# Restoring Floodplain Connectivity Along the Klickitat Haul Road: Technical Approach and Results

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# Presentation Objectives

- “Haul Road” project background
- Overview of technical assessment
- Overview of design
- Results of Phase 1 and 2 restoration
- Discuss challenges

# Reach Background and Significance

Some of the best rearing and spawning habitat in the mainstem Klickitat River occurs between river miles 20 and 32.2:

- Greatest channel complexity and the least amount of floodplain infrastructure in lower Klickitat River.
- Provides critical spawning, migration and rearing habitat for winter and summer steelhead (ESA-Threatened), Chinook salmon (spring and fall runs), and coho salmon.
- Provides a high proportion of the basinwide spawning habitat for all three species, accounting for roughly 30%, 51%, and 38% of the annually observed spawning basinwide for steelhead, fall Chinook, and coho respectively.
- A private valley-bottom road embankment constitutes the only local alteration of river and floodplain processes.

# Relevant History

1930s: RR embankment constructed

1950s: embankment converted to trucking road

early 1990s: Klickitat Mill closes

1996: flooding washed-out several portions of road

early 2000s: first site visit between YNFP and owner to discuss restoration (facilitated by WDFW)

2002: YNFP begins quantitative assessment work

2003: YNFP partners with Columbia Land Trust for implementation

2004: first grant awarded (Phase 1 SRFB)

2005: second grant awarded (Phase 2 SRFB)

2007: CLT acquires ownership of Haul Road

2009: Dead Canyon embankment removed; Phase 1 complete

2010: approximately 6700 l.f. of floodplain restored

winter 2011: re-planting; Phase 2 complete

# Partnership

The project is a partnership between Columbia Land Trust and the Yakama Nation Fisheries

- Columbia Land Trust:
  - Responsible for acquisition effort and is current owner
  - Lead for planning, administration, and stewardship
- The Klickitat Watershed Enhancement Project (sponsored by YNFP and funded by BPA):
  - Technical lead for assessment, design, and construction oversight
  - Also provided grant-writing, permitting, and planning support

# Assessment

Road segments delineated in the field based on 7 criteria:

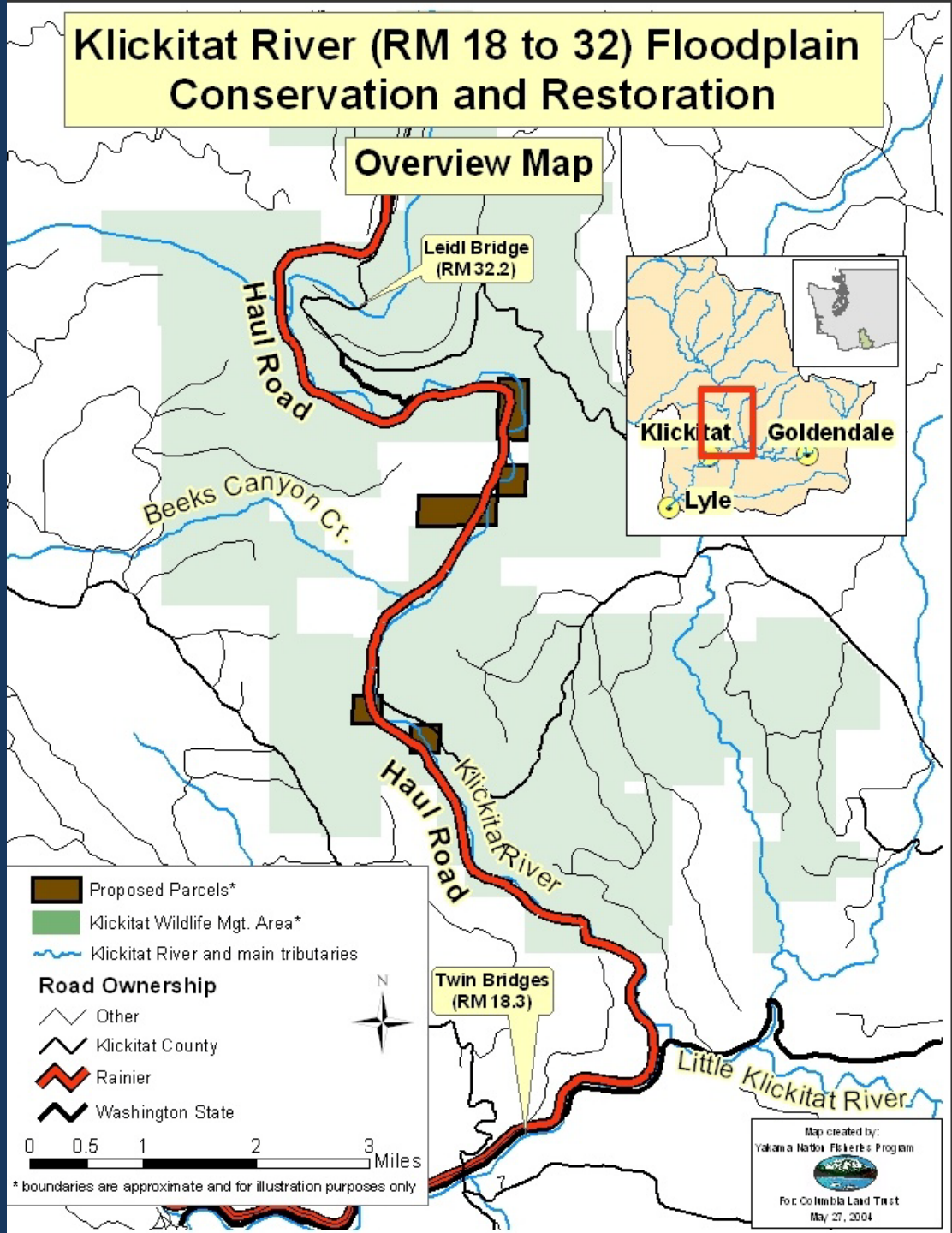
- Presence of floodplain landward of embankment
- Embankment contact with Klickitat R. main/side channel
- Bedrock presence immediately landward of embankment
- Bedrock projecting from toe of embankment
- Undisturbed hillside projection relative to embankment toe
- Major changes in the composition of the embankment face
- Degree to which the embankment is intact

Attributes such as erosion risk, encroachment by flow frequency, vegetation cover, evidence of historic repair, et al. were also collected

# Assessment Scope

Downstream End: "Twin Bridges" of SR 142

Upstream End: vicinity of "Truck Shop" near Leidl Br.



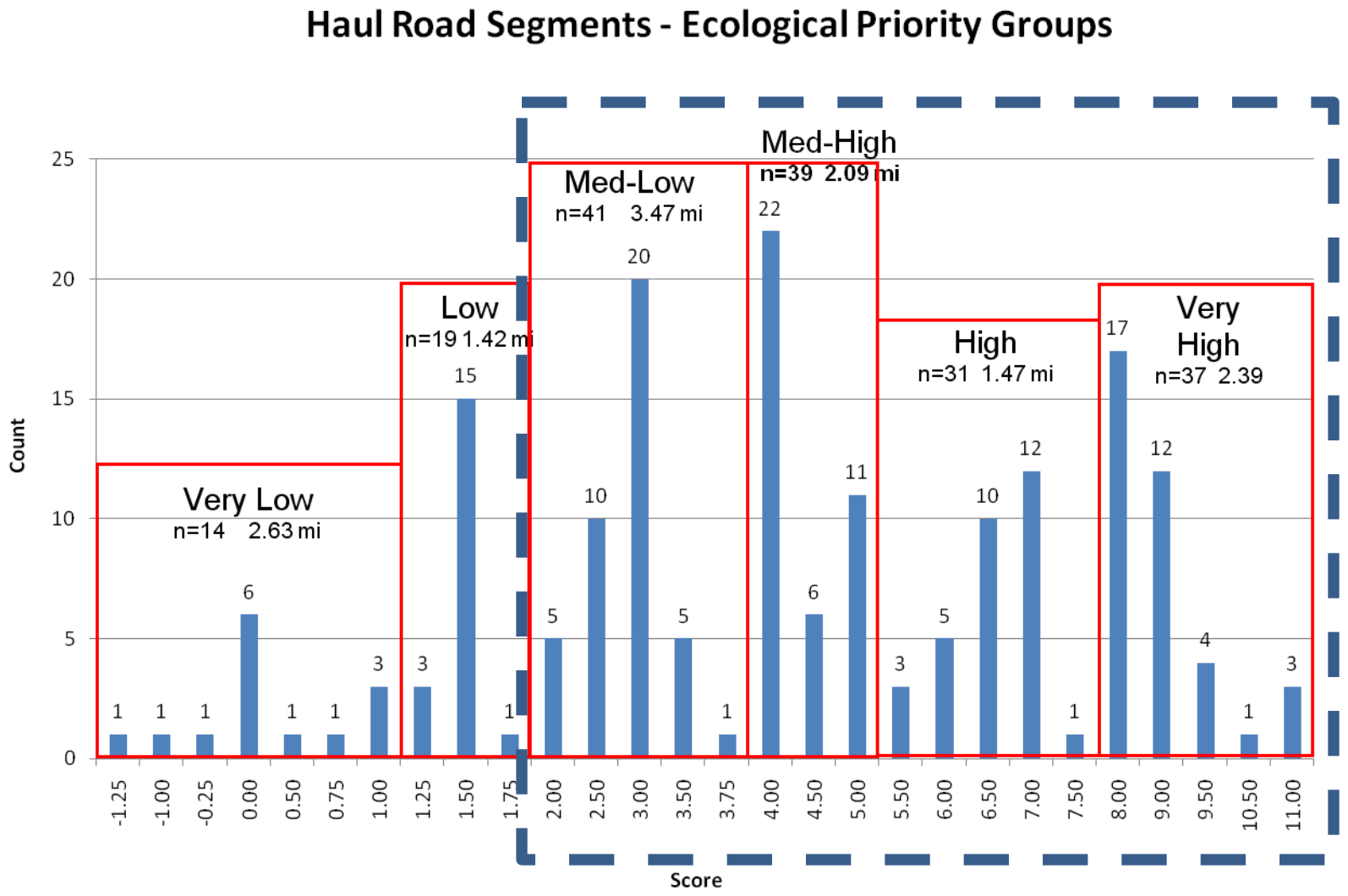
# Assessment - Results

- 181 segments delineated along 13.47 miles inventoried
- 179 segments totaling 11.73 miles occurred in the valley bottom of the Klickitat River and its tributaries
- 107 segments totaling 6.58 miles (56.1% by length) had contact with a primary or secondary channel of the Klickitat River.
- Geomorphic effects manifested in four ways:
  - Isolation of side channels and floodplains
  - Filling of active channel
  - Altering composition of channel margins
  - Preventing hillslope contact

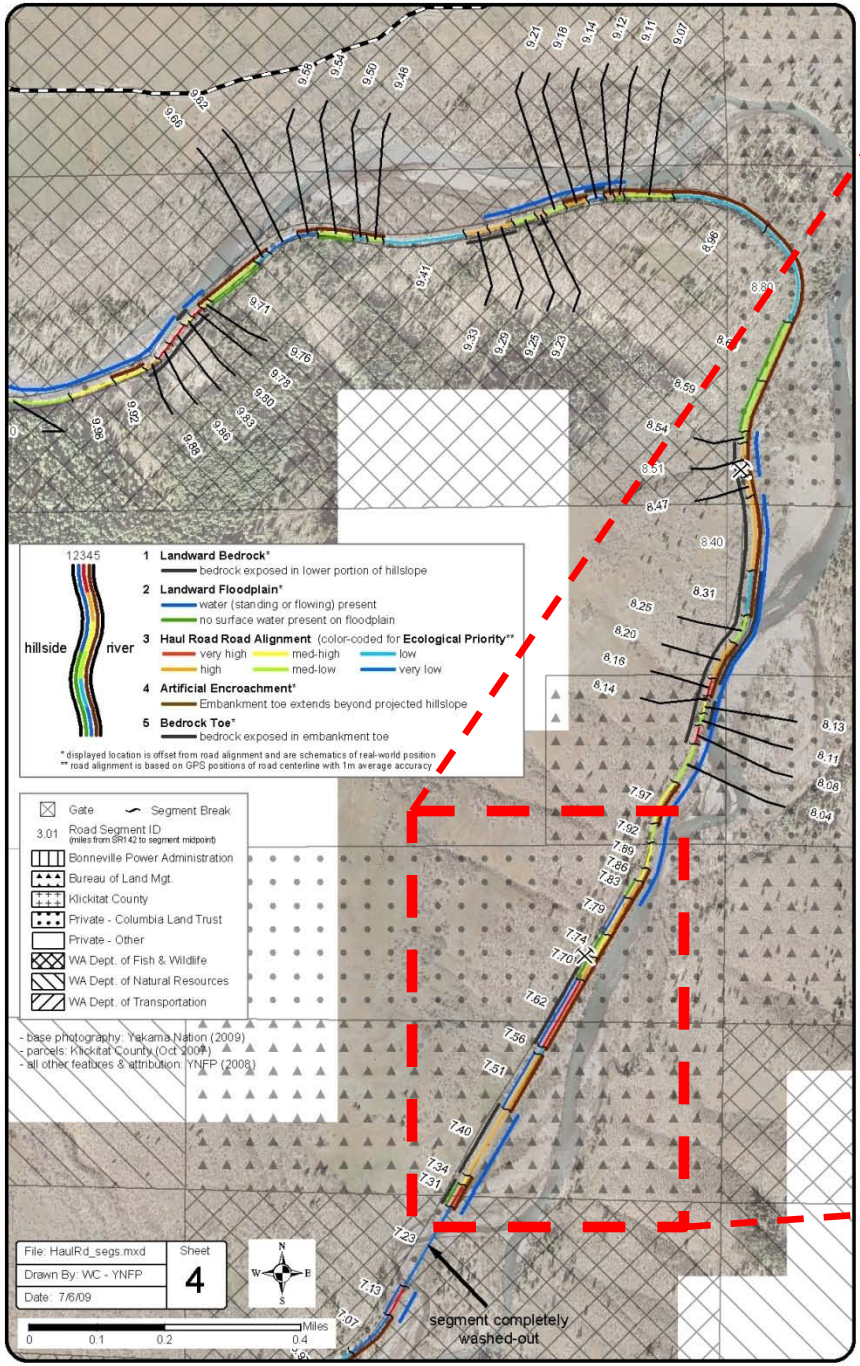
# Prioritization

| Condition | Value | Score | Modifying Condition |
|---|---|---|---|
| Landward Floodplain (without water present) | Land | 2 | |
| Landward Floodplain (water present) | Water | 4 | |
| Landward Bedrock | y | 3 | |
| Floodplain encroachment (inundation frequency) | <1.4 | 3 | |
| Floodplain encroachment (inundation frequency) | 5 | 2 | |
| Floodplain encroachment (inundation frequency) | 10 | 1 | |
| Floodplain encroachment (inundation frequency) | 25 | 0.75 | |
| Floodplain encroachment (inundation frequency) | 50 | 0.5 | |
| Floodplain encroachment (inundation frequency) | 100 | 0.25 | |
| Erosion Risk | vhigh | 3 | |
| Erosion Risk | high | 2 | |
| Erosion Risk | med | 1 | |
| Erosion Risk | low | 0.5 | |
| Hillslope Projects beyond embankment toe | y | -1 | LWBR = "n" |
| Bedrock Exposed In Embankment Toe | y | -2 | |

# Prioritization




Med-low and higher encompass nearly 100% of segments isolating floodplain and bedrock from the river as well as medium erosion risk and higher.


12345
hillside
river
1 Landward Bedrock*
bedrock exposed in lower portion of hillslope
2 Landward Floodplain*
water (standing or flowing) present
no surface water present on floodplain
3 Haul Road Road Alignment (color-coded for Ecological Priority**
very high
high
med-high
med-low
low
very low
4 Artificial Encroachment*
Embankment toe extends beyond projected hillslope
5 Bedrock Toe*
bedrock exposed in embankment toe
* displayed location is offset from road alignment and are schematics of real-world position
** road alignment is based on GPS positions of road centerline with 1m average accuracy
Gate
Segment Break
3.01 Road Segment ID
(miles from SR142 to segment midpoint)
Bonneville Power Administration
Bureau of Land Mgt.
Klickitat County
Private - Columbia Land Trust
Private - Other
WA Dept. of Fish & Wildlife
WA Dept. of Natural Resources
WA Dept. of Transportation
- base photography: Yakama Nation (2009)
- parcels: Klickitat County (Oct 2009)
- all other features & attribution: YNFP (2008)
File: HaulRd_segs.mxd
Drawn By: WC - YNFP
Date: 7/6/09
Sheet
4
N
W
E
S
Miles
0
0.1
0.2
0.4
segment completely washed-out

# Treatment Specifications - Example

| | |
|---|---|
| BREACH | Similar to FILL REMOVAL but only occurring at two or more sub-segments. Unless otherwise specified embankment materials will be removed from the upstream and downstream ends of a segment to a depth where 1) bedrock is encountered, 2) that matches adjacent floodplain elevations, or 3) the height of the perennial vegetation line in the vicinity of the OHW along the face of the embankment (whichever encountered first). The removed portion shall be no less than 100' from toe to toe measured along the road's centerline. Slope transitions at either end of a BREACH shall be evenly graded and no steeper than 3:1. Includes EROSION CONTROL. |
| DISPOSAL | Location that will receive material from another segment. Material will be graded into existing contours, revegetated, and abandoned. Includes EROSION CONTROL. |
| FILL REMOVAL | Unless otherwise specified embankment materials will be removed for an entire segment to a depth where 1) bedrock is encountered, 2) that matches adjacent floodplain elevations, or 3) the height of the perennial vegetation line in the vicinity of the OHW along the face of the embankment (whichever encountered first). Slope transitions at either end of a FILL REMOVAL area shall be evenly graded and no steeper than 3:1. Includes EROSION CONTROL. |
| PULLBACK | Involves re-sloping of an embankment face. Unless otherwise specified, it shall be assumed that the embankment face to be treated is on the riverward side of the road. Embankment face shall be re-sloped no steeper than 2:1. Existing woody vegetation in vicinity of toe shall be left intact. Remove rip-rap from embankment toe where possible without damaging trees. A small bench or terrace suitable for foot traffic and no wider than three feet shall be graded into the slope at approximately the elevation and alignment of the existing roadway. Includes EROSION CONTROL. |
| RECONTOUR | Involves re-shaping embankment to match adjacent topography. Generally, will involve resloping embankment face to a continuous slope between top of cut bank and 1) toe of embankment or 2) the height of the perennial vegetation line in the vicinity of the OHW along the face of the embankment (whichever encountered first), not to exceed 2:1. Remove rip-rap from embankment toe where possible without damaging trees. Includes EROSION CONTROL. |
| REMOVE ASPHALT | All asphalt and petroleum-stained subgrade shall be removed and transported to location specified in PLAN. In absence of further subgrade treatment includes ripping of subgrade to a depth of at least 2 feet below finished grade and EROSION CONTROL. |
| REMOVE CULVERT - TRIB_NU | Tributary Crossing Culvert Removal (Type N or U waters) - in all instances asphalt and fill shall be removed at least to the depth of the culvert invert. The culvert shall be removed and stockpiled along either segments 0.85 (for culverts associated with Work Groups I1, I2, and L1-L6) or 11.58 (for culverts associated with Work Groups I3 and U1-U5), and slopes graded no steeper than 2:1. Subgrade materials shall be re-shaped such that the toe width of the stream as it passes through the embankment is greater than or equal to the toe width of the stream upstream of the culvert inlet. Bank lines will be extended through embankment with slopes above the banks recontoured no steeper than 2:1. Includes EROSION CONTROL. |
| REMOVE CULVERT - TRIB_SF | Tributary Crossing Culvert Removal (type S or F waters) - see accompanying drawings. Culvert shall be removed and stockpiled along either segments 0.85 (for culverts associated with Work Groups I1, I2, and L1-L6) or 11.58 (for culverts associated with Work Groups I3 and U1-U5). Includes EROSION CONTROL. |
| REMOVE CULVERT - XDrain | Cross-drain culvert removal - Unless otherwise specified, in all instances asphalt and fill shall be removed at least to the depth of the culvert invert. The culvert shall be removed and stockpiled along either segments 0.85 (for culverts associated with Work Groups I1, I2, and L1-L6) or 11.58 (for culverts associated with Work Groups I3 and U1-U5), and slopes graded no steeper than 2:1. Includes EROSION CONTROL. |

# Work Plan - Example

| Station | Seg ID | Work Group | Specification | Treatment | Subgrade Destination | Asphalt Destination |
|---|---|---|---|---|---|---|
| 375+85 | 7.13 | L1 | REMOVE ASPHALT; FILL REMOVAL to match adjacent floodplain; dispose subgrade materials at segment 7.07 | FILL REMOVAL | 7.07 Disposal Area | 0.85 Stockpile |
| 376+18 | culvert | L1 | REMOVE CULVERT | REMOVE CULVERT - TRIB_NU | 7.07 Disposal Area | 0.85 Stockpile |
| 377+97 | 7.23 | I2 | washed-out; temporary access across side channel and floodplain | ACCESS | n/a | n/a |
| 388+92 | 7.31 | I2 | REMOVE ASPHALT; FILL REMOVAL to match adjacent floodplain; haul excavated subgrade material to 7.40 ditch/hillside; includes small patch of asphalt at upstream end of seg 7.23 | FILL REMOVAL | 7.40 Disposal Area | 0.85 Stockpile |
| 390+85 | 7.34 | I2 | REMOVE ASPHALT; RECONTOUR to match adjacent floodplain (transition between 7.31 and 7.40); haul excavated subgrade material to 7.40 ditch/hillside | FILL REMOVAL | 7.40 Disposal Area | 0.85 Stockpile |
| 391+75 | 7.40 | I2 | REMOVE ASPHALT; where riverward lip of fill is steeper than 2:1, PULLBACK from perennial vegetation line (exclusive) near embankment toe; grade subgrade materials from adjacent segments into ditch/hillside and RECONTOUR | DISPOSAL | grade-out within segment | 0.85 Stockpile |
| 397+74 | 7.51 | I2 | REMOVE ASPHALT; FILL REMOVAL - grade remaining surface between waterline of landward ditch and riverward embankment toe | FILL REMOVAL | 7.40 7.56, and 7.62 as necessary grade-out along top of remaining embankment | 0.85 Stockpile |
| 397+88 | culvert | I2 | REMOVE CULVERT (will occur as part 7.51 treatment) | REMOVE CULVERT – Xdrain | 7.40 Disposal Area | 0.85 Stockpile |
| 402+76 | 7.56 | I2 | REMOVE ASPHALT; RECONTOUR - grade materials into landward alluvial fan | PULLBACK | toe of alluvial fan (adjacent) | 0.85 Stockpile |
| 403+30 | 7.62 | I2 | REMOVE ASPHALT; BREACH upstream end and grade excavated materials onto remaining embankment. Downstream BREACH shall consist of RECONTOURing lower 230 l.f. of segment into hillslope toe | BREACH | Grade lower 230 l.f. into toe of hillside; grade materials from upstream breach uniformly onto remaining embankment | 0.85 Stockpile |
| 409+50 | 7.70 | I2 | REMOVE ASPHALT; FILL REMOVAL even with riverward floodplain; remove landward fill to a line approximately 75' landward of embankment toe; grade excavated materials uniformly into hillslope toe ~410+40 to 413+60) | FILL REMOVAL | hillslope toe between ~410+40 and ~413+60 | 0.85 Stockpile |
| 411+47 | 7.74 | I2 | REMOVE ASPHALT; FILL REMOVAL even with riverward floodplain; remove landward fill to a line approximately 75' landward of embankment toe; grade excavated materials uniformly into hillslope toe ~410+40 to 413+60) | FILL REMOVAL | hillslope toe between ~410+40 and ~413+60 | 0.85 Stockpile |

# Segments Currently Excluded

Extended areas not currently planned for treatment to facilitate recreational access:

- Approximately the lower 2 miles (Twin Bridges to ~1/2 mile above Little Klickitat confluence)
- Approximately the upper 1.75 miles (Truck Shop to Dead Canyon)

# Phase 1

- Completed in 2009
  - CLT acquired approximately 480 acres of floodplain, riparian and associated upland as well as the road itself
  - Removal of a cross-valley embankment and trestle across Dead Canyon Creek.

# Dead Canyon RR Embankment

- Abandoned when converted to truck road (~1950s)
- Cross-valley embankment constricted flow
- Seasonal pool associated with abutment scour caused routine O. mykiss mortality

# Dead Canyon - Treatment

- 570 l.f. of cross-valley embankment removed
  - graded into adjacent borrow ditches, or
  - end-hauled and graded into approaches
- Trestle and abutments removed
- Channel graded to match stream profile (and eliminate false-attraction of pool)
- Pullback of 2800’ l.f. of embankment (south approach)

# Dead Canyon - Results

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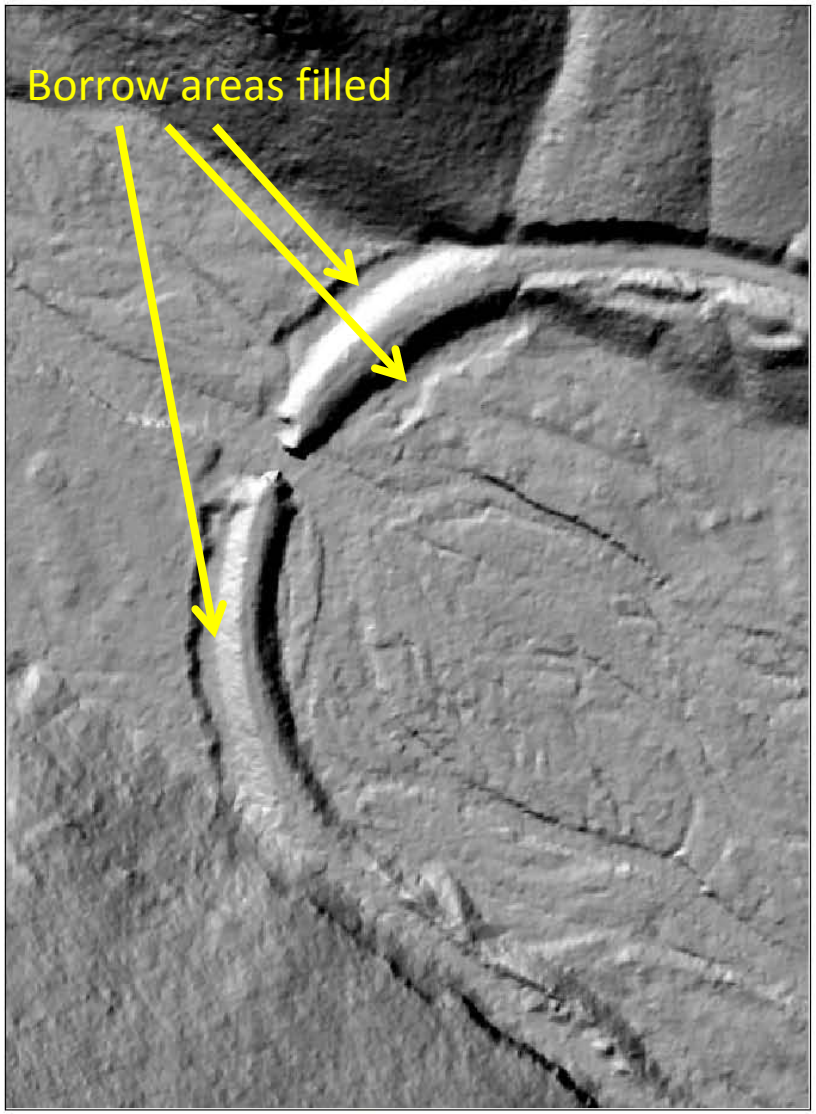



Before

After

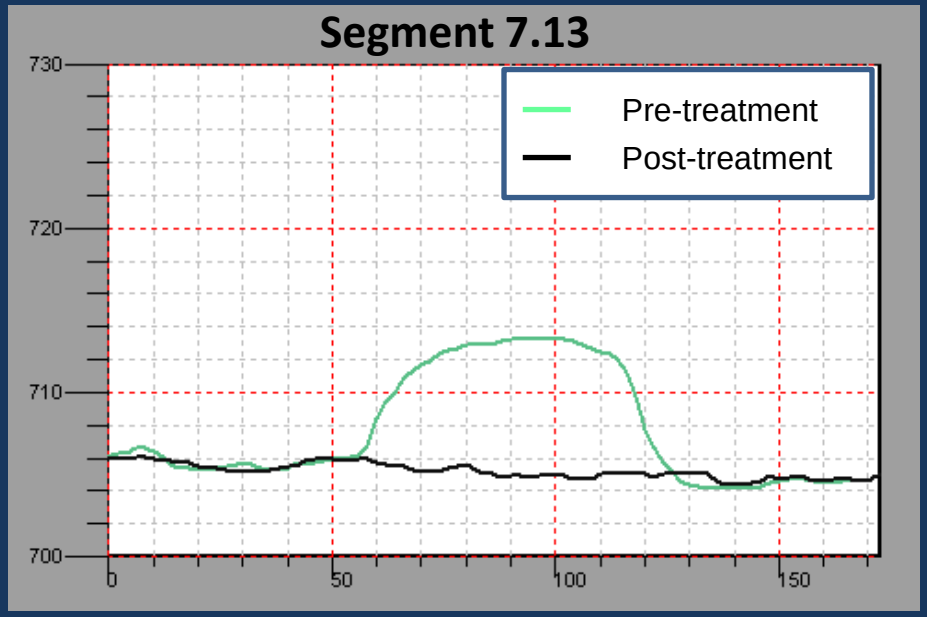
Imagery courtesy of Columbia Land Trust

# Phase 2

## Completed in 2011

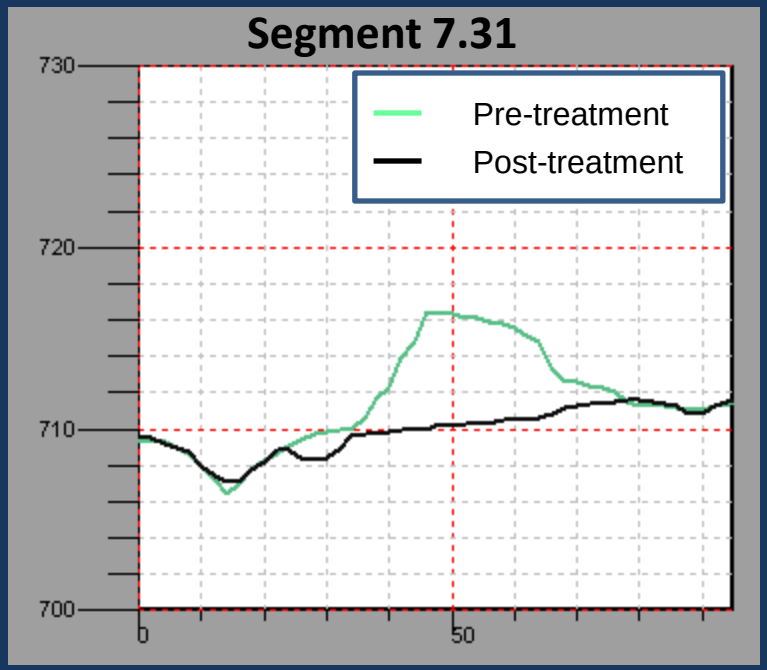
- Approximately 6700 l.f. of embankment graded to enhance riverine and floodplain function:
  - Construction of ~1780’ of floodplains channel
  - Construction of 11 woody debris jams
  - Restore deformability of channel margins to permit lateral channel migration and serve as long-term LWD source
  - Restore hillslope interaction
- Removed asphalt from 4.5 miles of floodplain road

# Segment 7.13

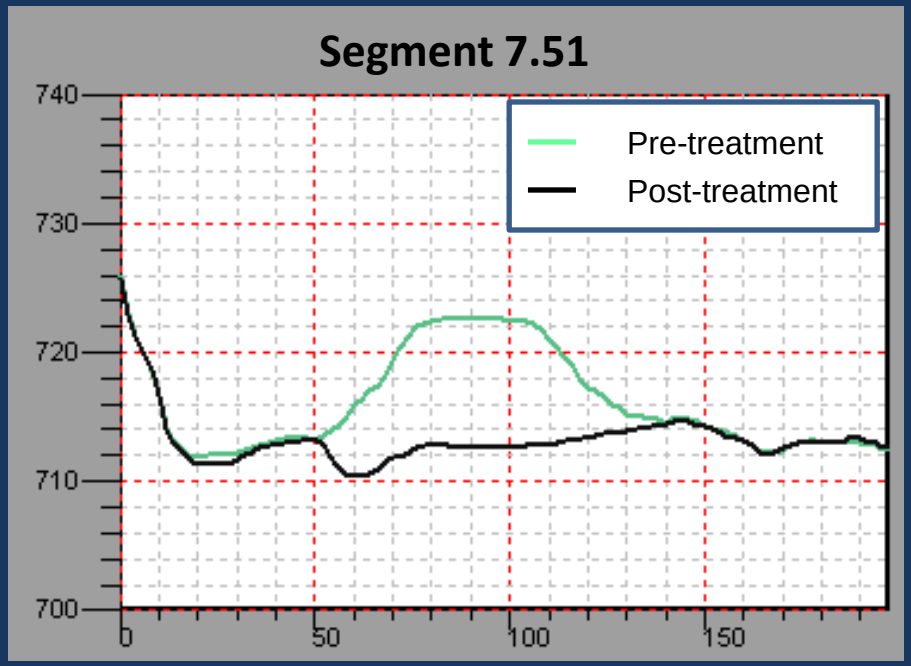



Constructed floodplain inundated at ~2-year recurrence flow (Jan 2011)

# Segment 7.31

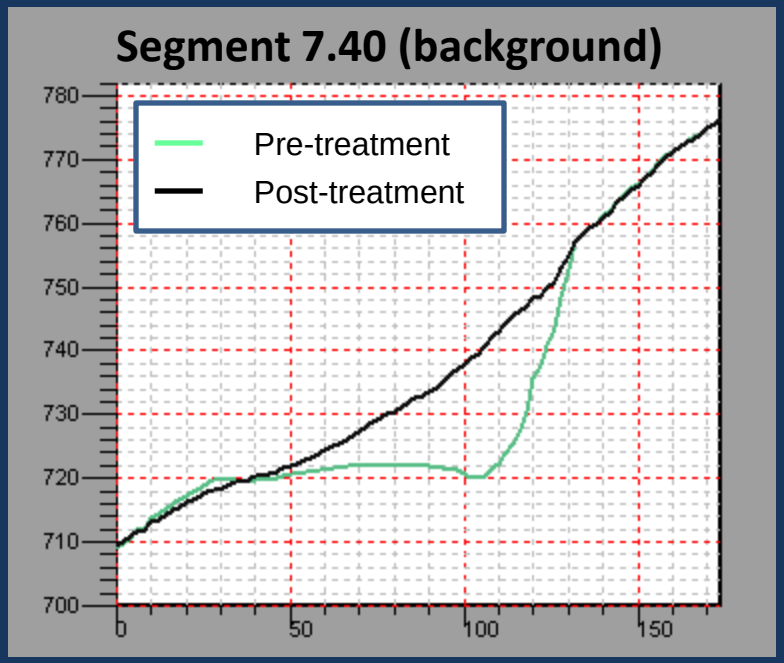

Segment 7.31
730
720
710
700
0
50
Pre-treatment
Post-treatment

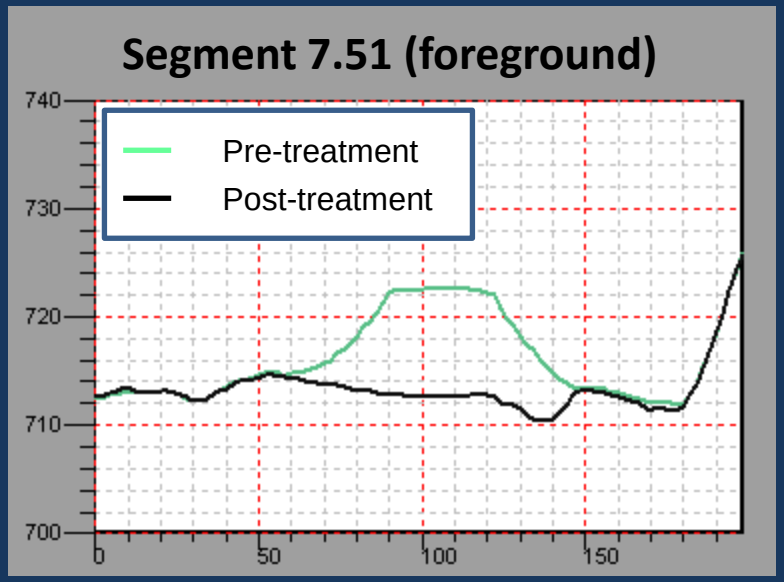
# Segment 7.51




floodplain channel constructed for spatial diversity, flood conveyance, and future capture (i.e. not built as 1° fish habitat)


# Segs 7.40 & 7.51

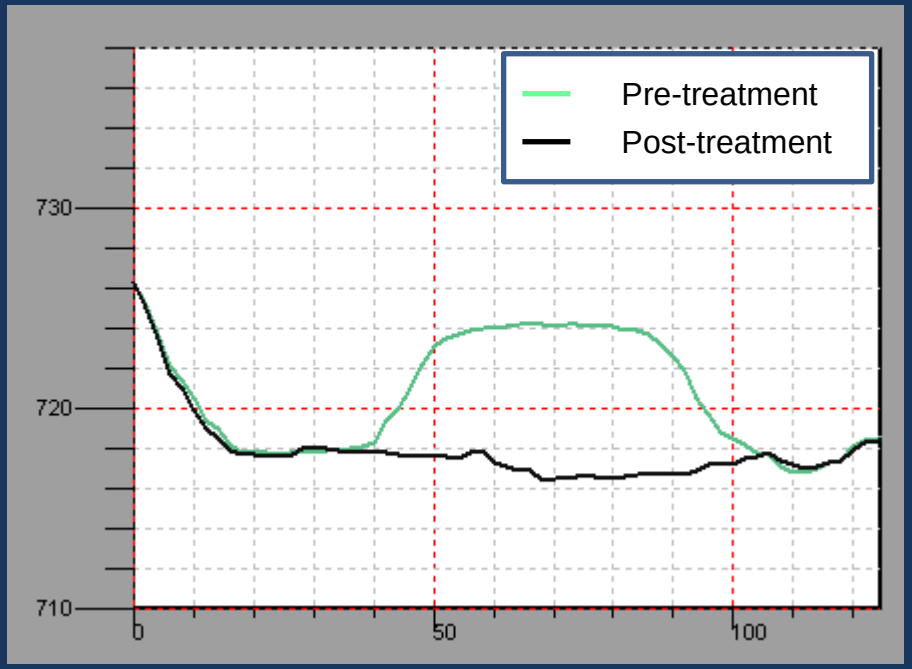

Segment 7.40 (background)
Pre-treatment
Post-treatment
780
770
760
750
740
730
720
710
700
0
50
100
150


Segment 7.51 (foreground)
Pre-treatment
Post-treatment
740
730
720
710
700
0
50
100
150

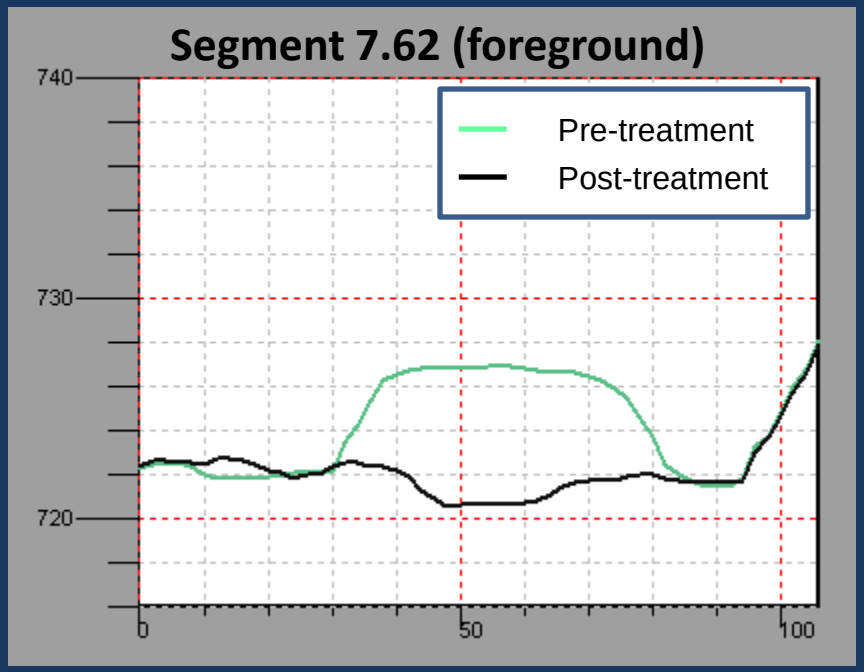

9 2:12 PM

# Segment 7.56

Overbank flow from ~3.5 year recurrence event inundated constructed floodplain (Jan 2011)

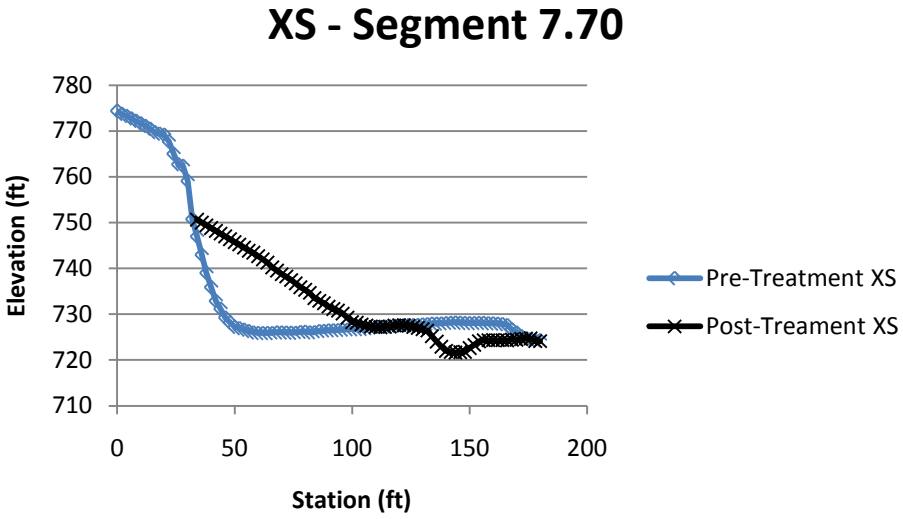



# Segment 7.62




floodplain channel constructed for spatial diversity, flood conveyance, and future capture (i.e. not built as 1° fish habitat)

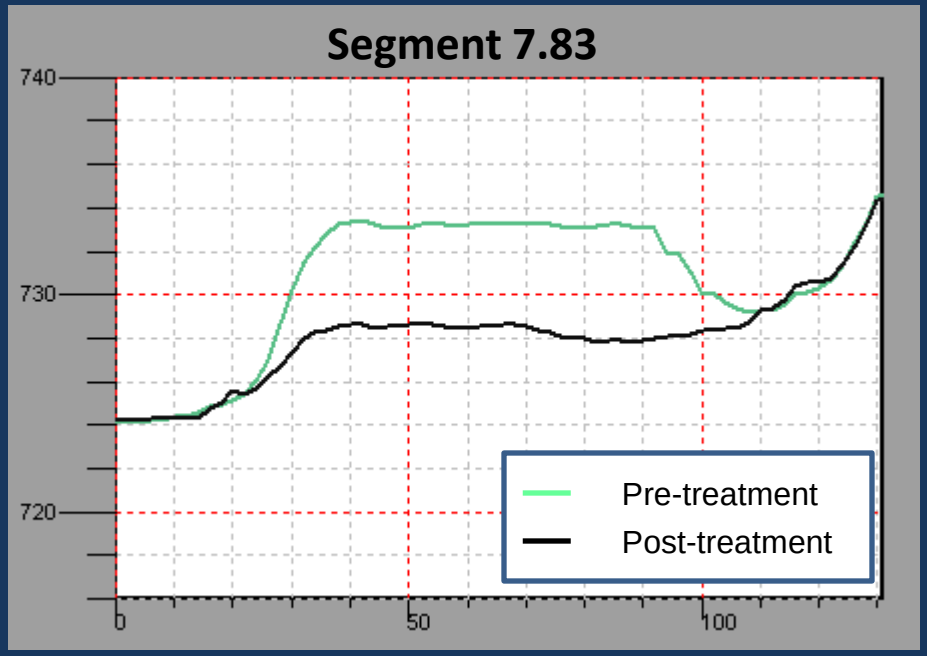

# Segment 7.70


XS - Segment 7.70
780
770
760
750
740
730
720
710
Elevation (ft)
0
50
100
150
200
Station (ft)
Pre-Treatment XS
Post-Treament XS

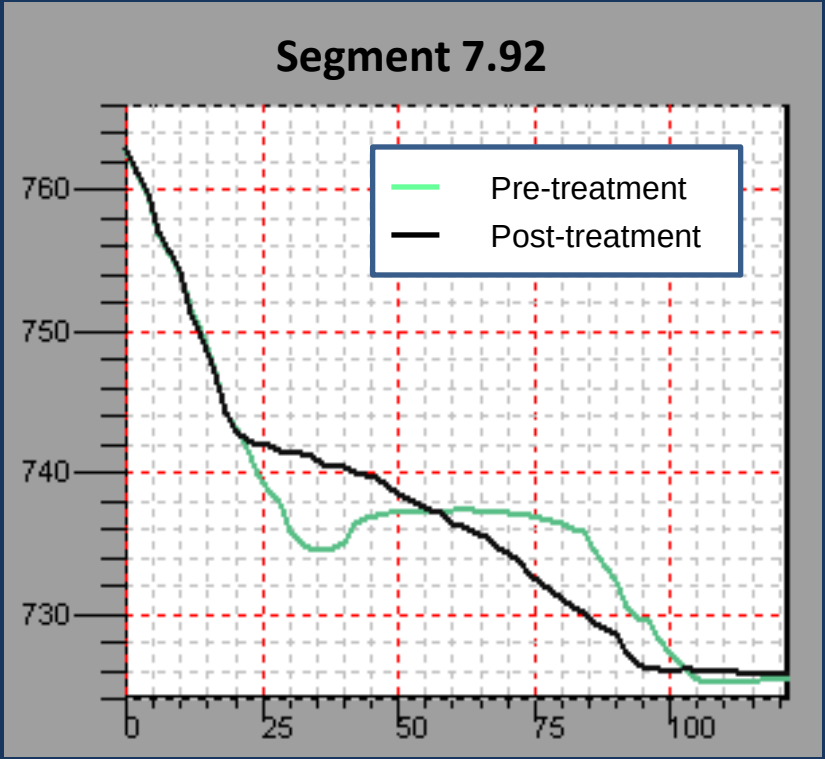

9 2:25

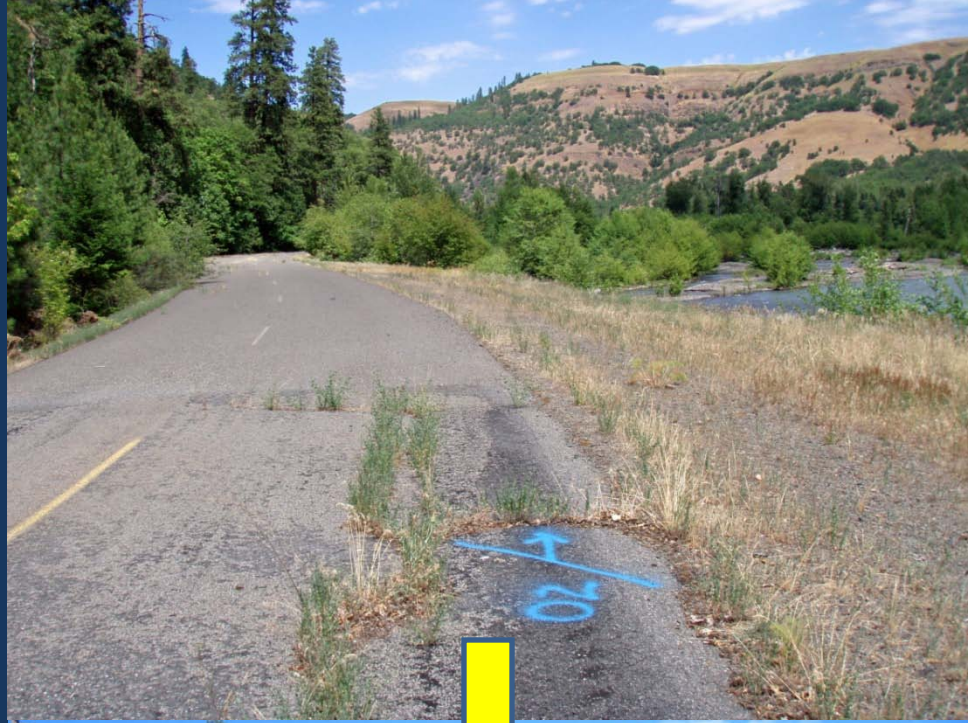
# Segment 7.83

High water mark from ~3.5-year recurrence flow (Jan 2011) approximately 0.5’ from topping breach constructed to flow at a 3 to 5 year flood




# Segment 7.83


Segment 7.92
Pre-treatment
Post-treatment
760
750
740
730
0
25
50
75
100



# Challenges

- Funding – grant-based
- Permits – Klickitat County took an unusually long time to issue the Shorelines Exemption causing the 2009 work window to be missed
- Public
  - Vandalism of survey points
  - Disregard for temporary closures
- Lack of pre-road info

# Haul Road Project Summary

- Is a partnership between Columbia Land Trust and YNFP
- CLT acquired ~ 480 acres of land and >14 miles of road
- ~6700 l.f. of embankment have been re-contoured to:
  - Restore channel complexity and floodplain access
  - Restore deformability of channel margins
  - Restore hillslope interaction
- Asphalt removed from 4.5 mi. of floodplain road
- 570 l.f. of cross-valley embankment removed
- Pullback of 2800’ l.f. of embankment
- Many Phase 2 segments have already been inundated, in some cases multiple times
- Remaining segments anticipated for treatment by 2015

# Acknowledgements


Columbia Land Trust

- Lindsay Cornelius
- Ian Sinks
- Cherie Kearney

Yakama Nation

- Ralph Kiona
- Deanna Lamebull
- David Lindley
- Susie Tynan

Salmon Recovery Funding Board

- funding via RCO Project #s 04-1715 and 05-1594

Bonneville Power Administration

- funding via Project # 1997-056-00

# Questions?