

Kootenai River Habitat Restoration Project Master Plan



Executive Summary

Kootenai Tribe of Idaho
July 2009

Executive Summary

Kootenai Tribe elders pass down the history of the beginning of time, which tells that the Kootenai people were created by Quilxka Nupika, the supreme being, and placed on earth to keep the Creator-Spirit's Covenant – to guard and keep the land forever. The Kootenais have never lost sight of their original purpose as guardians of the land.

Today, the Kootenai Tribe of Idaho seeks to fulfill this purpose by developing and implementing innovative, scientific approaches to guardianship of the land that consider the whole ecosystem at the watershed/subbasin scale, are socially and economically responsible, are supported by the local community and other partners within the watershed, and that incorporate adaptive management principles.

Towards this end, the Tribe has developed this Kootenai River Habitat Restoration Project Master Plan (Master Plan), which presents a framework for an ecosystem-based river habitat restoration project to be implemented in the Idaho portion of the Kootenai River subbasin. This Master Plan is the first planning phase of a multi-phase project. The Master Plan sets the stage for the Tribe and their partners to identify, rank in order of priority, design, and implement meaningful habitat restoration actions. The purpose of the Kootenai River Habitat Restoration Project described in this Master Plan is to:

- Restore and enhance Kootenai River habitat by addressing ecological limiting factors and constraints related to river morphology, riparian vegetation, aquatic habitat and river management. The desired result is a more resilient ecosystem, capable of sustaining diverse native plant and animal populations, and tolerant of natural disturbances and altered regimes.
- Restore and maintain Kootenai River habitat conditions that support all life stages (i.e., migration, occupancy, spawning, incubation, recruitment and early rearing) of endangered Kootenai River white sturgeon (*Acipenser transmontanus*) and other aquatic focal species; and
- Restore the Kootenai River landscape in a way that sustains Tribal and local culture and economy and contributes to the health of the Kootenai subbasin as both an ecological and socio-economic region.

During this initial Master Planning phase, the Kootenai Tribe's design team collected and analyzed large amounts of existing and new information and data in order to understand: historical and existing conditions in the Kootenai subbasin; specific physical and biological characteristics in each of the river reaches in the project area; and limiting factors related to habitat for focal aquatic species and other species within the project area. Based on this understanding, the Tribe's design team developed restoration strategies and habitat restoration treatments that could be used to address those limiting factors in each project reach. These restoration treatments were combined to form habitat actions that address all limiting factors within a reach, and then applied spatially as implementation scenarios to provide examples of potential minimum, moderate, and maximum restoration levels of effort. These implementation scenarios were also used as a basis to develop conceptual cost estimates. This initial Master Plan development phase also resulted in development of a conceptual adaptive management and

monitoring program, identification of anticipated environmental compliance and consultation requirements, a funding analysis, and identification of specific actions to be accomplished in subsequent project phases.

During later phases of this project, Kootenai Tribe and their design team will collect additional data to support designs, select and prioritize specific restoration actions for preliminary design, prepare preliminary designs of those selected actions, complete required environmental compliance and consultation, prepare final designs, and implement habitat restoration in a logical sequence. Ongoing stakeholder outreach and coordination will be significant components of all phases of the project.

The Kootenai Tribe developed this Master Plan with funding from the Bonneville Power Administration provided through the Northwest Power and Conservation Council's Columbia Basin Fish and Wildlife Program (Project 200200200).

Project Context

During the last century, the Kootenai subbasin was modified by agriculture, logging, mining, flood control, the Kootenai River was impounded by Libby Dam (Koocanusa Reservoir) upstream and Corra Linn Dam (Kootenay Lake) downstream. Conversion of more than 50,000 acres of floodplain to agricultural fields has resulted in loss of riparian and wetland plant and animal species, and related functions that normally support a healthy ecosystem.

Constructed levees were built on top of natural sand levees for flood control, limiting the hydrologic connection between the Kootenai River and its floodplain. Construction of Libby Dam began in 1966; the dam was completed in 1972 and became fully operational in 1974. Operations of Libby Dam effectively reducing annual peak flows by half, disrupting the hydrograph which historically had a single spring freshet that provided energy to help drive many ecosystem processes. Collectively, these modifications resulted in unnatural flow fluctuations in the Kootenai River and largely eliminated connection with the river's floodplain.

Although levee construction and the regulation of the natural flood regime through operations of Libby Dam benefited agriculture and played an important role in flood control, these activities also severely limited the capacity of the ecosystem to provide suitable habitat to support the complete life cycles of many species. This altered ecosystem reduced the Kootenai Tribe's access to traditional resources that the Tribe had historically relied on for long-term subsistence and cultural uses. Today, this modified ecosystem is no longer able to support the biological complexity it sustained historically.

Following construction of the levees and completion of Libby Dam, native fish stocks such as Kootenai River white sturgeon, burbot (*Lota lota*), kokanee (*Oncorhynchus nerka*), redband trout (*Oncorhynchus mykiss garideini*), westslope cutthroat trout (*O. clarki lewisii*) and bull trout (*Salvelinus confluentus*) as well as local wildlife populations began to decline. Restoration of these native fish stocks and local wildlife is the primary impetus for the Kootenai River Habitat Restoration Project.

The status of the Endangered Species Act (ESA) listed Kootenai sturgeon population imposes a particularly urgent timeline for implementation of the habitat restoration actions described in this Master Plan. The next 5 to 20 years are critical to the recovery of the Kootenai Sturgeon population. There may still be an adequate number of reproductive white sturgeon in the

Kootenai River population to take advantage of suitable spawning and rearing conditions if appropriate habitat is quickly identified and restored. However, without timely action, the wild population will continue to decline and mature fish will find it increasingly difficult to find mates. At some point, the few remaining fish will no longer be adequate to affect recovery and critical components of the native diversity will be lost. Without intervention, functional extinction will occur well before the last wild fish dies. Currently, the Kootenai Tribe's Tribal Sturgeon Hatchery is preventing extinction of Kootenai sturgeon while measures are taken to implement the habitat restoration actions described in this Master Plan.

Reintroduction of native burbot to the lower Kootenai River (i.e., rebuilding the population using genetically and behaviorally similar stock from within the Kootenai River) is also a matter of high priority for the Kootenai Tribe. Kootenai River burbot are functionally extinct, a status that occurs when populations are so small they are unable to recover on their own.

Because of the unique circumstances related to Kootenai sturgeon and native burbot, the Tribe is also submitting a separate Master Plan to the Northwest Power and Conservation Council for the *Kootenai River Native Fish Conservation and Aquaculture Programs* that will help to ensure survival of Kootenai sturgeon and support reintroduction of burbot while the habitat restoration actions described in this Master Plan are further refined, prioritized and implemented.¹

Project Location

The Kootenai River Habitat Restoration Project will be implemented in the Idaho portion of the Kootenai subbasin. The project area consists of a 55-mile reach of the Kootenai River that extends from the confluence of the Moyie and Kootenai rivers, downstream to the international border.

For the purposes of this Master Plan, the project area is divided into three major river reaches based on their unique geomorphic properties: the Braided Reaches, Straight Reach and Meander Reaches. The Braided and Meander reaches are each further delineated into two sub-reaches. Each of the project reaches are described below in reference to river miles (RM). These river miles represent defined locations along the river that were identified at a point in time. These RM locations have remained fixed while the river itself has moved; therefore, actual lengths of reaches are usually slightly different than the calculated difference between two river mile designations. Figure 1 shows the project area in the context of the Kootenai subbasin.

Braided Reach 1 extends nearly 4 river miles (RM 160.9 to RM 156.2) from the Moyie River confluence downstream to the upstream extent of the backwater influence from Kootenay Lake. Braided Reach 2 extends approximately 2.2 river miles (RM 156.2 to RM 152.7) from the upstream extent of the backwater, downstream to the U.S. Highway 95 Bridge. The Kootenai River from Libby Dam to near the confluence of the Moyie River is characterized by a steeper gradient and confined channel morphology. The Kootenai River downstream from the Moyie River confluence enters a wider valley with a decreasing gradient. Multi-channel, meandering, riffle-

¹ The Kootenai River Native Fish Conservation Aquaculture Programs Master Plan proposes critically needed renovations and expansions of the Tribal Sturgeon Hatchery, construction of a new artificial production facility for Kootenai sturgeon and burbot at the confluence of the Moyie and Kootenai rivers, and use of remote streamside incubation and early rearing facilities to imprint Kootenai sturgeon on waters from locations upstream of the current Tribal Sturgeon Hatchery.

pool characteristics predominate through the Braided Reaches. Gravel and cobble are dominant channel substrates in both Braided Reach 1 and 2.

The Straight Reach extends 1.1 river miles (RM 152.7 to RM 151.7) from the U.S. Highway 95 Bridge, downstream to Ambush Rock. This reach is characterized by a narrowed river corridor that is locked in place by flood protection measures designed to protect the town of Bonners Ferry, which occupies both banks through much of the reach. The U.S. Highway 95 bridge and train trestle are also confining features in the reach. Historically, the reach was naturally constrained by lateral hillslopes and bedrock. Channel substrate transitions from gravels to sand through the reach.

The combined Meander Reaches extend from the downstream end of Ambush Rock to Kootenay Lake. Meander Reach 1 begins at Ambush Rock and extends 9.7 river miles (RM 151.7 to RM 141.8) downstream to slightly below Shorty's Island. Meander Reach 2 spans 35.5 miles (RM 141.8 to RM 105.9) from the end of Meander Reach 1 to the international border. The Meander Reaches are situated in a low gradient lacustrine valley and channel substrates are dominated by sand and clay. Prior to levee construction, the Meander Reaches were free to migrate within portions of the historic floodplain.

The U.S. Fish and Wildlife Service designated Kootenai River white sturgeon critical habitat is included in the project area and spans 18.3 river miles from upstream of Bonners Ferry (RM 159.7) to downstream to below Shorty's Island (RM 141.4) (USFWS 2008). The critical habitat reach spans a portion of the Braided Reaches, the entirety of the Straight Reach, and the upstream portion of the Meander Reaches. Critical habitat includes the reach of the river where Kootenai sturgeon are known to spawn (Bonners Ferry downstream to Shorty's Island), as well as portions of the river where habitat conditions are believed to be conducive to successful egg adherence and embryo survival (Bonners Ferry to RM 159.7) but where spawning does not currently appear to be occurring.

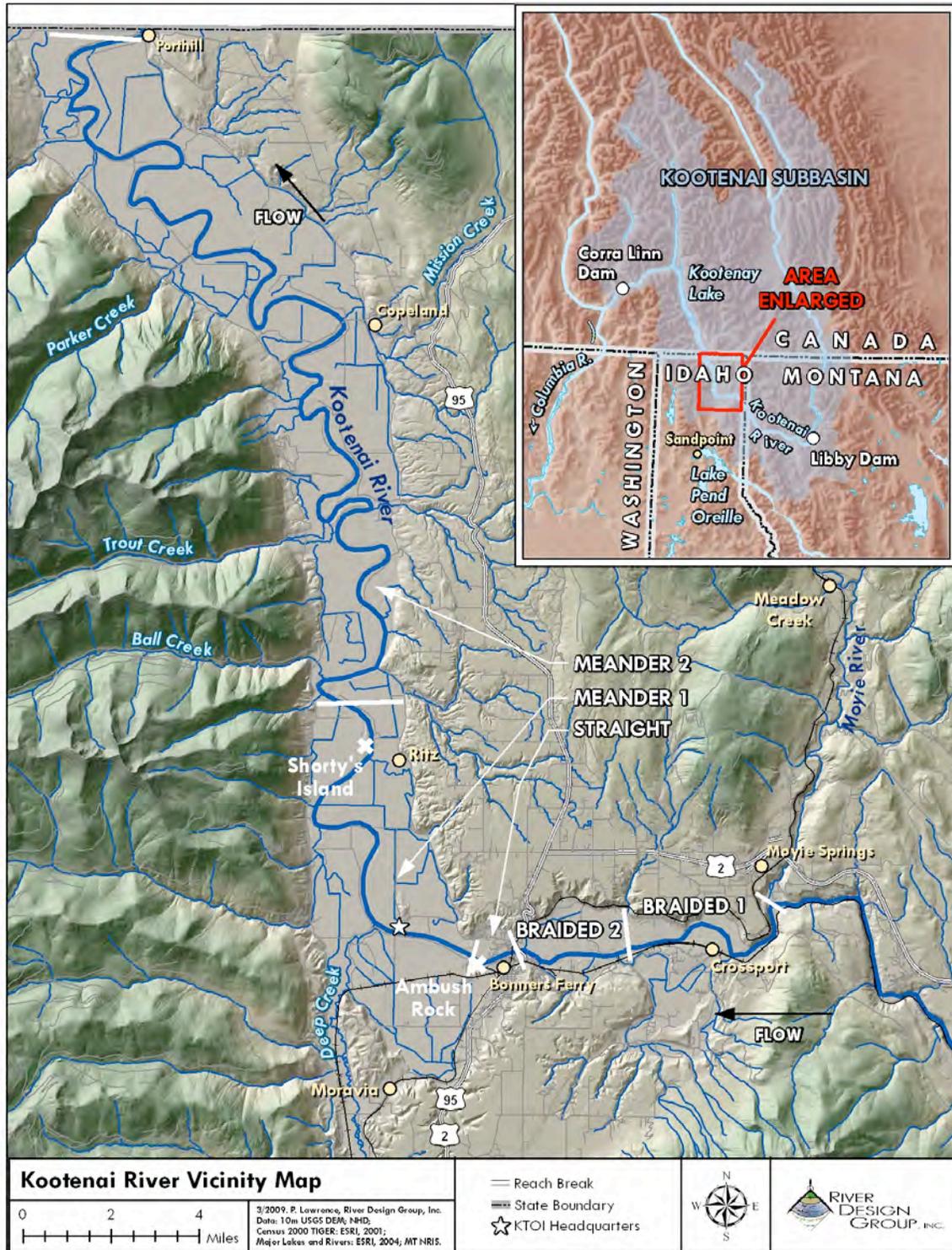


Figure 1. Project location within the Kootenai subbasin.

Project Vision, Goals and Relationship to Limiting Factors

The Kootenai Tribe envisions the Kootenai River and its floodplain as a healthy ecosystem with clean, connected terrestrial and aquatic habitats, which fully support traditional Tribal uses and other important societal uses.

In developing and implementing approaches to Kootenai River habitat restoration the Tribe will continue to emphasize a collaborative approach that takes into consideration the needs and values of the region. The Kootenai Tribe believes that cooperation among all groups with a stake in the region is the only way to ensure the sound and prosperous future of the Kootenai subbasin.

The Kootenai River Habitat Restoration Project has four goals, which address morphology, riparian vegetation, aquatic habitat, and river stewardship. Each of these four goals represents a logical grouping of the limiting factors and constraints the ecosystem restoration project is designed to address. The project's goals are:

- **Morphology.** Restore physical habitat by reducing the negative effects to river and floodplain ecological processes caused by river response to the altered landscape.
- **Riparian vegetation.** Restore native vegetation by establishing stream bank and floodplain conditions that sustain plant community development processes.
- **Aquatic habitat.** Restore aquatic habitat conditions that support all life stages of native fish and promote sustainable populations
- **River stewardship.** Create opportunities for river and floodplain stewardship in the community.

In the context of this Master Plan, limiting factors are defined as physical, biological, and ecological conditions within the project area that: 1) limit the ability of the ecosystem to sustain diverse native plant and animal populations, and to accommodate natural disturbances; 2) limit the quality or availability of habitat that supports all life stages of endangered Kootenai sturgeon and other focal species; and 3) limit the ability of the ecosystem to sustain the local tribal culture, subsistence needs, and the economy. Limiting factors can be addressed by active restoration or changes in management. In contrast, constraints are components like roads, bridges and other infrastructure that cannot be changed by management or active restoration, but must be considered during the design process.

Table 1 presents a summary of the habitat limiting factors and river and floodplain stewardship constraints identified in the project area. These limiting factors are generally interrelated and cumulative in their effects.

Table 1. Limiting factors related to morphology, riparian vegetation, aquatic habitat, and constraints related to river and floodplain stewardship in the project area.

Morphology limiting factors	Riparian vegetation limiting factors	Aquatic habitat limiting factors	Constraints related to river and floodplain stewardship
Factors that have altered natural and historical morphological processes:	Factors that have altered the native riparian vegetation community:	Factors that have altered the aquatic habitat conditions:	Several aspects of the ecosystem have been affected by river and floodplain management:
<ul style="list-style-type: none"> ▪ River response to altered hydraulics ▪ River response to altered sediment transport ▪ Loss of channel and floodplain connection ▪ Reduced channel boundary roughness (smooth banks lacking vegetation or woody debris) ▪ Bank erosion 	<ul style="list-style-type: none"> ▪ Lack of surfaces that support riparian vegetation recruitment ▪ Lack of outer bank vegetation ▪ Frequent scour and deposition of floodplain surfaces ▪ Altered hydroperiod (the length of time during the growing season when water is available in the rooting zone) ▪ Invasive plant species ▪ Lack of native plant diversity and seed sources ▪ Lack of nutrient sources for primary productivity ▪ Altered carbon balance (due to depletion of wetland systems) 	<ul style="list-style-type: none"> ▪ Insufficient depth for Kootenai sturgeon migration ▪ Insufficient velocity for successful Kootenai sturgeon spawning ▪ Lack of coarse substrate for egg attachment ▪ Lack of cover for juvenile fish ▪ Lack of pool-riffle complexity ▪ Simplified food web from lack of nutrients ▪ Insufficient pool frequency ▪ Lack of fish passage into tributaries ▪ Lack of off-channel habitat for rearing ▪ Altered water quality 	<ul style="list-style-type: none"> ▪ Dam controlled flow regime ▪ Dam controlled sediment regime ▪ Dam controlled thermal regime ▪ Dam controlled nutrient regime ▪ Bank armoring ▪ Levees and diking districts ▪ Transportation corridors ▪ Floodplain land use

Restoration Strategies, Treatments and Implementation Scenarios

The following terminology is used to organize components of the Master Plan framework that link limiting factors (problems) to restoration treatments (solutions):

- **Restoration Strategy** – Restoration strategies are the broad approaches to habitat restoration that will be used in each project reach. Each restoration strategy is described in terms of how the river channel, banks and floodplain would need to be modified in a reach to overcome limiting factors given specific conditions and constraints that are present.
- **Restoration Treatment** – Restoration treatments are actionable concepts that support a restoration strategy. Restoration treatments were selected based on analysis of limiting factors in the Kootenai subbasin and knowledge gained from efforts in other river systems where these types of restoration treatments have been successfully used to address similar habitat limiting factors.

- **Habitat Action** – A habitat action is the combined set of restoration treatments that address the limiting factors within a reach.
- **Implementation Scenario** – An implementation scenario is a spatial application of a habitat action based on criteria to determine a level of restoration effort. An implementation scenario is a quantifiable habitat action that can be used to estimate implementation costs at a conceptual level.

This Master Plan includes a toolbox of restoration strategies, restoration treatments and examples of potential implementation scenarios. In the Master Plan, both reach-specific and project-wide restoration strategies and treatments are identified. Reach-specific strategies present ways to modify the river channel, river banks and floodplain to overcome limiting factors throughout the project area and within each reach. Project -wide strategies are related to potentially manipulating timing of Libby Dam release flows and Kootenay Lake-controlled water levels to improve velocity and depth components of habitat, although these strategies may also have some effect on sediment transport. Other project-wide restoration strategies include working with landowners to adjust land management so it is compatible with restoration goals, and working with infrastructure owners to mitigate effects of infrastructure and limit restoration project impacts on infrastructure.

Restoration Treatments

The following discussion provides an overview of restoration strategies for the Braided Reaches, Straight Reach and Meander Reaches.

Braided Reaches Restoration Strategy

Due to altered flow and sediment regimes, portions of the Braided Reaches do not exhibit, nor trend toward a channel form that would occur naturally within the existing morphological setting. Until this is corrected, the Braided Reaches will attempt to adjust their location, gradient and flow capacity to match the altered hydraulics. A large portion of the subbasin sediment supply is being captured by Libby Dam, while a significant portion of the sediment supply below Libby Dam comes from bank erosion within the project area. Since the channel does not access its floodplain as it did during the pre-dam era, a greater proportion of the sediment load is stored temporarily within the active channel in Kootenai sturgeon spawning reaches rather than on the floodplain, causing the channel to remain wide and shallow and burying historical spawning beds. This results in lower velocities and shallower depths, which have been identified as limiting factors for some life stages of aquatic focal species including Kootenai sturgeon. Also, because surfaces where sediment is being deposited are scoured frequently, it is difficult for riparian vegetation to become established. In addition, the Kootenay Lake backwater exacerbates conditions in Braided Reach 2 by causing seasonal fluctuations in water surface elevation, energy gradient and sediment transport capacity. While floodplain vegetation is abundant in portions of the Braided Reaches, some areas lack stable surfaces that can sustain riparian plant community development processes, and other areas have been cleared of vegetation for agricultural purposes.

In order to address these conditions, the restoration strategy in the Braided Reaches focuses on establishing channel dimensions that are sustainable given the morphological setting and governing flow and sediment regimes, gradually reducing sediment supply and transport

competence in a downstream direction, promoting deposition of sediment on the floodplain, constructing a new floodplain that is connected to the channel during average annual peak flows, and revegetating the floodplain in a way that results in a complex, multi-structured native plant community with a mosaic of age classes and hydrologic regimes. Because natural processes that would form instream habitat for focal species are not currently functioning in the Braided Reaches, the restoration strategy also includes instream and bank structures that would function as habitat for aquatic species in the short-term. Over the long-term, as riparian and wetland plant communities develop on the floodplain and along stream banks, natural processes would result in large and coarse wood being recruited into the stream channel, providing ingredients for future aquatic habitat like woody debris jams, buried logs and the pools that would result from this addition of complex hydraulic components.

Straight Reach Restoration Strategy

The Straight Reach is approximately one mile long and flows through the urbanized center of Bonners Ferry. Aquatic and riparian habitat conditions are severely degraded in the Straight Reach due to bank armoring and vegetation removal. The reach is subject to constraints from infrastructure including a high percentage of riprap banks, two bridges at its upper end and levees along its entire length. These levees, combined with naturally occurring entrenched morphology, result in no floodplain being present in this reach and therefore no areas are available where sediment can deposit or plants can grow. As such, the Straight Reach is effective at routing sediment from the Braided Reaches into the downstream Meander Reaches. Dominant bed substrate transitions from gravel to sand in the lower half of the reach due to seasonal fluctuations in the Kootenay Lake backwater, which influences the energy gradient through the reach. Riparian vegetation is present along banks, but is mostly growing in narrow bands on levees, so a riparian buffer that could provide habitat or water quality protection is lacking in this reach.

The restoration strategy in the Straight Reach is focused on improving aquatic habitat by increasing cover, pool habitat and hydraulic complexity, and establishing a riparian buffer along the channel margins. This strategy would be accomplished by installing instream structures and these would allow the river to form pools and move sediment to channel margins, forming a narrow floodplain. Instream structures would project into the channel to re-direct and concentrate flows into a narrower channel that exhibits improved hydraulic complexity. Areas behind the structures would remain open water, but flow velocities would be relatively slower, allowing sediment to accumulate and eventually form a small, inset floodplain. Where possible, the riparian area width would be increased by planting woody vegetation. The Straight Reach and Braided Reaches strategies are linked, so they would need to be implemented together to most effectively address habitat limiting factors.

Meander Reaches Restoration Strategy

The Meander Reaches have been altered by a wide range of river and floodplain management activities. The 55,000-acre historical floodplain is entirely disconnected from river due to levees and decreased mean annual peak flows, which result in water-surface elevations that are nearly 10 feet lower than historical levels. Much of the historical riparian floodplain vegetation and wetlands have been converted to agricultural land, and lands are dewatered to facilitate agricultural practices. The consequences of these alterations on the ecosystem are significant, with the decline of Kootenai sturgeon being one indicator of an ecosystem in decline. Similarly,

the loss of floodplain connection, reduced availability of nutrients, lack of diverse habitat and altered sediment and flow regimes place stress on food web dynamics and dependent species.

In the Meander Reaches, the restoration strategy focuses on improving interaction between the river and floodplain. Due to the large percentage of private land ownership on the floodplain, site specific rather than reach-scale opportunities (such as in the Braided and Straight Reaches) to improve aquatic habitat are included as part of the restoration strategy. Specific opportunities for restoration in the Meander Reach will be further evaluated during later design phases. Meander Reach restoration strategies focus on areas inside the levees adjacent to the river and areas outside the levees that are known to be much lower in elevation and closer to the range of post-levee and post-dam river stage elevations.

The Meander Reaches strategy includes placement of instream and bank structures to improve habitat conditions and reduce bank erosion. Known Kootenai sturgeon spawning areas are located near Shorty's Island in Meander Reach 1, so these are areas where suitable spawning substrate could be placed. Outer meander bends could be supplemented with woody debris structures to create hiding cover for some aquatic focal species. Additional woody debris could be placed near tributary mouths to improve instream habitat at these confluences.

Adjacent to the channel, some areas have been identified where levees are located a distance from the river; floodplain surfaces could be excavated in these areas without compromising flood control infrastructure. These areas would be lowered to an elevation corresponding to the average peak flow river stage to create connected areas of restored floodplain. Other leveed areas along the river have sparse or no bank vegetation and/or eroding banks. In these areas, banks would be stabilized using a combination of natural materials like trees and river alluvium combined with planted vegetation.

Outside of the levees, in the largely agricultural floodplain, the land elevation is relatively low; in places, the floodplain is several feet below the peak flow river stage. Working closely with landowners and diking districts, there may be opportunities to restore wetlands and riparian plant communities in some of these low floodplain areas. Associated with riparian and wetland restoration, some of these areas could be connected to the river as a way to create off-channel habitat that would support some life stages of aquatic focal species. Also in the floodplain, several tributaries are present that include fish passage barriers which would be removed as part of the Meander Reaches restoration strategy. In addition to removing fish passage barriers, there are opportunities to restore aquatic and riparian habitat along tributary streams. Restoring tributaries would support various life stages of some aquatic focal species.

Restoration Treatments

Table 2 provides a summary of specific restoration treatments that together form a habitat action for each reach. Restoration treatments are proposed to achieve restoration strategies and address limiting factors and constraints for the entire project area and within each reach. The Master Plan includes a description for each restoration treatment that explains how each treatment would address limiting factors, anticipated benefits, potential drawbacks, and the degree to which each restoration treatment might overcome each limiting factor.

Table 2. Summary of potential habitat actions and restoration treatments by reach.

Habitat Action	Treatment Name
<i>Stewardship Actions that Apply to All Reaches</i>	<ul style="list-style-type: none"> ▪ Manage the discharge from Libby Dam ▪ Manage the backwater from Kootenay Lake ▪ Manage land use practices ▪ Mitigate for impacts from or to infrastructure ▪ No action
<i>Braided Reaches Habitat Action</i>	<ul style="list-style-type: none"> ▪ Excavate or dredge the river to modify channel geometry ▪ Construct floodplain surfaces ▪ Construct and/or enhance wetlands ▪ Construct and/or enhance secondary channels ▪ Revegetate the floodplain ▪ Install bank structures (bank protection, bioengineering) ▪ Install instream structures (habitat, river training, grade control)
<i>Straight Reach Habitat Action</i>	<ul style="list-style-type: none"> ▪ Excavate or dredge the river to modify the channel geometry ▪ Revegetate the riparian corridor and establish a riparian buffer ▪ Install bank structures (bank protection, bioengineering) ▪ Install instream structures (habitat, river training, grade control)
<i>Meander Reaches Habitat Action</i>	<ul style="list-style-type: none"> ▪ Excavate or dredge the river to modify the channel geometry ▪ Excavate floodplain adjacent to the river ▪ Construct or enhance wetlands adjacent to the river ▪ Construct or enhance wetlands behind the levees and connect to the river ▪ Construct or enhance secondary channels adjacent to the river ▪ Construct or enhance side channels behind the levees and connect to the river ▪ Revegetate the floodplain adjacent to the river ▪ Install bank structures (bank protection, bioengineering) ▪ Install instream structures (habitat, river training, grade control) ▪ Tributary restoration

Implementation Scenarios

The habitat actions shown in Table 2 above represent a toolbox of restoration treatments for each reach. These combinations of treatments were chosen because they are likely to overcome most or all of the limiting factors within a reach. In order to better illustrate where, and to what extent, restoration treatments might be applied within each reach, and in order to develop conceptual cost estimates, the Kootenai Tribe developed implementation scenarios, which are examples of how habitat actions could be applied spatially. Implementation scenarios do not represent specific recommended sets of restoration treatments; rather, they are ways to illustrate low, medium and high levels of effort that can then be translated into estimated costs to help with program planning. In addition, implementation scenarios show examples of different ways that restoration treatments could be combined to overcome key limiting factors where benefits to habitat increase as the level of restoration effort increases.

Because the Kootenai River Habitat Restoration Project covers such a large area and is designed to address such a complex combination of interrelated limiting factors, it will likely take a number of years to complete the work. This will likely result in various restoration phases being implemented in different reaches at different times. Funding availability, environmental compliance, and permitting schedules will also influence implementation sequencing. Later design phases will consider sequencing in greater detail with the recognition that the Kootenai

River Habitat Restoration Project is a single endeavor with component parts that are all inter-linked and inter-dependent.

The implementation scenarios presented in the Master Plan represent potential approaches to implementation and a way to understand the impacts of scale to both cost and project effectiveness; however, the actual restoration treatments, scale of implementation, and details about prioritization and sequencing of implementation will be determined in subsequent phases of this project. It is important to remember that the minimum, moderate and maximum implementation scenarios presented in the Master Plan are illustrative examples only.

Adaptive Management and Monitoring

In order to continually evaluate whether the Kootenai River Habitat Restoration Project is accomplishing the project purpose, goals and objectives described in the Master Plan, an adaptive management and monitoring program will be implemented to support the restoration project. The purpose of the Kootenai River Habitat Restoration Project Adaptive Management and Monitoring Plan is to provide a framework to:

- Evaluate the effectiveness of the implemented habitat actions in terms of achieving the project goals;
- Identify project maintenance needs;
- Identify any potential unforeseen negative impacts on infrastructure;
- Support decisions to modify restoration treatments; and
- Refine or modify restoration treatments that might be implemented in later phases of the project.

The Adaptive Management and Monitoring program provides a mechanism to make the design process adaptable and accountable, and to determine whether habitat restoration goals are being achieved. Goals are described in terms of limiting factors related to morphology, riparian vegetation and aquatic habitat (and constraints related to river stewardship) that must be overcome to restore habitat; restoration strategies are identified to overcome limiting factors, and objectives are quantifiable ways to determine whether limiting factors are being addressed by treatments. In this document, some objectives include placeholders for thresholds that will be developed during the next phase of the design process and used to determine whether success criteria are being met.

Once preliminary designs are completed for a project reach, success criteria will be developed based on either quantitative or qualitative criteria developed as part of the design. Success criteria provide a way to explicitly state the expected outcomes of restoration treatments within both short-term and long-term time frames. The associated monitoring program must include ways to measure these criteria in a manner that is quantifiable, repeatable and accurate. To accomplish this, metrics will be selected for each success criteria. Monitoring metrics are ways of measuring criteria; for example, size class distribution is a metric for sediment transport and feet per year is a metric for lateral bank erosion.

Three types of monitoring are necessary to establish the integrated monitoring program. These include baseline, implementation, and effectiveness monitoring.

- **Baseline monitoring** documents the pre-restoration condition.
- **Implementation monitoring** (also called as-built monitoring) documents the restoration project as completed.
- **Effectiveness monitoring** addresses whether project objectives are being met, determines maintenance needs, and provides inputs into decision pathways.

To support the Adaptive Management and Monitoring Program, the Kootenai Tribe will convene an interdisciplinary adaptive management and monitoring team that will include representatives from key management agencies (co-managers), a range of necessary disciplines (e.g., fish and plant biologists, hydrologists, etc.) and other experts in the field of restoration. This team will critically review monitoring data and other project-related information (in the office and in the field) so team members can interpret monitoring results in the context of developing ecosystem functions and processes. Through this framework, it will be possible to determine whether the implemented restoration treatments are meeting project objectives based on success criteria, which corrective measures may be necessary, whether maintenance is necessary, and whether monitoring methods and/or success criteria should be modified.

In addition to data collected specifically to support the Kootenai River Habitat Restoration Project, other data focused on biological populations are currently being collected to support related programs. The Kootenai River Habitat Restoration Project Adaptive Management and Monitoring Program will include data from other programs as part of evaluating the effects of the habitat restoration project. Data will be stored and managed in a centrally accessible database that will be designed to support adaptive management.

Environmental Compliance and Consultation

Various federal, state, and local environmental laws and administrative requirements will apply to the Kootenai River Habitat Restoration Project. The Master Plan provides an overview of anticipated environmental compliance and consultation requirements related to subsequent phases of the project. Applicable laws and environmental requirements include: NEPA, Clean Water Act, Idaho water quality requirements, local floodplain permits, other permits related to air quality and land use, Endangered Species Act, National Historic Preservation Act, and Federal Farmland Protection Policy Act. Comprehensive permit requirements, schedule, and associated costs will be developed and refined in the preliminary and final design phases.

Estimated Costs

To develop conceptual cost estimates, the Kootenai Tribe contracted with a large construction firm with extensive experience planning, estimating, and building projects of similar scope and scale. Cost estimates were developed for estimated construction and construction related costs, for the minimum, moderate and maximum implementation scenarios for each of the project reaches. The conceptual costs for the minimum, moderate and maximum implementation scenarios for each project reach were then translated into unit costs (e.g., feet, acres, units) in order to provide a flexible way to look at potential project costs by reach, scenario and treatment that is consistent with the conceptual framework presented in this Master Plan. Cost

estimates were based on the following categories: planning and coordination, data collection, preliminary and final design; construction; as-built documentation and establishment of monitoring baselines; post-construction effectiveness monitoring; biological monitoring; post-construction maintenance; permitting and environmental compliance; and management of land use practices.

As noted previously, the Kootenai River Habitat Restoration Project will likely be implemented over a number of construction seasons. Sequencing will be extremely important in managing costs. As designs and implementation strategies and planning are refined during preliminary and final design phases, it will be possible to determine which approach is likely be most cost efficient in accomplishing the varying scopes of work.

Next Steps

This Master Plan provides a framework for planning, design and implementation of the Kootenai River Habitat Restoration Project; it represents the first planning phase of this project. Critical next steps will include:

- **Interim Planning** – This phase will included targeted data collection and analysis necessary to address uncertainty, better understand risks associated with specific actions, and necessary to further refine specific design elements; prioritization and selection of the specific restoration treatments and implementation scenarios that will move forward to the preliminary and final design phases; and other necessary planning and coordination activities.
- **Preliminary Design Phase** – The preliminary design phase will include continued evaluation of project feasibility, through a series of documents that address data gaps, summarize data collection and analysis efforts, and identify specific reaches and floodplain areas where restoration work will occur. Environmental compliance activities will also be initiated, and in some cases completed in the preliminary design phase.
- **Final Design Phase** – The final design phase will include development of a series of specific documents and design drawings that describe the design elements for each of the project components and/or the river reaches and floodplain areas based on the project sequencing plan. Environmental compliance activities will be completed in the final design phase.
- **Implementation Phase** – During the implementation phase, the restoration project will be constructed, monitored and maintained according to the project sequencing schedule.

It is possible that various habitat restoration components of the Kootenai River Habitat Restoration Project will be proceeding through the preliminary and final design phases and implementation phase at different points in time. For example, there may be a phase 1 round of projects, followed by a phase 2 and phase 3 round of projects – all of which will be developed and adaptively managed within the framework of the Kootenai River Habitat Restoration Project.

The Kootenai River Habitat Restoration Project is a large and complex project. Successful design and implementation will require the ongoing cooperation and collaboration of a broad community of individuals and entities. The Tribe places a great deal of importance in ongoing

stakeholder outreach and coordination, and these will be significant components of all phases of the project.

This habitat restoration project will also complement and enhance the benefits derived from other related habitat and aquaculture projects that are being, and have been, implemented by the Tribe and others (e.g., Kootenai River Native Fish and Conservation Aquaculture Program, nutrient restoration, Libby Dam Operational Loss Assessment, wildlife mitigation, Kootenai River Valley Wetlands and Riparian Conservation Strategy, tributary restoration efforts, etc.)

The Kootenai Tribe looks forward to working with the regional co-managers, agency, and community partners to implement this important project.