Annex I

Lyons Ferry Hatchery Modification Plan

Annex I: Lyons Ferry Hatchery Modification Plan

I.1 General

The purpose of this annex is to discuss the modifications required for the Lyons Ferry Hatchery as a result of drawdown of the four lower Snake River dams. It is assumed that funding would be appropriated to modify Lyons Ferry Hatchery and water supply for operation during and after drawdown. All functions of the hatchery that would be affected by the drawdown were reviewed. The affected hatchery features include the water supply, collection of fish for spawning, return of selected fish to the river during the sorting process, release of smolts to the river at completion of rearing, and draining of hatchery process water into the Snake River.

In preparing this report, the study team reviewed original hatchery contract drawings to determine features likely to be affected by drawdown, consulted various designers knowledgeable about the Lyons Ferry Hatchery, and visited the site to discuss issues with the Hatchery Manager and gain a better understanding of hatchery operations. After reviewing the information, the team considered various options for each item that would be affected by the drawdown and selected a recommended approach for each item. The recommended approaches are conceptual plans intended to provide sufficient detail for a cost estimate.

I.2 Overview of Lyons Ferry Hatchery

The Lyons Ferry Hatchery was constructed as a part of the *Lower Snake River Fish and Wildlife Compensation Plan*. This plan consisted of construction of numerous fish facilities and development of habitat lands that were to serve as mitigation for fish and wildlife habitat lost or altered by construction of the four lower Snake River dams. Fish raised at Lyons Ferry Hatchery include steelhead, chinook salmon, and trout for release into the Snake River and its tributaries. Fish are also raised for research performed by the National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (USFWS), and the Nez Perce Tribe.

I.3 Hatchery Features Requiring Modifications

The hatchery features that will require modifications due to drawdown are shown in Figures I1 and I2 and include the following:

1. Water wells No. 1 and 3 through 9 at Marmes, which provide all hatchery process water
2. Water well No. 2, which provides water for domestic and fire water
3. A 1,524-millimeter (60-inch) concrete cylinder pipe (CCP) for water supply from sta 9+88 to sta 72+51
4. Fish ladder and 1,372-millimeter (54-inch) main hatchery drain pipe
5. Steelhead exit channel
6. Two 305-millimeter (12-inch) fish return pipes from the steelhead spawning facility
7. A 610-millimeter (24-inch) corrugated metal pipe (CMP) drain from the pollution abatement pond.

For this feasibility study, the study team assumed that each of these facilities would need to remain operational during and following drawdown, or a substitute function would need to be provided. Minor outages of a day or two in the water supplies would be acceptable, if required, to tie new facilities into the existing ones.

Options for maintaining the function of each feature during and after drawdown were considered by the study team on the basis of the option's functional effectiveness, construction details, logistics, and schedule requirements. The options were based on the assumption that drawdown would begin on the first of August and would take approximately 80 days to complete. Variations to some alternatives could be considered if drawdown were to occur during a different time of the year. For each feature modification, the study team examined the option of doing nothing, but concluded that in no instance would the "do nothing" option assure continuous hatchery operation, so this option was discarded.

I.3.1 Water Wells at Marmes

Description

A total of eight wells located at the Marmes site supply all process water for hatchery operations. All eight wells are located within a range of 37 meters to 82 meters (120 feet to 270 feet) from the edge of the reservoir and are drilled through Spokane flood sands and gravels. Water is pumped by vertical turbine pumps to a surge tank that provides head for gravity flow of the water to the hatchery. Salient characteristics of the wells are shown in Table I1.

Table I1. Well Characteristics

Well Number	Depth Below Existing Grade (feet)	Depth Below Reservoir Elevation, 540 feet	Flow (gallons per minute @ total dynamic head)	Pump HP	Column Connection Diameter (inches)
1	312	242	2,600@75	75	12
3	343.5	276	6,500@75	200	16
4	322.7	245	6,500@75	200	20
5	350.7	303	6,500@75	200	20
6	349.6	300.2	6,500@75	200	20
7	311.1	260	920@75	300	20
8	311.4	260	920@75	300	20
9	309.3	260	920@75	300	20

When the reservoir is drawn down, the drop in water surface will affect the wells at the Marmes site. The exact nature and extent of the effect cannot be determined until drawdown has occurred and the water table around the wells stabilizes. The best case would be that the existing wells would still function, but at reduced capacity. The worst case would be that the water table would be drawn down below the water producing strata that would render the wells nonfunctional.

Options Considered

Option 1 - Drill New Wells to Replace/Supplement the Existing Wells Prior to Drawdown
Under this option, the existing wells would remain a part of the system and continue to be used as long as they functioned properly. A new set of wells of similar design and capacity, except drilled approximately 100 feet deeper, would be added in the immediate vicinity of the existing wells. The new wells would be tied into the existing water supply pipeline for delivery to the hatchery. The new wells would be designed and constructed prior to drawdown in an attempt to maintain sufficient water supply to the hatchery during and after the drawdown.

Option 2 - Drill New Wells to Replace/Supplement the Existing Wells After Drawdown
Under this option, the existing wells would remain a part of the system and continue to be used as long as they functioned properly. Following drawdown, a new set of wells of similar design with capacity determined by need would be constructed after the water table had time to stabilize. (The study team assumed 1-year delay for water table stabilization.) The new wells would be tied into the existing water supply pipeline for delivery to the hatchery. The hatchery would operate on water from the existing wells during and after drawdown until the new wells were constructed. Hatchery operations would have to be modified, or completely terminated, depending upon the quantity of water produced by the existing wells. Until the new wells were installed, the hatchery would not have a definite, dependable amount of water for rearing fish.

Option 3 - Construct a River Intake with Pumping and Water Treatment Facilities
Under this option, a new river intake would be designed and built to provide the hatchery's water supply. The intake would be located on the Snake River upstream of all the hatchery drains and outfalls, a distance of approximately 150 meters (500 feet) from the hatchery site. The intake would be a cast-in-place, reinforced concrete structure with a screened intake to provide up to 3.4 m^3/s (120 cfs) of river water to the hatchery. Water would be pumped to the hatchery, where it would be treated for temperature, dissolved gasses, turbidity, suspended solids, and pH. Construction of the river intake, pumping plant, and supply piping would not be practical prior to drawdown. A temporary means of water supply for the hatchery, considering the quality and quantity required, is not considered practical.

Comparison of Options and Recommendation

None of the previous options would provide a guaranteed supply of water of adequate quality and quantity to maintain continuous operation of Lyons Ferry Hatchery. Option 1 would attempt to provide a continuous water supply, but there is no assurance that the new system of wells would function properly after drawdown since their design would be based on, at best, predictions concerning the water table level after drawdown, which may, or may not, in fact be true once the water table re-stabilizes. Options 2 and 3 would provide greater assurance of a dependable water supply, but neither would be available until after the drawdown and construction of new facilities. Option 2 also would require time for the water table in the vicinity of the wells to adjust, so the new wells could be properly designed. Option 3 would be the surest source of water but not without problems. The facilities required to treat the river water would be expensive to design, construct, operate, and maintain. The intake and pumping facilities also would have the added risk of having to survive flood flows on the Snake River.

Future design activities could include a groundwater investigation with numerical modeling to provide a better estimate of the extent of additional wells that may be required. The need for such detailed analyses will depend on the operational options that are available to the hatchery for the time period where a reduced supply of water may result from reservoir drawdown. Those options may include the use of satellite capture facilities for the interim time period or as a long-term operation change.

Under the current operating plan, the water supply is fundamental to hatchery operation and cannot be shut down for extended periods during fish rearing. None of the options discussed above can guarantee a definite, dependable, good quality water supply both during and after reservoir drawdown. For the purposes of this feasibility study, Option 2 is recommended because it is the only option that provides a reliable source of water. The continuous operation of the hatchery during drawdown will not be possible. The extent of operation impairment cannot be predicted since it depends on the effect of reservoir surface elevation on the groundwater.

I.3.2 Water Well No. 2

Description

Water well No. 2 provides domestic and fire water for the hatchery. It is located approximately 200 meters (656 feet) to the east of the hatchery near the Joso bridge. The well is drilled through Spokane flood sands and gravels and is 62 meters (205 feet) deep. Water is pumped by submersible turbine pump to the hatchery site. A total of four pumps are in the well. The primary pump is a submersible turbine pump with a capacity of 2.5 cubic meters per minute (m^3/m) (650 gallons per minute [gpm]) at 23 meters (75 feet) of total dynamic head (TDH) and a 127-millimeter (5-inch) diameter discharge. An identical backup pump is located in the well. Another submersible turbine pump has a capacity of 0.3 m^3/m (80 gpm) at 53 meters (175 feet) TDH and a 51-millimeter (2-inch) discharge. This pump also has an identical backup pump in the well.

When the reservoir is drawn down, the drop in water surface will affect well No. 2. The exact nature and extent of the effect cannot be determined until after the drawdown is completed and the water table around the well stabilizes. The best case would be that the existing well would still function, but at reduced capacity. The worst case is that the well would be rendered non-functional.

Options Considered

Option 1 - Install a New Well after Drawdown
Under this option, the existing well would be used during and after drawdown. If the quantity of water from the well dropped below that required to operate the fire protection system, a temporary pumping system would be furnished which could provide fire protection until a new well could be developed. If the drawdown resulted in a reduction of well capacity below that required for domestic use, a temporary supply of potable water would be furnished to the hatchery until a new well was developed. A new well would be constructed following drawdown, after allowing a sufficient time for the water table in the well vicinity to stabilize (the study team assumed 1 year after drawdown). This option would allow the hatchery to continue to operate with only minor inconvenience and would allow a new well to be developed at the most appropriate time (when the water table is stabilized after drawdown). If the well

became non-functional, it would cause some inconvenience to the hatchery and would increase risk in the event of a fire.

Option 2 - Install a New Well Before Drawdown
Under this option, a new, deeper well would be installed in the vicinity of the existing well. The new well would be drilled 100 feet deeper in an attempt to maintain the existing well capacity following drawdown. This option would allow the hatchery to continue to operate without disruption of its domestic and fire water systems. It would, however, also run the risk that the new well would not provide adequate capacity following drawdown. The effect of the drawdown on the well cannot be accurately predicted prior to the drawdown.

Comparison of Options and Recommendation
Option 1 would likely cause some inconvenience to the hatchery during drawdown, but would allow the best well design. Option 2 would provide an adequate quantity of water for domestic and fire purposes, but only if the assumed increased well depth were adequate. Since the domestic and fire water can be provided by temporary means, and the existing well is likely to continue to operate at some capacity, Option 1 is the recommended option. It will allow the hatchery to continue operations during the drawdown and give the best long-term solution to domestic and fire water supply.

I.3.3 Water Supply Pipeline

Description

The main hatchery water supply line is a 1,524-millimeter (60-inch) diameter CCP that runs from the Marmes well site to the hatchery, a distance of approximately 2,966 meters (9730 feet) (see Figure I1). The pipe is underground from its start at station 4+20 to station 9+50.49. From station 9+88 to station 72+76, the pipe is submerged in the reservoir and is supported by 104 pipe pile bents (see Figure I3). The bents are located at 20 meters (64 feet) on center for all straight runs, with closer spacing at turning points.

The 1,524-millimeter (60-inch) CCP was designed to be supported by bents spaced at 20 meters (64 feet) on center with the pipeline submerged. If the reservoir is drawn down, the pipe and supports will no longer be submerged. Analysis of the non-submerged pipe and support bents indicates the CCP will not have adequate flexural strength to span 64 meters (64 feet) when full of water, and the pipe pile bents will not have adequate strength to resist seismic and wind loads.

Options Considered

Option 1 - Construct a New Pipeline With Adequate Structural Supports
Under this option, a complete new pipeline from station 9+88 to station 72+76 would be constructed. The pipeline would be similar to the existing one, but with an adequate support structure. A completely new pipeline would supply all hatchery water requirements plus, being new, would have the advantage of extending the design life of the system. This system could be constructed prior to drawdown by working from a floating plant, thereby maintaining hatchery function except for a short period required to tie into

the existing system. A completely new pipeline, however, would be the most costly alternative and would take the longest to construct.

Option 2 - Construct a New Underground Pipeline

Under this option, a complete new pipeline from station 9+88 to station 72+76 would be constructed. The pipe would be similar to the existing one but would be buried in the ground in a manner similar to that used for the buried portions of the existing piping, instead of being supported on pile bents. Such a new pipeline also would supply all hatchery water requirements plus, being new, would have the advantage of extending the design life of the system. Because of the basalt cliffs near the Marmes site, however, the only practical alignment for an underground pipe is along the route of the existing water supply pipe (i.e. within the limits of the reservoir). Trenching along this route for installation would require waiting until the reservoir is drawn down and the reservoir bottom dried out sufficiently for construction equipment. The hatchery would have to be shut down until the new water supply pipe could be completed.

Option 3 - Construct a New Set of Piling Bents to Support the Existing Water Supply Pipeline

Under this option, a new set of pipe pile bents would be built to adequately support the existing water supply pipe. The bents would be similar in design and construction to the existing supports (see Figure I3). A new bent would be located at the center of each 20-meter (64-foot) span between station 9+88 and station 72+76, for a total of 97 new bents. A new set of bents would make the existing pipeline structurally adequate without shutting down the water supply to the hatchery. The new bents could be installed from a floating plant prior to drawdown. This option has no apparent technical disadvantages. Although less costly than building a new water supply pipe with support structure, this would still be a relatively costly option.

Comparison of Options and Recommendation

Option 2 would not meet the requirement to maintain hatchery operation during and after the drawdown; therefore, only Options 1 and 3 can be considered further. Option 1, constructing a new pipe with adequate structural supports, would maintain hatchery operation, but would also be the most costly alternative. It would also require shutting down the water supply system to tie in the new pipe to the existing system near station 9+88 and station 72+76. Option 3, adding a new set of piling bents, would completely satisfy the requirement to maintain hatchery operation and would also be significantly less costly than Option 1. Therefore, Option 3 is the recommended option.

It should be noted, however, that the existing 1,524-millimeter (60-inch) CCP may be nearing the end of its service life when drawdown occurs. The decision to replace the pipe may be the best decision at that time. The replacement might use the existing supports along with additional supports as required, or might require a complete new set of supports.

I.3.4 Fish Ladder and Hatchery Drain

Description

The fish ladder is a cast-in-place, reinforced concrete structure located along the reservoir edge at the south end of the hatchery complex (see Figure I2). Flows of between 76 m^3/m (20,000 gpm) and 198 m^3/m (51,000 gpm) are released through a 1,372- millimeter (54-inch) drain pipe at the downstream end of the ladder to provide attraction water for upstream migrating adult salmon and steelhead. Except for minor amounts of water used for fish release, all process water from the hatchery is released through this drain. A 26-m^3/m (6,900-gpm) pump located adjacent to the ladder removes water from the drain pipe at a point approximately 30 meters (100 feet) upstream of the outlet. This water is pumped into the upper diffuser of the fish ladder to provide flows through the ladder for fish passage. The fish ladder is operated during the period of 1 July through 15 November for collection of steelhead, and between 1 September and 15 December for collection of fall chinook salmon.

The fish ladder is designed to operate at reservoir elevations in the range of approximately 164 meters to 165 meters (537 feet to 540 feet) mean sea level (msl). (Mean sea level refers to North American Vertical Datum of 1929.) If the reservoir is drawn down, the fish ladder will not function and the drain will empty onto the bank and flow overland to the river. The bank of the river will be approximately 152 meters (500 feet) horizontally from the ladder. Also, the free flowing river will range in elevation from approximately 143 meters (468 feet) msl at 280 m^3/s (10,000 cfs) to approximately 147 meters (482 feet) msl at approximately 2,266 m^3/s (80,000 cfs) during the period of time the ladder is operated each year.

Options Considered

Option 1 - Build a Ladder and Holding Pond on the River Bank with Access Road to the Hatchery

This option would include construction of a cast-in-place, reinforced concrete ladder similar to the existing ladder at the edge of the river along with a holding pond with crowder and loading arrangement. An access road would be constructed between the hatchery and the new ladder/trap. Also, a fish hauling truck to carry fish back to the hatchery facility would be required. This option would require that the 1,372-millimeter (54-inch) drain be routed to the new facility to be used for attraction water and a new pumping arrangement be designed to provide flows in the ladder. Also, the existing ladder and entrapment structure would require modification to maintain the hydraulic function, since flows from the entrapment structure pass out through the ladder. Because the new ladder and holding pond, as well as a portion of the access road, would be built in the flood way, the facilities below elevation 151 millimeters (495 feet) msl would require design features to prevent damage during flood events. Construction of the ladder extension and drain extension would not be practical until the reservoir was drawn down and the bank sufficiently dried out to allow construction activities. During drawdown and until the new facilities were complete, water from the drain would have to be routed to the river in a manner to prevent erosion of the bank and high sediment discharge into the river. An alternate source of eggs to maintain hatchery operation would be required for the fish season during the year of drawdown. Eggs would be provided from fish trapped at Ice Harbor Dam or possibly from fish trapped at satellite hatcheries, such as the Tucannon Hatchery. This is a complicated alternative with not only significant new construction required, but also modification of the hatchery's operating procedures to include collecting fish at a new location and hauling them to the hatchery for spawning.

Option 2 - Extend the Existing Fish Ladder and Drain to the River Bank

This option would involve extension of the existing ladder to the river bank along with the 1,372-millimeter (54-inch) drain. The ladder extension would be a cast-in-place, reinforced concrete structure similar to the existing ladder (see Figures I4 and I5). The drain would run parallel to the ladder extension to the river bank and its outfall would be at the downstream end of the ladder extension to provide fish attraction water. The existing 26-m^3/m (6,900-gpm) pump, which provides water to the upper diffuser, would be adequate for fish passage. The ladder extension would require an entrance configuration that would be operational for water surface elevations from 143 meters (468 feet) msl at 283 m^3/s (10,000 cfs) to 147 meters (482 feet) msl at 2,266 m^3/s (80,000 cfs). Also, since the ladder extension would be constructed into the floodway, the structure below elevation 157 meters (495 feet) msl would be designed to prevent damage during flood events. Construction of the ladder extension and drain extension would not be practical until the reservoir was drawn down and the bank sufficiently dried out to allow construction equipment to operate. During drawdown and until the new facilities were complete, water from the drain would have to be routed to the river in a manner to prevent erosion of the bank and high sediment discharge into the river. An alternate source of eggs to maintain hatchery operation would be required for the fish season during the year of drawdown. Eggs would be provided from fish trapped at Ice Harbor Dam or possibly from fish trapped at satellite hatcheries, such as the Tucannon Hatchery.

Comparison of Options and Recommendation

Neither of these options would meet the requirement to maintain the operation of the fish ladder during the year of the drawdown.

Options 1 and 2 would require an alternate source of eggs for one fish rearing season either by collecting them at Ice Harbor Dam or from satellite hatcheries, such as Tucannon Hatchery. Option 2 is simpler than Option 1 in that it only extends the existing ladder and 1,372-millimeter (54-inch) drain pipe out to the bank of the river. It does not involve changes to spawning operations, the complication of trucking fish to the existing facilities for spawning, extra handling of fish, or construction of new pumping facilities to furnish water to a new facility. Both Options 1 and 2 maintain a supply of eggs to the hatchery after drawdown and construction of new facilities are completed. Option 2 would have less effect on hatchery operations and is anticipated to be less costly. Therefore, Option 2 is the recommended option.

The new fish ladder structure for either Option 1 or 2 would need to operate over a wide range of river levels. It would be a difficult design and could be a substantial and very costly structure.

It should also be noted that the 1,372-millimeter (54-inch) drain pipe would require temporary measures for diversion and care of water during the drawdown until the new facilities were constructed for either Option 1 or Option 2. One method would be to provide a riprap blanket to protect the bank from erosion. A blanket 3 meters (10 feet) wide by 0.6 meter (2 feet) thick by 152 meters (500 feet) long should be adequate.

I.3.5 Steelhead Exit Channel

The steelhead exit channel is a cast-in-place, reinforced concrete channel that is the outlet channel from the steelhead collection structure (see Figure I2). Both steelhead and salmon, reared in the three large rearing ponds, are released through this channel into the reservoir at the end of the rearing cycle. A flow of 17 m^3/m (4,500 gpm) is released through the exit channel during the emptying of each large rearing pond. Fish and water flow from the channel outfall at invert elevation 165 meters (540.75 feet) msl.

The steelhead exit channel was designed to operate at reservoir elevations in the range of approximately 164 meters (537 feet) to 165 meters (540 feet) msl. If the reservoir is drawn down, the river will be approximately 146 meters (480 feet) horizontally from the channel outfall and the water surface will be as low as elevation 143 meters (468 feet) msl. Water from the channel would flow overland to the river, causing unacceptable erosion and turbidity in the river. Fish mortality would likely be 100 percent.

Options Considered

Option 1 - Extend the Steelhead Exit Channel with a Cast-in-Place, Reinforced Concrete Channel
Under this option, the existing channel would be extended approximately 146 meters (480 feet) to the edge of the river with a cast-in-place, reinforced concrete channel similar to the existing channel. The flow of 17 m^3/m (4,500 gpm) on a slope of 0.0158 gives a channel width of 457 millimeters (18 inch) with a normal depth of approximately 102 millimeters (4 inch) and a velocity of 6 meters (20 feet) per second. The slope should be flattened out near the river to provide an impact velocity for fish entering the river of less than 9 meters (30 feet) per second. The channel would be in the floodway below elevation 151 meters (495 feet) and would be designed for appropriate flood flows by setting the channel flush with the existing groundline and providing rock armoring or other appropriate measures where necessary. This option would not be practical to construct prior to drawdown of the reservoir and, therefore, would require an interim plan for the drawdown year to allow for the banks to dry out and for construction of the channel extension. Fish from the rearing ponds could be pumped from the steelhead collection structure with a fish pump and transported to and released in the river with fish hauling trucks. Water from the steelhead exit channel would be diverted to the 1,372-millimeters (54-inch) main facility drain.

Option 2 - Extend the Steelhead Exit Channel with a High-Density Polyethylene (HDPE) Pipe
Under this option, the existing channel would be extended approximately 146 meters (480 feet) to the edge of the river with a HDPE pipe. The flow of 17 m^3/m (4,500 gpm) on a slope of 0.0158 gives a pipe diameter of 610 millimeters (24 inch) with a normal depth of approximately 127 millimeters (5 inch) and a velocity of 6 meters (21 feet) per second. The slope should be flattened out near the river to provide an impact velocity for fish entering the river of less than 9 meters (30 feet) per second. The pipe would be buried in the ground except where it ties into the existing channel and at its outfall near elevation 143 meters (468 feet) msl. The outfall would be designed for appropriate flood flows by providing rock armoring. This option would not be practical to construct prior to drawdown of the reservoir and, therefore, would require an interim plan for the drawdown year to allow for the banks to dry out and for construction of the channel extension. Fish from the rearing ponds could be pumped from the steelhead collection structure with a fish pump and transported to and released in the river with fish hauling trucks. Water from the steelhead exit channel would be diverted to the 1,372-millimeter (54-inch) main facility drain.

Comparison of Options and Recommendation

Both Options 1 and 2 would require a one-year modification to the hatchery's operation involving use of an alternate method of moving fish from the large rearing ponds to the reservoir. Both options also would serve the hatchery's purpose. Option 1 is a more complicated type of construction than Option 2 and would likely cost significantly more. Option 1 also would be more difficult to design for flood flows than Option 2. On the basis of cost and simplicity of design, Option 2 is the recommended option.

It should also be noted that, if the assumption that hatchery operations would not be modified were relaxed, the option of abandoning the steelhead exit channel and providing fish release by pumping fish into fish hauling trucks for release into the river would be feasible.

I.3.6 Steelhead Spawning Fish Return Pipes

Description

The steelhead spawning fish return pipes are two 305-millimeter (12-inch) diameter polyvinyl chloride (PVC) pipes that are used to release fish from the steelhead spawning building. The pipes pass out the south foundation wall of the building, through the fish ladder, with the outfall for both pipes located upstream of the fish ladder entrance.

The steelhead spawning fish return pipes were designed to operate at reservoir elevations in the range of approximately 164 meters (537 feet) to 165 meters (540 feet) msl. If the reservoir is drawn down, the river will be approximately 152 meters (500 feet) horizontally from the channel outfall, and the water surface will be as low as elevation 143 meters (468 feet) msl. Water from the pipes would flow overland to the river, causing unacceptable erosion and turbidity in the river. Fish mortality would likely be 100 percent.

Options Considered - Extend the Steelhead Spawning Fish Return Pipes to the River

Only one feasible option was defined for this modification. Under this option, the fish return pipes would be extended approximately 152 meters (500 feet) to the edge of the river with a 305-millimeter (12-inch) diameter HDPE pipe. The two 305-millimeter (12-inch) PVC pipes would be merged into one 305-millimeter (12- inch) pipe that would extend to the river at elevation 143 meters (468 feet) msl. The pipe would be buried in the ground except where it ties into the existing channel and at its outfall near elevation 143 meters (468 feet) msl. The outfall would be designed for appropriate flood flows by providing rock armoring. This option would not be practical to construct prior to drawdown of the reservoir and, therefore, would require an interim plan for the drawdown year to allow for the banks to dry out and for construction of the pipe extension. Fish from the spawning building could be collected during the interim year and transported to and released in the river with fish hauling trucks.

This option would require a one-year interim plan to release fish from the steelhead spawning building. This does not satisfy the assumption that hatchery operations should not be affected, but otherwise is a relatively simple option that would maintain the function of the 305-millimeter (12-inch) PVC fish release pipes.

It should also be noted that, if the assumption that hatchery operations would not be modified were relaxed, the option of abandoning the 305-millimeter (12-inch) PVC fish release pipes and providing fish release by hauling fish to the river in trucks would be feasible.

I.3.7 Pollution Abatement Pond Drain

Description

The pollution abatement pond is an earthen pond that functions as a settling basin where water from hatchery cleaning operations is treated prior to being released into the reservoir. As designed, the clarified water flows into the reservoir from a concrete outlet structure by flowing over an overflow weir constructed of wooden stoplogs, then flowing out through a 610-millimeter (24-inch) diameter CMP that passes through the earth berm which forms the south side of the pond. Only small intermittent flows from cleaning operations are sent to the pollution abatement pond. Consequently, little, if any, water actually flows into the reservoir.

The pollution abatement pond was designed to operate at reservoir elevations in the range of approximately 164 meters (537 feet) to 165 meters (540 feet) msl. If the reservoir is drawn down, the river edge would be approximately 122 meters (400 feet) horizontally from the pollution abatement pond outfall. Water from the outfall pipe would flow overland toward the river causing unacceptable erosion and turbidity in the river.

Options Considered

Option 1 - Construct a Seepage Pit for the Pollution Abatement Pond Effluent

Under this option, a seepage pit would be constructed to allow effluent from the pollution abatement pond to seep into the soils adjacent to the hatchery facility. The pit would be located approximately 15 meters (50 feet) to the south of the existing pond outfall. The seepage pit would be a 6-meter (20-foot) diameter by 4.5-meter (15-foot) deep circular pit with walls constructed of concrete circular type cesspool blocks or other approved materials. The pit would be covered with an arched, reinforced concrete lid with manhole cover. Coarse gravel 305-millimeters (1-foot) thick would be placed in the bottom of the pit. Backfill around the outside of the walls would consist of a 610-millimeter (2-foot) thick zone of 457 millimeters to 610 millimeters (1-1/2 to 2 inch) clean crushed stone. The existing 610-millimeter (24-inch) diameter CMP would be extended 15 meters (50 feet) and would terminate in the seepage pit. This option would not be practical to construct prior to drawdown of the reservoir and, therefore, would require an interim plan for the drawdown year to allow for the banks to dry out and for construction of the seepage pit. For approximately 6 months following drawdown, the hatchery would pump effluent from the outfall structure to the 1,372-millimeter (54-inch) main facility drain during cleaning operations.

Option 2 - Extend the Pollution Abatement Pond Effluent Pipe to the River

Under this option, the existing 610-millimeters (24-inch) diameter CMP outlet would be transitioned down to a 305-millimeter (12-inch) diameter CMP that would be routed directly to the river. The pipe extension would be approximately 122 meters (400 feet) long. A 305-millimeters (12-inch) CMP extending 122 meters (400 feet) from elevation 166 meters (545 feet) msl to 143 meters (470 feet) msl could pass 0.3 m^3/s (9.1 cfs) flowing half full, which would be more than adequate. This option would not be practical to construct prior to drawdown of the reservoir and, therefore, would require an interim plan for the drawdown year to allow for the banks to dry out and for construction of the CMP extension. The outfall would be designed for appropriate flood flows by providing rock armoring. For approximately six months following drawdown, the hatchery would pump effluent from the outfall structure to the 1,372-millimeter (54-inch) main facility drain during cleaning operations.

Comparison of Options and Recommendation

Both Options 1 and 2 would satisfy the requirement to maintain the function of the pollution abatement pond outlet. Option 1 is more complicated and would require further analysis to verify that it is adequately sized. Option 2 is simpler construction than Option 1, would easily satisfy all flow requirements that might be expected from the pollution abatement pond, and is likely to be the least costly option. Therefore, Option 2 is the recommended option.

I.4 Conclusions and Recommendations

Drawdown would significantly affect hatchery operation. The hatchery depends on large quantities of ground water from wells drilled in alluvial sand and gravel. The existing wells may not provide the required volume of water. However, it is expected that there would be enough water for the hatchery to operate at a reduced rate until ground water availability can be evaluated after drawdown. If the hatchery is to operated without interruption, additional pipe bents must be constructed to support the water supply pipe before drawdown occurs. Therefore, it is recommended that the following modifications be completed prior to drawdown:

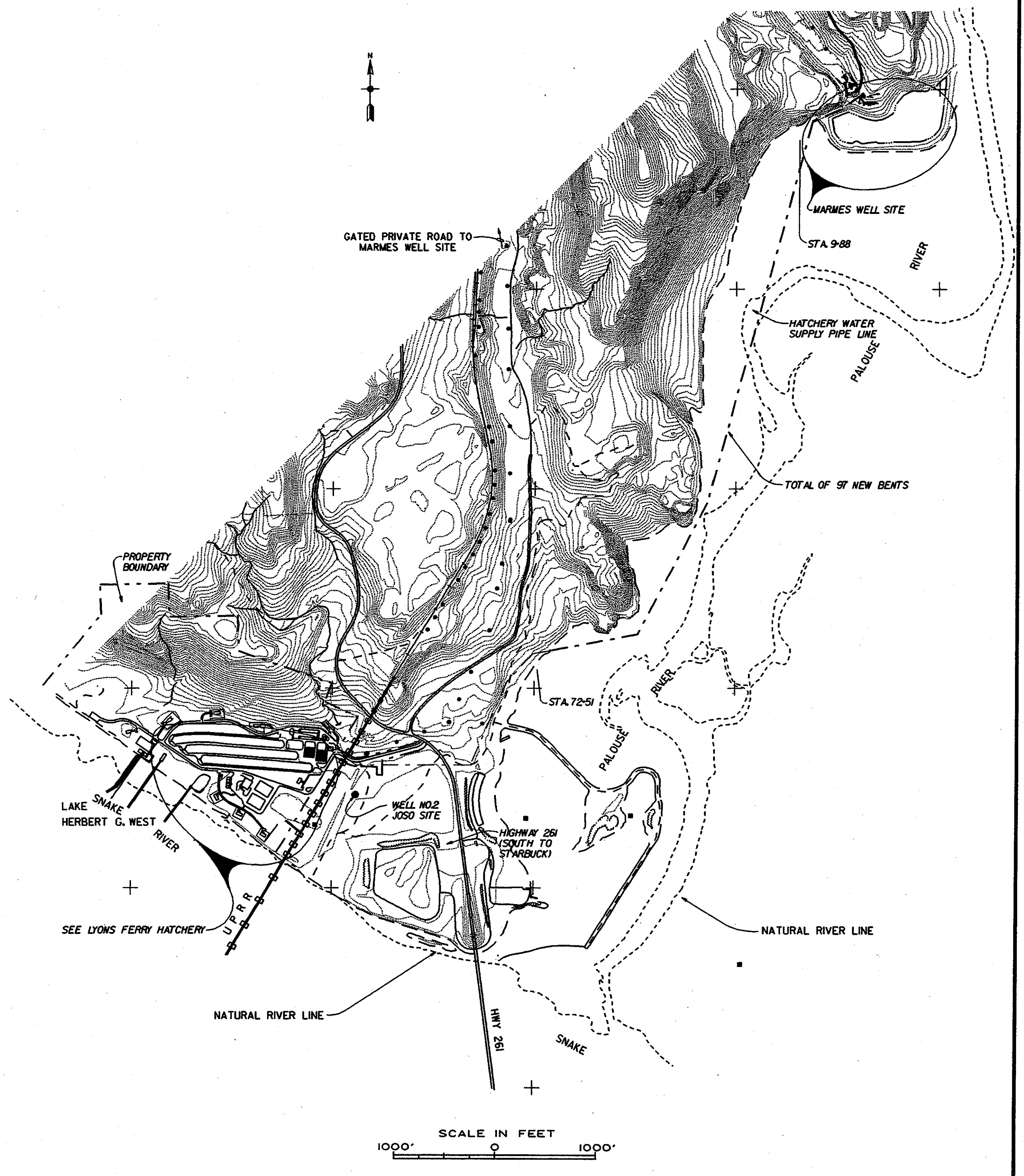
1. Install new pumps and set the intakes as deep as possible in the existing hatchery water supply wells and in the domestic well.
2. Install three new hatchery water supply wells to offset the expected reduced water production from the existing wells.
3. Install additional pipe pile bents be to support the existing water supply pipe.
4. Provide erosion protection along the slope from the 1,372-millimeter (54-inch) hatchery drain to the river.

The remaining modifications identified in this report would be performed after drawdown has occurred.

I.5 Construction Schedule

The construction schedule for the required hatchery modifications is as follows:

1. New pumps would be installed and the intakes set as deep as possible in the existing hatchery water supply wells and in the domestic well prior to drawdown.
2. Three new hatchery water supply wells would be constructed to augment the existing wells prior to drawdown.
3. Additional pipe pile bents would be constructed prior to drawdown to support the existing water supply pipeline between stations 72+76 and 9+88.
4. Erosion protection from the 1,372-millimeter (54-inch) hatchery drain to the river would be provided prior to drawdown.
5. The steelhead exit channel would be modified after drawdown.
6. A new domestic well would be drilled after drawdown.
7. The fish ladder would be modified after drawdown.
8. The steelhead spawning fish return pipes would be modified after drawdown.
9. The pollution abatement pond drain would be modified after drawdown.



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LOWER SNAKE RIVER JUVENILE SALMON MIGRATION FEASIBILITY STUDY

LYONS FERRY HATCHERY VICINITY MAP

Figure: I1

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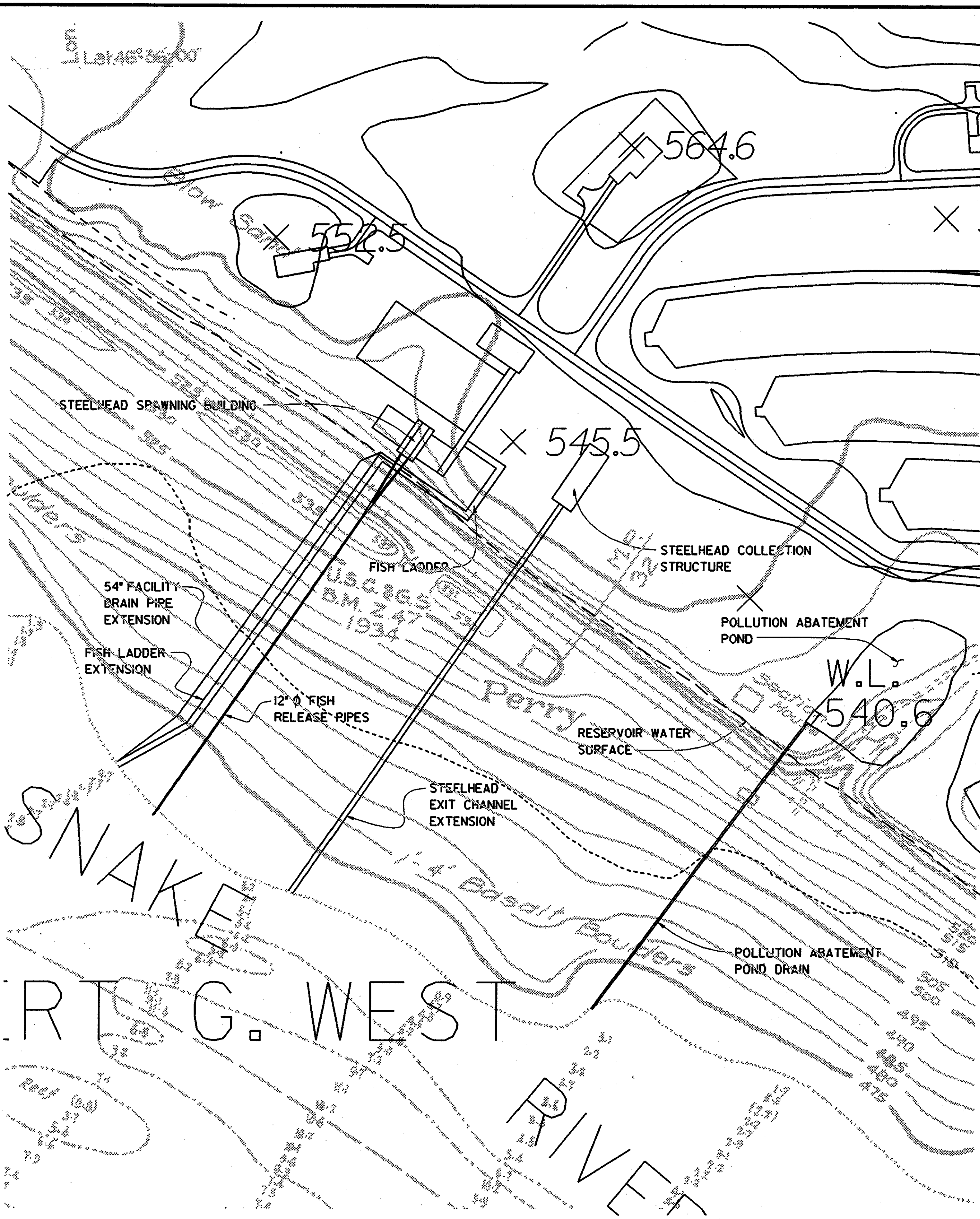
SHEET MAIN SCALE:



US Army Corps of Engineers Walla Walla District

LOWER SNAKE RIVER JUVENILE SALMON MIGRATION FEASIBILITY STUDY

LYONS FERRY HATCHERY SITE PLAN

Figure: I2

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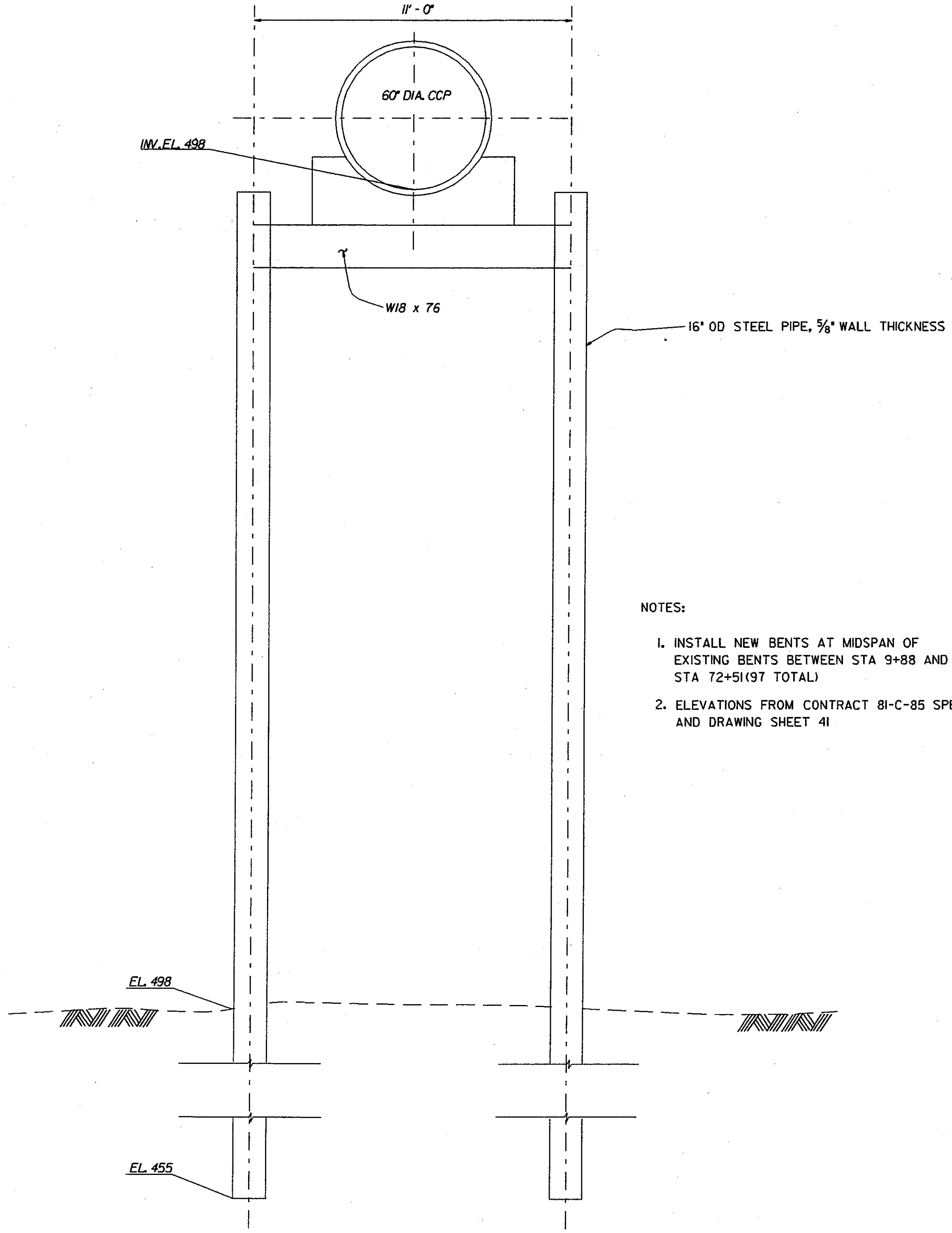

NOTES:

1. INSTALL NEW BENTS AT MIDSPAN OF EXISTING BENTS BETWEEN STA 9+88 AND STA 72+51(97 TOTAL)
2. ELEVATIONS FROM CONTRACT 81-C-85 SPEC 2B AND DRAWING SHEET 41

WATER SUPPLY PIPE
STA. 65+47

SCALE IN FEET
12" 0 5'

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Walla Walla District

LOWER SNAKE RIVER JUVENILE SALMON MIGRATION FEASIBILITY STUDY

WATER SUPPLY PIPE

Figure: I3

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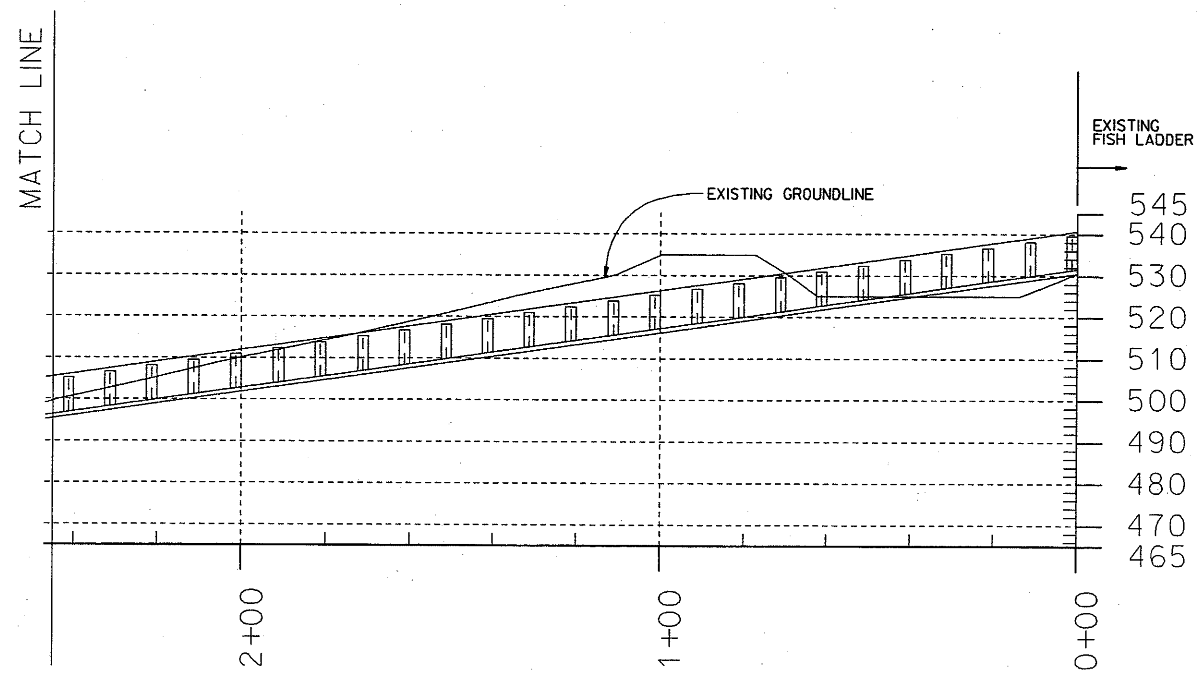

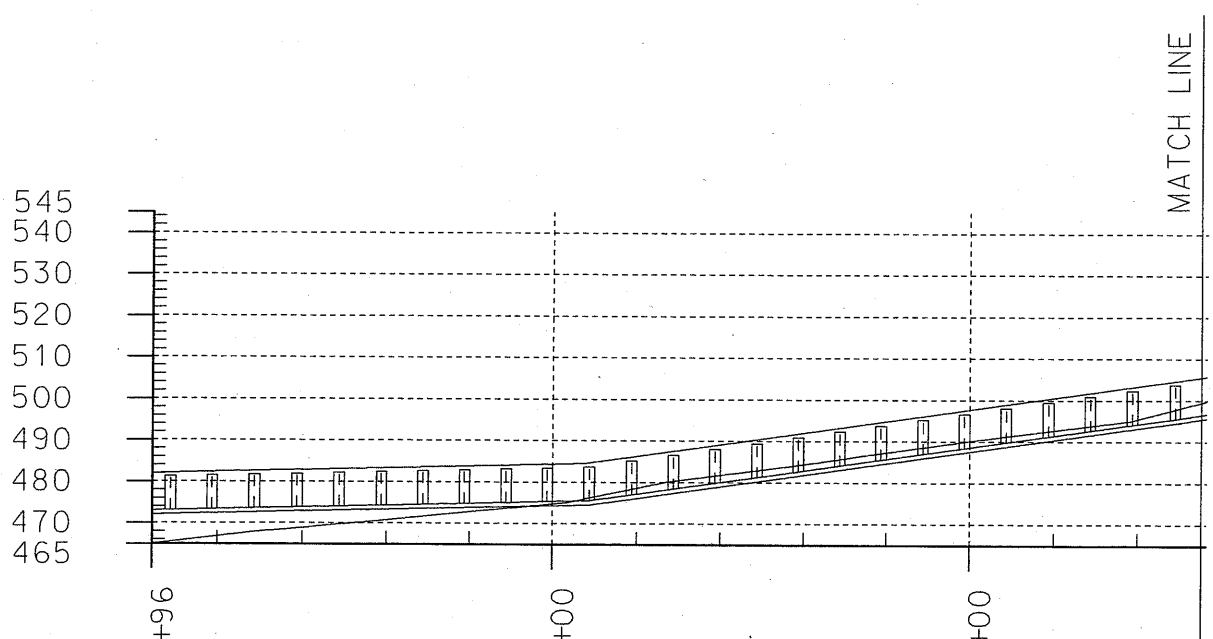

SHEET MAIN SCALE:

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LOWER SNAKE RIVER JUVENILE SALMON MIGRATION FEASIBILITY STUDY

FISH LADDER EXTENSION PROFILE

Figure:
I4

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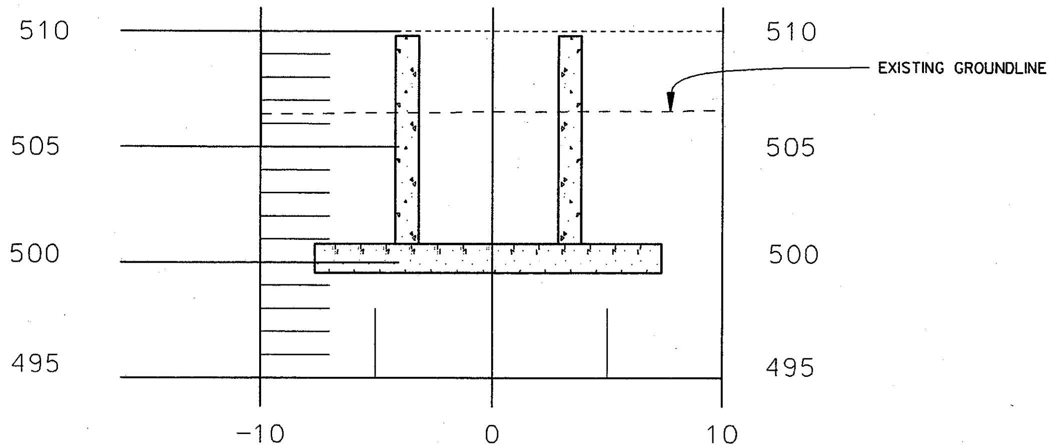
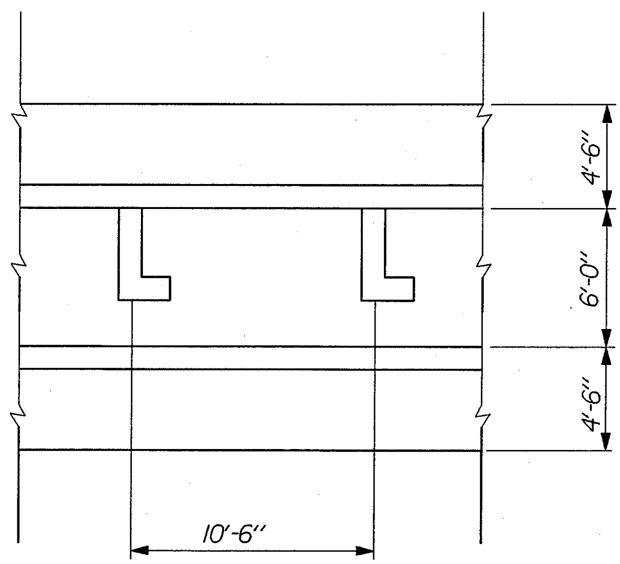


TYPICAL SECTION



TYPICAL PLAN

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LOWER SNAKE RIVER JUVENILE SALMON MIGRATION FEASIBILITY STUDY

FISH LADDER EXTENSION DETAILS

Figure: I5

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SHEET MAIN SCALE: