Pine Creek Fish Passage

Conceptual Engineering Design

January 31, 2007

Prepared for:

Yakama Nation

Harbor Consulting Engineers

Engineers • Planners • Surveyors

January 31, 2007

Yakama Nation
Fisheries Division
P.O. Box 151
Toppenish, WA 98948

Attention: Mr. Gregory Morris

Regarding: Pine Creek Fish Passage Conceptual Engineering Design

Dear Mr. Morris:

Harbor Consulting Engineers is pleased to submit our Pine Creek Fish Passage Conceptual Engineering Design report. Included in the report are conceptual design drawings illustrating the proposed design alternatives. In addition, preliminary construction cost estimates for the alternatives have been included.

Harbor Consulting Engineers has completed a preliminary evaluation of the feasibility of restoring fish passage to native habitat in Pine Creek. The existing site conditions and flow regime at Pine Creek have created unique challenges for the design alternatives. Several alternatives were considered and are discussed in the report; however, the most feasible alternative appears to be a combination of a concrete fish ladder and a fishway culvert. This alternative appears to provide the best potential for fish passage at the least cost.

It was discovered that Pine Creek is on the Washington State Department of Transportation (WSDOT) inventory of Fish Passage Barriers. The restoration project is currently in the Engineering Scoping phase and inline to receive funding in 2012. At this time no restoration design has been adopted.

We have enjoyed the opportunity to work with Yakama Nation on this challenging project, and we look forward to discussions to follow. If there are any questions, please don't hesitate to contact us.

Sincerely,
Harbor Consulting Engineers, Inc.

John R. Hutchins, P.E., S.E.
Principal

3006 Fuhrman Avenue East ▪ Seattle, Washington 98102 ▪ Telephone 206.709.2397 ▪ Facsimile 206.709.2398

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OBJECTIVES

The primary objectives of this report are to identify the current impediments to fish passage at the Washington State Route 14 and Burlington Northern Santa Fee (BNSF) crossings at Pine Creek, approximately 30 nautical miles up-river of John Day Dam, and develop conceptual alternatives to restore access to existing upstream habitat. Our investigation has been divided into two efforts. The first of which involves identifying the current fish passage barrier(s) and investigating the feasibility of restoring partial passage, utilizing existing facilities. The second effort consists of the conceptual design of alternatives to restore full, unimpeded access to upstream habitat.

EXISTING SITE CONDITIONS

Pine Creek is a small volatile stream with a basin area of approximately 56.8 square miles (36,352 acres). Flowing through Klickitat County in southern Washington State, Pine Creek feeds Lake Umatilla on the Columbia River upstream of the John Day Dam (See Figure 1). The Pine Creek drainage is located in the Wood/Alder Creek subbasin of Water Resource Inventory Area (WRIA) 31 as identified in the Level 1 Watershed Assessment dated November, 2004. For much of its downstream reach, Pine Creek exists as a subsurface channel flowing under an alluvium deposition zone from June through November. At its confluence with the Columbia River, Pine Creek expands to a small riparian pool from which a system of five culverts passes flow under State Route 14 and the BNSF railroad to Lake Umatilla.

The system of five culverts consists of three separate culvert arrangements. These culverts were constructed when the highway and railroad were relocated in the 1960's to accommodate the construction the John Day Dam. The culvert arrangement most utilized is a single 10-foot diameter pipe constructed at original river grade. Currently, the entrance is fully submerged near the middle of the riparian pool. This culvert discharges into Lake Umatilla at a depth of approximately 30 feet at its invert. It is believed that this culvert was originally intended to be a temporary structure to pass expected flows during construction of a permanent culvert; however it is the primary culvert in use today. The second culvert, believed to be the intended permanent structure, is composed of three 10-foot diameter pipes sharing a common concrete entrance headwall located on the east side of the pool. The upstream invert of these culverts is at elevation 268.8, several feet above the pool water surface much of the year. An additional single 10-foot diameter pipe is located on the west side of the pool with an upstream invert elevation of 270.7. The location and orientation of all culverts are shown in Appendix A on Drawings 1 and 2.

A large volume of sediment and woody debris has in-filled the previous creek channel nearly 15 feet and obstructed the entrance to the submerged culvert. Only a small opening crossed with woody debris exists to pass stream flows. The constricted culvert entrance has created a barrier to fish passage due to physical obstructions and high water velocities. Attempts were made to locate and inspect the upstream entrance of this culvert to determine its actual invert, location, orientation and extent of the current blockage. These attempts included an underwater inspection by a U.S. Geological Survey (USGS) diver, field survey, and an exploration with an underwater camera lowered from the water surface. Unfortunately, these attempts were unsuccessful at locating the culvert. The approximate location and invert of

the culvert were finally determined by performing transects across the pond with a drop line lowered from the water surface. These data were compared with existing and historical topography and the known downstream location of the culvert and appears to be consistent.

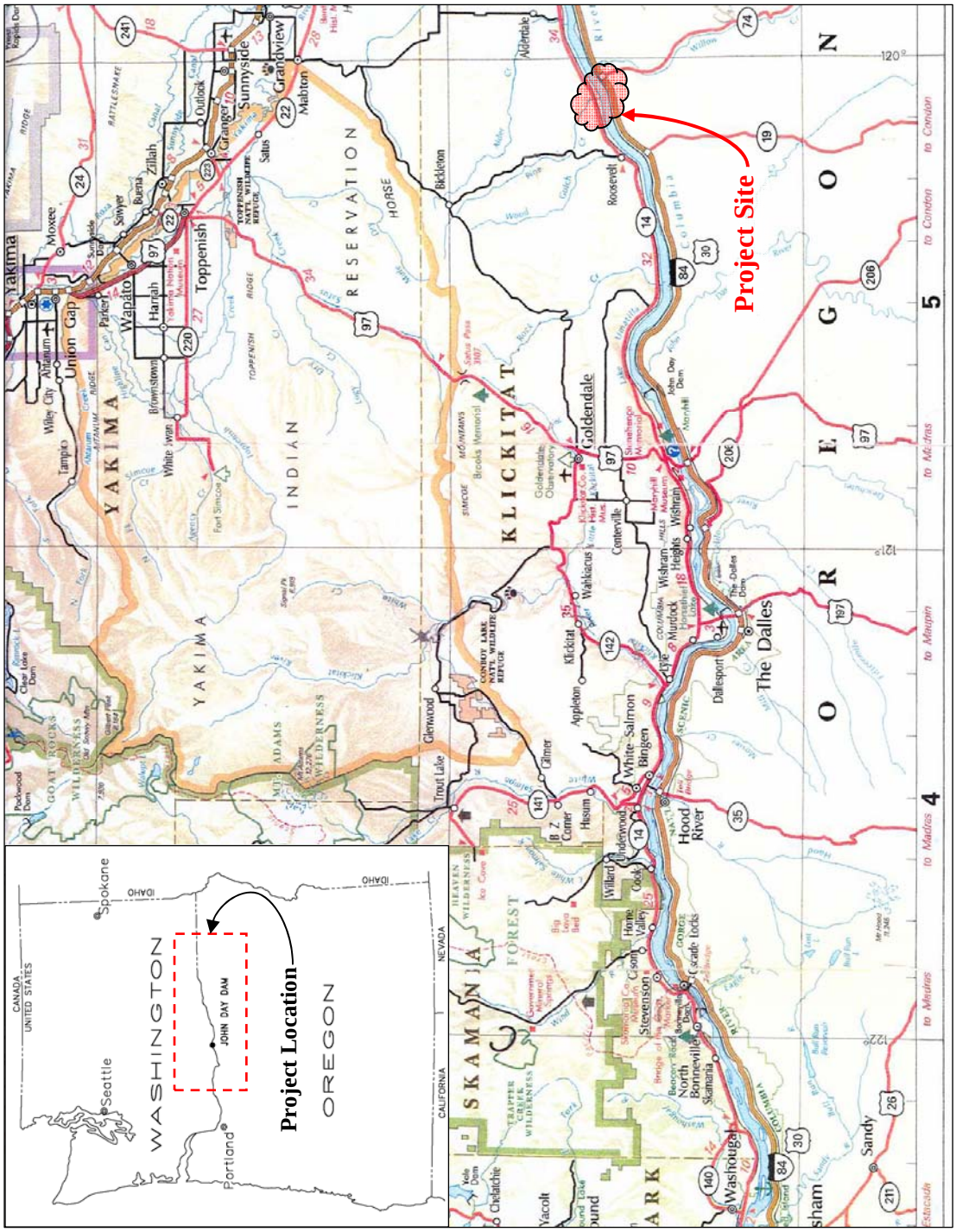

Figure 1 – Location Map

EXISTING HYDRAULIC CONDITIONS

Harbor Consulting Engineers has conducted a historical records search and field survey in an attempt to determine the present hydraulic conditions and dominate hydrologic processes at Pine Creek. As no USGS continuous stream flow gauges are or have been installed on Pine Creek, it was difficult to identify actual existing surface water discharge quantities. Several historical records were located and are outlined in Table 1 below, however the dates of these records span up to 50 years with no continuous period of measurement found. Depending on changes in land use and climatic conditions since the time of data collection, these stream flow measurements may not reflect the current flow regime at Pine Creek.

Table 1 –Miscellaneous Stream Flow Data for Pine Creek near Mouth

Frequency/Type	Flow (cfs)	Date	Source
50-year	2960	1960±	USACE Design Memorandum No. 1
60-day low	0.193	8/2/2001	WDFW – SSHEAR Report
Spot Measurement	29.4	3/4/1982	USGS (1989)
Spot Measurement	18.7	4/19/1982	USGS (1989)
Spot Measurement	1.94	5/24/1982	USGS (1989)

Significantly more data are available for Rock Creek, hydrologically similar to Pine Creek, located 15 miles to the west. Pine Creek is expected to display a hydrograph similar to that of Rock Creek characterized by steep rising limbs and high ratios of peak to average flows; the result of rapid stream flow response during storm events do to infiltration limited terrain. The hydrograph for Rock Creek near Roosevelt, Washington is shown below in Figure 2 for the USGS period of record dating from 10-01-1962 to 9-30-1968.

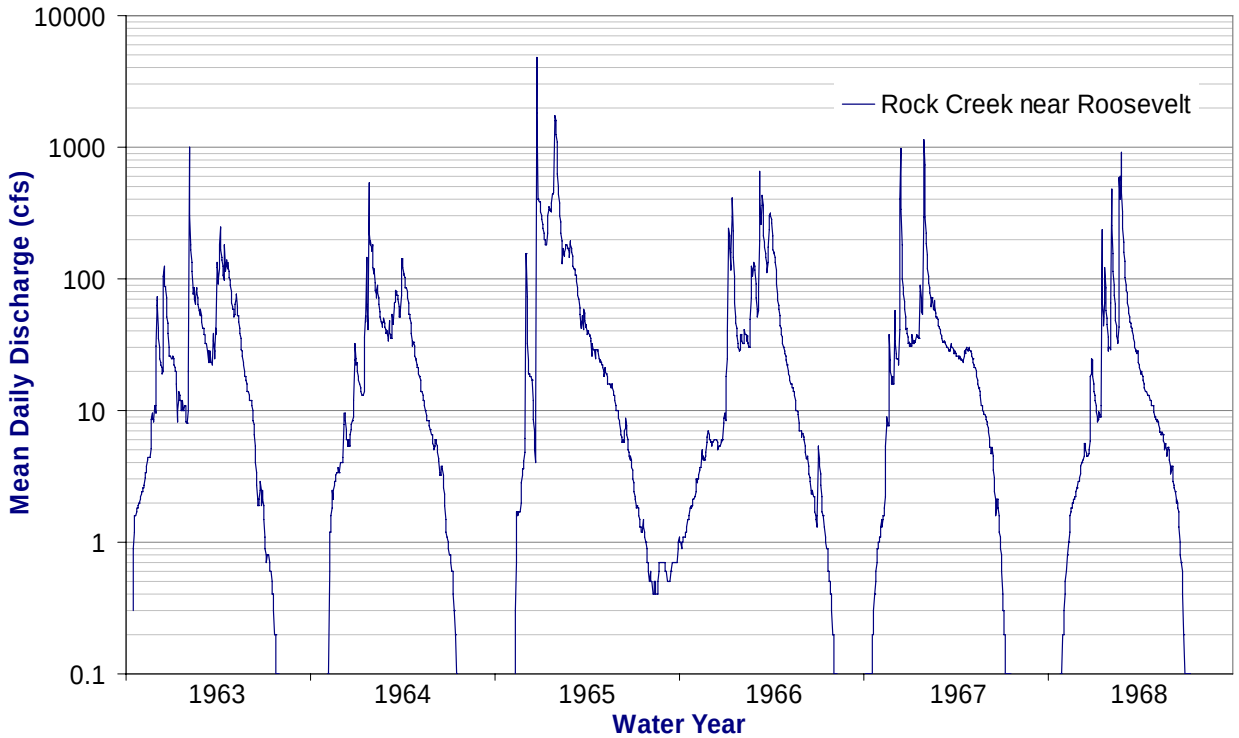

Figure 2 – Hydrograph: Rock Creek near Roosevelt, USGS Gauge 14036600

During dry summer months, surface water flows in both Pine and Rock Creeks typically recede and become intermittent with flows going subsurface for extended reaches. This is illustrated on the Rock Creek hydrograph as periods of zero flow between water years. The 1965 water year is an exception with minimal surface flow sustained throughout the year.

A straight-line comparison of drainage area, average annual precipitation, and basin elevation for the Rock Creek and Pine Creek drainages was used to determine anticipated average annual flows for Pine Creek. The results of this comparison are shown below in Table 2. These values can provide a rough estimate of expected flows for conceptual design; however a more detailed analysis should be completed prior to any further design work.

Table 2 – Rock/Pine Creek Drainage Comparison

	Rock Creek	**Pine Creek**	**Ratio**
Basin Area[1]	258 sq mi	56.8 sq mi	0.22
Average Annual Precipitation[1]	16.2 in	10.8 in	0.66
Average Basin Elevation[1]	2162 ft	1904 ft	0.88
Average Annual Flow	46 cfs[2]	11.5 cfs	0.25
Average Flow: November - April	94 cfs[2]	23.5 cfs	0.25

Notes:
[1] Data from: Level 1 Watershed Assessment (2004)
[2] USGS Gauge 14036600 Rock Creek near Roosevelt

An annual flow duration curve was created to identify the design flow range for fish passage at Pine Creek. The Pine Creek curve was adapted from a curve created for Rock Creek using the straight-line ratio of 0.25 from Table 2 above. This curve was calculated for the period when adult Steelhead are believed to be active in the Pine Creek system. This period, identified from the Level 1 Watershed Analysis (2004), spans from November through May, with adults entering the tributary systems when fall and winter rains increase stream flows to those adequate for passage. Once in the systems, spawning typically occurs from January through April as shown below in Figure 3.

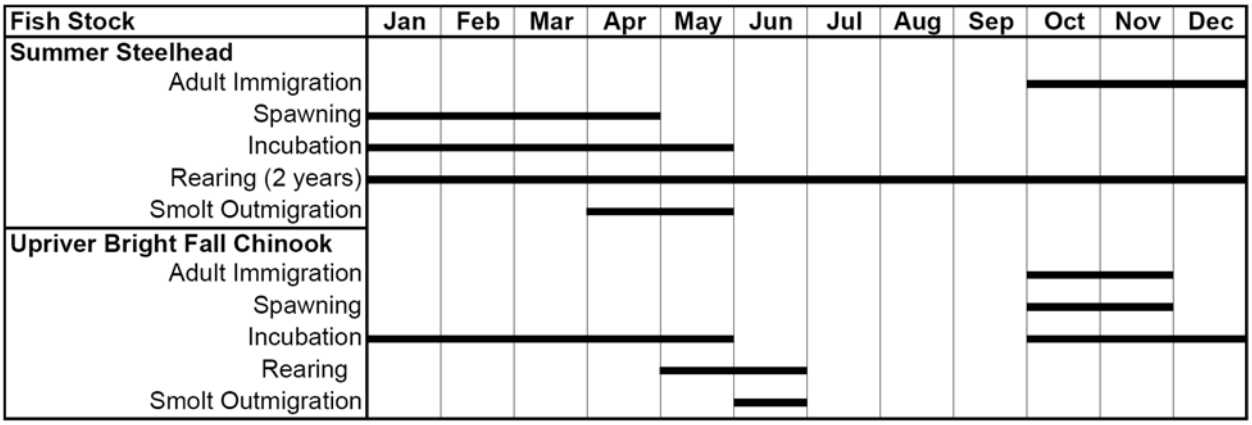

Figure 3 – Life History of Anadromous Fish Species Found in WIRA 31 (adapted from Level 1 Watershed Analysis (2004))

The annual flow duration curve for Rock Creek (see Figure 4 below) was created using data from USGS gauge 14036600, Rock Creek near Roosevelt. Data are only available for a period of six years, from October 1962 through September 1968. This period is generally considered to be a wet cycle, which may result in an overestimate of mean daily discharge over a much longer period. For the purpose of fish passage design, this would result in an overestimate of the high and low design flows, identified by National Marine Fisheries Service as the 5% and 95% exceedance of mean daily discharges respectfully. However, as the 95% exceedance flow for Pine Creek is near zero, a more realistic low flow of 5 cfs was used for fishway design. The 5% exceedance flow of 100 cfs for Pine Creek, obtained from the flow duration curve in Figure 4 below, is considered reasonable and was used as the high design flow for fishway alternatives.

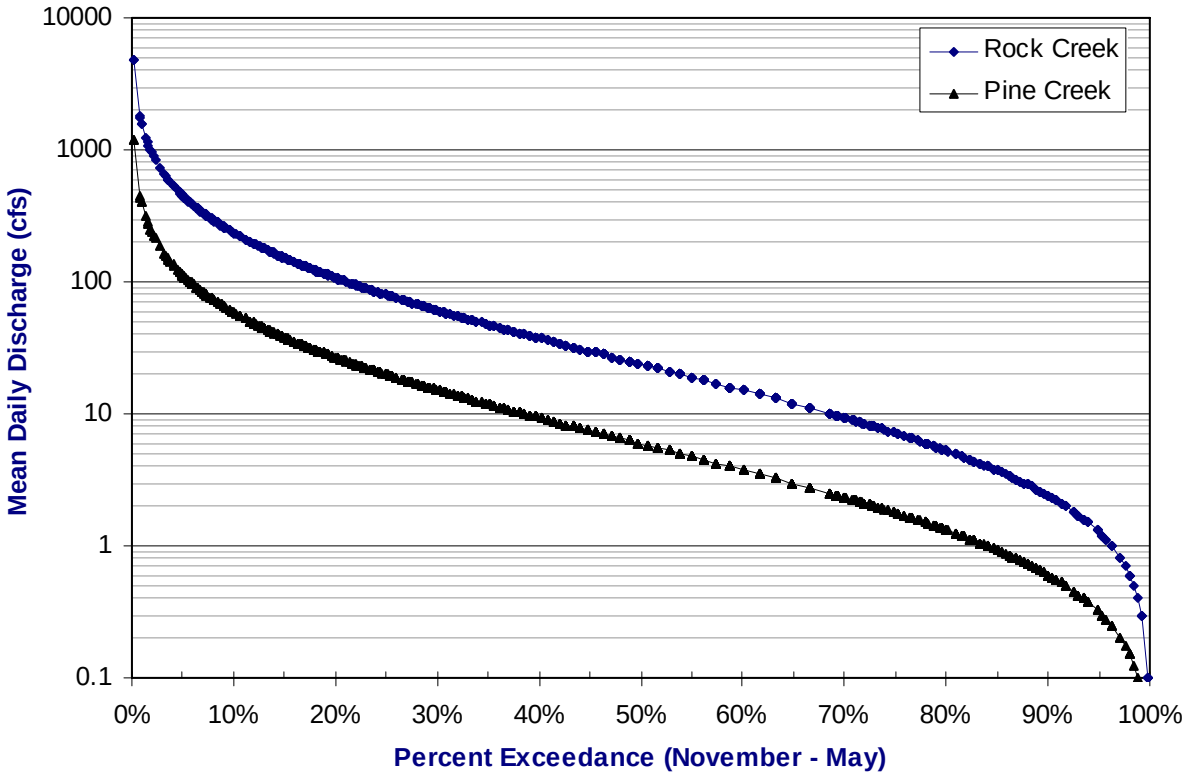

Figure 4 – Annual Flow Duration

JOHN DAY DAM POOL

The hydraulic design of any fish passage facility at Pine Creek must account for fluctuation of the water surface in Lake Umatilla behind the John Day Dam. Daily water surface data are available from the U.S. Army Corps of Engineers (USACE) for the operational life of the dam from December, 1970 to present day. The maximum pool, full pool, and minimum pool elevations are identified by USACE as 276.5, 268.0, and 257.0 feet above mean sea level respectively. For the first twenty years of operation, from 1971 into the early 1990's, the full range of usable storage was utilized with water surface fluctuations for the pool typically ranging from 257 to 268 feet. Over the last 10 years, however, water surface fluctuations have been reduced and now typically range from 263 to 265 feet.

Table 3 below compiles water surface elevation data for the last ten years from January, 1996 through December, 2006. This data is useful to determine probable pool elevations when fish are likely to be entering the Pine Creek system. Figure 5 and Figure 6 below show daily water surface elevation data for the John Day pool (Lake Umatilla). This data is taken at the John Day Dam, roughly 30 nautical miles downstream from Pine Creek. A difference of 0.4 feet existed between the recorded water surface elevation at the John Day Dam and the surveyed water surface on Lake Umatilla at Pine Creek on December 13, 2005. This corresponds to a water surface slope of approximately +0.0002% from Pine Creek to John Day Dam. The difference in water surface for the 35 nautical mile reach upstream of Pine Creek to McNary Dam was approximately 1.3 feet, corresponding to a slope of -0.0006%. The total difference in water surface elevation for the 65 nautical mile reach between John Day Dam and McNary Dam was approximately one foot. For the purpose of this study, the water surface elevation of Lake Umatilla at Pine Creek was assumed to be equal to that measured at John Day Dam.

Table 3 – John Day Dam Forebay Elevation Statistics 1996 – 2006 (feet)

Month	Average	1st Quartile	3rd Quartile	Max	Min
January	264.11	264.00	264.40	264.90	258.30
February	263.96	263.70	264.40	267.70	260.50
March	264.04	263.80	264.40	264.90	261.40
April	263.60	263.20	264.10	264.80	260.60
May	263.26	263.10	263.60	264.80	257.60
June	263.32	263.10	263.50	265.50	261.30
July	263.47	263.20	263.70	264.30	262.40
August	263.65	263.40	263.90	265.40	262.70
September	263.73	263.50	264.00	264.70	262.70
October	264.15	263.90	264.40	264.80	263.30
November	263.96	263.80	264.38	264.80	261.50
December	263.95	263.90	264.40	264.90	257.40

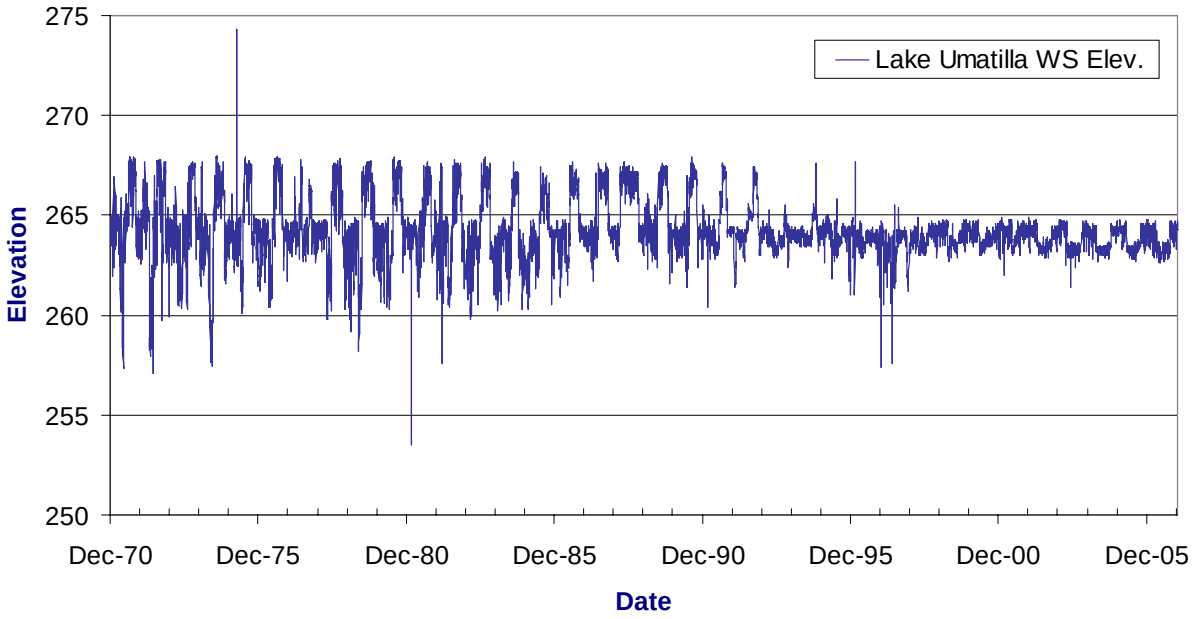

Figure 5 – Lake Umatilla Water Surface Elevation for Period of Record

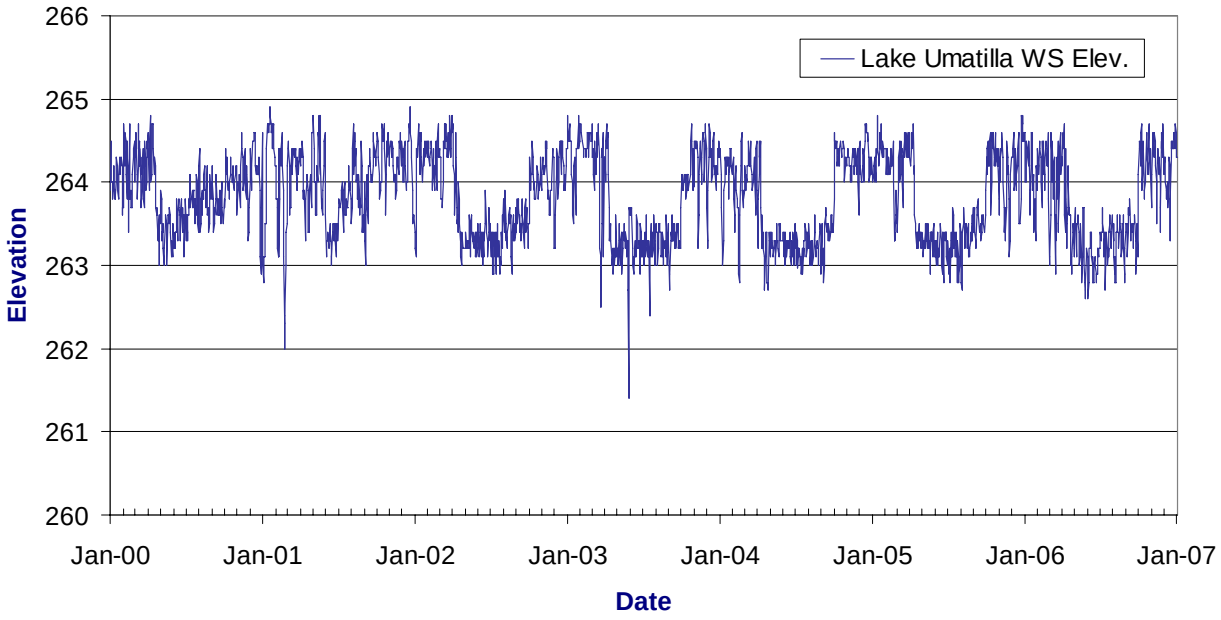

Figure 6 – Lake Umatilla Water Surface Elevation January 2000 thru January 2007

FISH PASSAGE DESIGN

Several alternatives have been considered to restore fish passage to Pine Creek. Four of these alternatives are outlined below. However, it was noted that Pine Creek is on the Washington State Department of Transportation (WSDOT) inventory of fish passage barriers (Site ID 990341). The WSDOT restoration project is currently in the Engineering Scoping phase and online to receive funding in 2012. Communication with the WSDOT Fish Passage Coordinator and WDFW Habitat Engineers revealed that a conceptual design to restore fish passage was accomplished but later determined to not be feasible. It is unclear when a conceptual design from WSDOT might be adopted.

Prior to the implementation of any design alternative, the existing blockage at the submerged culvert entrance must be cleared. This would include the excavation of debris and sediment that have in-filled the original channel and currently constrict the culvert entrance. A 100-foot radius conical shaped excavation made 15 feet deep is anticipated to restore full flow in the culvert. Because the culvert entrance exists midway in the pond, construction access can only be gained with floating equipment. A temporary platform could be constructed on site using equipment such as "Flexifloat Barges," which would provide the required access for a dredging effort. The cost of this effort has been included in the cost estimates for all design alternatives.

Alternative 1 – Passage through Existing Submerged Culvert

Site investigations indicate that partial passage can be restored through the existing submerged culvert on an interim basis if debris and sediment are cleared from its upstream entrance. However, debris and sediment will continue to infill the culvert entrance, restricting fish passage. A structural trash rack structure could be fitted to the entrance, reducing the occurrence of debris jams. In addition to the trash rack, a pile-supported catwalk would be required to provide access for maintenance. While reducing the occurrence of debris jams at the entrance would reduce the rate of sediment infill, periodic dredging would still be required.

Full passage of fish will not be realized with this alternative due to the depth and hydraulic properties of the culvert. With a downstream invert nearly 30 feet below the average water surface in Lake Umatilla, it is unlikely a majority of fish will locate the culvert for passage. In addition, water temperatures in Pine Creek are less than those in the Columbia River much of the year. The result is a predominately downward traveling discharge plume from the Pine Creek culvert further reducing the likelihood of passage occurring. The submerged fish entrance also results in a fully darkened transportation channel thus further conflicting with typical fish behavior.

It is anticipated that construction costs associated with this alternative would include:

Excavating and clearing debris	$112,000
Structural steel trash frame enclosure	$72,000
Estimating contingency	$56,000
Total:	**$240,000**

Alternative 2 – Concrete Fish Ladder and Fishway Culvert

Constructing a fishway using one of the three eastern culverts appears to be the most economical solution to near full-time fish passage. Drawings illustrating a conceptual design for this alternative are included in Appendix A. Several factors have guided the project in this direction:

1. In recent years the John Day Dam fore bay pool elevation fluctuations have been minimized and now vary only about two feet.
2. A cutoff wall can be used to hydraulically separate Pine Creek from the Columbia River, allowing a fishway to properly function.
3. A well designed fishway will accommodate all adult and juvenile fish behavior of multiple species.
4. The existing culverts are large enough to minimize the effects of passing fish through a dark fish transportation channel.
5. Reasonable access can be developed for maintenance and management activities.
6. Construction could begin soon and be completed within one in-water work period.

The anticipated construction cost would be approximately $1.5 million using 2007 as the construction cost base year. A detailed construction cost estimate is included in Appendix C.

Alternative 3 – Highway & Railroad Bridge

Replacing the existing culverts with highway and railroad bridge structures similar to those designed in 1964 can be accomplished using large diameter drilled shaft piers founded to the basalt rock below the embankments. Bridge construction would likely begin by first relocating the highway and railroad making space available for bridge construction followed by continued embankment removal. Once the bridges are constructed, the railroad and highway will be replaced to their current location.

Replacing the culvert with bridges will eliminate the need for a fish ladder and associated maintenance. It will also allow fish to migrate unimpeded throughout the year and without regard to the John Day Dam pool elevation.

Anticipated bridge replacement costs are:

Railroad Bridge Replacement 3 spans, 280 feet long:		$11,846,900
Highway Bridge Replacement 3 spans, 280 feet long:		$7,592,000
	Total:	**$19,438,900**

Using 2007 construction costs, a budget of approximately $20 million will be required if a bridge replacement alternative were selected. In 1964, the bridge alternative would have cost less than $2 million. A detailed construction cost estimate is included in Appendix C.

Alternative 4 – Precast Concrete Arch Culvert

A concrete lined excavated tunnel could be an alternative to either fishway structures or bridge replacement. A tunnel shaft could be excavated through the embankments and pre-cast concrete segments placed to support the tunnel wall. Its bottom elevation would be placed at sufficient depth below the John Day Dam pool elevation to accommodate appropriate fish passage.

Construction of the tunnel portals would require significant coffer dams and a substantial dewatering effort. A 320 foot-long, 14-foot diameter tunnel is estimated to cost nearly $20,000 per lineal foot or $6,400,000 to construct.

CONCLUSIONS

The alternatives presented cover a broad range of construction costs and passage regimes. The most economical of these alternatives appears to be Alternative 2, Concrete Fish Ladder and Culvert Fishway. With this alternative, sustainable fish passage can be restored for most of the year at an optimal construction cost.

Implementing any alternative will require further site investigations consisting of a detailed topographic survey, numerous geotechnical borings, and detailed drainage hydrology. These investigations will be necessary to confirm schematic design assumptions and develop more reliable construction costs.

Early coordination will be required with resource and land management agencies including Bonneville Power Administration, U.S. Army Corps of Engineers, Washington State Department of Transportation, Burlington Northern Santa Fee Railroad, and the Yakama Indian Nation. This coordination will provide a multi-agency consensus and unified project approach thereby facilitating project design, permitting, and funding.

APPENDIX A

Conceptual Design Drawings
Fishway Alternative

DRAFT

APPROX. EDGE OF WATER

BB 2

AA 2

PINE CREEK

10'ø CULVERT
APPROX. IE 233.80

10'ø CULVERT
IE 270.7

10'ø CULVERT
IE 268.8

10'ø CULVERT
IE 268.8

10'ø CULVERT
IE 268.8

CONCRETE HEADWALL

264.63 EW
264.17 EW
265.77 EW
264.86 GND
272.54 GND
278.77 GND
292.18 GND
298.68 RC
298.89 EA
299.39 ASPH
298.77 EA
288.16 GND
294.92 GND
299.50 GND
301.65 RR
299.47 RC
300.98 GND
301.66 RR
297.25 GND
274.90 GND
263.63 EW

℄ HIGHWAY 14 (APPROX.)

℄ RAILROAD (APPROX.)

OLD HWY. 14

10'ø CULVERT
IE 265.6

APPROX. EDGE OF WATER

10'ø CULVERT
IE 264.60

10'ø CULVERT
IE 265.00

10'ø CULVERT
IE 265.20

COLUMBIA RIVER

10'ø CULVERT
IE 229.20

OLD HWY 14
BRIDGE CROSSING

OLD HWY. 14

LEGEND

- 270 — HISTORIC CONTOUR
- × 299.47 GND — SPOT ELEVATION
- HISTORIC STREAM THALWEG
- EDGE OF WATER 12-13-05

SITE PLAN

HWY 14 CROSSING @ PINE CREEK
SCALE:1"=50'-0"

N

1"=50'-0"

50 0 50 100

Scale Feet

SCALE: 1" = 50'-0"
CHK BY: J. HUTCHINS
DRW BY: B. ABEL
REF:

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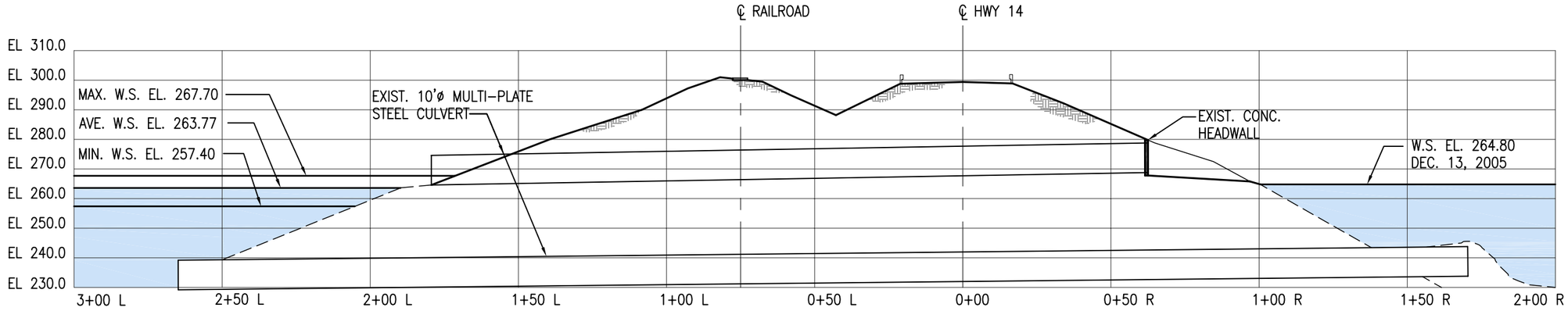
SEATTLE, WA 98102
(206) 709-2397

YAKAMA NATION
TOPPENISH, WASHINGTON

PINE CREEK FISH PASSAGE
PARTIAL SITE SURVEY PLAN

JOB NO. 05014.00
DATE: 01/31/07
SHEET: 1 OF 7
DWG.# 1

DRAFT



SECTION AA
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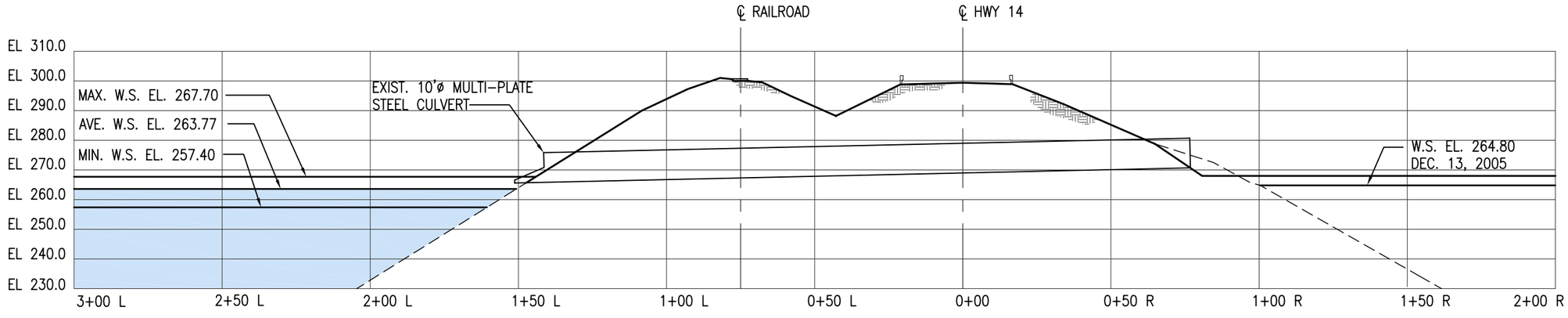

SECTION BB
SCALE: H: 1"=40'-0", V: 1"=40'-0"

1"=40'-0" 40 0 40 80
Scale Feet

SCALE: 1" = 40'-0"
CHK BY: J. HUTCHINS
DRW BY: B. ABEL
REF:

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YAKAMA NATION
TOPPENISH, WASHINGTON

PINE CREEK FISH PASSAGE
EMBANKMENT SECTIONS

JOB NO. 05014.00
DATE: 01/31/07
SHEET: 2 OF 7
DWG.# 2

DRAFT

PINE CREEK

NEW SHEET PILE CUTOFF WALL EL. 273.80
520 L.F.

FISHWAY CONTROL
SEE SHT. 7
EL. 268.80

ACCESS ROADWAY

TIP ELEV.
DISTANCE

258.0
110' L.F.

253.0
90' L.F.

243.0
35' L.F.

233.0
25' L.F.

220.0
90' L.F.

233.0
30' L.F.

243.0
45' L.F.

253.0
60' L.F.

258.0
35' L.F.

TIP ELEV.
DISTANCE

ACCESS ROADWAY

A

℄ HIGHWAY 14 (APPROX.)

FISHWAY CULVERT
SEE SHT. 4

10'ø CULVERTS

OLD HWY. 14

℄ RAILROAD (APPROX.)

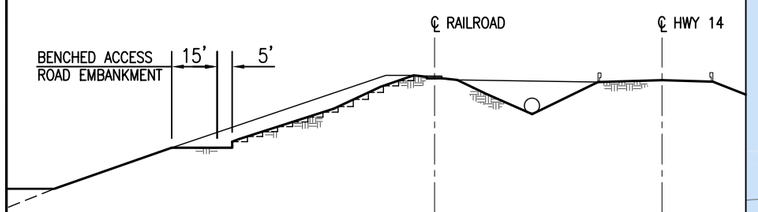
15% ACCESS ROAD

APPROX. EDGE OF WATER

COLUMBIA
RIVER

OLD HWY. 14

OLD HWY 14
BRIDGE CROSSING



ACCESS ROAD SECTION A
SCALE: 1' = 50'-0"

SITE PLAN
HWY 14 CROSSING @ PINE CREEK
SCALE:1"=50'-0"

N

1"=50'-0"

50 0 50 100
Scale Feet

LEGEND

270 HISTORIC CONTOUR

HISTORIC STREAM THALWEG

EDGE OF WATER

SCALE: 1" = 50'-0"
CHK BY: J. HUTCHINS
DRW BY: B. ABEL
REF:

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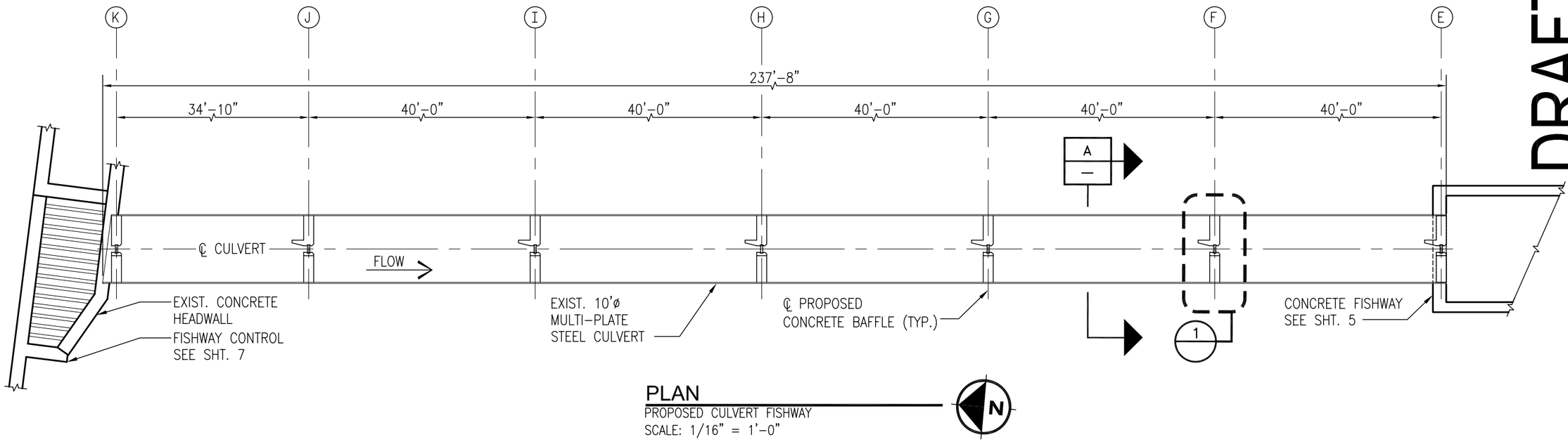
YAKAMA NATION
TOPPENISH, WASHINGTON

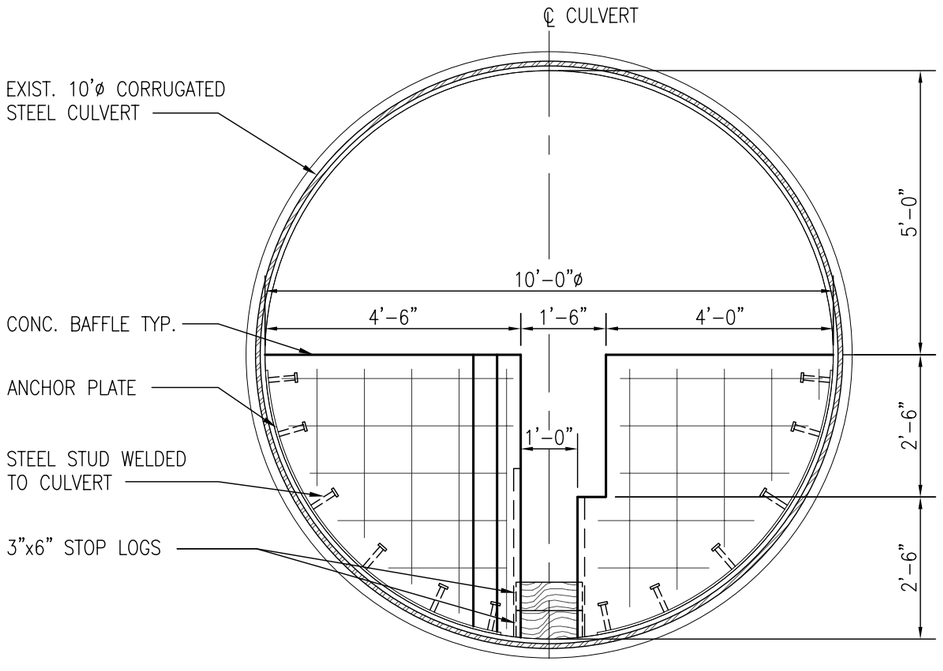
PINE CREEK FISH PASSAGE
SITE DEVELOPMENT PLAN

JOB NO. 05014.00
DATE: 01/31/07
SHEET: 3 OF 7
DWG.# 3

DRAFT

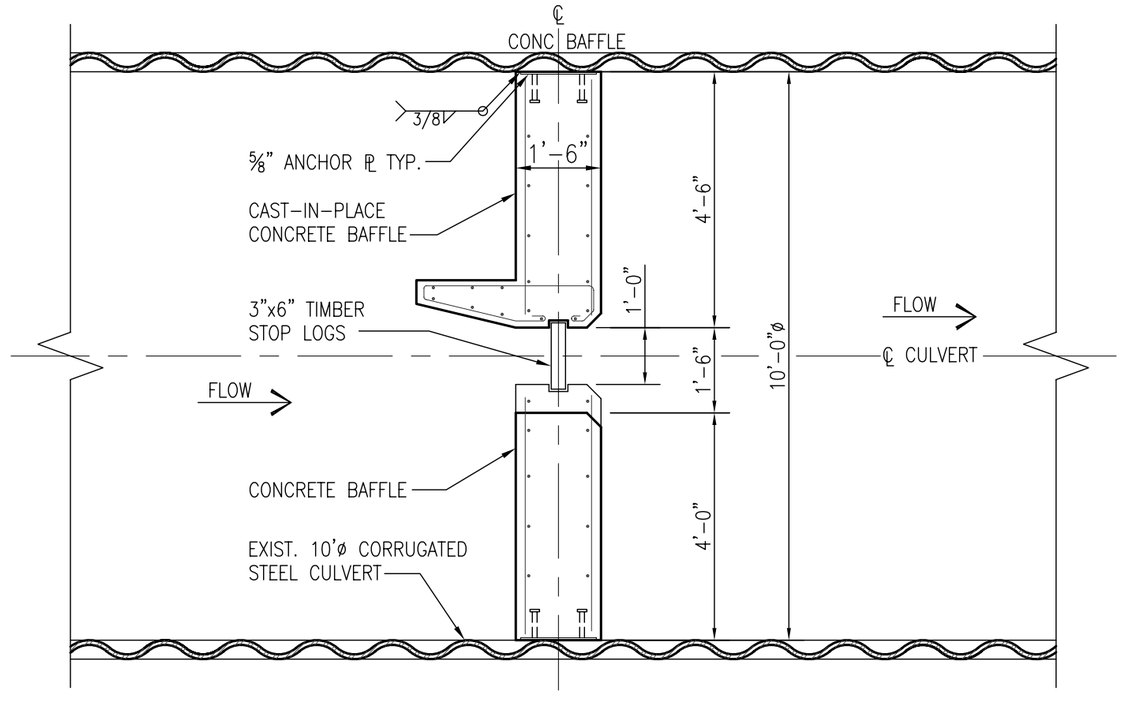


PLAN
PROPOSED CULVERT FISHWAY
SCALE: 1/16" = 1'-0"



SECTION
CULVERT FISHWAY
SCALE: 3/8" = 1'-0"

A



TYPICAL DETAIL
CONCRETE BAFFLE
SCALE: 3/8" = 1'-0"

1

SCALE: AS NOTED
CHK BY: J. HUTCHINS
DRW BY: B. ABEL
REF:

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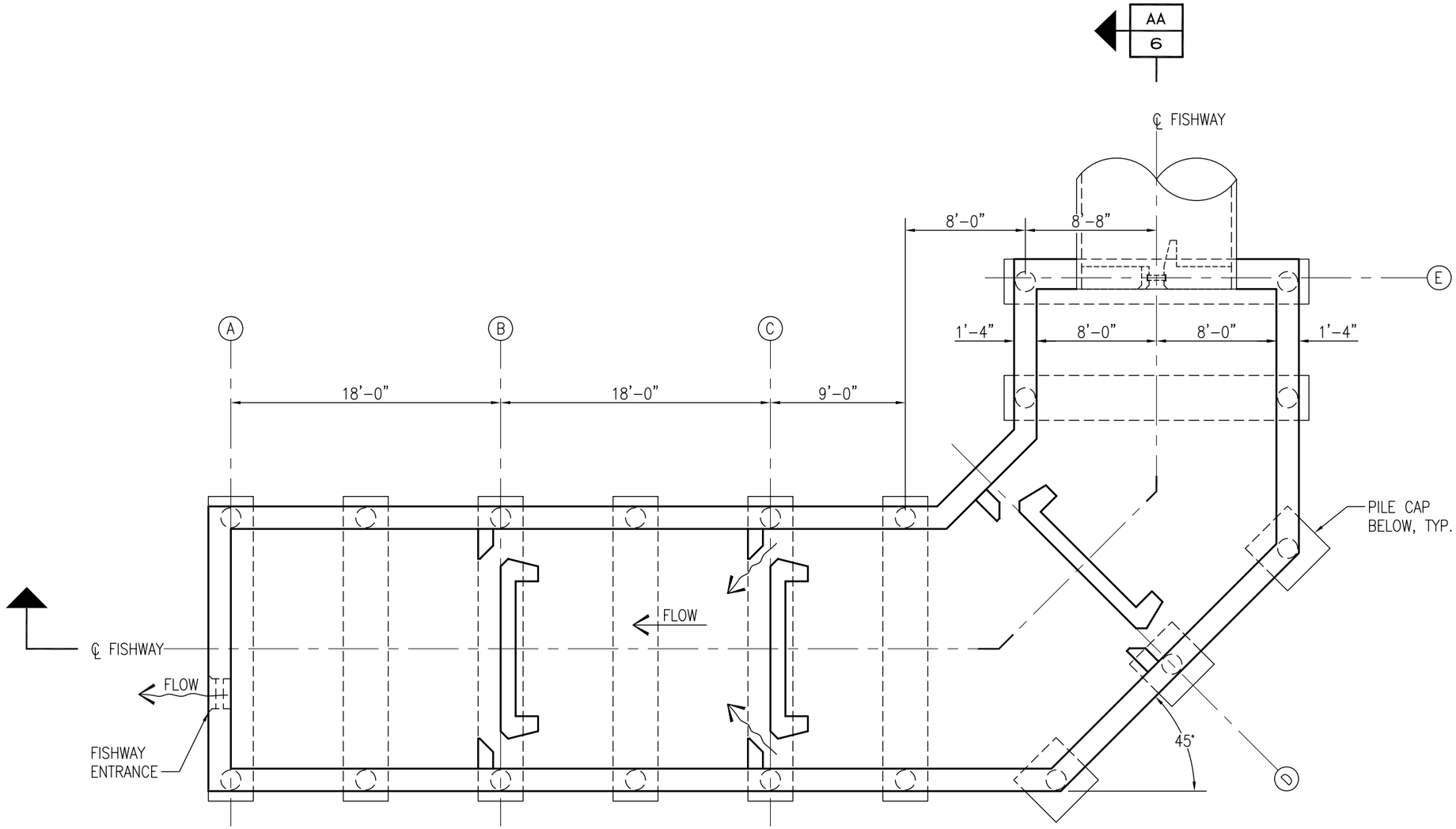
YAKAMA NATION
TOPPENISH, WASHINGTON

PINE CREEK FISH PASSAGE
FISHWAY CULVERT

JOB NO. 05014.00
DATE: 01/31/07
SHEET: 4 OF 7
DWG.# 4

DRAFT



FISHWAY PLAN

SCALE: 1/8" = 1'–0"

N

1/8"=1'–0" 5 0 5 10 Scale Feet

SCALE:	1/8" = 1'–0"
CHK BY:	J. HUTCHINS
DRW BY:	B. ABEL
REF:	

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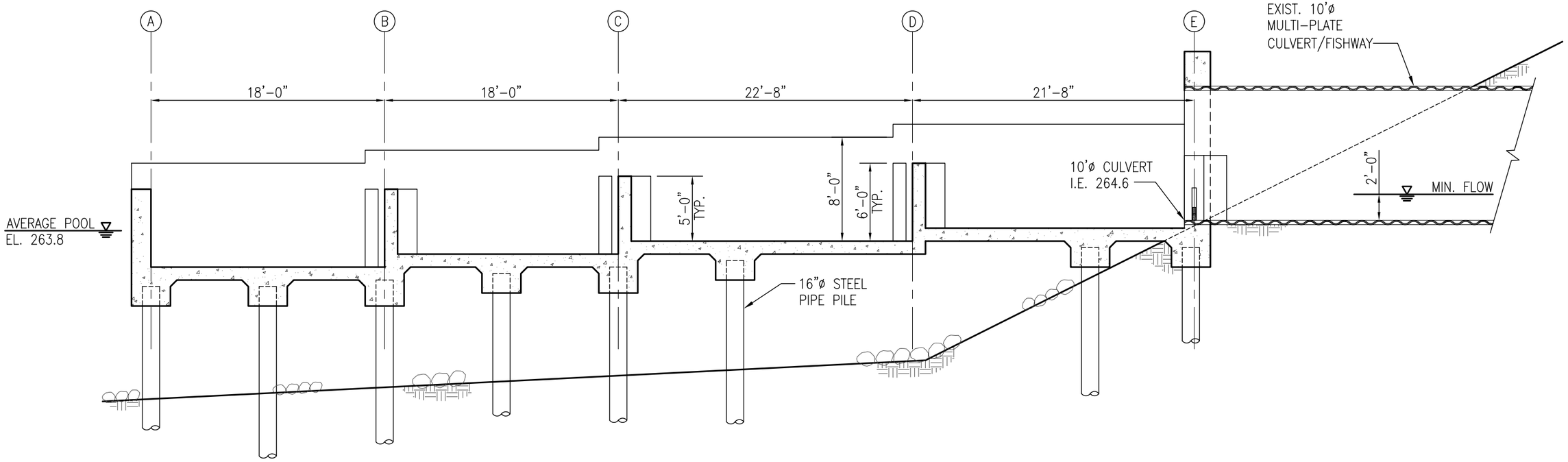
TOPPENISH, WASHINGTON

PINE CREEK FISH PASSAGE
ALTERNATIVE 1 – SECTIONS & DETAILS

JOB NO.	05014.00
DATE:	01/31/07
SHEET:	5 OF 7
DWG.#	5

DRAFT



DEVELOPED ℄ SECTION A-A

SCALE: 1/8" = 1'-0"

1/8"=1'-0"

5 0 5 10

Scale Feet

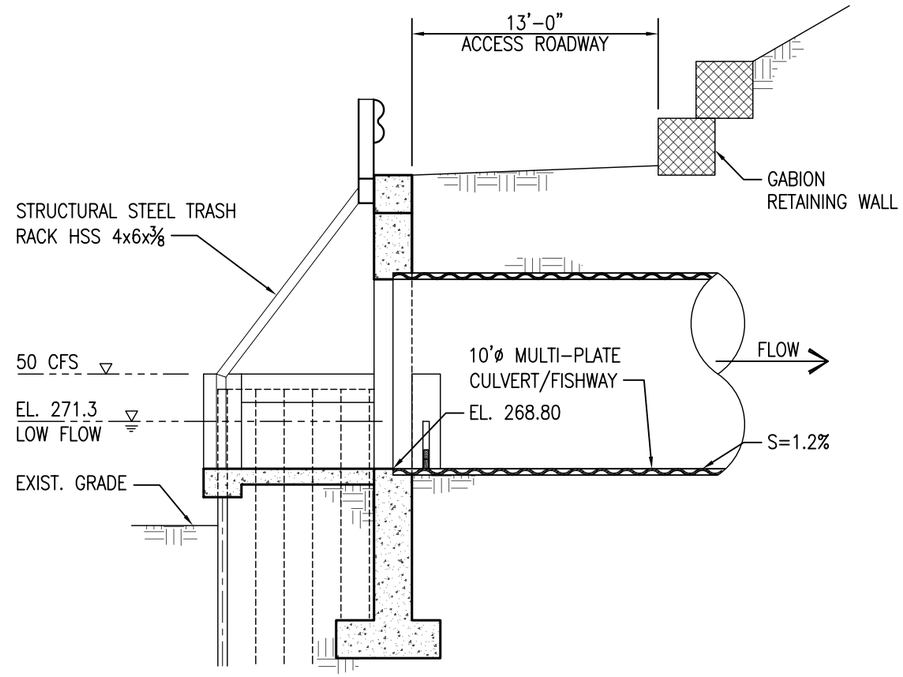
HARBOR CONSULTING ENGINEERS
ENGINEERS · PLANNERS · SURVEYORS
3006 FUHRMAN AVENUE EAST
SEATTLE, WA 98102
(206) 709-2397

SCALE: 1/8" = 1'-0"
CHK BY: J. HUTCHINS
DRW BY: B. ABEL
REF:

YAKAMA NATION
TOPPENISH, WASHINGTON

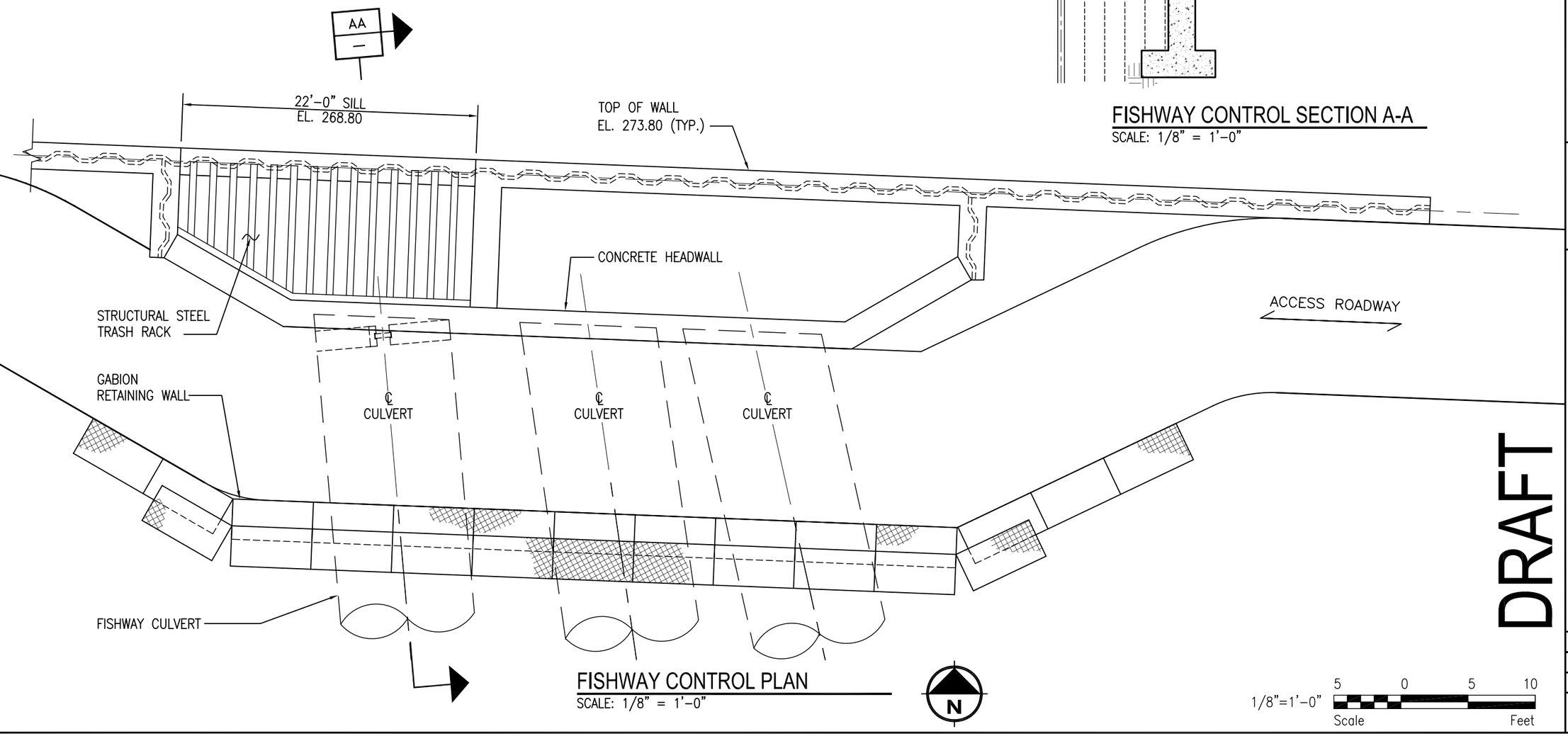
PINE CREEK FISH PASSAGE
ALTERNATIVE 1 – SECTIONS & DETAILS

JOB NO. 05014.00
DATE: 01/31/07
SHEET: 6 OF 7
DWG.# 6



FISHWAY CONTROL SECTION A-A

SCALE: 1/8" = 1'-0"



FISHWAY CONTROL PLAN

SCALE: 1/8" = 1'-0"

1/8"=1'-0" 5 0 5 10 Scale Feet

DRAFT

SCALE:	1/8" = 1'-0"
CHK BY:	J. HUTCHINS
DRW BY:	B. ABEL
REF:	

HARBOR CONSULTING ENGINEERS
ENGINEERS · PLANNERS · SURVEYORS
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SEATTLE, WA 98102
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YAKAMA NATION
TOPPENISH, WASHINGTON

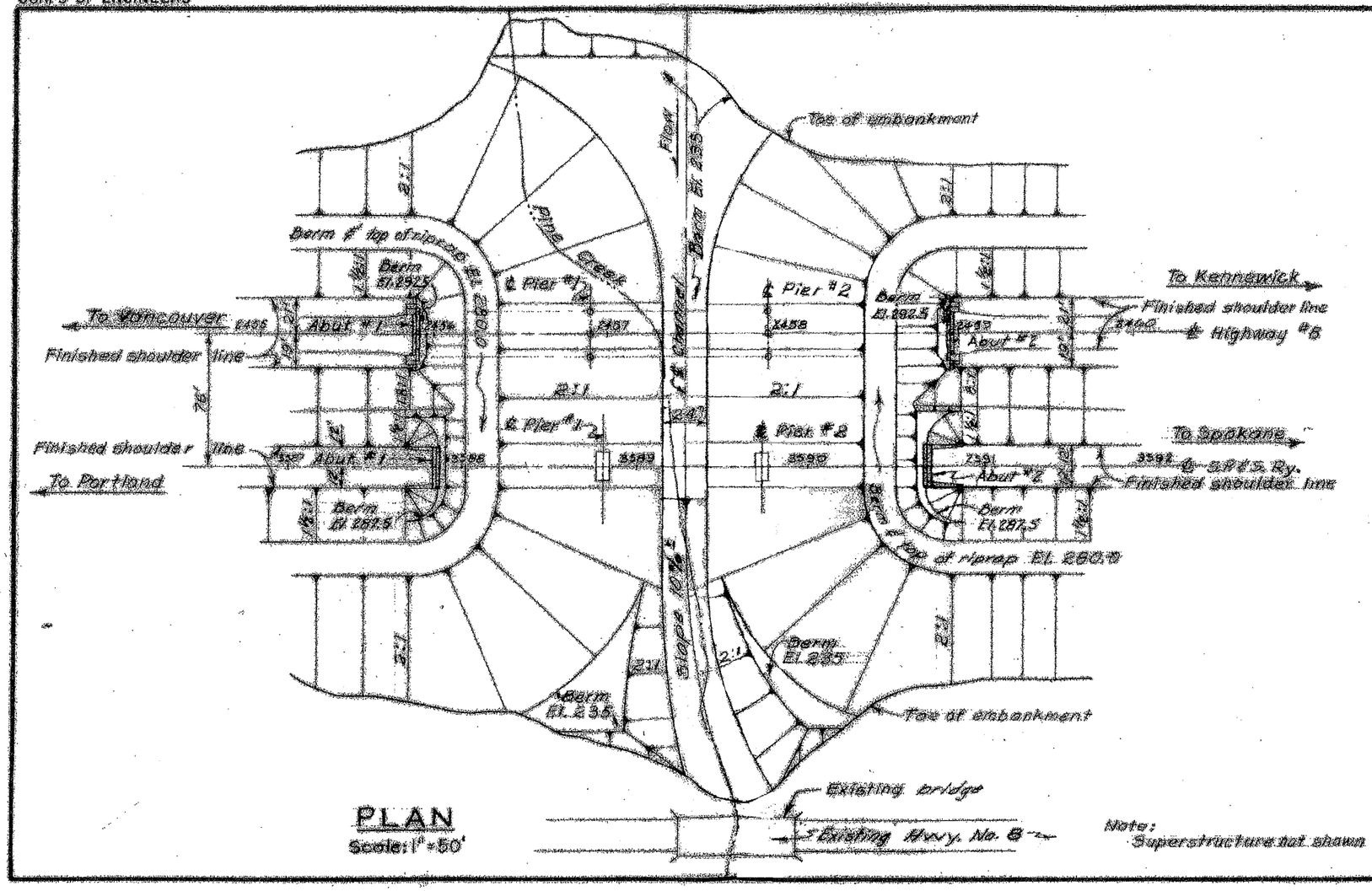
PINE CREEK FISH PASSAGE
SITE DEVELOPMENT PLAN

JOB NO.	05014.00
DATE:	01/31/07
SHEET:	7 OF 7
DWG.#	7

APPENDIX B

Conceptual Design Drawings
Bridge Alternative

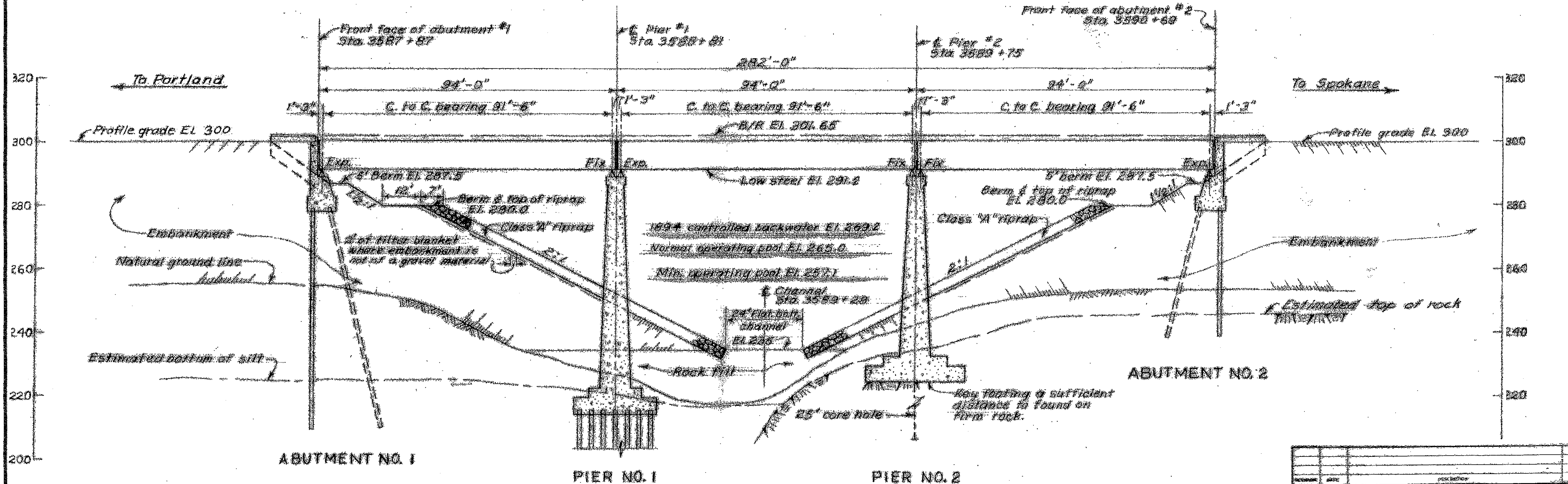
CORPS OF ENGINEERS



PLAN
Scale: 1" = 50'

U.S. ARMY ENGINEER DISTRICT SEATTLE, WASHINGTON		U.S. ARMY ENGINEER DISTRICT WALLA WALLA, WASHINGTON
D.A.S.	JOHN DAY LOCK AND DAM COLUMBIA RIVER OREGON AND WASHINGTON RELOCATION - S.P.&S. FACILITIES BRIDGE NO 133.54 (PINE CREEK) PLAN & ELEVATION	
J.C.P.		
J.W.R.		
H.D.S.		
Otto R. Bauer	Paul Hyndman	
E.C. Kruger		JD-05-11/86

Design Memorandum 5 — PLATE 22



℄ ELEVATION

PINE CREEK BRIDGE NO. 153.54

Scale: 1" = 20'

Note:
1. Bearings to be of pedestal type.
2. Abutment seat & top of pier El. 289.16.

U.S. ARMY ENGINEER DISTRICT SEATTLE, WASHINGTON	U.S. ARMY ENGINEER DISTRICT WALLA WALLA, WASHINGTON

JOHN DAY LOCK AND DAM
COLUMBIA RIVER OREGON AND WASHINGTON
RELOCATION - S.P. & S. FACILITIES
BRIDGE NO 153.54 (PINE CREEK)
PLAN & ELEVATION

Designed: D.A.S.
Drawn: J.C.P.
Checked: J.W.R.
Prepared: H.O.B.

Scale: As shown

JD-05-11/86

APPENDIX C

Preliminary Construction Cost Estimate
Fishway & Bridge Alternatives

Preliminary Construction Cost Estimate: Fishway Alternative

Project: Pine Creek Fish Passage

Client: Yakama Nation

ITEM	ITEMS OF WORK	QUANTITY	UNITS	UNIT COST	TOTAL COST
Submerged Blockage Removal: Pre-Fishway Construction					
1.	(3) Unifloats 10x6x40 ft	1	month	$5,000	$15,000
2.	Transportation Round Trip	6	trips	$1,200	$7,200
3.	Excavator with Thumb, Long Reach	6	days	$2,000	$12,000
4.	Excavator with Thumb, Std. Reach	6	days	$1,000	$6,000
5.	Equipment Transportation (Large Machine)	2	days	$2,200	$4,400
6.	Equipment Transportation (Midsize Machine)	2	days	$1,600	$3,200
7.	(2) Dump Trucks	4	days	$800	$6,400
8.	Labor:				
9.	(2) Equipment Operators	6	days	$750	$9,000
10.	(2) Truck Drivers	5	days	$600	$6,000
11.	(3) Labor	5	days	$500	$7,500
12.	Supervision	10	days	$800	$8,000
13.	Surveyors (1 Crew)	5	days	$1,700	$8,500
14.	Video Camera w/ Operator	2	days	$2,000	$4,000
15.	Small Tool Rental	1	LS		$5,000
16.	Debris Disposal	2,000	cy	$5	$10,000
	Subtotal				***$ 112,200***
Project Site Access: Highway 14 South Side Access					
1.	Paved Turnout	550	sy	$110	$60,500
2.	Culvert, 30" Dia.	50	LF	$95	$4,750
3.	Railroad Crossing	1	LS		$18,000
4.	Access Road and Landing	800	sy	$30	$24,000
	Subtotal				***$ 107,250***
Project Site Access: Highway 14 North Side Access					
1.	Access Road	1,700	sy	$30	$51,000
2.	Gabion Retainer	28	baskets	$250	$7,000
3.	Highway Guard Rail	60	LF	$50.00	$3,000
	Subtotal				***$ 61,000***
Pine Creek Pond Cutoff Wall					
1.	520 L.F. PMA-22 Sheet Pile	120	tons	$1,600	$192,000
2.	Sheet Pile Installation	520	LF	$250	$130,000
3.	Channel Cap, C6x13	3.5	tons	$2,100	$7,350
	Subtotal				***$ 329,350***

ITEM	ITEMS OF WORK	QUANTITY	UNITS	UNIT COST	TOTAL COST
Concrete Fishway					
1.	Temporary Coffer Dam	2,800	sf	$6	$16,800
2.	Steel Pile Foundation, (19) 16"Ø x 60ft Pile	295	tons	$1,400	$413,000
3.	Pile Driving	19	Ea	$1,600	$30,400
4.	Cast-In-Place Fishway Concrete	172	cy	$550	$94,600
	Subtotal				***$ 554,800***
Culvert Fishway					
1.	Concrete to Culvert Anchor	14	Ea	$500	$7,000
2.	Concrete Weirs	14	cy	$1,000	$14,000
3.	Entrance Weirs, Concrete Sills	8	cy	$800	$6,400
4.	Structural Steel Trash Rack	5,200	lbs	$2	$10,400
	Subtotal				***$ 37,800***
Summary					
	Blockage Removal				$112,200
	Site Access				$168,250
	Pond Cutoff Wall				$329,350
	Concrete Fishway				$554,800
	Culvert Fishway				$37,800
	Subtotal				***$ 1,202,400***
	Estimated Contingency @ 20%				$ 240,500
	TOTAL				**$1,442,900**

Preliminary Construction Cost Estimate: Bridge Alternative

Project: Pine Creek Fish Passage

Client: Yakama Nation

ITEM		ITEMS OF WORK	QUANTITY	UNITS	UNIT COST	TOTAL COST
Railroad Bridge: 3 Spans, 280 ft Long						
1.		Bypass Track	2,500	LF	$200	$500,000
2.		Highway Relocation	2,500	LF	$100	$250,000
3.		Temporary Highway Retaining Wall	500	LF	$1,600	$800,000
4.		Site Excavation & Stabilization	55,000	cy	$45	$2,475,000
5.		Drilled Shaft Piers				
6.		(4) 10' Dia x 120 ft	480	LF	$2,000	$960,000
7.		(4) 8' Dia. x 70 ft	280	LF	$1,500	$420,000
8.		Concrete Piers	240	cy	$600	$144,000
9.		Abutments on Pile Foundations	2	Ea	$112,000	$224,000
10.		Plate Girders: 10 ft Deep, In-Place	200	tons	$4,000	$800,000
11.		Floor Beams & Track	280	LF	$500	$140,000
12.		Final Excavation & Stabilization	40,000	cy	$60	$2,400,000
		Subtotal				***$ 9,113,000***
		Contingency @ 30%				$ 2,733,900
		TOTAL				**$ 11,846,900**
Highway Bridge: 3 Spans, 280 ft Long						
1.		Site Earthwork, Stage 1	20,000	cy	$40	$800,000
2.		Drilled Shaft Piers				
3.		(4) 6 ft Dia. x 120 LF	480	LF	$1,200	$576,000
4.		(4) 4 ft Dia. x 70 LF	280	LF	$1,000	$280,000
5.		(2) Pier Heads	100	cy	$800	$80,000
6.		Abutments	2	Ea	$90,000	$180,000
7.		Concrete Deck Girders	10,080	sf	$300	$3,024,000
8.		Site Earthwork, Stage 2	15,000	cy	$60	$900,000
		Subtotal				***$5,840,000***
		Contingency @ 30%				$1,752,000
		TOTAL				**$7,592,000**

Appendix D

Photograph Log

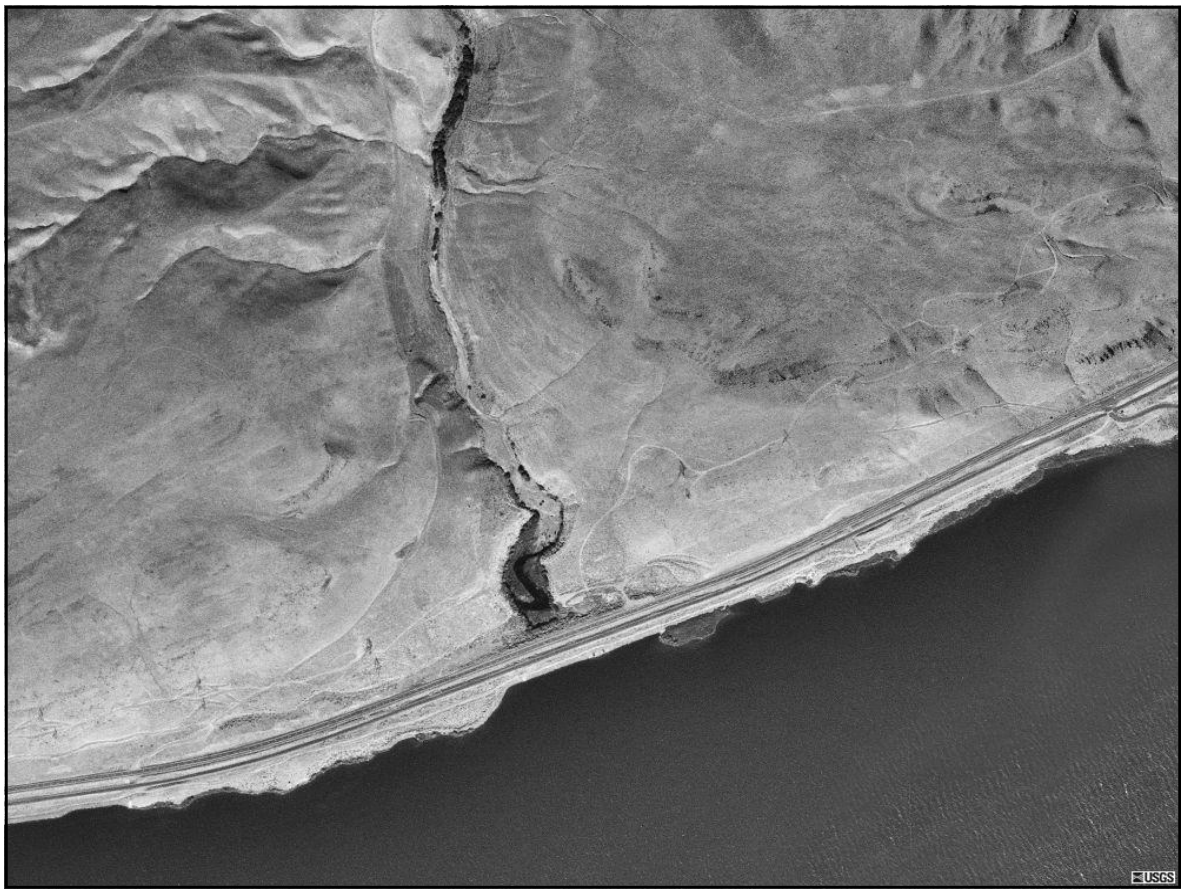


Photo 1

Aerial Photo — Pine Creek Site

Photo 2

Alluvium deposition zone upstream of project site

Photo 3

Pine Creek upstream of project site

Photo 4

Pine Creek riparian pond at Hwy. 14 crossing

Photo 5

Riparian pond at Hwy. 14 crossing

Photo 6

Underwater camera survey

Photo 7

Upstream entrance of 3-culvert conveyance with concrete headwall

Photo 8

Downstream discharge of 3-culvert conveyance into Columbia River

Photo 9

Discharge of culverts into Columbia River

Photo 10

West culvert discharge