

Pacific lamprey

2015 Regional Implementation Plan

for the

Upper Columbia

Regional Management Unit



First Draft

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Primary Authors	Primary Editors
XXX YYY ZZZ	XXX YYY ZZZ

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I. Status and Distribution of Pacific lamprey in the RMU

A. General Description of the RMU

Within the Upper Columbia Regional Management Unit (RMU) downstream of Chief Joseph Dam, the existing uppermost distribution point for anadromous fish species, are thirteen HUC4 subbasins, including Lower Yakima (#17030003), Naches (#17030002), Upper Yakima (#17030001), Wenatchee (#17020011), Upper Columbia-Entiat (#17020010), Methow (#17020008), Okanogan (#17020006), Similkameen (#17020007), Upper Columbia-Priest Rapids (#17020016) and Chief Joseph (#17020005). Limited or no information was available for Pacific lamprey in some of these subbasins, including Lower Crab (#17020015), Upper Crab (#17020013), Moses Coulee (#17020012), and Lake Chelan (#17020009). As a result, the assessment and prioritization focused on six basins/subbasins: Columbia, Yakima, Wenatchee, Entiat, Methow, Okanogan. Although historic distribution likely extended into Sanpoil (#17020004), Colville (#17020003), and Kettle (#17020002) subbasins, these areas were excluded from analysis at this time due to existing passage constraints.

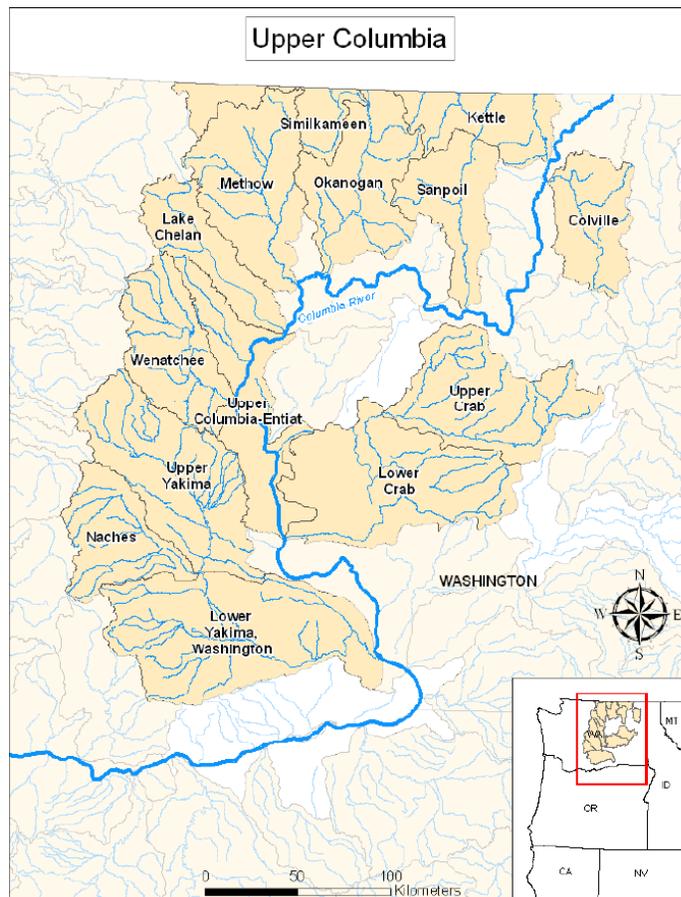


Figure 1. Map of the Upper Columbia Regional Management Unit (taken directly from the USFWS Conservation Assessment).

B. Status of Species

Conservation Assessment and New Updates

During the development of the USFWS Conservation Assessment (October, 2011), there was a high level of uncertainty in population status. However, recent field surveys and assessment throughout much of the RMU provided relatively high certainty of the population status, which appear to be severely diminished in many of the subbasins. According to the Conservation Assessment, historic occupancy was relatively high in the Yakima, Wenatchee, Entiat, Methow and Okanogan rivers. Current population size is very low (250-1000) or near zero in most areas of historic occupancy.

Distribution and Connectivity

There are five hydroelectric dams within the UC RMU downstream of Chief Joseph Dam: Priest Rapids, Wanapum, Rock Island, Rocky Reach, and Wells dams. The combined impacts from this series of dams appear to impose a significant impact on upper reach distribution and connectivity for Pacific lamprey. There are also many irrigation diversion and some hydroelectric dams in the key tributary streams; the Yakima River has multiple diversion dams operated by (or in part) the BOR plus many more on tributary streams. Based on radio telemetry studies in the Yakima Basin, mainstem dams were found to interfere with adult Pacific lamprey migration with passage rates ranging between 0 and 82%. Because of variability in passage rates by season, adult lamprey that successfully passed three or more of the lowermost dams were less than 5%. No lamprey were able to pass Roza Dam, the dam located near the lower end of the Upper Yakima Subbasin. In the Wenatchee Subbasin, Tumwater Dam was found to be the upper most distribution point for Pacific lamprey in recent years. Distribution in the Entiat Subbasin does not appear to be limited by these tributary dams. There is essentially no information regarding the Okanogan Subbasin.

Brief Narrative

Larval lamprey surveys have been performed in most of these subbasins by the Yakama Nation, USFWS, and the Wild Fish Conservancy/Methow Salmon Recovery Foundation. Although Western Brook Lamprey are widely distributed and reasonably abundant, Pacific lamprey are functionally extirpated throughout the Yakima Basin. The only locations where Pacific lamprey are found include Lower Yakima tributaries (Satus and Ahtanum), lower Naches River, and the middle reach of the mainstem Yakima River. The Yakama Nation has begun an active Pacific lamprey translocation program, ongoing over the past 4-years in key locations. Relatively low numbers of juveniles are found in the lower Wenatchee, Entiat and Methow subbasins. Pacific lamprey are believed to be extirpated in Crab Creek, and the upper Wenatchee, upper Methow and Okanogan. In the Methow Subbasin, recruitment of new larvae have been absent or severely limited in recent years and distribution severely reduced. There have been no recent surveys for lamprey in the Okanogan or Crab Creek.

C. Threats

Summary of Major Treats

The following table summarizes the known key threats within the Upper Columbia RMU tributaries (H – High, M – Medium, L – Low). (This Table has not been fully vetted by the RMU – Team.)

Key Threats	Okanogan	Methow	Entiat	Wenatchee	Yakima	Combined Score for Threats (H=3, M=2, L=1)
Adult Passage	H	L	L	M	H	8
Juvenile Passage	L	L	L	M	H	8
Dewatering & Flow Mgmt.	M	M	L	M	H	10
Stream & Floodplain Degradation	M	M	M	M	L	9
Water Quality	M	M	M	M	H	11
Predation	L	L	L	L	M	6
Small Population Size	H	H	M	H	H	14
Mainstem Passage	H	H	H	H	H	15
Climate Change	H	M	M	M	H	12

New Threats

Larval/juvenile entrainment has been examined extensively and intensively by the Yakama Nation within the Yakima Basin. Because of their small size, larvae that are less than <80 mm in length were easily entrained past the existing fish screens (made exclusively for juvenile salmonids). Diversion waterways were also found to provide ample larval lamprey habitat. However, dewatering severely impacts juvenile lamprey and their ability to survive or return back to the river. Concentration of a wide variety of contaminants in lamprey tissue as well as larval lamprey habitat (fine sediment) was found to be severely high in the Yakima Basin based on a collaborative research by the USGS, CRITFC, YN, and PNNL. Flow management in the Yakima Basin has heavily impacted the natural flow regime during key periods for Pacific lamprey (upstream migration, spawning, and newly hatching larvae). Predation is likely higher than was initially identified in many of the subbasins from invasive species (Smallmouth Bass, Largemouth Bass, Walleye, etc.) as well as native ones (Northern Pikeminnow, River Otters, etc.), especially in the Yakima Basin.

Restoration Actions

Within the mainstem Columbia River, improvements to Grant, Chelan, and Douglas County PUD hydroelectric dam fishways have occurred to increase adult passage success. These improvements are generally related to installation of plating over auxiliary water supply gratings and improvements to fish counting stations. To date, there have been no known lamprey habitat improvement projects implemented specifically for lamprey recovery.

Many instream and floodplain habitat restoration activities have been implemented in the Upper Columbia subbasins, although all of these actions have been designed / funded primarily for salmonid recovery. To date, the primary lamprey restoration activities that have occurred within this RMU include translocation of spawning adults (Yakima Basin), recent efforts towards adult passage (lower Yakima River), and salvage of entrained lamprey in irrigation diversions (Yakima Basin). Initial efforts have begun in artificial propagation (Yakama Nation, Umatilla Tribes and USFWS) and in the evaluations of juvenile entrainment mechanism and potential methods to prevent entrainment.

II. Selection of Priority Actions

A. Prioritization Process

Among the many threats identified in the Upper Columbia RMU, some showed a pervasive impact in the entire region, such as “mainstem passage”, “small population size”, “climate change”, and “water quality.” Other threats were more location specific, but nevertheless showed severe impacts at the local scale, such as “adult passage”, “juvenile passage”, and “dewatering & flow management.” Based on the conservation assessment, new monitoring and evaluation and multi-agency coordination meetings the following three projects were selected as priority projects for the Upper Columbia RMU: “Tributary Adult Passage”, “Juvenile Entrainment and “Toxicological Evaluations.”

Although “mainstem passage” is a key threat for this region, it was not included in the priority actions because there has already been a multi-agency focused effort (through Mid-Columbia Fish Forum meetings) to assess and reduce this impact. Responsible parties are clearly identified and we expect to see reasonable progress in improving the current status and conditions over time to improve passage in all of the Upper Columbia subbasins.

“Climate change” is identified as a critical subject for the region, but the feasibility and practicality in making tangible changes for lamprey through restoration actions is somewhat limited and requires large scale institutional changes.

“Small population size” is indeed a pervasive issue in the region. As a result, the YN has initiated adult translocation in the Yakima Basin and is in the process of beginning supplementation research using propagated larval outplanting. Translocation will likely be initiated in other subbasins in the near future as well, including Wenatchee, Methow, and Okanogan, in combination with adult passage monitoring.

“Dewatering & flow management” was also identified as a key threat in the Yakima Basin but meaningful restoration actions will require large scale institutional changes involving water rights and salmonid management and is likely a long-term action item. However, part of these threats could be addressed through restoration actions on “juvenile passage.”

B. High Priority Proposed Project Information

Tributary Adult Passage

Project Description:

This Project focuses primarily on the passage improvement of the lower five dams in the Yakima Basin (Horn Rapids, Prosser, Sunnyside, Wapato, and Roza dams) and the lower two dams in the

Wenatchee Subbasin (Dryden and Tumwater dams). Previous evaluations identified that passage is hindered at all of these facilities and mostly or completely blocked at Roza and Tumwater dams. Effectiveness monitoring will occur to evaluate the improvements in passage rates as well as to fine tune the passage structures. Secondly, monitoring will also occur in Entiat, Methow, and Okanogan subbasins to identify potential passage barriers and natural reaches for spawning. This will be operated in conjunction with anticipated translocation efforts in these subbasins and will use radio telemetry along with PIT tags. (*Note: passage studies will also need to be developed for the Okanogan Subbasin.*)

- **HUC 5:** Corral Creek-Yakima River (1703000312), Spring Creek-Yakima River (1703000310), Deep Canyon-Yakima River (1703000305), Umtanum Creek-Yakima River (1703000107), and Wenatchee River (1702001107). Migration behavior and spawning habitat in the Entiat, Methow, and Okanogan subbasins will also be pursued.
- **Facilities ownership:** Bureau of Reclamation (Yakima River) and Chelan County PUD (Wenatchee River). Multiple ownerships within the various subbasins.
- **Regulatory responsibilities:** BOR has fish passage responsibilities for the mainstem Yakima River irrigation diversion dams. Chelan County PUD and WDFW have shared responsibilities for fish passage at the lower Wenatchee River irrigation diversion dams along with associated Co-Manager activities monitoring salmonid populations.
- **Rationale and linkage to the watershed:** Yakima and Wenatchee subbasins hold an abundance of low gradient, nutrient-rich lamprey habitat; however, upstream distribution appears to be severely limited by existing irrigation diversion dams. By improving passage in the five lower reach dams on the Yakima River and in the lower reach of the Wenatchee River, significant improvements of passage rates are expected to occur which will improve distribution and abundance of Pacific lamprey in these two subbasins. Migration behavior and spawning habitat in these subbasins as well as the Entiat, Methow, and Okanogan subbasins will be pursued to help understand the spawning locations and overall distribution of the species within the Upper Columbia RMU. Currently, there is no information about adult passage within the Wenatchee, Methow and Okanogan subbasins.

Expected outcome (threats addressed): The goal of this Project is to provide safe, timely and effective adult passage across all dams and other obstructions that are operated within the Middle Columbia RMU to provide access to all spawning and rearing habitats throughout the basins. The near-term objective is to identify obstacle and barriers and describe the mechanisms to poor adult migration to tributary spawning areas, with a focus on Yakima and Wenatchee irrigation facilities. Passage improvement at Roza Dam will provide access to the entire Upper Yakima Subbasin. Passage improvement at Wapato and Sunnyside dams will provide access to Ahtanum Creek (a translocation stream), Wenas Creek, Naches Subbasin, as well as mainstem Yakima River. Passage improvement at Prosser and Horn Rapids dams will provide access to Satus and Toppenish creeks (both translocation streams) as well as mainstem Yakima River. Passage improvement at Tumwater and Dryden dams will provide access to all of mid and upper Wenatchee River as well as many tributaries including Nathan, Chiwawa, White, and Little Wenatchee. Establishment of adult spawning locations in the other subbasins will assist in

understanding key areas for future recruitment and selecting appropriate juvenile rearing “index sites” for future Status and Trends monitoring and will help identify barriers to adult migration passage so that these passage obstructions can be corrected.

- ***Identification and coordination with relevant stake holders:*** For the passage improvement projects, the primary stakeholders are the BOR, USFWS, WDFW, Yakama Nation and associated Irrigation Districts for the Yakima Basin, and the same aforementioned entities in addition to the Chelan County PUD for the Wenatchee Subbasin and the Colville Tribes in the Okanogan Subbasin. The Yakama Nation, USFWS and BOR have been in close coordination for the preliminary evaluations. Coordination has been low or non-existent at this time for the Entiat, Methow, and Okanogan subbasins, although there is strong concurrence among the partners that adult passage improvements are a high priority action.
- ***Feasibility and expected timeframes:*** Feasibility is high for the Yakima Basin projects due to availability of funding for passage improvement (USFWS and NRCS funding) and good cooperation among partnerships discussed above. Preliminary designs for passage improvement have already been devised in many of the lower reach facilities. The expected overall duration is approximately 5-6 years with anticipation to have four lower projects equipped with initial / pilot passage devices within the next 3-5 years (2018 - 2020). If sufficient funding can be secured for the Wenatchee Subbasin passage improvement and Upper Columbia monitoring, feasibility is high. The passage improvement and evaluation would occur over the period of 2-3 migration / spawning seasons.
- ***Proponent Role and Responsibilities:*** The Yakama Nation, BOR, USFWS will be primarily responsible for coordination and expenditure of funds and activities for these various projects.
- ***Consensus within the RMU Groups:*** There is high consensus within the RMU group that the Yakima Basin adult passage projects are high priority due to 1) the potential for high lamprey biological productivity within the basin, 2) the recent history of collaboration among the partners and 3) successes from the past and ongoing work. Consensus for the Wenatchee and Upper Columbia projects is high for the fisheries agencies responsible for proposing this action, although consensus has not yet been obtained from Chelan County PUD.

Budget and identification of potential funding sources: Funding for the passage improvement has been funded for Horn Rapids and Prosser dams through USFWS funding (approximately \$90,000) and for Sunnyside and Wapato dams through NRCS funding (~\$170,000). However, funding for passage improvement at Roza Dam (~\$50,000) and effectiveness monitoring in association with all these passage improvement projects (~\$100,000) is critically missing. Additional funding may come through the BOR, USFWS, and/or BPA Fish and Wildlife Program. New funding is needed for the Wenatchee passage improvement (~\$100,000) and Upper Columbia monitoring projects (~\$200,000), which may come through USFWS, and/or BPA Fish and Wildlife Program. Implementation of passage structures is difficult to estimate until initial analysis of appropriate placement is completed, alternative devices evaluated and preliminary designs of structures are available. Smaller contributions from the North Wasco Mitigation Fund are possible.

Reduction of Juvenile Entrainment in Tributaries

Project Description

Juvenile lamprey entrainment into various BOR facilities within the Yakima Subbasin and at Dryden irrigation diversion (lower Wenatchee River) is well documented and in many cases substantial. Prevention of entrainment is difficult due to the very small size of larvae/juvenile lamprey that enter canal intakes. Replacement of existing screens (designed for juvenile salmonids) would be expensive and likely impractical because screen mesh size would need to be reduced significantly (<1 mm, less than half the size of current requirement) for prevention of larval lamprey. However, lamprey can be effectively salvaged from these facilities using electrofishing or alternatively using heavy equipment and dump trucks lined with water proof liners. Natural side channel ponds can be used as a release location for these salvaged lamprey (so that turbidity issues from releasing fine sediment are minimized). Other short-term solutions are available, such as using flow barriers (such as ecology blocks) to prevent the accumulation of fine sediment in front of fish screens. Flow barriers can also be established downstream of the fish screens to prevent passage of larval lamprey further down the canal. There is also potential value in re-designing canal intakes in a manner that significantly reduces sediment intake and maintenance and potentially the entrainment of larvae/juvenile lamprey. The proposed method to develop and test these ideas is to build a physical model(s) that can provide (1) general guidelines for re-designed diversions and canal intakes and (2) facilitate individual designs for specific dimensions.

- **HUC 5:** Deep Canyon-Yakima River (1703000305) and Wenatchee River (1702001107).
- **Facilities Ownership:** Bureau of Reclamation (Yakima River) and Chelan County PUD (Wenatchee River).
- **Regulatory Responsibility:** BOR has fish passage responsibilities for the mainstem Yakima River irrigation diversion dams. Chelan County PUD and WDFW have shared responsibilities for fish passage at the lower Wenatchee River irrigation diversion dams along with associated Co-Manager activities monitoring salmonid populations.
- **Rationale and linkage to the watershed:** BOR owns, operates, and/or maintains five major irrigation diversions/ fish passage facilities in the lower Yakima River Basin (Horn Rapids, Prosser, Sunnyside, Wapato and Roza). Each of these diversions withdraws a substantial proportion of flow from the Yakima River and has the potential to entrain large numbers of larval/juvenile lamprey. In particular, Sunnyside and Wapato diversions entrain thousands of lamprey each year. The Dryden irrigation diversion is located in the lower Wenatchee River and is known to entrain substantial numbers (many thousands) of larval/juvenile lamprey, as evident from bi-annual sediment maintenance and lamprey recovery efforts.
- **Expected outcome (threats addressed):** The goal of this project is to provide safe, timely and effective juvenile passage past all irrigation facilities that are operated within the Yakima and Wenatchee basins to provide access to all rearing habitats and migration corridor below each of these Projects.
- **Identification and coordination with relevant stake holders:** The primary stakeholders in the

Yakima Subbasin are the BOR, USFWS, WDFW the Yakama Nation and associated irrigation Districts. Each of these entities have remained in close coordination during the past 4-years of preliminary evaluations. Both BOR and the YN have been active in providing updated information to the irrigation Districts within the Yakima River subbasin. The same entities and Chelan County Public Utility District (CCPUD) are the key stakeholders for Dryden irrigation facility. Considerable conversation associated with juvenile entrainment at Dryden is occurring within the Rocky Reach Fish Forum, a part of the Federal Energy Regulatory Commission process associated with the CCPUD.

- ***Feasibility and expected timeframes:*** Funding is available (through a NRCS grant) for a pilot project in Sunnyside and Wapato diversions using heavy equipment and dump trucks to salvage and transport deposited fine sediment and entrained larval lamprey into side channel ponds in close proximity. Expected timeframe for this project is 2015-2019. Mechanism of entrainment has been evaluated jointly by the USGS (in laboratory) and the YN (in the field) in recent years. The next logical step is to apply low-cost short-term solutions to mitigate these impacts. Screen technology is not currently available for fish below 60-80 mm size and costs have not been estimated due to lack of final designs. However, physical models can be developed to reduce movement of fine sediment and larval lamprey into diversions.
- ***Proponent Role and Responsibilities:*** The Yakama Nation, BOR, USFWS, Chelan County PUD will be primarily responsible for coordination and expenditure of funds and activities.
- ***Consensus within the RMU Groups:*** There is medium - high consensus within the RMU group that this project is high priority due to 1) the potential for high lamprey biological productivity within the Yakima and Wenatchee basins especially near the facilities of focus, 2) and the recent history of successful collaboration among the USFWS, BOR, WDFW, Chelan County PUD, and Yakama Nation, and 3) the range wide impact of entrainment and this project's applications to other subbasins within and outside of the Upper Columbia RMU.
- ***Expected outcome:*** Mortality associated with entrainment and dewatering in irrigation diversions will be reduced using a variety of proven methods available (electrofishing, transport through heavy equipment and dump trucks, etc.). Pilot projects will be implemented to evaluate various short-term measures to reduce larval/juvenile lamprey entrainment in diversions. Physical modeling is required to evaluate designs for longer-term solutions to reduce entrainment of fine sediment and larval lamprey into irrigation diversions.
- ***Budget and identification of potential funding sources:*** It is reasonable to estimate \$500,000 is needed over the next 5-years for additional research and pilot project design. Funding is secured from NRCS (~\$200,000) and the remaining is likely to come primarily through the BOR and BPA Fish and Wildlife Program. Smaller contributions from the North Wasco Mitigation Fund are possible.

Toxicological Evaluations

Project Description:

Results to date indicate that concentrations of a wide array of contaminants (both legacy and currently used) were severely high in both lamprey tissue and fine sediment in the Yakima Basin. Because water quality is an integral, key issue in the subbasin, we propose to evaluate the impacts of these contaminants for key sensitive life stages, namely spawning adults and newly hatched larvae. The highest detection frequencies and concentrations of pesticides generally occur during irrigation season, which coincide with Pacific lamprey adult migration, spawning, and egg hatching period. We will also evaluate how contaminants are transmitted vertically from parents to offspring. There will also be opportunities to track contaminant levels in primary restoration areas that coincide with Pacific lamprey habitat to document changes in contaminant accumulation associated with restoration activities over the years (2015-2019). Samples will be collected and analyzed each year to document when the benefits of restoration in the form of toxics reduction begin to take place. We will also be able to compare the results with other Yakima mainstem samples funded and analyzed as part of separate concurrent projects.

- **HUC 5:** various watersheds within Lower Yakima (17030003), Upper Yakima (17030001), and Naches (17030002) subbasins.
- **Land ownership:** Multiple ownerships within the various watersheds, including city, state, federal, tribal, and private land.
- **Regulatory responsibilities:** Responsibility for the water quality / contaminants is not clear.
- **Rationale and linkage to the watershed:** Water quality / contaminants were identified as a key threat to lamprey survival in the Yakima Basin as well as many of the other subbasins in the Upper Columbia RMU. Enhancing our understanding on the life stage specific impacts of contaminants will help provide guidelines on contaminant loading and summer minimum base flow.
- **Expected outcome (threats addressed):** The goal of this Project is 1) to assess the specific impacts of key contaminants previously identified for spawning adults and newly hatched larvae and 2) to evaluate the rate of vertical transmission of key contaminants from parents to offspring. If the impacts are severe during this life stage and/or high rates of vertical transmission of key contaminants are confirmed, it will provide scientific grounds to make recommendations for reduced toxicant loading during key seasons for lamprey. It could also provide evidence for the importance of increasing base flow during this season when hydrograph is severely managed and manipulated.
- **Identification and coordination with relevant stake holders:** The primary stakeholders are the BOR, USFWS, USGS, WDFW, Yakama Nation, and associated Irrigation Districts for the Yakima Basin.
- **Feasibility and expected timeframes:** Feasibility is high for the stated objectives on contaminant monitoring because 1) baseline information on contaminants were already assessed in 2012-2015 and 2) spawning adults and newly hatching larval lamprey are available through our artificial propagation efforts. The expected overall duration is approximately 3-5 years.

- ***Proponent Role and Responsibilities:*** The Yakama Nation, BOR, USFWS, and the USGS will be primarily responsible for coordination and expenditure of funds and activities for these projects.
- ***Consensus within the RMU Groups:*** There is high consensus within the RMU group that the toxicology project is high priority due to 1) the potential for high lamprey biological productivity within the subbasin, 2) the recent history of collaboration among the partners and 3) successes from the past and ongoing work on toxicology studies, which were rated as highly important in many subbasins within the Upper Columbia RMU, especially within the Yakima Basin.
- ***Budget and identification of potential funding sources:*** It is reasonable to estimate that a minimum of \$200,000 is needed over the next 3-5 years to provide clear scientific evidence on the impacts of toxicants. Matching funds will be available through USGS (~\$69,000) and CRITFC (~\$53,000) funding, if at least \$90,000 could be funded through other sources over the next 3-5 years. Remaining funding may come from the BOR, BPA Fish and Wildlife Program, Salmon Recovery Funding Board and/or Wasco Mitigation Funds.

Consistency with the Conservation Agreement

Each of these Projects are consistent with the Conservation Agreement, specifically with Objective 6. Other parallel activities associated with this Project are also consistent with the Agreement, including translocation, data sharing, public outreach and identification and distribution of Pacific lamprey throughout the Basin.