Restoring Salmonid Habitat Complexity and Resiliency in Tributaries of the Lower Klamath River
Innovations and Lessons Learned

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Presentation Goals

Less is more.....Wood and Sediment. Just add water!
Hunter Creek
DA = 61.6 km$^2$ (23.8 mi$^2$)

Terwer Creek
DA = 80.2 km$^2$ (31 mi$^2$)

Klamath Estuary

McGarvey Creek
DA = 23.0 km$^2$ (8.9 mi$^2$)
Background Conditions

Aggraded Valley Floors
Subsurface Flow Conditions

Tributary Deltas
Wood Handling Techniques

Log Tongs
Low Cost Pile Driver

Log Guide:
>14 inch OD, schedule 80 well casing.

Impact Tool Guide:
>6 inch OD, schedule 80 well casing.

Hydraulic Hammer:
4,500 lbs force minimum for cobble bed streams.

Attachment Chains:
Short sections of chain welded to hammer and strike plate, connected by clevis or hammer links.

Impact Tool Guide:
>6 inch OD, schedule 80 well casing.

Log Guide:
>14 inch OD, schedule 80 well casing.

Strike Plate:
>1 inch thick steel plate.
Willow Baffle
Basic Architecture

Stick-up Height
~ 6 ft

Embedment Depth
~ 14 ft

Section View

Willow Cuttings or Clumps
Baffle logs

Nurse logs

Rack Material
(not shown on drawing)

Photograph Example
Roughness Jams
Basic Architecture

- Design Discharge Depth
- Scour Depth
- Embedment Depth

Profile

Section

Variations on the theme:
Post Assisted Debris Rack
Channel Roughness Jam
Bar Roughness Jam

Photograph Example
Bar Apex Jam
Basic Architecture

Profile Section

Design Discharge Depth
Scour Depth
Embedment Depth

Photograph Examples
Post Assisted Debris Racks
Hunter Creek Site 7

Post 5-yr RI flood WY15
Flow

Post ~10-yr RI flood WY16
Post Assisted Debris Racks
Terwer Creek Site 2

Construction 2016

Post 2-yr RI floods
February 2017
Post Assisted Debris Racks
Terwer Creek Site 2

Post 2-yr RI floods
February 2017
Channel Roughness Jam
Hunter Creek Site 7

Downstream View

Upstream View

Profile View
Sediment Weir-Side Channel Assembly
Hunter Creek Site 6

Downstream View

November 2014

Constructed 2013
Sediment Weir-Side Channel Assembly
Hunter Creek Site 6
Upstream View
November 2014

Constructed
2013
Sediment Weir-Side Channel Assembly

Terwer Creek Site 5
Construction September 2017

Bank Posts
Woven Members
Bar Apex Jam
Sediment Weir-Side Channel Assembly

Terwer Creek Site 5

As-Built September 2017

Downstream View

Post ~2-yr RI Flow
January 2017
Sediment Weir-Side Channel Assembly
Terwer Creek Site 5

Downstream View
Post ~2-yr R1 Flow
January 2017

Upstream View
Hunter Creek Site 7 – Multiple Jams in Series

~As-Built
Sept 2014

First flows
Nov 2014
Hunter Creek Site 7 – Multiple ELJs in Series

April 2016
March 2016

Redwood recruitment from left bank

January 2017
Terwer Creek
Integrated Use of ELJs, Alcoves & BioEngineering
### ELJ Durability

<table>
<thead>
<tr>
<th>Location</th>
<th>Constructed</th>
<th>Remaining</th>
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<tbody>
<tr>
<td>Hunter Cr</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>McGarvey Cr</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Terwer Cr</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>27</strong></td>
<td><strong>26</strong></td>
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96% remain after multiple bankfull flood events
Next Steps

VALLEY FLOOR MANAGED AS TRANSPORTATION & FLOOD CORRIDOR

ECO–HYDRAULIC FUNCTION DISRUPTED BY FLOODPLAIN ROADS, LEVEES AND OTHER LAND USES

VALLEY FLOOR MANAGED AS FLOODPLAIN

RELOCATE ROAD

DISEMCUMBER THE CHANNEL MIGRATION ZONE

BEAVER AS ECOSYSTEM MANAGER
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Project of Partners

- U.S. Fish and Wildlife Service
- U.S. Bureau of Reclamation
- National Oceanic and Atmospheric Administration
- CA Dept of Fish and Wildlife
- Green Diamond Resources Company
- Yurok Tribe Watershed Restoration Dept.
- Yurok Tribe Environmental Program