Lower Kiona Creek and Cowlitz River Enhancement

Concept Design Report

SUBMITTED TO
Lower Columbia Fish Recovery Board

November 20, 2019

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PREPARED BY
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501 Portway Ave.
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Table of Contents

1 Introduction

1.1 BACKGROUND

The Kiona Creek Restoration Project was identified during the development of the Upper Cowlitz Cispus Habitat Strategy (in preparation, 2019). The landowners have worked with the Lower Columbia Fish Recovery Board (LCFRB) and Inter-Fluve, a restoration engineering design firm, to develop the following conceptual alternatives. The preferred alternative was developed in discussion with various stakeholders, including landowners in the project area and the Habitat Strategy workgroup.

The goal of the Upper Cowlitz Cispus Habitat Strategy is to: Develop a habitat restoration and conservation strategy to support short and long-term ESA-listed salmon and steelhead recovery needs that works for fish and for people. In addition, the Habitat Strategy is aligned with the Washington Lower Columba Salmon Recovery and Fish and Wildlife Subbasin Plan ("Recovery Plan," 2010) developed by the Lower Columbia Fish Recovery Board.

The following Conceptual Design Deliverables package follow the Manual 18, Salmon Recovery Grants requirements (March 2019 edition). The design package includes this design report, design drawings, and a rough cost estimate for the preferred alternative.

Project goal and objectives for the Kiona Creek Restoration include:

- Restore the extent and diversity of ESA-listed salmonid habitat in the Upper Cowlitz River
    - Where possible, use design elements that restore or support ecological processes that support recovery of ESA-listed salmonids.
    - Increase habitat cover and complexity on the mainstem Cowlitz and in off-channel areas (floodplain and tributary channels).
    - Work with landowners to develop a restoration project that will be compatible with other land uses.

1.2 SITE OVERVIEW

The project site is located near Cowlitz River river mile (RM) 101, near the confluence of Kiona Creek (Figure 1). The site is located within the "Cowlitz River – Randle" Landscape Unit (LU) as described in the Habitat Strategy Report (2019). The area is upstream of the Cowlitz Falls Dam and is near the upstream boundary of the Cowlitz Falls reservoir; it likely experiences some seasonal backwater effects from the dam.

Landownership is a combination of several private landowners and Lewis County Public Utility District. The lands are used for grazing, hay production, and conservation uses. A majority of landowners in the project area have been engaged in conversations regarding potential conceptual alternatives. Project alternatives illustrated in the attached drawings are only shown on parcels where landowners have been engaged in the discussion thus far.

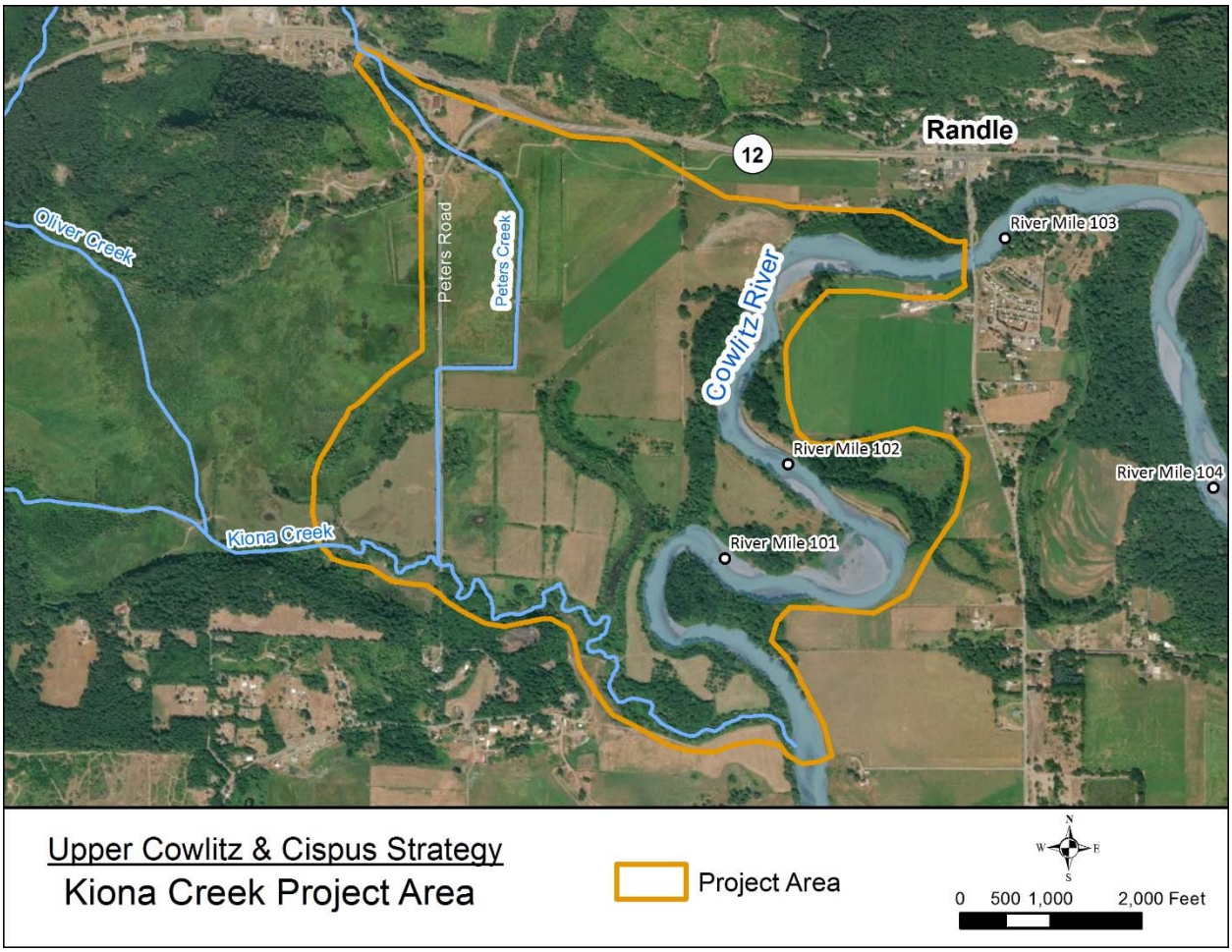


Figure 1. Vicinity map of the project area.

1.3 SITE CONDITIONS AND HABITAT STRATEGY CONTEXT

1.3.1 Fish Use

Target salmonid species in the Cowlitz River include spring Chinook, winter steelhead, and coho salmon. All life stages of these species use this area, or nearby areas for spawning, rearing, and holding. The limiting factors of these species from the Washington Lower Columbia Recovery and Fish & Wildlife Subbasin Plan (Recovery Plan) within the basin are shown in Table 1.

Table 1. Primary limiting factors affecting life stages for Upper Cowlitz/Cispus populations of focal salmon and steelhead species (summarized from EDT results).

Species and Population	Priority	Life stage	*Primary factors*	*Secondary factors*	*Tertiary factors*
Upper Cowlitz/ Cispus Spring Chinook	*Most critical*	Egg incubation	channel stability, sediment		
	Second	0-age summer rearing	competition (hatchery), food, habitat diversity, pathogens		
	Third	0-age winter rearing	channel stability, flow, food, habitat diversity		
Upper Cowlitz Coho	*Most critical*	Egg incubation	Channel stability, sediment		
	Second	0-age summer rearing	habitat diversity	competition (hatchery), food, predation, key habitat	pathogens
	Third	0-age winter rearing	habitat diversity	flow, key habitat	channel stability, food
Upper Cowlitz/ Cispus Winter Steelhead	*Most critical*	1-age summer rearing	competition (hatchery), flow, pathogens	habitat diversity, predation	channel stability
	Second	0-age summer rearing	competition (hatchery), pathogens	habitat diversity	food, flow
	Third	Egg incubation	sediment	channel stability, temperature	oxygen, pathogens, key habitat

1.3.2 Ecological Conditions

As described in the Habitat Strategy report, the mainstem Cowlitz River within the Randle LU historically would have had a low gradient highly sinuous planform with flow splits, side channels, abundant abandoned oxbows, and floodplain wetlands. Large portions of floodplain would have likely flooded annually during spring run-off, and nearly all of valley bottom would have flooded during large infrequent floods. There would have been a complex matrix of riparian and floodplain vegetation and abundant large wood in channels and throughout the floodplain. These conditions would have been expected to be present at the Lower Kiona Creek project area and nearby mainstem and floodplain areas.

The Upper Cowlitz Cispus Habitat Strategy describes conditions of Landscape Units of the basin. All of the descriptions can be found in the Strategy report (2019)[1]. In summary, the Ecological Indicators for the Randle LU are generally ranked as either Impaired or Moderately Impaired. The mainstem Cowlitz River, lower Kiona Creek, and lower Peters Creek are all impaired with respect to floodplain connectivity. This is related to varying degrees of artificial confinement from levees, culverts, and bridges, floodplain filling/grading, and ditching. Sediment conditions are impaired on the Cowlitz River due to the effects of the Lake Scanewa backwater increasing the deposition of fine sediment on the bed. Increased fine sediment is also assumed to be an issue in Peters and lower Kiona Creek as a result of landuse, loss of woody riparian vegetation to hold banks together, and channel incision. Channel type and form is particularly impaired in lower Peters Creek where it is ditched. Large wood quantities are low throughout the entire project area, both in channels and in floodplains. There is some off-channel habitat available during high flows but little well-connected off-channel or side-channel habitat during much of the year, limiting the available habitat for target

[1] Rankings for Upper Cowlitz Randle Landscape Unit are: Natural vs Human Disturbance (moderately impaired/impaired), Hydrologic alteration (functional), Sediment processes (impaired), Large wood processes (moderately impaired/impaired), Channel type and form (moderately impaired/impaired), Floodplain connectivity (impaired), Lateral and vertical channel dynamics (impaired), Off-channel habitat connectivity and refugia (moderately impaired/impaired), Riparian processes (impaired).

species. Riparian conditions are impaired along the mainstem, lower Kiona, and along Peters Creek, primarily related to past and on-going clearing and changes to stream form and function, which affects soil moisture conditions needed to support robust riparian and floodplain vegetation.

1.3.3 Relationship to Habitat Strategy

This project works to address and/or mitigate the effects of the stressors identified for the Randle LU in the Habitat Strategy, including floodplain encroachment, floodplain disconnection, and land cover conversions. All of the restoration objectives listed for the Randle LU are addressed by this project, which include the following: 1) protecting and/or restoring riparian forests and vegetation; 2) removing barriers to channel migration processes and reconnecting the channel to floodplains and side channels where possible; and, 3) enhancing mainstem and tributary habitats.

This project addresses various Habitat Actions that were identified in the Habitat Strategy, primarily UCR-31, 32, and 37; and also including portions of UCR-30, 34, 35, and 36.

2 Concept Design Alternatives

Three conceptual alternatives were identified to address the impaired watershed process needs. The actions that are part of these alternatives were informed by the information developed as part of the Habitat Strategy, particularly the condition of Ecological Indicators described above as well as the Habitat Actions that were identified for this area.

The design alternatives are presented below and are illustrated in the attached drawings. These alternatives can be considered “a la carte”; in other words, multiple elements of each alternative can be combined in the preferred alternative if deemed appropriate. Similarly, certain elements described in these alternative descriptions might not be in the preferred alternative; these are discussed in Section 2.4.2 (Alternatives Considered but not Selected).

2.1 ALTERNATIVE A – MAINSTEM HABITAT COMPLEXITY

Potential mainstem Cowlitz enhancement would extend from approximately River Mile (RM) 100, near the Kiona Creek confluence to near RM 103, at the Cispus Road Bridge (Hwy 131), although treatment length could be extended or reduced depending on available construction funding and landowner participation/access. Habitat enhancements would primarily include large wood placements in the main channel with the objective of enhancing salmonid habitat, with a focus on juvenile rearing and adult holding, including for spring Chinook. Large wood installations would consist of a variety of configurations, including small 1-5 piece structures along the channel margin or in alcoves. Structures could be configured to capture mobile large wood from upstream in order to build and sustain jams over time. Cover and complexity of mainstem rearing and holding habitat is likely missing in this area, and wood placements would be expected to create local scour pools around and within the structures, increasing the availability of pool habitat with complex cover.

Off-channel habitat enhancement is also possible within this segment, but would take coordination and acceptance from landowners. Off-channel habitat could consist of flow-through side-channels that could be active at a range of flow conditions, backwater alcoves consisting of a single mainstem

connection point, and connected floodplain wetlands. Existing low points within the floodplain, including former channel scars (e.g. abandoned oxbows), would be logical places for establishing and reconnecting these habitat types. Large wood habitat complexity would be added to the restored off-channel areas. Off-channel habitat would primary support juvenile salmonid rearing, including flood refuge and potentially temperature refuge during the summer.

Restoration of riparian vegetation conditions would support long-term goals of this alternative. Revegetation of native woody vegetation communities within areas disturbed as part of construction and also the establishment and replanting of streamside areas where agreements can be made with landowners will further support habitat wood in the mainstem Cowlitz River. Riparian revegetation is described in more detail in Alternative C.

Primary considerations for this alternative include landowner willingness and engineering to ensure safety and stability given large wood installations in a large powerful river. Wood placements would be targeted at elevations that best fit the needs of the species given seasonal fluctuations in river stage.

2.2 ALTERNATIVE B – PETERS CREEK RE-ALIGNMENT AND ENHANCEMENT

Peters Creek enhancement work includes lower Peters Creek habitat downstream of the Hwy 12 crossing west of Randle. There are two primary focus areas for this work. The first is at and around the Peters Road crossing. The second is the downstream ditched segment, which extends to the Kiona Creek confluence.

The Peters Road crossing area is located in a sediment deposition zone, essentially a tributary fan, where the stream transitions from the steeper upstream areas above the highway to the low-gradient Cowlitz River valley bottom. Streambed material originating from Peters Creek, which consists of sands and gravels, settles out in this zone and has created sedimentation and flooding problems at Peters Road and local properties. In natural settings, these deposition zones are characterized by frequent movement of the stream channel as it adjusts to continued sediment deposition in the channel. However, the constriction caused by the road crossing prevents this adjustment, resulting in chronic in-channel sediment deposition that causes frequent flooding, and which requires continual maintenance. Over time, streambed material has been removed from the channel and placed along the channel banks, forming levees, which only serves to decrease floodplain activation and thereby increases in-channel sediment deposition. Downstream of the road crossing, this process has resulted in a channel bed that is higher than the surrounding topography and that is confined by levees made up of the spoils material. Habitat conditions are impaired and sedimentation/flooding issues continue. There are several approaches that may be considered to address this issue, including 1) modifying the road crossing to increase conveyance capacity or creating new additional crossings through the road prism, 2) re-locating the channel to the north, where there is lower ground and more space for sediment deposition to occur with less consequences, and/or 3) removing the existing levees, re-grading the channel to a lower elevation, and defining a deposition zone “corridor” where future sedimentation and channel adjustment would be allowed to occur. There may be other viable approaches as well. The objective would be to enhance stream function to reduce the need for both channel excavation and the

creation/maintenance of levees. Improving these channel conditions would increase habitat complexity, reduce damage to habitat from maintenance dredging, and increase floodplain connectivity. These enhancements would primarily benefit coho spawning and rearing. Survey, modeling, and additional analysis will be necessary to determine the best approach that works for river processes, habitat, the County road, and local landowners.

The second area consists of the downstream portion of Peters Creek, which currently flows in a series of ditches for approximately 1 mile until it enters Kiona Creek. Habitat has been severely degraded due to the historical ditching of the stream. The current stream is straight, uniform, and lacks quality pools, complexity, cover, and woody riparian vegetation. Cattle have access to the stream/ditch and trampling and wallowing has increased habitat impairment and fine sediment delivery. For the lower 0.4 miles, the stream is within the Peters Road ditch, where nuisance flooding is also a problem. Restoring lower Peters Creek would entail re-aligning the stream channel into a meandering planform that better represents what would be expected under natural conditions. A riparian buffer would be established via planting native woody vegetation, and cattle would ideally be excluded from the channel, possibly establishing hardened crossings and off-channel watering stations. Habitat would be enhanced via creation of pools and addition of large wood complexity and cover. This effort would primarily target juvenile coho rearing. There are multiple options for the specific re-alignment pathway. The new channel could either enter the prominent oxbow wetland to the east, entering Kiona Creek further downstream than the current confluence (shown in the concept drawing), or flow westward under the current Peters Road crossing, entering the large wetland complex and connecting with Kiona Creek upstream of the current confluence.

There are several considerations for choosing the appropriate alignment. These include identifying appropriate topographic low points, evaluating effects on existing land uses, managing road runoff/drainage, managing flow from wetland complex that enters ditch network, and assessing the impact of flow changes for portions of Kiona Creek. These considerations are likely to provide various constraints and opportunities and will need to be evaluated during further site survey, analysis, and discussions with landowners.

2.3 ALTERNATIVE C – LOWER KIONA CREEK ENHANCEMENT

Enhancement of lower Kiona Creek would occur throughout the lower 1.6 miles of Kiona Creek, extending from the confluence with the Cowlitz up to where the large wetland complex (and Oliver Creek) enter from the north. Kiona Creek, through this area, has been affected by past channel manipulations, road crossings, riparian clearing, and grazing. The current channel is incised (downcut), but initial incision occurred many decades ago, and in most places the channel has developed inset low surfaces as it attempts to re-establish a floodplain. However, these surfaces and the channel banks are dominated by reed canary grass; there is a lack of native woody vegetation on streambanks and in riparian areas; pools are shallow and uniform; the stream lacks complex habitat cover and large wood complexity; and stream gravels are embedded with fine sediments.

Restoration actions in lower Kiona would primarily include large wood additions and riparian vegetation enhancement. Large wood additions would increase habitat cover and complexity, increase pool scour and cover, help sort and retain gravels, and increase lateral channel dynamics such as split flow conditions. Increasing lateral channel dynamics would speed the channel evolution process, creating more inset floodplain surfaces and thus increasing floodplain connectivity. Wood additions that span the channel and collect bedload material would also help to aggrade the channel bed, further addressing floodplain disconnection. A forested riparian buffer would be established and planted with native species. Cattle would be excluded if and where necessary. These enhancements would primarily benefit coho spawning and rearing, and to a lesser extent steelhead spawning and rearing. Additional enhancements would include increasing the connectivity of alcove and floodplain wetland habitat in the prominent abandoned oxbow to the north midway through the reach. This may include select excavation to increase connectivity, large wood placements, and riparian revegetation. This would primarily benefit juvenile coho rearing, as well as flood refuge habitat for all salmonids. Additional work would include installation of log structures in the mainstem Cowlitz in and around the Kiona Creek confluence. These structures would not only increase mainstem habitat similar to the large wood enhancements in Alternative A, but would also increase habitat and therefore attraction to Kiona Creek for rearing.

Considerations for this alternative include examining the impacts to existing vegetation from construction, particularly in the oxbow wetland; evaluating the potential impact of flow reductions (or increases) that may result from Alternative B (Peters Creek re-alignment); and impacts to landowners and existing land-uses. This effort is scalable depending on available construction funding, final landowner participation, and access.

2.4 PREFERRED ALTERNATIVE

2.4.1 Description

The preferred alternative is a combination of several elements of the conceptual alternatives. The following elements are included in the Preferred Alternative.

- Mainstem habitat wood placements (as described in Alternative A), that will support juvenile rearing and adult holding of all species, including spring Chinook. These structures are not intended to be dynamic channel forming structures, rather localized habitat features. Considerations for boater safety will be taken into account during design and construction. This element would primarily support spring Chinook, coho, and winter steelhead juvenile rearing and adult holding.
- Peter's Creek re-alignment (as described in Alternative B) both in the sediment deposition zone near Peter's Road, and farther downstream. The current preferred alignment includes re-meandering the channel to connect with the existing oxbow wetland (as shown in the drawings in the appendix); however, this alignment will be vetted in future design phases with additional survey and modeling. This element will primarily support coho rearing and migration.
- Riparian and instream habitat enhancement along Kiona Creek and the oxbow wetland (as described in Alternative C), which would include the new Peters Creek alignment through the

oxbow wetland. This action will support all species and life stages that use this area of the river and floodplain habitat. It further supports long term riparian processes in the area, which can encourage natural channel evolution and habitat development in the future.

Landowners have been involved in a site visit and multiple conversations during the development of the project effort. They are supportive of continuing to move forward with designs. Their primary questions, concerns, and constraints include:

If Peters Creek is re-aligned, what additional maintenance may be required of them?

This question will be answered with an analysis of flooding and sediment dynamics in this channel segment.

Will the oxbow wetland increase backwater effects that will limit their hay fields or other operations?

This question will be answered with additional topographic survey and modeling.

Will mainstem wood jams increase predation by birds by providing perching habitat?

This concern will be discussed with local biologists, and will be mitigated by increasing the amount of slash placed in the structures. Additional slash will provide additional habitat cover for target salmonids.

In future design phases, details of the preferred alternative will be guided by specific design criteria that are developed from the project goals and objectives. Next steps include topographic survey, additional site reconnaissance, hydraulic modeling, and stakeholder outreach. Design intervals will include preliminary designs, permit-level designs, and final designs. All of these next steps will include additional discussions with landowners and permitting agencies for feasibility. Those elements that are deemed feasible will be designed and brought forward to construction once agreement is reached with landowners.

2.4.2 Alternatives considered but not selected

The following elements were described above, or were otherwise considered as elements of the conceptual alternatives, but were not selected for the following reasons:

Alternative A: Flow through side channel. This element was not selected because it was not compatible with current land uses. While a flow-through channel provides additional off-channel habitat, landowners were concerned about potential increased risks of channel migration, seasonal flooding, and access to various parcels.

Alternative A: Large channel-spanning jams. These were not considered feasible given concerns over potential for increased flooding or channel shifting, and also concern for river recreational user safety.

Alternative B: Several additional alignments were identified as physically possible for the re-route of Peters Creek that were not selected. Considerations included identifying the most cost-effective

areas to add channel length and complexity, only re-routing the channel in areas with willing and participating landowners, and identifying alignments that are compatible with current land uses.

2.4.3 Cost Estimate

Kiona Concepts Cost Estimate

Notes:
These are early concept planning level estimates
Cost estimates are for construction only and do not include administration, design, permititng, construction observation, or construction management

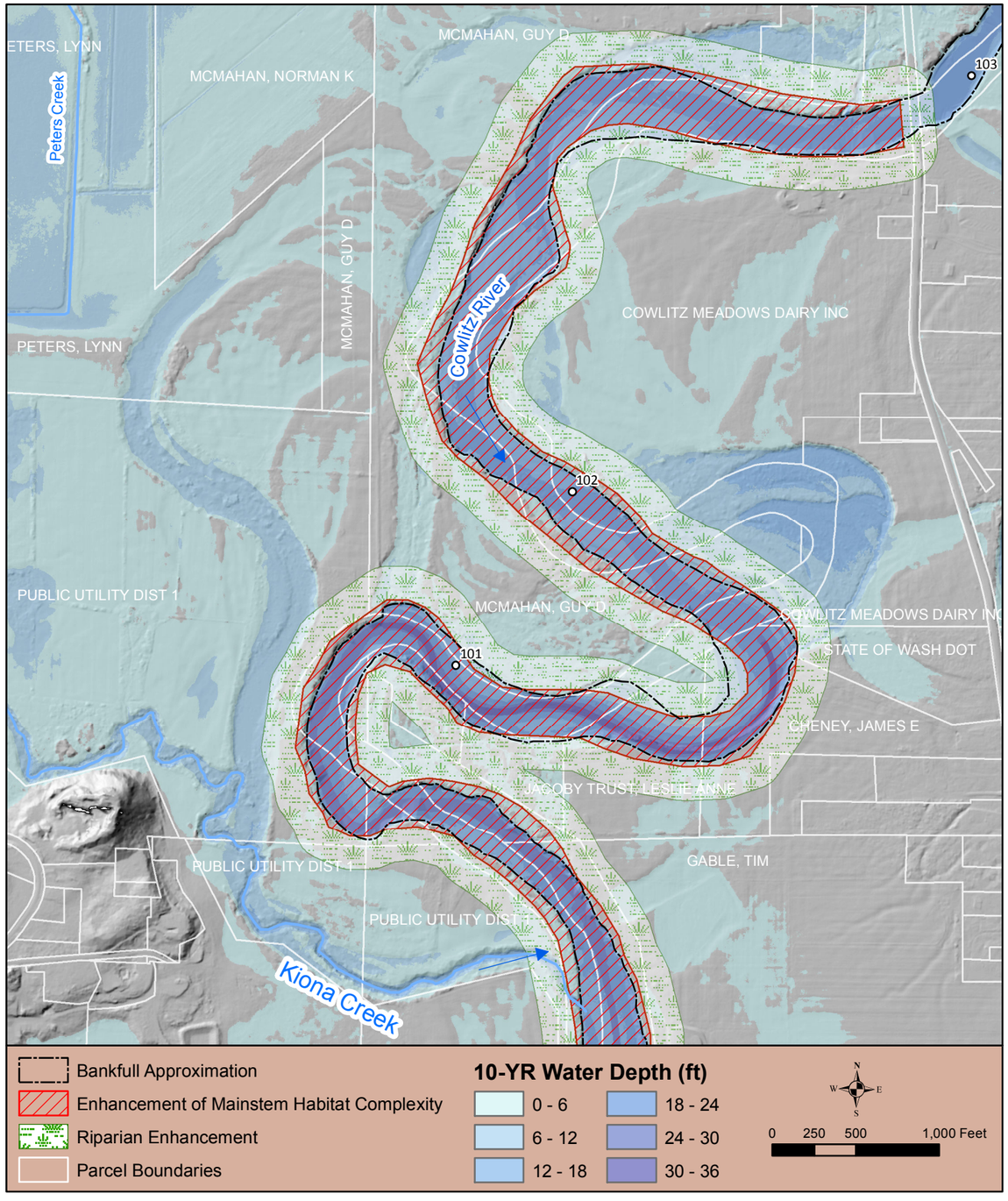
Location -overall assumptions are listed below each alternative. Other assumptions with respect to what is included are inherent in the list of Activities	Activity	Unit	Quantity	Cost	Total
Mainstem Cowlitz Enhancement	Primary large wood structures	Each	10	$120,000	$1,200,000
-assumes no off-channel habitat work	Smaller margin wood structures	Each	10	$24,000	$240,000
-assumes full length of study area treated	Mobilization (10%)	%	1	$144,000	$144,000
-assumes 5 jams/mi at 50 pieces/jam + 10 smaller structures					
-includes establishing access, worksite isolation, erosion control, grading	**Construction base costs**				$1,584,000
	WA State Taxes (7.8%)				$123,552
	Construction plus taxes				$1,707,552
Peters Creek Re-Alignment	Channel re-alignment, incl grading, dewatering	Lineal foot	4,000	$120	$480,000
-assumes re-alignment extends from upper Peters Road crossing to Kiona Cr. Connecting to oxbow wetlands would significantly reduce length/costs.	Cattle exclusion	Lineal foot	8,000	$6	$48,000
	Large wood furnish and install	Each	114	$1,200	$136,800
	Riparian enhancement	Acre	10	$12,000	$120,000
-assumes no alteration to Peters Road Crossings	Mobilization (10%)	%	1	$78,480	$78,480
-assumes large wood installed at 150 pcs/mi	**Construction base costs**				$863,280
-assumes full riparian replanting within 50 buffer	**WA State Taxes (7.8%)**				$67,336
	Construction plus taxes				$930,616
Lower Kiona Creek Enhancement	Large wood furnish and install	Each	280	$1,200	$336,000
-assumes large wood treatment along lower 1.6 miles of Kiona Creek and 0.3 miles of the oxbow wetland; 150 pcs/mile	Cattle exclusion	Lineal foot	3,000	$6	$18,000
	Riparian enhancement	Acre	20	$6,000	$120,000
-assumes 3,000 feet of cattle exclusion fencing	Excavation including haul, for oxbow connectivity	Cubic Yard	400	$48	$19,200
-assumes 50 foot buffer only needs partial riparian revegetation treatment	Mobilization (10%)	%	1	$49,320	$49,320
-assumes excavation only at lower end of oxbow wetland to enhance connectivity	**Construction base costs**				$493,200
	WA State Taxes (7.8%)				$38,470
	Construction plus taxes				$531,670
Total Estimate					**$3,169,837**

3 Appendix

APPENDIX A – CONCEPT DRAWINGS

Plan View

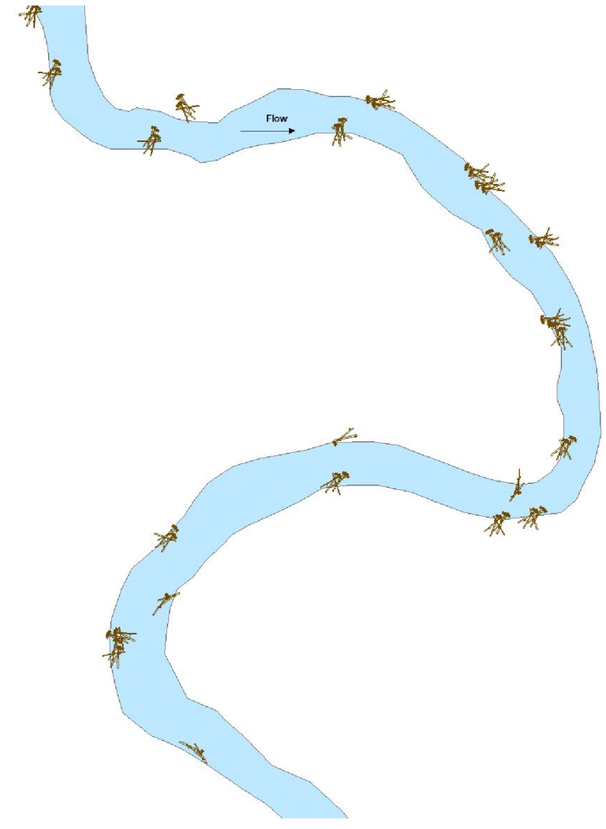
Location of Potential Main Channel Habitat Enhancements



Existing Conditions

Proposed Conditions

Mainstem Habitat Complexity - Typical



Example of Restored Condition

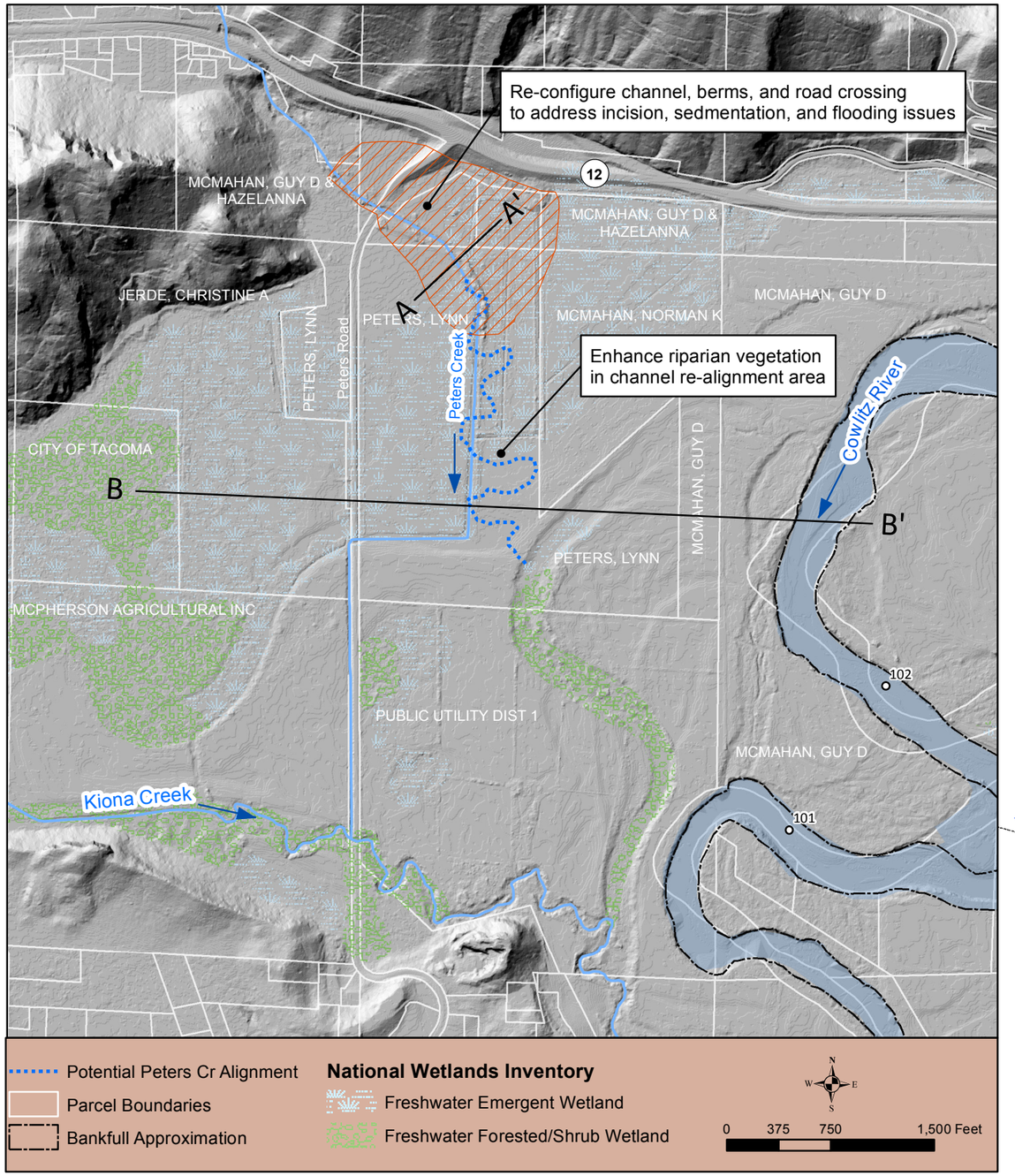
Alternative A
Cowlitz River Main Channel Enhancement

Upper Cowlitz & Cispus Strategy
Lower Columbia Fish Recovery Board
Upper Cowlitz River - Lewis County, WA

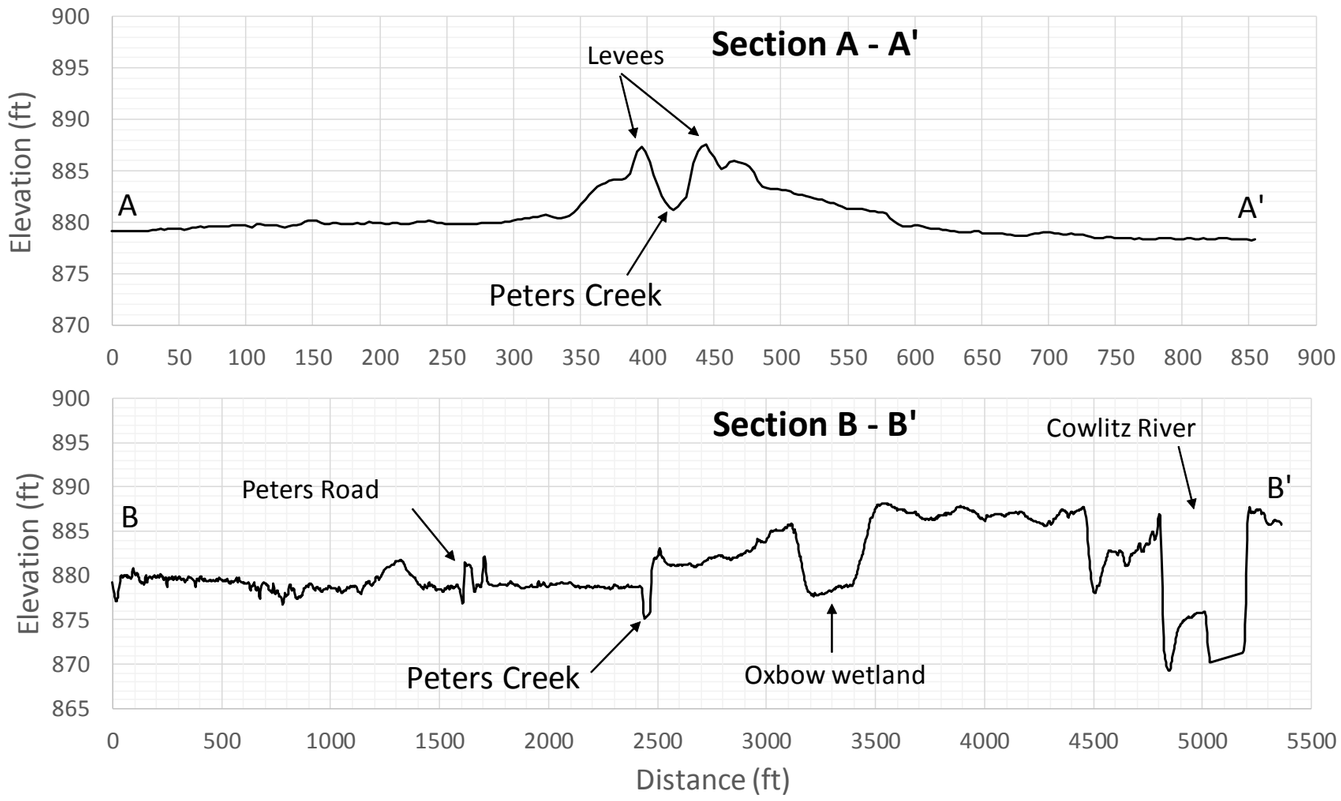
inter·fluve
501 Portway Ave, Suite 101
Hood River, Oregon 97031
www.interfluve.com
541.386.9003

Plan View

Location of Potential Peters Creek Re-Alignment & Enhancement

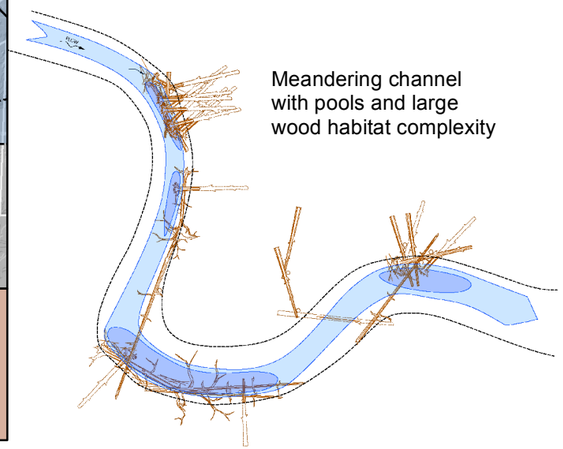


Existing Conditions



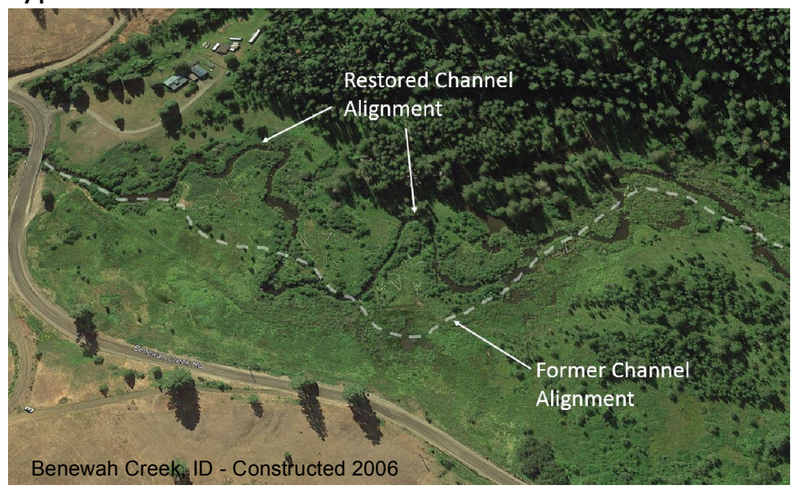
Proposed Conditions

New Constructed Channel



Example

Typical Restored Condition



Alternative B
Peters Creek Re-Alignment & Enhancement

Upper Cowlitz & Cispus Strategy
Lower Columbia Fish Recovery Board
Upper Cowlitz River - Lewis County, WA

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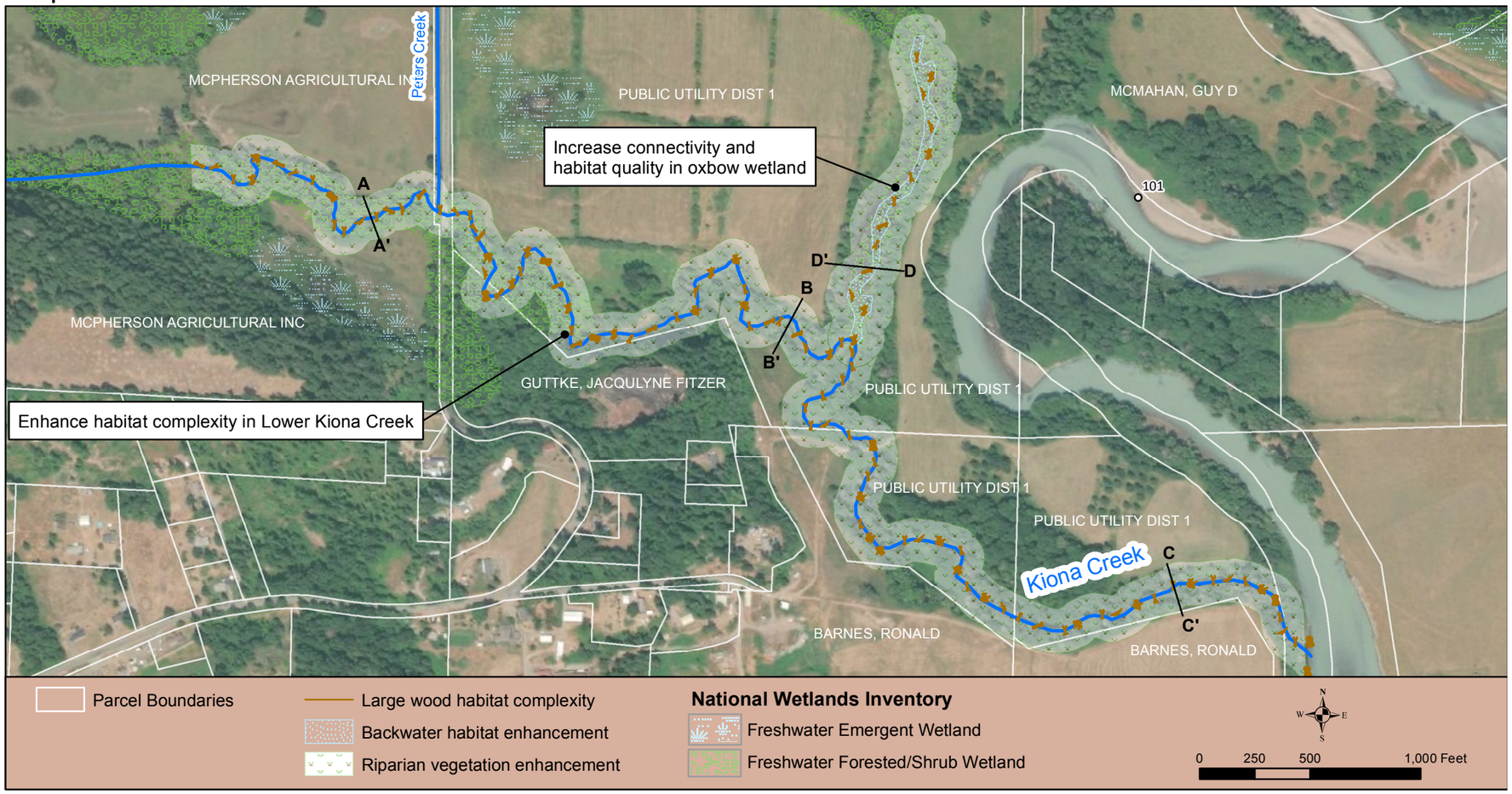
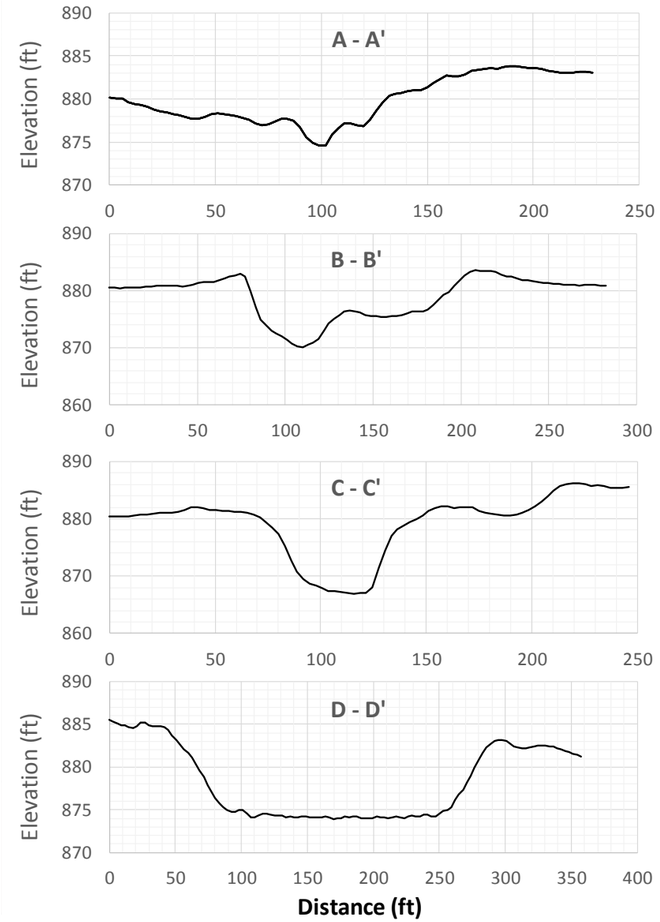
Plan View

Proposed Lower Kiona Creek Enhancements



Existing Conditions

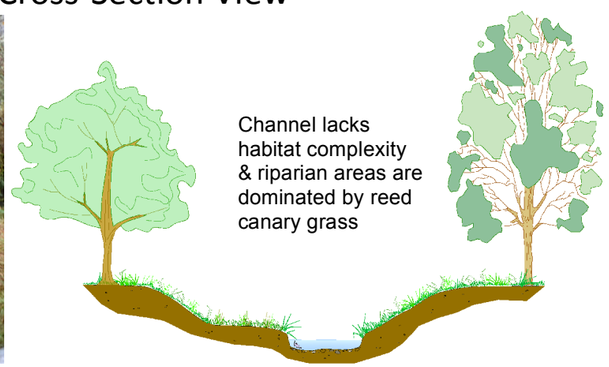
Channel Cross Sections



Existing Conditions

Lower Kiona Creek

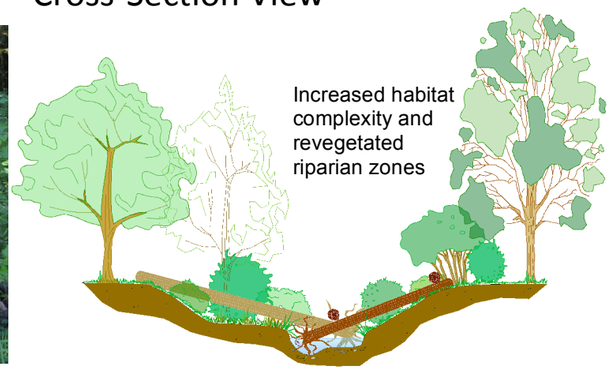
Cross-Section View



Proposed Conditions

Example Restored Condition

Cross-Section View



Alternative C
Lower Kiona Creek Enhancement

Upper Cowlitz & Cispus Strategy
Lower Columbia Fish Recovery Board
Upper Cowlitz River - Lewis County, WA

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