Technical Memorandum – Deferred Hatchery Maintenance

To:	Ryan McCormick	Project:	State of Oregon Contract # 835-099-24
From:	Jerrod Vaughn, PE William Zimmerman, PE	cc:	
Date:	6/14/2024	Job No.:	01F2404.00
Subject:	2024 Deferred Hatchery Maintenance Evaluations		

1.0 Background

The State of Oregon's Department of Fish and Wildlife (ODFW) has numerous hatcheries they own, operate and maintain in the State of Oregon. The ODFW has identified specific improvements at eight of these hatcheries. These are Alsea, Bandon, Elk River, Salmon River, Cedar Creek, Trask, Nehalem and Roaring River. In April 2024 ODFW contracted with QRS Consulting, LLC (QRS) to provide a brief description of the proposed improvements, verify their feasibility at a high level and provide a preliminary capital cost for each major element.

Construction costs provided do not include owner's cost for engineering support services, inspection services and project management costs. These costs are considered very conceptual and have an expected range of plus or minus 50%. Variations in these cost estimates could be significant based on the final scope of the project, selected project approach, year constructed, permitting requirements, and many other variables. These estimates are intended to provide ODFW with an approximate order of magnitude capital costs for long-term and overall budget planning.

2.0 Alsea Hatchery

Items under consideration at the Alsea Fish Hatchery include: an intake screen that meets criteria; realignment of the rearing ponds; and evaluation of available head at the hatchery building.

2.1 Intake Screen

The existing intake screen would meet velocity criterion of 0.4 ft/sec for a flow of no more than 37 cfs, well below the target flow of 47 cfs. The screen is oriented nearly flat to accommodate manual cleaning, which is not ideal for currently supplied automatic screen wipers. A new intake structure would be designed to accommodate a larger screen to meet velocity criterion. A modern wiper and a coarse trash rack would also be included in the design. The effective screen height for the new intake is assumed to be 5 feet. Therefore, the effective screen length would need to be at least 23.5 feet long. To assure compliance, 15%

was added for a length of 27 feet. The new screen wiper would be similar to those commonly supplied by Duperon or Atlas. The new concrete intake would be 30 feet by 30 feet overall in plan view but include a tapered section to the outlet pipe. There would be a slide gate to isolate the intake supply pipe.

Table 2.1 Construction Cost Estimate – Intake Replacement

Low Range	Estimate	High Range
$2.4M	$4.7M	$7.1M

2.2 Rearing Pond Alignment

The twenty 20’ by 100’ raceways will be replaced by eight 20’ by 250’ raceways (see Figure 2.1). Each 250’ long raceway would be partitioned into thirds for bio-separation. A new 42” main line would start at PT 7 (see ODFW drawing # 1-43), be routed along the north end of the new raceways, and connect to the existing 42” line to the holding pond and fish ladder. The existing 30” line into the hatchery would tee into the new 42” line. The proposed raceway layout would allow for a majority of the construction to occur without interfering with hatchery operations. One potential construction sequencing would be: demo ten rectangular and three circular raceways and associated lines on the north end of the grounds while protecting the water supply line to the hatchery building; construct the new raceways from the west to the east providing pipe stub connections; prior to constructing the far east raceway demo the existing east raceways (west raceways could still be in service); construct discharge lines from the new east raceways and connect to the existing lines to the settling pond and pond 26; demo existing west raceways starting on the north end and construct the discharge lines from the new raceways; construct the new supply line to the new raceways, hatchery building, and fish ladder. For the supply line cut over, maintain water supply to the hatchery building for incubation while putting into service the raceways starting on the west. This would allow fry to be moved to the raceways if needed during the cut-over process.

A ground survey and hydraulic analysis would need to be conducted to verify the validity of the proposed alignment.

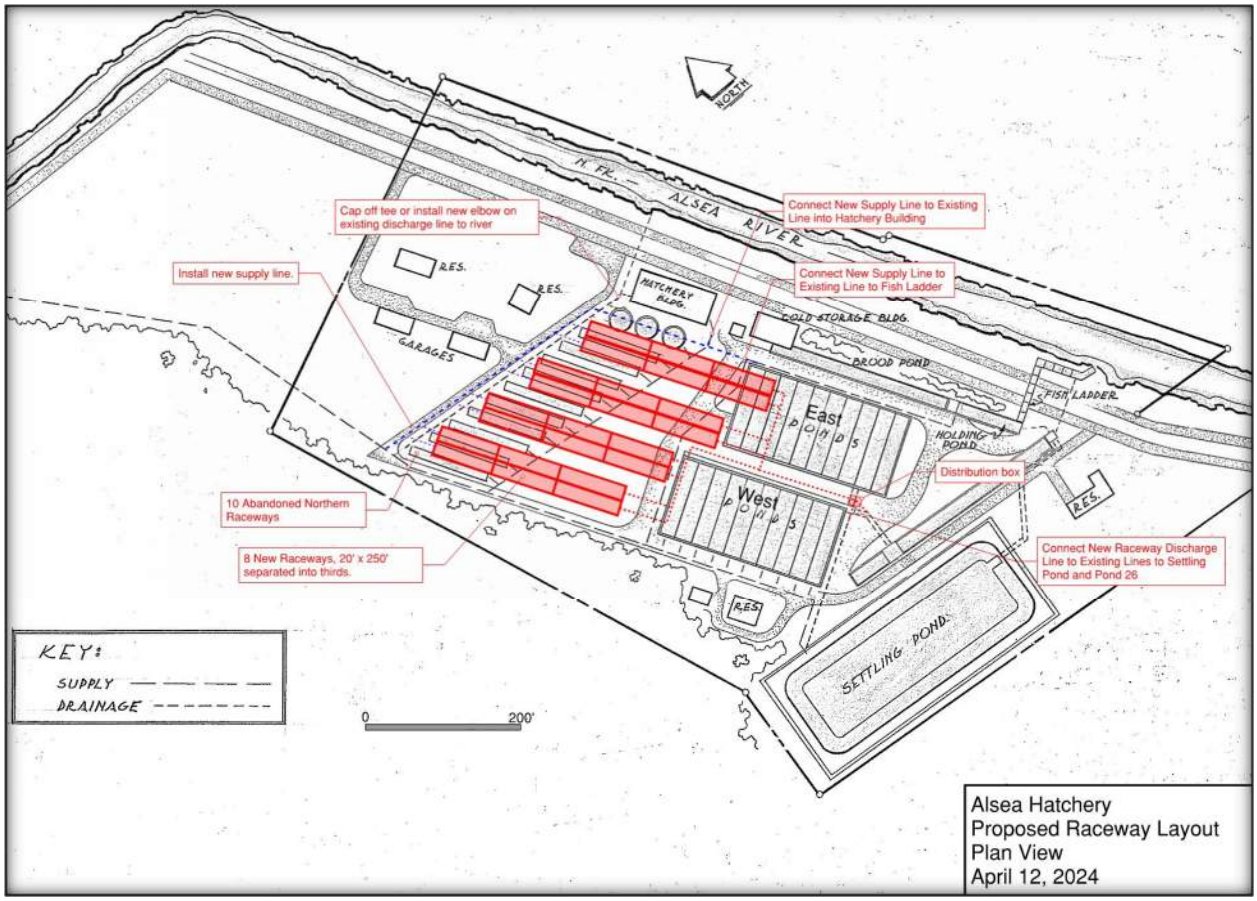

Figure 2.1 – Alsea – Proposed Raceway Layout

Table 2.2 Construction Cost Estimate-Rearing Pond Alignment

Low Range	Estimate	High Range
$5.0M	$10.1M	$15.1M

2.3 Hatchery Building Head Evaluation

Headloss to the hatchery building was calculated using current and proposed conditions. Under current conditions total headloss from the intake to the hatchery building with a 40 cfs main supply flow and 3.8 cfs flowing into the hatchery building is estimated at 3.1 feet. Under the proposed piping plan with a 47 cfs main supply flow, the headloss would increase to 4.4 feet. Comparing both current and proposed conditions with a main supply flow of 47 cfs, the proposed plan would increase the total head loss by 0.3 feet. Since the intake will need to be replaced to meet velocity criterion and the 42" main supply line is over 50 years old, it is suggested that the main supply line be replaced with 48" HDPE pipe with an alignment as shown in Figure 1. This would change the total headloss at the hatchery building to approximately 2.1 feet.

3.0 Bandon Hatchery

Items under consideration at the Bandon Fish Hatchery include removing and relocating the Geiger Creek dam and the Ferry Creek dam.

3.1 Geiger Creek Dam

Geiger Creek dam is a relatively small earth dam with a concrete overflow spillway located on Geiger Creek approximately 300 feet from the Bandon Fish Hatchery. Water from the dam flows into an intake structure and pipe the feeds water to Bandon Hatchery. Excess stream inflow discharges down a concrete overflow spillway and through a 48" diameter culvert. It has been proposed to remove the dam and construct a new diversion structure upstream.

The proposed location of the new diversion structure is approximately 350 feet upstream of the existing dam (see Figure 1). This location is at the approximate upstream end of the existing impoundment and is just downstream of a natural stream bend to the right (north). The diversion would be constructed of steel sheet pile. A geotechnical investigation would need to be conducted to verify soil type similar to the investigation completed for Ferry Dam. There would be an overflow section on the left side of the diversion to take advantage of the natural flow path to the left bank. The pipe entrance would be on the right side for easy personnel access. Lower-level sluice gates and a tilting weir gate in the center of the diversion would provide additional spill capacity during spring runoff as well as a means to flush sediment during runoff and clear floating debris during low flow periods. The diversion would only need to be around 6 feet tall to insure hydraulic entrance losses to the supply pipe are met at the maximum design flow. Final height would be determined, in part, by hydrology of the basin, site geology and spillway capacity.

The existing dam, culvert pipe, and concrete spillway would be removed. The access road to the new diversion would parallel the east bank. A section of stream channel would be constructed from the new diversion along the west side and connect to the stream channel downstream of the existing dam. The new supply pipe would parallel the access road and connect to the existing 14" supply line near Pond 1.

Construction is estimated to last 8 months but is highly dependent on the condition of the excavated material and scheduling constraints.

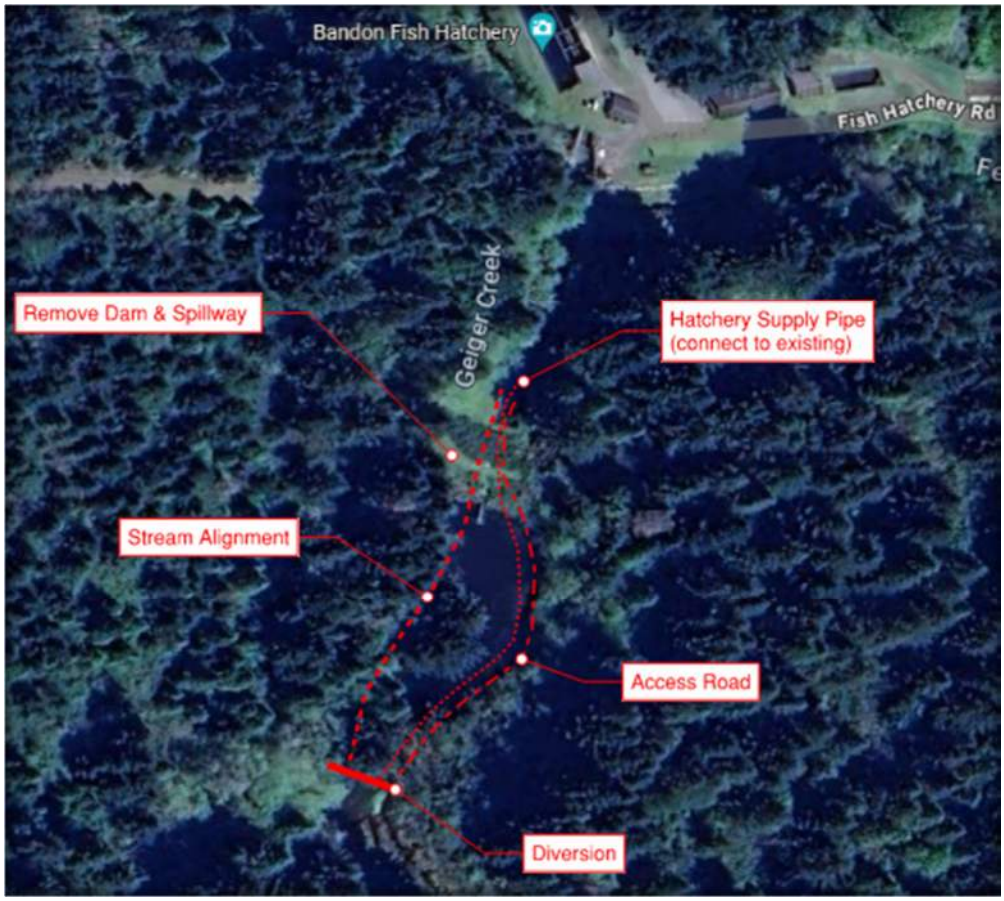

Figure 3.1 – Bandon – Proposed Geiger Creek Dam Relocation

Table 3.1 Construction Cost Estimate – Geiger Creek Dam Relocation

Low Range	Estimate	High Range
$2.2M	$4.4M	$6.6M

3.2 Ferry Creek Dam

Ferry Creek dam is a relatively small earth dam with a concrete overflow spillway located on Ferry Creek approximately 900 feet from the Bandon Fish Hatchery. Water from the dam flows into an intake structure and pipe that feeds water to Bandon Hatchery and the City of Bandon. Excess stream inflow discharges down a concrete overflow spillway and into Ferry Creek. Due to stability concerns arising out of a 2014 Geotechnical Investigation, it has been proposed to remove the dam and construct a new diversion structure upstream.

The proposed location of the new diversion structure is approximately 470 feet upstream of the existing dam and very near the end of the planned dredge work and temporary sandbag diversion noted on sheet R4 of the 1998 City of Bandon Water System Improvements (see Figure 2). This location is narrow and just downstream of a natural stream bend to the right (north). The diversion would be constructed of steel sheet pile which would take advantage of the dense sand layer noted in the geotechnical report. There would be an overflow section on the left side of the diversion to take advantage of the natural flow path to the left

bank. The pipe entrance would be on the right side for easy personnel access. Lower-level sluice gates and a tilting weir gate in the center of the diversion would provide additional spill capacity during spring runoff as well as a means to flush sediment during runoff and clear floating debris during low flow periods. The diversion would only need to be around 6 feet tall to insure hydraulic entrance losses to the supply pipe are met at the maximum design flow. Final height would be determined, in part, by hydrology of the basin, site geology and spillway capacity.

The south side of the existing dam and concrete spillway would be removed entirely to accommodate excess flow down Ferry Creek. The north side of the dam would be excavated as needed to provide a smooth vertical transition from its current approach to the new access road. The access road to the new diversion would parallel the north bank. A culvert would need to be installed at the small gulley from the north with outflow directed to Ferry Creek. A section of stream channel would be constructed from the new diversion along the south side to where the concrete spillway ends. The new supply pipe would parallel the access road and connect to the existing 14" supply line on the downstream side of the existing dam.

Construction is estimated to last 8 months but is highly dependent on the condition of the excavated material and scheduling constraints.

One item to note is flow from the small basin approximately 150 feet upstream of the dam and on the north side will not be captured but will flow directly into Ferry Creek. This basin is very small compared to the remainder of the basin feeding Ferry Creek.

Figure 3.2 – Bandon – Proposed Ferry Creek Dam Relocation

Table 3.2 Construction Cost Estimate – Ferry Creek Dam Replacement

Low Range	Estimate	High Range
$2.1M	$4.3M	$6.4M

4.0 Elk River Hatchery

Items under consideration at the Elk River Fish Hatchery include replacement of the hatchery's main water delivery system and installation of a new intake screen that meets current criteria.

4.1 Main Water Delivery System Pipeline Replacement

The existing delivery system includes three pumps located at the intake structure with 12" discharge lines that feed into a 36" main line. The main line is approximately 710' long and feeds a looped series of 16" pipes into twenty-four rearing ponds. The bulk of the discharge flow from the rearing ponds flows into a 30" drain line. At the intake structure, there is a provision for a fourth pump.

Current flow from the three pumps totals 20 cfs. This equates to 6.7 cfs per pump and a discharge velocity of 8.5 ft/sec. The proposed flow is 40 cfs. Assuming the pumps are running near their best efficiency point, it is highly likely that they need to be replaced to accommodate the new flow. Suggested is installing four pumps with 16" discharge lines for a velocity of 7.2 ft/sec. The current 36" diameter main line should be sufficient for the new flowrate solely based on the velocity of 5.7 ft/sec. However, headloss in the main line will increase from 0.9 feet to 3.3 feet. A thorough hydraulic analysis, including hydraulic and energy grade lines, from the intake to the rearing ponds should be completed. Replacing the 36" main line with a 48" line would nearly match the current headloss. The 30" drain line from the raceways may also need to be upsized to accommodate the new flow of 40 cfs. A hydraulic analysis of this line should be completed to verify sizing.

The following cost estimate is based on replacing the existing piping from the pump discharge to the raceways, the 16" raceway piping and the 30" discharge piping all in-kind.

Table 4.1 Construction Cost Estimate – Pipeline Replacement

Low Range	Estimate	High Range
$1.3M	$2.6M	$3.9M

4.2 Intake Screen

The current intake includes a fixed coarse trash rack with bars spaced at 4" on center. The overall width of the rack is approximately 29'-4". Water levels from the base of the rack range from 2' to 12'-6". If the fixed trash rack was replaced with a wedge wire screen and wiper, it is possible to meet the 0.4 ft/sec criterion for a flow of 23 cfs at a depth of 2' and 40 cfs for depths above 3.5'. Without a coarse trash rack there is a risk of damage to the screen and wiper. To accommodate a new coarse trash rack, the intake concrete would need to be extended around 7 to 8'. A new rack and personnel walkway would be added. This would require a cofferdam and water management. Cofferdam type and cost would be significantly

impacted by river flow height, which can vary 12'. An alternative solution could be a natural deflector that could be installed during low river flow. The following cost estimate includes extending the intake, a new coarse trash rack, and a screen and wiper.

Table 4.2 Construction Cost Estimate – Intake Replacement

Low Range	Estimate	High Range
$2.6M	$5.1M	$7.7M

5.0 Salmon River Hatchery

Items under consideration at the Salmon River Fish Hatchery include installation of an Obermeyer weir, new fishway with trap, intake screens; perimeter fencing for the rearing and asphalt ponds; and replacement of the pipeline and header valves.

5.1 Intake Area Improvements

The proposed intake area improvements outlined in the drawing set (provided by ODFW), Salmon River Fish Hatchery Intake Redesign, dated in year 2020 include replacing the diversion structure with two separate Obermeyer style weirs, constructing a new hatchery intake further into the river to minimize deposition and a new fishway. The existing pump station will remain intact.

The proposed intake design has a new diversion at a slight acute angle with the intake trash rack with a long and short section of Obermeyer style weirs at two heights. This design would provide operational flexibility for varying river flows. The deeper and shorter weir section next to the intake should allow for flushing sediment and floating debris that collects near the intake while the longer and shallower weir could provide spill capacity at higher river flows. Obermeyer mentioned there may be extra tooling costs for the 14' tall section. ODFW may want to discuss sizing options with Obermeyer prior to finalizing the design. The intake to the hatchery includes two basins, one for the coarse trash rack and another for the fine screens, wipers and pumps with a siphon feed between the two. The concern with this layout is the possibility of fines settling in the first basin. ODFW may want to consider moving the pump station where the siphon is located to minimize the "dead space" between the trash rack and pump inlets. Pump outlet pipes could be routed over the top of the new fishway and into the main header. The fine screens are located adjacent to the pump motors with minimal distance. This would impede work on the pumps and allow trash to fall on or near the pump motors. This distance should be increased. The work plan presented in the drawing set has merit. However, using bulk bags over a gravel bed may require large sump pumps thereby increasing water management costs. The plan also includes fill material downstream at the temporary culverts. This fill will most likely be required by the permitting agencies to be removed completely. Once again increasing construction costs. ODFW may want to consider using a sheet pile cofferdam and resequencing the work such that the short weir section and intake area are completed first. The second stage would only include the long section of weir, but at that time the flow could be directed to the deeper and shorter weir section. Although a sheet pile cofferdam may be more expensive upfront, water management costs, contractor's risk associated with flow variations, and scheduling flexibility may offset this cost. The sheet pile cofferdam may also be easier to permit. Effective cofferdam work is highly dependent on seasonal river flows, site geology, hatchery schedule and construction timing, none of which were included in this scope of work.

ODFW may want to consider as part of the project a value engineering clause for the cofferdam work where the successful bidder is required to work with ODFW on minimizing cost and schedule prior to work commencing.

Table 5.1 Construction Cost Estimate – Intake Area Improvements

Low Range	Estimate	High Range
$5.5M	$11.0M	$16.5M

5.2 Rearing and Asphalt Pond Flood Enclosures

The intent for the enclosures is to keep fish from escaping the ponds during a flood event. The cost below reflects a 4' high perimeter fence around each of the two large ponds and a single perimeter fence around the seven shorter ponds to the east. The fence would include a concrete footing and stem wall with 1.5" schedule 40 upright posts at 8' centers; top, mid-span and bottom rails; ¾" maximum fence fabric; and a total of eight 4' wide gates. Post connections included in the cost are bolted and flush mount so sections can be removed. Details would need to be worked out in the design.

Table 5.2 Construction Cost Estimate – Pond Flood Enclosures

Low Range	Estimate	High Range
$0.9M	$1.8M	$2.7M

5.3 Pipeline and Valve Replacement

The proposed pipeline and valve replacement work includes replacing approximately 115' of 30" pipe, approximately 500' of 16" pipe and the pump header and valves. It is assumed engineered shoring will be needed to a maximum depth of 12' and there is asphalt to be removed and replaced. Construction will be fairly slow due to shoring and replacing the 30" pipe under existing and protected infrastructure. It may be possible to reduce shoring cost by providing sheet pile shoring only along the length of and against the holding ponds and sloping the opposite (south) side of the trench back to meet OSHA requirements. This may impede access to the two buildings in the vicinity. The cost of this work is expected to be less if combined with the intake and diversion replacement.

Table 5.3 Construction Cost Estimate – Pipeline and Valve Replacement

Low Range	Estimate	High Range
$1.0M	$1.9M	$2.9M

6.0 Cedar Creek Hatchery

Items under consideration at the Cedar Creek Fish Hatchery include a drum filter cover, steelhead raceway replacement, and adding four raceways to the asphalt pond.

6.1 Drum Filter Cover

The drum filter cover would be approximately 24’ by 25’ with open steel frame, wood trusses and metal roofing. The foundation would be concrete cylinders placed outside of the existing thickened slab of the existing structure. A potential option would be to attach the cover to the existing structure. This option would require a structural analysis.

Table 6.1 Construction Cost Estimate – Drum Filter Cover

Low Range	Estimate	High Range
$125k	$250k	$375k

6.2 Steelhead Raceway Replacement

The scope of work would include demolishing the existing steelhead raceway ponds 8 through 11 and constructing a set of new raceways. The existing raceways have a footprint of approximately 47’ by 213’. The new raceways would be a set of four, each matching the size of existing raceways 4A and 4B. New ponds 9A/9B would be in series with 8A/8B and ponds 10A/10B would be in series with 11A/11B (see Figure 6.1). The overall footprint would change to approximately 42’ by 240’. Flow availability, pipe sizing and hydraulics would need to be verified.

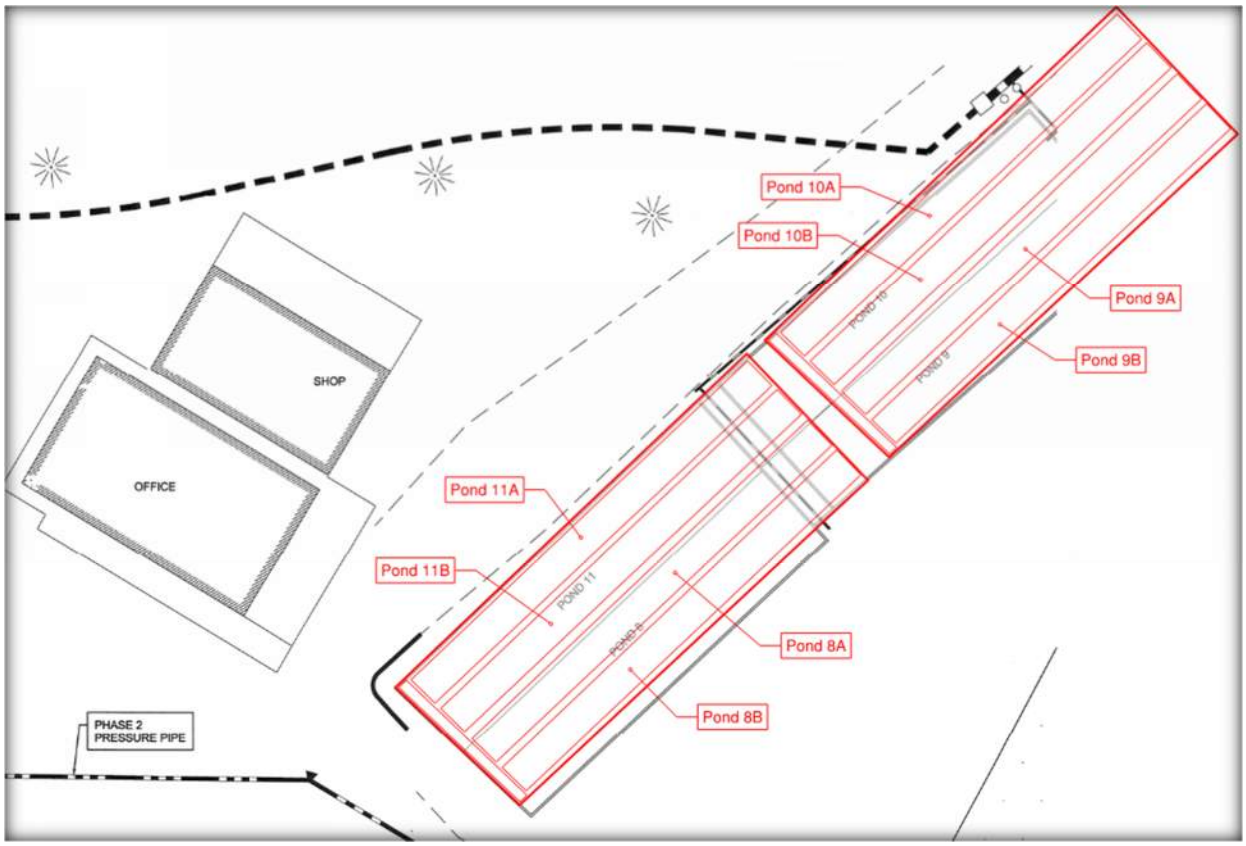

Figure 6.2 – Cedar Creek – Proposed Raceway Layout (Ponds 8-11)

Table 6.2 Construction Cost Estimate – Steelhead Raceway Replacement

Low Range	Estimate	High Range
$2.2M	$4.5M	$6.7M

6.3 Asphalt Pond Expansion

The scope of work includes demolishing the asphalt pond and constructing a set of new raceways. The existing pond has a slightly irregular footprint of approximately 100' by 270'. The new raceways for this location would be a set of four, each matching the size of raceways 4A and 4B. There would be four new ponds arranged like those proposed in Section 6.2 (see Figure 6.2). The overall footprint would change to approximately 42' by 240'. Flow availability, vertical placement, pipe sizing and hydraulics would need to be verified.

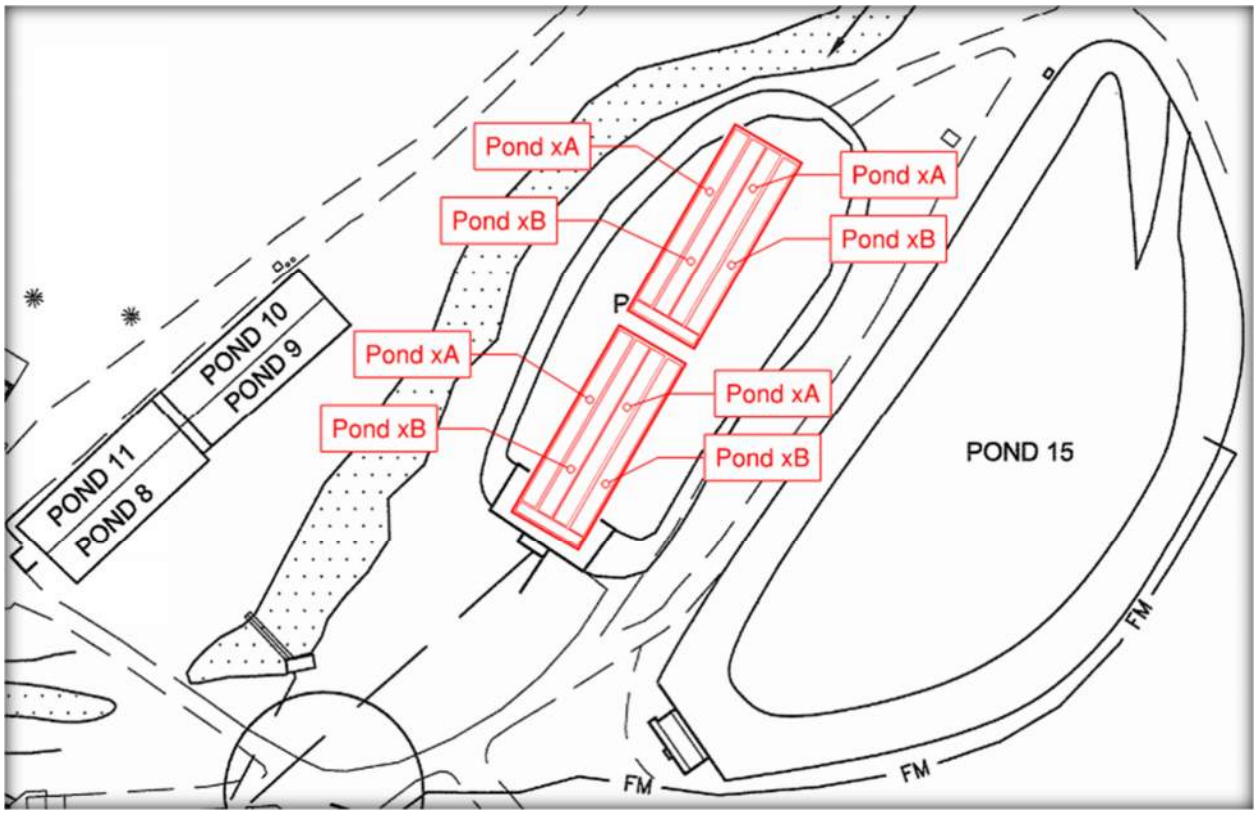

Figure 6.2 – Cedar Creek – Proposed Raceway Layout (Pond 14)

Table 6.3 Construction Cost Estimate – Asphalt Pond Expansion

Low Range	Estimate	High Range
$2.3M	$4.5M	$6.8M

7.0 Trask Hatchery

Items under consideration at the Trask Fish Hatchery include replacing the shop, replacing the abatement pond, installing a new intake structure on Gold Creek, replacing the upper adult holding pond, and expanding the lower adult holding pond.

7.1 Shop Building Replacement

The scope of the work would include demo of the abandoned hatchery building measuring 36’ by 60’ and the attached 23’ by 33’ garage and constructing a new shop building for general hatchery and vehicle maintenance. The new shop size suggested is 24’ wide by 32’ deep with a 10’ wide garage door. This size will accommodate an F350 crew cab long box at 22’ overall length and work benches along the walls. An overhead crane is not included.

Table 7.1 Construction Cost Estimate – Shop Building

Low Range	Estimate	High Range
$350k	$700k	$1.0M

7.2 Abatement Pond Replacement

The existing irregular-shaped abatement pond is roughly 35’ by 50’ with a detention volume of approximately 4500 cubic feet. Detention time, based on an inflow of 1 cfs, is approximately 75 minutes. ODFW has suggested the pond be four times this size. The proposed concrete settling pond, see Figure 7.1, has an overall footprint of 55’ by 90’ and a detention volume of approximately 18,500 cubic feet (4.1 times larger). Incoming water would enter through diffusers to direct the water downward. Water would exit through a launder at the opposite end. The floor near the launder would be sloped to allow equipment into the pond to remove waste material during shutdowns. This design would require a discharge permit into the Trask River.

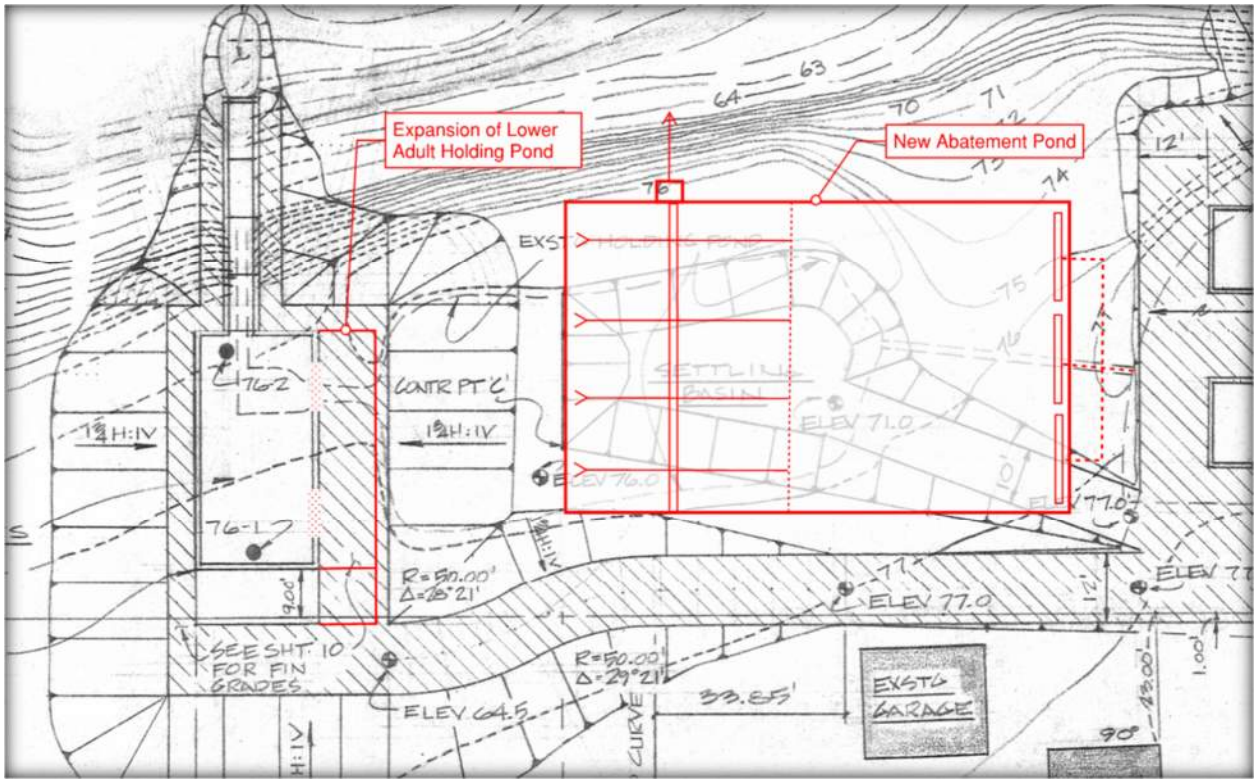

Figure 7.3 – Trask – Proposed Layout -Abatement Pond and Lower Adult Holding Pond

Table 7.2 Construction Cost Estimate – Abatement Pond

Low Range	Estimate	High Range
$0.8M	$1.6M	$2.4M

7.3 Gold Creek Intake

The project includes demolishing the existing Gold Creek canal intake, constructing a new intake on Gold Creek and piping water to the nearby pond. The design flow is 9 cfs. The new intake would have an overall footprint of 10’ by 15’ and equipped with a coarse trash rack, self-cleaning screens and isolating slide gate.

Table 7.3 Construction Cost Estimate – Gold Creek Intake

Low Range	Estimate	High Range
$1.2M	$2.5M	$3.7M

7.4 Upper Adult Holding Pond Replacement

The project includes demolishing the existing 3’4” deep adult holding pond at the upper fish trap and constructing an 8’ deep pond with the same overall footprint of 31’4” by 51’4” in the same location. Given the new pond will be deeper than the fish ladder exit, there will need to be consideration given on how to drain the new pond. This could be pumping using temporary pumps or a drain to the fish ladder or Gold Creek.

Table 7.4 Construction Cost Estimate – Upper Adult Holding Pond Replacement

Low Range	Estimate	High Range
$0.5M	$1.0M	$1.5M

7.5 Lower Adult Holding Pond Expansion

The project includes expanding the existing 21'4" by 41'4" adult holding pond at the lower fish trap. The pond is bounded on the north by the Trask River and bounded on the east, south and west by embankments. It appears from images on Google Earth that the area for expansion on the west side is too small. Expansion to the south is limited to about 20' and using all 20' would remove the spawning slab and vehicular access unless a retaining wall was constructed to hold the road embankment. Expanding the pond to the east seems the most reasonable. The area to the east allows for a 10' expansion without encroaching on the embankment. It appears the embankment starts approximately 12' from the pond's east wall. This embankment forms one side of the abatement pond. If expansion of the holding pond occurs in conjunction with construction of the new abatement pond, it may be possible to expand the holding pond 20' to the east, thereby doubling its size. The cost estimate below reflects a 10' expansion to the east including a spawning slab and removal of two sections of the existing east wall to allow fish into the new holding area, see Figure 7.1.

Table 7.5 Construction Cost Estimate – Lower Adult Holding Pond Expansion

Low Range	Estimate	High Range
$280k	$560k	$830k

8.0 Nehalem Hatchery

Under consideration at the Nehalem Fish Hatchery is the installation of a new intake screen.

8.1 Intake Screen

The intake consists of a 39'6" long screen with 1-3/16" clear spacing and four pumps located in the downstream 15'6" of the screen. Each pump is within its own bay with a width of 3'3". The total flow is 24 cfs. Normal water depth within the intake is 3'3". Locating individual screens at each pump bay would not meet the 0.4 ft/sec maximum approach velocity criterion if each pump had a flowrate of 6 cfs. Locating screens in front of each pair of pumps would also fail this criterion. Replacing the 39'6" screen would meet the approach criterion but would probably fail a hydraulic analysis to show an even velocity distribution across the screen since the pumps are located in the downstream 40% of the screen length. The minimum length of screen to meet approach velocity criterion for a water depth of 3'3" is 18'9". It may be possible to modify the intake in front of the pumps to meet both approach velocity and velocity distribution criteria, but the solution would need to be verified with hydraulic modeling. Another possible solution would be to raise the water level so the approach velocity in each pump bay is below 0.4 ft/sec. The cost estimate below is for modifying the intake area in front of the pumps, see Figure 8.1. The estimate assumes an intake screen length of 20', screen wipers, and allowances for demo, concrete and screen supports.

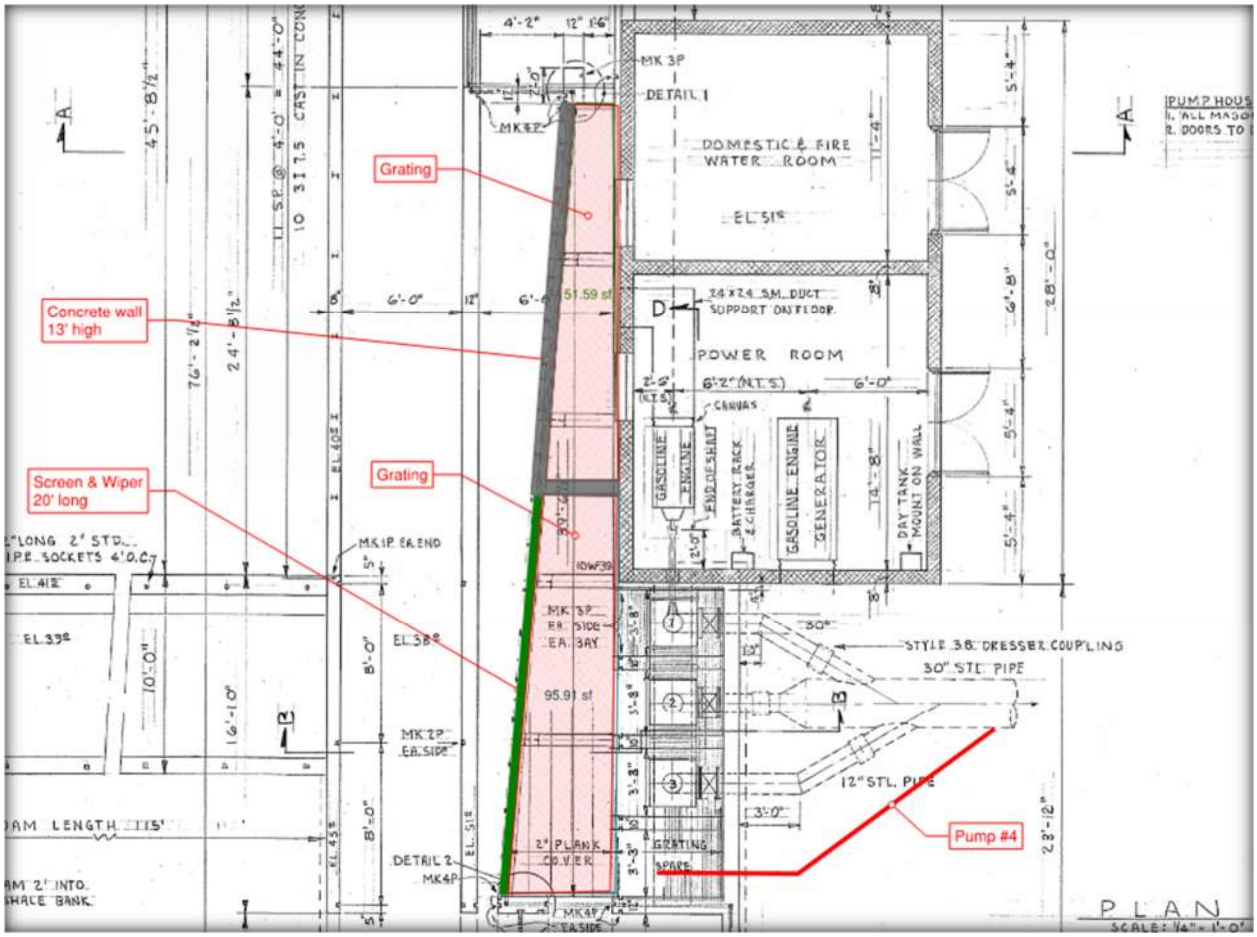

Figure 8.4 – Nehalem – Proposed Intake Layout

Table 8.1 Construction Cost Estimate – Intake Screen

Low Range	Estimate	High Range
$1.5M	$3.1M	$4.6M

9.0 Roaring River Hatchery

Under consideration at the Roaring River Fish Hatchery is a new intake, fish ladder and recirculation system. Intake flow is 33.5 cfs.

9.1 Intake, Fish Ladder and Recirculation System

QRS reviewed the Roaring River Hatchery Intake & Pipeline Modifications drawing set and associated cost estimate provided by ODFW. The project is delineated into three work areas. Work area 1 includes a new intake with a Farmers screen, a fish ladder and a recirculation water diffuser. Work Area 2 includes the recirculation pump house and collection basin. Work Area 3 outlines details of the main pipe connections. The modifications in Work Area 1 appear to be laid out well other than the close proximity to the property line. If this layout is finalized, there will no longer be vehicular access to the new water diffuser building.

This may or may not be an issue for the ODFW. If this layout is constructed, it is suggested that the water diffuser be constructed prior to the new intake screens to allow for construction vehicles which will lower construction costs. Also suggested is adding vehicle access to the diffuser as part of the design to aid in operation and maintenance. The following cost estimate updates and expands upon the estimate provided by ODFW.

Table 9.1 Construction Cost Estimate – Intake, Fish Ladder, Recirculation System

Low Range	Estimate	High Range
$2.3M	$4.5M	$6.8M