

LTPBR WORKSHOP

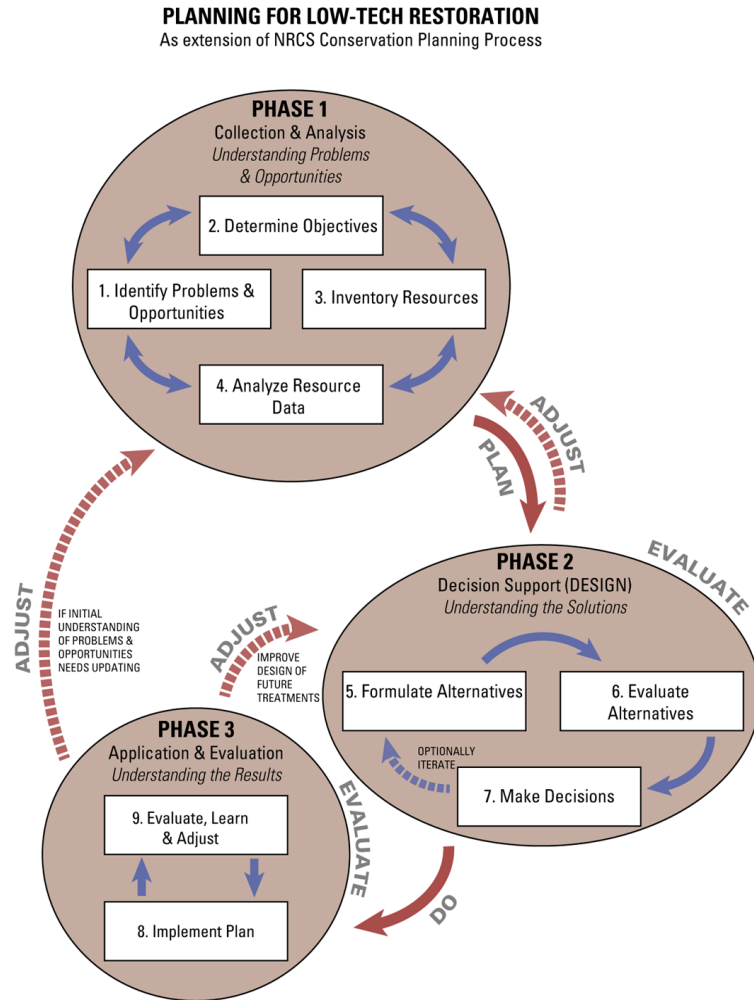
LOW-TECH DESIGN



OUTLINE

I. Conservation Planning Process

- I. Phase 1 – Planning (module 3)
- II. Phase 2 – Design (module 4)
- III. Phase 3 – Implementation (module 5)



Design Manual References – Chapters 4 & 5

Chapter 4 – MIMICKING & PROMOTING WOOD ACCUMULATION & BEAVER DAM ACTIVITY WITH POST-ASSISTED LOG STRUCTURES & BEAVER DAM ANALOGUES



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IMPLICATIONS FOR PRACTICE

- Post-assisted log structures (PALS) and beaver dam analogues (BDAs) are hand-built structures. PALS mimic and promote the processes of wood accumulation, whereas BDAs mimic and promote beaver dam activity.
- PALS and BDAs are permeable, temporary structures, built using natural materials.
- BDAs differ from PALS in that BDAs create ponds using a variety of fill materials; PALS are built with only woody material, which tends to be larger diameter than the woody material used for BDAs.
- PALS and BDAs are both intended to address the broad impairment of structural starvation in wadeable streams, but can also be used to mitigate against a range of more specific impairments.
- PALS and BDAs can be built using a variety of natural materials, and built to a range of different shapes, sizes and orientations.
- PALS and BDAs are most likely to achieve restoration goals when built in high numbers.
- Some PALS and BDAs are likely to breach and/or lose some wood, but when many structures are installed, that material will accumulate on downstream structures or in natural accumulation areas leading to more complexity.

CHAPTER 4: MIMICKING & PROMOTING WOOD ACCUMULATION & BEAVER DAM ACTIVITY WITH PALS & BDAs

RIVERSCAPE RESTORATION MANUAL

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Chapter 5 – DESIGNING LOW-TECH RESTORATION PROJECTS



Prepared by:

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IMPLICATIONS FOR PRACTICE

- A complex is a group of structures designed to work together to mimic and/or promote specific processes to achieve one or more project objectives. Complexes are the building blocks of a low-tech restoration design.
- The low-tech restoration design process for complexes:
 - is rapid, low-cost, flexible, transparent, field-based, and generates clear and testable design hypotheses;
 - hypothesizes the hydraulic zone of influence (laterally constrained by the valley bottom) of the treatment, which helps set expectations for the extent of impact of the treatment relative to overall project goals and reach objectives for recovery potential;
 - identifies low-flow, typical-flood, and extreme-flood hypotheses (i.e., process-based responses), which articulate the connection between the processes initially mimicked, later promoted, and hopefully eventually taken over naturally by the system.
- Design of low-tech restoration projects focuses on the complex-scale rather than the individual structure to maintain focus on the scope of riverscape degradation due to structural starvation.

CHAPTER 5: DESIGNING LOW-TECH RESTORATION PROJECTS

RIVERSCAPE RESTORATION MANUAL

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Chap 4: Shahverdian et al. (2019a)

DOI: [10.13140/RG.2.2.22526.64324](https://doi.org/10.13140/RG.2.2.22526.64324)

Chap 5: Shahverdian et al. (2019b)

DOI: [10.13140/RG.2.2.11621.45286](https://doi.org/10.13140/RG.2.2.11621.45286)

PHASE 2 with Low-Tech

Addressed during Phase 1

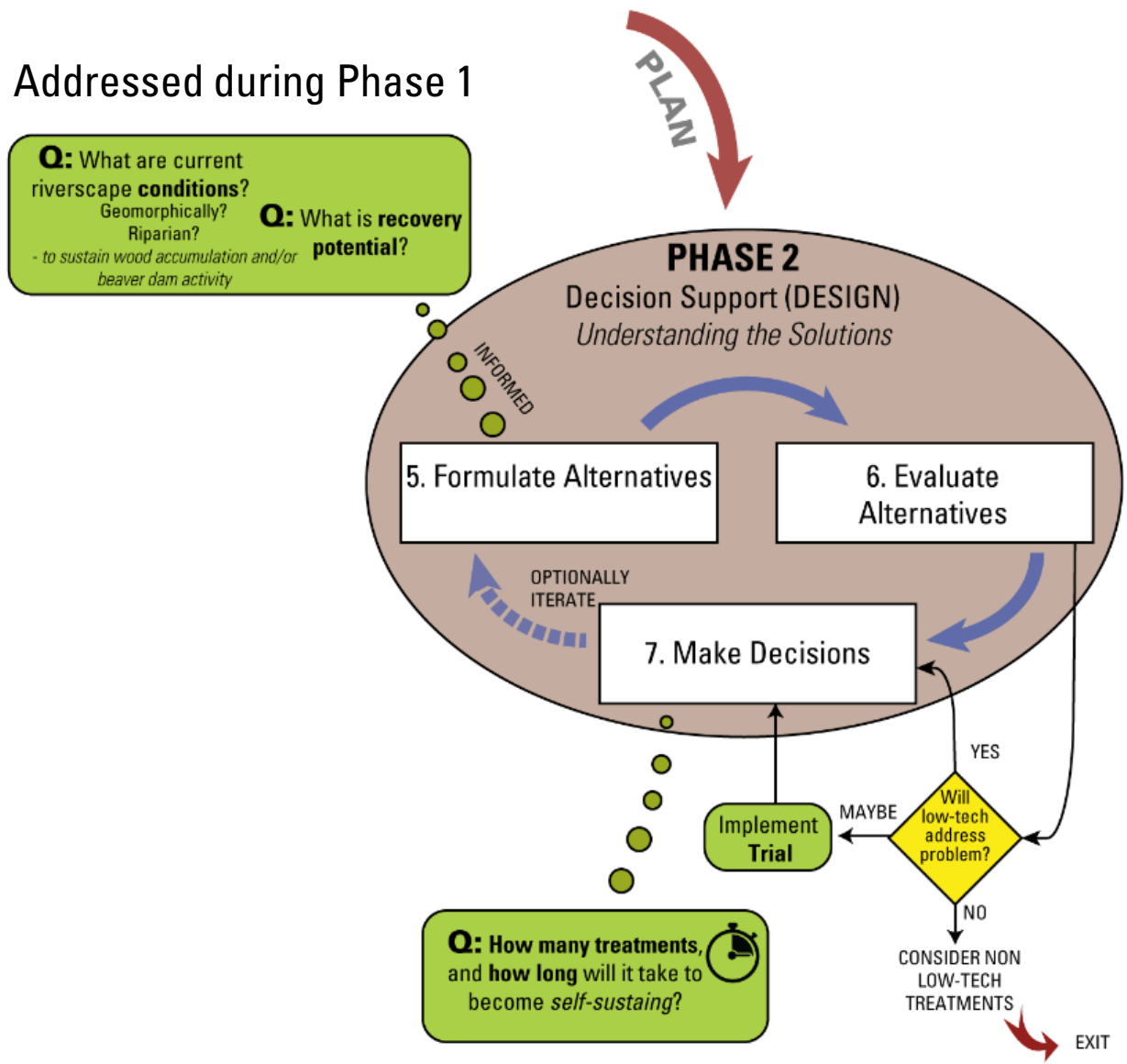


Figure 5.1 from Chap 5: Shahverdian et al. (2019)

NRCS Conservation Practice 643 – Specification Sheet

Restoration of Rare or Declining Natural Communities:

Beaver Dam Analogues and Post-Assisted Log Structures for Low-Tech Stream Restoration

Conservation Practice 643 - Specification Sheet



Natural Resources Conservation Service

Client:		Date:	
Location:		County:	
Contract #:		Tract/Field:	
Planner:		Acres:	

Practice Description

Beaver Dam Analogues (BDAs) and Post-Assisted Log Structures (PALS) are low-tech woody structures designed to facilitate process-based restoration of streams and riparian areas. BDAs mimic and promote the processes of beaver activity, while PALS mimic and promote the processes of wood accumulation. Structures are low, semi-permeable, and hand-built using native materials (wood, sod, etc.) with untreated wooden fence posts added where necessary for extra stability. Structures are designed to be short-lived and used primarily as a temporary tool to promote natural process recovery. Typically, 'complexes' consisting of multiple structures are used within a stream reach to meet project objectives. The desired outcome is to initiate restoration of natural processes that self-sustain healthy valley bottoms and riparian habitats. For more details, reference: [Low-Tech Process-Based Restoration of Riverscapes: Pocket Field Guide](#)

Reach Conditions/Complex-Scale Objectives (complex = group of structures designed to work together)

Reach/Complex Name	Length	Baseline Conditions	Goals & Objectives	Target Conditions
Stony Creek	500 ft	Channel incision (~3 feet) limits regular floodplain access. Riparian vegetation minimal and only where inset floodplains have developed.	Improve floodplain connectivity, expand riparian vegetation to improve native fish and wildlife habitat	The desired outcome is to widen incision trench by one active channel width, expand inset floodplain, and increase riparian vegetation extent by 50% within 5 years.

Treatment Specifications

Reach/Complex Name	Structure No.	Structure Type	Approximate Dimensions (ft) (L x W x H)	Site-Specific Notes
Stony Creek	1	Bank-attached PALS	7x2x3	Use bank blaster to force high flows into cutbank

Design drawings and maps See Appendix A for standard structure drawings and installation instructions. Refer to conservation plan map for layout of structures.

Permits and consultations (List stipulations, timing restrictions, conservation measures, and notifications required by permitting/consultations.)

Risk mitigation measures and additional notes (Complete risk considerations checklist and describe any measures needed to reduce risks)

Conservation Practice 643 – Specification Sheet

Operation, Maintenance, and Adaptive Management

BDAs and PALS are intended to be short-term structures to mimic and promote natural processes. The design life is minimally one year, but the functional life of structures is often 5+ years. Maintenance and repair will likely be required until objectives and desired conditions for the complex are achieved. Structures should be inspected annually after peak runoff events but more frequent monitoring is encouraged. The amount and type of maintenance needed depends on project objectives. The failure of an individual structure may not be problematic if undesired impacts are not occurring and management objectives are still being achieved across the whole complex of structures.

Typical maintenance activities include:

- Replacing posts
- Refilling structure with woody material
- Plugging leaks in ponds (BDAs)
- Extending structure length

Since the long-term goal is to restore self-sustaining processes (e.g., wood accumulation and/or beaver dam activity), adaptive management should include regular evaluation to determine if additional treatments are needed through time.

CLIENT'S ACKNOWLEDGEMENT STATEMENT:

- The Client acknowledges that:
- a. They have received a copy of the specification and understand the contents and requirements.
 - b. It shall be the responsibility of the client to obtain all necessary permits and/or rights, and to comply with all ordinances and laws pertaining to the application of this practice.

Accepted by: _____

Date: _____

CERTIFICATION:

I have completed a review of the information provided by the client or have conducted a site visit and certify this practice has been applied according to NRCS standards and specifications.

Certified by: _____

Job title: _____

Date: _____

Conservation Practice 643 – Specification Sheet

BEAVER DAM ANALOGUES

STEP 1

Decide where to locate BDA along stream



STEP 2

Build up first layer only to just above existing water surface, and make sure crest is level across bed and its pooling water upstream to this temporary crest elevation



STEP(S) 3

Build up subsequent layer(s) in 6" to 12" lifts, packing well with mud, turf, leaves, needles, sediment and other material until ponding water to this next temporary crest elevation.



FINISHING STEP

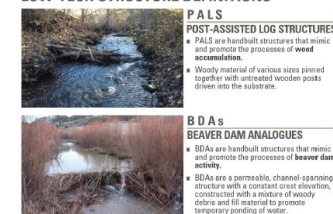
Bring dam up to desired design crest elevation. Make sure crest is perfectly level (no preferential flow or weir effect). If stream is flowing, water should be backed up and ponding, but flow over and through dam should equilibrate so that flow into equals flow out (over and through) heavy dam.



Conservation Practice 643 – Specification Sheet

Appendix A: Structure schematics and installation instructions. From Wheaton et al. 2019. [Low-Tech Process-Based Restoration of Riverscapes: Pocket Field Guide](#). Utah State University Restoration Consortium. Logan, UT.

LOW-TECH STRUCTURE DEFINITIONS



BANK-ATTACHED PALS



MID-CHANNEL PALS



CHANNEL-SPANNING PALS



POSTLESS BDA



POST-ASSISTED BDA



POST-LINE WICKER WEAVE



Conservation Practice 643 – Specification Sheet

HOW TO BUILD BDAs

1. Decide location of BDA dam crest orientation, configuration (e.g., straight or convex downstream), and crest elevation (use landscape flags if necessary). Position yourself with your eye-level at the proposed crest elevation of the dam (make sure it is < 5' in height). Look upstream to find where the pond will backwater to. Adjust crest elevation as necessary to achieve desired size of pond, inundation extent, and overflow patterns. If concerned about head pond (water surface elevation difference) over BDA, build a secondary BDA downstream with a crest elevation set to backwater into base of this BDA (and lessen head pond or elevation difference between water surface in pond and water surface downstream of BDA).
2. Build up first layer or course by widening base upstream and downstream of crest to flat height of 5 to 12' above existing water surface, and make sure it holds back water.
 - a. If larger key pieces (i.e., larger logs, cobble or small boulders) are locally abundant, these can be used to lay out the crest position across the channel. Optionally, they can be 'keyed' in by excavating a small trench (no need to be deeper than ~1/3 of the height of key piece diameter) and place key pieces in and pack with excavated material.
 - b. Lay out first layer of larger fill material, being careful not to go to higher than 6" to 12" above existing water surface. The first layer should be just high enough to backwater a flat water surface behind it.
 - c. Using mud, bed material & turf (typically sourced from backwater area of pond) as fine fill material to plug up leaks, combine with sticks and branches of various sizes to build a wide base. Make sure base is wide enough to accommodate anticipated dam height (most dams will have a 1.5:1 to 3:1 (horizontal : vertical) proportions).
 - d. Build up first layer only to top of key pieces from first layer. Make sure the crest is level across the channel and water is pooling to this temporary crest elevation.

continued >>

