Infrastructure and Operations Audit: Magic Valley Fish Hatchery, 2024

Magic Valley Fish Hatchery
Lower Snake River Compensation Plan

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Executive Summary

On April 4, 2024, Nathan Wiese, LSRCP Program Coordinator LSRCP, Chris Starr – Asset Manager LSRCP, John Rankin – Hatchery Manager, and Steve Kammeyer – Assistant Hatchery Manager, conducted a high-level one-day infrastructure and operations assessment of the Magic Valley Fish Hatchery. On April 4, 2024, Nathan Wiese, Program Coordinator LSRCP, Chris Starr, Asset Manager LSRCP, John Rankin, Hatchery Manager, and Steve Kammeyer, conducted a high-level one-day infrastructure and operations assessment of the Magic Valley Fish Hatchery. A final facility assessment addressing steelhead trout (*Oncorhynchus mykiss*) production was made by Shawn Sanders – LSRCP/FWS Fish Biologist, John Rankin – Hatchery Manager, Steve Kammeyer – Assistant Hatchery Manager, and Brandon Filloon – Complex Manager on September 16, 2024, to record any additional program needs.

The purpose of this document is to provide the Lower Snake River Compensation Plan (LSRCP) and other stakeholders ample conceptual-level information of the current infrastructure challenges. The goal is to incorporate audit findings into a 10-year strategic plan for LSRCP that will maximize in-house and external improvement opportunities by developing solutions that fit resources, budgets, and supportive programs in a logical sequence. These efforts are intended to significantly improve water quality, program capacity, efficiency, and flexibility at the facility and ultimately increase opportunities for LSRCP to meet adult mitigation targets.

The LSRCP plans to assess all steelhead rearing facilities within the program prior to the 10-year spring/summer Chinook Program Review for the Independent Scientific Review Panel (ISRP) in January 2025. With this review, the LSRCP intends to identify strategies towards optimizing performance to achieve project area goals of 55,100 steelhead adult returns. From 2004-2017, the LSRCP averaged 70,319 spring/summer steelhead adult returns.

The Magic Valley audit(s) resulted in several options for increasing steelhead trout capacity including the following:

- Rebuilding Raceways: The Magic Valley raceways need repair/replacement due to 40 years of use and deteriorating concrete at expansion joints with annual concrete repair costs exceed $25,000. Cost – TBD

- Offsite Acclimation: Both Irrigon and Lyons Ferry Fish Hatcheries have utilized acclimation sites. Acclimation sites are the final rearing facility and allow for fish to acclimate to a new water source prior to release, a direct river or volitional strategy utilized at most sites. Cost – 1.75M

- Early Rearing Expansion: Current early rearing is limited by water drainage and rearing space. Expansion would accommodate reducing densities and the potential for expansion. Cost – $750,000

- Intake Structure Repair: Additional protection and maintenance to the spring could protect the water source from potential future disease transfer. Cost – $100,000

- Steelhead Production Reduction (B-run): An operational strategy to reduce MVFH production or transfer production to another facility or acclimation site would increase the potential of B-run returns and boost the potential for MVFH to meet mitigation goals. Cost – TBD

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1 Scope

On April 4, 2024, Nathan Wiese, Program Coordinator LSRCP, Chris Starr, Asset Manager LSRCP, John Rankin, Hatchery Manager, and Steve Kammeyer, conducted a high-level one-day infrastructure and operations assessment of the Magic Valley Fish Hatchery. A final facility assessment addressing steelhead trout (*Oncorhynchus mykiss*) production was made by Shawn Sanders – LSRCP/FWS Fish Biologist, John Rankin – Hatchery Manager, Steve Kammeyer – Assistant Hatchery Manager, and Brandon Filloon – Complex Manager on September 16, 2024, to record any additional program needs.

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2 Background

Magic Valley Fish Hatchery's (MVFH) goal is to return 11,660 steelhead to the LSRCP program area. The original smolt production target deemed necessary to meet the adult mitigation goal was 2.0 million yearling smolts at 4.5 fpp and an SAR of 0.67% (Table 1). Reduced spring flows within the Hagerman Valley, since program initiation, currently limit production to 1.55 million yearling smolts. Current production at MVFH is 403,000 Sawtooth A-Run (SawA) to Little Salmon River, 434,000 to Upper Salmon River B-Run (USRB) to Pahsimeroi Weir, 279,000 SawA to Sawtooth Weir, and 434,000 USRB to Yankee Fork.

2.1 Infrastructure

2.1.1 Hatchery Water Supply

The Magic Valley Fish Hatchery receives water from a spring on the north wall of the Snake River canyon. The spring (Crystal Springs) is mostly covered to prevent contamination. Water is delivered to the hatchery through a 42-inch pipe that crosses the Snake River, to a maximum of 125.5 cubic ft/s (cfs). Spring water temperature remains a constant 15.0 ºC year-round.

2.1.2 Broodstock Collection

The Sawtooth Fish Hatchery operates as primary broodstock collection facility for the LSRCP Salmon River A-run steelhead program. Additional eggs may be utilized from the Pahsimeroi Fish Hatchery (integrated Sawtooth and Pahsimeroi broodstock) if annual shortages exist (AOP 2022). Eyed eggs are generally shipped to receiving hatcheries when they have accumulated approximately 425 FTUs.

Upper Salmon River B-Run (USR-B) stock is collected at the Pahsimeroi Fish Hatchery for the program. Future broodstock collection of the USR-B is expected at the Yankee Fork of the Salmon River.

2.1.3 Incubation

Incubation facilities at the Magic Valley Fish Hatchery consist primarily of 40, 12-gallon upwelling containers. Each container is capable of incubating and hatching 50,000 to 55,000 eyed steelhead eggs. Two incubators are placed in each concrete vat. Eggs are typically disinfected in 100 ppm Iodophor for a minimum of 10 minutes by receiving hatcheries.

Disinfected eyed eggs are loaded into upwelling incubators at approximately 50,000 eggs per jar with a flow rate of 6 to 8 gallons/minute (gpm). All stocks are reared in the incubation building.

Water flow to incubation jars is adjusted so eggs gently roll while all eggs are moving within the vessel. Temperature is tracked daily to monitor egg development. Water temperature is a constant 15.0ºC.

Fry are allowed to volitionally exit upwelling incubators and move directly into early rearing vats through approximately 1,000 Fahrenheit Temperature Units (FTU's). Once fry have developed to that stage incubators are dumped into vats. Fry are generally ponded into rearing vats between May and early June.

2.1.4 Nursery Rearing

A total of 20 vats are available. Vats measure 40' long x 4' wide x 3' deep. Each vat has the capacity to rear 115,000 to 125,000 steelhead to 200 fish per pound (fpp). Vats, generally, have a carrying capacity of up to 100,000 fry. Each stock is reared in separate culture rearing units. Putting less than 90,000 fry into most vats will restrict production due to limited rearing space. To maximize efficiency all vats are utilized. However, if egg production is reduced, fewer individuals are reared in vats. When fish density, in vats is reduced, and spawning timing is variable, the size variation is increased. Size variation within fish groups makes mass marking operations difficult to complete efficiently. To alter fish development, eggs from later takes are reared on heated water to sync egg and fry development among groups to meet mass marking goals. These operational protocols are coordinated with Sawtooth hatchery.

Initial rearing flows are set at 60 gpm and ramped up to 250 gpm prior to transfer to outside raceways. There is a maximum flow of 10 cfs for initial rearing due to drainage issues. Fish are reared within indoor vats to a maximum density index of 0.60 and a maximum flow index of 1.20, respectively.

Feeding typically begins 15 to 17 days post-hatch when approximately 90% of the fry achieve button-up. Steelhead fry are started on a Rangen starter diet that is fed at a minimum frequency of once per hour during rearing in the hatchery building.

2.1.5 Outdoor Rearing

Raceways have a carrying capacity of 62,000 smolts or 31,000 smolts per raceway section (two sections per raceway).

The Magic Valley Fish Hatchery has 32 outside raceways available for juvenile steelhead rearing, while under current operations only 25 are utilized for production. Each raceway measures 200' x 10' x 3' with a volume of 6,000 ft^3. Each raceway has the capacity to rear approximately 65,000 fish to release target size. Raceways may be subdivided to create 64 rearing sections. A movable bridge, equipped with 16 automatic Neilsen fish feeders span the raceway complex. Two 20,000 bulk feed bins complete the outside feeding system. Density (DI) and flow (FI) indices are maintained to not exceed 0.30 and 1.2, respectively (Piper et al. 1982).

Fish are transferred in groups of approximately 32,000 fish per outside section as part of the mass-marking operations, for a total of 50 sections. The upper sections are used for initial outdoor rearing. Screens are placed at the 50-foot keyway and the upper 100-foot section is divided into two rearing sections. Transfer to outdoor raceways begins in late July and is completed by early August. Fish will range in size from 110 to 180 fpp, respectively.

Raceway cleaning is not necessary within outdoor raceways, as the density, flow, and fish activity results in a natural sweeping effect, but are swept if needed. Sample counts are conducted monthly and fish mortalities are removed daily.

MVFH produces fish between 180 and 250 mm and 4.5 fpp at release. Length gained per month for the first three months of culture at both facilities is typically between 0.8 and 1.0 inches (20.3 to 25.4 mm). Fish gain approximately 0.65 to 0.75 inches per month (16.5 to 19.1 mm) thereafter. To meet the release size target, fish may be fed on an intermittent schedule beginning in the fourth month of culture. During this period density typically reaches an index of 0.30 and a maximum flow index of 1.30, respectively.

Once outside, fish are hand-fed until larger feeds can be conveyed through the feeding system from on-site bulk feed storage containers. Currently, for the last seven months of growth steelhead are fed an appropriate 450 extruded slow sink diet. Feeding duration varies by fish and feed size. Fish are fed on a five-day-on and two-day-off schedule to control growth as needed during the fall. Seven-day-a-week feeding resumes as soon as possible in the spring.

Dissolved oxygen and total gas saturation are monitored intermittently throughout the rearing cycle. Water temperature remains a constant 58 ˚F

Steelhead are projected for an average size of 220 mm at release. Sample counts are performed monthly on representative raceway sections, and length frequencies are measured prior to transport.

2.1.6 NPDES

Magic Valley is limited by phosphorus daily phosphorus discharge. Hagerman NFH limits are provided for comparison purposes (Table 2) because the facilities rear very similar numbers of steelhead (1.55M vs 1.56M).

2.1.7 Transportation

Loading and transportation procedures are similar among rearing hatcheries. Generally, yearlings are crowded in raceways and pumped into 5,000-gallon transport trucks using an 8-inch Magic Valley Heliarc pump and dewatering tower. Transport water temperature is chilled to approximately 7.2 ºC. Approximately 5,000 pounds of fish are loaded into each truck. Transport duration to release sites range from 4 to 6 hours. Trucks are equipped with oxygen and fresh flow agitator systems. Fish are not fed for up to four days prior to loading and transporting.

3 Operational/Infrastructure Changes for Program Efficiency

3.1.1 Rebuild Raceways

The Magic Valley raceways need repair/replacement due to 40 years of use and deteriorating concrete at expansion joints. Currently, annual concrete repair costs exceed $25,000. LSRCP is working with IDFG to discuss new options to:

- Assess a minimum of five options to repair or replace the existing raceways and clearly define pros and cons for each option. The options considered will include replacing the existing raceways in kind with structural improvements (including a comparison of repair and replacement of the raceways), paired raceways like those in design at Nampa Fish Hatchery, lakes like those at Lyons Ferry Fish Hatchery, circular ponds in flow-through, the use of offsite acclimation ponds, and no action. Additional options, if identified, are to be identified by the A-E.

  - The following will be identified for each option:

    - Benefits and drawbacks
    - Clearly define all infrastructure improvements required to meet the needs of the proposed option and include these improvements in the cost estimates
    - Option-specific operations and maintenance activities
    - Identify how to meet current production goals and future production goals
    - When available, include information about adult returns related to the option
    - Identify fish health risks by how many rearing units are used by each option
    - Identify any changes in operating and maintaining costs and staffing requirements associated with each option
    - Model Idaho DEQ NPDES phosphorous changes
    - Facility lifespan (minimum 50 years) and address potential water declines over that period
    - Preliminary sizing and layout

- A level-5 cost estimate
- Propose a high-level construction schedule for each option identified

- Sizing of alternatives will:
  - Be sized for 75 cfs with the ability to expand to 125.5 cfs
  - Produce 1.55M smolts to 4.5 fpp, not to exceed 0.3 DI or 1.2 FI
  - Maintain Raceway Turnovers > 2.0 per hour
  - Not exceed NPDES permit requirements
  - Improve disease prevention

3.1.2 Offsite Acclimation

Both Irrigon and Lyons Ferry Fish Hatcheries have utilized acclimation sites. Acclimation sites are the final rearing facility and allow for fish to acclimate to a new water source prior to release, a direct river or volitional strategy utilized at most sites. This rearing strategy has several benefits:

1. Homing response/reduced straying – Acclimated smolts tend to home better to release locations

2. Rearing Conditions – Acclimation locations generally have lower rearing densities promoting higher smolt to adult return rates

3. Hatchery Operational Demands – Main rearing facilities would require less total space to sustain large smolts during peak Spring loading periods.

Two acclimation units (ponds) designed for approximately 500,000 steelhead would have an approximate area of 350,000 ft^3 each and with available flow of approximately 12 cfs of water. A similar acclimation pond is used at Cottonwood (Grande Ronde River) for acclimation of steelhead from 7 fpp to 4.5 fpp and has a unit area of approximately 600'x 100' x 6' (360,000 ft^3).

The location of one acclimation pond would be in the Upper Salmon Basin. Upper Salmon Basin water temperatures would be 32 °F and increase to 42 °F at release in April. These reduced temperature parameters would require MVFH to transfer fish at 5 fpp to achieve a target release size of 4.5 fpp in April.

This acclimation pond strategy would allow MVFH to maintain a 1.2 Flow Index onsite while producing 2.05M steelhead smolts to 4.5 fpp between both rearing strategies (onsite and acclimation site rearing).

Estimated cost of $1.75M for acclimation ponds and additional early rearing infrastructure.

3.1.3 Early Rearing Expansion

Current early rearing is limited by water drainage and rearing space. Expansion would accommodate reducing densities and the potential for expansion. This expansion would remove and repair current drainage with correctly designed drains and potentially add rearing units to maximize production with current available water sources.

Estimated cost is $750,000.

3.1.4 Intake Structure Maintenance and Repair

Currently the intake structure is partially covered to prevent animals and birds from accessing the site, however additional protection and maintenance to the spring could protect the potential for future disease transfer from the water source to fish rearing units. Working within this area also requires site assessment to reduce the potential of destruction of habitat to the endangered Bliss Rapids Snail (*Taylorconcha serpenticola*), which is present within the springs.

Cost: $100,000

3.1.5 Steelhead Production Reduction – B-run

This facility produces both A- and B- run Steelhead trout. Long-term data suggests that returns (SAR) for B-run steelhead are substantially less than A-run fish. For this reason, an operational strategy to reduce MVFH B-run production and increase A-run production or transfer production to another facility or acclimation site would increase the potential of adult returns and boost the potential for MVFH to meet mitigation goals.

Cost: Production costs would be reduced through either an early transfer options or transfer of strain to another production site.

4 Infrastructure Needs

MVFH discussed a number of infrastructure needs to support the mission of the facility. These requests are listed below.

4.1.1 Electrical Infrastructure on Raceway Bridge

The raceway bridge, utilized for both feeding and cleaning of rearing units needs maintenance to repair and upgrade the current electrical systems. Maintaining this piece of equipment is necessary to complete normal culture tasks on the raceways and staff could not safely access the culture units without the bridge.

Cost: $75,000

4.1.2 Pole Barn

The addition of a Pole Barn on MVFH would help to properly store equipment on this facility and provide storage options during certain times of the year.

Cost: $50,000

4.1.3 Raceway Netting

Raceway netting is a necessity on MVFH to prevent access to birds and other wildlife around the facility. Preventing access to wildlife is the first and easiest way to prevent the spread of pathogens between local populations and production fish.

Cost: $50,000

4.1.4 Effluent Pond Excavation

The effluent ponds have never been cleaned at MVFH. This is a task that is familiar to the current staff and a maintenance item that was identified at a site assessment.

Cost: $100,000

5 References

Annual Operation Plan (AOP). 2022. Annual Operation Plan for Salmon and Steelhead Production Programs in the Salmon and Snake River Basins. Prepared by Idaho Department of Fish and Game, Nez Perc Tribe, Shoshone-Bannock Tribes, U.S Fish and Wildlife Service, and Idaho Power Company. https://www.fws.gov/sites/default/files/documents/2022%20Salmon-Snake%20AOP.pdf

Hatchery Genetic Management Plan (HGMP). 2002. Salmon River Basin A-Run Steelhead. Sawtooth Fish Hatchery. Magic Valley fish Hatchery. Hagerman National Fish Hatchery. https://www.fws.gov/sites/default/files/documents/Sawtooth%20Magic%20Hagerman%20HGMP.pdf

6 Appendix B. Water Quality Parameters

Primary IOC Contaminants	Magic Valley
Arsenic	
Barium	
Cadmium	<0.001
Chromium	0.00138
Mercury	<0.0001
Nickel	
Selenium	0.00143
Sodium	
Flouride	
Secondary and Other IOC Contaminants	
Chloride	
Iron	<0.01
Manganese	
Dissolved Solids	340.000
Zinc	
Silver	
Sulfate	
Calcium	62.800
Hardness (as $CaCO_3$)	222.000
Magnesium	24.200
pH	7.210
Potassium	5.360
Lead	<0.001
Copper	<0.001
Comments	
Alkalinity (mg/l)	182.000
Ammonia (mg/l)	<0.05
Gasoline (mg/l)	
Lube Oil (mg/l)	
Diesel (mg/l)	
Nitrate/N	2.650
Nitrite/N	
Flow (cfs)	80.00
Temperature (°F)	59
Dissolved Oxygen	85%

7 Tables

Table 1: Comparison of Annual SAR (%) of Magic Valley Steelhead production from 2000 to 2015, respectively.

Brood Year	SAR
2000	1.53%
2001	1.15%
2002	0.92%
2003	0.89%
2004	1.01%
2005	1.31%
2006	1.16%
2007	2.57%
2008	1.17%
2009	1.14%
2010	0.65%
2011	1.11%
2012	0.74%
2013	0.82%
2014	0.10%
2015	0.28%
Avg	1%

Table 2. Magic Valley and Hagerman daily Phosphorus Discharge Limit (NDPES), 2024

Sample Month	Magic Valley Max Discharge (lbs./day)	Hagerman NFH Max Discharge (lbs./day)
January	21.7	17.8
February	21.7	17.8
March	21.7	17.8
April	21.7	17.8
May	7.7	6.0
June	7.7	6.0
July	7.7	6.0
August	7.7	6.0
September	16.2	12.8
October	16.2	12.8
November	16.2	12.8
December	16.2	12.8