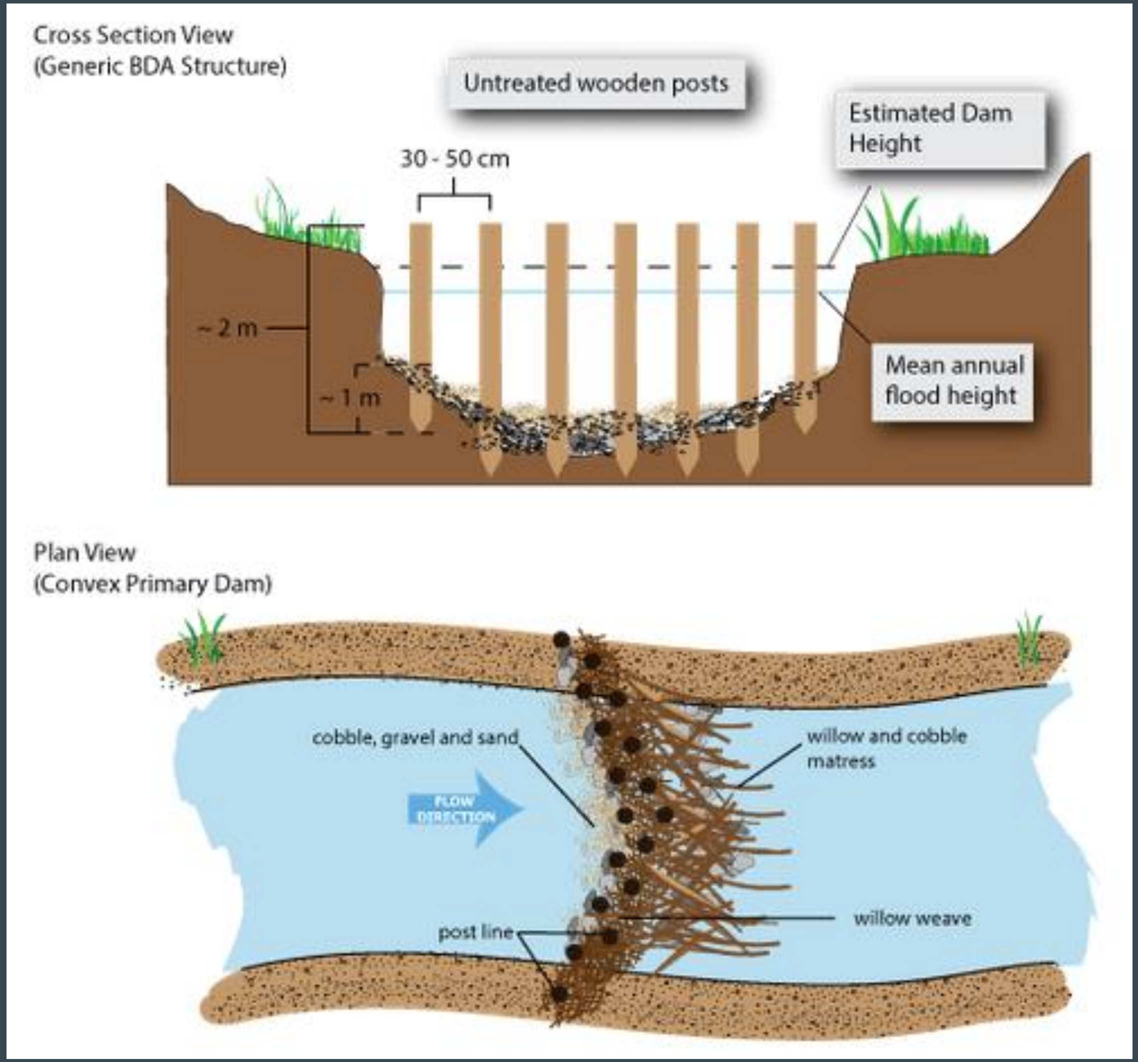


Figure 10 - Hypothesized hydraulic and geomorphic responses associated with bank-attached, mid-channel, and debris jam post-assisted log structures (PALS) from Figure 3.5 from Camp (2015a). Note: what is labeled as 'debris-jam' is referred to in this chapter as 'channel-spanning'.

SCAPE RESTORATION MANUAL

BDA

- Pond water to create pool habitat
- Primary BDAs often followed by Secondary BDAs
- Do not act as a barrier to fish passage
- Messy is good



Type	Hydraulic	Hydrologic	Geomorphic
PALS Channel-spanning	create upstream backwater or pond, and plunge hydraulics downstream	increase frequency and magnitude of overbank flow, increase hyporheic flows	channel aggradation, channel avulsion, bank erosion, dam and plunge pool formation, bar formation
PALS Bank-attached	force convergent flow (deeper and faster), create eddy behind structure	force overbank flows*	bank erosion, scour pool formation, bar formation, sediment sorting, channel avulsion
PALS Mid-channel	force flow separation, create eddy in lee of structure	force overbank flows*	bank erosion, scour pool formation, bar formation, sediment sorting, channel avulsion
Primary BDA	create deep slow water	increase frequency and magnitude of overbank flow, increase hyporheic flows	channel aggradation upstream, bar formation, bank erosion (if breached on ends), sediment sorting
Secondary BDA	create deep slow water	increase frequency and magnitude of overbank flow, increase hyporheic flows	channel aggradation, channel avulsion, bank erosion, dam pool formation, bar formation

BDAs vs PALS

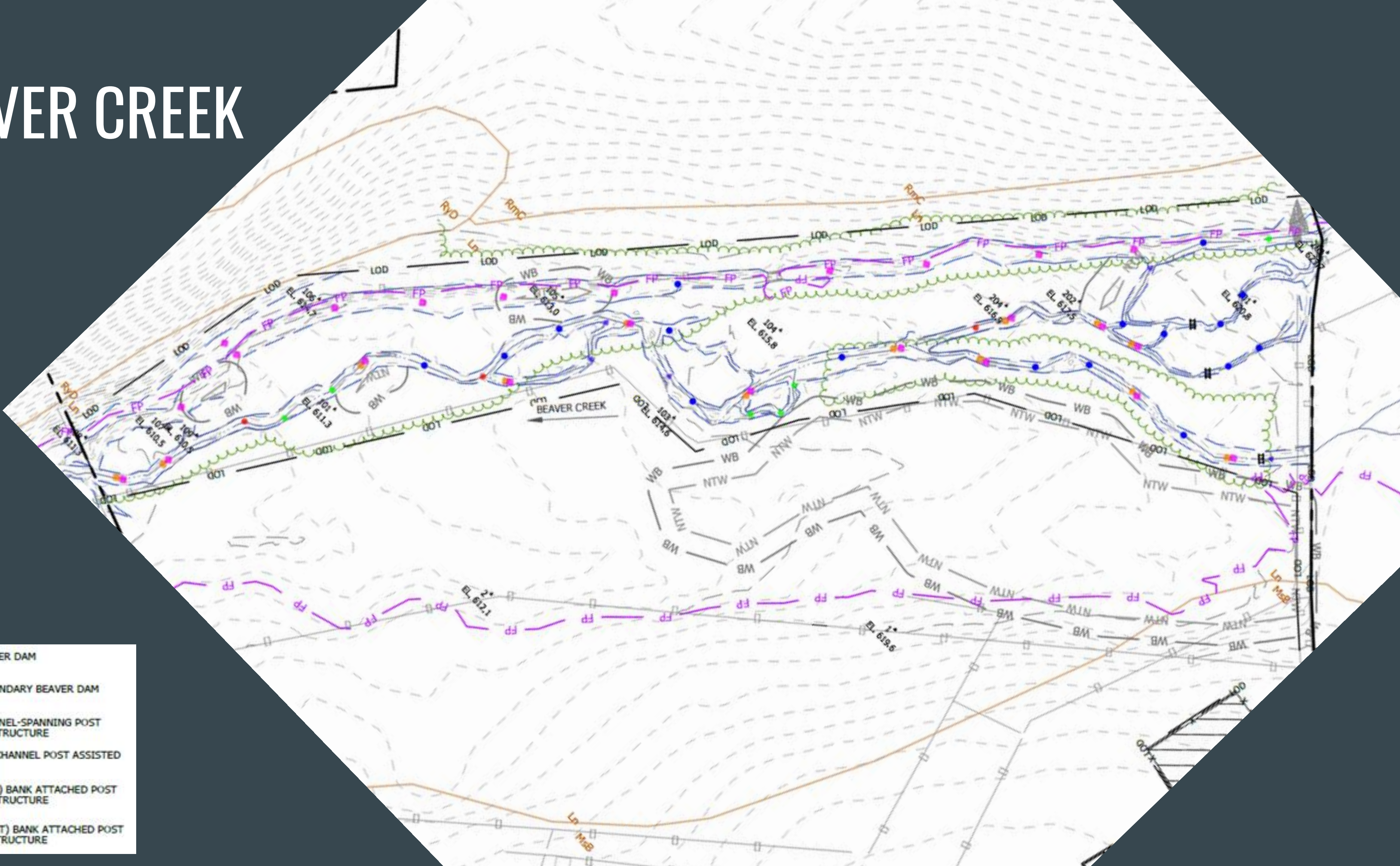
- PALS - woody material of various sizes pinned together with wood posts driven into the substrate. Mimic natural wood accumulations.
- BDAs - channel-spanning structure with a constant crest elevation, constructed with a mixture of woody debris and fill material to form a pond. Mimics a natural beaver dam by ponding water to create pool habitat.

STRUCTURE LIFESPAN

- Ex. of PALS evolution from as-built to one-year survey

- Most BDAs and PALS are designed and constructed to have a lifespan of <1 year
    - Can be extended through adaptive management
- Structure function and form can change
- System can recruit wood to make new structures

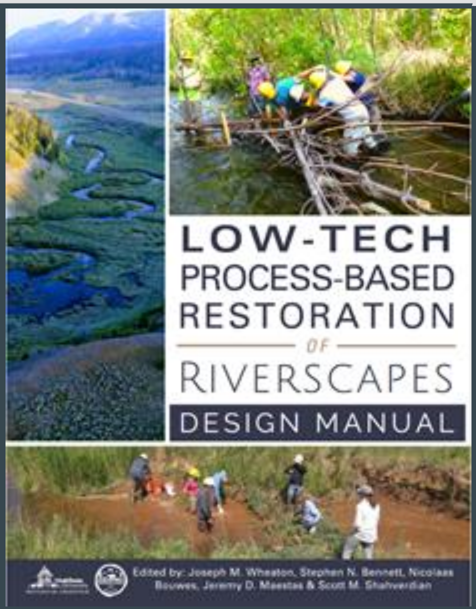
BEAVER CREEK



- PROPOSED BEAVER DAM ANALOGUE
- PROPOSED SECONDARY BEAVER DAM ANALOGUE
- PROPOSED CHANNEL-SPANNING POST ASSISTED LOG STRUCTURE
- PROPOSED MID-CHANNEL POST ASSISTED LOG STRUCTURE
- PROPOSED (LEFT) BANK ATTACHED POST ASSISTED LOG STRUCTURE
- PROPOSED (RIGHT) BANK ATTACHED POST ASSISTED LOG STRUCTURE

Success Rate

Images and details are referenced from Anabranch Solutions and the *Low-Tech Process-Based Restoration of Riverscapes Design Manual* from the Utah State University Research Consortium



ANABRANCH SOLUTIONS

Process Based Restoration LOW TECH

UtahStateUniversity RESTORATION CONSORTIUM

Sources/helpful links

- LTPBR Manual
- LTPBR manual resources
- Anabranch Solutions
- History of LTPBR techniques
- Cluer and Thorne Stream Evolution Model (Stage Zero/Eight)

Questions?

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