

6. Recommendations for Channel Rehabilitation

The scope of this work included particular request for a focused review on the Channel Rehabilitation Process. Without being involved in an actual design process, information can be garnered only from design reports, interviews, and rapid site tours. Many of the recommendations provided above are relevant to Channel Rehabilitation and information provided below is intended to illustrate an overarching review of Channel Rehabilitation with specific actionable recommendations for design.

6.1 STRENGTHS AND WEAKNESSES OF THE DESIGN AND DESIGN REVIEW PROCESS

Based upon the methods described above, the following over-arching strengths and weaknesses of the Program's Overall Approach to Channel Rehabilitation are outlined below.

Design Process Strengths

- Design teams and the larger Design Group have a considerable body of knowledge and library of lessons-learned from implemented previous projects to draw from.
- Interdisciplinary and interagency collaboration on design development and refinement.
- Integration of state-of-the-science techniques in restoration design and engineering analysis.

Design Process Weaknesses

- Lack of updated programmatic guidance in Channel Rehabilitation designs.
- Potential lack of diversity of thought/input/lessons learned from other regions and a risk that institutional knowledge is not formally captured anywhere.
- Lack of uniform, regular integration and collaboration between the Science Work Groups and Design Group.

6.2 STRENGTHS AND WEAKNESSES OF THE PROGRAM'S OVERALL APPROACH TO CHANNEL REHABILITATION

Based upon the methods described above, the following over-arching strengths and weaknesses of the Program's overall approach to Channel Rehabilitation are outlined below.

Approach Strengths

- Robust data collection, remote sensing, survey, engineering and design capabilities.
- Programmatically thinking big and acting big where possible.
- Interdisciplinary and interagency collaboration on design development and refinement.
- Integration of state-of-the-science techniques in restoration design and engineering analysis.

Approach Weaknesses

- Inconsistent definition of success criteria.
- Inconsistent performance monitoring and design reporting (largely between the different design teams).
- Missing documentation that links fish life stage, flows, and vegetative community, and how these linkages inform design.
- Use of large wood structures that is more conservative (in some cases) than stream restoration industry standards (e.g., American Whitewater 2012) require.

6.3 RECOMMENDATIONS TO IMPROVE CHANNEL REHABILITATION DESIGN

Based upon the methods described above, and the strengths and weaknesses outlined in Sections 6.1 and 6.2, the authors of this report were asked to provide specific actionable feedback to improve Channel Rehabilitation design and the design process. It should be noted that our recommendations listed above Section 5 outline a number of recommendations that are relevant to channel rehabilitation. Most notably, these recommendations include:

1. Making clear linkages between geomorphic trajectory/setting and project objectives and design criteria,
2. More clearly linking fish use, hydrologic timing, and geomorphic trajectory to inform designs (As originally recommended by Buffington et al. 2014)

While it is our understanding that these items are discussed by the individual design teams and the Design Workgroup, more explicitly stating and describing them in design reporting will ensure that these disciplines are being connected throughout the design process and that management actions are clearly linked to design criteria.

In addition to these items, the area where we see the most significant opportunities for growth in Channel Rehabilitation design is related to the use of large woody material (LWM). Accordingly, we have provided the following detailed and actionable recommendations for how the TRRP can improve its use of LWM in project designs.

Recommendation 15: Increase Use of Large Wood Material in Projects.

The restoration practice of LWM restoration has evolved substantially over the same timeframe that TRRP channel rehabilitation projects have been implemented. In the late 1990s and early 2000s, placement of large wood in rivers was an emerging, novel restoration practice. By 2010, it had become a common technique in restoration of western rivers. Today, the importance of large wood in the river ecosystem, and in the field of river restoration, is well established in the literature. Numerous guidance documents are available that highlight the role and range of function of LWM in river restoration, as well as and provide extensive guidance on analysis, design, implementation, and monitoring procedures leading to successful LWM implementation. Restoration practitioners

within the TRRP made significant contributions to one such document, the National Large Wood Manual (USBR & ERDC 2016).

On the Trinity River, Cardno Entrix & CH2MHill (2011) provided a comprehensive evaluation of the precedence and historical functions of LWM. That report also suggested goals, objectives, and criteria for increasing use of LWM in the Phase II channel rehabilitation projects. The use of LWM in TRRP projects appears to have been gaining prominence in recent years (Boyce and Goodman 2018). However, use of LWM has largely been focused on direct fish habitat creation in lateral habitats, with less emphasis on LWM implementation in mainstem locations and/or as geomorphic forcing features. LWM to drive geomorphic processes can enhance creation of, or provide stability to, complex aquatic and riparian habitats.

These observations, in combination with the literature review, interviews, and peer review conducted during development of this report, indicate the use of LWM elements within Channel Rehabilitation projects could be increased substantially. This may include increased quantities of LWM in future TRRP channel rehabilitation projects, supplemental LWM enhancement at the Phase I and early Phase II rehabilitation projects, LWM augmentation in sub-reaches that are outside of specific channel rehabilitation project boundaries, or LWM utilized in new ways to encourage greater geomorphic channel function.

Several constraints within the Trinity River and TRRP may have moderated past LWM utilization in Channel Rehabilitation designs. The high recreational utilization of Trinity River, FEMA floodplain considerations, landowner/access constraints, availability of source materials, availability of project funding, and willingness to implement this technique in deference to initial-established restoration strategies have all been identified as notable constraints. Other river systems in California, and the Pacific Northwest that have overcome similar challenges may provide valuable templates for the TRRP.

Based on our understanding regarding LWM utilization within the TRRP, we offer the following specific recommendations:

Programmatic Recommendations

1. Establish a Large Wood Workgroup
 - a. Include practitioners and construction contractors from other basins/regions as external members of the workgroup.
 - b. Conduct a focused review of LWM use in other regulated (flow and/or FEMA floodplain) recreational rivers.
 - c. Evaluate novel uses and installation methods from other basins/regions, for utilization in the TRRP.
 - d. Convene regular TRRP-specific LWM utilization workshop(s) to share and transfer knowledge gained and lessons learned.
 - e. Over time, develop TRRP-specific LWM design guidelines.

2. Update and maintain a current LWM inventory. Include both restored and unrestored reaches for comparison using metrics developed by Cardno Entrix & CH2MHill (2011) and Boyce & Goodman (2018) for targets.
3. Establish a LWM procurement framework to guarantee reliable, high-quality LWM supply to use in Channel Rehabilitation projects, to either be implemented at the TRRP level or at the design program-level (e.g., Yurok, Hoopa).
4. Supplement LWM in Phase I and early Phase II channel rehabilitation projects to increase project effectiveness.
5. Integrate programming and practices to augment LWM loading in reaches where prior channel rehabilitation projects have been constructed
6. Clearly report how Channel Rehabilitation designs meet target metrics (such as target quantities or size classes of LWM).

Project-level Recommendations

1. Follow prior recommendations for LWM loading during Channel Rehabilitation project development (e.g., Cardno Entrix & CH2MHill 2011).
2. Reference existing design standards and guidelines, such as the National Large Wood Manual (USBR and ERDC 2016) and Integrating Recreational Boating Considerations into Stream Channel Modification & Design Projects (American Whitewater 2011), among others.
3. Collaborate with external practitioners for improvement and evolution of LWM implementation techniques.
4. Increase use of LWM to achieve geomorphic processes in the mainstem, in the floodplain, and in the lateral habitat junctions.
5. Increase scale of LWM utilization for both geomorphic forcing and direct habitat enhancement, to match loading recommendations in Cardno Entrix and Ch2MHill (2011).
6. Increase diversity of structure types, installation strategies, and placement locations to improve effectiveness of direct habitat placements.
7. Consider alternative LWM delivery or construction techniques to overcome access constraints, such as helicopter-assisted LWM delivery, helicopter-based construction, or paired helicopter and ground-based construction.
8. Integrate novel but established LWM installation techniques to support more diverse LWM utilization while maintaining adequate performance and stability. Techniques might include installation of timber piles via vibratory or vibrasonic pile driving equipment, extensive inclusion of slash into larger LWM structures, and integration of floodplain LWM as both a ground stabilization mechanism and geomorphic driver emulating mature forest conditions.

9. Selective clearing of even-aged stands of riparian alder to generate smaller LWM materials utilized as slash and create overbank complexity.
10. Follow LWM material procurement framework (recommended above) to guarantee reliable high-quality LWM supply.