Infrastructure and Operations Audit of Clearwater Fish Hatchery 2022

Clearwater Fish Hatchery
Lower Snake River Compensation Plan

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Executive Summary

On September 20, 2022, Nathan Wiese, Program Coordinator LSRCP, Denys Chewning, Clearwater Hatchery Manager, Joe Wannemuehler, Clearwater Assistant Hatchery Manager, Hayden Fitte, Clearwater Assistant Hatchery Manager, Steve Rodgers, Dworshak Complex Manager, Jeremy Sommer, Dworshak Hatchery Manager, and Mark Drobish, Dworshak Hatchery Manager, conducted a high-level one-day infrastructure and operations assessment of the Clearwater Fish Hatchery. Cassie Sundquist, Beau Gunter, Chris Sullivan, and John Cassinelli, IDFG, provided review of this document.

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 spring/summer Chinook rearing facilities within the 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.

The assessment identified several opportunities for additional Chinook smolts and adults. First, examining the Red River spring Chinook releases would likely increase the average SAR for Clearwater (BY2000-2018) from 0.28% to 0.34%. That would increase the total number of adults returned from 10,500 to 12,750 annually. That increase would meet the 11,900 project area goal set for the Clearwater Fish Hatchery on an average year.

Clearwater Hatchery has added significant Chinook production over the past decade and limited opportunities exist with existing infrastructure. Adding additional water supplies and incubation could significantly increase the potential of the facility with a cost of $61.2M and an additional 1.6M Chinook smolts annually.

Action	Smolts
New Pipeline to Clearwater	1,600,000 at $61M and additional 1.8 million smolts at Dworshak NFH
Expand Incubation	30 additional stacks for 480 useable trays - $225,000

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1 Scope

On September 20, 2022, Nathan Wiese, Program Coordinator LSRCP, Denys Chewning, Clearwater Hatchery Manager, Joe Wannemuehler, Clearwater Assistant Hatchery Manager, Hayden Fitte, Clearwater Assistant Hatchery Manager, Steve Rodgers, Dworshak Complex Manager, Jeremy Sommer, Dworshak Hatchery Manager, and Mark Drobish, Dworshak Hatchery Manager, conducted a high-level one-day infrastructure and operations assessment of the Clearwater Fish Hatchery.

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2 Background

The Clearwater Hatchery program is operated by the IDFG and includes the main Clearwater Fish Hatchery and three satellite facilities. Returning adults are collected at the Crooked River Trap and Red River Satellite in the South Fork Clearwater River watershed, at Kooskia National Fish Hatchery in the Middle Fork Clearwater River watershed, and at the Powell Satellite facility in the Lochsa River watershed. Spawning, incubation, and rearing occur at Clearwater Hatchery for the spring Chinook and the summer Chinook are spawned at Powell.

The LSRCP adult mitigation goal for the facility is 11,900 adult Chinook Salmon and 14,000 adult steelhead to the project area above Lower Granite Dam. To achieve those goals, Clearwater releases 3,749,000 Chinook smolts at 16 fpp and 843,000 Steelhead at 4.5 fpp.

The main Clearwater Hatchery is located at Ahsahka, Idaho approximately 45 miles east of Lewiston, Idaho on highway 12 on the NF Clearwater River. Red River facility is located near the Red River Ranger station approximately 15 miles east of Elk City, Idaho. The Crooked River facility is located approximately 5 miles west of Elk City, Idaho. The Powell facility may be seen by driving on state highway 12 to approximately milepost 163.5 and then turning south on the Elk Summit road and travel two miles to the entryway sign of the Powell fish trap.

The Clearwater Fish Hatchery consists of two separate incubation facilities, 12 outdoor raceways for steelhead rearing, 21 outdoor raceways for Chinook salmon rearing, and an adult holding and spawning area also used for Chinook salmon smolt rearing.

Clearwater Fish Hatchery is water limited and does not rear fish in the E sections of the 300-foot raceways. Because of this limitation, Clearwater has reduced its steelhead release number from 1,040,000 to 843,000 smolts with downstream multi-agency negotiations.

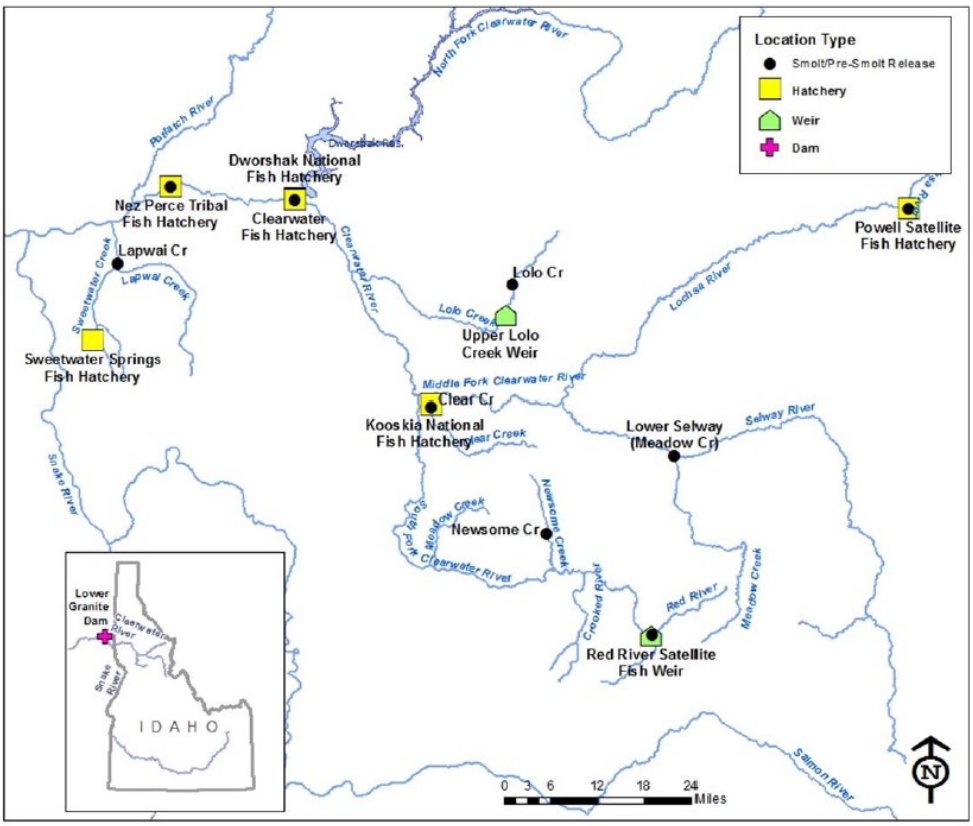
Since construction completion in the early 1990s, Clearwater has attempted acclimation at the Powell, Red River, and Crooked River acclimation sites. However, numerous water and other logistics issues have prevented safe acclimation at those sites. As such, none of the acclimation sites are used for more than a few hours of "acclimation" for trucked smolts.

Adult return rates for Clearwater have averaged 0.28% from BY 2000 to 2018.

Clearwater Fish Hatchery Chinook releases

Release Location	Smolts
North Fork Clearwater	709,000
Clear Creek	720,000
Lower Selway	400,000
Red River	1,280,000
Powell	640,000
	3,749,000

Clearwater Hatchery Steelhead Releases	
Location	Smolts
Red House	219,000
Meadow Creek	501,000
Newsome Creek	123,000
	843,000



Clearwater FH Chinook Returns	
Brood Year	SAR
2000	0.38%
2001	0.09%
2002	0.15%
2003	0.19%
2004	0.56%
2005	0.39%
2006	0.61%
2007	0.35%
2008	0.43%
2009	0.10%
2010	0.42%
2011	0.47%
2012	0.27%
2013	0.19%
2014*	0.13%
2015*	0.06%
2016*	0.09%
2017*	0.12%
2018*	0.30%
Avg	0.28%

Data from LSRCP Annual Report

*Data from PBT Release Years

2.1 Biological Opinion

The seven Clearwater River hatchery programs are included as part of the proposed action collect adult broodstock at numerous locations throughout the Clearwater River Subbasin. Release of hatchery smolts also occurs at numerous locations throughout the subbasin (Figure 1). Juvenile release targets include approximately 3 million steelhead, 6 million Chinook salmon, and 500,000 coho salmon. (BIOP 2017)

To meet adult mitigation goals, the original annual production from Chinook Salmon hatcheries in the Clearwater drainage was approximately 1.35 million smolts. This level of production assumed that about 0.87% of smolts released would return to LGR but actual SAR's have averaged less than half of that value. To offset these below anticipated SARs, attempts have been made to increase production from Chinook Salmon hatcheries in the Clearwater drainage and annual releases now total approximately 6,380,000 smolts (Spring and Summer runs combined, including new production) and 925,000 parr and pre-smolts. (AOP 2022)

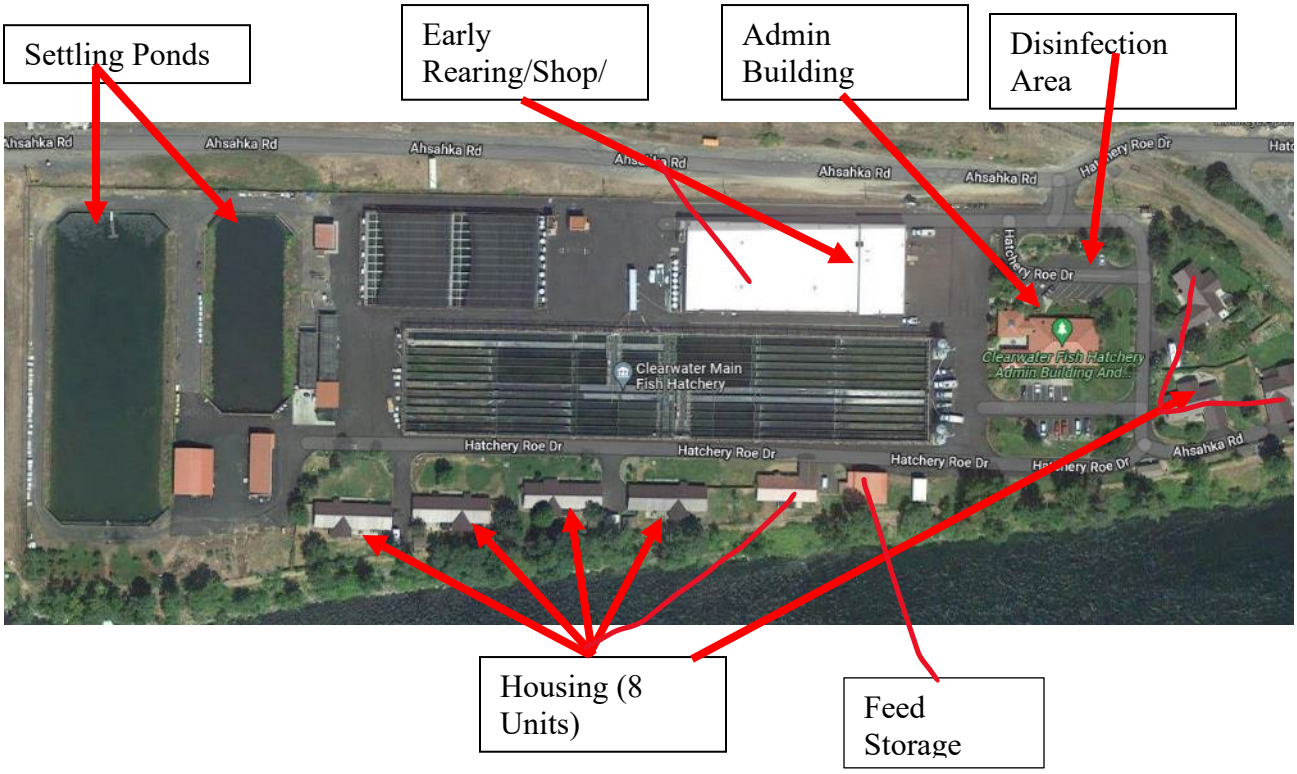
Additional flexibilities exist within Endangered Species Act consultation because the original natural populations of spring/summer Chinook Salmon in the Clearwater drainage were

extirpated after the construction of Lewiston Dam in 1927. The dam was removed in 1973 and subsequent hatchery production of spring/summer Chinook Salmon in the basin was sourced from the original Hells Canyon spring run population that was also the brood source for the hatchery Program at Rapid River Hatchery in the Salmon River drainage. However, based on historic evidence, the original natural population in the Clearwater River may have had a run timing resembling that of summer run populations in the South Fork Salmon River drainage.

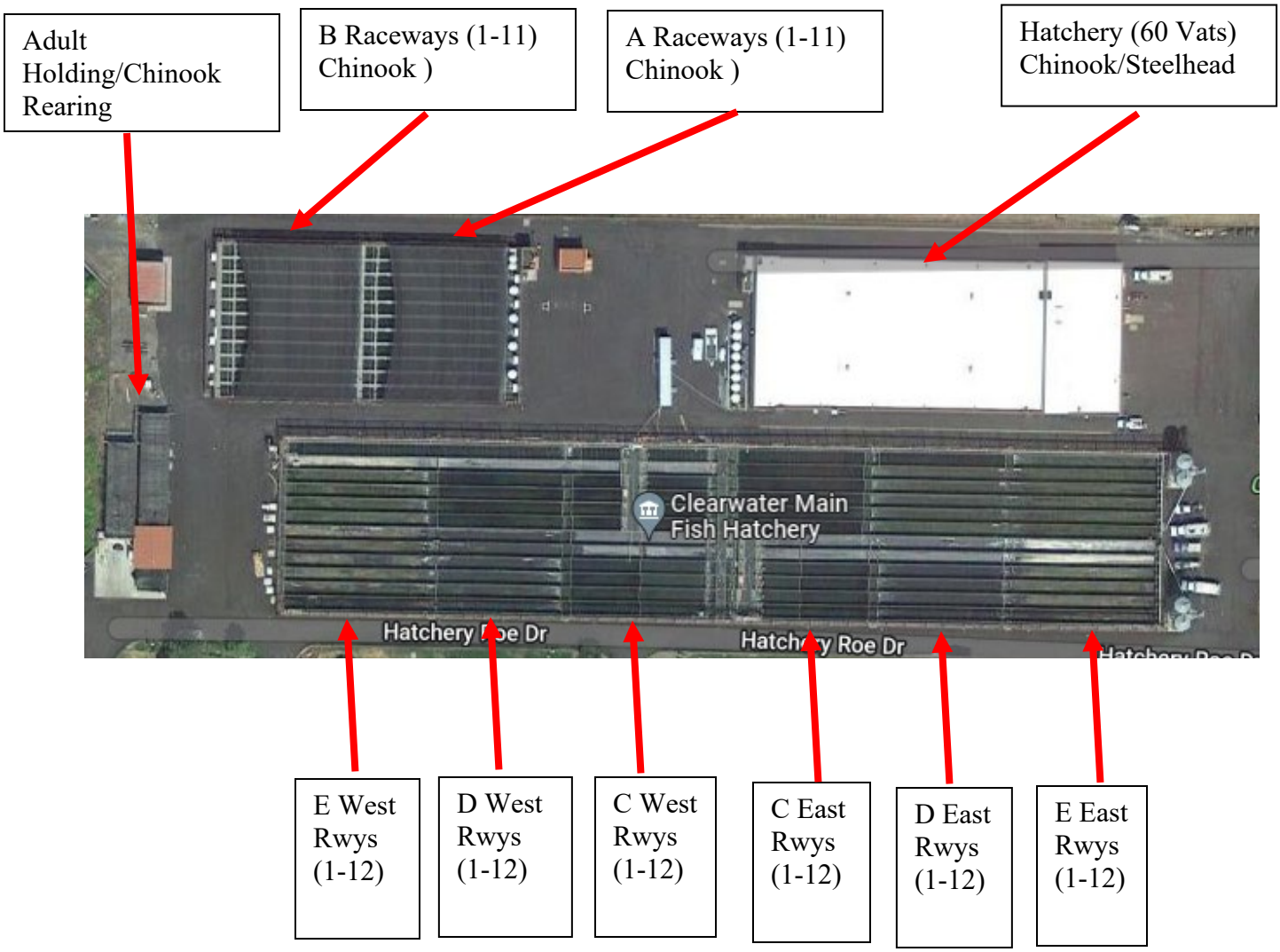
Based on the historic information and a desire to diversify fisheries in the Clearwater drainage, managers initiated a relatively small 200,000 smolt summer Chinook Salmon hatchery mitigation program at the CFH beginning in BY 2009. The program replaced a comparable segment of Spring Chinook Salmon production from CFH and the original brood for the program was sourced from the hatchery returns of summer Chinook Salmon to the South Fork of the Salmon River. The original BY09 summer run smolts were released in 2011 at Crooked River but conversions of adult returns to that trap location were poor so releases were relocated to the Powell satellite facility on the upper Lochsa River in 2014 (BY12). The intent is to build a program that releases between 640,000 to 1,000,000 smolts with all brood being collected from adult returns to the Clearwater Basin.

2.2 Infrastructure

Overview of Clearwater Fish Hatchery:

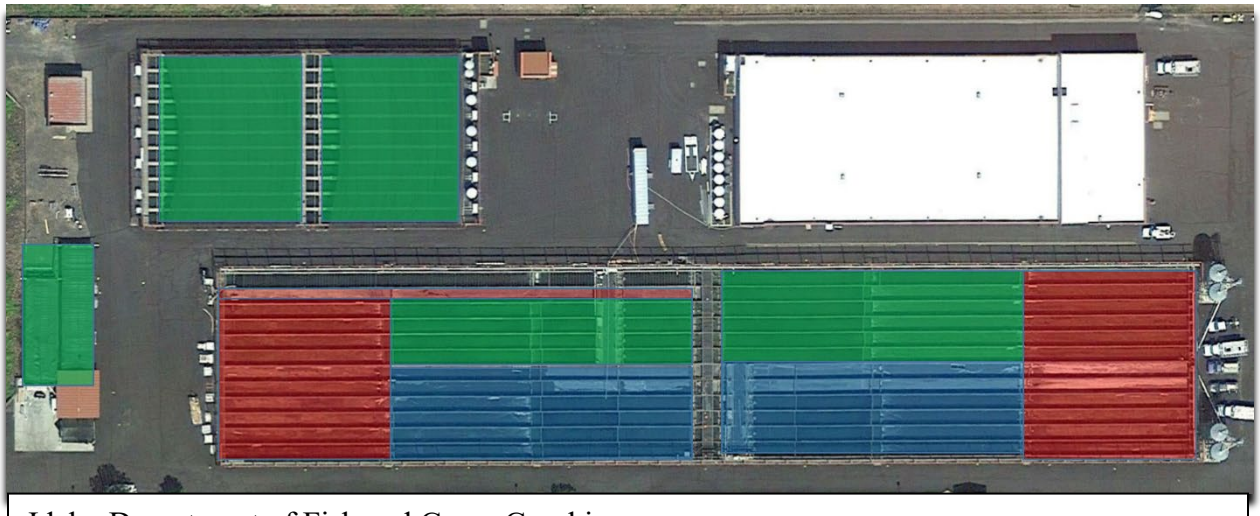


Clearwater Fish Hatchery Rearing Infrastructure:



Rearing locations for Chinook and Steelhead smolts at Clearwater Fish Hatchery:

Green = Chinook smolts, Blue = Steelhead smolts, Red = Empty



Idaho Department of Fish and Game Graphic

Generally, Chinook rearing occurs in the A and B raceways (3000 ft^3 each), in the adult holding ponds (13,000 ft^3 total), and 10 raceways in the East and West raceways (6000 ft^3 each).

Steelhead rearing occurs in 12 raceways in the East and West raceways (6,000 ft^3 each).

2.2.1 Red River

The two adult holding ponds have a total volume of 3,600 cubic feet, with a total holding capacity of 400 adult fish, and are supplied with 4.09 cfs of water. The facility also has a covered spawning area with live tanks at the head of each holding pond. The facility has one rearing pond with a volume of 53,550 cubic feet. The rearing pond has a plastic liner with cobblestones placed on the inclined banks to hold the liner in place. The bottom of the pond is bare, which aids in pond vacuuming. Maximum water flow through this pond is 6.24 cfs. A low-water alarm system is installed in the adult holding and acclimation/rearing ponds. A rigorous screen-cleaning schedule has been implemented to ensure that screens stay clear of debris during periods of high discharge.

The water right for the Red River Satellite authorizes the diversion of 6.6 cfs in compliance with the maximum diversion authorized by the Idaho Department of Water Resources water right No. 82-07156. Although the water right authorizes the diversion of up to 6.6 cfs, on average, a maximum of 4 cfs is diverted from the Red River from May 1 through September 31.

Red River Satellite Facility

2.2.2 Crooked River

The Upper Crooked River facility consists of two raceways, each measuring 145 ft x 20 ft x 4 ft. The combined capacity of both raceways is 700,000 juvenile Chinook with D.I. = 0.29. However, high mortality has occurred from raceway releases and acclimation has since been discontinued. Like Red River, the parasite Ichthyophthirius multifilis has been a problem in the summer which prevents juvenile rearing and limits acclimation of juveniles. Water flow into the acclimation raceways is 6.0 cubic feet per second.

The adult trapping facility is 10 ft x 12 ft x 4 ft. Water flow is 10 cubic feet per second. The fish trap at Crooked River is emptied daily during the trapping season. There are no holding ponds at Crooked River so fish need to be loaded onto a transport truck or passed above the weir if of natural origin. Fish that are put into a transport truck are either taken to Red River for temporary holding, then ultimately hauled to CFH or hauled directly back to CFH.

From May through September, a water right authorizes the diversion of up to 8.18 cfs from the Crooked River; however, the facility typically diverts only about 3 cfs.

Crooked River Trap

2.2.3 Powell

The Powell facility has two adult ponds with a total volume of 9,500 cubic feet, which are supplied with a maximum of 6.24 cfs of water. The facility has a covered spawning area with live tanks at the head of each holding pond. A rearing pond has a volume of 53,625 cubic feet and is supplied with a water flow of 6.24 cfs. An alarm system is in place to detect low water resulting from an obstructed water intake. A rigorous screen-cleaning schedule has been implemented to ensure that screens stay clear of debris during periods of high discharge. When nightly air temperatures drop below 29°F, screens are cleaned as often as necessary to maintain constant flow of water to the rearing pond.

An average of 5 cfs is diverted from Walton Creek from May 1 through September 31. The maximum diversion is 6.24 cfs, which complies with the maximum diversion authorized by the Idaho Department of Water Resources water right No. 81-07119 (Walton Creek).

Powell Satellite Facility

2.2.4 Hatchery Water Supply

The Clearwater Fish Hatchery consists of two separate incubation facilities, 12 outdoor raceways for steelhead rearing, 21 outdoor raceways for Chinook salmon rearing, and an adult holding and spawning area also used for Chinook salmon smolt rearing. Generally, A & B raceways are supplied 1.5 to 1.7 cfs/raceway and D & E raceways are supplied with 2.0 cfs/raceway.

The hatchery receives water through two supply pipelines from Dworshak Reservoir that pass through Dworshak Dam. Water is carried 1.8 mile downstream, where energy is dissipated through a hydroelectric plant. The water then continues through the two separate pipelines delivering water of two different temperatures to the rearing facility. The delivery of two separate water temperatures allows Clearwater Fish Hatchery to raise both Spring Chinook salmon and summer steelhead at optimum rearing temperatures. On average, 64 cfs are diverted from the reservoir; the maximum surface water diversion is 89 cfs, which complies with the maximum diversion authorized by the Idaho Department of Water Resources water right No. 85-07593.

The warm water intake is attached to a floating platform in Dworshak Reservoir and can be adjusted from 5 feet to 40 feet below the surface. The cool water intake is stationary at 245 feet below the top of the dam. An estimated 10 cfs is provided by the cool water supply and 70 cfs by the warm water supply. The cool water supply has remained fairly constant between 40°F and 45°F. The warm water can reach 80°F, but is adjusted regularly to maintain 56°F for as long as possible throughout the year. When water temperatures drop in the fall, the intake is moved to

the warmest water available until water temperatures rise in the spring. All water is gravity fed to the hatchery. Surface water diverted from the Dworshak Reservoir is returned to the North Fork Clearwater River near the mainstem Clearwater River about 3 km downstream of the dam.

Currently, insufficient water flow and quality is available to run E sections at Clearwater hatchery for fish production.

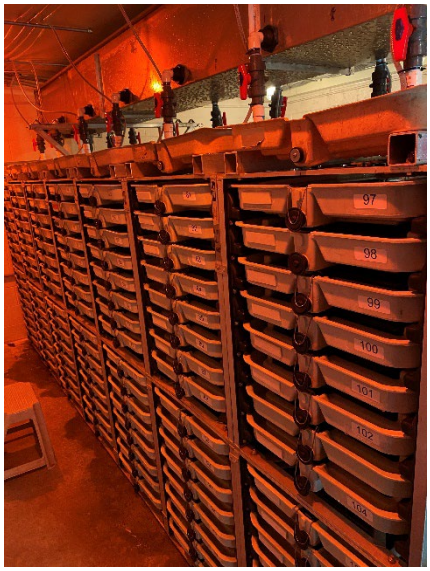
2.2.5 Broodstock Collection

Trapping begins in late May to early June and continues until September 1 or five consecutive days of zero fish trapped. Spawning occurs twice weekly.

2.2.6 Incubation

There are 240 trays in isolation incubation (15 stacks) and 784 trays in the main incubation room (49 stacks). A top mixing tray allows use of all 16 trays in the stacks.

Eggs are treated every other day with formalin until hatch. The trays are loaded with a maximum of 2 females per tray. A flow rate of 5-6 gpm is maintained.



2.2.7 Vat Rearing

Vats are 370 ft^3 and flow is ramped up to 150 gpm max. Each vat is loaded with approximately 60,000 swim-up Chinook fry. Fry remain in indoor vats until they are ~120 fpp. Flow and density indices are maintained within recommended values.

Steelhead are loaded with approximately 45,000 fry per vat. Currently, approximately 40 vats are used for Chinook and 20-22 vats for Steelhead. A minimum of 20 vats must be marked and moved outside in late April after the annual valve exercise to make room for the steelhead.

2.2.8 Outdoor Rearing

Raceways are generally loaded at 80,000 Chinook smolts per raceway (3000 ft^3) after marking at 120 fpp. Holding Ponds 1&2 are loaded at 200,000 smolts total (7000 ft^3) and Holding Ponds 3&4 are loaded at 170,000 total smolts (6000 ft^3).

Chinook are ponded in either the 10 C and D bank raceways or into the 22 A and B bank raceways for final rearing. The NF Clearwater fish that are destined to be reared in the adult holding ponds are placed in the 200-foot sections on the North Bridge raceways and then pumped to the 4 adult holding ponds once all adults are removed and the ponds thoroughly disinfected. Two of the adult holding ponds have baffled raceways.

2.2.9 Release

Releases of Chinook are done mostly by trucking to multiple locations across the Clearwater basin.

Of note on release location, the Red River release of Chinook have survived at lower rates to Lower Granite Dam and subsequent adults SARs compared to other release locations. Red River has a particular turbulent stretch of river during the correct flow conditions that seems to correlate to lower downstream survival.

Lower Granite Dam survival, Chinook salmon smolts, Clearwater Fish Hatchery 2017-2022

Release Site	2017	2018	2019	2020	2021	2022	2017-2021 Average
Clear Cr.	79.8	75.5	68.1	93.9	96.1	101.9	82.7
Powell Pond	62.6	54.0	55.2	60.0	65.4	72.2	59.4
NF Clearwater	79.7	72.4	66.9	88.2	88.1	97.4	79.1
Red R. Pond	51.4	64.5	26.0	62.3	82.4	89.2	57.3
Lower Selway River	74.9	61.2	44.7	60.9	65.5	76.5	61.4

Clearwater Release Site Performance for Adult Chinook Returns (SAR), Release Year 2014-2020 PBT Data. (North Fork releases excluded – began in 2016)

Release Year	Powell	Selway	Clear Creek	Red River
2020	0.09	0.20	0.34	0.10
2019	0.04	0.04	0.10	0.05
2018	0.11	0.05	0.08	0.11
2017	0.07	0.32	0.19	0.13
2016	0.47	0.48	0.39	0.29
2015	0.38	0.29	0.25	0.20
2014	0.42	0.44	0.85	0.21
Average	0.25	0.27	0.31	0.16

2.2.10 NPDES

The facility operates one offline settling pond and one full flow settling pond and has remained within NPDES compliance to date.

3 Operations

3.1.1 Marking

When the fry reach approximately 120 fish per pound, they are run through the marking trailer and into outdoor raceways. Chinook marking starts in late April after the valve exercise and finishes in late May (Appendix C).

Steelhead marking starts in late July and generally finishes the first week of August.

3.1.2 Chinook Smolt Size at Release and Adult Returns

A sensitivity analysis was explored using adult returns from release years 2016-2020 for Dworshak and Clearwater Hatcheries into the North Fork Clearwater river. On average, larger smolts (16 fpp) from Clearwater Hatchery returned at a higher rate (0.23%) compared to smaller smolts (20 fpp) from Dworshak (0.14%).

However, rearing smolts to a larger size significantly reduces the infrastructure capacity of the facilities. We calculated that rearing Dworshak smolts larger (16 fpp) would reduce the rearing capacity at Dworshak from 2.15 M (Raceways and SRKW Burrows Ponds) to 1.83M.

Likewise, we estimated that decreasing the size of smolts reared at Clearwater from 16 fpp to 20 fpp would result in an increased number of smolts to 4.4 M from 3.8M.

Based on SAR data, rearing smolts at a smaller size would return an additional 503 adults on average and reduce Clearwater Fish Hatchery pounds produced by 17,500 lbs.

Sensitivity Analysis of Dworshak vs Clearwater returns, Release Years 2016-2020 in the North Fork Clearwater River

Release Year	DWO SAR	CRW SAR	Adults DWO 16 fpp	Adults CRW 16 fpp	Adults DWO 20 fpp	Adults CRW 20 fpp	Total 20 fpp	Total 16 fpp	Difference
2020	0.41	0.42	7,704	15,998	8,815	18,040	26,855	23,702	3,153
2019	0.24	0.05	878	1,824	5,160	10,560	15,720	2,702	13,018
2018	0.13	0.09	1,685	3,499	2,795	5,720	8,515	5,184	3,331
2017	0.06	0.11	2,079	4,316	1,290	2,640	3,930	6,395	(2,465)
2016	0.17	0.46	8,385	17,412	3,655	7,480	11,135	25,797	(14,662)
Ttl/Avg*	0.27	0.31	16,968	35,234	17,630	36,080		**AVG**	**503**

* Ttl/Avg only includes 2016, 2019, and 2020 due to high TDG issues at Dworshak NFH

Sensitivity Analysis of Size at release and total weight at Dworshak and Clearwater Hatcheries

Size	DWO Smolts	CRW Smolts	Total	CRW Lbs
20 fpp	2,150,000	4,400,000	6,500,000	220,000
16 fpp	1,830,000	3,800,000	5,630,000	237,500
			Difference	17,500

3.1.3 Steelhead Smolt Size at Release and Adult Returns

4 Operational/Infrastructure Changes for Program Efficiency

Steelhead reared at the Dworshak National Fish Hatchery average 5.8 fish per pound (fpp) and steelhead smolts reared at Clearwater Fish Hatchery average 4.5 fpp.

Work by Brian Leth, Idaho Department of Fish and Game, analyzed adult returns from steelhead releases at the Red House Hole. Larger smolts (4.5 fpp) have an estimated relative Smolt to Adult (SAR) benefit (4.5 fpp / 5.8 fpp) of 1.43. In other words, 1.43 adults return from 4.5 fpp smolts compared to 1 adult from 5.8 fpp smolts.

Red House Hole Steelhead Releases SARs to Lower Granite PBT Estimate

Hatchery	Brood Year	Smolts Released	1-Oc	2-Oc	3-Oc	Total LGD return	SAR-Rel to LGD	Relative SAR
CFH	2010	229,509	111	701	0	812	0.35%	0.93
CFH	2011	179,433	369	1,927	0	2,296	1.28%	1.27
CFH	2012	208,673	48	1,289	43	1,380	0.66%	1.01
CFH	2013	224,416	838	3,285	229	4,352	1.94%	1.14
CFH	2014	224,554	158	420	0	578	0.26%	1.38
CFH	2015	232,066	593	1,150	0	1,743	0.75%	1.56
CFH	2016	238,476	70	361	0	431	0.18%	1.34
CFH	2017	233,792	114	1,929		2,043	0.87%	2.80
DNFH	2010	438,393	266	1,393	0	1,659	0.38%	
DNFH	2011	403,894	360	3,668	45	4,073	1.01%	
DNFH	2012	399,753	350	2,221	37	2,608	0.65%	
DNFH	2013	418,067	934	6,042	162	7,138	1.71%	
DNFH	2014	484,298	43	842	17	902	0.19%	
DNFH	2015	424,642	530	1,508	0	2,038	0.48%	
DNFH	2016	402,027	118	423	0	541	0.13%	
DNFH	2017	417,333	89	1,212		1,301	0.31%	
Average						2118	0.70%	1.43

However, updated SAR data to Red House from the Nez Perce Tribe (Bill Young, personal communication), shrinks the 4.5 fpp benefit to 1.14:

Red House SAR data for Dworshak and Clearwater

Brood Year	CRW 4.5 fpp	DWO 5.8 fpp	Relative SAR
2010	0.35%	0.52%	0.68
2011	1.28%	1.23%	1.04
2012	0.66%	0.52%	1.27
2013	1.94%	1.46%	1.33
2014	0.26%	0.17%	1.51
2015	0.75%	0.65%	1.16
2016	0.18%	0.18%	1.00
2017	0.87%	0.76%	1.15
			1.14

However, this analysis is incomplete because rearing smaller smolts results in more total smolt rearing capacity of the hatchery facility while maintaining the same Density Index. Taking into account the increased smolt capacity of rearing 5.8 fpp smolts, the relative benefit of rearing larger, 4.5 fpp smolts is lost (0.99 relative SAR). Switching to 5.8 fpp would save 32,000 pounds of production at Clearwater Hatchery.

Relative benefit of rearing Clearwater River Steelhead to 4.5 fpp

	Size at Rel (FPP)	**Number Produced**	**Density Index**	**Adults Produced**	**Relative Benefit at 4.5 FPP**
CFH	4.5	843,000	0.30	6,238	**0.99**
CFH	5.8	998,400	0.30	6,315	
DNFH	5.8	2,100,000	0.27	13,282	**0.99**
DNFH	4.5	1,773,137	0.27	13,121	

Steelhead Adults DWO/CRW

Total at 4.5 FPP	19,359
Total at 5.8 FPP	19,597
Difference	**-237**

SAR	0.7%
Rel. SAR	1.17

	DWO Lbs	CRW lbs
4.5 fpp	187,333	394,030
5.8 fpp	172,138	362,069
	Difference	31,961

4.1.1 Move Chinook release sites to maximize adult returns

The Red River releases of 1,280,000 Chinook smolts have returned at about 50% of the SAR of releases at other locations. Smolts have been released at Red River to expand fishery opportunities across the basin and provide unique sport and Tribal angler experiences. Fishery managers would need to consider alternative locations to serve in lieu of Red River releases that would hopefully find support from their anglers by increasing adult return numbers.

Moving all of the Red River releases would likely increase the average SAR for Clearwater (BY2000-2018) from 0.28% to 0.34%. That would increase the total number of adults returned from 10,500 to 12,750 annually. That increase would meet the 11,900 project area goal set for the Clearwater Fish Hatchery on an average year.

4.1.2 Expand Incubation

Current incubation is at maximum capacity. Any additional rearing would require additional incubation stacks. Plans are in discussion for either moving stacks into the current incubation room or expanding the incubation room by remodeling.

An additional 30 stacks (16 trays each) would add 480 useable trays.

Total Cost: $75,000 for stacks, $150,000 for remodeling, plumbing, etc.

4.1.3 New Pipeline for additional water supplies

The Idaho Governor Brad Little's Salmon Workgroup (Idaho Governor's Workgroup 2020) identified an additional pipeline to the Clearwater Hatchery as dramatically enhancing operations to both the Clearwater and Dworshak hatcheries. A presentation to the Northwest Power and Conservation Council in 2022 identified that the new pipeline could produce an addition 1.6 million spring Chinook smolts that would return an additional 6,000 adult Chinook salmon (IDFG estimates). In addition, Dworshak hatchery could produce an additional 1.8 million spring Chinook smolts that would return an additional 10,000 adult Chinook salmon (NPT estimates).

Current LSRCP estimates (Asset Management Plan 2022) are a total project cost of $61.2M to replace the Clearwater pipeline.

Exploratory work of adding additional water supplies to select raceways should be pursued in upcoming brood years to assess challenges with operating "E" bank raceways.

4.1.4 Create larger rearing units

McCall Fish Hatchery has consistently produced higher SAR rates than other facilities and utilizes shade structures and large rearing units (40 ft wide x 196 ft long x 4.5 ft deep). Creating "large" rearing units at Clearwater Hatchery could be accomplished by concrete saw-cutting walls from 4 raceways out to create a 40' x 200 x 3' rearing "pond".

Total cost estimate is unknown for this project and it would be prudent to try some experimental large rearing units at Clearwater before converting all raceways.

Realizing the substantial cost of replacing the concrete walls if this does not work makes the idea of testing this not a high priority at Clearwater.

4.1.5 Summary

Clearwater Hatchery has added significant Chinook production over the past decade and limited opportunities exist with existing infrastructure. Adding additional water supplies could significantly increase the potential of the facility with a cost of $61M and an additional 1.6M Chinook smolts annually. In addition, incubation needs to be expanded for any additional smolt production at a cost of $225,000.

Adjusting to release sites with higher return rates has the potential to increase adults returned, but has other fishery management implications.

Changing to smaller size at release (20 fpp SCS and 5.8 fpp in STT) with current SAR data could save 49,500 pounds of production, but adult return differences are negligible.

Creating larger rearing units could be beneficial, but further work on costs to remove and possibly replace the concrete walls is needed.

Action	Smolts
New Pipeline to Clearwater	1,600,000 at $61M and additional 1.8 million smolts at Dworshak NFH
Expand Incubation	30 additional stacks for 480 useable trays - $225,000

5 References

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U.S. Fish and Wildlife Service (USFWS). 2011. *Review of Idaho Lower Snake River Compensation Plan State-Operated Hatcheries, Clearwater, Magic Valley, McCall, and Sawtooth Fish Hatcheries: Assessments and Recommendations. Final Report, March 2011*. Hatchery Review Team, Pacific Region. U.S. Fish and Wildlife Service, Portland, Oregon.

6 Appendix A. Water Quality Parameters

Water Quality Data - Source IDFG, 2021

Primary IOC Contaminants	Clearwater
Arsenic	ND
Barium	0.009
Cadmium	ND
Chromium	ND
Mercury	ND
Nickel	ND
Selenium	ND
Sodium	1.780
Flouride	ND
Secondary and Other IOC Contaminants	
Chloride	0.228
Iron	0.099
Manganese	0.002
Dissolved Solids	36.000
Zinc	ND
Silver	ND
Sulfate	0.563
Calcium	4.100
Hardness (as $CaCO_3$)	14.000
Magnesium	0.924
pH	7.920
Potassium	0.633
Lead	ND
Copper	ND
Comments	
Alkalinity (mg/l)	16.0 to pH 4.2
Flow (cfs)	74

Appendix B. General Marking Schedule

- February 10th Pit tagging Spring-Run Chinook at Clearwater
- April 26th-May 24th Marking Spring-Run Chinook and Summer-Run Chinook at Clearwater
- May 11th-13th Marking Summer-Run Chinook at Pahsimeroi
- May 29th- June 3rd Marking Spring-Run Chinook at Sawtooth
- June 7th-22nd Marking Spring-Run Chinook at Rapid River
- June 14th-17th Marking Summer-Run Chinook at McCall
- June 26th-June 30th Marking Summer-Run Sockeye at Springfield
- July 12th- 20th Marking Summer-Run Chinook at McCall
- July 26th-August 5th Marking Summer-Run Steelhead at Clearwater
- July 28th- August 4th Marking Summer-Run Steelhead at Magic Valley
- August 12th-17th Marking Summer-Run Steelhead at Niagara Springs
- August 25th - August 30th Marking Summer-Run Steelhead at Hagerman National
- September 20th-September 23rd Pit tagging Spring-Run Chinook, Summer-Run Chinook, and Summer-Run Steelhead at Clearwater
- September 27th-September 30th Pit tagging Spring-Run Chinook at Rapid River
- October 5th and 6th Pit tagging Spring-Run Chinook at Sawtooth
- October 11th- 14th Pit tagging Summer-Run Chinook at McCall
- October 19th-21st Pit tagging Summer-Run Sockeye at Springfield
- October 28th and 29th Pit tagging Summer-Run Steelhead at Magic Valley
- October 30th-October 31st Pit tagging Summer-Run Steelhead at Niagara Springs
- November 9th and 10th Pit tagging Summer-Run Steelhead at Pahsimeroi
- November 16th and 17th Pit tagging Summer-Run Chinook at Hagerman National
- November 29th-December 2nd Pit tagging Spring-Run Chinook at Clearwater

Appendix C. Options Discussed

6.1.1 Install LHOs on D and E sections

LHO's were discussed, but current water quality (i.e. solids management), precludes use of these raceways. Staff has tested E bank with existing water supplies and experienced fish health problems.

Currently, section E is not used at the facility due to water limitation concerns. The addition of Low-Head Oxygenation units (LHOs) would provide the Dissolved Oxygen boost needed to provide a suitable rearing environment in the E section. Adding LHOs to the D section would provide additional opportunity to maximize Oxygen levels at the section as well.

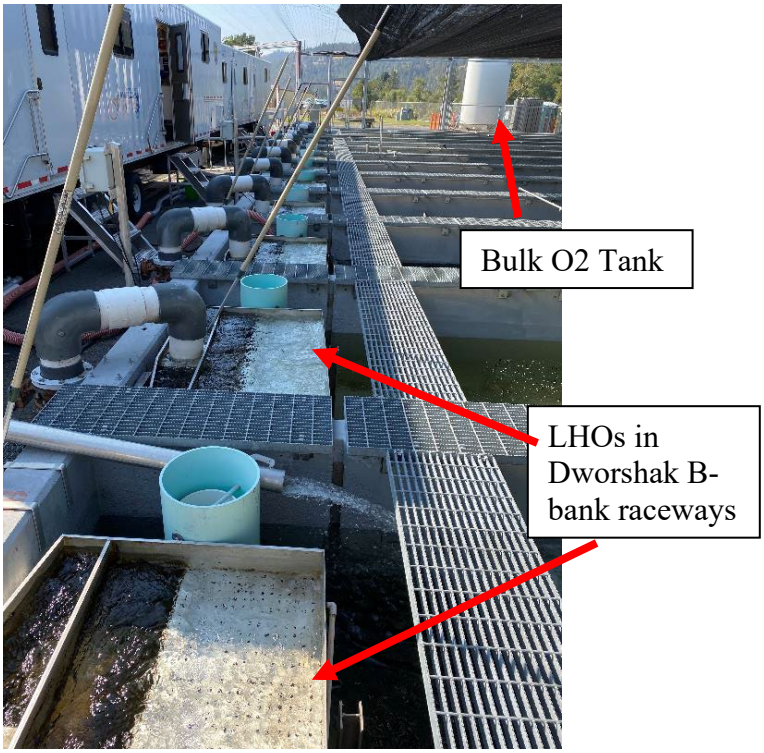
If 22 of the E-section raceways were used (assuming rainbow trout in two E sections), a total of 40 sections at 90,000 Chinook smolts/section could be utilized. This would increase the facility rearing potential by 1,980,000 Chinook smolts. However, early rearing in the vats is already maxed out. To solve this, 5 raceways in A section would need to be used for early rearing and taken out of production for smolt rearing. That would reduce the net gain of smolts from 1,980,000 to 1,440,000 (5 raceways * 90,000/rwy). In addition, additional E section raceways would be needed to increase steelhead production back to 1,040,000 from 843,000. That would further reduce the Chinook potential to 1,240,000.

Location	Smolts
A&B Raceways (17 useable)	1,530,000
Holding Ponds	370,000
East and West (C,D,E) – 40 useable sections	3,600,000
Total	5,500,000

Dworshak recently installed LHOs on their 30 raceways at a cost of approximately $5,000 per LHO. Total cost to install LHOs on D & E sections would be $240,000. In addition, the facility would likely need two bulk oxygen tanks. Tanks and install is estimated at $200,000.

Total infrastructure cost = $440,000. Additional annual cost of $186,000 for fish food, marking, etc. ($0.15/smolt * 1,240,000 smolts).

Example LHOs at Dworshak NFH:



6.1.2 Install Shade Structure over raceways

Due to cost and other facilities, like Rapid River not using shade structures, this option is not recommended until additional testing could be completed.

McCall Fish Hatchery has the most successful Smolt to Adult survival rates (0.85%) of all the LSRCP programs. The program has a lower Density Index criteria (0.21), but higher Flow Index criteria (1.96 at 39F and 5,000 ft). McCall has also had covered (shaded) rearing since inception.

Clearwater staff has used temporary shade cloth over A and B raceways since 2014 with some benefits on-station. However, a solution has not been found to cover the East and West raceways (C-E) with shade cloth.

A SWOT analysis of installing a shade structure over the Chinook rearing raceways at Clearwater was completed in 2021:

Strengths

- Shading benefits smolt growth (Pickering 1987 - https://www.sciencedirect.com/science/article/abs/pii/0044848687902262)
- Shade structure will reduce predation and Aquatic Invasive Species/Disease contamination

- Baffle installation is effective because sunlight is eliminated resulting in less staff for cleaning efforts and reduced fish disturbance
- Extends epoxy coating and automatic feeder lifespan
- Less overhead disturbance to fish from birds and less staff interaction by reduction of cleaning activities
- Replaces existing bird net structure
- Improves working conditions for staff

Weaknesses

- Cost potential of $6.0M
- Reduces resources available for other infrastructure and program needs
- Labor for install/removal/cleaning of baffles for marking and release
- Does not address Chinook needs in Salmon basin (5% of return goals in 2021)

Opportunities

- Opportunity to increase adult Chinook returns
- Current SAR rates are below target (0.87) and have room to improve
- Potential to install LHO's towards "Michigan-style" raceways

Threats

- Catastrophic failure potential (Carson NFH rain on snow event example)
- Increased incidence of Gyrodactylus has been anecdotally noted at covered facilities
- Currently considered capital project under existing MOA
- LSRCP Program buy-in to large capital project
- Buy-in to LHO's and baffles

Total Cost estimate to construct shade structure: $5.9M

6.1.3 Expand Clearwater Fish Hatchery production space

Expanding production space would require land not yet owned by the USFWS, hence this option was not pursued.

The Clearwater footprint is already maximized for rearing space. However, additional vacant land is adjacent to the property owned by the USFWS and owned by the Nez Perce Trust. Assuming the new Clearwater pipeline was installed and could deliver additional water supplies, discussions/negotiations with the Department of Natural Resources within the Nez Perce Tribe about possible acquisition/lease/etc. for expansion would be warranted.

Potential cost is unknown, but the land base could double the facility footprint and output. Water supplies would likely need to be doubled as well to around 200 cfs.

Expansion with Partial Recirculating Aquaculture Systems (PRAS) and circular tanks could reduce the water supplies needed.

Adjacent land to Clearwater Fish Hatchery:

6.1.4 Convert Dworshak to Chinook and Clearwater to Steelhead

With the majority of Dworshak on a pumped water source, 100% conversion of facilities to single species (Salmon or Steelhead) presents too much of a risk to pursue at this time. Appendix D outlines this option and could be feasible if additional water sources or recirculating opportunities were available.

Dworshak and Clearwater both rear steelhead and Chinook smolts. There are some benefits to this arrangement:

1) Risk of catastrophic failure is spread between two facilities

2) Staff experience rearing both steelhead and Chinook smolts

Spreading both species across these two facilities has multiple opportunity costs:

1) Risk of catastrophic IHN failure of steelhead at Dworshak NFH on river water supplies continues

2) Water heating to achieve 60 fpp on steelhead smolts before introduction to river water exceeds 11.5M kwh or the equivalent of $1.15M annually at $0.10/kwh (Dworshak does not currently pay electric costs)

3) Releasing Chinook smolts later in mid-April is challenging because rearing space is needed for the subsequent brood year.

4) Dworshak Chinook eggs/fry are chilled to temperatures of 37 F and colder to slow growth during winter months

5) Clearwater steelhead/Chinook compete with each other at both facilities as staff choose between size targets for each species and limited water supplies/temperatures

6) Dworshak and Clearwater are underutilized by 17% because of balancing between multiple species at each location

7) Dworshak and Clearwater produce 26% less Chinook adults and 21% less Steelhead adults than could be achieved by focusing on one species.

Numerous political and social constraints factor in the decision on what Dworshak and Clearwater facilities annually produce. This report will focus mainly on the biological criteria rather than those obstacles to implementation.

Converting all steelhead production to Clearwater Fish Hatchery on reservoir water supplies to avoid IHN risks. Max production would be achieved in March annually at 3,500,000 steelhead smolts at 5.8 fpp and a corresponding DI of 0.28 (assuming use of A-E banks) and a FI of 2.31 at 41 F. Piper (1982) specifies a maximum FI of 2.52 at 41 F and 1000 feet of elevation to maintain dissolved oxygen concentrations above 5 ppm. If higher dissolved oxygen levels are desired, Low-Head Oxygenation systems can be installed in E-bank raceways (see Clearwater report). Early rearing of approximately 843,000 steelhead would still occur at Dworshak NFH on the 6400 gpm of reservoir water supplied to their nursery building. This would accommodate early steelhead takes without robbing additional water from final rearing at Clearwater Fish Hatchery. Limited water heating would be needed to match size of Clearwater steelhead at 100 fpp in July. 843,000 steelhead would be targeted for rearing in the existing Clearwater A&B 1-11 raceways (currently Chinook) to keep fingerlings transferred from Dworshak isolated in one area of the facility. Clearwater would likely need additional labor resources for feeding to meet 5.8 fpp size targets.

Dworshak would maintain Coho production in 6 Burrows Ponds and convert remaining Burrows Ponds (78) to spring Chinook production at 100,000 smolts/Burrows Pond. Maximum production would occur in April at 7,800,000 spring Chinook at 20 fpp and a DI of 0.32 and FI of 1.36. Total flow required is 54,600 gpm (700 gpm per Burrows Pond) and 10,200 gpm for early rearing of Chinook/Coho in raceways. Limited chilling would be required to match Chinook egg takes and releases could occur in mid-April to May to shorten travel times to Lower Granite Dam.

Current smolt production at Dworshak and Clearwater Fish Hatcheries

Facility	Species	Numbers	FPP	SAR	Adults	Total
Dworshak	STT	2,100,000	5.8	0.69%	14,490	21,150
Clearwater	STT	843,000	4.5	0.79%	6,660	
Dworshak	SCS	2,150,000	20	0.20%	4,300	13,270
Clearwater	SCS	3,900,000	16	0.23%	8,970	

Converting Clearwater Hatchery to all steelhead would result in an increase of adult steelhead of 3,000 (0.69% SAR) or 14% more steelhead adults from baseline. Converting Dworshak to all spring Chinook production would result in an increase of adult Chinook of 2,330 (0.20% SAR) or 18% more Chinook adults from baseline.

Smolt production by switching Dworshak and Clearwater to single-species rearing

Facility	Species	Numbers	FPP	SAR	Adults	Net Adult Benefit	Adult Increase
Dworshak	SCS	7,800,000	20	0.20%	15,600	2,330	18%
Clearwater	STT	3,500,000	5.8	0.69%	24,150	3,000	14%

Total cost of implementation: $450,000 to skim coat/epoxy 30 remaining Burrows Ponds, $288,000 for additional fish food and $97,000 for additional marking/tagging/etc. for 970,000 additional spring Chinook.

6.1.5 Convert Dworshak to Steelhead and Clearwater to Chinook

With the majority of Dworshak on a pumped water source, 100% conversion of facilities to single species (Salmon or Steelhead) presents too much of a risk to pursue at this time.

Another exercise can be done by switching Clearwater Hatchery to Chinook production and Dworshak Hatchery to steelhead production. In this example, we also switched coho (600,000 smolts) to Clearwater Hatchery assuming that Dworshak would solely manage for steelhead.

Because of early-rearing reservoir water bottlenecks (limited to 9,000 to 12,000 gpm to 60 fpp from piping restriction), Dworshak could rear 3,024,000 steelhead. The size of steelhead is also limited to 5.8 fpp for later takes because winter water temperatures are limited by the ambient temperature of the North Fork Clearwater River (41-45 F).

Clearwater was limited to 7,800,000 Chinook at 20 fpp with a Density Index criteria of 0.30 for final rearing. Raceways A1-11 and B1-2 were used for early earing to 100 fpp of Chinook and Coho leaving them unusable for final rearing. Density indices for those raceways were capped at 0.40 DI (for small fish).

The net expected result from this switch is an increase of 2,330 adult Chinook and a net decrease of 284 adult steelhead.

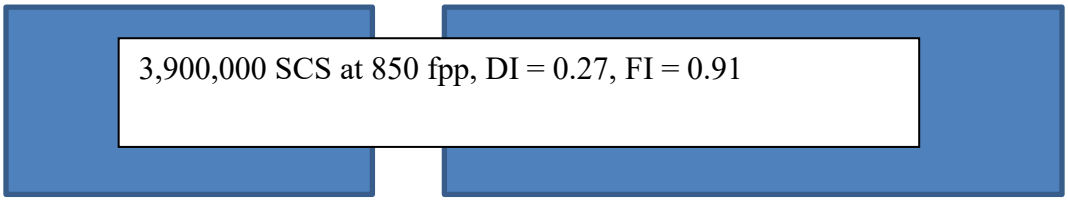
Smolt production by switching Dworshak and Clearwater to single-species rearing

Facility	Species	Numbers	FPP	SAR	Adults	Net Adult Benefit	Adult Increase
Dworshak	STT	3,024,000	5.8	0.69%	20,866	-284	-1%
Clearwater	SCS	7,800,000	20	0.20%	15,600	2,330	18%

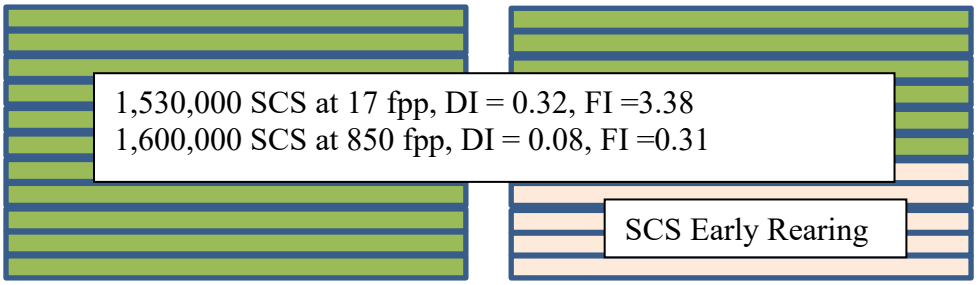
7 Appendix D. Monthly Production Strategy–Clearwater Fish Hatchery

7.1.1 January

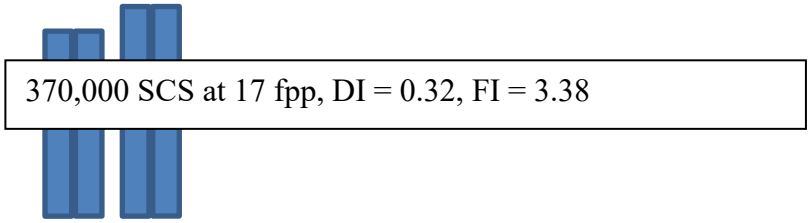
Incubation (60 vats – 190 ft3 each) – 1-22 STT and 1-60 SCS



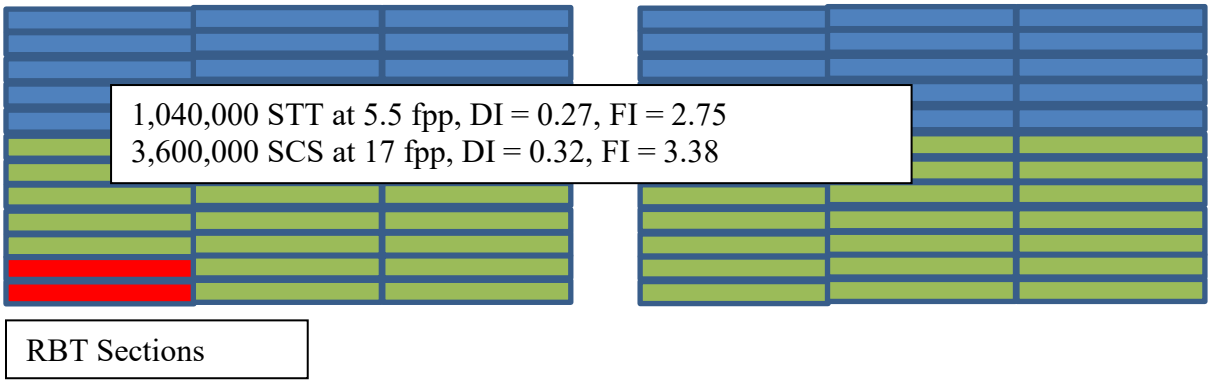
A&B Raceways – (3000 ft3 and 1.8 cfs each)



Adult Holding (3,000 ft3 and 3500 ft3 each)

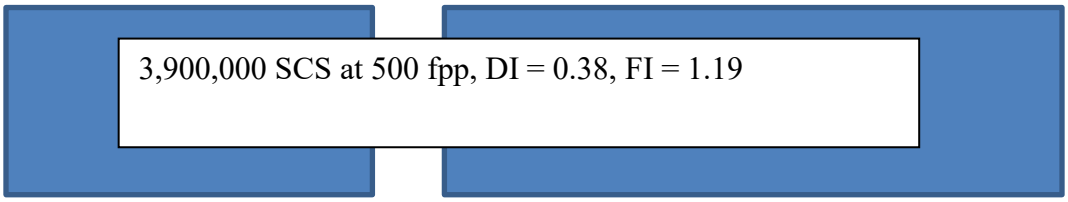


East and West Raceways (C,D,E) – (3000 ft3 and 2.0 cfs each)

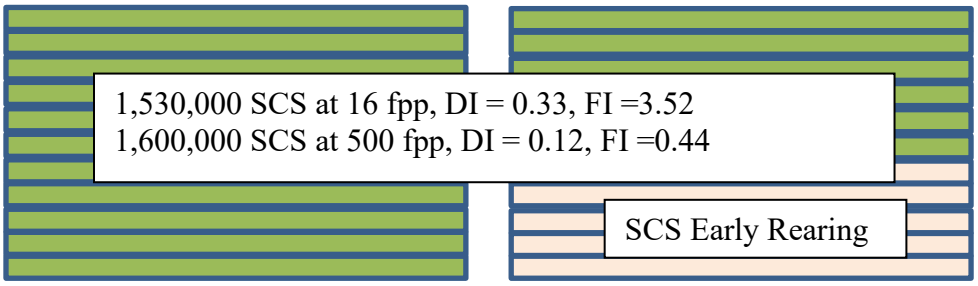


7.1.2 February

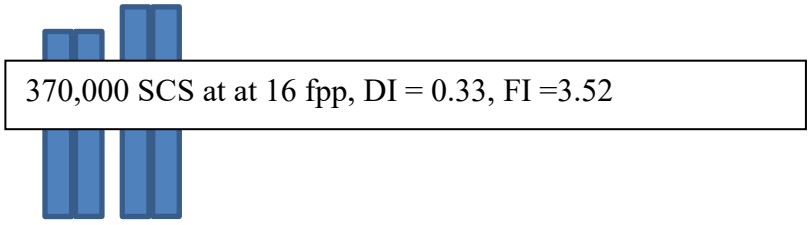
Incubation (60 vats – 190 ft3 each) – 1-22 STT and 1-60 SCS



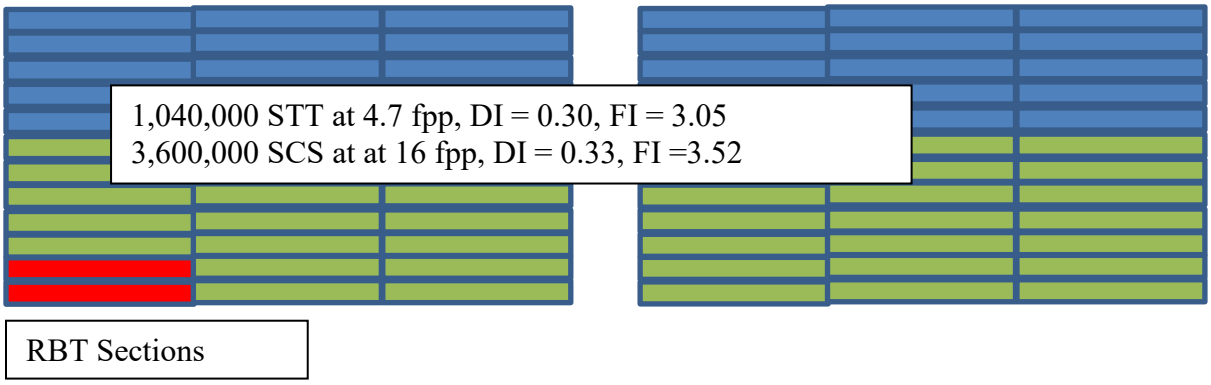
A&B Raceways – (3000 ft3 and 1.8 cfs each)



Adult Holding (3,000 ft3 and 3500 ft3 each)

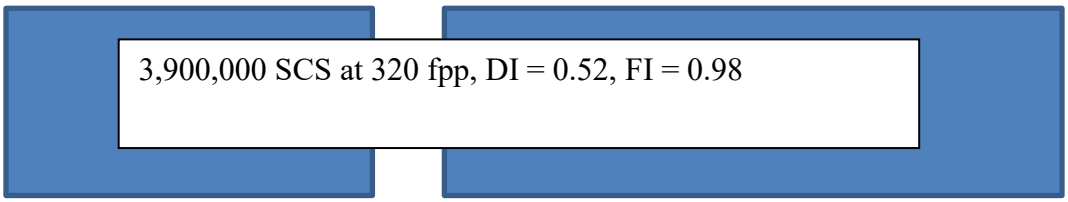


East and West Raceways (3000 ft3 and 2.0 cfs each)

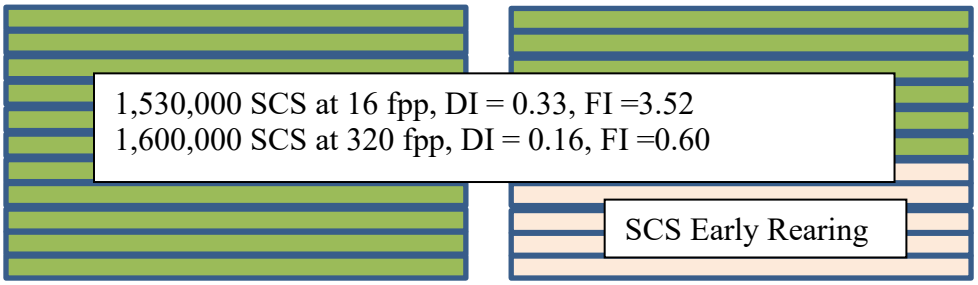


7.1.3 March

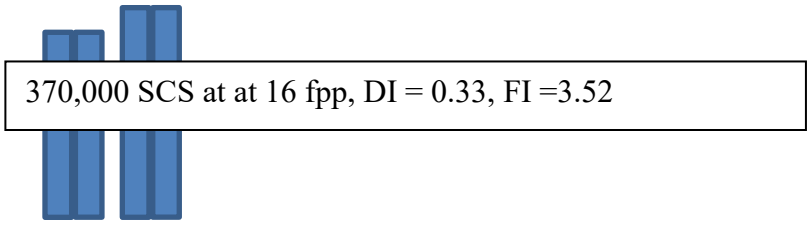
Incubation (60 vats – 190 ft3 each) – 1-22 STT and 1-60 SCS



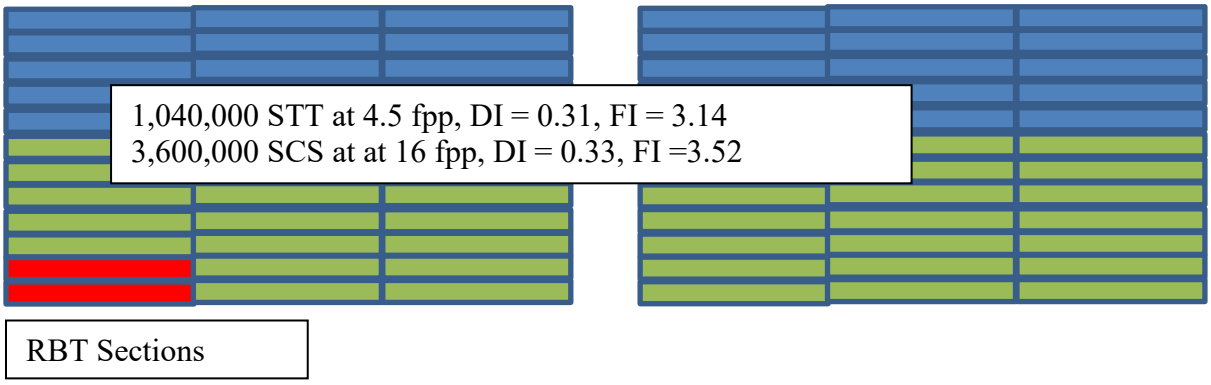
A&B Raceways – (3000 ft3 and 1.8 cfs each)



Adult Holding (3,000 ft3 and 3500 ft3 each)

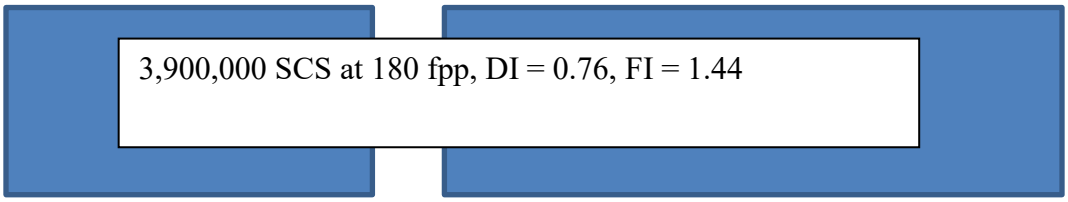


East and West Raceways (3000 ft3 and 2.0 cfs each)

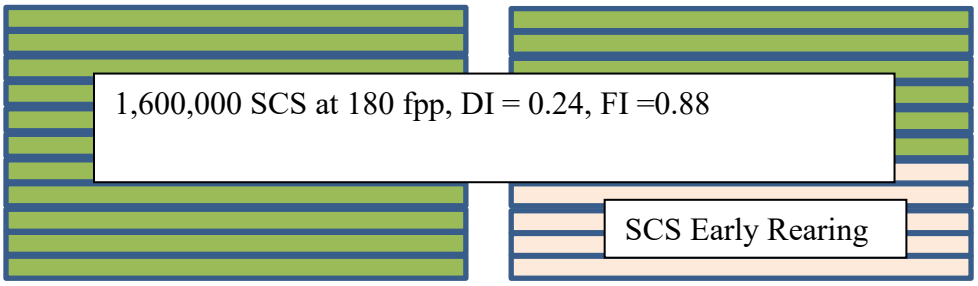


7.1.4 April

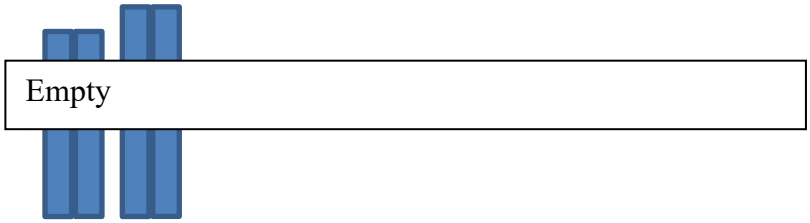
Incubation (60 vats – 190 ft3 each) – 1-22 STT and 1-60 SCS



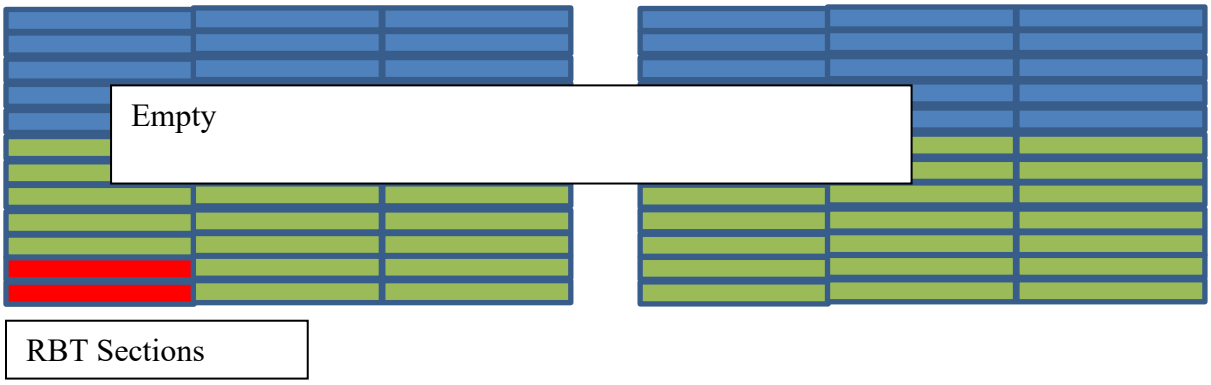
A&B Raceways – (3000 ft3 and 1.8 cfs each)



Adult Holding (3,000 ft3 and 3500 ft3 each)

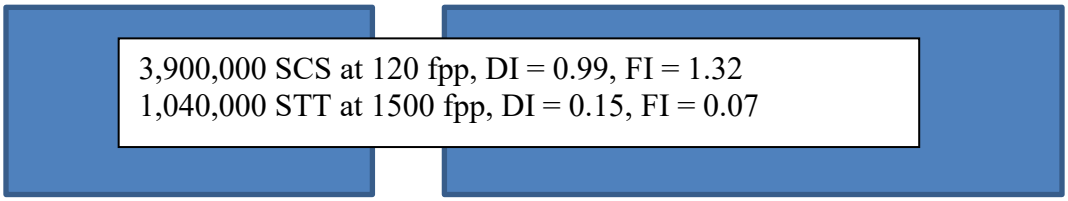


East and West Raceways (3000 ft3 and 2.0 cfs each)

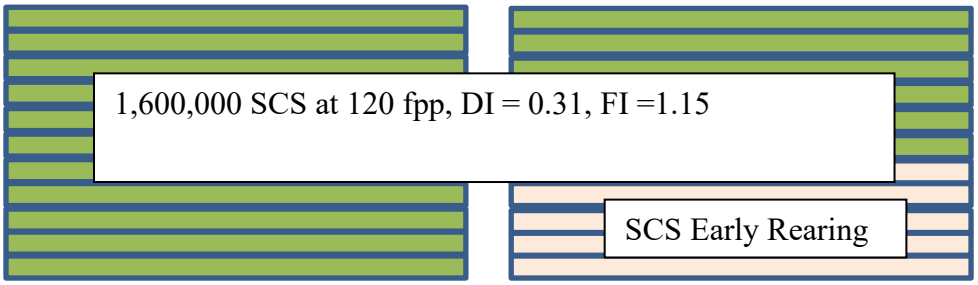


7.1.5 May

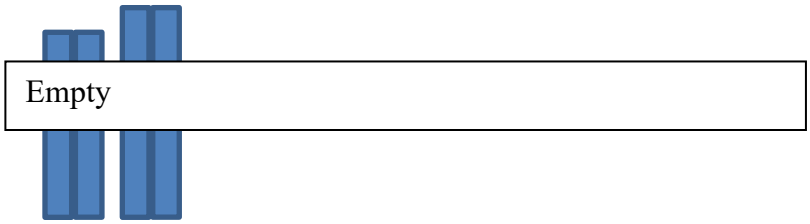
Incubation (60 vats – 190 ft3 each) – 1-22 STT and 1-60 SCS



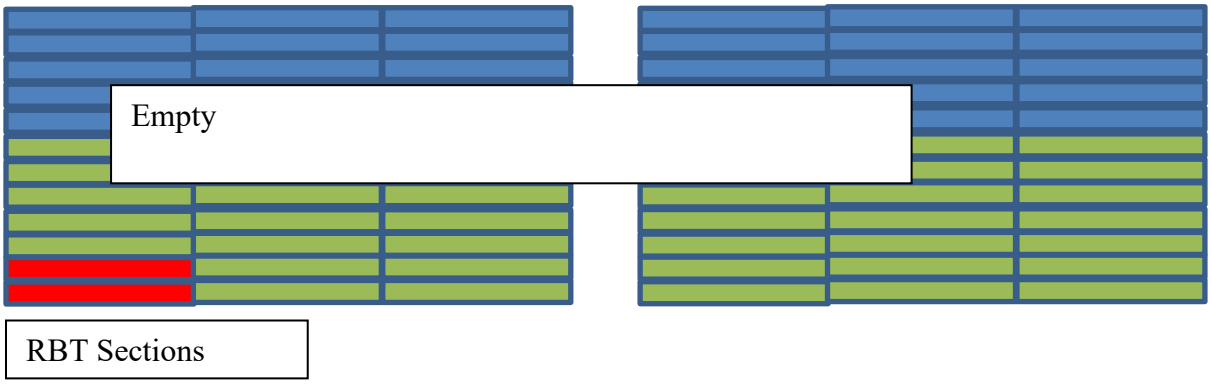
A&B Raceways – (3000 ft3 and 1.8 cfs each)



Adult Holding (3,000 ft3 and 3500 ft3 each)

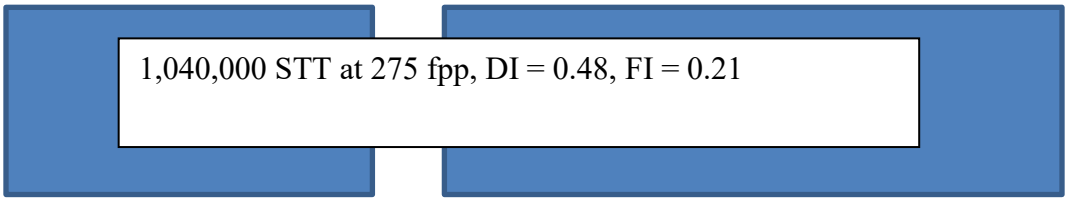


East and West Raceways (3000 ft3 and 2.0 cfs each)

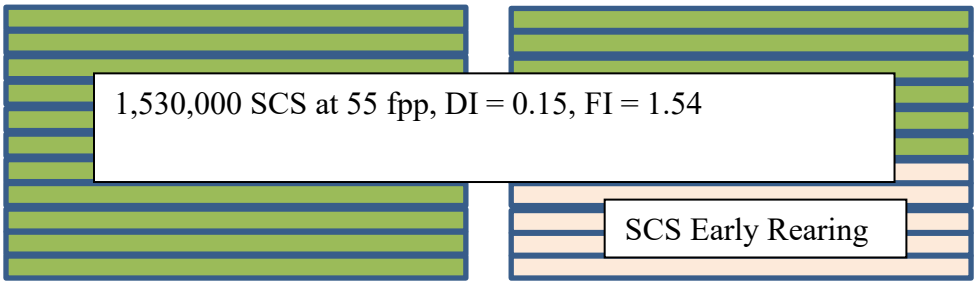


7.1.6 June

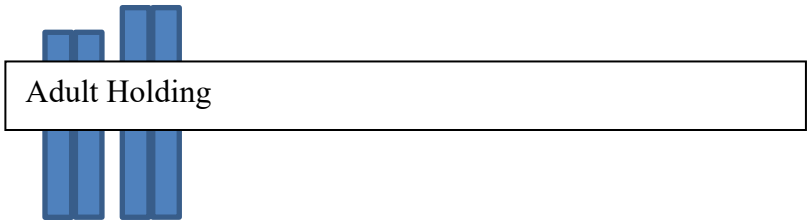
Incubation (60 vats – 190 ft3 each) – 1-22 STT and 1-60 SCS



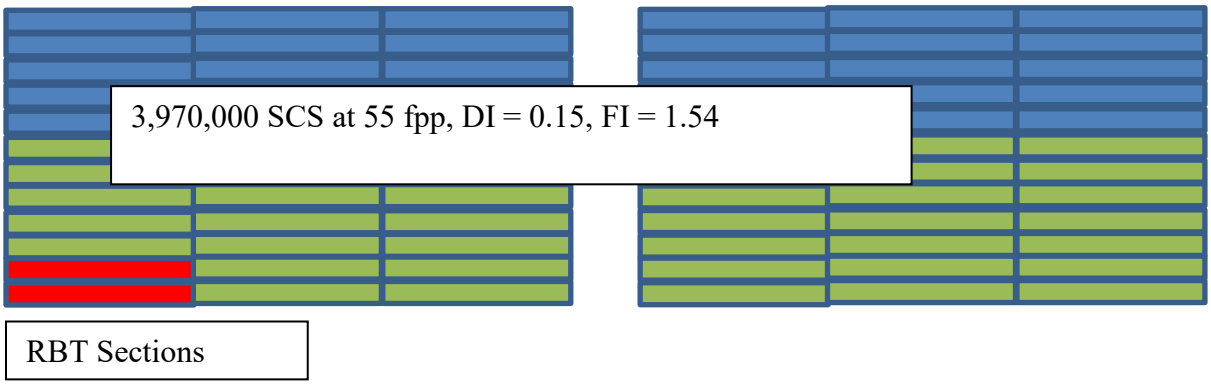
A&B Raceways – (3000 ft3 and 1.8 cfs each)



Adult Holding (3,000 ft3 and 3500 ft3 each)

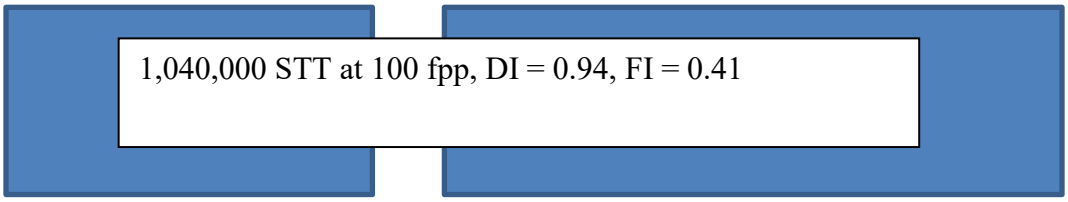


East and West Raceways (3000 ft3 and 2.0 cfs each)

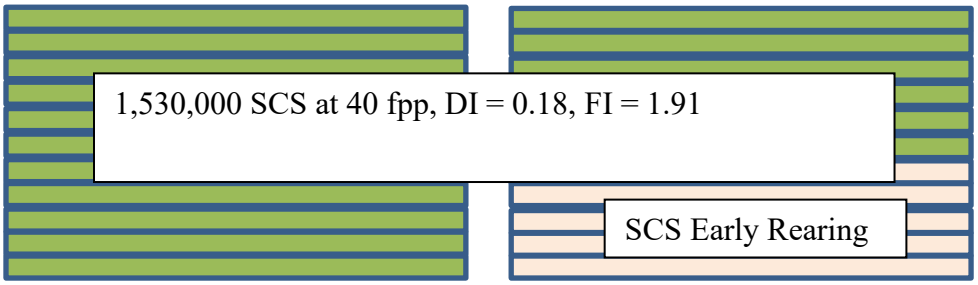


7.1.7 July

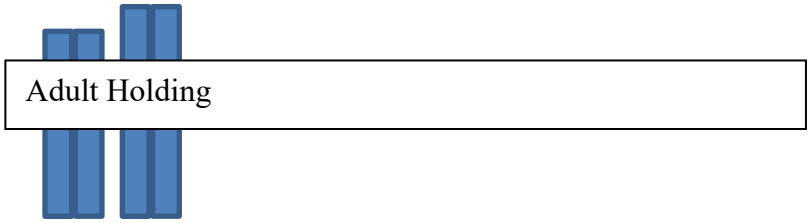
Incubation (60 vats – 190 ft3 each) – 1-22 STT and 1-60 SCS



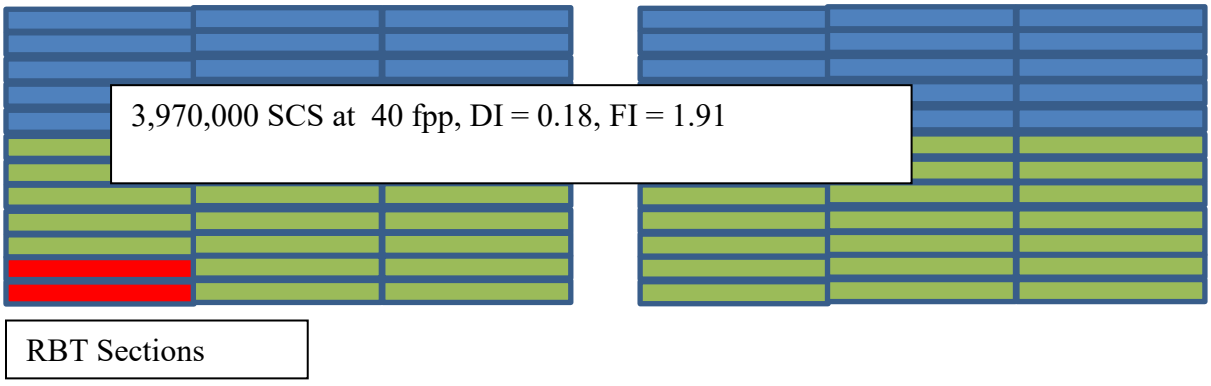
A&B Raceways – (3000 ft3 and 1.8 cfs each)



Adult Holding (3,000 ft3 and 3500 ft3 each)

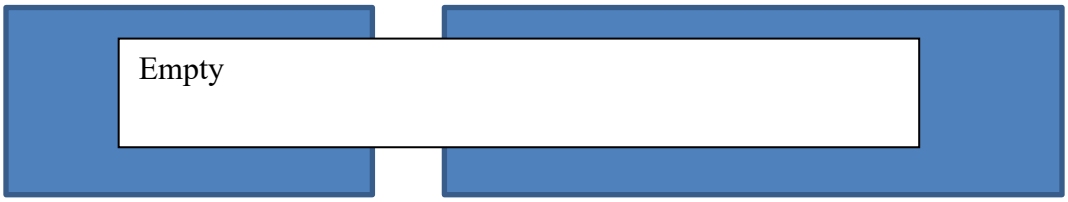


East and West Raceways (3000 ft3 and 2.0 cfs each)

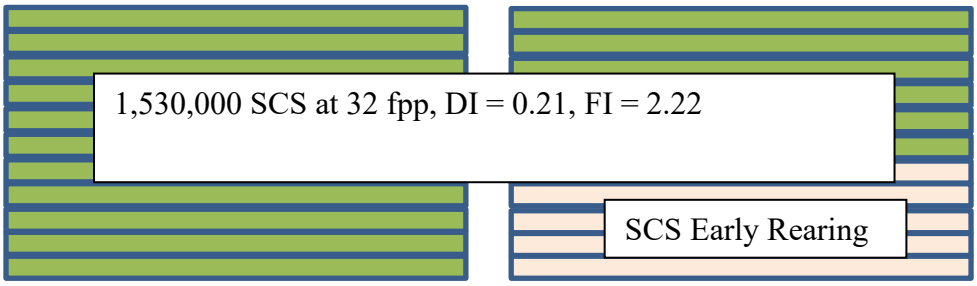


7.1.8 August

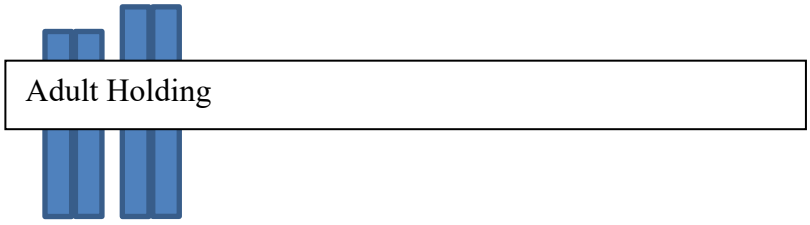
Incubation (60 vats – 190 ft3 each) – 1-22 STT and 1-60 SCS



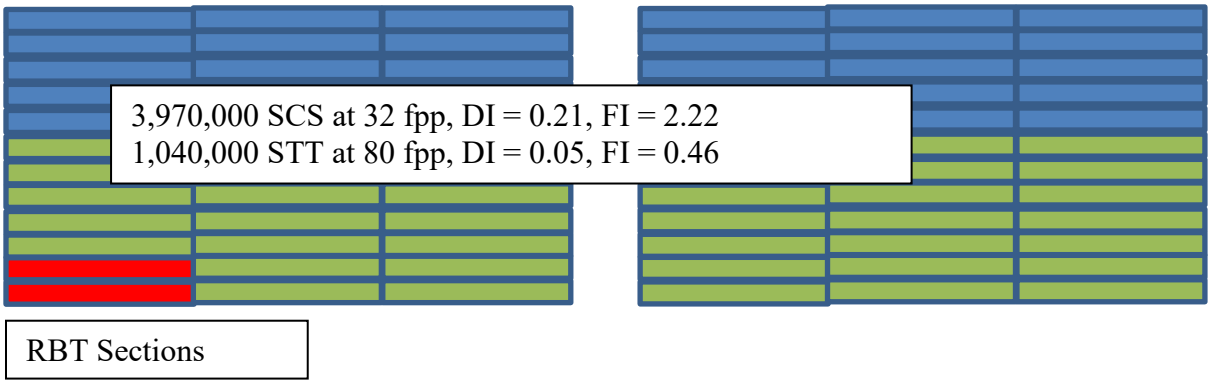
A&B Raceways – (3000 ft3 and 1.8 cfs each)



Adult Holding (3,000 ft3 and 3500 ft3 each)

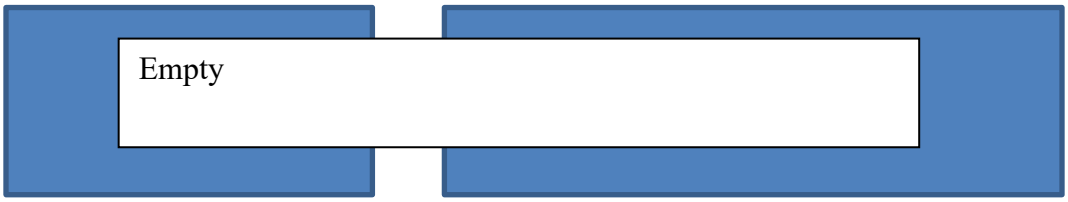


East and West Raceways (3000 ft3 and 2.0 cfs each)

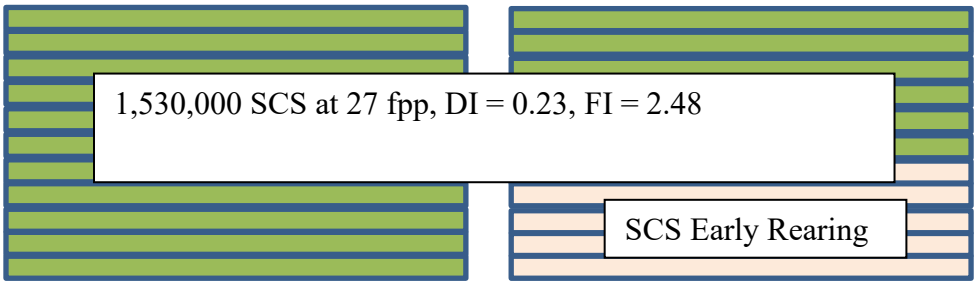


7.1.9 September

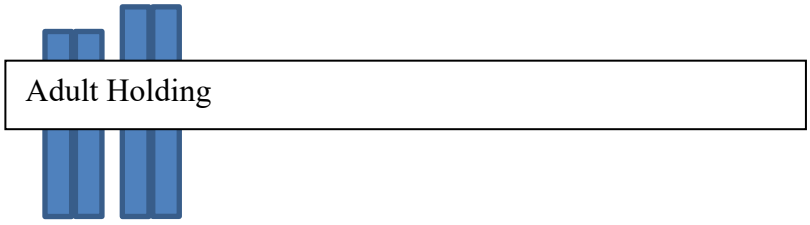
Incubation (60 vats – 190 ft3 each) – 1-22 STT and 1-60 SCS



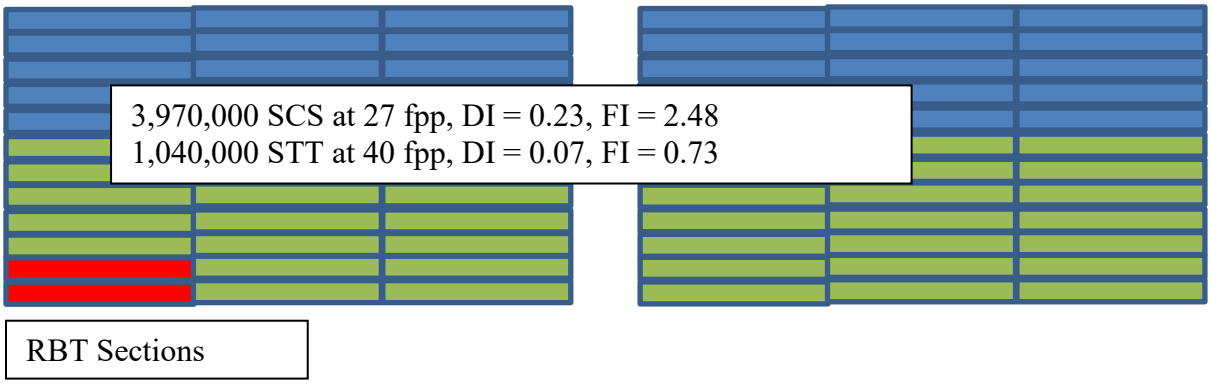
A&B Raceways – (3000 ft3 and 1.8 cfs each)



Adult Holding (3,000 ft3 and 3500 ft3 each)

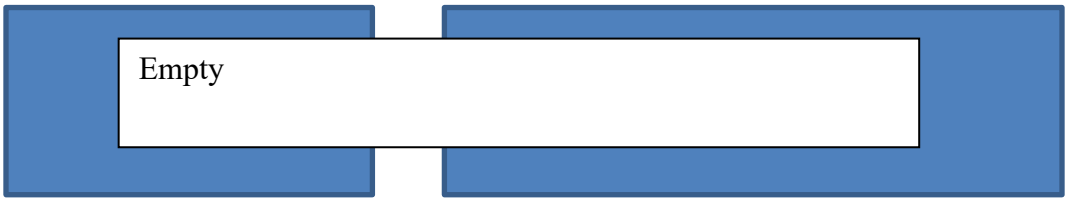


East and West Raceways (3000 ft3 and 2.0 cfs each)

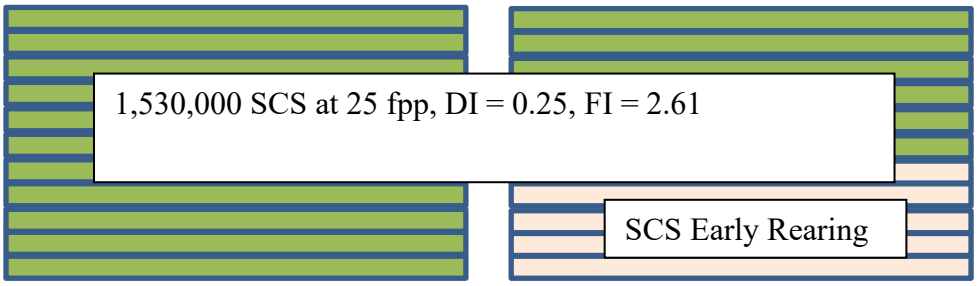


7.1.10 October

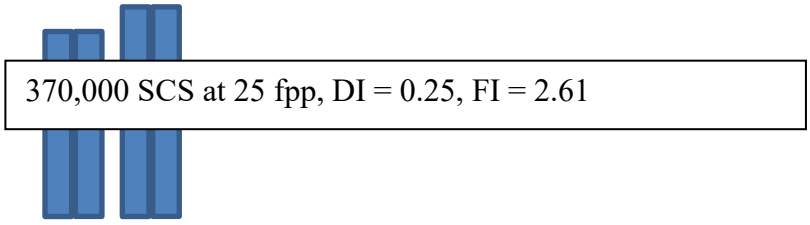
Incubation (60 vats – 190 ft3 each) – 1-22 STT and 1-60 SCS



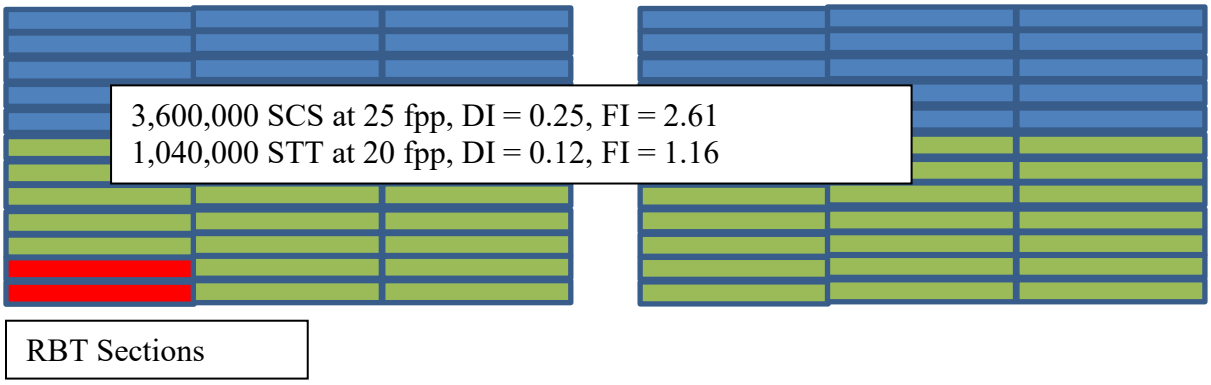
A&B Raceways – (3000 ft3 and 1.8 cfs each)



Adult Holding (3,000 ft3 and 3500 ft3 each)

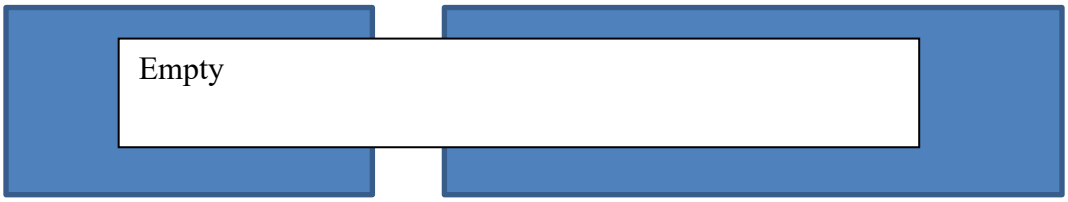


East and West Raceways (3000 ft3 and 2.0 cfs each)

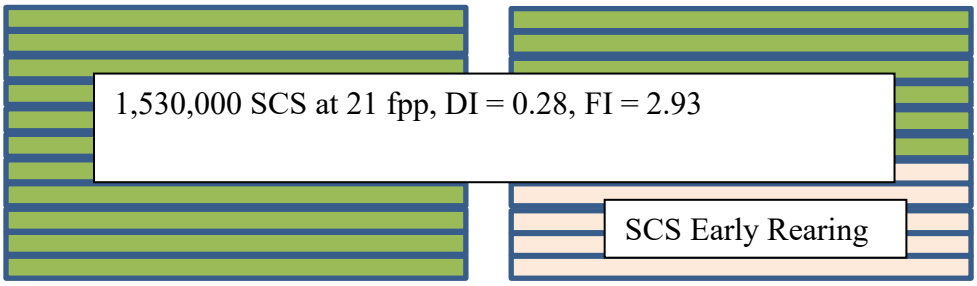


7.1.11 November

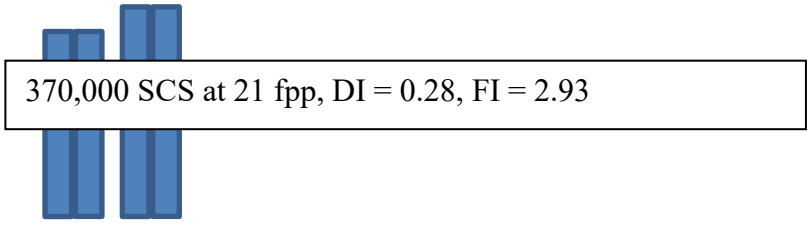
Incubation (60 vats – 190 ft3 each) – 1-22 STT and 1-60 SCS



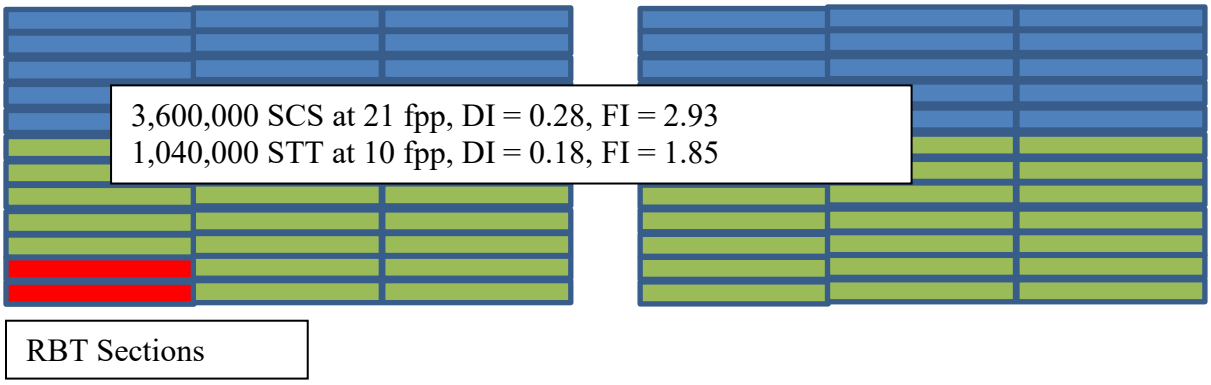
A&B Raceways – (3000 ft3 and 1.8 cfs each)



Adult Holding (3,000 ft3 and 3500 ft3 each)

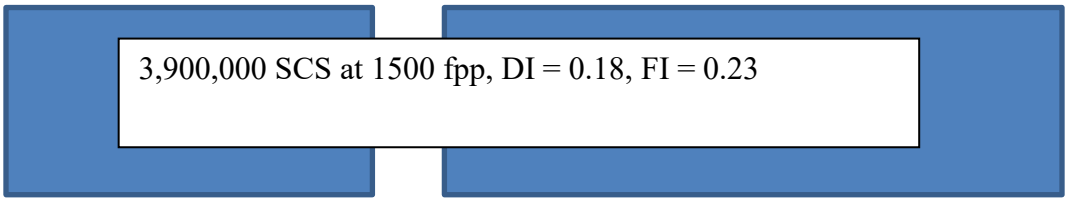


East and West Raceways (3000 ft3 and 2.0 cfs each)

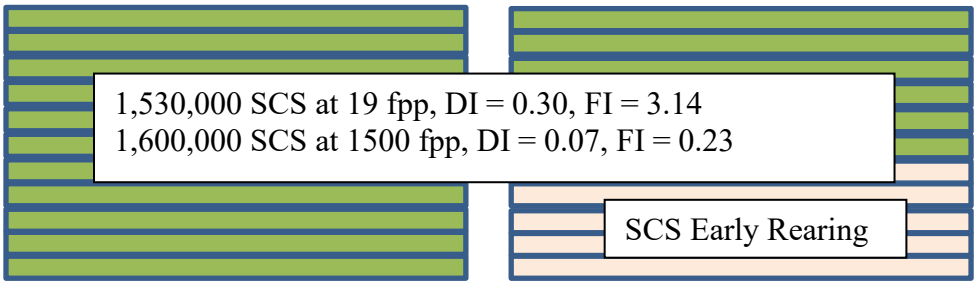


7.1.12 December

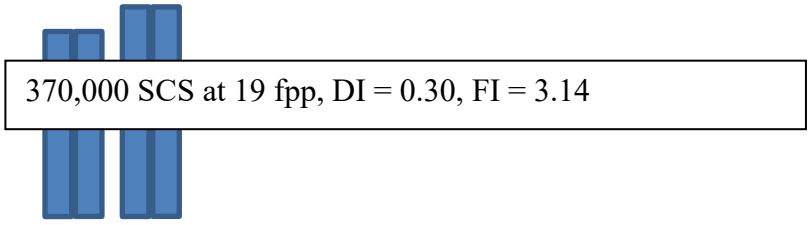
Incubation (60 vats – 190 ft3 each) – 1-22 STT and 1-60 SCS



A&B Raceways – (3000 ft3 and 1.8 cfs each)



Adult Holding (3,000 ft3 and 3500 ft3 each)



East and West Raceways (3000 ft3 and 2.0 cfs each)