# MALONEY CREEK RESTORATION AND INTERPRETIVE TRAIL PROJECTS


**Presented by:**

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Bend, Oregon

# Location


- Town is located on west slope of the Cascade Mountains
- Opportunity to be a hub for the numerous recreational opportunities in the region

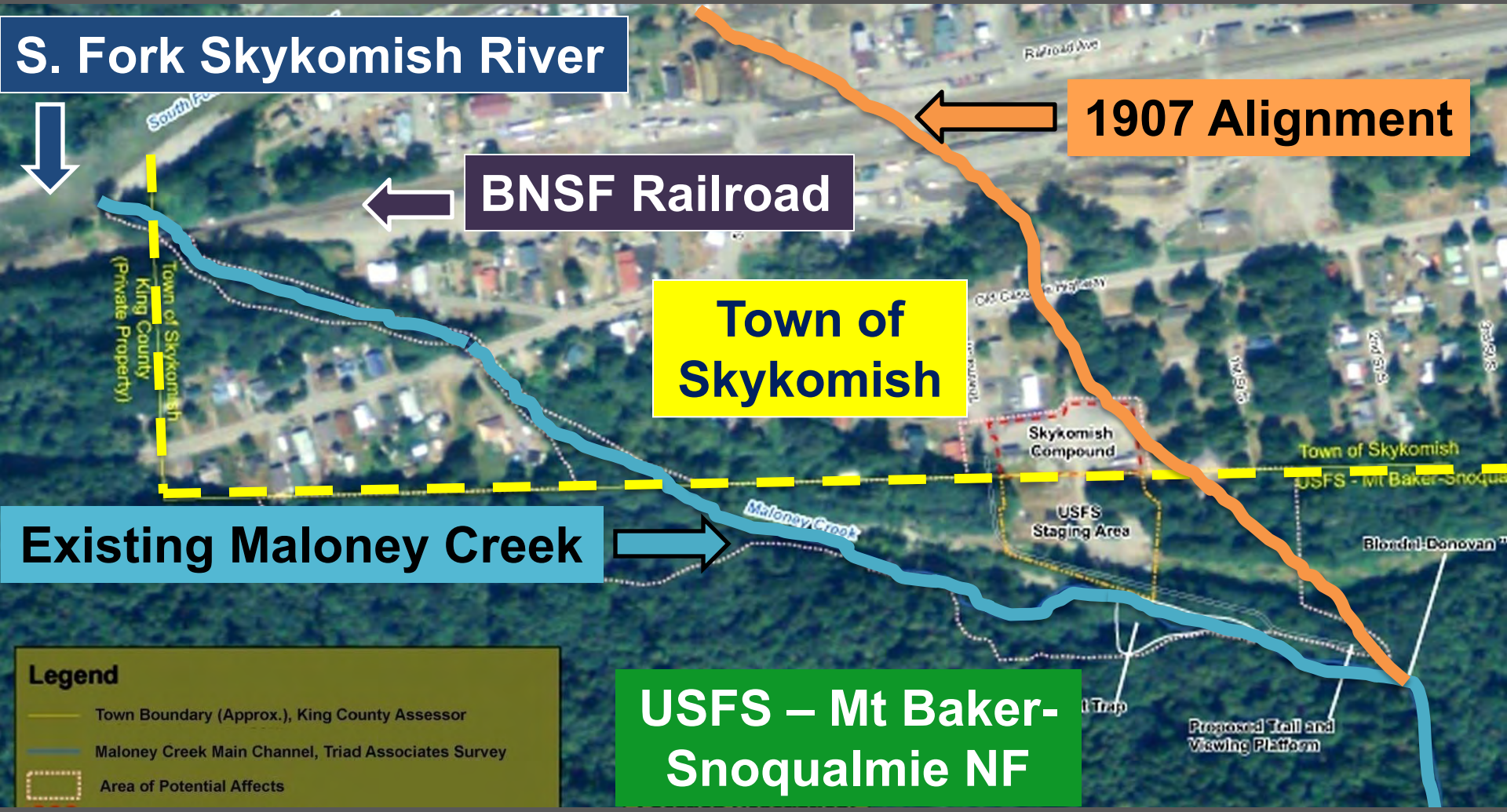
# History


- Early 1900's – BNSF RR and Lumber Mill
- Release of petroleum and heavy metals during locomotive refueling and maintenance
- 1912 Maloney Creek realignment – longer path with reduced gradient

# Restoration of a Town


- Recent $100 million contamination cleanup, primarily funded by BNSF through WA Dept of Ecology
- NRDA funds supported ecological restoration of Maloney Creek and the development of recreational opportunities, including a new nature trail

# Stream Restoration Overview




Lower Maloney Creek's current alignment (0.60 mi.) passes through USFS and Town property in a degraded channel that is not able to efficiently convey sediment and flow

# Basin Characteristics


- Catchment Area: 3.6 sq. mile
- Elevation Range: 910 ft to 5,200 ft
- Mean Annual Precipitation: 117 in.
- 2nd Order Stream with alluvial fan on floodplain of S. Fork Skykomish River
- Channel Gradient: 20% to 0.5%

# Flow and Sediment Transport Characteristics

- Bankfull Flow – 190 cfs (“flash” flows)
- 100-year Flow – 1,190 cfs
- Low Surface Flow – 0 cfs (Late Summer)
- Annual Sediment Load – 450 to 925 cy (episodic)

Lower Maloney Creek
“typical flow”

Lower Maloney Creek
near bankfull flow

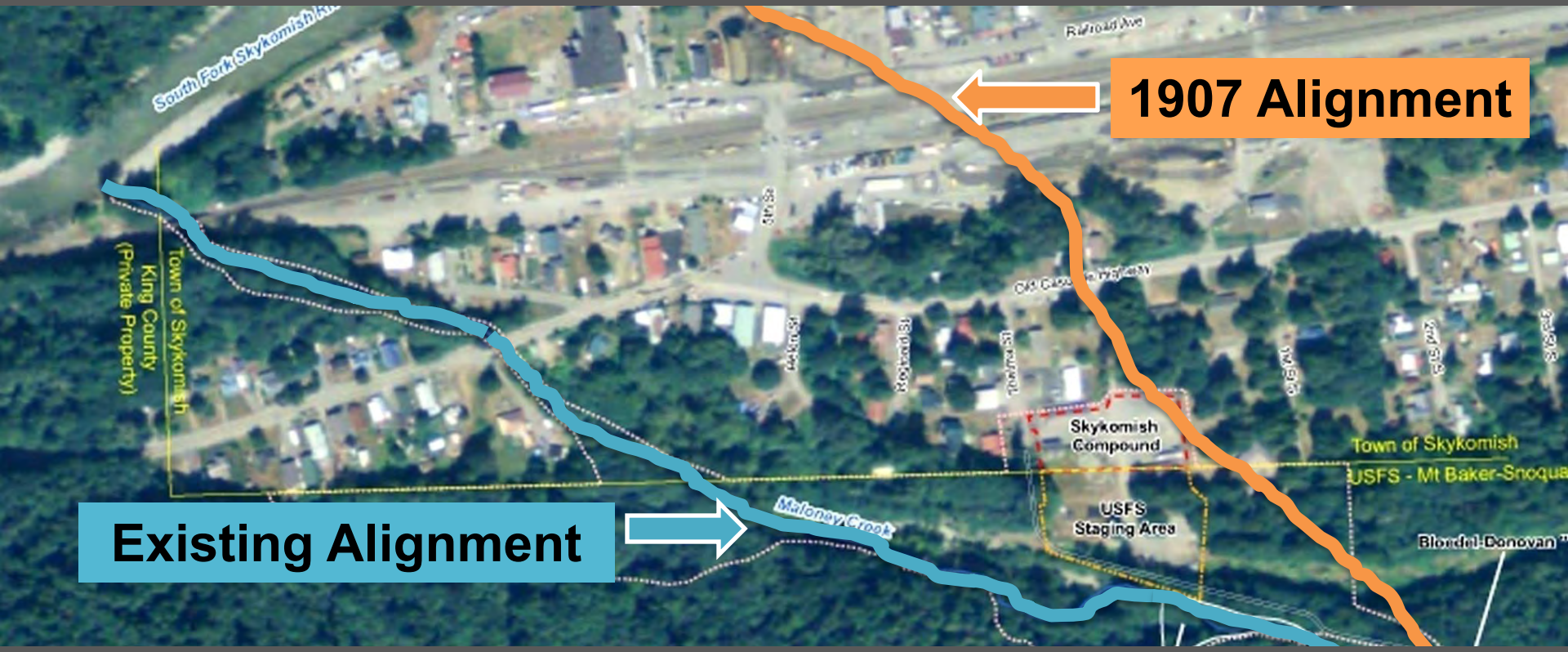
# Fish Populations

- Target Species: Coho and Steelhead
- Plane-bed morphology lacks hydraulic complexity needed for quality spawning and rearing habitat
- Stranding occurs in late summer in aggraded channel when surface flow seeps through porous alluvium

# Purpose & Need

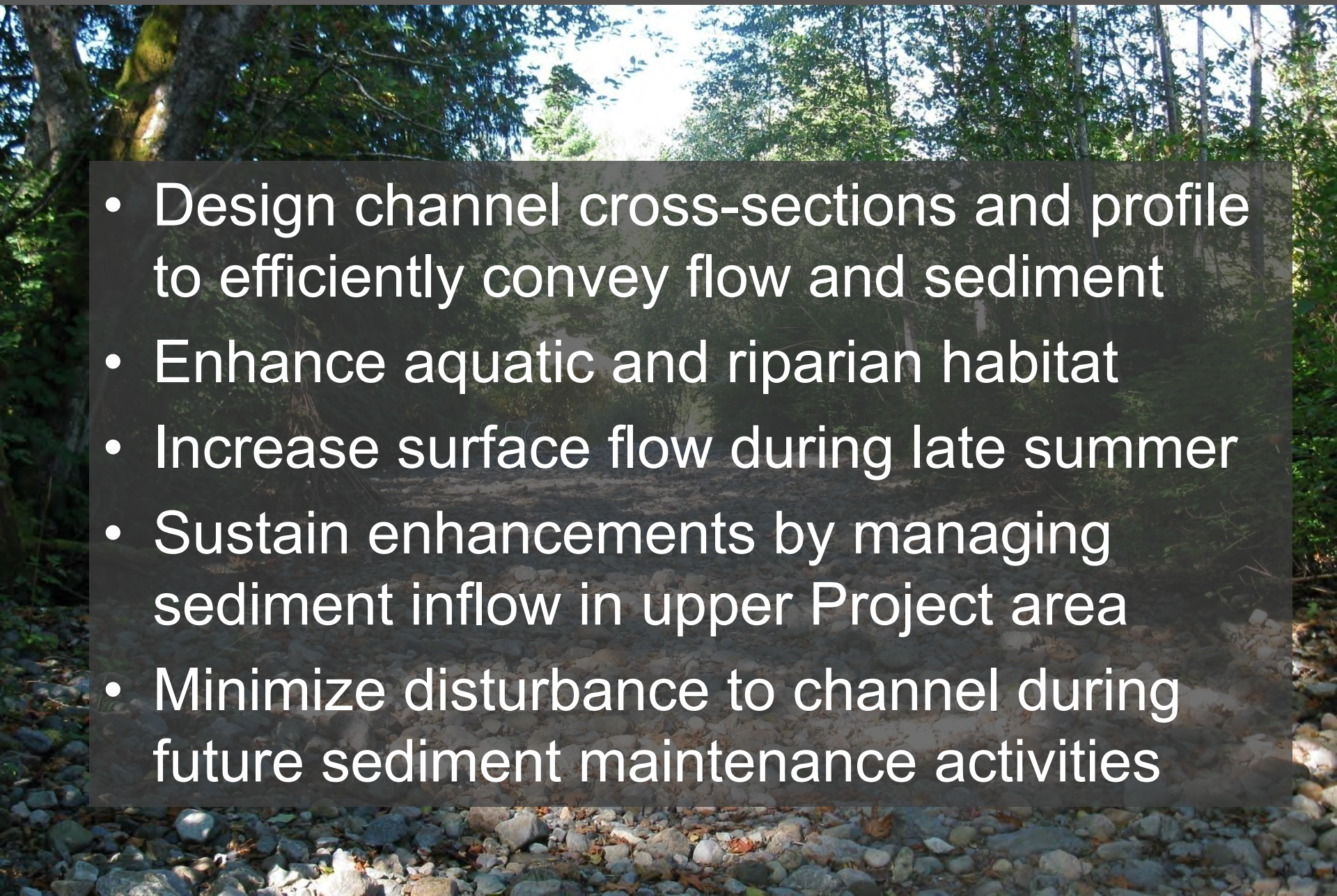
- Habitat Restoration – create and maintain
- Flood Mitigation – increase flow conveyance
- Sediment Control – manage deposition

# Alternatives Analysis (2009)



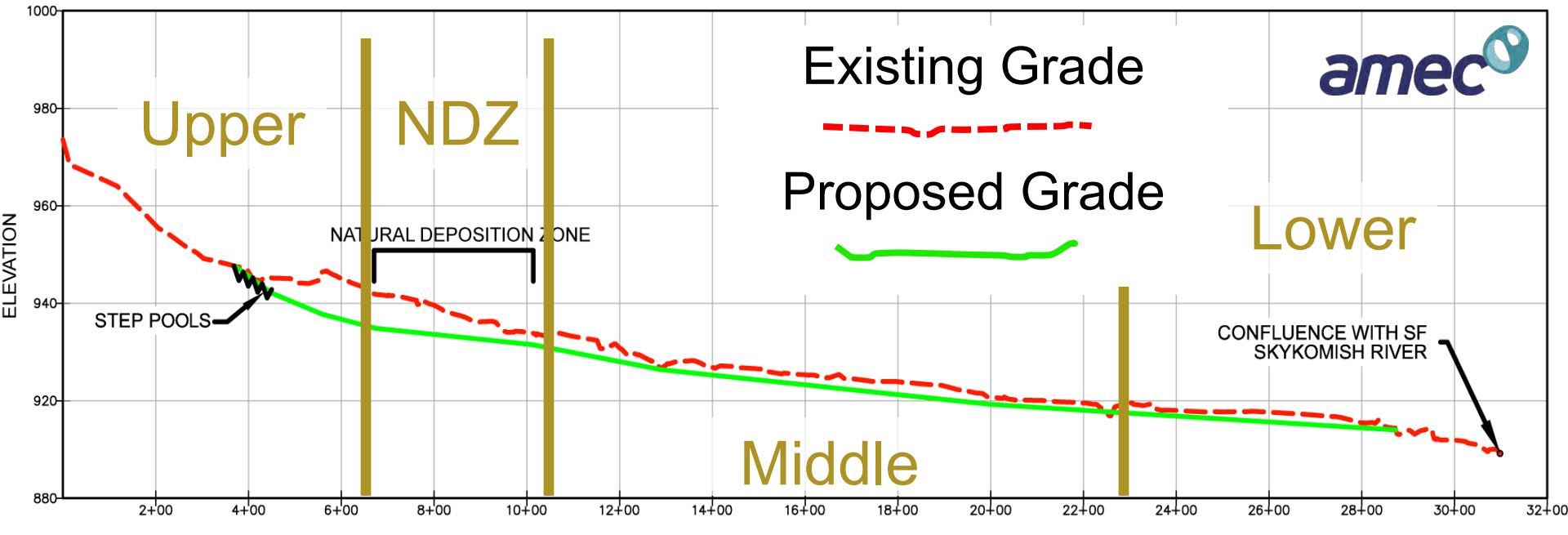

- Reduce Sediment Input in Basin – costly and inaccessible
- Restore Original Alignment – impractical due to existing Town and Railroad infrastructure
- Do Nothing – issues continues to get worse
- Habitat Restoration & Flood Control – Preferred Alternative

# Proposed Objectives



- Design channel cross-sections and profile to efficiently convey flow and sediment
- Enhance aquatic and riparian habitat
- Increase surface flow during late summer
- Sustain enhancements by managing sediment inflow in upper Project area
- Minimize disturbance to channel during future sediment maintenance activities

# Main Channel Improvements

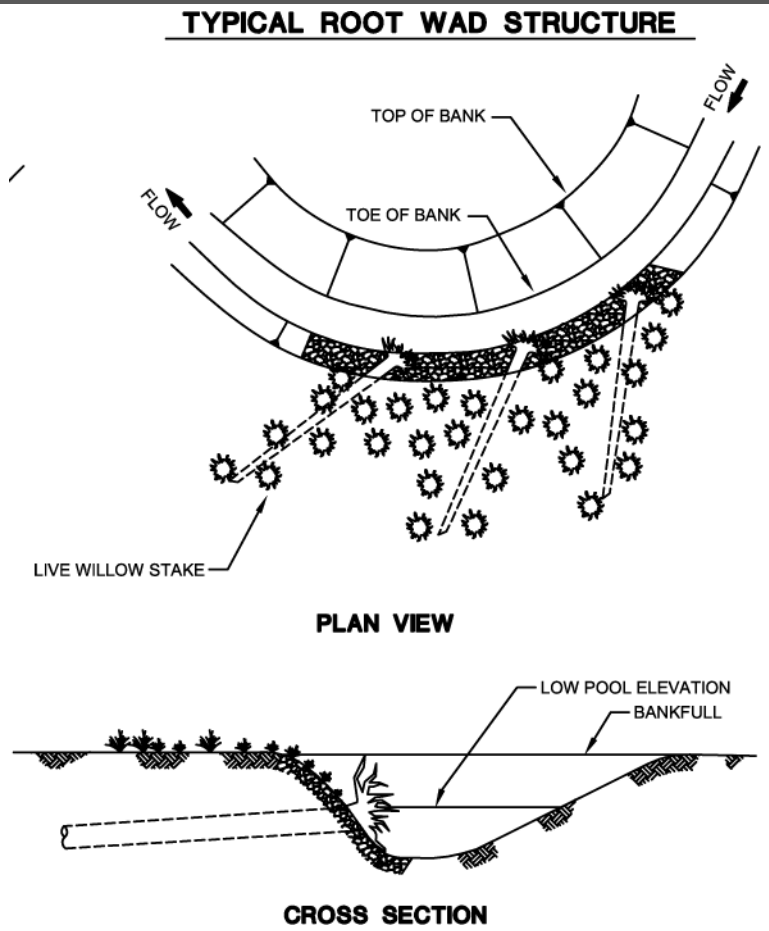


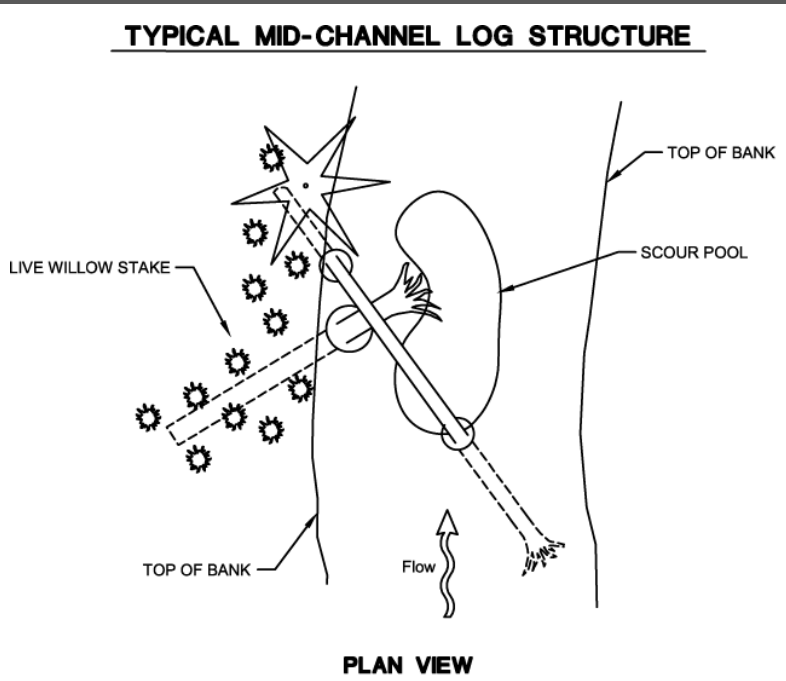

- Narrow (17’ avg) and deepen (2’ avg) main channel to improve its ability convey flow and transport sediment
- Removal of 10,000 CY of sediment
- HEC-RAS models: 100-yr flow and sediment transport
- Realignment to improve base flows during summer
- Create step pools in upper reach to allow fish passage

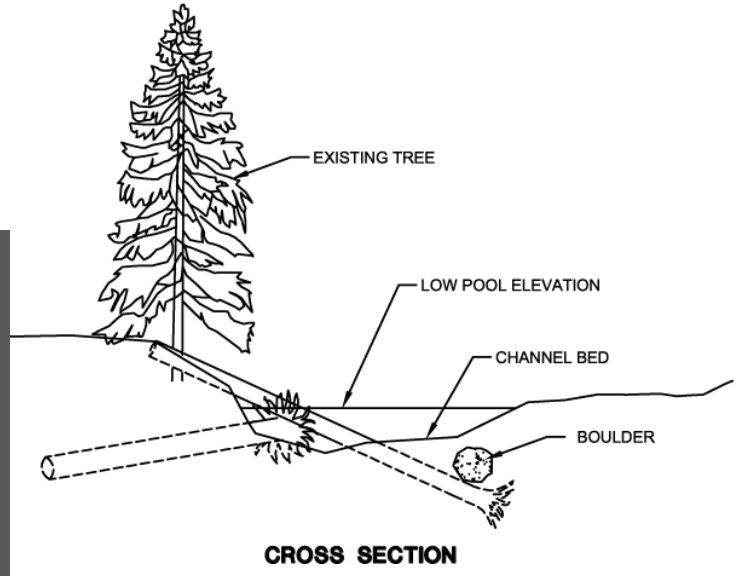
# Habitat Enhancement

- Aquatic Habitat:
  - Create pool-riffle morphology
  - Increase hydraulic complexity
  - Install 28 large wood structures (45 total logs, 18”-24” Dia.)
  - Install multiple rock structures
  - Create local scour and provide cover
- Riparian Vegetation:
  - Protect existing trees to extent possible
  - Remove noxious weeds
  - Plant native vegetation (e.g., conifers)

# Large Wood Design



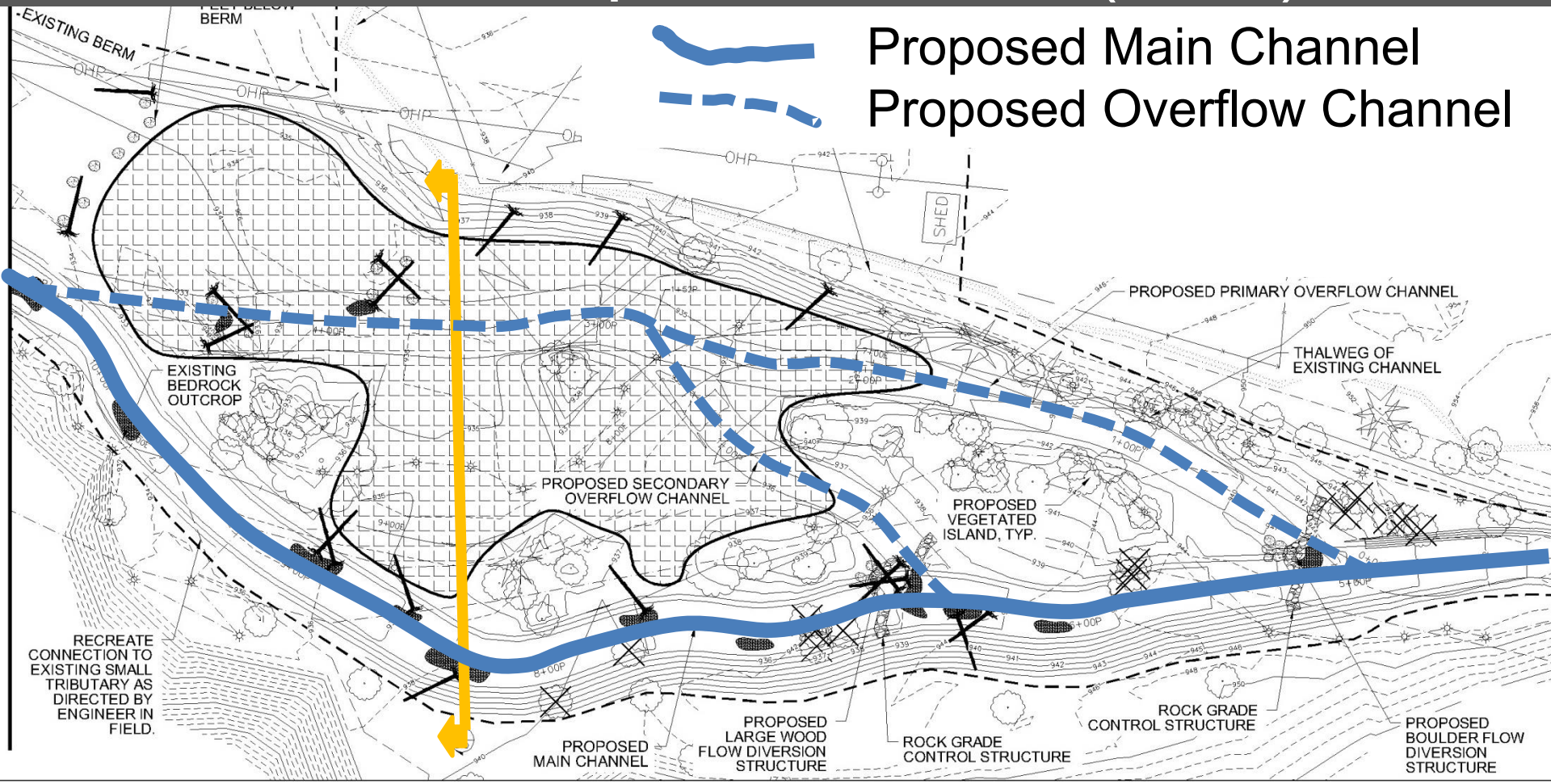



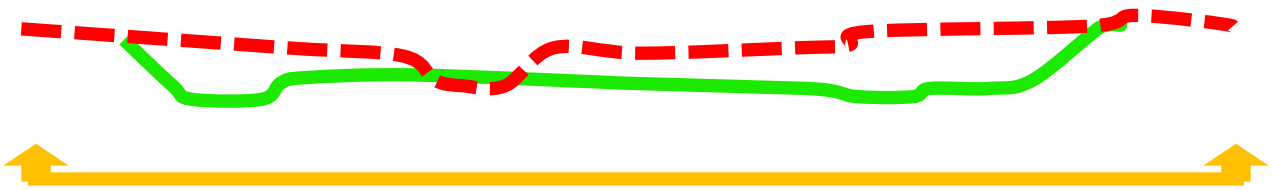

- Limit impacts to flow conveyance
- No mechanical anchors (per USFS)
- Stability calculations - Buoyancy, drag, and moment forces (NRCS)

# Sediment Management

- Design channel would have improved sediment transport capacity but still would be overwhelmed by large (episodic) sediment inflows
- Therefore, a Natural Deposition Zone (NDZ) was created to sustain downstream improvements
  - NDZ located at upstream end of project where the stream corridor flattens and widens
  - Overflow channels convey peak flows into NDZ
  - Designed to capture coarse sediment
  - Storage capacity ~4,000 CY; expected annual deposition of ~450 to 600 CY per year in NDZ
  - Periodic maintenance required (~10-year intervals)

# Natural Deposition Zone (NDZ)



NDZ Cross-Section

Existing Grade

Proposed Grade

# Construction (Fall 2011)


Before
Before
Downstream of NDZ
After
After


Before
Before
Middle Reach
After
After


Before
Before
Lower Reach
After
After

# Maintenance & Monitoring Obligations

- Town committed to monitoring and maintenance
- 25-year Special Use Permit (SUP) from USFS
- Bi-annual physical monitoring
- Monitoring posts measure sediment accumulation
- Remove sediment from NDZ (~10 year intervals)

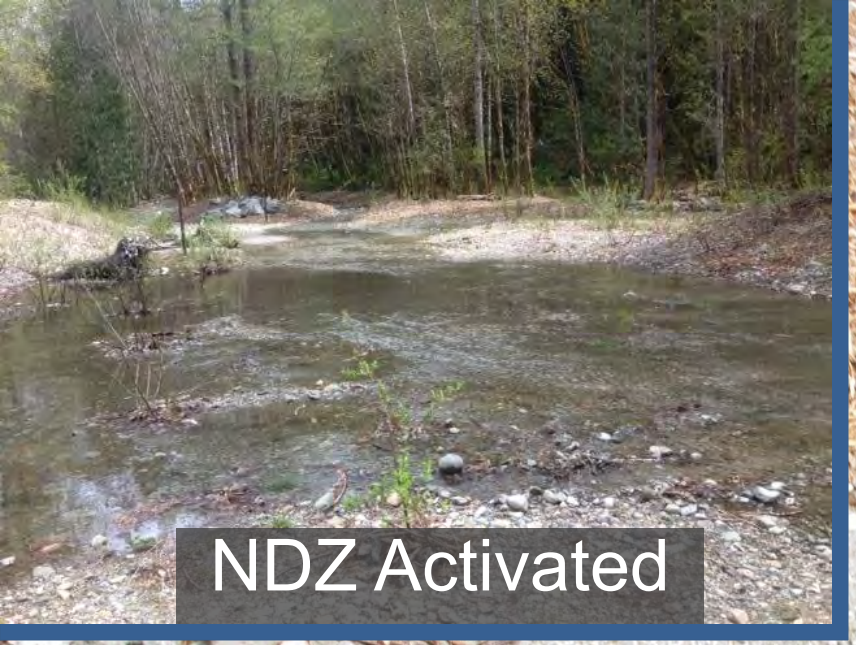
# Post-Construction Updates

Photo:  May 2012


Photo:  August 2014


Photo:  May 2012


Photo: May 2012



NDZ Activated

Photos:  April 2012


Photo:  August 2014


Photo:  August 2014


Photo:  August 2014


Photo: May 2012


Photo:  August 2014


Coho Spawning Pair
Photo: January 2012


Photo: August 2014


Photo:  August 2014


Photo: May 2012


Photo:  May 2012

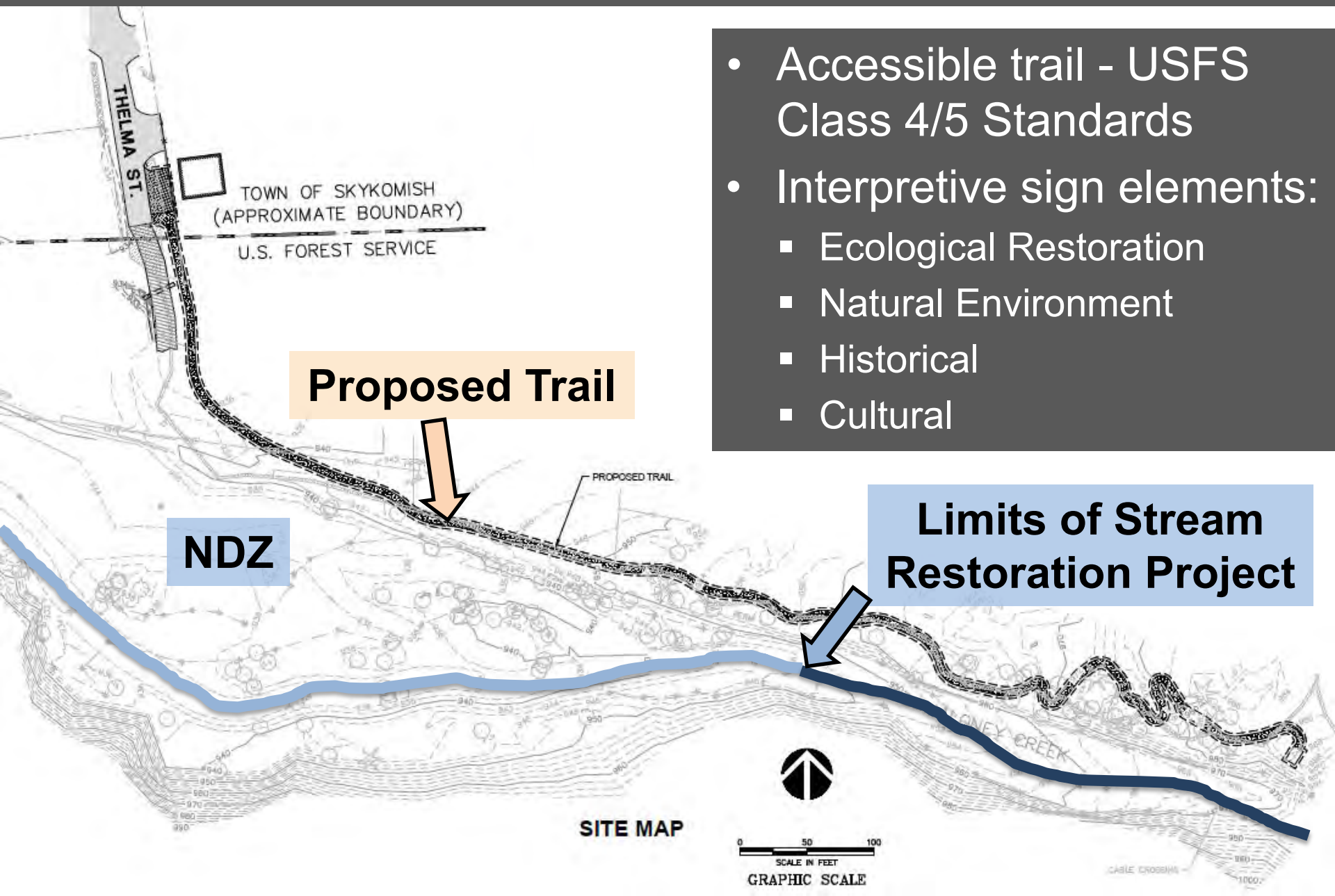

Photo:  August 2014


Upper Reach
Lower Reach
Surface flow in
“dry season”
Photos: September 19, 2014

# Lessons Learned

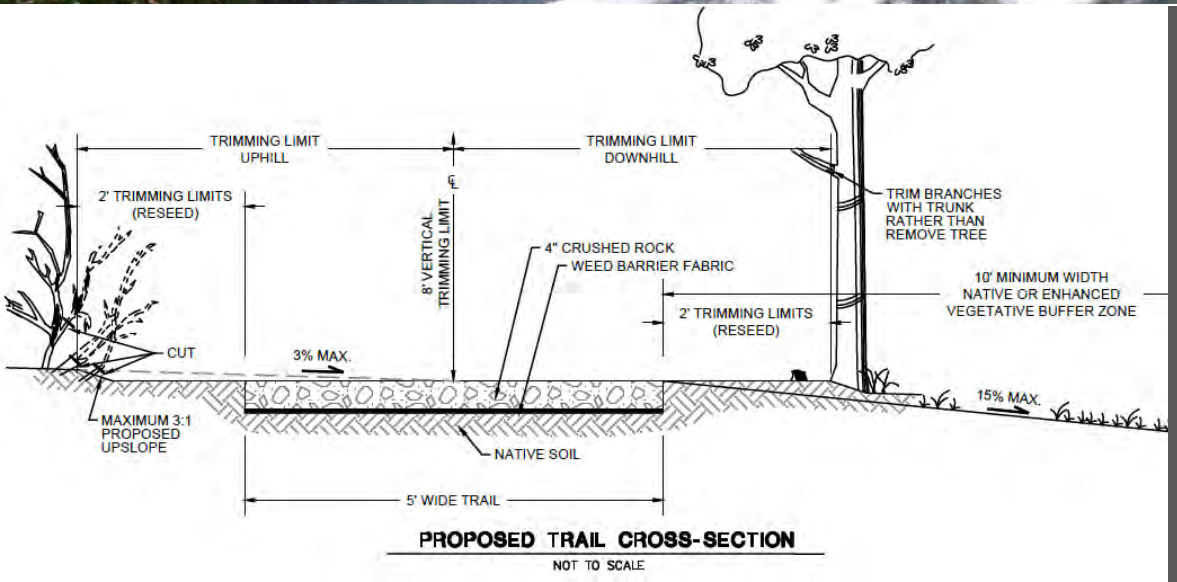

- A passive design approach can be effective for balancing stream restoration and flood control
- Sediment influx following construction – Slightly reduce design channel width
- Construction oversight by stream professionals is critical!
- NDZ results have been encouraging, but waiting for first big test

# Interpretive Trail Overview




- Accessible trail - USFS Class 4/5 Standards
- Interpretive sign elements:
  - Ecological Restoration
  - Natural Environment
  - Historical
  - Cultural

# Trail Design (2013)




Special “trail mix” from fully crushed 1/2-minus with the addition of 25% finer crushed screening reject material to add additional binder

# Virtual Walk of the Constructed Trail (2014)

Photo:  August 2014


Photos:  August 2014


Photo:  August 2014


Historic wood-staved pipe
Photo: August 2014


Photo:  August 2014

# Perspective from Viewing Platform

Photo:  August 2014

# Questions?

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**Special Thanks to:**