Trinity River Restoration Program

P.O. Box 1300, 1313 South Main Street, Weaverville, California 96093

Memorandum

To: Trinity Management Council

From: Robin Schrock, DJ Bandrowski and Ernie Clarke

Subject: Future Restoration Actions in the Lewiston Area near Trinity River Hatchery

Date: August 8, 2014

The purpose of this memorandum is to inform the Trinity Management Council (TMC) of the past and possible future restoration strategies in the Lewiston area near Trinity River Hatchery (TRH) (Figure 1), findings from external hatchery experts on the likely effect of restoration in this reach, and differing internal views on restoration actions in the Lewiston area. Four simplified restoration options for the Lewiston area are described. Given divergent internal and external views, we seek TMC guidance on the desired restoration option.

Background

In 2012, the Physical Work Group (WG) and Design Team recommended a further gravel augmentation project be conducted at the hatchery site to replenish the gravels mobilized by the 2011 high flows (Figure 1). Additionally, the Physical WG and Design Team recommended that the gravel augmentation project include some channel modifications and be designed and implemented using the channel rehabilitation design process. In August 2012, the HVT submitted a letter to the Trinity River Restoration Program (TRRP) opposing the selection of the hatchery reach as a priority channel rehabilitation project given the potential negative influence of the high proportion of hatchery origin fish within that reach. In February 2013, a memo was circulated to all technical WGs seeking input on the proposed hatchery project. In March 2013, the Fish WG discussed the potential genetic concerns raised by the HVT and recommended: "Coarse sediment augmentation at TRH rehabilitation site should be strategically implemented to replenish spawning habitat." The recommendation also stated "The Fish WG will continue to discuss and consider management implications at the TRH site and potential effects on distribution and success of hatchery and natural origin spawners."

Design work for the hatchery project began in January 2014 with project construction anticipated for the summer 2016. Renewed concerns regarding genetic interactions caused by large numbers of hatchery salmonids spawning in the river were expressed at a Design Team meeting in March 2014 by USFWS, and again at the TMC meeting in March by CDFW, USFWS, and HVT. Design work on the hatchery project has been halted until there is agreement on metrics and

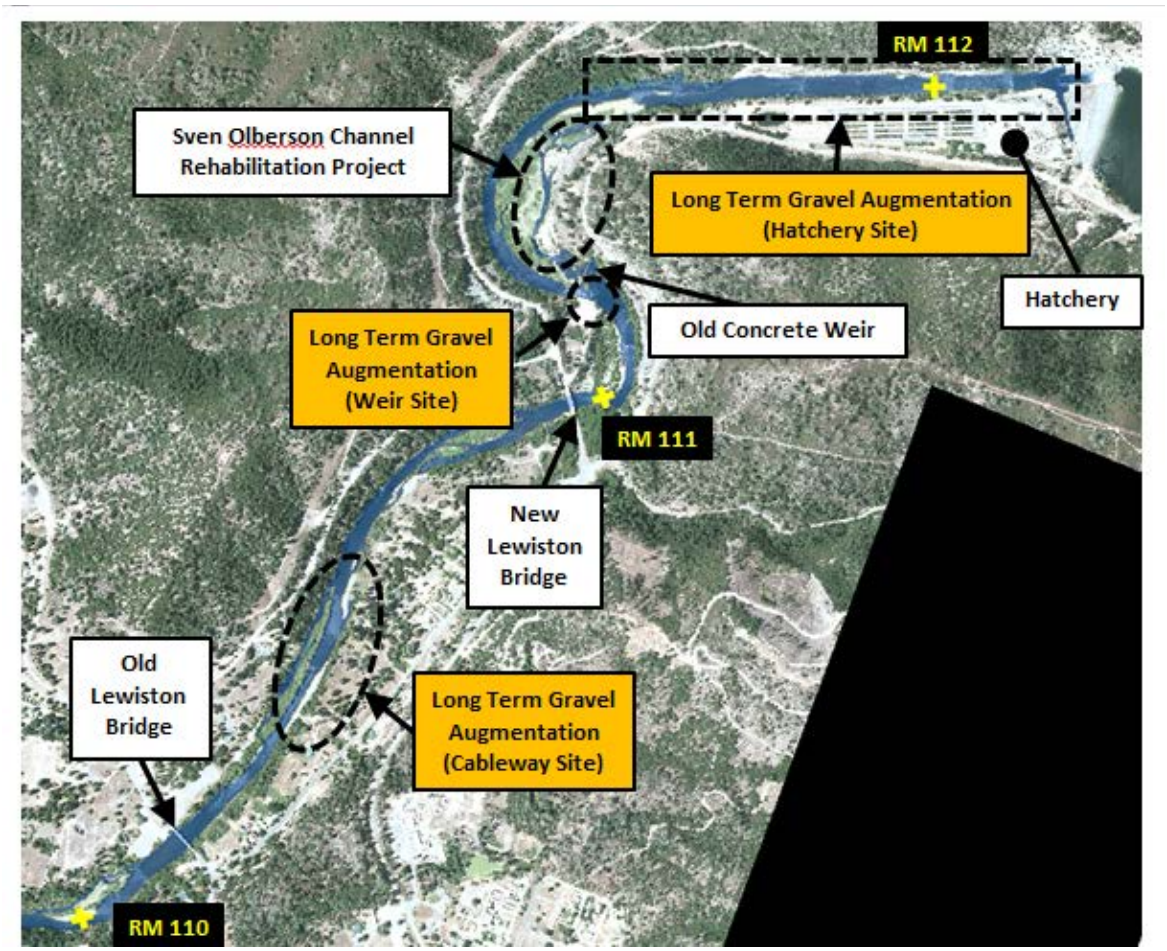

Figure 1. Map of the hatchery restoration reach. Lewiston, California.

criteria for measuring the influence of hatchery domestication concerns and the spatial extent of those concerns.

Past and Proposed Restoration Management Actions

Hatchery Site

Past Restoration Management Actions

The hatchery site is classified as a long-term gravel augmentation site (USFWS and HVT 1999). A total of 31,370 cubic yards of spawning size gravels have been augmented in the project site between 1972 and 2007 (Figure 2). Between 1972 and 1977, a series of four artificial spawning riffles were constructed at the hatchery site, and periodic gravel augmentation was conducted to replenish the artificial spawning riffles through 1990. After 1990, the focus of gravel augmentation shifted from maintaining the artificial spawning riffles to providing a supply of gravel to promote fluvial processes, channel complexity, and suitable substrate conditions.

The last restoration project in the hatchery site was constructed in 2006-07, which combined gravel augmentation (constructed in-channel bars) with channel rehabilitation (lowering of grade control structures, riparian removal, channel widening). The intent of the project was to increase

channel complexity, provide immediate spawning habitat, facilitate sport fishing, and provide a future supply of gravel for flow releases exceeding 6,000 cfs to mobilize (i.e. wash the constructed bars downstream). Additional gravel augmentation would be required once high flows mobilized gravel in the constructed bars downstream.

The 2011 high flow release of 11,000 cfs was the third largest flow release since flow regulation began and the largest release since 1974. The two main effects of the 11,000 cfs release were: 1) mobilization and transport of the gravel bars constructed in 2007 (as planned) leaving behind a coarsened channel bed upstream of river mile 111.8; and, 2) mobilization of the bar at river mile 111.63 that created a wedge of gravel extending 600 feet downstream. The gravel wedge largely cut off the upper entrances to the side channel complex located at the upper end of the Sven Olberson site, lowering the use and value of this feature for juvenile rearing.

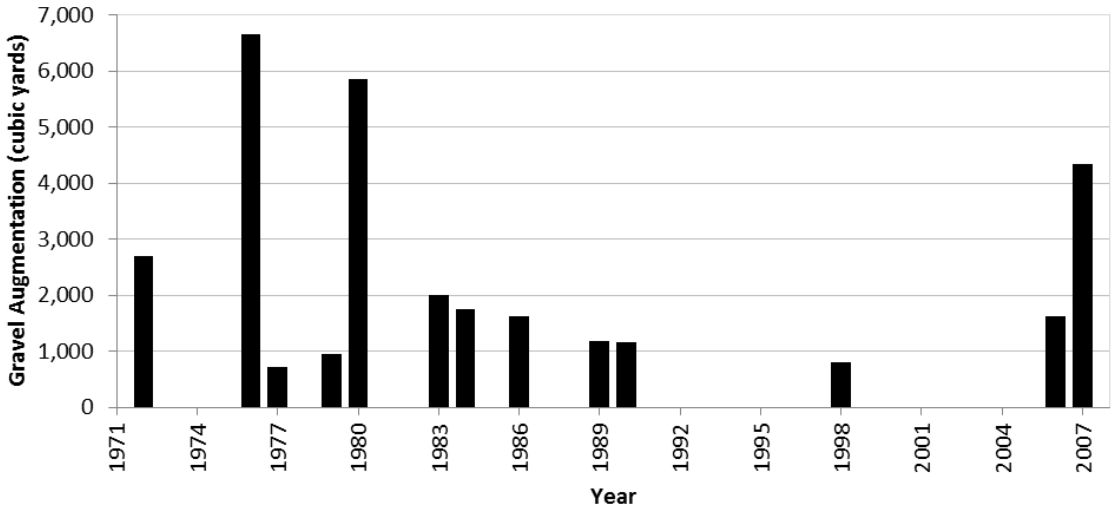

Figure 2. Gravel augmentation between Lewiston Dam and the weir. From Krause (2012).

Proposed Future Restoration Management Actions

The initial concepts for the 2016 hatchery project include a combination of channel rehabilitation and gravel augmentation to improve channel complexity and sediment routing to: 1) provide a balance of spawning, rearing, and adult holding habitat; 2) open and maintain the entrance to the Sven Olberson side channel complex; and 3) transition long-term gravel augmentation placements at the hatchery site from the current strategy of mechanically constructed in-channel features to direct high-flow injection. Direct injection lets the river immediately transport the augmented gravel which hydraulically builds and maintains a complex channel more naturally than mechanical construction can.

Sven Olberson Site

Past Restoration Management Actions

The Sven Olberson side channel complex was originally constructed in 1983 to provide avian and salmonid habitat. The original side channels became stagnant and did not provide suitable salmonid habitat. The Sven side channel complex was rebuilt in 2008 to provide rearing habitat for the high number of fry produced in this area. Construction of the 2008 Sven project included side channel construction, floodplain lowering and removal of the partial levee across the floodplain. The combination of these actions tripled available base flow rearing habitat in the side channel area. As described above, the 2011 high flow release caused significant deposition

that has largely cut off access to the Sven Olberson side channel complex, reducing the amount of habitat available for rearing.

Proposed Future Restoration Management Actions

Restoration actions at the Sven Olberson site include opening and maintaining the entrance to the Sven Olberson side channel complex in order to ensure juvenile fish passage and maximize rearing in this side channel complex.

Weir Site

Past Restoration Management Actions

A large, valley spanning, concrete weir was constructed in 1956 to facilitate dam construction and broodstock collection. In 1976, the weir was partially breached on the far right side to allow fish passage. The weir currently serves no purpose. The weir creates a backwater at high flows that extends up to the entrance to the Sven Olberson side channels. A large adult holding pool is located on the downstream side of the weir. The weir site is classified as a long-term gravel augmentation site (USFWS and HVT 1999). Augmentation at the weir site provides a downstream supply of gravel intended to promote fluvial processes that build and maintain a complex channel. Approximately 10,000 cubic yards of spawning size gravels have been augmented in the weir site between 2000 and 2014.

Proposed Future Restoration Management Actions

Continued high-flow gravel augmentation is proposed on an annual basis with augmentation volumes varying by water year type. More gravel is augmented during the larger flow releases in wetter years and little to no gravel is augmented in drier years. The gravel augmentation does not affect the adult holding pool below the weir.

Cableway Site

Past Restoration Management Actions

Augmentation at the cableway site has been used to construct bars to provide channel structure, as well as to provide a downstream supply of gravel to promote fluvial processes that build a complex channel with adequate salmonid habitat. Approximately 8,700 cubic yards of gravel have been augmented at the Cableway site between 2000 and 2008.

Proposed Future Restoration Management Actions

Periodic gravel augmentation is proposed at the Cableway site. A primary purpose of the augmentation is to maintain the hydraulic control that ensures adequate flow into the Miller side channel which provides a large amount of high quality rearing habitat across a range of flows.

Feedback from Hatchery Experts

Three experts on hatchery management practices, Dr. David Hankin, Dr. Carlos Garza, and Dr. Andrew Kinziger, were asked to answer five questions about the effect of restoration in the Lewiston area on salmonid production, and whether or not they supported restoration (gravel augmentation and channel rehabilitation) in this reach. Their opinions were mixed. Dr. Hankin and Dr. Kinziger did not support TRRP pursuing restoration in the Lewiston area until steps were taken in the hatchery and in the river to control the number of hatchery spawners in the river, and the proportion of naturally produced salmon in the broodstock. Dr. Garza supported future gravel augmentation and channel rehabilitation without the caveats of the other experts, while noting his assumptions and recommending ideas for further study. Both Dr. Hankin and Dr. Kinziger commented that TRH management should be coordinated with TRRP management.

Dr. Hankin advised that TRRP not encourage spawning of first generation hatchery fish by improving spawning or rearing habitat near the hatchery. While he noted gravel recruitment downstream of dams is a recognized problem, he advised that further augmentation of gravel should not be carried out without thoroughly considering the effect of a high proportion of hatchery fish spawning in the river. He stated that the current high proportion of hatchery fish spawning in this reach is incompatible with the management of TRH as an integrated hatchery program. Dr. Hankin noted that augmentation of spawning gravels in the upper reach might increase the number of redds that are constructed and might increase survival to the fry stage. However, whether or not that would have any influence on the number of returning spawners was not a question he could answer. Dr. Hankin and Dr. Kinziger both thought that focus should be placed on controlling the proportion of naturally produced salmon in the broodstock, and the number of hatchery spawners in the river prior to further restoration in the Lewiston area. Dr. Kinziger stated that as a general recommendation, the proportion of natural origin broodstock should be greater than the proportion of hatchery fish on the spawning grounds.

Dr. Garza wrote that TRRP should continue gravel augmentation and spawning habitat restoration in the Lewiston area. He reasoned that all potential spawning and rearing habitat should be considered important in order to provide the opportunity for sufficient natural production to meet TRRP objectives. He noted that the restoration of spawning habitat in the Dam Reach should have beneficial short- and long-term effects for natural fish production, provided that the restoration project would not substantially change the number of hatchery spawners in the reach. The progeny of the hatchery fish produced in this area will spawn only after they have passed the ultimate test of natural selection, which will eliminate mal-adaptive traits in natural areas. Their resulting progeny will likely spawn in other natural areas and, having been exposed to selection against domesticated traits, should relatively quickly have similar fitness to those fish that do not have hatchery ancestry. This creates a multi-generational, stepping-stone of gene flow which should be beneficial overall to natural production, by providing a demographic subsidy and through reintegration of some of the historic genetic variation of upper Trinity River salmon into the naturally spawning population. The relative reproductive success of hatchery and natural spawners in this area should be carefully examined, because concerns about gene flow are only valid if there are large differences in the fitness/reproductive success of hatchery and natural fish, and this has not been tested on the Trinity River.

TRRP Partner Input

A conference call was held on April 30, 2014 so that each representative of partner agencies could express their opinion on the planned hatchery restoration. At the time of that call, there was disagreement among TRRP partners as to whether or not to move forward with the planned gravel augmentation and channel rehabilitation. The opinions of the TRRP partner agencies given here were the current positions of the representatives as of the April 30, 2014 call; with new information received since that time these may or may not have changed. USFWS, HVTF, and USFS thought that restoration actions in this reach should not proceed until concerns about hatchery fish spawning in the river had been alleviated. CDFW did not make a recommendation to move forward with the project or not, noting that there was uncertainty that remained. CDFW recommended that TRRP consider study methods to help clarify the issue prior to future restoration actions, consider opening side channels without gravel augmentation, and coordinate

with existing hatchery management goals and hatchery genetic management planning. YTFP recommended moving forward with the designs while maintaining current spawning habitat quality and quantity and reconnecting the Sven Olberson side channel complex, combined with hypothesis testing on the effects of hatchery spawners in this reach. NOAA supported moving forward with the project.

Recommendations from the Fish WG

While there is some uncertainty and difference of opinion within the Fish WG on the best way to proceed with restoration in the Lewiston area, the Fish WG came to agreement on the following recommendations:

- A salmon and steelhead selection weir in the Trinity River as recommended by Dr. Hankin and Dr. Kinziger should be utilized to reduce the proportion of hatchery origin spawners in the upper Trinity River, possibly near Old Lewiston Bridge.
- 100% of all hatchery fish should be tagged so that their origin can be readily identified.
- The proportion of natural origin broodstock for all species at TRH should be closely monitored, and where appropriate, maximized to the extent practicable.
- Management and operations of TRRP and TRH should be coordinated to ensure that objectives for natural fish production are harmonized between these restoration and mitigation programs.

The Fish WG has other specific recommendations for changes in hatchery practices, and looks for guidance from TMC on how best to collaborate with TRH co-managers on these important issues.

Potential Criteria for Continuing Restoration in the Lewiston Area

The proportionate natural influence (PNI) would appear to be a logical metric to measure the problem of hatchery domestic selection in the Lewiston area. The PNI is a measure of gene flow between hatchery and naturally produced fish, and when monitored closely, can help limit the negative consequences of domestication selection. The PNI is calculated as PNI = pNOB/(pNOB+pHOS), where pNOB is the proportion of natural origin fish in the broodstock, and pHOS is the proportion of hatchery origin fish on the spawning grounds. The CAHSRG (2012) recommended a minimum value of 0.5; further research can determine the importance of shifting the PNI toward higher values. CAHSRG (2012) did not make reach specific recommendations or recommend calculating the PNI at a smaller scale than the population unit size. However, calculation of the PNI assumes that hatchery spawners are randomly mixed in the population, which is not the case in the Trinity River because the distribution is skewed towards the hatchery. In this case it may be useful to calculate the PNI, or some surrogate, for the area upstream of Lewiston Bridge.

Following Mobrand et al. (2005), Dr. Kinziger recommended that pNOB > pHOS. This could be a potential metric for the continuing gravel augmentation in the Lewiston area. Assuming a pNOB of 0.25, a pHOS of less than 0.25 would be required to meet this standard. One would implement the use of this metric by choosing the point in the river at which the estimated proportion of hatchery fish is less than pNOB (Figure 3). Downstream of that point, concerns over domestication would be reduced to a level that would be consistent with operation of an integrated hatchery, and spawning and rearing habitat restoration and gravel augmentation may not conflict with TRRP goals. Using this example, the point at which domestication concerns

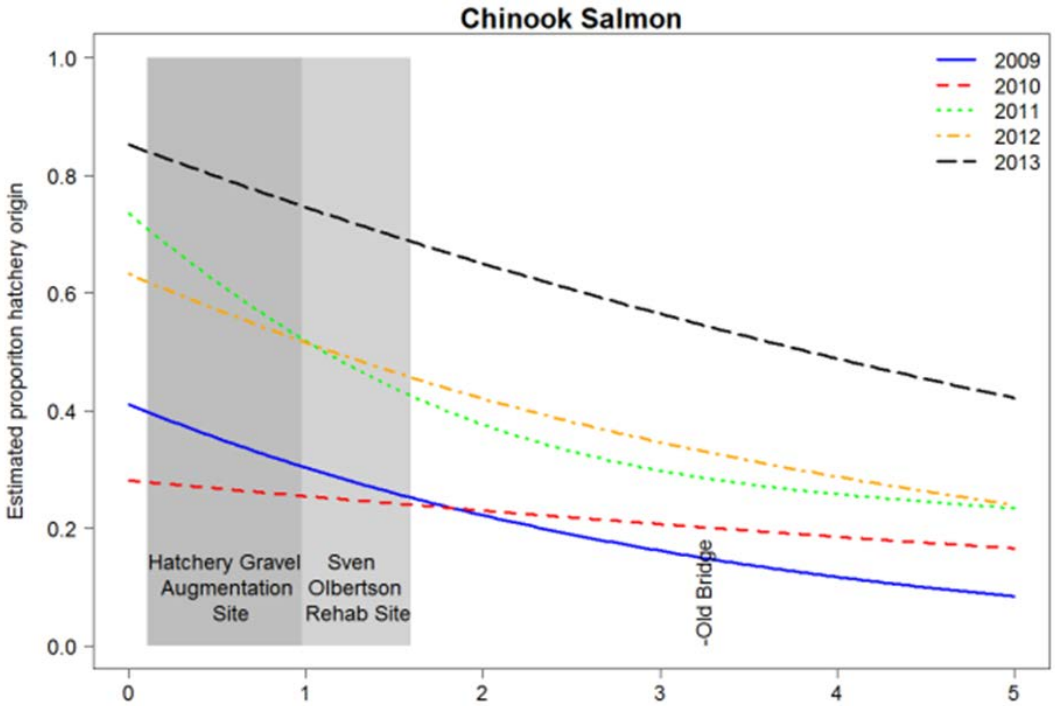

Figure 3. Estimated proportion of hatchery chinook salmon in the upper Trinity River. Red line indicates a pHOS of 0.25.

would be of less concern would vary from year to year, but on average would be approximately downstream of Old Lewiston Bridge (rkm 3.2).

Next Steps

TRRP partner representatives should agree on the metrics and the criteria above and attempt to reach consensus on when a restoration project in this reach could be implemented after changes at the hatchery have been implemented. If consensus cannot be reached, it might be appropriate to seek further guidance from the TMC. Concerns expressed by partners are related to the high proportion of hatchery fish spawning in the Lewiston area, which is considered a hatchery management issue, not a restoration issue. Solutions to these concerns involve changes in hatchery practices, such as use of more wild broodstock, 100% tagging or marking of Chinook salmon, new spawning protocols, and installation of a segregation weir, as recommended by some of the hatchery experts, which could take from one to several years to implement. The hatchery experts consulted for this memorandum and representatives of TRRP partners believe that TRH and TRRP should be coordinated. Some questions the TMC may want to deliberate are below:

- Until hatchery practices and TRRP goals can be better coordinated, what should be done in Lewiston area during the interim? Table 1 describes potential options.
  - Should gravel augmentation and channel rehabilitation continue as planned?
  - Should gravel augmentation proceed while channel rehabilitation is halted?
  - Should gravel augmentation and channel rehabilitation cease altogether?
  - If there is a cessation in gravel augmentation or channel rehabilitation, how long should that last?

References

California Hatchery Scientific Review Group (California HSRG). 2012. California Hatchery Review Statewide Report. Prepared for the US Fish and Wildlife Service and Pacific States Marine Fisheries Commission. April 2012. 100 pgs.

Krause, A.F. 2012. History of Mechanical Sediment Augmentation and Extraction on the Trinity River, California, 1912 – 2011. Technical Report TR-TRRP-2012-2 (Revised). Bureau of Reclamation. Trinity River Restoration Program. Weaverville, California.

Mobrand, L., and coauthors. 2005. Hatchery Reform in Washington State: Principles and Emerging Issues. Fisheries 6:11-23.

U.S. Fish and Wildlife Service (USFWS) and Hoopa Valley Tribe (HVT). 1999. Trinity River Flow Evaluation Final Report. June 1999.

Table 1. Restoration options for the Lewiston area in the interim period prior to changes in hatchery practices and projected outcomes of restoration options.

OPTION	Full restoration	Gravel augmentation	Limited gravel augmentation	No action
Description	Proceed with channel rehab. near Hatchery & Sven Olberson; gravel augmentation at Hatchery, Weir, & Cableway consistent with long term objectives.	Gravel augmentation at Hatchery, Weir, Cableway consistent with long term objectives. No channel rehabilitation.	Limited gravel augmentation at Weir &/or Cableway consistent with long term objectives. No gravel augmentation or channel rehabilitation at Hatchery.	Defer all channel rehabilitation & gravel augmentation in Lewiston area until further review or coordination with hatchery practices.
Salmonid production	Option balances spawning, fry, & juvenile habitat area for all species by opening access to Sven Olberson, creating side channel at current alcove, & adding complexity adjacent to hatchery. Option likely to lead to an increase in juvenile survival in this reach. Improves adult holding habitat area. Potential increase in production of F2 generation hatchery fish, with associated negative consequences.	Results in the largest quantity of spawning habitat available because adding gravel without other restoration actions maintains uniformly suitable spawning habitat throughout hatchery reach. More hatchery fish spawning in the river in Lewiston area. Could also increase fry rearing area. No change in adult holding habitat. No change in juvenile rearing area. This option maintains current conditions. Potential to increase competition with fry downstream if more fry in this area move downstream into other habitats.	Spawning habitat adjacent to hatchery continues to coarsen & become less productive. Egg & fry survival within Lewiston area decreases. From weir downstream, no change in egg, fry, or juvenile survival. No change in adult holding habitat. Potentially aids in survival of progeny of natural spawners downstream by reducing density of fry & juveniles downstream of Lewiston area	Spawning habitat adjacent to hatchery continues to coarsen & become less productive. Unlikely to change spawner distribution, hatchery fish will still spawn in this area. Potentially aids in survival of progeny of natural spawners downstream by reducing density of fry & juveniles downstream of Lewiston area. No change in adult holding habitat.
Physical impacts	Near Hatchery: Improved channel complexity. Maintains coarse sediment budget. Substrate remains mobile & within suitable spawning size. Near Sven Olb.: Improved gravel routing & channel complexity. Opens & maintains access to Bear Island split flow channel & upper Sven side channel complex. Near Weir: Balanced coarse sediment budget provides adequate downstream sediment supply. Near Cableway: Maintains current planform & substrate conditions.	Near Hatchery: Maintains coarse sediment budget. Substrate remains mobile & within suitable spawning size. Channel complexity low unless gravel mechanically placed as temporary bars. Near Sven Olb.: Bar building & channel dynamism follows historic patterns. Gravel wedge cutting off Bear Island split flow channel remains intact. Access to upper Sven side complex remains limited. Near Weir: Balanced coarse sediment budget provides adequate downstream sediment supply. Near Cableway: Maintains current planform & substrate conditions.	Near Hatchery: Creates coarse sediment deficit, channel bed armoring, substrate coarsening, & loss of complexity. Near Sven Olb.: Gravel wedge cutting off Bear Island split flow channel remains intact. Access to upper Sven side complex remains limited. Near Weir: Balanced coarse sediment budget provides adequate downstream sediment supply. Near Cableway: Maintains current planform & substrate conditions.	Near Hatchery: Creates coarse sediment deficit, channel bed armoring, substrate coarsening, & loss of complexity. Near Sven Olb.: Gravel wedge cutting off Bear Island split flow channel remains intact. Access to upper Sven side complex remains limited. Near Weir: Coarse sediment budget becomes unbalanced creating a deficit. Near Cableway: Minor substrate coarsening & loss of channel complexity.