

## Carr Slough Preservation and Tidal Wetland Restoration

Carr Slough is a 103-acre privately owned tidal freshwater wetland connected to the Lower Columbia River near Prescott, Oregon in Columbia County (Figure 1). It is located at approximately River Mile 73 just upstream of Cottonwood Island and is situated between Highway 30 and the railway (Table 1). It has approximately 1.8 miles of channels, of which approximately one mile is comprised of straight channel drainage ditch with the remaining portions as an apparent natural channel with meanders and woody riparian vegetation. The site is mapped as entirely Rafton-Sauvie-Moag Complex soil type, a floodplain silty-clay alluvium derived of mixed sources and having extremely poor drainage.

There is an opportunity to protect Carr Slough and its natural resource values for fish and wildlife habitat in perpetuity via the Natural Resources Conservation Service’s Wetland Reserve Program (WRP). The site has excellent value for a variety of species and important habitat types in the Lower Columbia, as detailed below, and would be an important site to preserve. There is also potential to undertake habitat improvement actions to increase the existing natural resource values of the site after the site has been preserved.

Project Fourth Field Hydrologic Unit Code (HUC):	Lower Columbia/Clatskanie 17080003
Project Fifth Field Hydrologic Unit Code (HUC):	Beaver Creek/Columbia River 1708000302
Project T/R/S Location:	T7N, R3W, Section 26 SE, 35 NE
Project Latitude/Longitude:	46.0524381N, 122.8950261W
USGS Quadrangle Map Name:	Rainier
County:	Columbia

### Potential Resource Benefits & Preservation Value of Carr Slough

There are multiple habitat types of value at Carr Slough, including freshwater tidal emergent wetland, shrub-scrub wetland, slough and freshwater tidal channel. These habitats in close proximity to the Lower Columbia River support a variety of listed and species of concern fish species and declining avian species. Protection of the current values at this site will help ensure an important part of the Lower Columbia River’s landscape diversity is preserved.

*Fish Access and Juvenile Rearing of ESA Listed Salmonids* – Carr Slough has direct connectivity with the Columbia River via an approximately 12 foot wide channel (Photo 1) beneath the railroad trestle. The channel gradient is fairly flat (approximately 1.5%) and flows out through a county-owned wetland complex and directly connects to the mainstem Columbia River (Photo 2). Inspections of the connection indicate that the channel is likely fully passable under a variety of flows for a wide variety of salmonid species and life-history forms. Species that could use the site include Federally threatened Lower Columbia River stocks of Coho, Chinook, steelhead, and chum as well as species of concern coastal cutthroat trout and perhaps lamprey

species. The site could potentially provide rearing habitat available to other Upper Columbia basin stocks of wild salmon as well.

There are two freshwater tributaries, Jack Falls and Little Jack Falls, which enter Carr Slough from the hill slope above highway 30 (Figure 1). Although Oregon Department of Forestry fish distribution models indicate that both streams have anadromous fish use throughout most of their lengths, waterfalls located just upstream of the Highway 30 road crossing on both creeks make anadromous fish use above unlikely. It is likely that resident coastal cutthroat trout use these streams. There is potential for very short reaches of Jack Falls and Little Jack Falls creeks above Highway 30 but below the falls to be used by anadromous fish. Confirmation of passable culverts under the highway has not been made; but given the limited amount of potential accessible upstream habitat, upstream salmonid use is not considered a primary resource benefit.

The Carr Slough wetlands and channel habitats have significant potential to provide tidally influenced freshwater juvenile salmonid rearing habitat. These habitats are particularly scarce in the Columbia River and are vital for juvenile salmonid survival. Current site conditions indicate that juvenile rearing is likely already occurring to some degree, however, there is potential to enhance existing site features to improve water quality, cover, and perhaps fish forage base availability within the 103-acre site which may also improve outflow of nutrients and detritus for juvenile fish foraging along the margins of the mainstem Columbia.

Waterfowl Use – Carr Slough is actively used by multiple species of geese and ducks. In conjunction with the adjacent PGE site, which comprises nearly 150 acres of habitat in a more open water lacustrine condition, the overall complex provides a variety of waterfowl loafing, feeding, and breeding opportunities. Although no formal surveys have been done, existing waterfowl use on the Carr Slough site has been observed during both the spring and fall migration, as well as during summer by a few species indicating that nesting habitat may be present for some species, such as mallard (*Anas platyrhynchos*), Canada goose (*Branta canadensis spp*), widgeon (*Anas americana*), and wood duck (*Aix sponsa*).

Migratory Songbird Use – Carr Slough has a mixed species variety of shrubs and trees growing in a mosaic fashion over approximately 45% of the land surface (Figure 2, Photo 3). Species present include ash, willow, dogwood, Douglas spirea, alder, and oak. Other cover types present are open water/channel with the dominant land cover being primarily invasive reed canary grass. Formal bird surveys have not been conducted at this site, but per on site observations and bird occurrences in similarly located areas with similar habitat conditions, this site is likely to support foraging and / or nesting for a variety of songbird species. Typical species may include willow flycatcher (*Empidonax traillii*) pacific-slope flycatcher (*Empidonax difficilis*), rufous hummingbird (*Selasphorus rufus*), tree swallow (*Tachycineta bicolor*), northern rough-winged swallow (*Stelgidopteryx serripennis*), barn swallow (*Hirundo rustica*), black-capped chickadee (*Poecile atricapillus*), golden-crowned kinglet (*Regulus satrapa*), yellow warbler (*Dendroica petechia*), common yellowthroat (*Geothlypis trichas*), Wilson's warbler (*Wilsonia pusilla*), song sparrow (*Melospiza melodia*), and others.

## Potential Resource Questions to Evaluate at Carr Slough

Water Quality Considerations—Water quality, in particular temperature and dissolved oxygen, will influence the potential for this site to provide rearing habitat for native salmonids. It will also influence habitat suitability for non-native fishes that may prey on and compete for resources with native salmon. Evaluating the existing water quality will provide important insights into restoration and enhancement opportunities.

The connection point between Carr Slough and the Mainstem River feeds directly into the ditched channel section that parallels Highway 30. There is no direct connection from the inlet to the more natural meandering section of slough channel (Figure 2). It appears that there was a historic connection which has been cut off by fill material. At the south end of the property, there is a culvert with an old degraded tide gate affixed that connects Carr Slough to the open water lacustrine habitat that is presumable owned by Portland General Electric (PGE) (Figure 2, Photo 4). The flap on the tide gate appears to be rusted and likely has impaired functions, leaving the pipe partially open.

Questions to consider include:

- How does water quality (temperature and dissolved oxygen) vary from the inlet at the railroad trestle throughout the nearly 2 miles of ditch/slough?
- Does temperature and dissolved oxygen become unsuitable for salmonids, and if so, at what time periods?
- Does flow from Jack Falls and Little Jack Falls Creeks affect temperature and dissolved oxygen in the ditch?
- How do these parameters compare to those in the mainstem Columbia in this area?
- Would reconnecting the natural meandering slough channel directly (i.e., removal of fill within the slough indicated on Figure 2) have potential to increase direct flows, influence water quality, and provide more direct access for fish to slough habitat?
- How does water quality vary between Carr Slough and the open water lacustrine habitat type just to the south? How would alteration (opening up or closing off) the existing connection affect water quality in Carr Slough? Does this connection serve as an entry point for stocked non-native warm water predator fish into Carr Slough?

Sampling Considerations for Water Quality—These water quality questions could be answered by installing autonomous data loggers for temperature and water depth and staffing them with a technician to download the data monthly. While dissolved oxygen is of primary interest, data loggers to collect that information are extremely staff time intensive (i.e., every two days), so instead, temperature will be used as an indication. Dissolved oxygen measurements will be taken periodically during staff visits via a hand held meter. A suggested sampling design for further discussion is shown on Figure 2. Approximate cost per unit is \$500 making a total supplies purchase cost of \$2500. Staff time would likely be a combination of Estuary Partnership, Soil & Water Conservation District, and US Fish & Wildlife Service staff and would amount to approximately one day per month to download data and approximately 1.5 days per year to analyze data.

Station Number	Description of Location	Rationale
WQ1	Close to or within the Mainstem Columbia	Establish a reference of the baseline Columbia River influenced conditions.
WQ2	Above the Railroad but near the connection point	Establish a reference of baseline condition of inflow conditions.
WQ3	In the ditched section of channel either close to Prescott Road or somewhere paralleling Prescott Road. Caution to avoid a site likely to be impacted by vandalism.	Establish conditions in the ditch and the potential impacts of lack of cover and high solar radiation.
WQ4	In the natural meandering slough channel.	Establish conditions in the natural channel and the potential impacts good canopy cover but limited direct surface flow connection to mainstem flows.
WQ5	PGE parcel – open water area.	Establish a reference of the baseline conditions in this parcel to infer impact of hydrologic connection on water quality.

The tidal fluctuation and hydrologic connections between Carr Slough and the Lower Columbia River influence water temperature, depth, and water quality parameters at the site. As such, they will influence the plant survival zones and tolerances for native shrubs and trees, the ability to sequester or retain large wood within the wetland complex, interchange of nutrients and detritus, and fish access opportunities both to and within the site. Water marks on the railroad trestle indicate that water levels do fluctuate by several feet. An assessment of the site’s basic hydrology and a measure of the tidal amplitude based on nearby gauge data would be helpful information to incorporate into restoration strategies, in particular planting prescriptions and large wood installation.

*Aquatic Species Habitat Considerations* – A better understanding of the current anadromous fish use in Carr Slough would improve our ability to assess the site’s value and make effective restoration prescriptions. Understanding fish species presence, the timing or season of use, and general distribution within the site will provide a clear picture of whether there is salmonid use of the site, which species are present, whether there are seasonal or distributional differences that may relate to water quality and life history attributes, and the degree of exotic fish species presence. If determination between in-basin and out of basin anadromous fish stock presence is desired, genetic sampling could be incorporated to better address this aspect.

Key considerations related to the habitat conditions at the site include the channel morphology of the ditch and the meandering slough, its width to depth ratio, the habitat complexity for cover and invertebrate substrate, and amount of canopy cover present to provide shade and nutrients.

## Potential Restoration Actions to Evaluate at Carr Slough

*Improved Channel Complexity and Connectivity*—Large wood is currently lacking at Carr Slough. The ditched section has no canopy cover and no large wood present. The meandering slough section has good canopy cover, but limited large wood. Historically, natural processes would have likely delivered some large wood into this floodplain wetland habitat from the hill slope above, however, the construction of Highway 30 and agricultural development has cut off this process. Additions of complex large wood structures would provide juvenile salmonids with cover and invertebrate substrate. Evaluations of the tidal amplitude should be considered in determining structure location and configuration as well as the size, type, and dimensions of wood to use. Potential to integrate vertical members into the wood structures to reduce potential for mobilization would be evaluated relative to the tidal fluctuation. The key infrastructure concern at this site is the railroad trestle which is insufficiently wide to pass large wood.

Connection of the meandering slough directly to the Columbia River via removal of fill should be explored. This would provide juvenile fish accessing the site from the mainstem with more direct access into the complex portions of the slough which currently have better canopy, some large wood, and more natural habitat conditions. Evaluation of the water quality data will be useful in determining the potential benefit of this action. Reconnecting the channel directly could provide an increased outflow of nutrients, invertebrates, and detritus that would add to the local food web and provide foraging benefits to juvenile fish on the Mainstem Columbia River margins.

Alteration of the width-to-depth ratio and complexity of the ditch could provide improvements in juvenile fish rearing capacity of the ditch. The following actions should be evaluated: potential for equipment access, the potential to successfully establish native trees and shrubs and install and sequester large wood (relative to the tidal fluctuation and flow from the two tributaries). Consideration of the water quality data and the fish use of and inputs of water from the two tributaries would be part of formulating the final plan for this section.

Consideration should be given to the effects of the failed culvert / tide gate between Carr Slough and the PGE site on both water quality within Carr Slough and also movement of fish, in particular exotic predator fish. The connection may have limited effect on Carr Slough.

*Vegetation: Improved Native Tree and Shrub Composition & Invasive Species Control*—The portions of the site which are not under shrub or tree cover or in open water conditions tend to be dominated by reed canary grass. It would be extremely difficult and management intensive to shift the reed canary to other non-woody plant communities. Evaluation of the basic hydrologic information (i.e., tidal amplitude) to determine the likelihood of successful survival of shrubs and trees in these areas, and in particular along the ditch, would be a key first step. Next would be the development of a planting plan that incorporates rigorous site preparation and several years of post-planting establishment follow-up. Additional coverage by shrubs and trees would probably not increase the avian or aquatic species diversity, but could increase the habitat quality for these species over a larger proportion of the site.

Yellow-flag iris was observed in multiple locations at the site, primarily along the open water edges of both the ditch and the meandering slough. Mapping locations and follow up treatment would have potential to be effective in reducing presence of this species.

Nest Boxes—Potential to add nest boxes for tree swallows in the open water areas and for wood ducks in the denser canopy covered areas of the site would provide additional habitat features. Consideration could also be given to bat box installations or mallard nesting baskets. Linkages with school or Boy or Girl Scout troops could be made to add education and outreach elements to this project.

Figure 1. Map location of Carr Slough.

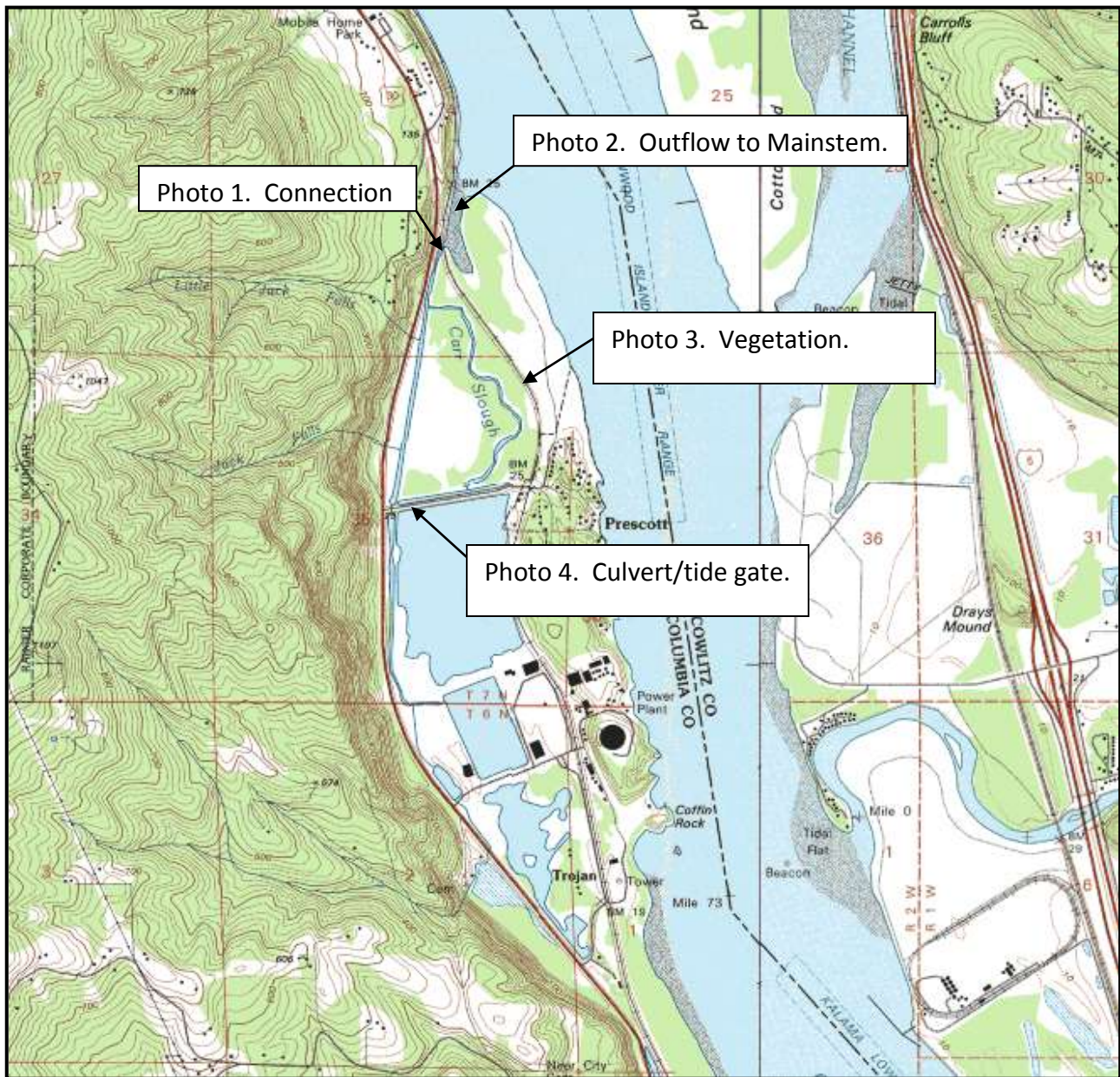




Figure 2. Aerial Photograph of Carr Slough Showing Current Site Conditions. Potential water quality sampling sites are noted in orange. The current tide gated culvert connecting Carr Slough to the adjacent parcel is indicated in red.





Photo 1| Connection of Carr Slough to the Columbia River under the railroad trestle.



Photo 2. Below rail road trestle looking toward mainstem Columbia River.



Photo 3. General vegetation composition at Carr Slough.



Photo 4. Location of culvert/ failed tide gate connecting Carr Slough with the PGE site.

