# Whychus Canyon Restoration Plan

# Design Report

Prepared by: Upper Deschutes Watershed Council

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## EXECUTIVE SUMMARY

### *Background*

Historically Whychus Creek provided high quality spawning and rearing habitat for summer steelhead (*Oncorhynchus mykiss*), and spring Chinook salmon (*Oncorhynchus tshawytscha*). Over the last 100 years however, channelization and other stream modifications along Whychus Creek have resulted in the loss of diverse high quality fish and wildlife habitat. Prior to the construction of a series of hydroelectric dams at the Pelton Round Butte Complex on the Deschutes River in the early 1960s, Whychus Creek was one of the most important spawning areas in the subbasin, responsible for a significant portion of summer steelhead trout and spring Chinook salmon production. Some estimates attribute nearly 40% of all steelhead spawning in the Upper Deschutes to the Whychus Creek watershed (Nehlsen 1995).

Starting in 2007-2008, steelhead trout and Chinook salmon were reintroduced into Whychus Creek as part of a regional effort to restore anadromous fish runs above the Pelton Round Butte Dams. This reintroduction work has led to a significant effort to restore habitat, eliminate fish passage barriers and improve water quality. As the reintroduction of anadromous fish proceeds, it is important to improve habitat conditions and provide fish passage to ensure that fish have and can access high quality diverse habitat in Whychus Creek.

Although there is riparian vegetation along portions of Whychus Creek, it is often found confined to channel margins, is generally young and has a limited species composition. Large historic riparian forests once found on the alluvial and meadow reaches have disappeared. Whychus Creek has become disconnected from the floodplain in many reaches through active incision, bank erosion and channel straightening and berming. This has resulted in the loss of the pool habitat and channel complexity necessary to provide diverse, high quality habitat for native resident and anadromous fish populations. In addition, only 15 miles out of 43 (35%) of Whychus Creek's overall length run through low gradient broad floodplain habitats that have the potential to support diverse, high quality healthy complex habitat types for both fish and wildlife. The remaining 28 miles (65%) are high gradient transport reaches confined in a canyon.

The six mile long Whychus Canyon Restoration Project (Project) area is located 7-13 miles upstream of the confluence of Whychus Creek with the Deschutes River (Appendix A, Drawing 1.0). The Project is located on Deschutes Land Trust (DLT) Property or property protected via permanent conservation easements with the DLT.

### *Design Methodology*

While numerous approaches can be taken towards a restoration project of this type and size, this Restoration Design developed by the Deschutes National Forest in coordination with the Upper Deschutes Watershed Council balanced how best to meet Project goals and objectives while taking into account site specific limitations, implementation costs, permitting, phasing and material availability.

The intent of this Restoration Design is to take a process based approach and not dictate a channel pattern, profile and dimension with project elements developed to hold that design. Instead the intent is to restore hydrologic processes such as floodplain connectivity that will encourage habitat development and a dynamic equilibrium that is typical for this valley type. It is expected that the Project site will continue to evolve and develop post implementation over several years as the site reacts to improved floodplain connectivity, retained sediments / nutrients and reestablished riparian vegetation throughout the valley floor.

Reference reach analysis was conducted to provide a model for Project design. The Whychus Creek reference reaches used for this Project function hydrologically per Project goals and objectives with plant community structure and native species diversity that provides a picture of potential vegetation for the area to be restored. This Project is part of the holistic watershed-scale restoration approach currently underway in Whychus Creek since 2005. As such, lessons learned from similar projects upstream of this Project were applied when developing the Restoration Design. Field reviews were conducted on site to ensure outside expert restoration practitioners could inform Restoration Design development.

Given Project size and scope, implementation will occur over multiple years in close coordination with landowners, funders, and Project partners (i.e. state/federal agencies). The six mile Project area is divided into 6 reaches and reach breaks are linked to implementation timing based on the fact that work in each reach can be completed within one implementation season.

### *Design*

The Whychus Canyon Restoration design involves implementation along all six miles using three broad approaches including:

- Elevating the base level of the channel, thereby reconnecting Whychus Creek with its historic floodplain and flow paths valley wide;
- Developing multiple or dynamic flow paths activated at a range of flows above and below bankfull; and
- Providing highly dynamic aquatic and riparian habitats.

Active restoration will occur on all six reaches within the Project area. Building the floodplain connection and associated aquatic and terrestrial habitat requires many actions including but not limited to channel aggradation.

This restoration plan is designed to reverse the effects of the historic channel and floodplain manipulation that has led to the degradation of Whychus Creek through the Project area. The degradation is primarily linked to channel straightening, berming, subsequent incision and disconnection of the channel from the floodplain. The Restoration Design once implemented will provide fish passage, high quality fish habitat and will allow for energy dissipation during flood events through a highly dynamic stream network fully connected to the floodplain that is able to adapt to future changes in flow, sediment regime or climate.

The primary components of the design and what each seeks to accomplish are highlighted below:

| What is proposed | What it will accomplish |
|---|---|
| Construct Log Jams (helicopter) | • Promote natural channel bed aggradation<br>• Facilitate floodplain connection and associated side channel development<br>• Provide fish habitat (pools, cover, slow water refugia) |
| Construct Log Jams(excavator) | • Provide stream stability until vegetation is established<br>• Provide fish habitat (pools, cover, complexity) |
| Berm removal | • Facilitate floodplain connection and reactivation of relic channels<br>• Provide onsite material for aggrading the channel (see below) |
| Floodplain grading | • Utilize limited meadow habitat<br>• Facilitate floodplain connection and the recovery of natural hydrologic processes<br>• Reduce fine sediment inputs to the system by eliminating a step in the natural channel evolution process<br>• Decrease distance to groundwater table in order to support plants<br>• Provide material for aggrading the channel or plugging the channel |
| Aggrade channel or realign straightened channel | • Facilitate floodplain connection and accelerate recovery of natural hydrologic processes<br>• Decrease channel slope by increasing sinuosity<br>• Decrease distance to groundwater table in order to support plants and provide water storage<br>• Utilize existing onsite cut material |
| Develop multiple flow paths active at a range of flows | • Increase instream habitat and habitat diversity at a variety of flows<br>• Provide bedload and suspended load depositional areas that promote diverse aquatic and terrestrial species habitat<br>• Dissipate high energy flows in multiple channels |
| Floodplain wood | • Reduce velocities on the floodplain until vegetation can establish<br>• Provide areas to deposit silts and collect debris<br>• Provide instream wood to new channels as they develop |
| Plantings | • Provide stability to the channels and floodplain |

| What is proposed | What it will accomplish |
|---|---|
| | • Increase riparian plant diversity and extent |
| Diversion abandonment | • Eliminate passage barriers and threats to fish from unscreened diversions |

Providing abundant in-channel and off-channel habitat through the creation of numerous channels and the addition of wood will create complex habitats including cover, over-hanging banks, alcoves, pocket pools, and lateral scour pools that is currently lacking in the Project area. In addition the dense and diverse riparian vegetation that will extend throughout the valley floor areas will provide stream shade, bank and floodplain stability, and riparian habitat for resident and migratory wildlife and allochthonous inputs to the creek. By reconnecting the floodplain and raising the groundwater table, backwater areas and off-channel areas will be restored providing complex habitat for aquatic and terrestrial species. Over time, vegetation communities will represent a diversity of age classes and will change as the stream channel migrates laterally across the floodplain.