East River: Assessment and Restoration Plan

Written by the Kalispel Tribe of Indians

in collaboration with the Priest River Watershed Group

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A Process-Based Assessment for the East River Watershed

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Introduction and Restoration Framework

Effective restoration requires a process by which the results of watershed assessments and monitoring are used to prioritize projects. Our approach has been modeled after an approach adopted by Coeur D'Alene Tribe (Firehammer et al. 2011) that connects watershed analysis and monitoring through 1) setting clear goals and objectives for restoration activities, 2) selecting a prioritization scheme that is consistent with the goal, 3) using watershed assessments to identify restoration actions, and 4) prioritizing the list of actions (Figure 1). The restoration goal for the East River Watershed will be to address impairments to habitat forming processes and hydrologic connectivity and climate resilience through promotion of environmental variability and spatial heterogeneity (see Beechie et al. 2012 for project types that address future peak and low flows and temperature).

Effective planning, design, and implementation of aquatic habitat restoration efforts require an understanding of how watershed processes drive the structure and functions of riverine ecosystems, as well as how those processes support a wide variety of ecosystem services (Roni and Beechie 2013). Watersheds are hierarchical in nature (Figure 2), with channel slope and valley constraint being the "master variables" that control the range of channel types seen on the landscape. Sediment supply and runoff processes operate at the watershed scale and largely determine stream size and channel form (e.g., pool-riffle, plane bed, step pool, etc.), within the limits set by valley confinement and channel slope. Wood supply, root strength, and shade operate at the reach scale and can change channel form and create or modify habitat. Wood can be as important a control on channel morphology as sediment; most forested or historically forested watersheds have vegetation or wood-driven morphologies (Kramer and Wohl 2017). The availability of large riparian wood and the recruitment of large wood into the stream are both critical for development and maintenance of multiple anabranching channels (Montgomery and Abbe 2006). Healthy riparian forest also provides shade to the stream, which maintains or lowers water temperature, and contributes food and nutrients to the aquatic ecosystem.

Restoring hydrologic connectivity (longitudinal, lateral, and vertical) typically improves both physical and biological functions of river systems. Restoring longitudinal connectivity for aquatic species is

primarily intended to reestablish fish migration to diverse habitats that have been lost through construction of artificial barriers such as dams or culverts, but it often also restores downstream transport of essential flows, sediment, and wood or organic matter. Restoring lateral connectivity generally refers to reconnection of rivers to their floodplains by removing levees or removing bank armoring. These actions restore the ability of the river system to create and sustain diverse habitats and to allow migration of aquatic organisms into those habitats. Actions that aim to restore vertical connectivity seek to aggrade incised or scoured channels, which increases the connection between surface and subsurface flows and increases floodplain connectivity over time (Beechie et al. 2012).

The purpose of this watershed assessment was to delineate the geologic and topographic features that define channel types (i.e., the litho-topographic template, see Montgomery 1999), quantify the major aquatic habitat-forming processes (sediment supply, flow, and wood) using a budgeting approach when possible (Beechie et al. 2010) and identify process impairments and potential conservation and restoration actions in the East River Watershed. The ultimate intent of this assessment is to identify conservation and restoration actions that result in a self-maintaining functional ecosystem that is appropriate given the current and future flow, sediment, and wood regime.

Watershed Description

The East River Watershed is located on the western edge of the Selkirk Mountains, between the Okanogan Highlands landform province to the west and the Rocky Mountain trench to the east. It is approximately 20 kilometers northwest of Sandpoint, Idaho and is within the Priest River subbasin, flowing into the Priest River downstream of Priest Lake. The watershed is approximately 176 km^2 in size (Figure 3). Lands within the watershed are primarily state and federally managed, with a very small percentage of privately owned lands scattered throughout. The northernmost portion of the watershed was burned by wildfire in 1965. No other largescale wildfires have occurred within the watershed in recent years. Current uses of land within the watershed are primarily timber harvest and outdoor recreation. The US Forest Service operates the Priest River Experimental Forest in the southwest portion of the watershed, which includes Canyon Creek. This research area was established in 1911 and is used for research on fire behavior, silviculture methods, and other forestry related topics.

The watershed contains two subwatersheds: East River/Middle Fork East River and North Fork East River. North Fork East River drains the northern and western portions of the watershed and includes the tributaries of Lost and Race creeks. Middle Fork East River drains the central, eastern, and southern

portions of the watershed and includes East River itself and Canyon, Tarlac, Uleda, Devils, Chicopee, and Keokee creeks.

Most of the soils in the East River Watershed are members of the Vay, Hun, and Bonner map units (NRCS, 2024). Soils in these map units are deep, well drained, formed in glacial till mantled with volcanic ash and loess, and are silt loam to loam in texture.

Average annual precipitation within the watershed varies and tends to increase with elevation. Lowland areas receive approximately 60 to 90 cm of precipitation a year, which increases to 115 cm annually along the top of the watershed. Runoff is snowmelt dominated with base flow occurs during the summer and early fall months when there is little to no precipitation outside of the occasional thunderstorm.

Tree composition throughout the watershed is largely defined as “Northern Rocky Mountain Mesic Montane Mixed Conifer Forest” or “Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest” depending on slope steepness, aspect, and soil moisture. The valley bottoms are primarily classified as “Northern Rocky Mountain Lower Montane Riparian Woodland” (LANDFIRE.gov). These compositions consist primarily of Douglas fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), and western red cedar (*Thuja plicata*) in the riparian areas with ponderosa pine (*Pinus ponderosa*) and lodgepole pine (*Pinus contorta*) being commonly found in the upland areas.

Fish are found throughout the East River Watershed, though species composition varies depending on location (Olson and Andersen, 2006). Native Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi)* and Bull Trout *(Salvelinus confluentus)* are found throughout the watershed, though in lower numbers than non-native Eastern Brook Trout (*Salvelinus fontinalis*) and Brown Trout (*Salmo Trutta*). Mountain Whitefish (*Prosopium williamsoni*) and sculpin (Cottus Ssp.) are also common in the watershed.

Methods

Valley Confinement, floodplains, and channel segment types

The Valley Confined Algorithm (VCA) developed by Nagel et al (2014) and available at https://www.fs.fed.us/rm/boise/AWAE/projects/valley_confinement.shtml, was used to identify valley reaches. This algorithm defines confined and unconfined areas using stream and landscape characteristics such as ground slope, valley width, and flood height. Channel segment types were identified from habitat surveys conducted by the Kalispel Tribe and U.S. Forest Service (unpublished data), and stream channel characterization work performed by Beechie and Imaki (2014). We then used

the channel response matrix from Washington Department of Natural Resources (WDNR) (2011) to infer dominant watershed processes (Table 1). Floodplains were delineated by merging unconfined valleys from Nagel et al. (2014) with floodplain mapping from Woznicki et al. (2019). Unconfined valley segments (Valley Width > 4x Channel Width) serve as important habitat areas for native trout (Baxter and Hauer 2000, Wenger et al. 2011). The channel bed morphology typical of watersheds in the Pacific Northwest (Table 1) are, for the most part, independent of changes in sediment supply or flow (WDNR 2011). Channel incision and floodplain disconnection were estimated from calculating the difference between the geomorphic floodplain depth (Dodov and Foufoula-Georgiou 2006) and the depth necessary to completely flood valley reaches. Incision values of < 1m were given a "Good" rating, 1-2 m were "Fair", and >2m were "Poor". Incision categories were based on channel incision analysis work described in Beechie et al. (2008) and Mejia et al. (2021).

Sediment Supply (Erosion and Sediment Yield)

Sediment input estimates were taken from the Total Maximum Daily Load (TMDL) that was issued for the East River in 2003 (Rothrock, 2003).

Runoff

Historical (1997-2006) and future (2040 and 2080) mean summer (June 1 to September 30) and bankfull (1.5-year return interval) flow data and the changes between historical and 2040 and historical and 2080 were obtained from shapefiles from the FSGeodata Clearinghouse[1]. Floodplain roads were defined as all open roads within the delineated floodplains. Road data was obtained from the U.S. Geological Survey's (USGS) National Transportational Dataset (2024). A stream's rating was considered "Poor" if there was a >20% increase in bankfull flow or >20% decrease in mean summer flow under future conditions. A rating of "Fair" was given if it fell between 10% and 20%. Anything below 10% was considered "Good".

In-stream LWD

Instream LWD counts were taken from previous fish and habitat surveys (Olson and Andersen, 2006). These surveys identified LWD as any piece of wood within the wetted channel that was at least 10 cm in diameter and at least 1 m in length.

[1] https://data.fs.usda.gov/geodata/edw/datasets.php?xmlKeyword=hydro+flow+metrics+west

Barriers

Fish barrier information was compiled by Idaho State Department of Fish and Wildlife (IDFG, 2022) to identify and map total and partial man-made fish passage barriers.

Results

Valley confinement, floodplains, and channel segment types

Numerous unconfined channels exist within the East River Watershed (Figure 4). These unconfined areas are generally small, mostly between 0.1 and 0.3 km in width, though their lengths can extend for several kilometers. They are primarily found in the East, Nork Fork East, and Middle Fork East rivers and the lower half of Lost Creek, where the largest unconfined valley in the watershed is located. The tributaries, other than Lost Creek, contain nearly zero areas of unconfined channel and associated floodplain. The unconfined areas of the watershed contain a mixture of pool-riffle and plane-bed habitat, both of which are important for spawning and rearing of native trout species. Step-pool and cascade channel segments are spread throughout the tributaries and upper reaches of both the North Fork East and Middle Fork East rivers where the gradient increases considerably compared to the lower reaches in the watershed. Channel incision was 1-2 m in valley reaches, giving rating of “Fair”.

Sediment Supply

The natural background sedimentation rate was estimated to be 936 metric tons per year. The total sediment yield from all sources for the East River Watershed was estimated at 2,664 metric tons per year. The majority of this additional sedimentation is believed to come from the road system that is found throughout the watershed. There are approximately 426 km of road (including closed or abandoned) within the watershed, 27 km of which are in close proximity to a stream. This excess sedimentation prompted a TMDL to be established in 2003 to address the issue.

Runoff

2040 Low flow

The entire East River Watershed is projected to have a considerable reduction in flow during the low flow months of June through August. Decreases in flow from 32% in the lower portion of the watershed

up to 37% in the upper tributaries, such as Chicopee and Keokee creeks are expected by mid-century. This puts the whole watershed into the "Poor" category.

2040 High flow

Bankfull flows within the East River Watershed are predicted to remain relatively close to historic levels. Increases of 5-7% are predicted throughout the watershed. In some cases, such as Race Junta creeks, bankfull flows are expected to decrease from historic levels. The gives the watershed a rating of "Good" for bankfull flows for the near future.

2080 Low flow

End of the century low flows within the East River Watershed are projected to continue decreasing from their current levels. Decreases of 43% are expected in the lower watershed, while much of the upper portions are predicted to have decreases up to 49%. As a result, the whole watershed maintains its rating of "Poor".

2080 High flow

End of the century bankfull flows are projected to continue to increase throughout most of the watershed. The lower portions of East River are expected to increase 13%. Changes within the watershed vary with Lost Creek projected to increase the most at 17%, while bankfull flows in some of the tributaries are expected to continue to decrease several percent below historic flows. Overall, the whole watershed receives a rating of "Fair".

In-stream LWD

Instream LWD varied throughout the watershed but was in general relatively abundant (Table 2). LWD abundance was greatest in the tributaries, with rates averaging between 38.3 pieces per 100 m in Race Creek to a high of 58.6 pieces in Tarlac Creek. The Middle and North Fork East rivers were noticeably lower in LWD, with averages of 22.4 and 21.3 pieces per 100 m respectively. The East River itself had the lowest LWD rate with only 10.2 pieces per 100 m.

Barriers

Manmade barriers withing the East River Watershed are at a minimum, with two located within the Middle Fork East River subwatershed (Figure 4). One complete barrier culvert is located near the

headwaters of the Middle Fork East River, just upstream of the confluence with Devils Creek. There also appears to be a small dam on Uleda Creek, approximately 0.8 km upstream from its mouth, that is a partial barrier to fish passage. The reasons for these structures being barriers (slope, drop, etc.) are not readily available

Discussion and Next Steps

The East River Watershed is in relatively decent condition with regards to rankings from this assessment but is not without its issues

Base flows are predicted to be considerably lower by the end of the century, as much as 49% lower, and peak flows are expected to rise approximately 17% higher than current conditions within parts of the watershed. A Total Maximum Daily Load (TMDL) is currently in place for the entire watershed for temperature (IDEQ, 2016). Decreasing low flows during the warm summer months will not aid with the water temperature issues throughout the watershed. Storing water within the system for longer periods of time will likely be one of the most effective efforts to help combat the predicted lower low flows and assist in meeting the TMDL requirements. The East River Watershed is one of the only Bull Trout strongholds within the Lower Priest River Subbasin (Rothrock, 2003). Should conditions within the watershed not change, models, based on climate change scenarios, indicate that kilometers of habitat suitable for Bull Trout (*S. confluentus*) could be reduced nearly ten-fold by the end of the century (Isaak et al. 2017).

The East River Watershed contains numerous unconfined valley segments containing plane-bed or pool-riffle habitat. These areas tend to be more receptive to floodplain reconnection projects than steeper, confined portions of a creek system and serve as important habitat areas for native trout (Baxter and Hauer 2000, Wenger et al. 2011). Unconfined valleys have the capability to store water within a floodplain which helps reduce the impacts of high seasonal flows (WDNR 2011). These areas tend to retain LWD better due to lower water velocities than those found in higher gradient channels (WDNR 2011). Pool formation, especially around LWD is common in these channel types, thus adding additional habitat and cover for aquatic organisms. Channel incision averages 1-2 m within the valleys. Through various efforts, it is possible to restore this level of incision and reconnect floodplains in areas where the incision depth is currently preventing connection. East River and the lower portion of Middle Fork East River both contain low gradient meandering stream channels with numerous side channels.

Those areas with disconnected side channels may potentially benefit from a stage-0 type project (Cluer and Thorne, 2014) where the stream bed is brought back up to its historic elevation and the stream is allowed to reconnect with its entire floodplain. Other projects such as LWD placement, reconnection of side channels, or beaver dam analogs (BDA's) within these low gradient areas may help base flows from declining to their end-of-century predicted levels by slowing the flow of water out of the system.

Despite efforts being made at the time to upgrade the road system, sediment inputs from roads was high enough to establish a TMDL for the East River in 2003 (Rothrock, 2003). Additional steps needed mitigate the sediment inputs were described in the TMDL and included cattle exclusion fencing, assessing stream crossings, and continuing to evaluate and upgrade the current road system. It is expected that if the TMDL is followed, sediment yields within the watershed can be reduced to an appropriate level, though it may take 2 or 3 decades to accomplish.

Culverts or other manmade structures that cause migration issues for aquatic organisms do not appear to be a major issue within the East River Watershed. It is possible that other unknown barrier structures exist, or that those identified within this assessment have been removed or replaced.

LWD appears to be relatively abundant within the watershed, though it is lacking within certain reaches (ex. East River). The data used for LWD rates came from surveys conducted in 2005 and 2006. Standards for what is considered LWD, in particular with regards to size and volume, have changed over the years. Assessments recently conducted in neighboring streams in Washington State have used the volumes and sizes listed in Fox and Bolton (2007) as the benchmark for whether LWD is at suitable levels within a stream system. It is not possible to adequately convert the LWD counts used in this assessment to those described by Fox and Bolton. Site visits to determine the sizes and volumes of LWD in areas of interest within the watershed are needed prior to the design or implementation of any restoration project.

This watershed assessment helped identify process impairments and level of impairment and sets the foundation for potential restoration actions. The next step is to identify potential restoration actions and rank them using ranking criteria agreed upon by the Priest River Watershed Group. The ranking criteria and list of ranked projects will be provided under separate cover.

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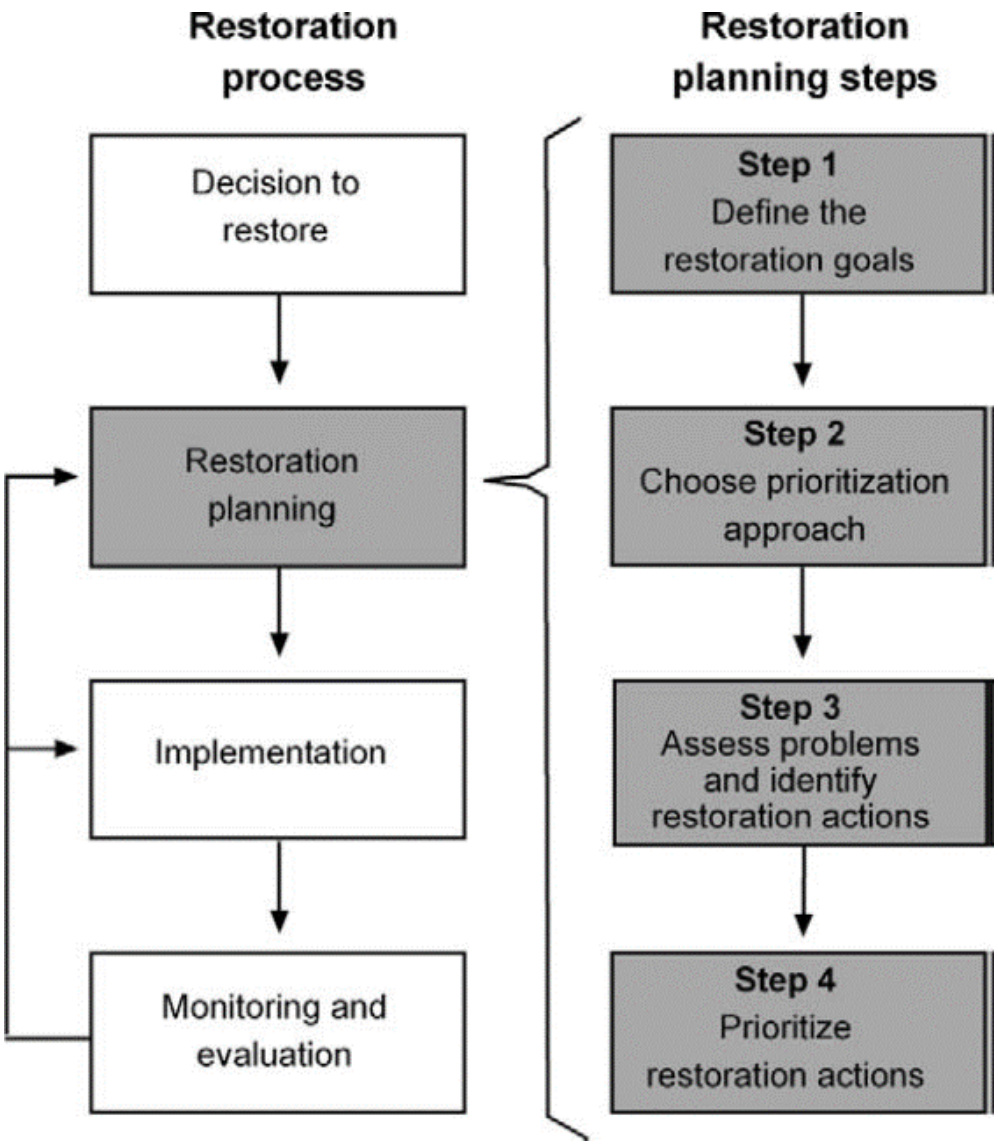

Figure 1. Restoration Process and Planning Steps (from Firehammer et al. 2011).

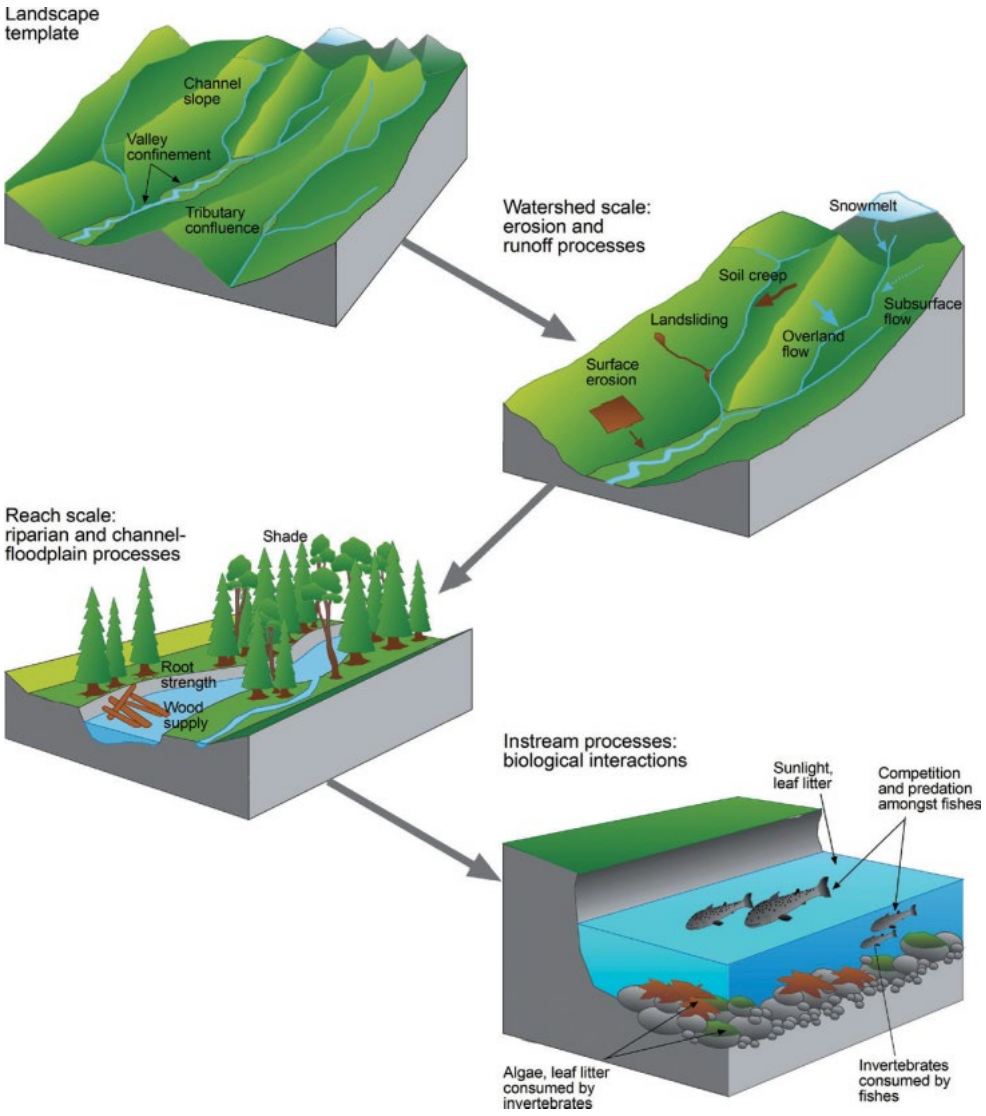

Figure 2. The hierarchical nature of watersheds and related watershed processes (from Roni and Beechie 2013).

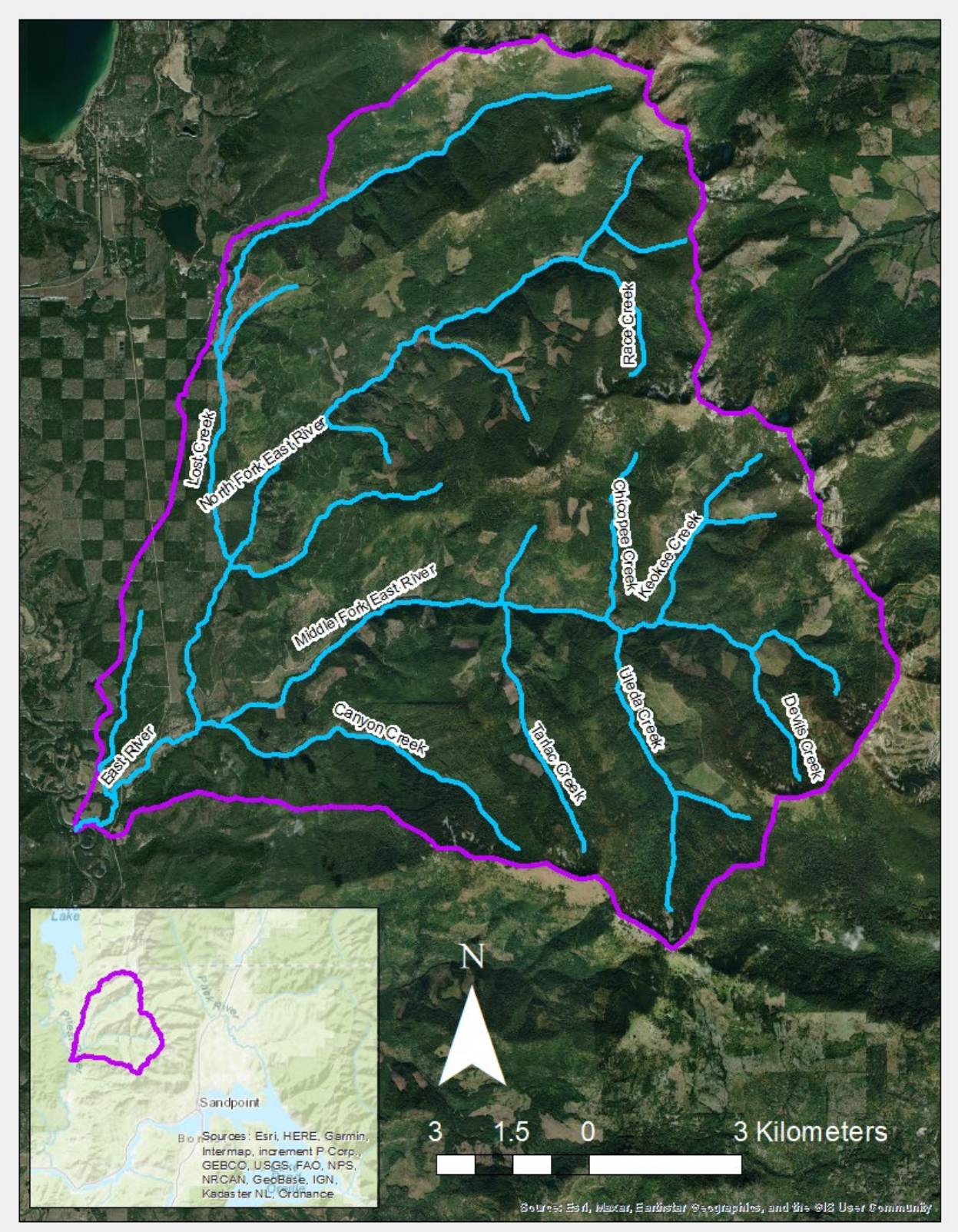

Figure 3. The East River Watershed in Bonner County, Idaho.

Table 1. The Channel Response Matrix (from WDNR 2011).

	SEDIMENT	DISCHARGE	WOOD	CATASTROPHIC EVENTS		
	FS _ Fine Sediment Deposition CS - Coarse Sediment Deposition	SC - Scour Depth SF - Scour Frequency BE - Bank Erosion	WL - Wood Loss WA - Wood Accumulation	DFS - Debris Flow Scour DFD - Debris Flow Deposition DB - Dam Break Flood		
VW > 4CW UNCONFINED	FS BE WA	WL SF FS BE	DB DFD BE CS SF WL	DFS/DFD DB WL	DFS	.....
2CW < VW < 4CW MODERATELY CONFINED	FS BE WA	CS BE SD WL FS	CS BE DB SD DFD WL SF	DFS/DFD DB SF WL	DFS	DFS
VW < 2CW CONFINED	.....	CS WL	CS SD WL DFD DB	DFS/DFD DB SF WL	DFS	DFS
	<1.0 Pool-Riffle	1.0 - 2.0 Pool-Riffle, Plane-Bed	2.0 - 4.0 Plane-Bed, Forced Pool-Riffle	4.0 - 8.0 Step-Pool	8.0 - 20.0 Cascade	> 20.0 Colluvial

VALLEY GRADIENT AND TYPICAL CHANNEL BED MORPHOLOGY

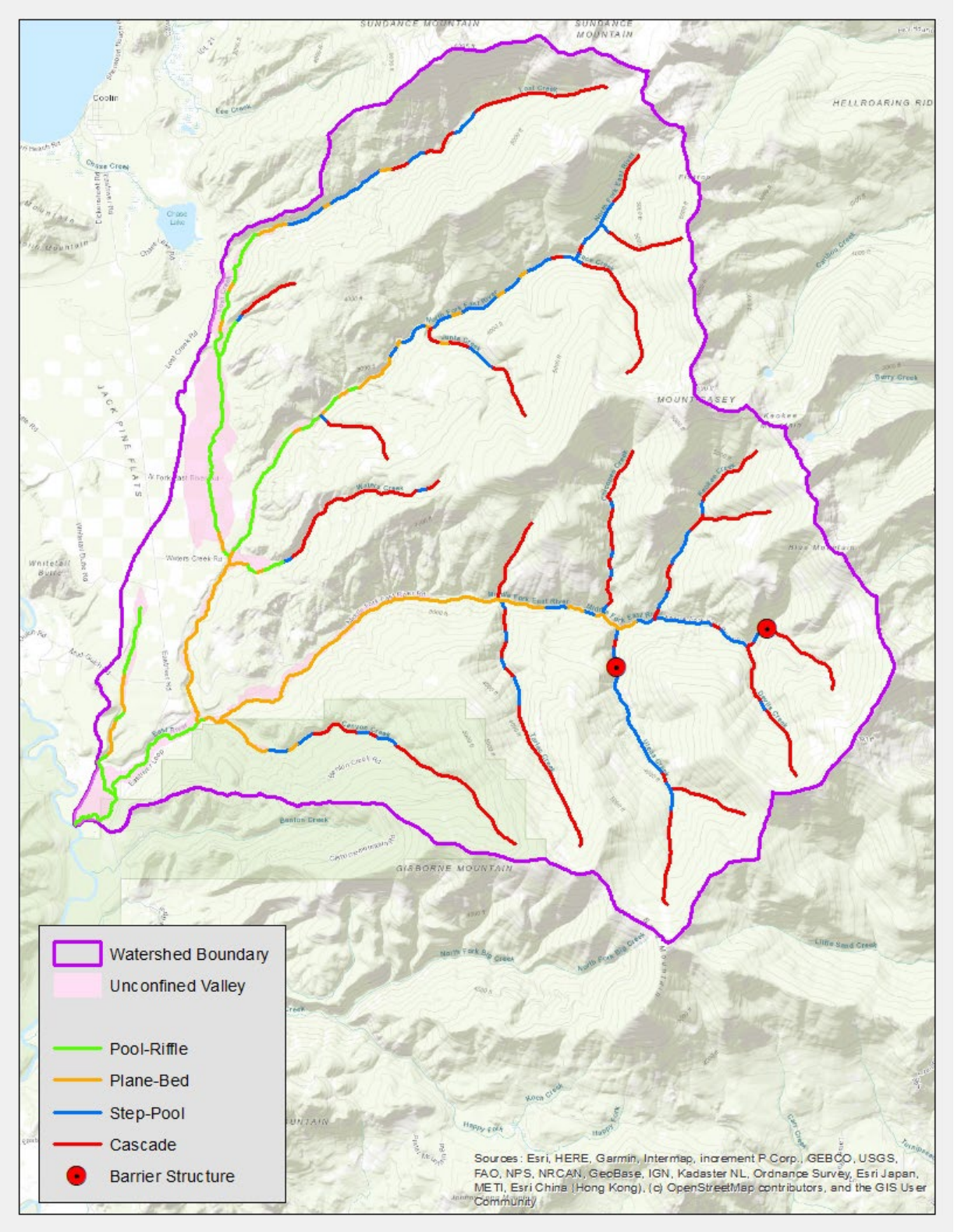

Figure 4. The unconfined valley segments, channel types, and barrier structures in the East River Watershed, Bonner County, Idaho.

Table 2. The amount of instream LWD larger than 10 cm in diameter and 1 m in length for surveyed reaches within the East River Watershed. Taken from Olson and Andersen, 2006 and 2007.

Stream	Reach											Average
	1	2	3	4	5	6	7	8	9	10	11	LWD/100m
East R.	11.7	9.2	9.7									10.2
Middle Fork East R.	15.9	15.2	13	14.3	22	26.3	21.8	29.3	43.8			22.4
Canyon Cr.	50.4	40.8										45.6
Tarlac Cr.	53.5	74.3	47.9									58.6
Chicopee Cr.	45.6	58.9	31.3	50.9	46.1							46.6
Uleda Cr.	57.1	37.5	49.1	55.3	44.6							48.7
Keokee Cr.	53.1	46.4	36.2									45.2
Devils Cr.	47.2											47.2
North Fork East R.	10.2	23.2	13.3	10	20.3	18.1	19.1	31.2	24.9	35.8	28	21.3
Race Cr.	44.1	32.5										38.3

Final Ranked Restoration Opportunities

Overview

Previous investigations have shown that the East River valley bottoms suffer from accelerated streambank erosion and are deficient in large wood (LWD) and pools, both key ingredients for bull trout foraging and overwintering habitat. The Restoration Opportunities described below are all proven techniques. Restoration Opportunities 1,3,4, and-5 aim to increase the amount of foraging and overwintering habitat for bull trout and westslope cutthroat trout. Restoration Opportunity 2 aims to reduce accelerated streambank erosion from livestock disturbance within known bull trout foraging, migration, and overwintering habitat.

Restoration Opportunity (RO)) - 1 - Stage-0 Peterson Family Property

Stage-0 refers to a restoration strategy in which an incised stream channel is restored to its historical floodplain elevation, restoring lateral connectivity to disconnected off-channel habitats. These projects help to retain water, wood and sediment. When constructed in valley bottom settings, Stage 0 projects have the potential for a high return on investment, high ecological benefit potential and are low-risk for failure. Wood addition and plantings are likely to be components of this project.

Restoration Opportunity 1 is approximately 75 acres and is located primarily on private property adjacent to a reach of the East River that is deficient in pools and instream large woody debris (LWD) that serves as foraging, migration, and overwintering habitat for bull trout and westslope. This project would help reconnect side channels (lateral connection), provide additional foraging and overwintering habitat for bull trout (and westslope cutthroat trout), and help retain water within the river during low water periods (vertical connection). Brook trout have been identified throughout the East River. Most of the land is owned by a willing private landowner, with a small downstream portion owned by Idaho Department of Lands. Equipment access is easy with roads nearby and low gradients.

Next steps and considerations:

- USFWS will move this forward into discussion for NRCS's Wetland Reserve Easement program.
- Eric B will touch base with the Peterson Family to get a feel for their openness to a conservation easement.
- Consider adding an adjacent project that expands this work into the IDL oxbows off of the neighboring Priest River. This project would be harder to fund as it is on IDL and USFS land, but would be a much lower cost than the Peterson project as mostly entails only wood additions. Explore potential for BPA and/or Avista funding?

RO-2- Riparian Fencing/Stock Watering

The 2008 Addendum to the Priest River TMDL lists approximately 3,000 feet of fencing being needed in the East River to prevent bank erosion from cattle. In reality, approximately 7,500 feet is necessary to effectively fence livestock from the East River to reduce streambank erosion. A total of seven private landowners would have to agree with this project. Equipment access appears to be good. Livestock fencing (and associated stock watering systems), are relatively low cost, proven techniques. Similar to RO-2, this project is located within known foraging, migration, and overwintering habitat for bull trout. Plantings would be associated with this project.

Next steps and considerations:

- There was discussion whether there is actually grazing occurring on these properties at a level that would warrant fencing.
- Next step will be for one of the team members to inspect the area and report back on grazing, cattle and/or horse use.
- Someone would ideally contact the landowners and see if there was interest in a project

RO-3 - Instream LWD placement

The East River below Eastside Road is deficient in large wood (LWD) and has the potential to benefit from additional LWD placement projects. This portion of the river has a plane-bed channel morphology, which tends to be receptive to LWD placements, has numerous side channels of varying connectivity, and has a low number of pools. Strategic LWD placements near these side channels will help keep the channels flowing through a wider range of flows, create scour pools to provide additional rearing and overwintering habitat for bull trout and westslope cutthroat trout. This reach of the East River is a mix of federal (USFS) and state (Idaho Department of Lands) ownership. Equipment access would be challenging but doable.

Next steps and considerations:

- Option to package this project with RO-1?
- Coordination with USFS
- IDL property not currently generating revenue – that may be a positive

RO-4A Beaver PALS on NF East River

North Fork East River has the potential to benefit from additional LWD placement projects. The section between the confluence of Middle Fork East River upstream to the approximately the Waters Creek Road crossing has a very low number of instream LWD and pools. This section of the river is owned by Idaho Department of Lands. It has also historically had a relatively large beaver presence. Due to its low gradient and higher beaver activity, a low-tech project such as pole assisted log structures (PALS) may work well to help improve the pool to riffle ratio. Equipment access would be challenging but doable.

RO-4B- Upgrade Waters Creek crossing on NF East River

This is a culvert on Waters Creek near the East River where it appears that beavers are compromising the effectiveness of the culvert. Ideally this would an upgrade to a bridge to alleviate conflict with the beavers and allow them to continue building habitat.

Next steps and considerations for 4a and 4b:

- Prevalence of brook trout on the North Fork East River dropped the scoring on these projects. It was determined that brook trout management needs to precede focus on these projects.

RO-5 – Beaver Pools Instream LWD placement/ beaver dam analogs/pole assisted log structures

East River between East River Road and East River Loop consists of a pool-riffle stream type that is dominated by riffles and a lack of LWD. While the pools that exist in this reach tend to be large, the number is few and far between. Pool-riffle channels respond best to LWD placement projects and this reach is no exception. Augmenting with LWD is a good alternative. Low-tech options such as beaver dam analogs may work well in this area. This reach is privately owned by seven different landowners. Getting

landowner agreement could potentially be difficult. It would be possible to do LWD placements on only those parcels with agreeable landowners and still enhance the habitat within this reach.

Next steps and considerations:

- Tech team had concerns that it would be difficult to get the landowners to move forward with this project.
- Someone would ideally contact the landowners and see if there was interest in a project