

Infrastructure and Operations Audit of the Lookingglass Fish Hatchery 2022



Lookingglass Fish Hatchery
Lower Snake River Compensation Plan

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Executive Summary

In June 2022, Chris Starr, Facility Coordinator LSRCP, Nathan Wiese, Program Coordinator LSRCP, Diane Deal, McCall Hatchery Manager, Brian Devlin, Budget Analyst, and Christian Hargrove, Facilities Operation Specialist 1, conducted a high-level one-day infrastructure and operations assessment of the Lookingglass Fish Hatchery.

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.

This audit is a kick-off effort to assess all spring/summer Chinook rearing facilities within the LSRCP program prior to the 10-year spring/summer Chinook Program Review for the Independent Scientific Review Panel (ISRP) in December 2022. With this review, the LSRCP intends to identify strategies toward improving performance of achieving project area goals of 58,700 spring/summer Chinook salmon adult returns. From 2004-2017, the LSRCP averaged 29,115 spring/summer Chinook salmon adult returns and failed to achieve the project area goal on any year during the period.

To maximize the production capacity of Lookingglass Fish Hatchery, rearing could be done at 75,000 smolts in each raceway (DI = 0.15) resulting in a total increase of 100,000 smolts. Total cost is \$20,000 annually.

Rearing to a DI of 0.2 would increase capacity by 810,000 smolts or 2.2M total. Annual cost for additional smolts is \$162,000. Alternatively, 2.2 M smolts could be reared at a DI of 0.15 by constructing 3 additional raceways in the endemic building footprint and extending the current eighteen raceways. Total cost is \$800,000 for raceway construction and modification and an additional \$500,000 for incubation expansion.

Maximize production capacity of Lookingglass Fish Hatchery

Program	Current Smolts	Proposed Smolts
Optimize Rearing Containers	1,390,000	1,490,000 (DI = 0.15)
Rear at 0.2 DI	1,390,000	2,200,000

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1 Scope

In June, 2022, Chris Starr, Facility Coordinator LSRCP, Nathan Wiese, Program Coordinator LSRCP, Diane Deal, McCall Hatchery Manager, Brian Devlin, Budget Analyst, and Christian Hargrove, Facilities Operation Specialist 1, conducted a high-level one-day infrastructure and operations assessment of the Lookingglass Fish Hatchery.

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This audit is a kick-off effort to assess all spring/summer Chinook rearing facilities within the LSRCP program prior to the 10-year spring/summer Chinook Program Review for the Independent Scientific Review Panel (ISRP) in December 2022. With this review, the LSRCP intends to identify strategies toward improving performance of achieving project area goals of 58,700 spring/summer Chinook salmon adult returns. From 2004-2017, the LSRCP averaged 29,115 spring/summer Chinook salmon adult returns and failed to achieve the project area goal on any year during the period.

2 Background

Lookingglass Fish Hatchery is part of the Lower Snake River Compensation Plan (LSRCP). The LSRCP has a project area goal of 58,700 spring/summer Chinook salmon adult returns to mitigate for survival reductions resulting from construction and operation of the four lower Snake River dams. However, from 2004-2017, the program failed to reach that goal and averaged 29,115 adult returns (USFWS 2020).

As part of the LSRCP, the Lookingglass Fish Hatchery has a target to return 5,820 hatchery adults into the Grande Ronde Basin. The Imnaha and Lostine River target to return depends on run return projects each year.

Lookingglass Fish Hatchery is located on the Lookingglass Creek adjacent to the Grande Ronde River located outside of Elgin, OR, and was completed in 1982. The Hatchery is located on a site formerly occupied by the Lookingglass Mill, that was selected for a site for salmon production because it was accessible year around, had a known water supply, and suitable infrastructure was available to support construction and operation of the facility. Adult collection and spawning are conducted at the hatchery in two traps aptly named the Upper Trap and Lower Trap, and at the Imnaha River Satellite, located on the Imnaha River approximately 29 miles south of the town of Imnaha. The facility is in the Hells Canyon Wilderness area.

Lookingglass Fish Hatchery has two tribal co-managers, the Nez Perce Tribe, (NPT) and the Confederated Tribes of Umatilla Indian Reservation (CTUIR). NPT is responsible for trapping Lostine River adults at their facility located near Wallowa, OR, and CTUIR is responsible for trapping Grande Ronde River and Catherine Creek adults located outside of Union and La Grande, OR.

Up to 453 females and 453 males are collected annually to contribute 1,390,000 smolts (1,140,000 Conservation and 250,000 Harvest), to the Snake River system.

Production goals are to provide 250,000 smolts for Lookingglass Creek 81, 150,000 smolts for Catherine Creek 201, 250,000 smolts for Upper Grande Ronde River 80, 250,000 smolts for Lostine River 200, and 490,000 smolts for the Imnaha River 29 stocks.

Lookingglass 5-year average performance of smolts onsite is excellent with Green to Eyed survivals at up to 96% and Eyed to Smolt survivals of 85%.

Lookingglass Fish Hatchery, 5-year Average Performance Metrics (AOP 2022)

Disease Culling	5%
Green to Eyed	96%
Eyed to Smolt	85%



Lookingglass Fish Hatchery



Lookingglass Fish Hatchery spring Chinook releases and returns.

Basin	Facility	Location	Smolts	Basin Adult Goal	BY07-16 Mean SAR
Northeast Oregon	Lookingglass	Catherine	150,000	970	0.58%
Northeast Oregon	Lookingglass	Lostine	250,000	1,654	0.86%
Northeast Oregon	Lookingglass	Upper Grande Ronde	250,000	1,617	0.44%
Northeast Oregon	Lookingglass	Lookingglass Creek	250,000	1,617	0.57%
Northeast Oregon	Lookingglass	Imnaha River	490,000	3,210	0.62%
Basin Total			1,390,000	9,068	0.61%

2.1 Infrastructure

2.1.1 Hatchery Water Supply

The Hatchery receives water through an underground 42-inch gravity line from Lookingglass Creek located upstream from the main hatchery complex. The hatchery can also draw from the Tempering Well # 2 located in the same area for tempering incubation and inside early rearing done in 30 double deep Canadian troughs. Summertime water temperature can reach a high of 67 degrees for a short time in late afternoon. Water temperatures reach a low 32 F in mid-winter which provides lower than permitted Cfs for those winter months.

During the fall and winter months, even though LGH has permits for CFS, creek levels are lower than what the permit uses, CFS which effectively affects availability of water for incubation and early rearing. Water management is in effect during those times.

Annual maintenance involves inspection of water control valves and the two traveling water screens used to filter debris and ice from the intake water supply, applying grease as needed to ensure smooth operation and visual inspection of the screens and pumps providing water to the spray bars to clean the screens. Periodic inspection of the intake area below the traveling water screens by professional divers, and/or video inspection of the area and water pipelines should be performed on a 10-15 year cycle. The last such inspection took place in Summer of 2010 (HGMP 2011, and 2019). TW screens are run daily to clean them and should be pressure washed annually to ensure efficient operation. The screens are kept in automatic mode at all times, when

not working on them (at that time the screens are shut off and locked out), so if there is debris build up and the water level drops six inches the screens activate automatically.

2.1.2 Broodstock Collection

Lookingglass Creek adult chinook salmon are collected at the upper trap (by the intake of the facility), and lower trap (by the outflow of the adult holding ponds) at Lookingglass Hatchery. The Imnaha River 29 adults are collected at the Imnaha River Acclimation and Adult Trap located 29 miles south of the town of Imnaha in the Hells Canyon Wilderness area. The Imnaha facility consists of a liftable weir, fish ladder, trap, one acclimation pond, a power crowder and adult collection area, a fully furnished cabin and shop. The facility is a flow through Imnaha River water facility. It is 100% propane generator powered. The adult trap holding capacity for the facility is approximately 100 to 200 adult salmon which are worked daily. Adults are collected but not spawned at this facility. They are collected using a collection strategy with in-season adjustments if returns are different from originally predicted, then transported to Lookingglass Hatchery and held until ready to spawn.

LGH's tribal co-manager, The Nez Perce Tribe, are solely responsible for the collection of Lostine River 200 adults which are collected using a spawning strategy then brought to Lookingglass Hatchery and held until ready to spawn. LGH's tribal co-manager, CTUIR, are solely responsible for the collection of Upper Grande Ronde River 80 adults and Catherine Creek 201 adults using a spawning strategy then brought to Lookingglass Hatchery and held until ready to spawn. As each stock is spawned, each female and each Egg Lot and are kept separate.

All females spawned will be tested for *R. salmoninarum* using ELISA. Eggs from females with optical densities above 0.250 are generally deemed to be at high risk of vertical transmission. As a general rule, eggs from high-risk females should be culled from highest to lowest until hatchery production needs are met. Close coordination with the E. Region ODFW Fish Health Lab will be needed when egg needs do not align with ELISA results. At least 60 kidney/spleen and 60 ovarian fluid samples will be taken (120) fish from each stock and examined for viral replicating agents.

Since 2018/19 a *M. cerebralis* study has been conducted at Lookingglass Hatchery using triploid Rainbow Trout. The trout are kept separate from the rest of the Chinook population for six months, then a total of 60 head wedges will be taken to monitor for *M. cerebralis*.

Recycling adults doesn't always happen on Lookingglass Creek. Because LGC stock was declared exacerbated many years ago, Rapid River stock replaced LGC stock, and then Catherine Creek Stock replaced Rapid River stock which was determined to be the closest genetically to LG Stock and part of the Grande Ronde River system. Excess Catherine Creek stock can be recycled into LG Creek but is done on a year-by-year basis as needed.

Recycling adults at the Imnaha River weir is done per the Annual Operating Plan (AOP) for tribal and public fisheries.

Eggs collected and fertilized at the Lookingglass Fish Hatchery are water-hardened in 100 ppm iodine for 15 minutes and then trayed down in incubation stacks.

2.1.3 Incubation

Segregated eggs are loaded into trays at one female per tray until Elisa test results are completed by Pathology. Then, eggs are combined at a maximum incubation tray densities of 5,000 eggs per tray at 4 GP due to water restrictions and formalin treatment calculations for 4 GPM. Flows can be increased to 5 GPM after fry begin to develop and water is available and Formalin Treatments are no longer being done. Each egg lot is kept separate, and any BKD positive females not culled, are placed back in incubation separately, not combined. IHOT maximum standard is 8,000 eggs per tray but with four of the five stocks of Spring Chinook reared at LGH ESA listed, maximum tray density is 5,000 eggs per tray. The Lookingglass Fish Hatchery has 45, eight-tray vertical incubation stacks (Marisource-type) available for incubating eggs, plus up to 16 more stacks available which are plumbed into hatchery water supply and placed into double deep Canadian Troughs as needed.

Formalin is added to each incubation stack to retard fungus development three times a week at a rate of 1,667 ppm (15-min drip). Formalin treatments are initiated 2 days following spawning and continue until immediately prior to hatch. Silt removal from incubator trays through rodding will begin once the eggs are eyed. At 550-600 FTU's (Fahrenheit Daily Temperature Units) eggs are shocked and picked (enumerated) the following day. Eggs generated from females demonstrating ELISA optical densities greater than 0.250 will be culled prior to eye-up and egg enumeration. Individual Lot averages will be assigned to these eggs for fecundity and % eye-up. Once eggs have been enumerated additional eggs may be culled, based on ELISA results, to reduce inventory to achieve a "full capacity" hatchery level. Several hand picks are performed throughout development and hatch (1,000 – 1,050 FTU's). Fry are transferred to indoor double deep Canadian troughs for early rearing at swim-up (1,700 – 1,750 FTU's).

2.1.4 Nursery Rearing

Rearing facilities at the Lookingglass Fish Hatchery include 30 double deep Canadian troughs (32" Wide x 21 ½" deep 18 .6' long) = 89 ft³ = 607.3 gpm used for early rearing.

At swim-up, Spring Chinook fry are transferred into the 30 indoor rearing troughs with screens initially placed at the lower end of each trough. Fry are set out in a manner to allow for spawn timing proportionality representation for CWT and individual pond marking. Approximately 45,000 fry are set out in each trough. Flows are set at 15 gpm then increased by 5 gpm increments until reaching 50 gpm (maximum) when fry are well on feed and regular samples are taken to calculate Density (DI) and flow (FI).

Initial feeding occurs at 1850 - 1900 TU's or up to 14 days post set out due to the potential occurrence of a fungal infection of the underdeveloped air bladder and/or digestive tract. Hourly hand feeding during the day commences after this extended period of morphological growth

expires. Extruded starter feed in the BioVita formula, produced by Skretting/BioOregon, is used during early rearing. Feed size transitions occur consistent with Skretting/BioOregon guidelines.

Initial growth rates in the nursery tanks, once feed is introduced and taken well, increases quickly due to water temperatures of 42 – 44 °F.

Newly hatched fry are started on #0 and then to #1 and # 2 feed and remain on #2 until they reach 150 fish per pound (fpp) and then are transitioned to 1.2 mm pellet. Feed conversion rates average .65 to .85 (wt:wt) during the fry- rearing stage (USFWS 2011).

2.1.5 Outdoor Rearing

Outdoor rearing occurs in 18 concrete ponds (10 ft wide x 100 ft long x 4.5 ft deep) with no coverage. At time of release density and flow indices do not exceed 0.15 and 1.3 respectively. In September of each year, after spawning and no more adults held in the adult holding ponds, Lookingglass Creek 81 juveniles are split between raceway 1 and four adult holding ponds

During final rearing, outside raceways are cleaned weekly and flushed weekly, but dead fish are removed daily.

2.1.6 Release

Yearling smolts are transported at 20 - 25 fpp to the Imnaha River, Lostine River, Catherine Creek, and Upper Grande Ronde River for release. Transport takes approximately 2 hours (1 hr. each to load/unload and up to four hours transport) and is completed at ½ pound of fish per gallon of water.

2.1.7 Settling Pond

Water from incubation and early rearing and rearing in the raceways and circular tanks, used for fish culture, passes through the hatcheries outdoor settling basin to removed settleable solids prior to being discharged into Lookingglass Creek. The settling basin is an asphalted pond with a concrete bottom; a concrete outflow structure is in place with piping extending to the creek at creek bottom grade. Annually, the fence surrounding the settling basin needs to be maintained and gates locked as a documented safety measure to discourage access by hatchery visitors. Periodically vegetation that works up through the cracks of the pond must be removed to prevent bank degradation. An annual inspection is in place and assessment will be done yearly to determine when the pond should be cleaned out and resealed.

Periodically, hatchery flow needs to be diverted and water removed from the settling basin to allow for the removal of accumulated waste materials and should be done on a five-year cycle. The last such cleaning took place in June 2022.

2.1.8 NPDES

The facility has had no violations. In 2020 an unexpected storm event occurred which sent silt and debris throughout the hatchery supply water system, but LGH was able to continue operations with no violations.

2.1.9 Marking

Parr are marked in outdoor raceways during July. Currently, all Chinook are AD-clipped, except for approximately 132,000 Upper Grande Ronde 80 for (AD clip and AD/CWT; CWT only for Grande Ronde 80) into outdoor ponds during marking events in August at < 100 fpp.

PIT tagging is done in October and a percentage is marked into each raceway and each stock as a representation of the population.

2.1.10 PIT Tagging

In 2022 PIT tags are inserted into 49,000 pre-smolts in October. PIT tag numbers are done on a year-to-year basis depending on population at the hatchery and research studies being conducted.

3 Operational/Infrastructure Changes for Program Efficiency

Please note: When a site visit was conducted at LGH in summer/2022, several suggestions were made to increase production at Lookingglass Hatchery. The bottleneck is water supply.

Water is supplied through a 42” mainline coming from the Intake building. Once the water reaches the main hatchery building, water is diverted from the mainline to various sizes of supply pipes from 12”, 10”, 8”, to 6” to supply water to the UV room, Incubation and Early Rearing, spawning area, Adult Holding Ponds, Raceways and Circular tanks. The mainline makes a 90 degree turn at the end of raceway 18 and ends at the edge of Lookingglass Creek for flushing. Even though LGH has permits that provide enough CFS for current and possibly more production, the creek itself does not provide the CFS permitted for sustainable year-round supply. During the months of most production (July – October), water management is crucial to provide enough rearing water, incubation water; and water needed for the upper fish ladder and trap. Because of low head pressure, extra caution is taken to make sure LGH doesn’t lose that head pressure from too much water use. The months of July – October are the months the flows

in Lookingglass Creek steadily drop. Average water temperatures (per the USGS station that was on LG Creek), range from 63 degrees F to 69 degrees F at the peak of the summer to lows in the upper 30-degree F as early as late September or early October. Lookingglass Hatchery's water temperatures and water supply are impacted by what is happening in the upper Lookingglass Creek watershed.

Because of the low water supply in Lookingglass Creek at times, the idea was suggested putting in recirculation systems and pumping systems. The negative side to a recirculation system is the pathogens and possible cross-contamination that could happen in the reused water. Fish Health has recommended low density rearing due to pathogen concerns that are naturally occurring in LG Creek. Per a study conducted by Warren J. Groberg, Sam T. Onjukka, Kassandra Brown, and Richard Holt (Pathology) in November of 1999 the primary pathogen is Bacterial Kidney Disease (BKD), but other diseases such as IHNV, Yersinia ruckeri, furunculosis, Flavobacterium psychrophilum, Erythrocytic Inclusion Body Syndrome, EIBS, Y ruckeri, A. salmonica and Cold-Water Disease have occurred at LGH.

Because Lookingglass Hatchery is at the end of the commercial electrical lines, LGH experiences year-round power outages. LGH's main water supply is a flow-through mainline pipeline with water supply from LG Creek. The secondary water supply is a well that is used primarily for de-icing the intake water supply, incubation, and early rearing. Supply is limited. Approximately 5 CFS is available – 3 CFS for early rearing and 2 CFS for de-icing the intake which is a total of or just under 2,245 GPM. Any use over 1,400 GPM use, the well cannot recover fast enough to maintain supply. Using pumps to supply water for ESA listed stocks, with the many power outages LGH experiences, this is not an option that should be considered.

LGH has rearing ponds that can rear up to 100,000 juveniles/smolts to maximum size of 20 fpp at release. (DI =0.20). But, LGH does not have incubation or early rearing space for approximate additional 810,000 juveniles.

3.1.1 Optimize Rearing Ponds

Current production is 1.39M across 5 release sites. Smolt production can be increased to 1.49M by operating each raceway (18 total) at 75,000 smolts each (1.35M Total) and four adult holding ponds at 35,000 smolts each (140K Total). The increase to 1.49M can be accomplished within the current 0.15 density index criteria.

Preliminary discussions have identified Lookingglass Creek (50K) and the Upper Grande Ronde (50K) as release locations. However, the current BIOP (expires 2027) would need modification through NOAA to expand these releases from 250,000 to 300,000 smolts each.

Current Lookingglass Production:

Location	Smolts
Catherine	150,000
Lostine	250,000
Upper Grande Ronde	250,000
Lookingglass Creek	250,000
Imnaha River	490,000
Basin Total	1,390,000

Proposed with maximizing each raceway to 75,000:

Location	Smolts
Catherine	150,000
Lostine	250,000
Upper Grande Ronde	300,000
Lookingglass Creek	300,000
Imnaha River	490,000
Basin Total	1,490,000

Annual costs for an additional 100,000 smolts is estimated at \$20,000 annually (\$0.20 per smolt).

3.1.2 Increase Density Index to 0.2

From experience, the facility management is confident that final rearing density can be increased to 0.20 (max DI for Chinook though NEOH recommends no more than .15 for Chinook), which would put total rearing at 2,200,000. Since Lookingglass Hatchery has had a high Smolt to Adult survival rate, this option is likely the lowest priority. Although simple to implement, maintaining the successful program with current low-Density Indices may be preferable while experimenting is done in the other rearing containers.

A proposal has been made to remove the Endemic Building which houses six circular tanks and replace everything with three additional raceways. The challenge is the need for additional water supply and additional adult holding ponds. Currently the tanks are used to hold Lostine River 200 Spring Chinook adult brood stock from late May through September, plus the area is also used for spawning those adults.

Another need if the Endemic Building was to be removed, is a new Lab which is currently housed in the south end of the Endemic Building. The lab used to be in the central area of the main hatch house/incubation area but was removed from that area due to concerns bringing pathogens into the hatch house and possible cross-contamination.

An increase of 810,000 smolts would cost \$162,000 annually.

3.1.3 Provide additional space

The facility could maintain a 0.15 DI by expanding existing raceways (18) and also replacing the current Endemic building with three additional raceways. It is expected that the facility could rear up to 2.2M smolts at a DI = 0.15 with this expansion. Expanded and new Raceways (21 total) would be ponded at 100,000 smolts each and adult holding ponds would be ponded at 25,000 smolts each.

To maintain Density Indices criteria, eighteen raceways could be extended several feet. This would be a major project. The tail race/discharge vault that runs along all 18 raceways would need to be removed and rebuilt. The negative side to this proposal is water supply and lack of incubation to provide juveniles/smolts for each program. Also, this would involve redoing the permits to collect additional brood stock adults for each stock.

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If the Endemic Building was removed, a new Lab which is currently housed in the south end of the Endemic Building, would need to be constructed. The lab used to be in the central area of

the main hatch house/incubation area but was removed from that area due to concerns bringing pathogens into the hatch house and possible cross-contamination.

Construction is expected to cost \$800,000 and annual costs for an additional 810,000 smolts is \$162,000 annually.

3.1.4 Expand Incubation Space

Lookingglass Hatchery is currently at its maximum incubation capability. When the suggestion was made to increase the Imnaha River 29 production from 490,000 smolts to 520,000 smolts several options have been discussed. Lack of incubation does not allow for increased production, along with water supply and aged chiller units which in 2022 began to fail.

As a temporary fix, single 8 tray stacks are installed into the double deep Canadian troughs, (two in each trough up to 16 stacks) and plumbed into the existing water supply. This system has worked but not without challenges. In the winter of 2021, Pex (cross link polyethylene), hose that supplied water began to collapse and one line shut off water supply to a stack causing significant fry loss. Since this happened, PVC piping has replaced all Pex hoses.

It is difficult for crew to maintain these stacks. It requires climbing into the double deep Canadian troughs to check and pick eggs. When it's time for ponding fry, again, the crew must climb into the troughs and hand out trays of eggs.

During the visit by LSRCP this year, staff looked at options of adding onto the incubator area. There is one area past Incubation Banks C/D where two more banks of 8 stacks each could be installed. The concern again, is water supply. The possibility of adding ½ stacks (4 trays each) to the existing full stacks was discussed. Because of the low head pressure that is not an option and would require using pumps. Due to the many power outages Lookingglass Hatchery experiences, pumps are not a good option.

Incubation expansion and re-configuration is estimated to cost \$500,000.

3.1.5 Provide additional water supply

Providing additional water would benefit the facility during raceway rearing with expanded and additional raceways.

Providing water to the raceways from September until March (release) could be accomplished by reusing water from the current hatchery building (approximately 300 gpm from Sept through January and up to 1500 gpm from February through April) or by pumping water back from the tail race of the outflow of the raceways. Re-using hatchery building water would maintain a Flow Index below 1.6.

Early rearing is accomplished by moving fingerlings to outdoor raceways in early May prior to marking which happens in August. Additional smolts will also require work to ensure compliance with National Pollution Discharge Elimination System (NPDES) permit phosphorus discharge limits.

Costs have not yet been developed for a re-use supply line from hatchery building water or a re-use pump back system. For a re-use pump application, cold winter temperatures likely preclude the need for installation of a back-up generator system or tying into the existing main hatchery generator system.

Costs of re-use pump system are estimated at \$500,000.

3.1.6 Summary

Maximize production capacity of Lookingglass Fish Hatchery

Program	Current Smolts	Proposed Smolts
Optimize Rearing Containers	1,390,000	1,490,000 (DI = 0.15)
Rear at 0.2 DI	1,390,000	2,200,000
New raceways	0	300,000
Expand Existing Raceways	0	510,000
Total New Smolts	1,390,000	2,200,000

4 References

- Annual Operation Plan (AOP). 2022. Annual Operation Plan for Salmon and Steelhead Production Programs in the Grande Ronde and Imnaha River Basins, Oregon. Prepared by Oregon Department of Fish and Wildlife, Nez Perc Tribe, Confederated Tribes of Umatilla Indian Reservation, for Lower Snake River Compensation Plan, U.S Fish and Wildlife Service, and Bonneville Power Administration. <https://www.fws.gov/media/annual-operations-plan-grande-ronde>
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5 Appendix A. Monthly Production Strategy – Lookingglass Fish Hatchery

5.1.1 January

Incubation

<p>45 stacks,(8 trays each at 5 gpm) 225 gpm at 40/42 F</p>
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Indoor Vats – 30 Double Deep Canadian Troughs (19’ x 3’ x 21 ½”) 603.7 gpm at 42.0 F

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Outdoor Rearing – 18 Raceways (100x10x4.5’) 4500 gpm at 38.5 F Avg.

<p>75,000 @ 28 fpp and DI = 0.15</p>	<p>18 raceways at 75k Each.</p> <p>4 Adult Holding Ponds at 45k Each.</p>
<p>45,000 @ 28 fpp and DI = 0.13</p>	

5.1.2 February

Incubation

All fry moved out of incubation and into indoor rearing troughs first week of February

Indoor Vats – 30 Double Deep Canadian Troughs (19'x 3' x21 1/2'') 603.7 gpm at 42.0 F

45,000 @ 1100 fpp and DI = 0.17	There are 30 of these rearing troughs
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Outdoor Rearing – 2 Ponds (196x50x4') 4998 gpm at 38.6 F

75,000 @ 24 fpp and DI = 0.15	18 raceways at 75k Each.
45,000 @ 24 fpp and DI = 0.13	4 Adult Holding Ponds at 45k Each

5.1.3 March

Fry being reared in indoor Double Deep Canadian Troughs

Indoor Vats – 30 Double Deep Canadian Troughs (19'x 3' x21 1/2") 603.7 gpm at 44.0 F

45,000 @ 450 fpp and DI = 0.17	There are 30 of these rearing troughs
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75,000 @ 22 fpp and DI = 0.15 Smolt transfers begin	18 raceways at 75k Each. 4 Adult Holding Ponds at 45k Each
45,000 @ 22 fpp and DI = 0.13	

5.1.4 April

Indoor Vats – 30 Double Deep Canadian Troughs (19’x 3’ x21 1/2”) 603.7 gpm at 42.0 F

45,000 @ 200 fpp and DI = 0.17	There are 30 of these rearing troughs
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Smolts moved to acclimation sites	18 raceways at 75k Each.
Volitional release for LG stock starting April. 1 st through 15 th to force out.	4 Adult Holding Ponds at 45k Each

5.1.5 May

ALL FRY MOVED OUT OF THE HATCH HOUSE INTO THE OUTDOOR RACEWAYS

Indoor Vats – 30 Double Deep Canadian Troughs (19’x 3’ x21 1/2”) 603.7 gpm at 42.0 F

	There are 30 of these rearing troughs
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Fry are moved outside to raceways at 75,000 @ 150 fpp and DI = 0.15	18 raceways at 75k Each. 4 Adult Holding Ponds
Four adult holding ponds not used for rearing. Will hold adults for spawning. Circular tanks in Endemic Building hold adults for spawning.	Three circulars in Endemic building

5.1.6.June

Incubation

Nothing in incubation or indoor rearing troughs until after August 15th

Indoor Vats – 30 Double Deep Canadian Troughs (19’x 3’ x21 1/2”) 603.7 gpm at 42.0 F

45,000 @ 4200 fpp and DI = 0.17	There are 30 of these rearing troughs
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Juveniles in raceways at 75,000 @ 90 fpp and DI = 0.15	18 raceways at 75k Each.
Four adult holding ponds not used for rearing. Will hold adults for spawning. Circular tanks in Endemic Building hold adults for spawning.	4 Adult Holding Ponds at 45k Three circulars in Endemic building Each

5.1.6 July

Indoor Vats – 30 Double Deep Canadian Troughs (19’x 3’ x21 1/2”) 603.7 gpm at 42.0 F

	There are 30 of these rearing troughs
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75,000 @ 60 fpp and DI = 0.15	18 raceways at 75k Each. 4 Adult Holding Ponds at 45k
Four adult holding ponds not used for rearing. Will hold adults for spawning. Circular tanks in Endemic Building hold adults for spawning.	Three circulars in Endemic building Each

5.1.7 August

Incubation

<p>45 stacks, (8 trays each at 5 gpm) 225 gpm at 40/42 F</p>

Indoor Vats – 30 Double Deep Canadian Troughs (19’x 3’ x21 1/2”) 603.7 gpm at 42.0 F

	There are 30 of these rearing troughs
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<p>75,000 @ 50 fpp and DI = 0.15</p> <p>Marking/tagging begins for juveniles in raceways</p>	<p>18 raceways at 75k Each.</p> <p>4 Adult Holding Ponds at 45k</p> <p>Three circulars in Endemic building</p> <p>Each</p>
<p>Four adult holding ponds not used for rearing. Will hold adults for spawning. Circular tanks in Endemic Building hold adults for spawning.</p>	

5.1.8 September

Incubation

45 stacks, (8 trays each at 5 gpm) 225 gpm
at 40/42 F

Adults are done spawning so Lookingglass
Creek stock is split into the adult holding
ponds at 45,000 @ 32 fpp and DI = 0.15

Indoor Vats – 30 Double Deep Canadian Troughs (19'x 3' x21 1/2") 603.7 gpm at 42.0 F

	There are 30 of these rearing troughs
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75,000 @ 32 fpp and DI = 0.15	18 raceways at 75k Each. 4 Adult Holding Ponds at 45k Each
45,000 @ 32 fpp and DI = 0.15	

5.1.9 October

Incubation

45 stacks, (8 trays each at 5 gpm) 225 gpm
at 40/42 F

PIT tagging is completed this month

Indoor Vats – 30 Double Deep Canadian Troughs (19'x 3' x21 1/2") 603.7 gpm at 42.0 F

45,000 @ 4200 fpp and DI = 0.17

There are 30 of these rearing troughs

75,000 @ 30 fpp and DI = 0.15

18 raceways
at 75k Each.

45,000 @ 30 fpp and DI = 0.15

4 Adult
Holding
Ponds at 45k
Each

5.1.10 November

Incubation

45 stacks, (8 trays each at 5 gpm) 225 gpm at 40/42 F

Indoor Vats – 30 Double Deep Canadian Troughs (19’x 3’ x21 1/2”) 603.7 gpm at 42.0 F

45,000 @ 4200 fpp and DI = 0.17

There are 30 of these rearing troughs

Smolts moved to acclimation sites	18 raceways at 75k Each.
Volitional release for LG stock starting April 1 st through 15 th to force out.	4 Adult Holding Ponds at 45k Each

5.1.11 December

Incubation

45 stacks, (8 trays each at 5 gpm) 225 gpm at 40/42 F

Indoor Vats – 30 Double Deep Canadian Troughs (19'x 3' x21 1/2'') 603.7 gpm at 42.0 F

45,000 @ 4200 fpp and DI = 0.17	There are 30 of these rearing troughs
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Smolts moved to acclimation sites	18 raceways at 75k Each.
Volitional release for LG stock starting April 1 st through 15 th to force out.	4 Adult Holding Ponds at 45k Each

6 Appendix B. Proposed Adult Holding Ponds

The facility could maintain a 0.15 DI by expanding existing raceways (18) and also replacing the current Endemic building with three additional raceways. It is expected that the facility could rear up to 2.2M smolts at a $DI = 0.15$ with this expansion. Expanded and new Raceways (21 total) would be ponded at 100,000 smolts each and adult holding ponds would be ponded at 25,000 smolts each.