

APPENDIX D: POTENTIAL PROJECT OPPORTUNITIES

1 BACKGROUND

Potential habitat restoration project opportunities were identified throughout the study reach. The objective of the project identification exercise was to identify projects that address habitat limiting factors, with a focus on ESA-listed salmonids. Projects are designed to achieve the restoration targets identified in the Restoration Strategy (Section 4) and are developed in consideration of the geomorphic and hydraulic context of the site, which is based on the results of analyses conducted as part of this assessment.

Potential project opportunities were identified through a combination of methods, including: 1) field surveys of project opportunities, 2) discussions with agency personnel, 3) previous studies, and 4) remote sensing using aerial photography and LiDAR. Location information, general site conditions, and photographs were acquired for each project opportunity area.

Projects are named using their river mile location, with the approximate midpoint used for long projects. An “R” (right bank) or “L” (left bank) designation is included in the name if the project is predominantly oriented along one side of the river. Reference to river-left or river-right is always oriented facing the downstream direction. Potential feasibility constraints are included in the descriptions where the information was available and is applicable.

2 SUMMARY OF PROJECT OPPORTUNITIES




This effort identified sixty-one project opportunities within the study reach (19 miles). The spatial distribution and types of projects are a function of the condition of biophysical processes, the level of human disturbance, and observed site-specific opportunities to achieve restoration targets.



Numerous projects were identified in order to provide a viable suite of projects available for potential implementation. This ensures there is an adequate source of projects in case some projects are not able to be implemented due to landownership, access, or other constraints. This is an important consideration in the Upper Wenatchee study area because many projects are located along private lands and/or have challenging and remote access conditions.




This project list should be viewed only as an initial effort to identify potential projects. Selecting specific projects and moving them forward to the design stage will require additional survey, analysis, and alternatives evaluation at the site-scale. The Yakama Nation Upper Columbia Habitat Restoration Program utilizes a project prioritization approach in order to identify project areas that warrant further analysis. The prioritization approach takes into consideration many factors, including the degree to which potential projects will address habitat limiting factors, how well the project addresses root causes of observed problems, geomorphic considerations, and cost and feasibility issues.




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3 PROJECT OPPORTUNITY DESCRIPTIONS



Reach	Project Number	Project Name	Action Type	Description	Photo	
11	Project RM 53.85	Bridge pillar removal	Habitat reconnection via removal/modification of bank armoring, levees, roadways, or fill Riparian restoration	Abandoned bridge piers from decommissioned bridge still remain on both banks. Remove piers and revegetate disturbed area.		Abandoned bridge pilings on river-left.
11	Project RM 53.75	First Island	Placement of structural habitat elements including large wood, log jams, or boulders	A small vegetated island complex splits the flow at the first riffle, which serves as the hydraulic control for lake Wenatchee during low flow periods. There are a couple of large rootwads here currently. One or two apex log jams at the head of the island complex could enhance split flow conditions, complexity, and cover habitat. Existing piling structures may be able to be utilized for anchoring or removed as part of the project.		View from right-bank of existing 2 rootwads on small island complex.
11	Project RM 53.7R	Nason Confluence Upstream	Off-channel habitat enhancement	A series of flood overflow/distributary channel scars are located along the left bank of Nason Creek and extend down to the confluence area. There is an existing small backwater area that is connected to lower Nason at low flows. This could be expanded via excavation and enhanced with LWD. There is a longer flood channel that is only connected at high flows. This channel extends further upstream on Nason and could be excavated to enhance connectivity and potentially be configured to connect directly to the Wenatchee at the right bank alcove at RM 53.7.		Existing small backwater connecting to lower Nason Creek just above the confluence.




Reach	Project Number	Project Name	Action Type	Description	Photo	
10	Project RM 53.6R	Nason Confluence Downstream	Off-channel habitat enhancement	A series of flood overflow/distributary channel scars are located at the downstream end of the confluence area between Nason Creek and the highway. This formerly complex and dynamic delta area has been simplified due to the highway. This area may provide a good opportunity to create side-channel habitat that will no longer be created via natural channel dynamics. Existing channel depressions could be excavated to enhance seasonal availability of side-channel habitat. The dynamic deltaic environment would need to be considered for any projects conducted here. There may be a high chance of filling with sediment at the downstream end due to Nason Creek sediments.		
10	Project RM 53.65R	Lower Nason Jams	Placement of structural habitat elements including large wood, log jams, or boulders	Large wood meander jams could be placed along the left channel margin on lower Nason Creek just before the confluence. Jams could extend up to the sand bar on the river-left. Jams would enhance pool scour, create complex margin habitat, and provide rearing cover.		Lower Nason left-bank just upstream of the confluence. The small backwater described in Project RM 53.7R is just to the left of this photo.
10	Project RM 53.5R	Brae Burn Streambank Enhancement	Habitat reconnection via removal/modification of bank armoring, levees, roadways, or fill Placement of structural habitat elements including large wood, log jams, or boulders Riparian restoration	Numerous sections of riprap, masonry walls, and spur dikes serve to armor banks and reduce margin habitat complexity along the Brae Burn Road development area. Look for opportunities to work with landowners to enhance habitat by removal of hard armoring, replacement with LWD jams or other bio-engineering techniques, or enhancement through incorporation of wood material.		Example of riprap bank along this section.




Reach	Project Number	Project Name	Action Type	Description	Photo	
10	Project RM 53.4L	Alcove and Side-Channel Enhancement	Placement of structural habitat elements including large wood, log jams, or boulders	A small low flow alcove and high flow channel are located along the left bank at a riffle. An apex jam(s) could enhance split-flow conditions and enhance habitat complexity in the alcove.		View from upstream of left bank low flow alcove and high flow channel.
10	Project RM 53.1L	Midway Jams	Placement of structural habitat elements including large wood, log jams, or boulders	Place LWD meander jams on river-left. Jams would enhance pool scour, create complex margin habitat, and provide rearing cover.		View of project site from upstream.
10	Project RM 53L	Midway Backwater Enhancement	Off-channel habitat enhancement Placement of structural habitat elements including large wood, log jams, or boulders	A backwater area within the river-left floodplain is connected at high flows. Excavation could be used at the entrance to enhance connectivity and within the site to increase off-channel rearing capacity. Enhance with LWD.		View of existing shallow backwater area from near outlet.




Reach	Project Number	Project Name	Action Type	Description	Photo	
10	Project RM 52.8	Pirate Island	Placement of structural habitat elements including large wood, log jams, or boulders	An island splits flow with a small side-channel on river right. Potential treatments include an apex jam on the island and margin jams along the banks of the left channel. Jams along the right bank of the left channel could be used to force erosion/migration into the left bank, resulting in recruitment of mature cottonwoods. Houses are located along the river-right bank.		View of left bank of project area from upstream.
10	Project RM 52.7L	Chiwawa Jct Backwater	Off-channel habitat enhancement Placement of structural habitat elements including large wood, log jams, or boulders	A large backwater area is connected to the mainstem at all flow levels. Add LWD to the backwater area to enhance rearing cover and complexity.		Backwater area.
10	Project RM 52.45	Pirate Island II	Placement of structural habitat elements including large wood, log jams, or boulders	An island splits flow with a small side-channel on river right. Potential treatments include an apex jam on the island and margin jams along the banks of the left channel. Jams along the right bank of the left channel could be used to force erosion/migration into the left bank, resulting in recruitment of mature cottonwoods. Houses are located along the river-right bank.		Upstream view of river-left channel around island and mature forest in river-left floodplain.




Reach	Project Number	Project Name	Action Type	Description	Photo	
10	Project RM 52.3R	Natapoc Margin Jams	Placement of structural habitat elements including large wood, log jams, or boulders	Potential for meander bend log jams along the outside of the bend but also some good erosion and tree recruitment happening. Place log jams, or just single or bundled “key pieces” to mimic recruited trees, but also allow for or encourage bank erosion and future tree recruitment in areas. Consider placement of jams on inside of bend if additional erosion and recruitment is desired. This project closely relates to what happens at the Natapoc Project (Project RM 52R)		View looking downstream of river-right bank.
10	Project RM 52R	Natapoc Project	Off-channel habitat enhancement Placement of structural habitat elements including large wood, log jams, or boulders Riparian restoration	A large off-channel complex made up of historical meander scars in the river-right floodplain is only connected at high flows. There are multiple potential restoration and enhancement scenarios at this site, ranging from select excavation to enhance existing connectivity to larger-scale excavation and enhancement to create a connected flow-through side-channel. Potential connection points include near RM 52.33 and RM 51.65. A meander bend migration analysis at the bend at RM 52.3 would help to determine the appropriate approach.		View of Natapoc off-channel area.
10	Project RM 52.1L	Fish Lake Run Backwater	Off-channel habitat enhancement Placement of structural habitat elements including large wood, log jams, or boulders	A large backwater area is connected to the mainstem at all flow levels. Fish Lake Run Creek empties into the backwater area. Add LWD to the backwater area to enhance rearing cover and complexity.		View of backwater area.



Reach	Project Number	Project Name	Action Type	Description	Photo	
10	Project RM 52L	Mile 52 Colluvial Jams	Placement of structural habitat elements including large wood, log jams, or boulders	A steep, mostly vegetated bank extends along river-left but channel margin habitat is low. Construct jams that mimic existing “colluvial jams”, which consist of jams formed by collapse of large trees at top of bank. These jams form key members that collect fluvially-transported wood to form large complex jams.		View looking upstream of river-left bank.
10	Project RM 51.7	Natapoc Outlet Apex Jams	Placement of structural habitat elements including large wood, log jams, or boulders	There is a shallow gravel deposition area within the channel (right half) near the outlet of the Natapoc backwater channel. One or two bar apex jams here would create pocket pool scour and would be expected to create additional gravel deposition and island formation behind the jam(s), resulting in a split flow channel, increased margin habitat, and increased channel and habitat complexity.		View looking downstream at shallow submerged gravel deposit




Reach	Project Number	Project Name	Action Type	Description	Photo	
9	Project RM 51.2	Mosquito Alley Channel Complexity	Placement of structural habitat elements including large wood, log jams, or boulders Off-channel habitat enhancement	This project opportunity area is located along the straight section of channel between RM 50.9 and 51.5. The river-left side is a steep bank along a high terrace. The river-right side consists of a low, narrow, partially connected off-channel complex. There is the potential for a series (3-4) of “colluvial jams” along the left bank. Along the right bank, a series of bar apex jams and select excavation could be used to divert flow into the low surface and create connected side channel and off-channel habitats. Access can be obtained through USFS property and unsurfaced access roads.		View looking upstream from downstream of this project area. The low surface on the river-right bank is on the left side of this photo.
9	Project RM 50.9R	Mosquito bend Off-Channel and Complexity Enhancement	Off-channel habitat enhancement	On river right, at the outside of the left hand bend there is the potential for excavating a connected backwater area. This treatment could potentially be tied into work described for the right bank as part of the Mosquito Alley project. Large wood for cover could be placed at the inside of the bend in existing alcove habitat. There may be potential for installing “colluvial jams” on the steep bank on river-right just downstream of the bend. Access can be obtained from Beaver Valley Road and unsurfaced access roads.	 	View looking upstream from downstream of project area. The backwater area is located to the left of the photo at the inside of the bend. View of river right bank from downstream




Reach	Project Number	Project Name	Action Type	Description	Photo	
9	Project RM 50.5	Beaver Valley Rd Off-Channel and Complexity Enhancement	Placement of structural habitat elements including large wood, log jams, or boulders Off-channel habitat enhancement	This project opportunity area is located between RM 50.3 and 50.77. The river-left side is a steep bank along a high terrace. There are dispersed camping areas along the top of the terrace. There is the potential for a series (2-5) of “colluvial jams” along the left bank. On river-right there is a variable width low surface with occasional alcoves and wetland habitats. This site could be enhanced with additions of wood and jams for complexity along channel margins and with possible select excavation and apex jam construction that would encourage side-channel and off-channel development. The downstream end may have filling risk (with fine sediment) if backwaters are created. Access to the river-left side can be obtained through USFS property and unsurfaced access roads. Access to the river-right side can be gained off of Beaver Valley Road.		View looking upstream at river-left bank near RM 50.7.
						View of existing alcove habitat on river-right near RM 50.56.
9	Project RM 50.2L	Fifty-mile Side Channel	Off-channel habitat enhancement	This is a low terrace on river-left where relic channel scars could be connected as an active side-channel via excavation. Access can be obtained through USFS property and unsurfaced access roads.		Alcove near downstream end of project area (left bank)




Reach	Project Number	Project Name	Action Type	Description	Photo	
9	Project RM 50	Fifty-mile Log Jams	Placement of structural habitat elements including large wood, log jams, or boulders	Log jams could add complexity and contribute to lateral channel dynamics between RM 49.7 and 50.1. Locations include a meander bend jam on the right-bank at RM 50.03, just downstream of the high steep bank; meander bend jams on river-left downstream of the outlet of the potential fifty-mile side channel project; apex jams at the head of the mid-channel bar between RM 49.9 and 50; and meander bend jams along the river-left bank between RM 49.7 and 49.9. Access to the river-left side can be obtained through USFS property and unsurfaced access roads. Access to the river-right side is undetermined.		Mid-channel bar between RM 49.9 and 50 where an apex jam(s) could help maintain split flow and habitat complexity.
8	Project RM 49.5	Cottonwood Lane Habitat Complexity	Placement of structural habitat elements including large wood, log jams, or boulders	There is a long sequence of uniform pools and glides at the outside extent of the large bend at RM 49.5. Large wood pieces and complexes could be placed almost anywhere throughout this segment to enhance habitat cover and complexity. Houses along the river-left bank will affect access and feasibility.		
8	Project RM 49.3L	Cottonwood Lane Off-Channel Habitat	Off-channel habitat enhancement Riparian restoration	There is a cleared low surface on river-left at RM 49.3 just upstream of the hatchery intake. There is an actively eroding low bank at the river with immature shrub vegetation. A backwater area could be excavated at this site to provide connected off-channel rearing habitat. Large wood could be added for cover and complexity within the backwater area and along the mainstem channel margin. There is good access off of Cottonwood Lane. Landownership is the Chiwawa Community Association.		Photo of cleared low surface area along river-left bank near RM 49.3.




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8	Project RM 49.2	Intake Island Log Jams	Placement of structural habitat elements including large wood, log jams, or boulders	Just downstream of the hatchery intake there is a mid-channel island. On the river-right bank there is existing alcove habitat. Large wood and log jams could be placed in the alcove to enhance cover and complexity. Wood could also be placed on the left bank of the river-left channel around the island. Apex jam(s) could be considered on the island but potential impacts to the nearby hatchery intake structure would need to be evaluated. Access would be from Cottonwood Lane for left bank work and access is unknown along the right bank.		View looking upstraeam at island complex near RM 49.2.
8	Project RM 49.1L	Intake Island Off-Channel Habitat	Off-channel habitat enhancement Placement of structural habitat elements including large wood, log jams, or boulders	There is an existing channel scar and connected wetland/alcove area on the river-left bank that outlets near RM 49.1. This off-channel area could be enlarged and enhanced by adding large wood complexes for cover and complexity. Access would be obtained from Cottonwood Lane. Federal property.		Left bank off-channel area near RM 49.1.
8	Project RM 48.85L	Chiwawa Fan Island Off-Channel Habitat	Off-channel habitat enhancement	There is an existing small alcove and channel scar outlet on the river-left bank near RM 48.8. This could be enlarged as a connected backwater channel, and could potentially be connected up with Project RM 49.1. Access is via federal land off of Cottonwood Lane.		View of outlet area of potential off-channel project area on river-left near RM 48.8.




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8	Project RM 48.8	Chiwawa Fan Island Jams	Placement of structural habitat elements including large wood, log jams, or boulders	There is a mid-channel bar at RM 48.8. An apex log jam(s) here would help to maintain and enhance split flow conditions and habitat complexity. The river-right bank is a high sand terrace that would be a potential site for channel margin “colluvial jams” to enhance pool scour and habitat cover. Access to the left bank is via federal land off of Cottonwood Lane. Access to the right bank is via federal land off of Beaver Valley Road.		View looking upstream at mid-channel bar near RM 48.8.
8	Project RM 48.6L	Chiwawa Jct Jams	Placement of structural habitat elements including large wood, log jams, or boulders	There is opportunity for increasing channel margin habitat on river-left in this long uniform glide. Individual wood pieces and/or log jams could be placed along the channel margin to encourage local pool scour and to increase habitat cover and complexity.		View looking upstream at river-left bank from near RM 48.5.




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7	Project RM 48.3L	Riparian and Streambank Restoration	Riparian restoration	There is a cleared riparian and streambank area along the river-left bank associated with a streamside residence. Re-plant with native riparian forest vegetation and streambank shrubs and trees. Wood could be added for interim stability along the eroding streambank.		View of river-left bank (cleared riparian and eroding streambank) near RM 48.3.
6	Project RM 47.6L	Schugart Flat Levee Removal and Riparian Enhancement	Habitat reconnection via removal/modification of bank armoring, levees, roadways, or fill Riparian restoration	There is a push-up levee along the river-left bank that extends from near RM 47.5 upstream to the Chelan County gravel pit at RM 47.75. The levee is small (<4 ft average height) and discontinuous but it likely impairs floodplain inundation rates and patterns. Look for opportunities to remove or selectively breach the levee. Riparian buffer width could be expanded in the area of the county gravel pit. County and private property protections are potential constraints with this project.		Aerial photo of county gravel pit near Schugart Flat.
5	Project RM 45.8L	Gravel Pit Colluvial Jams	Placement of structural habitat elements including large wood, log jams, or boulders	There is a high bank on river-left adjacent to a Chelan County gravel pit. Riparian conditions on the slope and at the top of the bank are degraded and are in a cleared or early seral stage condition. There are opportunities here to create “colluvial” jams to mimic jams that would have formed historically through riparian tree recruitment from slope failures.		Example of a natural “colluvial” jam from a site further upstream near RM 48.8.




Reach	Project Number	Project Name	Action Type	Description	Photo	
5	Project RM 45.1R	45-Mile Margin Jams and Riparian Enhancement	Riparian restoration Placement of structural habitat elements including large wood, log jams, or boulders	On river-right there is a high unvegetated eroding bank that extends from RM 45.3 to RM 45.15. Riparian restoration work on the bank and at the top of bank would enhance long term riparian processes. Channel margin “colluvial” jams could be placed to enhance margin habitat complexity. There is a good location for a meander bend jam further upstream on the right bank near RM 45.28. There is opportunity for riparian enhancement at this location as well. This area is private land and there are nearby houses.		View of cleared river-right bank at RM 45.1
						Location of potential meander-bend jam on river-right near RM 45.28
5	Project RM 44.9L	Camp 12 Apex Jam	Off-channel habitat enhancement Placement of structural habitat elements including large wood, log jams, or boulders	There is an opportunity to enhance activation of a left-bank side channel at the bend near RM 44.9. An apex log jam on the existing bar would create a split flow condition and would enhance lateral channel dynamics as well as instream cover and complexity. There is bedrock (conglomerate) just downstream of the project site. Private land.		Upstream view of left bank project area and existing shallow gravel bar.



Reach	Project Number	Project Name	Action Type	Description	Photo	
5	Project RM 44.3	Powerline Riparian and Margin Habitat Enhancement	Placement of structural habitat elements including large wood, log jams, or boulders Riparian restoration	<p>Just downstream of the powerline crossing (RM 44.4) and extending downstream to RM 44.13, there are potential sites for channel margin and riparian enhancement. Potential log jam sites to enhance local pool scour, habitat complexity, and cover include: 1) on river-left where an existing house-sized boulder could be utilized to help ballast a large jam, 2) on river-right near RM 44.35 (1-2 jams), 3) “colluvial” jams along the tall bank on river-left from RM 44.1 to RM 44.3, and 4) a bar apex jam on river-right near RM 44.2 to enhance side-channel activation.</p> <p>There are also opportunities for riparian work on both sides of the stream. There is a narrow riparian buffer on river-right (ag fields) and riparian clearing along river-left associated with residential development in the Ponderosa Estates community.</p>		Upstream view of river-left bank and house-sized boulder near RM 44.4.
						Residential impacts to riparian conditions in the Ponderosa Estates development.
5	Project RM 43.7R	River Road Channel Margin Enhancement	Habitat reconnection via removal/modification of bank armoring, levees, roadways, or fill Riparian restoration	There is discontinuous riprap and rock spurs along River Road along the river-right bank. Look for opportunities to modify bank armoring to include bioengineering approaches and log jams. There are good meander bend log jam opportunities through here (4-6 jams total, between riprap sections) that would enhance local pool scour, cover, and complexity.		View of riprap bank along river-right near RM 43.8.




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5	Project RM 43.5L	Ponderosa Estates Riparian and Channel Margin Enhancement	Habitat reconnection via removal/modification of bank armoring, levees, roadways, or fill Riparian restoration	There is streamside residential development (Ponderosa Estates community) extending along the left bank from upstream of RM 44.1 down to RM 43.2. Many of the homes have clearing of riparian vegetation and rock or concrete walls to protect banks from erosion. Look for opportunities to enhance riparian conditions and to restore bank margin complexity through removal/modification of bank armoring or replacement with bioengineering approaches.		View looking downstream at left bank residential development near RM 43.6.
5	Project RM 43.2L	Riata Bend Enhancement	Placement of structural habitat elements including large wood, log jams, or boulders Off-channel habitat enhancement	At the outside of the bend at RM 43.15, there is good opportunity for using log jams to increase lateral channel dynamics and to enhance pool scour, cover, and complexity. Meander bend jams could be placed along the left bank and could potentially be anchored to existing boulders in the channel. There may also be opportunities for excavation of alcove habitat at this bend. Right bank log jams could be placed for cover and complexity.		Upstream view of river left bend near RM 43.1.
4	Project RM 42.9	Mule Tail Flats Log Jams	Placement of structural habitat elements including large wood, log jams, or boulders	This area extends from RM 42.8 to RM 43.05. There is a series of gravel bars that offer a good opportunity for construction of bar apex log jams that would enhance lateral channel dynamics, split flow conditions, and improve local pool scour, cover, and habitat complexity. There are also opportunities for meander bend jams along the left bank from RM 42.8 to 42.9. Access would be through private lands from Mule Tail Flats Road.		View looking downstream at gravel bar complex near RM 42.9.

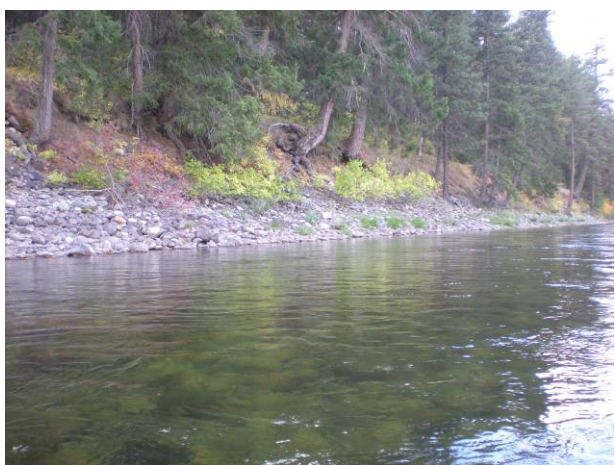


Reach	Project Number	Project Name	Action Type	Description	Photo	
4	Project RM 42.7L	Primitive Park Alcove Enhancement	Placement of structural habitat elements including large wood, log jams, or boulders Off-channel habitat enhancement Riparian restoration	There is existing small alcove habitat on river left between RM 42.65 and RM 42.73. Adding individual pieces and small log jams would enhance cover and complexity. There is also opportunity for riparian restoration in this area.		View of river-left bank near RM 42.7.
4	Project RM 42.4L	Primitive Park Apex Jams	Placement of structural habitat elements including large wood, log jams, or boulders	There is an island complex along the left bank between RM 42.4 and 42.5. These offer good opportunities for bar apex log jams that would enhance lateral channel dynamics, split flow conditions, and habitat complexity and cover. Meander bend jams along the left bank could also be beneficial here.		View looking downstream at island complex between RM 42.4 and 42.5.
4	Project RM 42.3L	Primitive Park Side Channel Enhancement	Habitat reconnection via removal/modification of bank armoring, levees, roadways, or fill Off-channel habitat enhancement Riparian restoration	There is potential side-channel reconnection potential along the left bank through the low surface extending from RM 42.2 to 42.45. Private lands prevented full field inspection of this surface but LiDAR suggests there has been fill placed in a channel scar and that this feature could be restored as a side-channel; either a flood flow channel or possibly an active low flow channel.		View looking downstream at left bank at potential upstream entry point for side-channel (near RM 42.5).



Reach	Project Number	Project Name	Action Type	Description	Photo	
4	Project RM 42.1R	Railroad Bridge Apex Jams	Placement of structural habitat elements including large wood, log jams, or boulders	There is a shallow gravel bar along river-right upstream of the railroad bridge. Bar apex jams could enhance lateral channel dynamics, split flow conditions, and habitat complexity and cover. Meander bend jams could be placed along the right bank downstream of the gravel bar to enhance local pool scour, complexity, and cover.		View looking upstream at gravel bar on river-right bank and location for potential apex and meander bend jams near RM 42.1.
4	Project RM 41.9R	Railroad Bridge Channel Margin Enhancement	Placement of structural habitat elements including large wood, log jams, or boulders Riparian restoration	There is a long, discontinuous riprap bank and cleared riparian area that extends upstream and downstream of the railroad bridge (RM 41.8 to RM 42). There are opportunities to construct meander bend “colluvial” jams at the base of the bank to enhance pool scour and habitat cover and complexity. Restore riparian vegetation on the bank and on top of bank. Remove or modify riprap where possible to utilize natural materials (e.g. wood) and bioengineering approaches to maintain stability.		View looking downstream at river-right bank at railroad crossing near RM 41.9.
3	Project RM 41.7R	Meacham Road Side Channel Enhancement	Habitat reconnection via removal/modification of bank armoring, levees, roadways, or fill Off-channel habitat enhancement Riparian restoration	There is a side-channel on river-right downstream of the railroad bridge. There is a large bar apex jam on the island apex forming the side channel. The river-right bank within and downstream of the side-channel is armored with concrete and rip-rap, which extends from RM 41.8 to 41.5. Look for opportunities to remove or modify bank armoring and to enhance margin complexity. Log jams could be placed throughout this side-channel and along the channel margin downstream. There are private residences close by. Many of these parcels could also benefit from riparian restoration, where possible.		View looking downstream within side-channel near RM 41.8.




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3	Project RM 41.5L	Wenatchee Pines Off-Channel Habitat Enhancement	Off-channel habitat enhancement Placement of structural habitat elements including large wood, log jams, or boulders	There is a low floodplain surface on river left prior to the sharp bend at RM 41.5. There is the potential here for development of off-channel habitat. The surface is likely too high for reasonable excavation of a connected flow-through side-channel, but there may be the possibility of a connected backwater extending upstream from the downstream end. There are also opportunities for meander bend jams along the left bank at the upstream and downstream ends of this project area.		View looking downstream at river-left bank at low surface where there is the potential for backwater channel development (RM 41.5).
3	Project RM 41.3L	RM 41.3 Meander Bend Jams	Placement of structural habitat elements including large wood, log jams, or boulders	There is a good location to construct one or two meander bend jams on river-left near RM 41.3 to enhance pool scour, cover, and complexity. There is an existing rootwad to build off of.		View looking upstream at river-left bank at existing rootwad near RM 41.3.
3	Project RM 41.1	RM 41.1 Side Channel Enhancement	Off-channel habitat enhancement Placement of structural habitat elements including large wood, log jams, or boulders	There is an existing high flow side-channel along river left between RM 41.1 and 41.2. Select excavation, particularly at the upstream end, combined with a bar apex jam, could activate this side channel at lower flows. There is also the potential for a meander bend jam on the left bank downstream of the side-channel outlet.		View of side-channel near RM 41.2.




Reach	Project Number	Project Name	Action Type	Description	Photo	
3	Project RM 41L	RM 41 Jams	Placement of structural habitat elements including large wood, log jams, or boulders	There is a good location for a bar apex jam on an existing shallow gravel bar near RM 41 that would enhance lateral channel dynamics, split flow conditions, and improve local pool scour, cover, and habitat complexity. There are also good locations for 1 or 2 meander bend jams downstream along the left bank at the outside of the bend.		View looking downstream at left bank at potential bar apex and meander log jam locations near RM 41.
3	Project RM 40.8R	Meacham Flats Off-Channel Enhancement	Off-channel habitat enhancement	There is an existing alcove and side-channel on river-right at the outside of the bend at RM 40.8. This may be a good location to create a groundwater-fed channel that extends up-valley across the large Meacham Flats bar. Channel scrolling features visible on the LiDAR suggest the presence of hyporheic flow across the bar that could supply a groundwater channel. Additional investigation (groundwater monitoring) would be needed. An investigation of the location of bedrock would also assist with determining whether the necessary channel elevations could be achieved. This site offers a good opportunity for creating off-channel habitat because residential development and associated bank armoring along the upstream meander bend will prevent natural river processes from creating off-channel habitat on its own.		View of river-right bank at bend at RM 40.8.

Reach	Project Number	Project Name	Action Type	Description	Photo	
3	Project RM 40.6R	High Valley US Riparian & Margin Habitat Enhancement	Habitat reconnection via removal/modification of bank armoring, levees, roadways, or fill Riparian restoration	The river-right bank from RM 40.25 to RM 40.75 is dominated by riprap, rock spurs, and degraded riparian vegetation conditions associated with River Road and residential development. Look for opportunities to remove or modify riprap using log jams and bioengineering approaches to streambank stabilization. Replant riparian areas where possible.	 	<p>Oblique aerial view of river-right bank with riprap and rock spurs near RM 40.7.</p> <p>View looking downstream at ripraped river-right bank near RM 40.7.</p>
3	Project RM 40.5L	RM 40.5 Alcove Enhancement	Off-channel habitat enhancement Placement of structural habitat elements including large wood, log jams, or boulders	There is an existing alcove on river-left at the outside of the bend at RM 40.5. Wood could be added to the existing alcove to enhance habitat cover and complexity. There may be additional potential off-channel work on this low surface but the surface is relatively high and there is a lot of bedrock; further investigation would be necessary to evaluate additional off-channel potential.		View looking upstream at river-left alcove/backwater at RM 40.5.

Reach	Project Number	Project Name	Action Type	Description	Photo	
3	Project RM 40.4L	RM 40.4 Meander Bend Jams	Placement of structural habitat elements including large wood, log jams, or boulders	There is a good opportunity for 1-2 meander bend log jams along the river-left bank near RM 40.4. The existing habitat lacks channel margin complexity. Jams would increase pool scour, cover, and complexity. Access may be difficult and may have to be obtained from across the river.		View of river-left bank near RM 40.4 that lacks channel margin complexity.
3	Project RM 40L	RM 40 Meander Bend Jams	Placement of structural habitat elements including large wood, log jams, or boulders	There is a good opportunity for several meander bend log jams along the river-left bank between RM 39.9 and 40.2. The existing habitat lacks channel margin complexity. Jams would increase pool scour, cover, and complexity. Access may be difficult and may have to be obtained from across the river.		View of river-left bank near RM 40 that lacks channel margin complexity.
3	Project RM 39.7R	High Valley DS Riparian & Margin Habitat Enhance	Habitat reconnection via removal/modification of bank armoring, levees, roadways, or fill Riparian restoration	The river-right bank from RM 39.5 to RM 39.9 is dominated by riprap, rock spurs, and degraded riparian vegetation conditions associated with streamside residential development. Look for opportunities to remove or modify riprap using log jams and bioengineering approaches to streambank stabilization. Replant riparian areas where possible.		Oblique aerial view at river-right bank and residential development near RM 39.7.

Reach	Project Number	Project Name	Action Type	Description	Photo	
3	Project RM 39.6L	RM 39.6 Off-Channel Enhancement	Off-channel habitat enhancement Placement of structural habitat elements including large wood, log jams, or boulders	There is an existing side-channel and alcove habitat on the left bank between RM 39.5 and RM 39.7. Wood jams could be added to these existing off-channel areas to enhance local pool scour, cover, and complexity. Mainstem wood placements in this area would be challenging given the high stream energy at this location.		Existing alcove habitat on river-right near RM 39.7.
3	Project RM 39.4L	RM 39.4 Meander Bend Jams	Placement of structural habitat elements including large wood, log jams, or boulders	There is a good opportunity for 1-3 meander bend log jams along the river-left bank between RM 39.3 and 39.5. The existing habitat lacks channel margin complexity. Jams would increase pool scour, cover, and complexity. Access may be difficult and may have to be obtained from across the river.		Oblique aerial view looking downstream near RM 39.4. The project opportunity area is along the left bank upstream of the left-hand bend in the river.

Reach	Project Number	Project Name	Action Type	Description	Photo	
3	Project RM 39.3R	Zimmerman Off-Channel and Mainstem Enhancement	Off-channel habitat enhancement Placement of structural habitat elements including large wood, log jams, or boulders	There is a large gravel bar and existing backwater/alcove near RM 39.2 at the crux of the bend. One option here includes excavating additional backwater habitat along the hillslope/terrace toe at the inside of the bend; however, due to the high rate of observed sediment deposition in this area, there may be a risk of filling with sediment over time. There is also the potential for creating a groundwater-fed channel within this floodplain surface that extends up to near the main channel at RM 39.5. More investigation is needed to evaluate groundwater flow potential. On the large existing gravel bar, there is the potential to create active split flow conditions through construction of a bar apex jam on the bar and other wood placements for bar roughness.	 	<p>Oblique aerial view looking downstream at project area near RM 39.3.</p> <p>Existing low water backwater at crux of bend near RM 39.2.</p>
	Project RM 39L	Tunnel Alcove Enhancement	Off-channel habitat enhancement Placement of structural habitat elements including large wood, log jams, or boulders	This is a high flow side-channel between RM 38.9 and 39 that has a small low water alcove at the downstream end. Wood could be placed for cover habitat within the alcove. Excavation and a bar apex jam at the top end could also be considered to establish a low-flow active side-channel here; although there may be filling risk because of the relative difference in gradient compared to the mainstem. Access may have to be gained from across the river.		Upstream view of alcove at downstream end of river-left high flow side-channel near RM 38.9.

Reach	Project Number	Project Name	Action Type	Description	Photo	
3	Project RM 38.9R	Deadhorse Island Side-Channel Enhancement	Off-channel habitat enhancement Placement of structural habitat elements including large wood, log jams, or boulders	This large mainstem side-channel presents a good opportunity for placement of log jams within the active channel that are out of the way of river recreationists. Wood placements could be conducted throughout the side-channel. Upstream of the island along the river-right bank are good locations for wood jams to enhance cover habitat and complexity. Bar apex jams could be placed on the bar at the apex of the island although there are existing jams in this area. Bar apex jams could also be considered for the mainstem gravel bar at the downstream end near RM 38.7. Jams here would enhance split flow conditions, pool scour, cover, and complexity. Potential access from closed forest road along river-right.		Outlet of river-right mainstem side-channel near RM 38.7.
1-2		Protect and Maintain	Protect and maintain	Protect and Maintain is the highest priority action for the lower two reaches. These reaches are in relatively healthy condition and are within US Forest Service lands. There are multiple split flow conditions and abundant side-channel and off-channel habitats. Channel margin habitat is high quality, with overhanging riparian vegetation and high complexity. There are log jams and other wood pieces. Riparian areas are in more mature seral stages compared to upstream areas and are on a trajectory towards late seral conditions where they will eventually be able to provide adequate shade and LWD recruitment. There is abundant and high quality spawning habitat within pool tail-outs, riffles, and glides.		Oblique downstream aerial view of Reach 2 near RM 36-37.
1-2		Key Piece Supplementation	Placement of structural habitat elements including large wood, log jams, or boulders	A potential project opportunity identified for these lower reaches is to add large key pieces of wood that would be available to initiate log jam formation and enhance lateral channel dynamics, pool scour, cover, and complexity. The very large key pieces needed to form log jams are much less abundant than historical conditions and it is believed that re-introducing key pieces would create a positive habitat response by collecting additional wood, sorting sediment, and providing direct habitat benefits. Access is difficult so key pieces would likely have to be flown in and placed by helicopter. In some areas, existing access roads may be able to be utilized.		Example of bar in Reach 1 where large key pieces would help to encourage jam formation, island development, and split flow conditions.

