WAHKIACUS HATCHERY
CONCEPTUAL DESIGN STUDY

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Introduction

The Wahkiacus Hatchery and Acclimation Facility (WHAF) site is located near the town of Klickitat, WA at approximate river mile 17.2 on the Klickitat River.

Harbor Consulting Engineers, Inc., was tasked by the Yakima/Klickitat Fish Project (YKFP), Yakama Nation, through funding provided by Bonneville Power Administration (BPA), to accomplish a 30% conceptual design for the development of a new salmon hatchery. This effort focused on the following features and operations of the Hatchery:

- Well and river water supply;
- Site access, planning and circulation;
- Fish handling and rearing facilities;
- Incubation facilities for 2,000,000 Fall Chinook and 1,000,000 Coho;
- Office facilities for hatchery operations;
- Maintenance and storage buildings;
- Dedicated chemical storage building;
- Hatchery staff housing.

Design efforts are in conjunction with the 30% conceptual design of the Klickitat Hatchery located at river mile 42 of the Klickitat River.

History

Currently, the Yakima / Klickitat Fisheries Project field office personnel work from this site. Structures include:

- A two story residence, used as offices;
- Storage shed;
- Trailer, used as offices;
- Maintenance shop.

Property Ownership

The proposed hatchery site is located on property owned by the Confederated Tribes and Bands of the Yakama Nation and is at approximate River Mile 17.2 on the Left Bank of the Klickitat River. Swale Creek runs through the site from the southeast toward the northwest and its confluence with the Klickitat River. Also traversing through the site are County Road No. 22140, Horseshoe Bend Road, and the Klickitat Trail, a former railroad right-of-way, now owned by the Washington State Parks and Recreation Commission. County Road No. 21690, Schilling Road, forms the southerly boundary of the hatchery parcel. Surrounding property ownerships are as follows:

- To the north – Washington Dept. of Fish and Wildlife and separate private owner;
- To the east – three parcels, all private owners;
- To the south – two parcels, all private owners;
- To the west – Washington Dept. of Fish and Wildlife;
- A small parcel fronting on Horseshoe Bend Road and surrounded on the other three sides by Yakama Nation property is owned by private owner.

Purpose of This Project

The WHAF is identified as a critical facility for the Yakama Nation to meet the goals and objectives within the Klickitat Subbasin Anadromous Fishery Master Plan. By shifting production of coho and fall Chinook down river to this site from the Klickitat Hatchery, 24.8 miles of the high quality habitat is made available for natural spawning and rearing. This geographic shifting of coho and fall Chinook production also minimizes negative interactions between hatchery and endemic stocks.

During the development of the WHAF, Harbor Consulting Engineers held design charrettes with the Yakama Nation and concerned agencies to develop the hatchery layout. Participants also included USFWS, WDFW and USGS. The final design accommodates fish production goals, curbs the potential for biological contamination, minimizes the environmental footprint of the facility, and incorporates a significant level of flexibility and safety. This much needed facility will help ensure the successful production of fish and aid in reaching future production goals.

Permitting

Anticipated permits required for this project include:

- Dept of the Army, Corps of Engineers, Section 404 Permit;
- Washington Dept. of Fish and Wildlife, Hydraulic Project Approval;
- Washington Dept. of Ecology, Section 401 Water Quality Certification;
- Klickitat County Planning Dept., Shoreline Permit and State Environmental Policy Act (SEPA) approval;
- Klickitat County Building Dept., Building Permit;
- Klickitat County Health Dept., On-site Sewage Installation Permit.

Expected time needed to prepare applications and secure approval will range from 6 to 12 months, depending on the responsiveness of the agencies listed above.

Site Planning

Civil aspects of the site design were implemented with priorities placed on site functionality and environmental impact. Impervious surfaces are minimized, storm water runoff will be collected and subjected to Washington Department of Ecology Best Management Practices prior to discharge and special attention has been given to minimizing site disturbance.

Vehicle traffic at the site will consist primarily of light passenger vehicles with occasional H-20 loading from fish transfer and feed supply trucks. As such, primary site paving will consist of crushed rock surfacing over 12 inches of 4 inch minus compacted base course. Impervious surfaces are limited to only those areas expected to experience frequent vehicle traffic and will consist of 4 inches of asphalt pavement over 6 inches of crushed rock base and will total approximately 0.96 acres near the main hatchery building. Storm water runoff on impervious surfaces and building roofs will be collected and directed to a catchment for primary treatment to isolate sediments and debris prior to discharge to the river. Hazardous material and fuel transfer areas on site will be isolated from the primary stormwater network and will include a dedicated spill containment system to prevent site contamination.

The existing residence, storage building and mobile trailers will be demolished and removed from the site.

The site elevation will be raised to elevation 526 (NAVD88) to protect against flooding up to a 100 year exceedance flood flow. No fill will be placed within the floodway as determined by FEMA 1-foot rise criteria. Borrow material for site fill will be obtained from an onsite source located at the proposed residence site. A volume of approximately 25,000 cubic yards of material will be required. Above ground concrete raceways will be utilized to minimize predation of fish populations and eliminate seepage of effluent waters into adjacent soils. Adequate driveway clearance has been provided around all structures to allow drive through access for all required vehicle traffic including fish transfer trucks and emergency vehicles. No offsite disposal of material is anticipated. Site grading will be designed to channel stormwater away from buildings by swales and/or slopes.

Sanitary waste water from hatchery buildings and residences will be conveyed to septic systems designed in accordance with Washington State and Klickitat County requirements. Manholes or surface cleanouts will be located at changes in grade or alignment of conveyance pipes and at connections of new to existing services.

New hatchery water collection and distribution piping will supply and drain new facilities. Pipelines have been sized to minimize head loss using a maximum allowable velocity of five feet per second. New piping will be steel where exposed above ground or where subjected to high pressure or velocity head or where transient pressures (water hammer) are a possibility. All other piping will be thermoplastic, either PVC or HDPE. All buried piping will be placed on minimum six inches of bedding and backfill will be compacted to 95% maximum dry density. Pipe bedding and backfill will meet requirements of WSDOT Standard Specifications. Above ground piping will be supported on restrained concrete supports placed at a maximum spacing of 40 feet. Flexible couplings will be provided at locations where pipes enter structures or where thermal expansion is a concern. Thrust blocks will be provided as required to restrain piping at changes in slope and alignment.

Contractor material storage and staging areas will be located to minimize site impacts. Temporary erosion and sediment control best management practices will be implemented at all disturbed areas and material storage locations. Following construction, all disturbed areas will be hydroseeded with a seed mix consisting of native grasses and forbs.

Site Security

Public vehicular traffic will access the site via the Horseshoe Bend Road from Highway 142. Visitor parking will be located along Wahkiacus Park Road. Monitoring cameras and alarms will be installed. This security surveillance system will include remote monitoring via satellite internet connection.

Hatchery Water Supply

The proposed water system includes creek water from Swale Creek in addition to river water drawn directly from the Klickitat River. Some water for domestic consumption may be drawn from an existing well. Facility water needs have been calculated based upon the biological demand of the proposed hatchery's capacity.

Design Criteria & Methodology

The Wahkiacus Hatchery Water System design is a combination of two goals: 1) to meet the requirements for the biological demand of the design loading of fish; 2) to design a hatchery that is not only functional but has a minimal environmental footprint. The newly proposed design is intended to provide for the needs of 2 million fall Chinook and 1 million coho. The water requirements for the facility are anticipated to have a high of 25 CFS during the month of March and a low of 10 CFS during the month of June. The majority of this water will have to be pumped river water while a portion will be taken from Swale Creek.

In order to operate the hatchery on this volume of water, it is necessary to reuse water within each species. This is done for two reasons. One, by reusing the water it is possible to reduce the power consumption of the facility, in that less water must be pumped from the river. It should be noted that there is nominally zero hydraulic head available at this facility and any reduction in water usage results directly in power savings. The second reason for recycling flows is to minimize the facility's environmental impact on the local hydrology.

Water Considerations

Harbor Consulting Engineers considered a variety of possible water flows/use patterns and decided upon one that would make the best possible use of the available water. Specific focus was placed on ensuring that hatchlings and broodstock would have their biological water needs met. The system is designed to use gravity feeds whenever possible, thereby minimizing multiplicative pump losses. In order to minimize water consumption for the facility, water recycling (passing water from juveniles to adults of the same species) is a key design implementation. This results in reducing the peak required water by approximately 30%. Since additional water would have to be taken from the Klickitat River, this lessens the impact on river flows in addition to reducing the amount of pumping required for the operation of the facility thereby improving the facility's environmental footprint.

Harbor's design intent is that the facility will likely be in operation for 40+ years and may require a significant level of flexibility in the design. The system is designed to minimize maintenance, reduce energy consumption, maximize flexibility, and maintain a high level of reliability throughout its lifetime.

Environmental

As with any hatchery, fish health and habitat (both within and outside the facility) were a major concern. Water flows are managed in such a manner as to prevent disease from spreading from one species to another. Additionally, techniques to mitigate contamination to the Klickitat River are incorporated to ensure that hatchery operations do not adversely affect river water quality. All waste streams are contained and treated in an appropriate manner prior to release. All intakes are designed in such a manner as to ensure safe passage for juvenile fish and minimize the impact on wildlife.

One of the primary goals of the design is to make the hatchery as 'green' as possible. The facility will require nearly all of its water to be pumped from the river. However, by properly routing the water it is possible to pump it only once, resulting in improved system efficiency when compared to systems utilizing booster pumps. All river water will be centripetally filtered. This ensures a long system life by reducing fouling, in addition to using an efficient and environmentally friendly means of cleaning the water, as opposed to cartridge filters, or

chemical treatments. The end result is a facility that, although operating on pumped water, will require minimal maintenance and volume of water compared to the level of production.

Inspection & Maintenance

As with any major facility, continual maintenance and inspection will be required for operation. However, it has been a major design focus to reduce the need for this via two routes. The primary route is to remove unnecessary mechanical components (mainly pumps) from the design via careful attention to elevations. This results in a reduction in the number of mechanical components required, thereby reducing any associated maintenance on those systems. Aside from minor subsystems, the only pumping required is forwater drawn from the Klickitat River. This water is pumped only once, removing multiplicative efficiency losses and then used multiple times throughout the facility. Reused water will be cascaded in order to ensure the highest possible dissolved oxygen levels in addition to ensuring that any byproducts are removed prior to reuse.

A primary design feature is to incorporate centripetal filtration units located at the river water intake in order to reduce the level of maintenance associated with river water use. While the filter units themselves will require periodic inspection and maintenance, the end result will be the elimination of the need for a settling pond and much cleaner water flowing throughout the system, thereby reducing fouling.

System redundancy is a key design feature meant to improve reliability, in addition to allowing for maintenance to be performed without compromising the continued operation of the system. Dual filtration skids and redundant water flows are intended to allow for system isolation both for inspection and to facilitate repairs if necessary. Furthermore the facility will be connected to the local utility for electrical power and will have backup generator sets available in the event of an electrical failure.

River Water Intake

A new river intake has been designed to fulfill the anticipated water demands of the proposed hatchery. The new intake structure takes special consideration to meeting National Marine Fisheries Service (NMFS) guidelines for juvenile fish protection, as set forth in the Anadromous Salmonid Passage Facility Design guide.

The new river intake has been located at an existing constriction in the river created by a bridge abutment downstream of the hatchery site. The constriction provides a maintained scour hole to draw hatchery water from year round. The bed elevation of the river in this reach is dynamic, however the constriction and associated scour hole provide a stable minimum water depth.

A maximum water demand of 30 CFS at the 95% exceedance river flow was used as the basis for the river intake design. A screen area of 75 SF was determined to be required to meet NMFS screen approach velocity criteria. Screens are designed to be self cleaning, operating as required to maintain unobstructed flow. Airburst will be utilized to mobilize sediments that accumulate in the intake structure. The intake design includes an oversized trash rack placed parallel to river flow in an effort to maximize sweeping velocity and minimize transverse water velocities at the intake entrance. This effort will minimize juvenile fish entrainment and reduce sediment loads in the intake.

The intake has been designed to minimize water velocities through the trash rack while utilizing the main channel flow for sweeping velocity past the screens. Juvenile fish and debris egress is realized through an open downstream end of the intake structure.

Main Hatchery, Vehicle Storage and Maintenance Building

The main hatchery, offices, vehicle storage and maintenance functions will be combined into one structure. The approximate areas are:

First floor office / personnel spaces	4,350 SF
Second floor office / personnel spaces	3,000 SF
Incubation room	2,250 SF
Vehicle storage	3,500 SF
Maintenance shop	2,500 SF
Total square feet	15,600 SF

The first floor office / personnel spaces will feature:

- a small lobby and work area for office equipment;
- 4 offices;
- a large conference room;
- men's & women's restrooms with showers;
- lunchroom;
- mudroom;
- storage;
- mechanical room;
- server / IT room.

A second story is anticipated to house the YKFP field office staff. The second story will include:

- 6 offices;
- men's and women's restrooms;
- a common work area for office equipment;
- a small lunch / coffee area;
- storage rooms.

The vehicle and maintenance facility will be attached to the hatchery building.
These areas will include the following features:

- maintenance workshop area;
- one office;
- unisex restroom;
- locked shop storage room;
- open storage shelves for parts storage;
- welding shop;
- wood shop;
- vehicle storage for 5 large vehicles.

Six vehicle bays are provided with 13 foot tall roll-up doors. The bays can accommodate vehicles up to 40 ft. long. Consideration was given to the possibility of providing a vehicle lift, or lift pit. It was determined that major vehicle maintenance would not be done at this facility,

so a pit lift would rarely be needed. Also, worker safety would be a major concern around vehicle lift equipment. A three ton overhead bridge crane will be installed to assist with equipment maintenance.

A steel / welding and carpentry shop will be included in the vehicle and maintenance section of the building. Features of the shops will include:

- Compressed Air;
- 220 volt power;
- Fire suppression;
- Exhaust system;
- Emergency eye wash station.

The vehicle and maintenance areas of the facility will be "Keep From Freezing" (KFF), which means the interior temperature will be kept above 40°. The radiant hot water heat will be able to accomplish this. The heating system will be supplemented with electric wall heaters in the office and restroom. Radiant overhead heaters can be located for on demand work shop heat in shop areas.

The construction of this facility will be:

- Concrete slab on grade, with radiant heat incorporated into the slab;
- Concrete Masonry Unit (CMU) cavity walls, with interior steel framing;
- Wood frame, steel stud or CMU interior partitions;
- Aluminum windows;
- Steel trusses;
- Standing seam metal roof over insulation and steel roof decking;

Also considered was the potential need for isolated incubation in the future. Should the need arise, freestanding aluminum frame with acrylic wall panels are available for less than $5,000. These can be quickly assembled using hand tools. One company who provides these systems is 80/20 http://8020.net/Contact-Info.asp.

Chemical Storage

The facility uses the following chemicals in their hatchery operations:

- Virkon Aquatic;
- "Parasite-s" (Formalin mixture);
- Ovadine (PVP Iodine).

The critical chemical relative to storage is the Parasite-s. This preparation is a "Class III A" combustible. According to the 2009 International Building Code, the maximum allowable quantity per control area (a fire separated area within another structure) is 330 liquid gallons (6 barrels). This facility requires 12 barrels of storage. The code requirements dictate a separate chemical storage structure. The chemical storage building will be a CMU structure 23 ft. x 15 ft. (345 square feet) with a containment vault in the floor and a metal roof.

Sorting and Spawning Facility

The new sorting and spawning facility will be located to the northwest of the hatchery and maintenance facility. PIT tag transceivers will also be housed in this structure

The features of this facility will include:

- Concrete fish lift, with mechanical stainless steel lifting brail;
- Shock tank;
- Stainless steel work tables;
- Fish return chutes (16" pipes – four to the adult holding bays,one back to the river and one to the fish transport truck)
- Wire tag reader;
- Egg take area;
- Biological sampling work area;
- Carcass holding racks;
- Gear wash down area with floor drain;
- Mud room with gear lockers;
- Men's and women's ADA restrooms;
- Flake ice machine and storage;
- Freezer.

The construction of this structure will include:

- Concrete slab on grade in the basement, with radiant heat incorporated into the slab;
- Concrete filled metal deck with floor / trench drains;
- Concrete masonry unit (CMU) walls, with interior steel framing;
- Wood frame or CMU interior partitions;
- Aluminum windows;
- Steel trusses;
- Standing seam metal roof over insulation and steel roof decking;

The floor drains in the spawning area will have a two-way valve to control drainage. The default position will send wash-down water to the river. When sanitizing the spawning area becomes necessary, the valve can be turned, and water used along with sanitizing chemicals can be allowed to drain to a dry well.

Fish Ladder

A vertical slot fishway will be used to bring returning adults to the adult holding area containing three swim-through pit tag antennas. River water return will exit through the fish ladder entrance. The ladder will join a transportation channel leading to the adult holding ponds through a fike gate.

Adult Holding

The fish will enter through a fish ladder. A holding channel will lead to four adult holding bays. These concrete holding ponds are 7'-6" wide, 41 ft. long and 10 ft. high. Actual water depth will be 3 to 5 feet, depending on species being held. Each pond will have water supply and elevation control. A crowder will also be provided in the channel to move the fish into the fish lift. The fish lift will raise the fish with a mechanical brail. This will bring the fish into the adult sorting and spawning facility. Adult holding facilities will accommodate truck transported fish of various species.

Water Distribution Building

The Water Distribution building will be located adjacent to the river water intake structure on the left bank. Water distribution functions will be associated with river water pumping, water sediment removal and equipment associated with intake screen cleaning. Additionally, space will be provided for equipment relating to fishway PIT tag antennas. Screen cleaning features will include compressed air, hydraulic fluid pumping, security & monitoring systems and electrical controls. A cast-in-place concrete pump well containing four turbine pumps will supply up to 30 CFS of water for fish production. Pumping will be achieved through a series of 4 vertical axial flow wet pit pumps operating in parallel. Depending on hatchery water demand, pumps may be cycled to reduce pumping costs. The pump manifold and discharge 36" diameter piping are planned to be placed below finish floor in trenches covered with steel grating. Two centrifugal liquid/solid separators will be utilized to remove sediments from the hatchery water supply. Additional filtering of incubation water will be performed to minimize potential for obstruction of incubation equipment.

The slab-on-grade building will use spread footings and walls constructed of CMU, with a 12 foot eave height. The 6:12 pitch roof will be constructed of steel trusses and insulated metal deck sheathed with standing seam metal roof. A two ton overhead bridge crane will be installed to assist with equipment maintenance. An overhead coiling door, 10 feet wide by 10 feet tall will provide equipment and maintenance access. Personnel egress will be code compliant. Lighting will be a combination of natural daylight, and artificial lighting. Standby power generated on site will be sufficient for pumping and control equipment requirements.

Juvenile Rearing Raceways

These raceways will include the following features:

- Independent water supply;
- Individual pond depth control;
- Crowders;
- 'Kettle' on drain end.

Pollution Abatement Facilities

A two-part settling basin coupled with aeration is anticipated to reduce dissolved and settle-able solid discharge. Vacuumed fish pond sediments will be pumped to pollution abatement facilities.

Staff Housing

Two or three stick-framed, two story, four bedroom, two bathroom, two car garage homes are proposed. Electric power will be used for residential heat. Wood burning fireplace/ stove will serve for added comfort and heat in the event of a power outage. Two sites are under consideration for staff housing. Residence option A is located south of the proposed hatchery complex, between Schilling Road and the Klickitat Trail. Residence option B is located to the east of the proposed hatchery complex at the hatchery fill borrow area.
Use of manufactured homes was investigated and not recommended. The advantages of conventional home construction over manufactured homes are:

- Life cycle costs are favorable with conventional construction;
- Conventional wood frame homes require less maintenance;

- Conventional wood frame homes will be more pleasant and better for employee morale;
- Conventional wood frame homes lend themselves to proper remodeling if required in the out year;
- In this forest environment, fire hardened homes will be required.

Structural Design Criteria:

This site has been examined for structural design criteria. The current code is the 2009 International Building Code(IBC). Site specific load criteria is as follows:

Seismic:	Design Criteria Site Class C (IBC & ASCE 7) Ss = 0.48, S1 = 0.18
Ground Snow Load:	155 PSF (Per Klickitat County Planning Department)
Wind:	In accordance with ASCE 7, Min Design Load for Building and other Structures. Basic wind speed (3-second gust) = 85 MPH, exposure B and I, Wind Importance Factor,Iw = 1.0
Live Loads:	Per IBC
Frost Depth	18”

Adult Holding - Volume & Flow Calculations - Wahkiacus

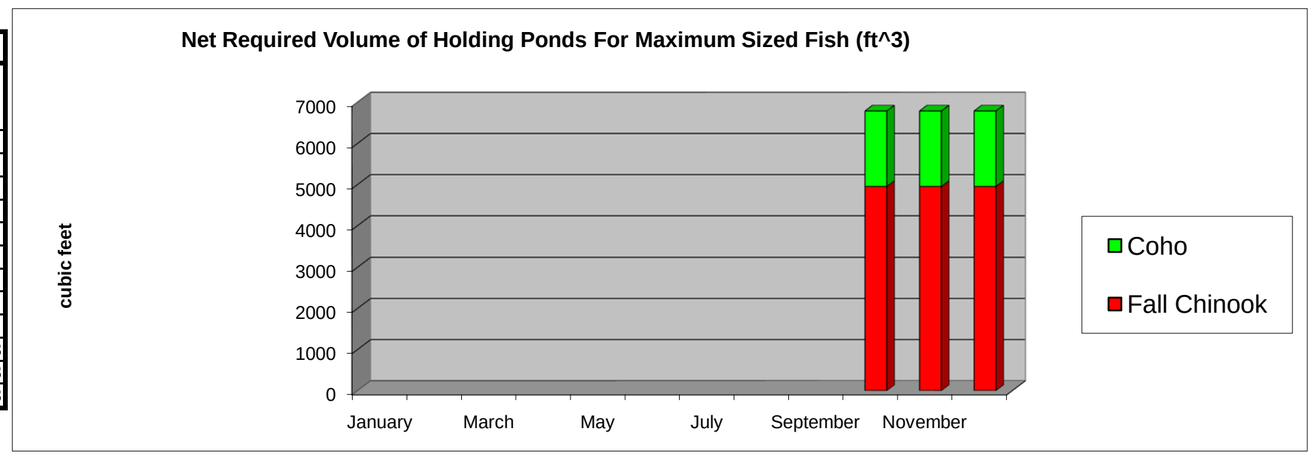
<<indicates value may be varied by user

Species	Number of adults	Minimum Size (lbs)	Minimum Size (as per curve fit of Piper Table I-4&5 - inches)	Maximum Size (lbs)	Maximum Size (as per curve fit of Piper Table I-4&5 - inches)	D (as per Piper 1982 rec for broodstock--lbs/ft^3/in)	Flow index (1.5 corrected to altitude of 1000ft & 60 deg H2O temp)	Percentage of Broodstock being held
Fall Chinook	1000	15	36.7	20	40.4	0.1	1.24	100.00%
Coho	842	10	30.6	10	30.6	0.15	1.24	100.00%

Species	Adult holding Pond Length (ft)	Adult holding Pond width (ft)	Adult holding Pond depth (ft)	Adult holding Pond volume (ft^3)	Net Minimum Required flow (GPM)	Net Minimum Required Volume (ft^3)	Net Maximum Required flow (GPM)	Net Maximum Required Volume (ft^3)	Minimum scenario # of ponds required	Maximum scenario # of ponds required
Fall Chinook	48	9	6	2592	330	4086	399	4953	2	2
Coho	48	9	6	2592	222	1833	222	1833	1	1

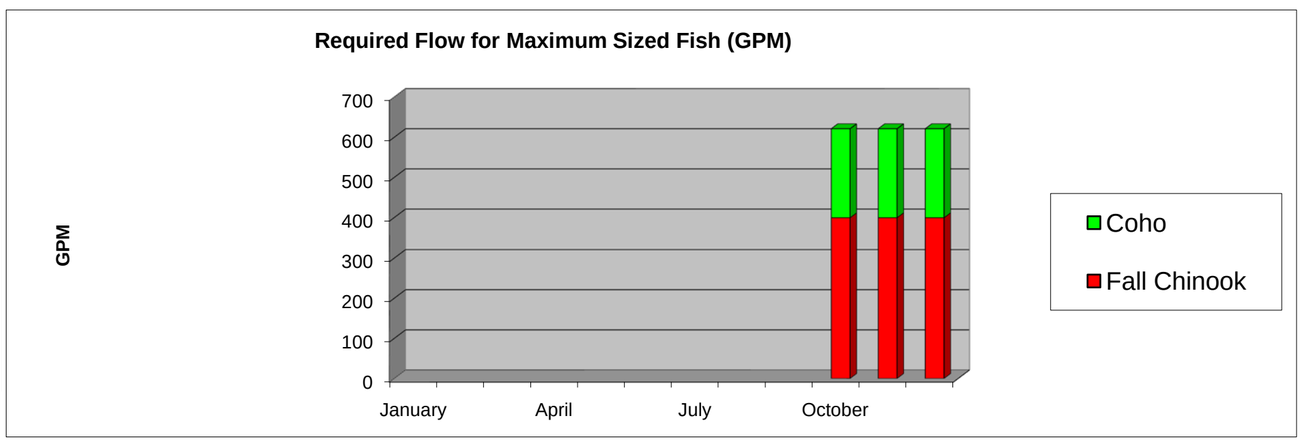
Required Volume for Maximum Sized Fish (ft^3)

Dates		Fall Chinook		Coho
January				
February				
March				
April				
May				
June				
July				
August				
September				
October		4953		1833
November		4953		1833
December		4953		1833



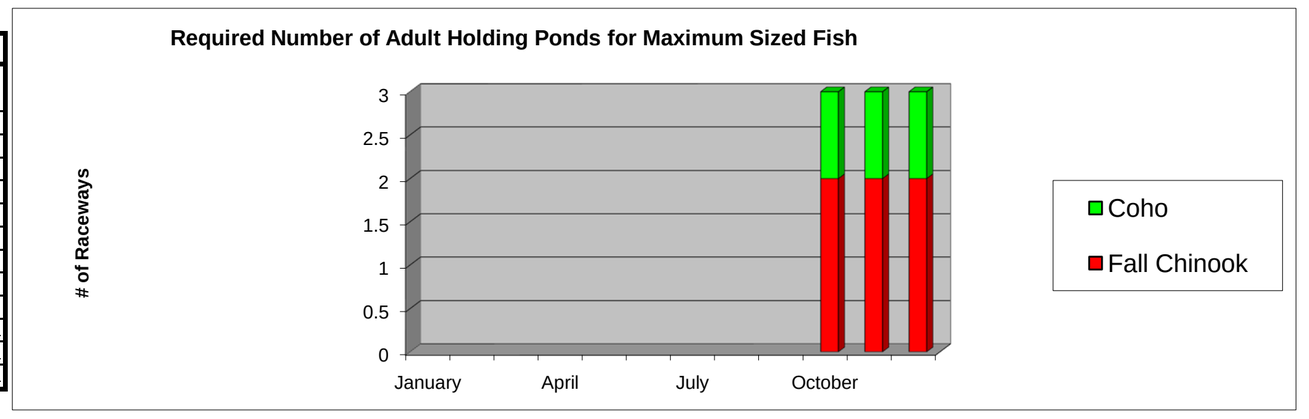
Required Flow for Maximum Sized Fish (GPM)

Dates		Fall Chinook		Coho
January				
February				
March				
April				
May				
June				
July				
August				
September				
October		399		222
November		399		222
December		399		222



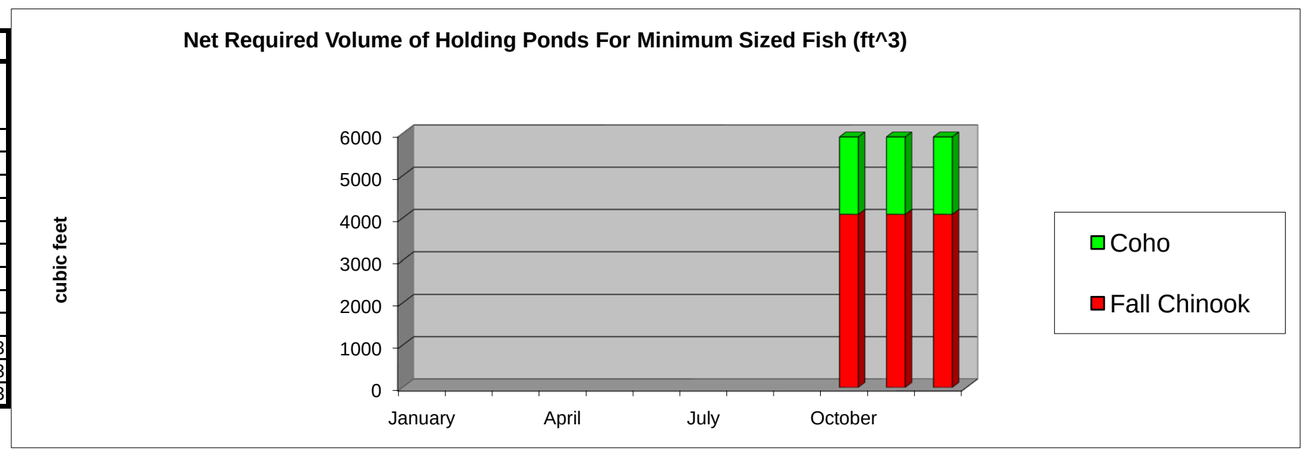
Required # of Adult Ponds for Maximum Sized Fish

Dates		Fall Chinook		Coho
January				
February				
March				
April				
May				
June				
July				
August				
September				
October		2		1
November		2		1
December		2		1



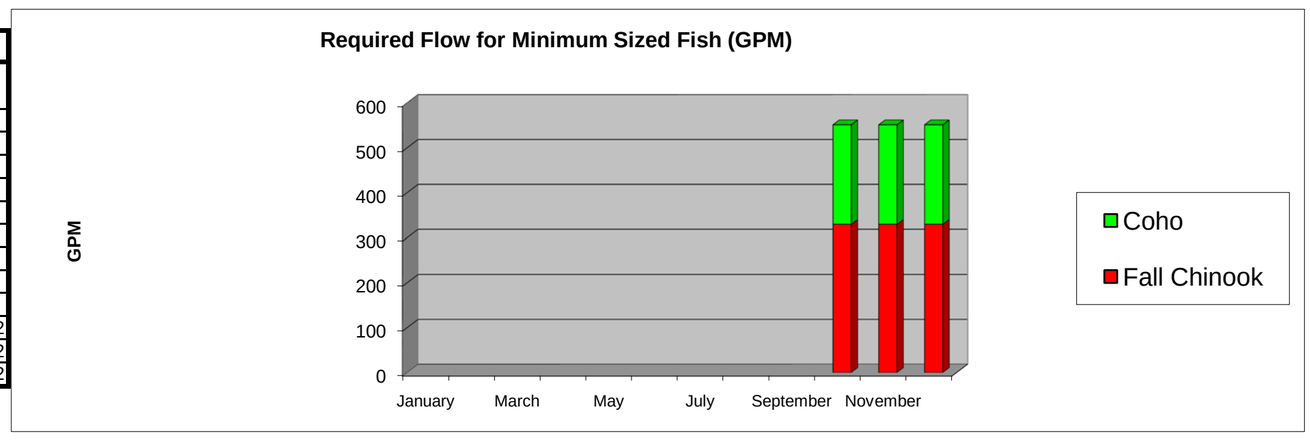
Required Volume for Minimum Sized Fish (ft^3)

Dates		Fall Chinook		Coho
January				
February				
March				
April				
May				
June				
July				
August				
September				
October		4086		1833
November		4086		1833
December		4086		1833



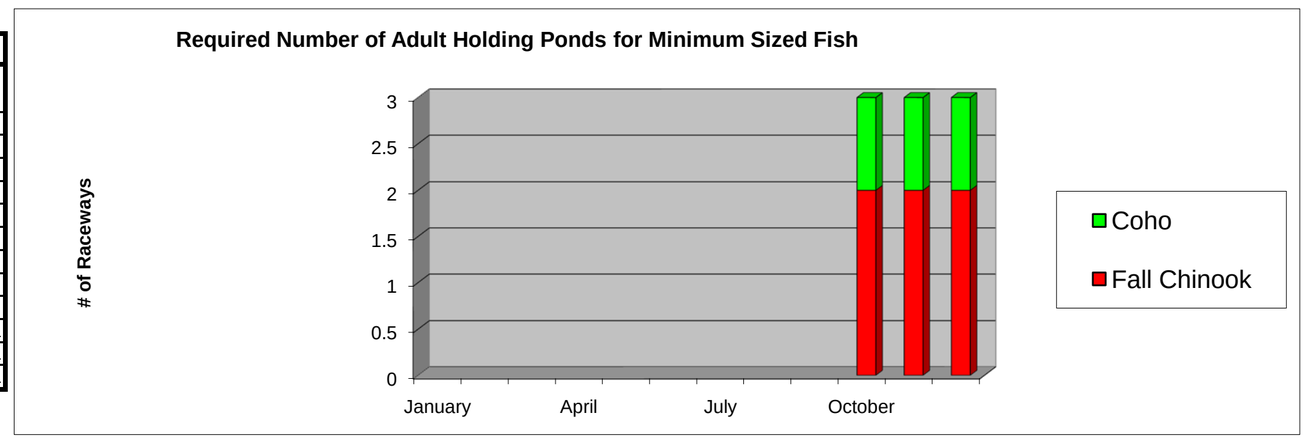
Required Flow for Minimum Sized Fish (GPM)

Dates		Fall Chinook		Coho
January				
February				
March				
April				
May				
June				
July				
August				
September				
October		330		222
November		330		222
December		330		222



Required # of Adult Ponds for Minimum Sized Fish

Dates		Fall Chinook		Coho
January				
February				
March				
April				
May				
June				
July				
August				
September				
October		2		1
November		2		1
December		2		1



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Jumbo Raceway - Volume & Flow Calculations - Wahkiacus

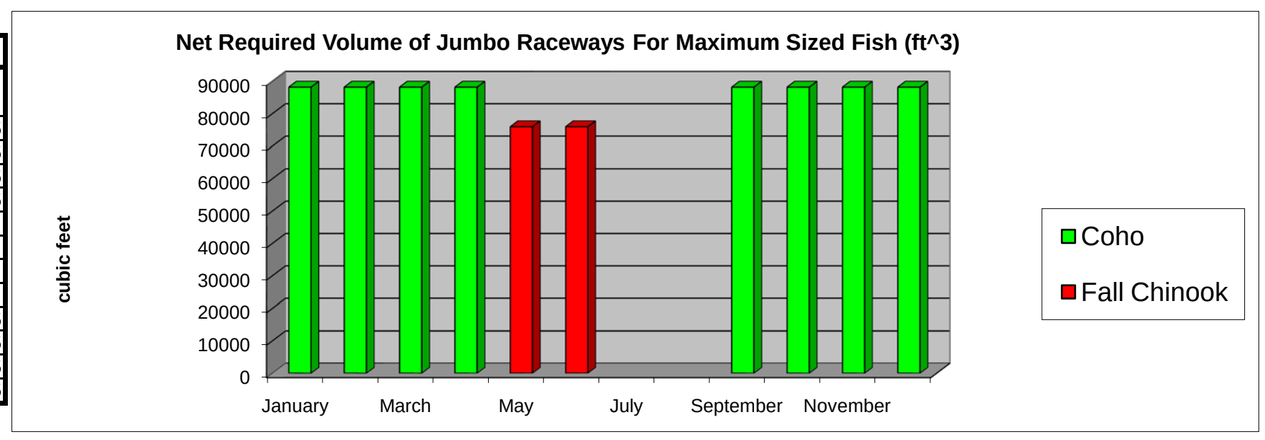
<<indicates value may be varied by user

Species	Number of	Minimum Size (lbs)	Minimum Size (as per curve fit of Piper Table I-4&5 - inches)	Maximum Size (lbs)	Maximum Size (as per curve fit of Piper Table I-4&5 - inches)	D (as per Piper 1982 rec for broodstock--lbs/ft^3/in)	Flow index (1.5 corrected to altitude of 1000ft & 60 deg H2O temp)	Percentage being held
Fall Chinook	2000000	0.0125	3.427	0.0133	3.501	0.1	1.24	100.00%
Coho	1000000	0.0500	5.270	0.0660	5.756	0.13	1.24	100.00%

Species	Jumbo Raceway Length (ft)	Jumbo Raceway width (ft)	Jumbo Raceway depth (ft)	Jumbo Raceway volume (ft^3)	Net Minimum Required flow (GPM)	Net Minimum Required Volume (ft^3)	Net Maximum Required flow (GPM)	Net Maximum Required Volume (ft^3)	Min scenario # of Jumbo raceways required	Max scenario # of Jumbo raceways required
Fall Chinook	90	20	6	10800	5883	72951	6127	75970	7	8
Coho	90	20	5	9000	7652	72985	9247	88205	9	10

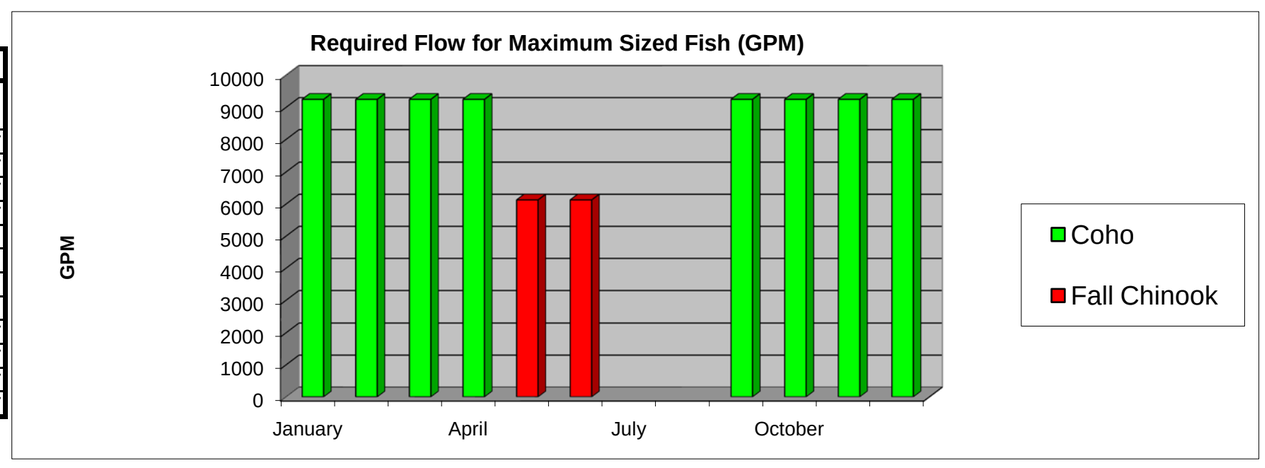
Required Volume for Maximum Sized Fish (ft^3)

Dates		Fall Chinook		Coho
January				88205
February				88205
March				88205
April				88205
May		75970		
June		75970		
July				
August				
September				88205
October				88205
November				88205
December				88205



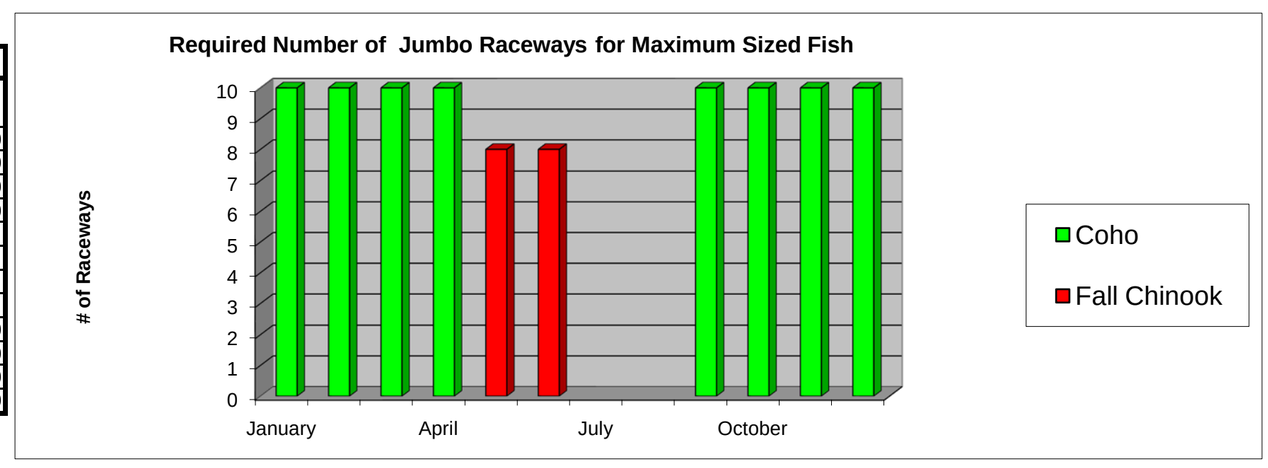
Required Flow for Maximum Sized Fish (GPM)

Dates		Fall Chinook		Coho
January				9247
February				9247
March				9247
April				9247
May		6127		
June		6127		
July				
August				
September				9247
October				9247
November				9247
December				9247



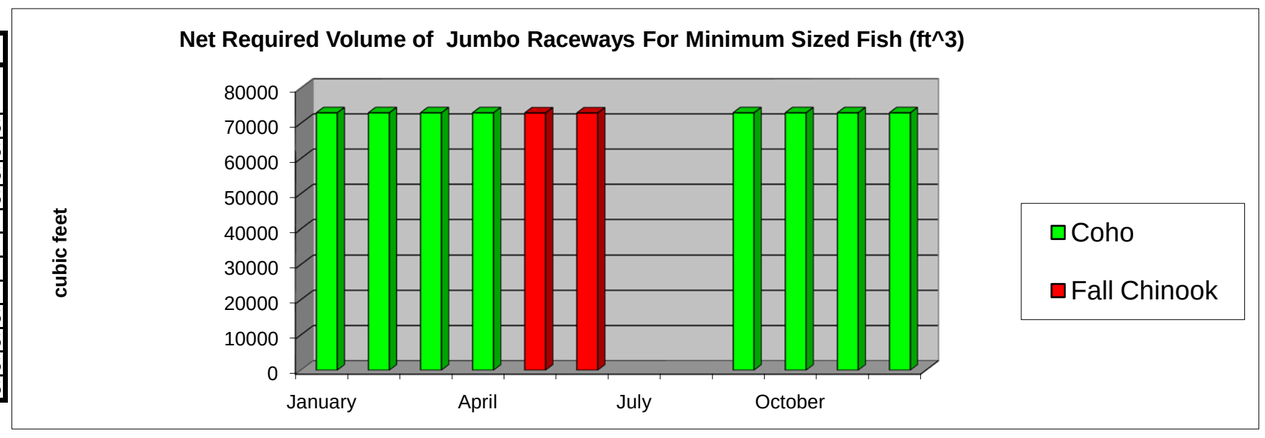
Required # of Jumbo Raceways for Maximum Sized Fish

Dates		Fall Chinook		Coho
January				10
February				10
March				10
April				10
May		8		
June		8		
July				
August				
September				10
October				10
November				10
December				10



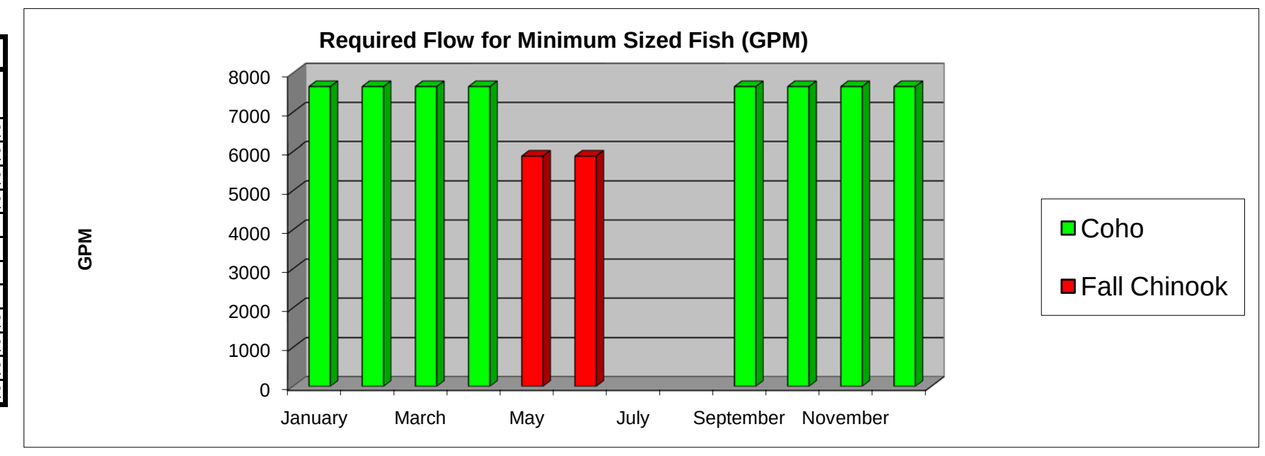
Required Volume for Minimum Sized Fish (ft^3)

Dates		Fall Chinook		Coho
January				72985
February				72985
March				72985
April				72985
May		72951		
June		72951		
July				
August				
September				72985
October				72985
November				72985
December				72985



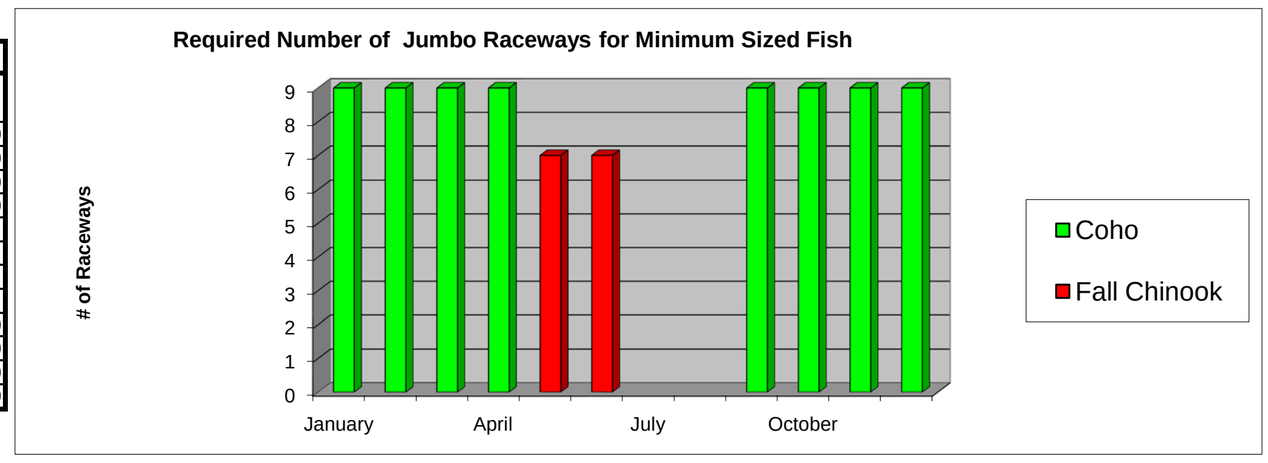
Required Flow for Minimum Sized Fish (GPM)

Dates		Fall Chinook		Coho
January				7652
February				7652
March				7652
April				7652
May		5883		
June		5883		
July				
August				
September				7652
October				7652
November				7652
December				7652



Required # of Jumbo Raceways for Minimum Sized Fish

Dates		Fall Chinook		Coho
January				9
February				9
March				9
April				9
May		7		
June		7		
July				
August				
September				9
October				9
November				9
December				9



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Wahkiacus Anadromous Water Usage

<<Green Values can be varied by user

Fall Chinook

2,000,000	Desired Number
125	Desired FPP
0.20	Volume Density (lbs/cubic ft H2O)
6.00	Flow Density (lbs/GPM)
	Raceway Volume needed (cubic ft H2O)
6	Raceways Used

6,000	Number of eggs/tray
366.67	Number of Trays
10	GPM/Stack of trays (@15 trays/stack)
444.44	Raceway Flow Needed (GPM)
500	Raceway Flow Used (GPM)
2,700	Pond Flow Used (GPM)

1,000	Broodstock Holding (GPM)
4,400.00	Fecundity
350	Bucket Incubation (GPM) **(NA for Fall Chinook)**

green- eyed survival	eyed ponding survival	eyed smolt survival	fry-fingerling survival	fingerling-smolt survival	Egg take goal requierd to meet goal	Eggs taken & Incubated
100.00%	100.00%	90.90%	100.00%	100.00%	2,200,220	2,200,000

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
1-Jan				261.90			0.00	261.90
8-Jan				261.90			0.00	261.90
15-Jan				261.90			0.00	261.90
22-Jan				261.90			0.00	261.90
29-Jan				261.90			0.00	261.90
Avg. Weekly (GPM)	0.00	0.00	0.00	261.90	0.00	0.00	0.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
5-Feb				261.90			0.00	261.90
12-Feb				261.90			0.00	261.90
19-Feb				261.90	3000.00		0.00	3261.90
26-Feb				261.90	3000.00		0.00	3261.90
Avg. Weekly (GPM)	0.00	0.00	0.00	261.90	1500.00	0.00	0.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
5-Mar				261.90	3000.00		0.00	3261.90
12-Mar				261.90	3000.00		0.00	3261.90
19-Mar					3000.00		0.00	3000.00
26-Mar					3000.00		0.00	3000.00
Avg. Weekly (GPM)	0.00	0.00	0.00	130.95	3000.00	0.00	0.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
2-Apr					3000.00		0.00	3000.00
9-Apr					3000.00		0.00	3000.00
16-Apr					3000.00		0.00	3000.00
23-Apr					3000.00		0.00	3000.00
30-Apr					3000.00		0.00	3000.00
Avg. Weekly (GPM)	0.00	0.00	0.00	0.00	3000.00	0.00	0.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
7-May					3000.00	2700.00	2700.00	3000.00
14-May					3000.00	2700.00	2700.00	3000.00
21-May					3000.00	2700.00	2700.00	3000.00
28-May					3000.00	2700.00	2700.00	3000.00
Avg. Weekly (GPM)	0.00	0.00	0.00	0.00	3000.00	2700.00	2700.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
4-Jun					3000.00	2700.00	2700.00	3000.00
11-Jun					3000.00	2700.00	2700.00	3000.00
18-Jun					3000.00	2700.00	2700.00	3000.00
25-Jun					3000.00	2700.00	2700.00	3000.00
Avg. Weekly (GPM)	0.00	0.00	0.00	0.00	3000.00	2700.00	2700.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
2-Jul					3000.00		0.00	3000.00
9-Jul							0.00	0.00
16-Jul							0.00	0.00
23-Jul							0.00	0.00
30-Jul							0.00	0.00
Avg. Weekly (GPM)	0.00	0.00	0.00	0.00	600.00	0.00	0.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
6-Aug							0.00	0.00
13-Aug							0.00	0.00
20-Aug							0.00	0.00
27-Aug							0.00	0.00
Avg. Weekly (GPM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
3-Sep							0.00	0.00
10-Sep							0.00	0.00
17-Sep							0.00	0.00
24-Sep							0.00	0.00
Avg. Weekly (GPM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
1-Oct	1000.00						0.00	1000.00
8-Oct	1000.00						0.00	1000.00
15-Oct	1000.00			261.90			0.00	1261.90
22-Oct	1000.00			261.90			0.00	1261.90
29-Oct	1000.00			261.90			0.00	1261.90
Avg. Weekly (GPM)	1000.00	0.00	0.00	157.14	0.00	0.00	0.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
5-Nov	1000.00			261.90			0.00	1261.90
12-Nov	1000.00			261.90			0.00	1261.90
19-Nov	1000.00			261.90			0.00	1261.90
26-Nov	1000.00			261.90			0.00	1261.90
Avg. Weekly (GPM)	1000.00	0.00	0.00	261.90	0.00	0.00	0.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
3-Dec	1000.00			261.90			0.00	1261.90
10-Dec	1000.00			261.90			0.00	1261.90
17-Dec	1000.00			261.90			0.00	1261.90
24-Dec				261.90			0.00	261.90
31-Dec				261.90			0.00	261.90
Avg. Weekly (GPM)	600.00	0.00	0.00	261.90	0.00	0.00	0.00	

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Wahkiacus Anadromous Water Usage

<<Green Values can be varied by user

Coho

1,000,000	Desired Number
15	Desired FPP
0.13	Volume Density (lbs/cubic ft H2O)
6.00	Flow Density (lbs/GPM)
	Raceway Volume needed (cubic ft H2O)
14	Raceways Used

7,000	Number of eggs/tray
228.57	Number of Trays
10	GPM/Stack of trays (@15 trays/stack)
793.65	Raceway Flow Needed (GPM)
300	Raceway Flow Used (GPM)
7,500	Acclimation Pond Flow Used (GPM)

842	Broodstock Holding (GPM)
3,800.00	Fecundity
295	Bucket Incubation (GPM) (**NA for COHO**)

green- eyed survival	eyed ponding survival	eyed smolt survival	fry-fingerling survival	fingerling-smolt survival	Egg take goal requierd to meet goal	Eggs taken & Incubated
100.00%	98.00%	100.00%	88.00%	89.00%	1,302,870	1,600,000

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
1-Jan				163.27		7500.00	0.00	7663.27
8-Jan				163.27		7500.00	0.00	7663.27
15-Jan				163.27		7500.00	0.00	7663.27
22-Jan				163.27		7500.00	0.00	7663.27
29-Jan				163.27		7500.00	0.00	7663.27
Avg. Weekly (GPM)	0.00	0.00	0.00	163.27	0.00	7500.00	0.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
5-Feb				163.27		7500.00	0.00	7663.27
12-Feb				163.27		7500.00	0.00	7663.27
19-Feb				163.27		7500.00	0.00	7663.27
26-Feb				163.27		7500.00	0.00	7663.27
Avg. Weekly (GPM)	0.00	0.00	0.00	163.27	0.00	7500.00	0.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
5-Mar				163.27	4200.00	7500.00	4200.00	7663.27
12-Mar				163.27	4200.00	7500.00	4200.00	7663.27
19-Mar				163.27	4200.00	7500.00	4200.00	7663.27
26-Mar				163.27	4200.00	7500.00	4200.00	7663.27
Avg. Weekly (GPM)	0.00	0.00	0.00	163.27	4200.00	7500.00	4200.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
2-Apr				163.27	4200.00	7500.00	4200.00	7663.27
9-Apr				163.27	4200.00	7500.00	4200.00	7663.27
16-Apr				163.27	4200.00	7500.00	4200.00	7663.27
23-Apr				163.27	4200.00	7500.00	4200.00	7663.27
30-Apr				163.27	4200.00	7500.00	4200.00	7663.27
Avg. Weekly (GPM)	0.00	0.00	0.00	163.27	4200.00	7500.00	4200.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
7-May					4200.00	7500.00	4200.00	7500.00
14-May					4200.00	7500.00	4200.00	7500.00
21-May					4200.00	7500.00	4200.00	7500.00
28-May					4200.00		0.00	4200.00
Avg. Weekly (GPM)	0.00	0.00	0.00	0.00	4200.00	5625.00	3150.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
4-Jun					4200.00		0.00	4200.00
11-Jun					4200.00		0.00	4200.00
18-Jun					4200.00		0.00	4200.00
25-Jun					4200.00		0.00	4200.00
Avg. Weekly (GPM)	0.00	0.00	0.00	0.00	4200.00	0.00	0.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
2-Jul					4200.00		0.00	4200.00
9-Jul					4200.00		0.00	4200.00
16-Jul					4200.00		0.00	4200.00
23-Jul					4200.00		0.00	4200.00
30-Jul					4200.00		0.00	4200.00
Avg. Weekly (GPM)	0.00	0.00	0.00	0.00	4200.00	0.00	0.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
6-Aug					4200.00		0.00	4200.00
13-Aug					4200.00		0.00	4200.00
20-Aug					4200.00		0.00	4200.00
27-Aug					4200.00		0.00	4200.00
Avg. Weekly (GPM)	0.00	0.00	0.00	0.00	4200.00	0.00	0.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
3-Sep					4200.00	7500.00	4200.00	7500.00
10-Sep					4200.00	7500.00	4200.00	7500.00
17-Sep						7500.00	0.00	7500.00
24-Sep						7500.00	0.00	7500.00
Avg. Weekly (GPM)	0.00	0.00	0.00	0.00	2100.00	7500.00	2100.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
1-Oct	842.11					7500.00	0.00	8342.11
8-Oct	842.11					7500.00	0.00	8342.11
15-Oct	842.11					7500.00	0.00	8342.11
22-Oct	842.11					7500.00	0.00	8342.11
29-Oct	842.11					7500.00	0.00	8342.11
Avg. Weekly (GPM)	842.11	0.00	0.00	0.00	0.00	7500.00	0.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
5-Nov	842.11			163.27		7500.00	0.00	8505.37
12-Nov	842.11			163.27		7500.00	0.00	8505.37
19-Nov	842.11			163.27		7500.00	0.00	8505.37
26-Nov	842.11			163.27		7500.00	0.00	8505.37
Avg. Weekly (GPM)	842.11	0.00	0.00	163.27	0.00	7500.00	0.00	

Dates	Broodstock Holding (GPM)	Disinfection (GPM)	Bucket Incubation (GPM)	Vertical Incubation (GPM)	Raceways (GPM)	Acclimation Ponds (GPM)	Recycled Flow From Raceway to Pond (GPM)	Total Per week (GPM)
3-Dec	842.11			163.27		7500.00	0.00	8505.37
10-Dec	842.11			163.27		7500.00	0.00	8505.37
17-Dec	842.11			163.27		7500.00	0.00	8505.37
24-Dec	842.11			163.27		7500.00	0.00	8505.37
31-Dec	842.11			163.27		7500.00	0.00	8505.37
Avg. Weekly (GPM)	842.11	0.00	0.00	163.27	0.00	7500.00	0.00	

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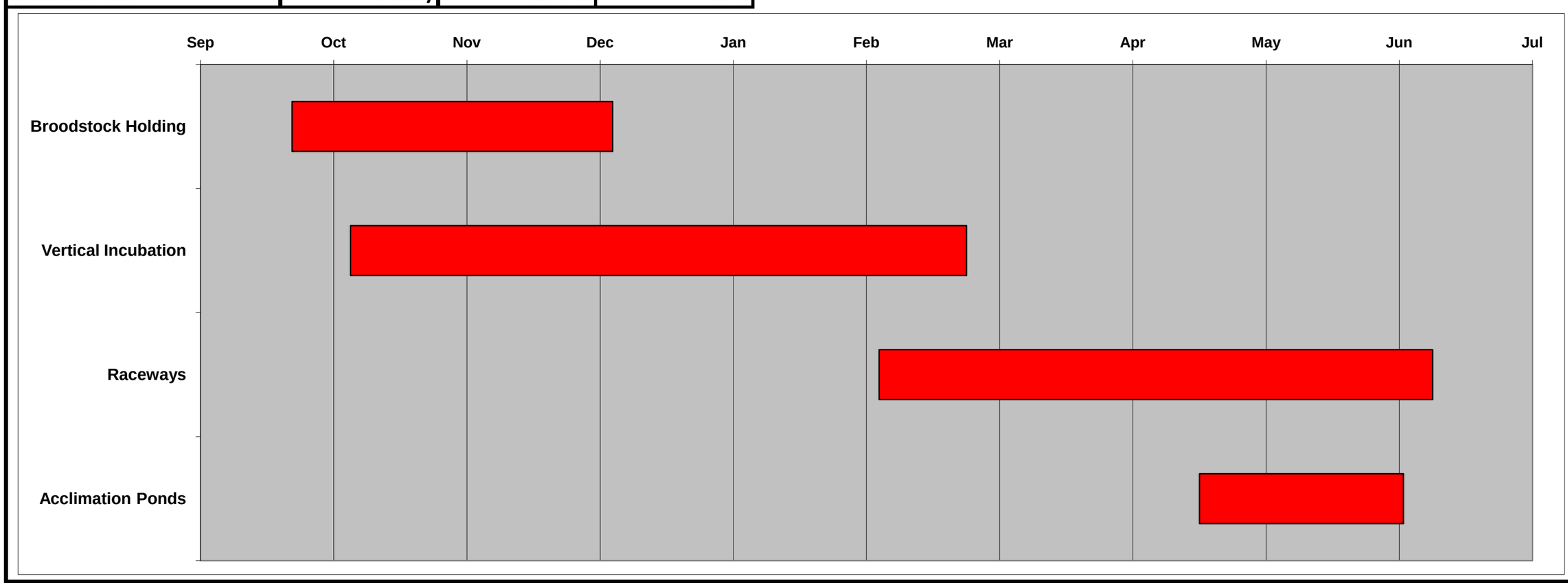
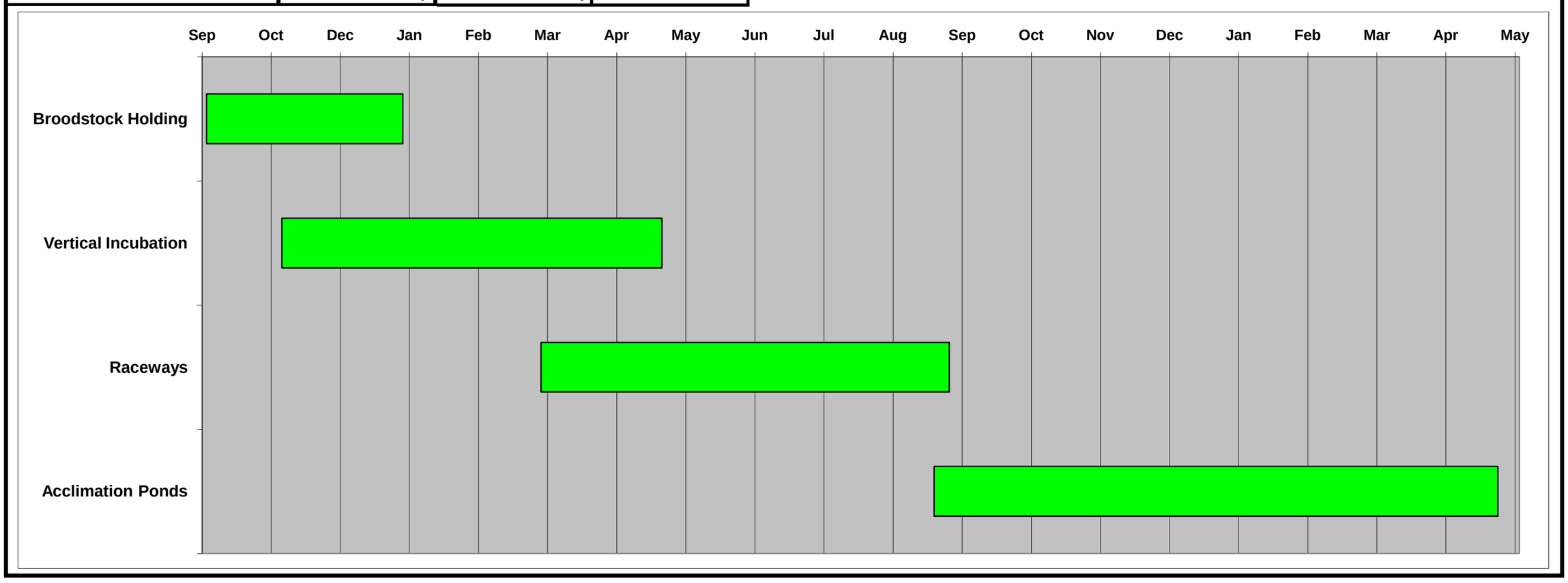
Fall Chinook

Task	Start date	End Date	duration (days)
Broodstock Holding	1-Oct	17-Dec	77.00
Vertical Incubation	15-Oct	12-Mar	148.00
Raceways	19-Feb	2-Jul	133.00
Acclimation Ponds	7-May	25-Jun	49.00



Coho

Task	Start date	End Date	duration (days)
Broodstock Holding	1-Oct	31-Dec	91.00
Vertical Incubation	5-Nov	30-Apr	176.00
Raceways	5-Mar	10-Sep	189.00
Acclimation Ponds	3-Sep	21-May	261.00



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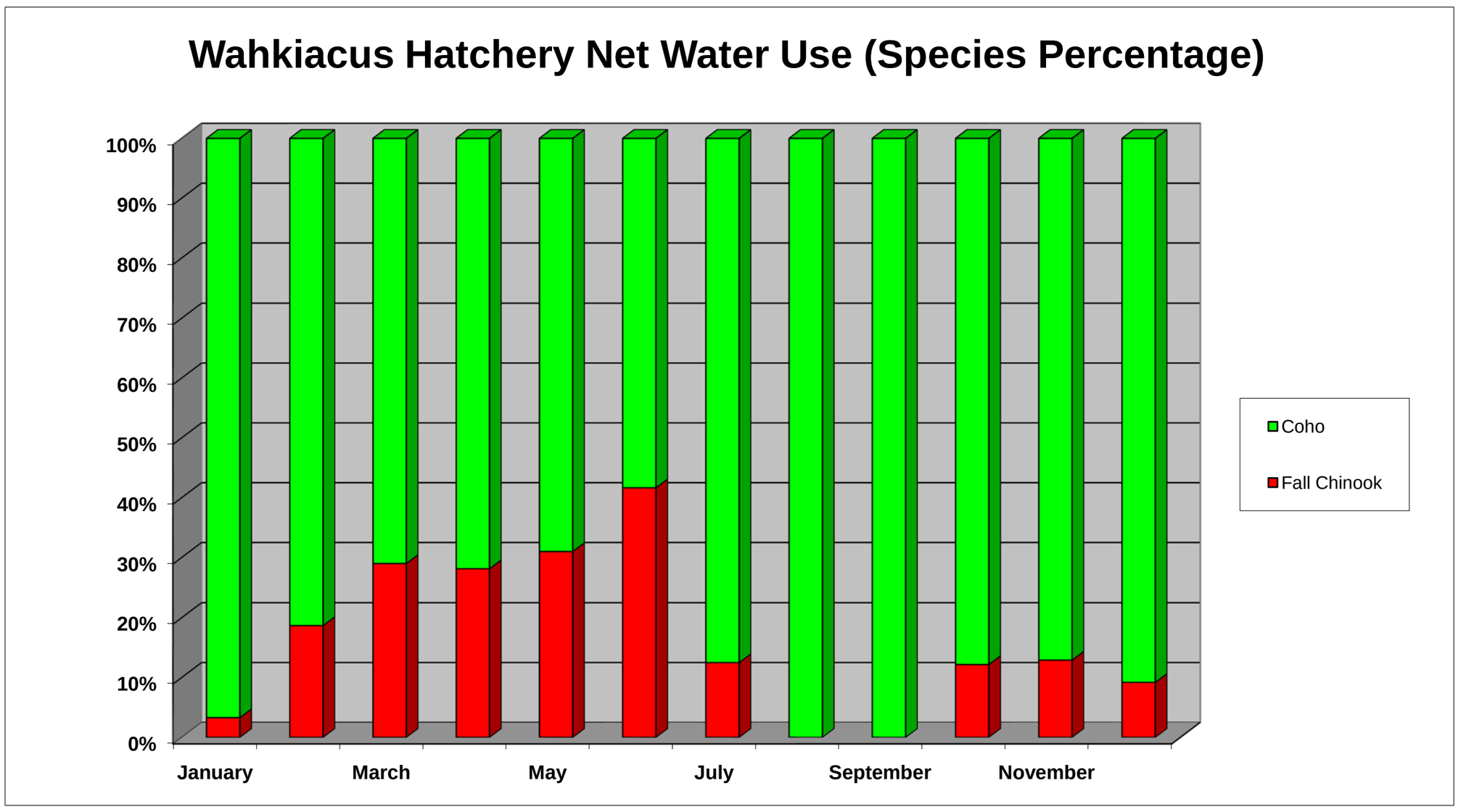
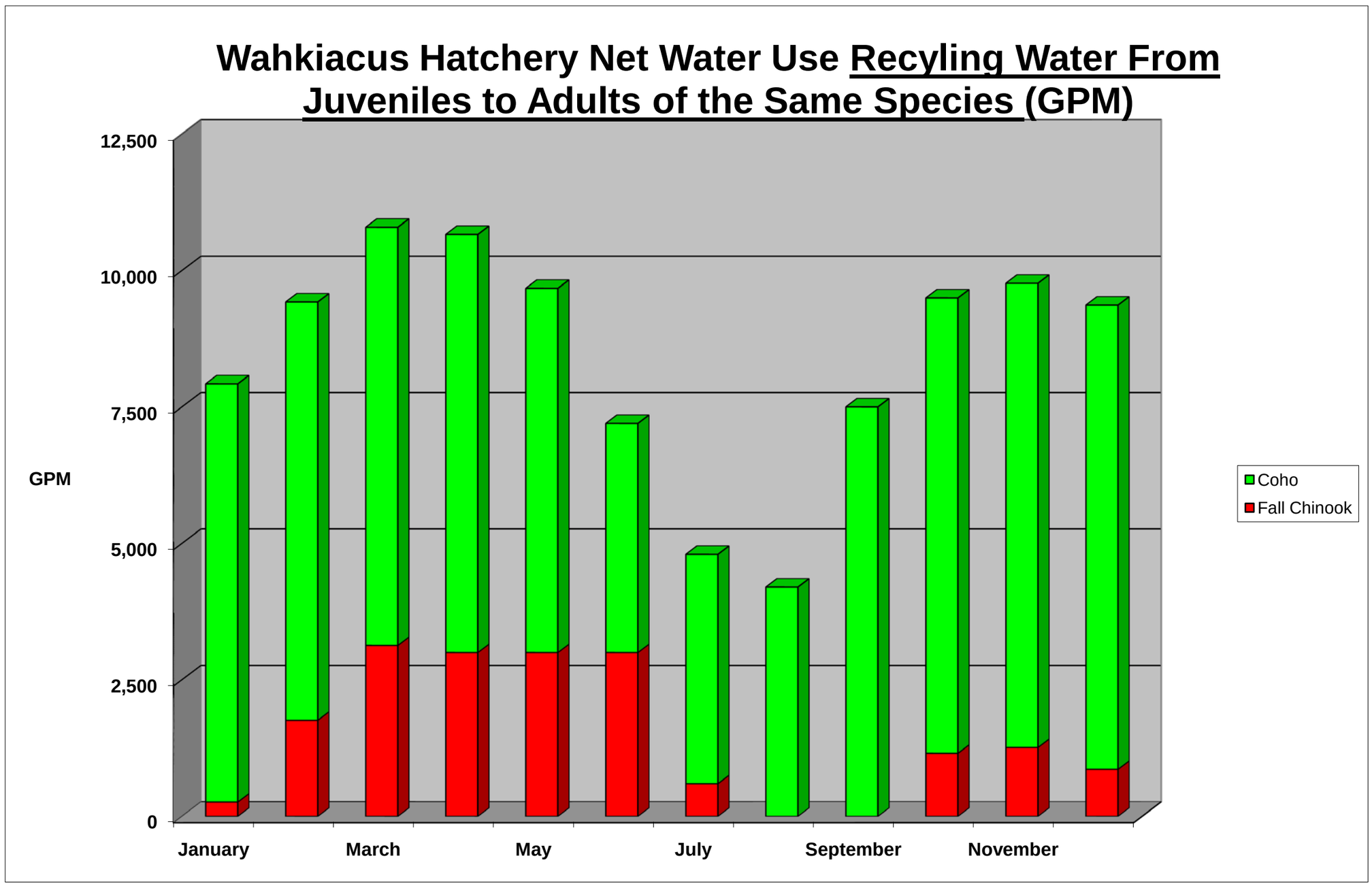
Net Monthly Water flows (GPM)

Dates	Fall Chinook (Monthly avg GPM)	Coho (Monthly avg GPM)
January	261.90	7663.27
February	1761.90	7663.27
March	3130.95	7663.27
April	3000.00	7663.27
May	3000.00	6675.00
June	3000.00	4200.00
July	600.00	4200.00
August	0.00	4200.00
September	0.00	7500.00
October	1157.14	8342.11
November	1261.90	8505.37
December	861.90	8505.37





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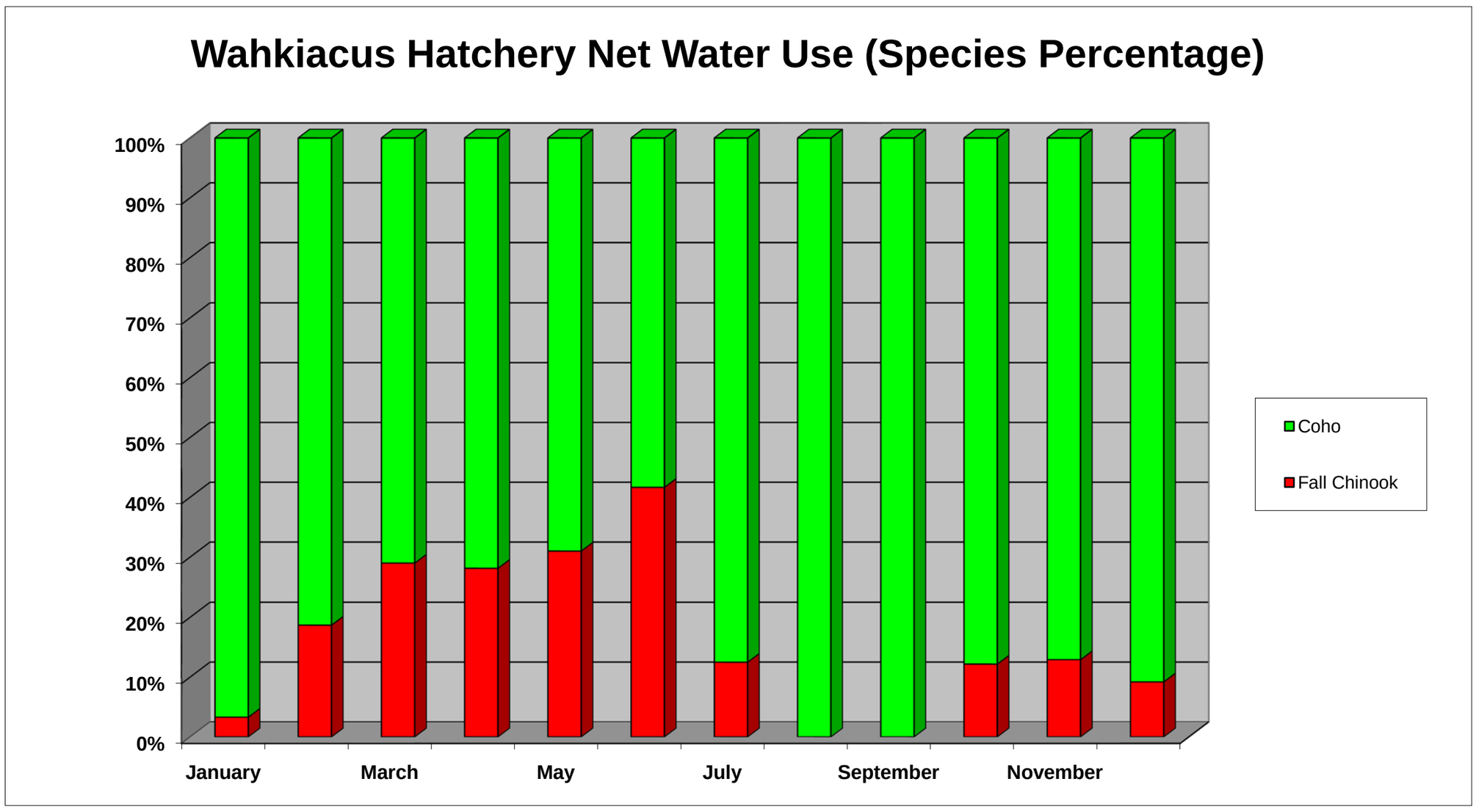
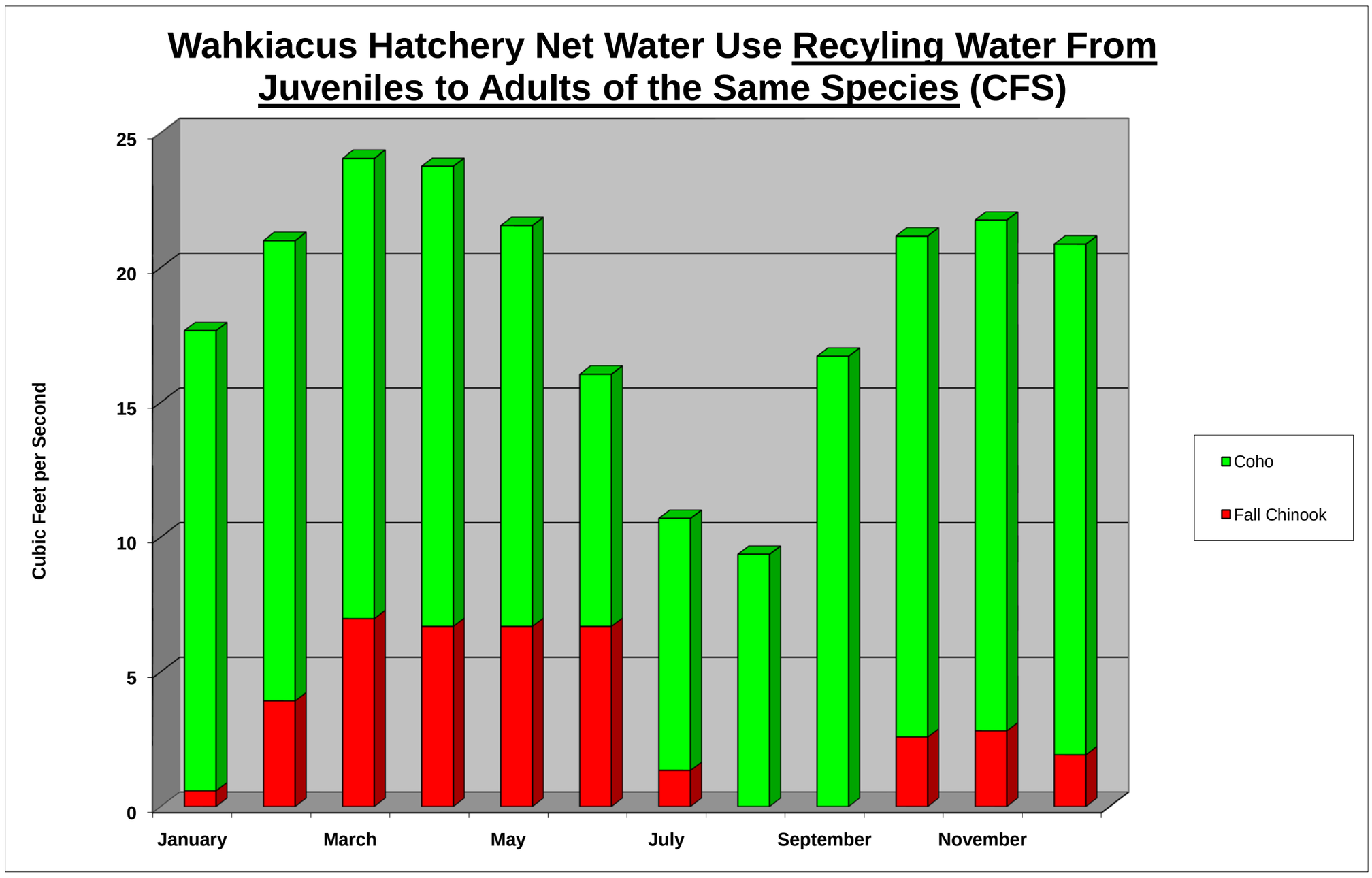
Net Monthly Water flows (CFS)

Dates	Fall Chinook (Monthly avg CFS)	Coho (Monthly avg CFS)
January	0.58	17.07
February	3.93	17.07
March	6.98	17.07
April	6.68	17.07
May	6.68	14.87
June	6.68	9.36
July	1.34	9.36
August	0.00	9.36
September	0.00	16.71
October	2.58	18.59
November	2.81	18.95
December	1.92	18.95





Harbor Consulting Engineers, Inc.
3006 Fuhrman Ave. E. Seattle, WA 98102 • Phone: 206.709.2397 • Fax: 206.709.2398

[F] TABLE 307.1(1)
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD[a, j, m, n, p]

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE[b]			USE-CLOSED SYSTEMS[b]			USE-OPEN SYSTEMS[b]	
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)
Combustible liquid[c, i]	II	H-2 or H-3	N/A	120[d, e]	N/A	N/A	120[d]	N/A	N/A	30[d]
	IIIA	H-2 or H-3		330[d, e]			330[d]			80[d]
	IIIB	N/A		13,200[e, f]			13,200[f]			3,300[f]
Combustible fiber	Loose	H-3	(100)	N/A	N/A	(100)	N/A	N/A	(20)	N/A
	Baled[o]		(1,000)			(1,000)			(200)	
Consumer fireworks (Class C, Common)	1.4G	H-3	125[d, e, l]	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cryogenics, flammable	N/A	H-2	N/A	45[d]	N/A	N/A	45[d]	N/A	N/A	10[d]
Cryogenics, inert	N/A	N/A	N/A	N/A	NL	N/A	N/A	NL	N/A	N/A
Cryogenics, oxidizing	N/A	H-3	N/A	45[d]	N/A	N/A	45[d]	N/A	N/A	10[d]
Explosives	Division 1.1	H-1	1[e, g]	(1)[e, g]	N/A	0.25[g]	(0.25)[g]	N/A	0.25[g]	(0.25)[g]
	Division 1.2	H-1	1[e, g]	(1)[e, g]	N/A	0.25[g]	(0.25)[g]	N/A	0.25[g]	(0.25)[g]
	Division 1.3	H-1 or H-2	5[e, g]	(5)[e, g]	N/A	1[g]	(1)[g]	N/A	1[g]	(1)[g]
	Division 1.4	H-3	50[e, g]	(50)[e, g]	N/A	50[g]	(50)[g]	N/A	N/A	N/A
	Division 1.4G	H-3	125[d, e, l]	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Division 1.5	H-1	1[e, g]	(1)[e, g]	N/A	0.25[g]	(0.25)[g]	N/A	0.25[g]	(0.25)[g]
	Division 1.6	H-1	1[d, e, g]	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Flammable gas	Gaseous	H-2	N/A	N/A	1,000[d, e]	N/A	N/A	1,000[d, e]	N/A	N/A
	Liquefied			(150)[d, e]	N/A		(150)[d, e]	N/A		
Flammable liquid[c]	1A	H-2	N/A	30[d, e]	N/A	N/A	30[d]	N/A	N/A	10[d]
	1B and 1C	or H-3		120[d, e]			120[d]			30[d]
Flammable liquid, combination (1A, 1B, 1C)	N/A	H-2 or H-3	N/A	120[d, e, h]	N/A	N/A	120[d, h]	N/A	N/A	30[d, h]
Flammable solid	N/A	H-3	125[d, e]	N/A	N/A	125[d]	N/A	N/A	25[d]	N/A
Inert gas	Gaseous	N/A	N/A	N/A	NL	N/A	N/A	NL	N/A	N/A
	Liquefied	N/A	N/A	N/A	NL	N/A	N/A	NL	N/A	N/A
Organic peroxide	UD	H-1	1[e, g]	(1)[e, g]	N/A	0.25[g]	(0.25)[g]	N/A	0.25[g]	(0.25)[g]
	I	H-2	5[d, e]	(5)[d, e]	N/A	1[d]	(1)	N/A	1[d]	(1)[d]
	II	H-3	50[d, e]	(50)[d, e]	N/A	50[d]	(50)[d]	N/A	10[d]	(10)[d]
	III	H-3	125[d, e]	(125)[d, e]	N/A	125[d]	(125)[d]	N/A	25[d]	(25)[d]
	IV	N/A	NL	NL	N/A	NL	NL	N/A	NL	NL
	V	N/A	NL	NL	N/A	NL	NL	N/A	NL	NL
Oxidizer	4	H-1	1[e, g]	(1)[e, g]	N/A	0.25[g]	(0.25)[g]	N/A	0.25[g]	(0.25)[g]
	3[k]	H-2 or H-3	10[d, e]	(10)[d, e]	N/A	2[d]	(2)[d]	N/A	2[d]	(2)[d]
	2	H-3	250[d, e]	(250)[d, e]	N/A	250[d]	(250)[d]	N/A	50[d]	(50)[d]
	1	N/A	4,000[e, f]	(4,000)[e, f]	N/A	4,000[f]	(4,000)[f]	N/A	1,000[f]	(1,000)[f]

(continued)

Yakama Nation
Post Office Box 151
Toppenish, Washington 98948

KLICKITAT RIVER
WAHKIACUS HATCHERY DEVELOPMENT

DRAFT
Hydraulic Conditions Report

December 2010

Prepared for:

Yakama Nation

Report Prepared by

HARBOR CONSULTING ENGINEERS
3006 Fuhrman Avenue East
Seattle, Washington 98102

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APPENDICIES

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INTRODUCTION

The proposed site has been selected by Yakama Nation Fisheries as the location for a new salmon hatchery. The site is located on the Klickitat River at Wahkiacus (river mile 17.2), immediately downstream of the Swale Creek confluence (see Vicinity Map, Figure 1). Access to the site is achieved from Washington State Route 142 via Horseshoe Bend Bridge at river mile 17.1. At present, the site is utilized for Yakama Nation Fisheries field office facilities. An existing residential office building, modular office building and prefabricated shop building currently occupy the site.

The proposed improvements include a full build out of hatchery facilities; including a new hatchery building, maintenance & storage facilities, water intake & treatment facilities, rearing ponds, fishway & adult holding ponds, and new hatchery residences (refer to Appendix B). These facilities will be placed partially within the 100-year floodplain for the Klickitat River.

The following report summarizes the existing hydraulic and hydrologic conditions on the Klickitat River in the vicinity of the proposed Wahkiacus Hatchery.

BACKGROUND

The Klickitat basin (HUC 17070106) is drained by the Klickitat River whose headwaters are founded at Goat Rocks, north of Mount Adams. The river discharges 95.7 miles downstream to the Columbia River near Lyle, Washington. The Klickitat basin is markedly diverse with flow distributions varying significantly in the western and eastern portions of the basin. Proximity to Mount Adams strongly influences runoff from the northwestern portion of the basin where substantially higher annual precipitation as well as seasonal storage in the form of snow and ice occurs. The southeastern portion of the basin is characterized by much dryer foothills with summertime runoff flows near zero. Summertime low flows in the Klickitat River are almost entirely comprised of groundwater base flow from the upper basin above Summit Creek. Flood flows in the basin tend to vary, with upper basin peaks generally occurring during the spring thaw, whereas peaks in the lower basin tend to occur mostly in January or February, the result of heavy rain combined with melting snowpack.

There are currently three flow monitoring gauges operated by the United States Geological Survey (USGS) on the Klickitat River. An additional site, located at approximately river mile 50.3, was operated from 1910 through 1979. No flow monitoring station is present at the hatchery site. A description of the available data is presented below in Table 1.

Table 1. USGS Flow Monitoring Sites

Gauge No.	Description	River Mile	Elevation NGVD29	Drainage Area	Length of Record
14107000	Klickitat River above West Fork	64.7	2,720 ft.	151 sq. mi.	50 years
14110000	Klickitat River near Glenwood, WA	50.3	1,703 ft.	360 sq. mi.	69 years
14111400	Klickitat River below Summit Creek	34.3	900 ft.	749 sq. mi.	12 years
14113000	Klickitat River near Pitt, WA	7.0	289 ft.	1,297 sq. mi.	82 years

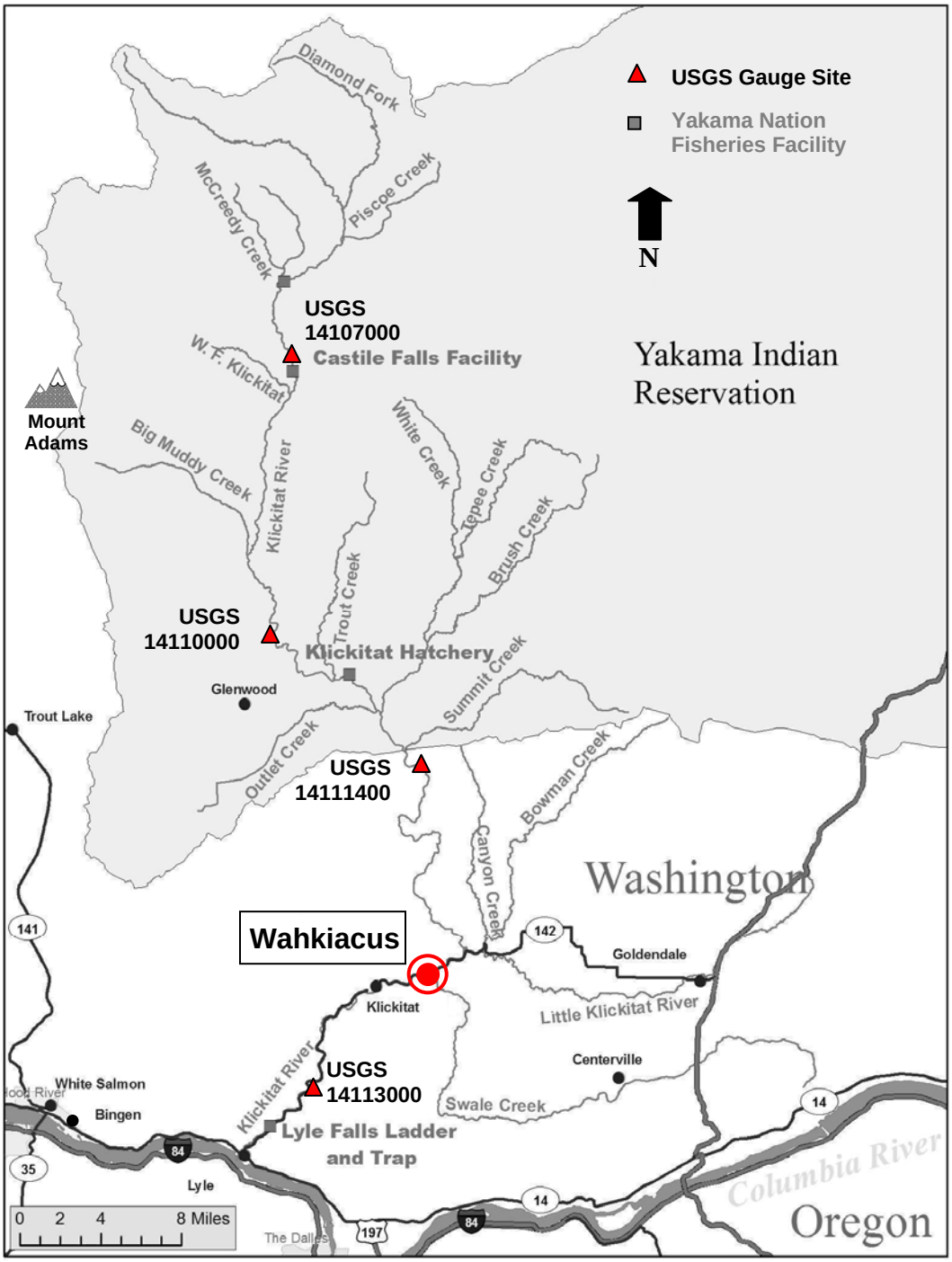


Figure 1. Vicinity Map

HYDROLOGY

Wahkiacus is located at river mile 17.2 on the Klickitat River on an existing alluvium fan at the confluence of Swale Creek and the Klickitat River. The surrounding slopes consist of deeply incised bedrock and landslide deposits.

Swale Creek

No stream gage is present on Swale Creek. Flood hydrology was estimated using regression equations developed by the USGS for the State of Washington (USGS, 2001). Drainage area was estimated to be 120 square miles with an average annual precipitation of 23 inches. Table 2 below summarizes calculated return interval flood discharge flows.

Table 2. Estimated Swale Creek Flow Regime

Exceedance Interval	Return Interval	Flow (cfs)	Description
1	1 year	170*	Peak Flood Discharge
0.50	2 years	954	Peak Flood Discharge
0.20	5 years	1,800*	Peak Flood Discharge
0.10	10 years	2,525	Peak Flood Discharge
0.04	25 years	3,631	Peak Flood Discharge
0.02	50 years	4,589	Peak Flood Discharge
0.01	100 years	5,704	Peak Flood Discharge

* Approximated

Klickitat River at Wahkiacus

USGS stream gage 14113000 Klickitat River near Pitt, WA is located at river mile 7.0, approximately 10 miles downstream from the project site. This gage was selected to determine the flood flow regime at Wahkiacus. Using an estimated contributing drainage area of 1225 square miles and USGS regression equations established by The National Flood Frequency Program (USGS, 2001), the following peak discharges were calculated. Refer to Appendix C for additional hydrologic data.

Table 3. Estimated Klickitat River Flood Discharge at Wahkiacus

Exceedance Interval	Return Interval	Flow (cfs)	Description
0.50	2 years	7,300	Peak Flood Discharge
0.20	5 years	13,700	Peak Flood Discharge
0.10	10 years	19,300	Peak Flood Discharge
0.02	50 years	36,000	Peak Flood Discharge
0.01	100 years	45,300	Peak Flood Discharge

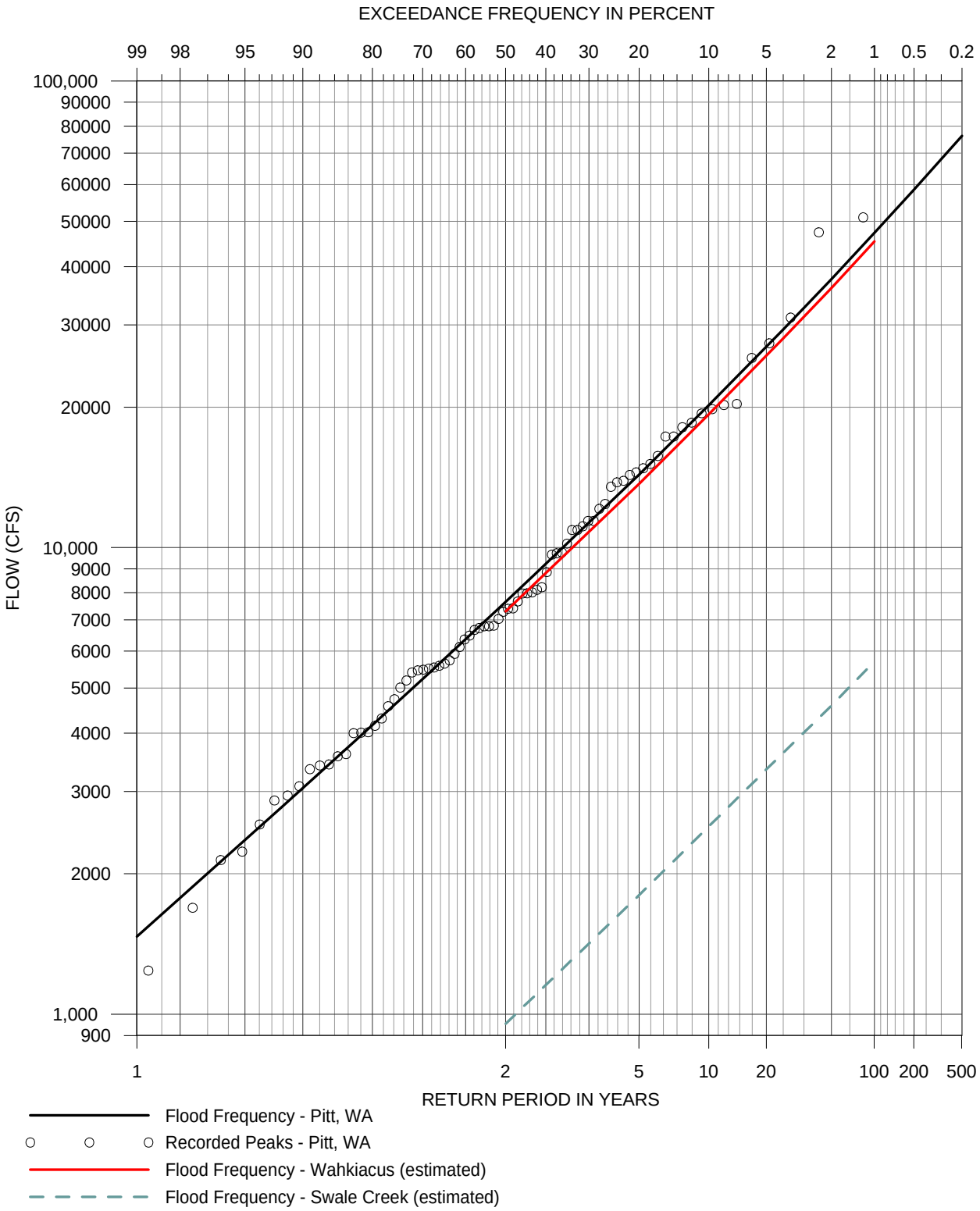


Figure 2. Estimated Flood Frequency Curve for Klickitat River at Wahkiacus

Hydraulic Analysis

The United State Army Corps of Engineers (USACE) Hydrologic Engineering Center's River Analysis System (HEC-RAS) was used to develop a one dimensional, steady state flow model for the Klickitat River at Wahkaicus. The basic computational procedure is based on the solution of the one dimensional energy equation for steady, gradually varied flow. Energy losses are evaluated using Manning's Equation for frictional components and contraction/expansion coefficients for changes in velocity head.

The model was constructed by combining LiDAR topography data collected in 2009 by Yakama Nations Fisheries with river bed geometry for the Klickitat River and Swale Creek collected by Harbor Consulting Engineers in October of 2002. The HEC-RAS model was developed using the available survey and hydrology data together with multiple field investigations performed by Harbor Consulting Engineers.

Klickitat River at Wahkiacus

A steady flow analysis was performed using a mixed flow regime for existing site conditions. The model was then calibrated using known water surface elevations collected during the site survey as well as approximate elevations provided by Yakama Nation personnel from the February 1996 flood, which is believed to be a 100-year recurrence flood.

Horseshoe Bend Bridge, immediately downstream of the Wahkiacus site and the corresponding left bank approach fill impede overbank flood flows which are forced through a 130 foot wide opening between the left and right bridge abutments. This constriction creates a backwater upstream, resulting in reduced channel velocities and increased water surface elevation.

Preliminary results indicated a 100-year flood elevation much higher than was documented during the 1996 flood, with flood flows overtopping the existing Horseshoe Bend Bridge and flooding the existing residence on site. However, it is understood that the residence did not experience flooding, with flood waters only approaching the basement door at approximate elevation 524.5.

A scour analysis at the existing bridge indicated that scour depths in excess of 7 feet were possible during peak flows, with channel velocities reaching 20 feet per second. A modified model was created with channel geometry updated to reflect an anticipated scour condition. A maximum scour depth of 4.5 feet was used at the bridge site, with scour depths reducing upstream. The result produced water surface elevations near those expected upstream of the bridge. This scoured condition geometry was used to calculate water surface profiles when channel velocities exceeded 10 feet per second upstream of the existing bridge which occur during the 10-year and greater flood discharges.

A stage-discharge curve for the Klickitat River at Wahkiacus is presented below in Figure 3. The transition between normal and scoured conditions is visible at the 10-year event, approximately 20,000 cfs. At this point, channel velocities are sufficient to mobilize bedload and channel geometery is anticipated to shift to a scoured condition. Refer to Appendix D for additional hydraulic model data.

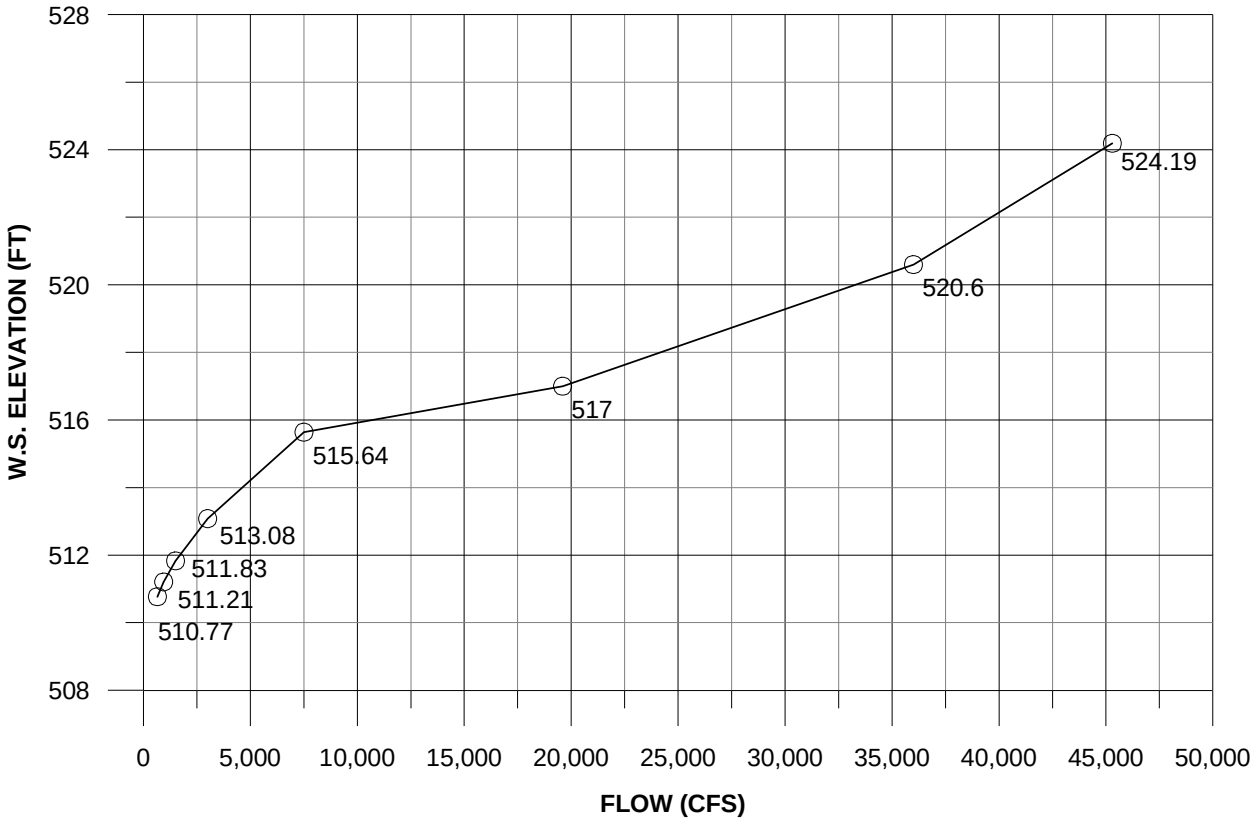


Figure 3. Estimated Stage-Discharge Curve for Klickitat River at Wahkiacus, scour included

Swale Creek

A steady flow analysis was performed using a mixed flow regime for existing site conditions. The model was then calibrated using known water surface elevations collected during the site survey as well as approximate elevations provided by Yakama Nation personnel.

100-year water surface elevations on Swale Creek fluctuate based on the water surface elevation of the Klickitat River at the confluence with Swale Creek. Backwater effects are realized up to 600 feet upstream from the confluence. At 600 feet upstream, backwater effects from the Klickitat River during a 100-year flood event are reached. Further than 600 feet upstream channel slope is sufficient to reach a normal water surface condition with no backwater effects from the Klickitat River.

The selected 100-year flood flow model for Swale Creek used a confluence water surface elevation of 524.0 on the Klickitat River. This corresponds to a 10 to 20-year flood event on the Klickitat River discharging approximately 25,000 cfs.

Results of the modeling indicate that Swale Creek is capable of conveying its 100-year flood flow within its existing bank and levee system. Flood flows reach the top of bank near cross section 0.1657, however it is believed that flows will remain within the established channel. Refer to Appendix D for additional hydraulic model data.

PROPOSED IMPROVEMENTS

Proposed site improvements include a full build out of hatchery facilities; including a new hatchery building, maintenance & storage facilities, water intake & treatment facilities, rearing ponds, fishway & adult holding ponds, and new hatchery residences (see Appendix B). The site elevation within the 100-year floodplain fringe will be raised to accommodate hatchery operations and protect structures from periodic flooding. No construction will occur within the floodway as defined by Federal Emergency Management Agency (FEMA) 1-foot rise criteria.

It is anticipated that the existing Horseshoe Bend Bridge will be removed and a replacement constructed immediately downstream. The replacement bridge will incorporate a longer span to accommodate flood flows within the natural channel and restored overbank conveyance. The result will be a reduced backwater effect upstream of the crossing.

It is proposed that the existing left bank bridge abutment will be modified to accommodate a hatchery water intake. The constriction created by the existing bridge abutments is desirable for maintaining a scour hole to draw hatchery water from. The intake will be constructed with a deck elevation approximately equal to the 5-year recurrence flood. This will provide for a maintained scour hole while allowing large flood flows to utilize resorted overbank conveyance.

Preliminary hydraulic analysis of proposed site conditions indicates a drop in water surface of approximately 1 foot can be expected at the Wahkiacus Hatchery site. Additional hydraulic analysis of proposed site conditions is required to set finish grades for both Klickitat and Swale Creek Facilities.

REFERENCES

1. Cline, Denzel R. USGS Open-File Report 75-518, Reconnaissance of the Water Resources of the Upper Klickitat River Basin, Yakama Indian Reservation, Washington. 1976.
2. Richardson, Don. Washington State Department of Ecology Office Report #48, Monthly Streamflow in the Klickitat Basin. May 1976.
3. United State Geological Survey. Bulletin #17B, Guidelines for Determining Flood Flow Frequency. March 1982.
4. USGS. The National Flood-Frequency Program – Methods for Estimating Flood Magnitude and Frequency in Washington, 2001.

Appendix A

Photograph Log

1

Klickitat River at Swale Creek— Aerial orthophoto, 2009. (Yakama Nation)

2

Klickitat River at Swale Creek—Aerial photo, 1947. (USGS)

Klickitat River at Horseshoe Bend Bridge—looking downstream.

Swale Creek confluence with Klickitat River—looking upstream.

Klickitat River looking downstream from Horseshoe Bend Bridge.

Klickitat River looking upstream from Horseshoe Bend Bridge.

Swale Creek looking upstream from confluence with Klickitat River.

Swale Creek upstream of Wahkiacus Hatchery site.

Appendix B
Project Drawings

FIGURE 1 EXISTING FACILITIES SITE PLAN

FIGURE 2 PROPOSED FACILITIES SITE PLAN

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SECTION LINE

HWY 142

50 LF ROW

ORDINARY HIGH WATER

N87°02'48"W 656.61'

KLICKITAT RIVER

DENSE TREES

HORSESHOE BEND BRIDGE

N01°12'45"E 349.99'

SWALE CREEK

N87°02'48"W 476.56'

N87°02'48"W 790.48'

S01°12'45"W 349.99'

LUDLUM PARK WDFW

MAINTENANCE SHOP

TRAILER

RESIDENCE

SHED

WAHKIACUS PARK ROAD

EDGE OF EXIST. ROAD

N87°02'48"W 476.56'

FLOODWAY

PROPERTY LINE

N00°03'00"W 668.09'

RIVER MILE 170 KLICKITAT RIVER

200 LF KLICKITAT TRAIL ROW

HORSESHOE BEND ROAD

PROPERTY LINE

FLOODWAY LIMIT

N87°20'29"W 655.28'

60 LF ROW

PRIVATE PROPERTY

SCHILLING ROAD

N00°25'00"W 664.62'

200 LF KLICKITAT TRAIL ROW

EXIST. LEVEE

KLICKITAT TRAIL

60 LF ROW

EXISTING SITE PLAN

SCALE: 1" = 50'

REVISED DESCRIPTION	DATE

SCALE: 1:50
CHK BY: MC
DRW BY: BA
REF: X

HARBOR CONSULTING ENGINEERS
ENGINEERS · PLANNERS · SURVEYORS
3006 FUHRMAN AVENUE EAST
SEATTLE WASHINGTON 98102
PHONE: (206) 709-2397

WAHKIACUS HATCHERY
YAKAMA KLICKITAT FISHERIES PROGRAM

SITE PLAN
EXISTING FACILITIES

JOB NO. 03006.00
DATE: 10.07.10
SHEET: X OF X
DWG.# FIG 1

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE: 1:50
CHK BY: MC
DRW BY: BA
REF: X

REVISED DESCRIPTION | DATE

HARBOR CONSULTING ENGINEERS
ENGINEERS · PLANNERS · SURVEYORS
3006 FUHRMAN AVENUE EAST
SEATTLE WASHINGTON 98102
PHONE: (206) 709-2397

SECTION LINE

HWY 142

ORDINARY HIGH WATER

N87°02'48"W 656.61'

KLICKITAT RIVER

DENSE TREES

60' ROW

HORSESHOE BEND BRIDGE TO BE DEMOLISHED

NEW COUNTY BRIDGE (BY OTHERS)

RIVER WATER INTAKE

FISHWAY

N00°05'00"W 668.09'

RIVER MILE 170 KLICKITAT RIVER

(8) JUMBO RACEWAYS

SPAWNING BLDG.

WATER DISTRIBUTION BLDG.

HATCHERY / MAINTENANCE BLDG.

COVERED STORAGE

WAHKIACUS PARK ROAD

FUEL STORAGE 2000 GAL.

VISITOR KIOSK

HORSESHOE BEND ROAD

200 LF KLICKITAT TRAIL ROW

PROPERTY LINE

N87°20'29"W 655.28'

60' ROW

SCHILLING ROAD

N00°25'00"W 664.67'

SWALE CREEK

N01°12'45"E 349.99'

N87°02'48"W 476.56'

N87°02'48"W 790.48'

S01°12'45"W 349.99'

LARGE WOODY DEBRIS (TYP.)

LUDLUM PARK WDFW

WATER CONDITIONING BLDG.

POLLUTION ABATEMENT BASIN

N87°02'48"W 476.56'

FLOODWAY

PROPERTY LINE

(10) COVERED REARING RACEWAYS

(10) COVERED REARING RACEWAYS

MARKING TRAILER PAD, TYP. (12'x40')

APPROX. TOE OF FILL

CHEMICAL STORAGE BLDG.

(5) REARING RACEWAYS

(2) JUMBO RACEWAYS

FLOODWAY LIMIT

SECURITY FENCE LINE

PRIVATE PROPERTY

SHEET PILE LEVEE REINFORCEMENT AT EXIST. LEVEE

200 LF KLICKITAT TRAIL ROW

16"ø STL PIPELINE

60' ROW

KLICKITAT TRAIL

MATCHLINE-A SEE SHEET C003

MATCHLINE-A SEE SHEET C003

Key Plan

CONCEPTUAL DESIGN
SITE DEVELOPMENT PLAN
SCALE: 1" = 50'

50 0 50 100
SCALE IN FEET 1" = 50'

WAHKIACUS HATCHERY
YAKAMA KLICKITAT FISHERIES PROGRAM

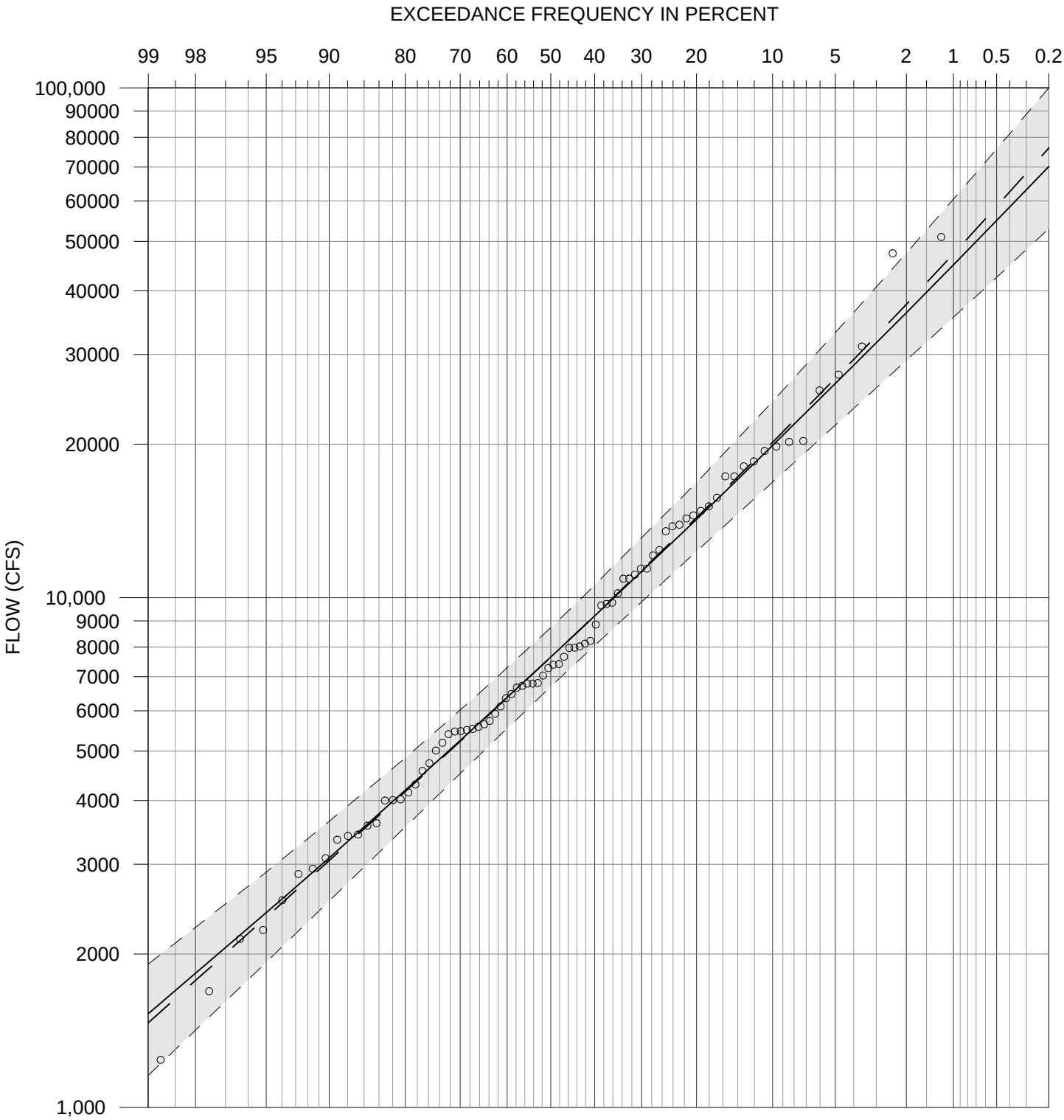
SITE DEVELOPMENT PLAN
MAIN HATCHERY

JOB NO. 09006.00
DATE: 10.07.10
SHEET: X OF X
DWG.# FIG 2

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

Appendix C

Klickitat River Hydrology
Additional Figures



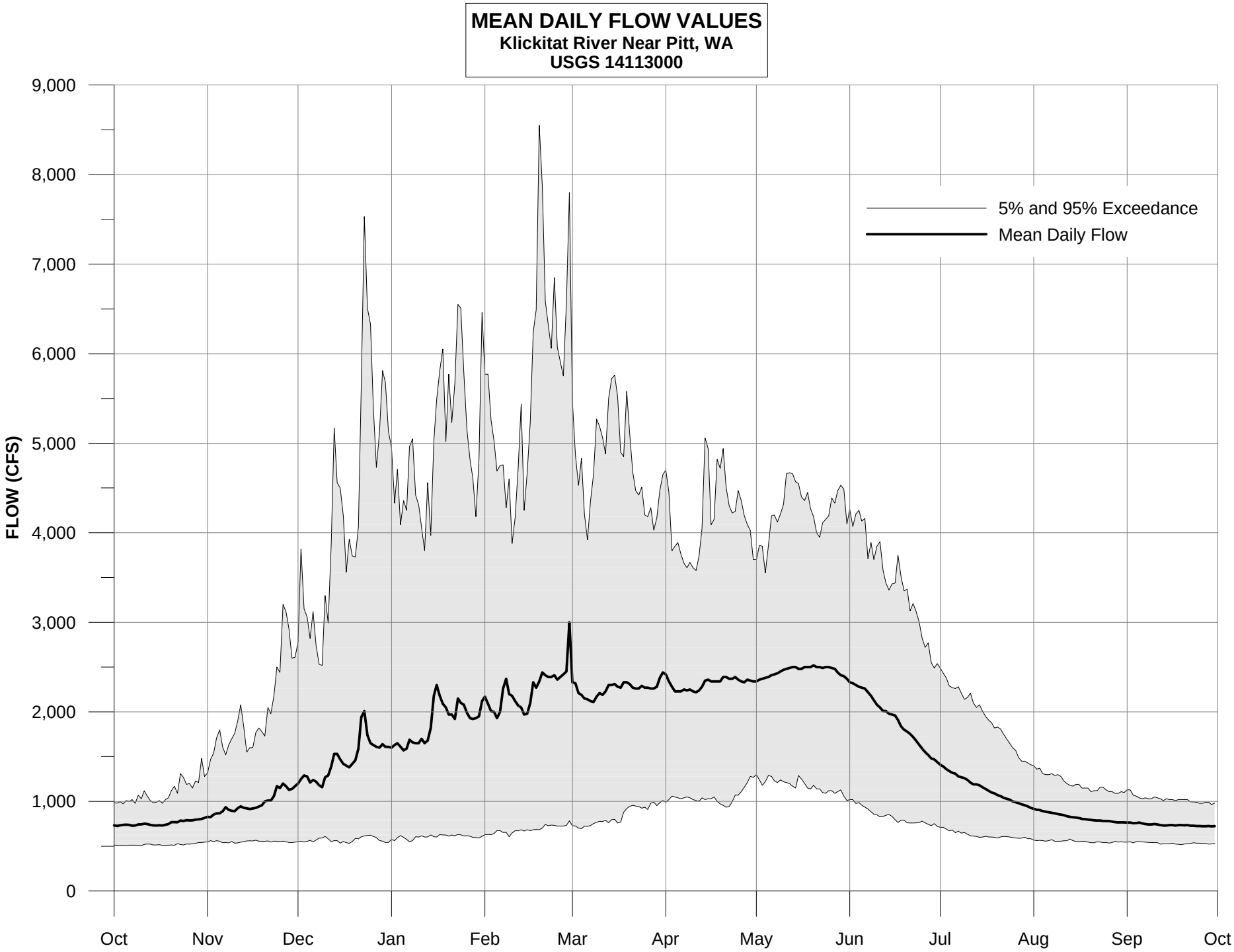
95% Confidence Limit
Flow Frequency
Flow Frequency (w/ Exp. Prob.)
Recorded Peaks

FREQUENCY STATISTICS
WEIGHTED LP3 TRANSFORM OF FLOW, CFS

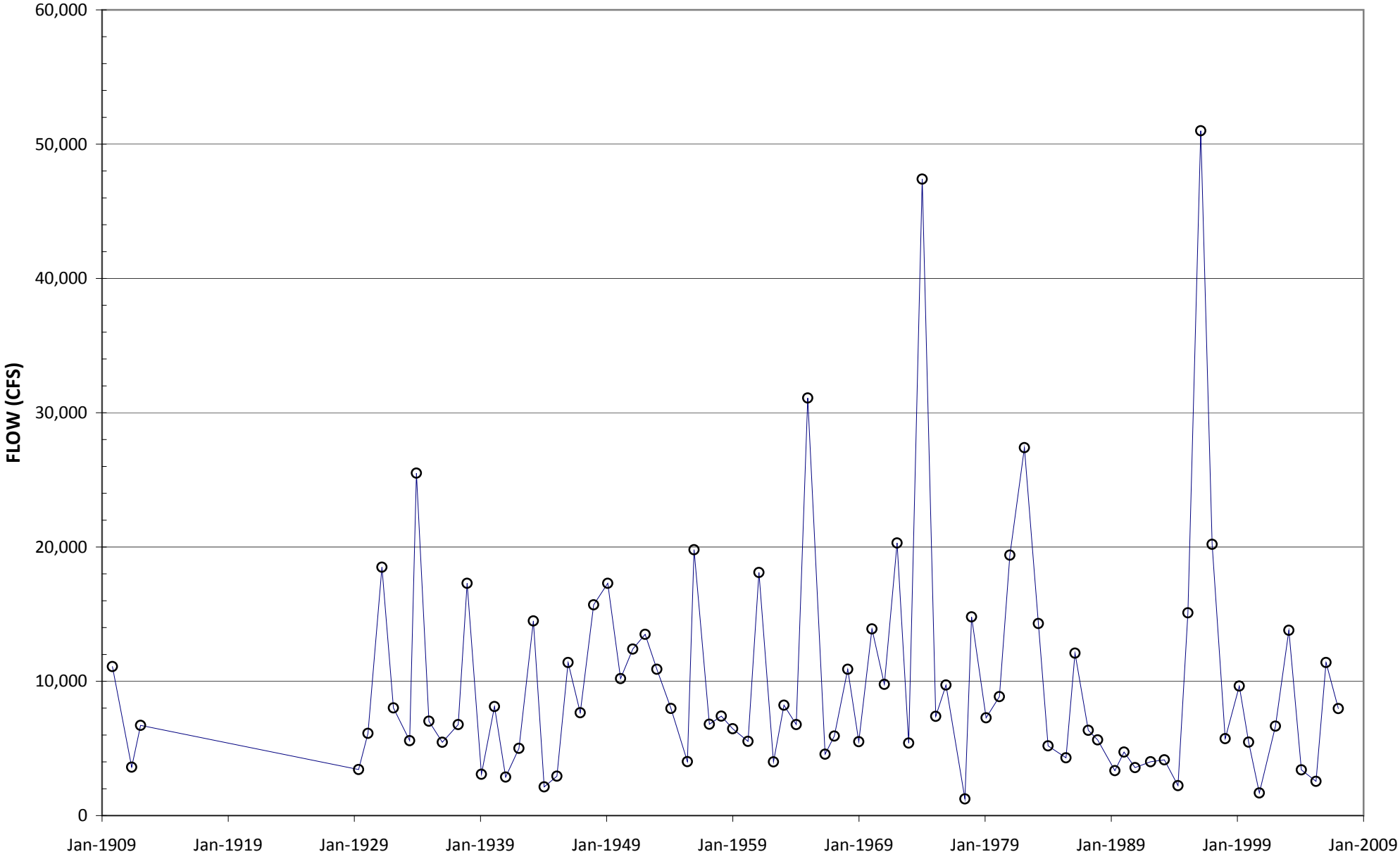
MEAN	3.8901	HISTORIC EVENTS	0
STANDARD DEV	0.3157	HIGH OUTLIERS	0
SKEW	0.123	LOW OUTLIERS	0

FLOOD FREQUENCY CURVE

Klickitat River Near Pitt, WA
USGS Station 1413000
River Mile = 7.0
Basin Area = 1297 SQ MI
Annual Peak Discharge
Water Years in Record:
1909 - 1912, 1928 - 2007


MEAN DAILY FLOW VALUES
Klickitat River Near Pitt, WA
USGS 14113000
FLOW (CFS)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
5% and 95% Exceedance
Mean Daily Flow

ANNUAL PEAK DISCHARGE
Klickitat River Near Pitt, WA
USGS 14113000



USGS National Flood Frequency Program

Hydralogic Region	6
Regional Exponent	0.75

$$Q_u = Q_g \left(\frac{A_u}{A_g} \right)^x$$

Ungaged Site		
Name	Wahkiacus	
River Mile	17.2	
Drainage Area	1225	sq. mi.
Q100	45269	cfs
Q50	36023	cfs
Q25	28100	cfs
Q10	19324	cfs
Q5	13748	cfs
Q2	7328	cfs

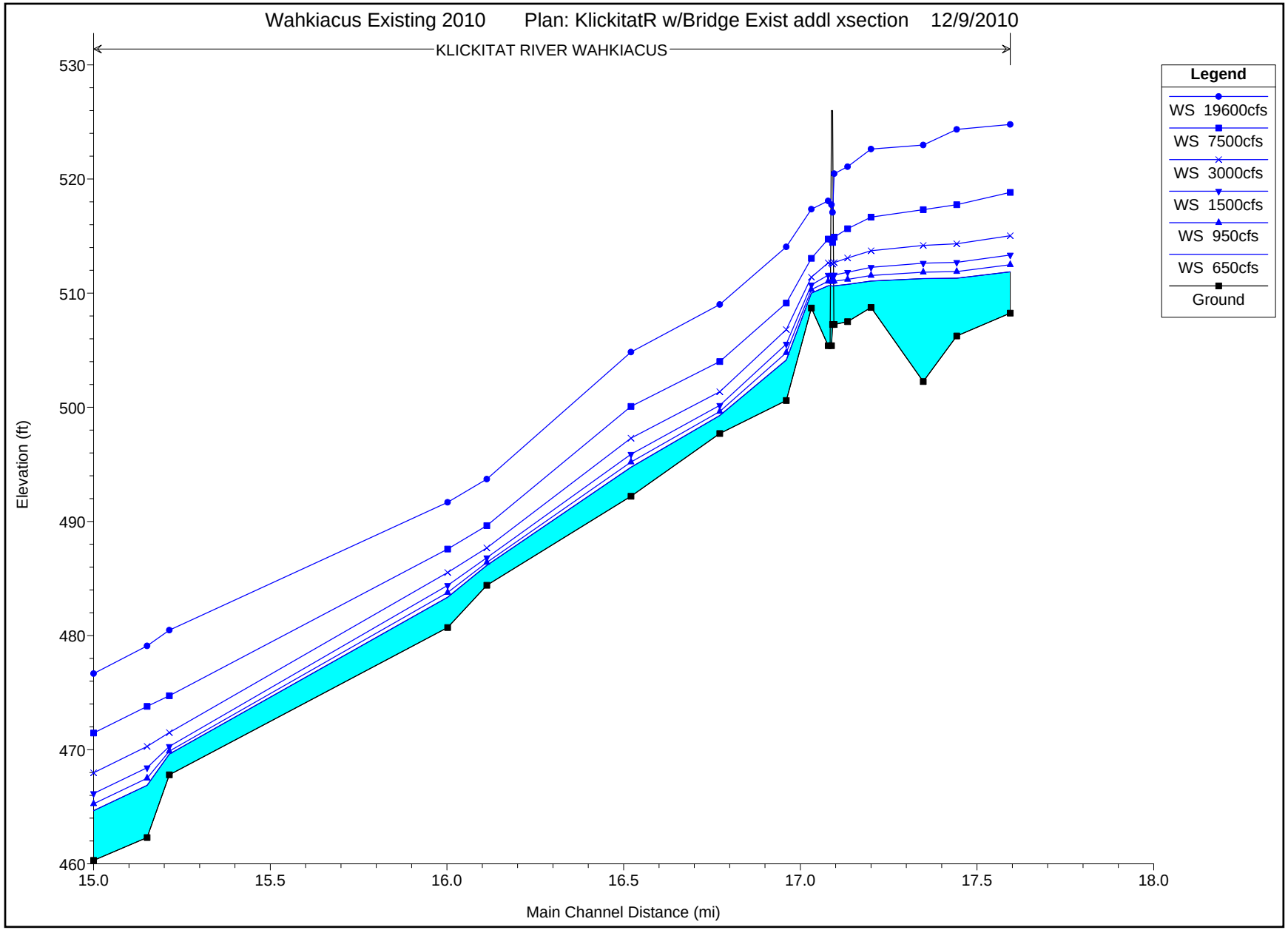
Gaged Site No.	**1**	
Name	Klickitat River near Pitt, WA	
River Mile	7	
Drainage Area	1297	sq. mi.
Q100	47250	cfs
Q50	37600	cfs
Q25	29330	cfs
Q10	20170	cfs
Q5	14350	cfs
Q2	7649	cfs

Appendix D

HEC-RAS Model Output
Existing Conditions

Appendix D-1

KLICKITAT RIVER AT WAHKIACUS SURVEYED CONDITION


Wahkiacus Existing 2010 Plan: KlickitatR w/Bridge Exist addl xsection 12/9/2010
KLICKITAT RIVER WAHKIACUS
Legend
WS 19600cfs
WS 7500cfs
WS 3000cfs
WS 1500cfs
WS 950cfs
WS 650cfs
Ground
Elevation (ft)
530
520
510
500
490
480
470
460
15.0
15.5
16.0
16.5
17.0
17.5
18.0
Main Channel Distance (mi)

HEC-RAS Plan: KR Exist +xsect River: KLICKITAT RIVER Reach: WAHKIACUS

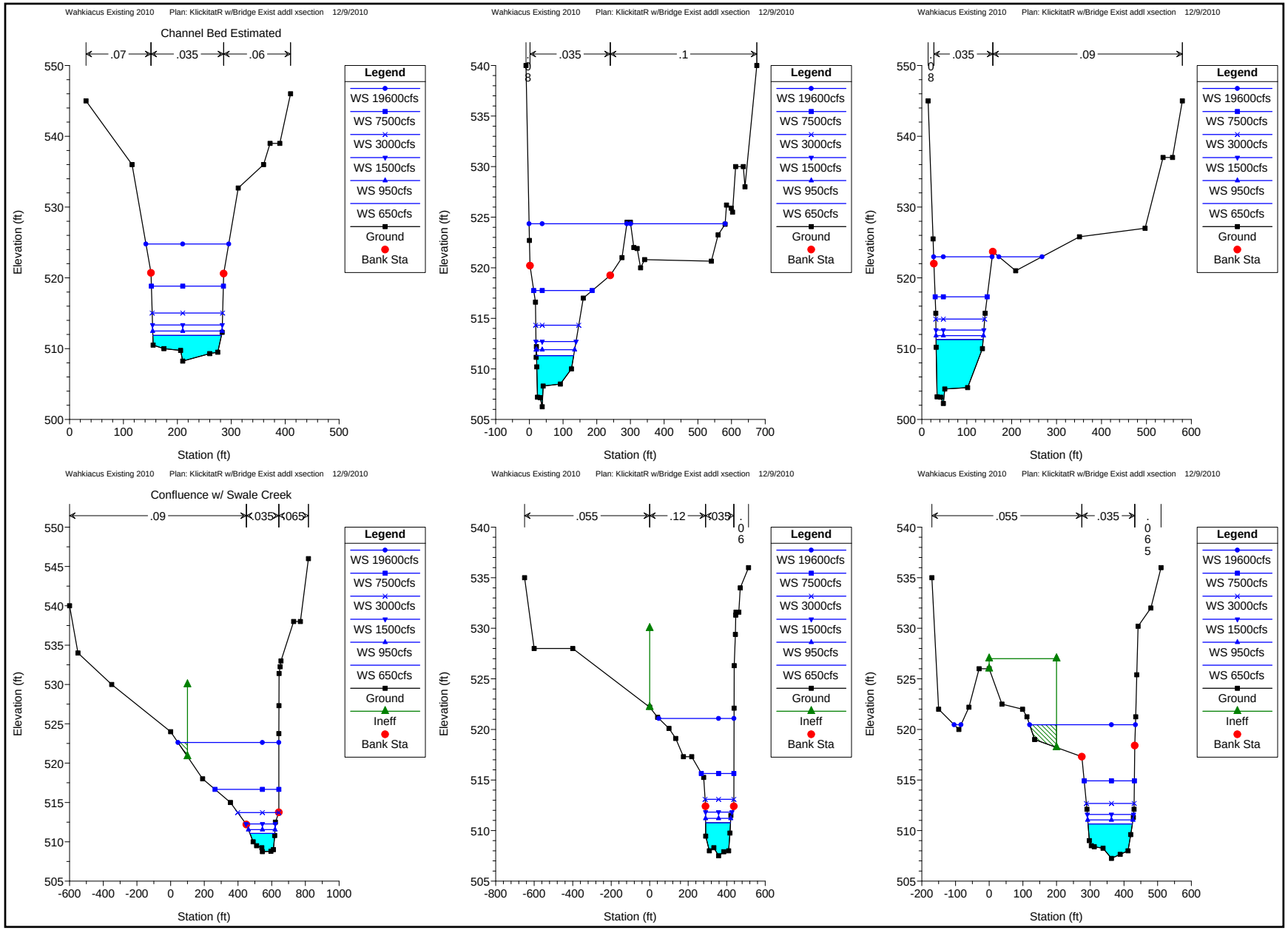
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
WAHKIACUS	17.5880	650cfs	625.00	508.25	511.87	510.29	511.94	0.000731	2.04	306.07	127.31	0.23
WAHKIACUS	17.5880	950cfs	900.00	508.25	512.49	510.59	512.58	0.000717	2.33	385.58	128.85	0.24
WAHKIACUS	17.5880	1500cfs	1350.00	508.25	513.34	510.95	513.46	0.000712	2.72	495.62	129.49	0.25
WAHKIACUS	17.5880	3000cfs	2500.00	508.25	515.03	511.74	515.22	0.000744	3.49	715.68	130.77	0.26
WAHKIACUS	17.5880	7500cfs	6700.00	508.25	518.83	513.88	519.30	0.000983	5.51	1216.88	133.62	0.32
WAHKIACUS	17.5880	19600cfs	17600.00	508.25	524.79	517.83	525.95	0.001290	8.69	2058.88	153.69	0.40
WAHKIACUS	17.4365	650cfs	625.00	506.25	511.31		511.38	0.000666	2.09	299.23	110.33	0.22
WAHKIACUS	17.4365	950cfs	900.00	506.25	511.89		511.98	0.000760	2.47	364.17	114.27	0.24
WAHKIACUS	17.4365	1500cfs	1350.00	506.25	512.70		512.84	0.000840	2.94	459.38	119.09	0.26
WAHKIACUS	17.4365	3000cfs	2500.00	506.25	514.32		514.55	0.000958	3.79	659.20	127.78	0.29
WAHKIACUS	17.4365	7500cfs	6700.00	506.25	517.75		518.28	0.001667	5.88	1139.10	173.61	0.40
WAHKIACUS	17.4365	19600cfs	17600.00	506.25	524.35		524.91	0.000908	6.23	3727.28	570.76	0.33
WAHKIACUS	17.3418	650cfs	625.00	502.25	511.28		511.30	0.000054	0.98	634.80	104.77	0.07
WAHKIACUS	17.3418	950cfs	900.00	502.25	511.84		511.87	0.000084	1.30	693.68	105.55	0.09
WAHKIACUS	17.3418	1500cfs	1350.00	502.25	512.63		512.68	0.000133	1.74	777.17	106.66	0.11
WAHKIACUS	17.3418	3000cfs	2500.00	502.25	514.19		514.29	0.000248	2.65	944.84	108.85	0.16
WAHKIACUS	17.3418	7500cfs	6700.00	502.25	517.32		517.74	0.000691	5.17	1295.92	115.86	0.27
WAHKIACUS	17.3418	19600cfs	17600.00	502.25	522.98		524.18	0.001340	8.81	2087.73	226.26	0.40
WAHKIACUS	17.2092	650cfs	625.00	508.75	511.06		511.15	0.001664	2.47	252.77	147.87	0.33
WAHKIACUS	17.2092	950cfs	900.00	508.75	511.55		511.67	0.001581	2.74	328.15	157.99	0.34
WAHKIACUS	17.2092	1500cfs	1350.00	508.75	512.26		512.40	0.001433	3.03	445.57	173.55	0.33
WAHKIACUS	17.2092	3000cfs	2500.00	508.75	513.71		513.90	0.001203	3.51	745.84	242.80	0.32
WAHKIACUS	17.2092	7500cfs	6700.00	508.75	516.66		517.04	0.001123	5.01	1641.05	378.71	0.34
WAHKIACUS	17.2092	19600cfs	17600.00	508.75	522.63		523.09	0.000682	5.99	4577.01	598.95	0.30
WAHKIACUS	17.1506	650cfs	650.00	507.50	510.77	508.98	510.83	0.000570	1.91	339.48	129.37	0.21
WAHKIACUS	17.1506	950cfs	950.00	507.50	511.21	509.27	511.30	0.000740	2.40	396.36	130.76	0.24
WAHKIACUS	17.1506	1500cfs	1500.00	507.50	511.83	509.72	511.98	0.001055	3.13	478.49	137.25	0.30
WAHKIACUS	17.1506	3000cfs	3000.00	507.50	513.08	510.69	513.40	0.001581	4.54	661.45	149.47	0.38
WAHKIACUS	17.1506	7500cfs	7500.00	507.50	515.64	512.91	516.45	0.002193	7.22	1057.38	169.15	0.48
WAHKIACUS	17.1506	19600cfs	19600.00	507.50	521.08	516.86	522.59	0.002008	10.12	2567.35	390.70	0.50
WAHKIACUS	17.0938	650cfs	650.00	507.25	510.65	508.91	510.71	0.000619	1.95	332.80	131.67	0.22
WAHKIACUS	17.0938	950cfs	950.00	507.25	511.05	509.20	511.14	0.000833	2.46	385.50	134.43	0.26
WAHKIACUS	17.0938	1500cfs	1500.00	507.25	511.59	509.65	511.75	0.001198	3.27	459.19	137.56	0.32
WAHKIACUS	17.0938	3000cfs	3000.00	507.25	512.68	510.65	513.05	0.001933	4.91	611.61	141.85	0.42
WAHKIACUS	17.0938	7500cfs	7500.00	507.25	514.91	512.78	515.91	0.003166	8.00	936.93	149.01	0.56

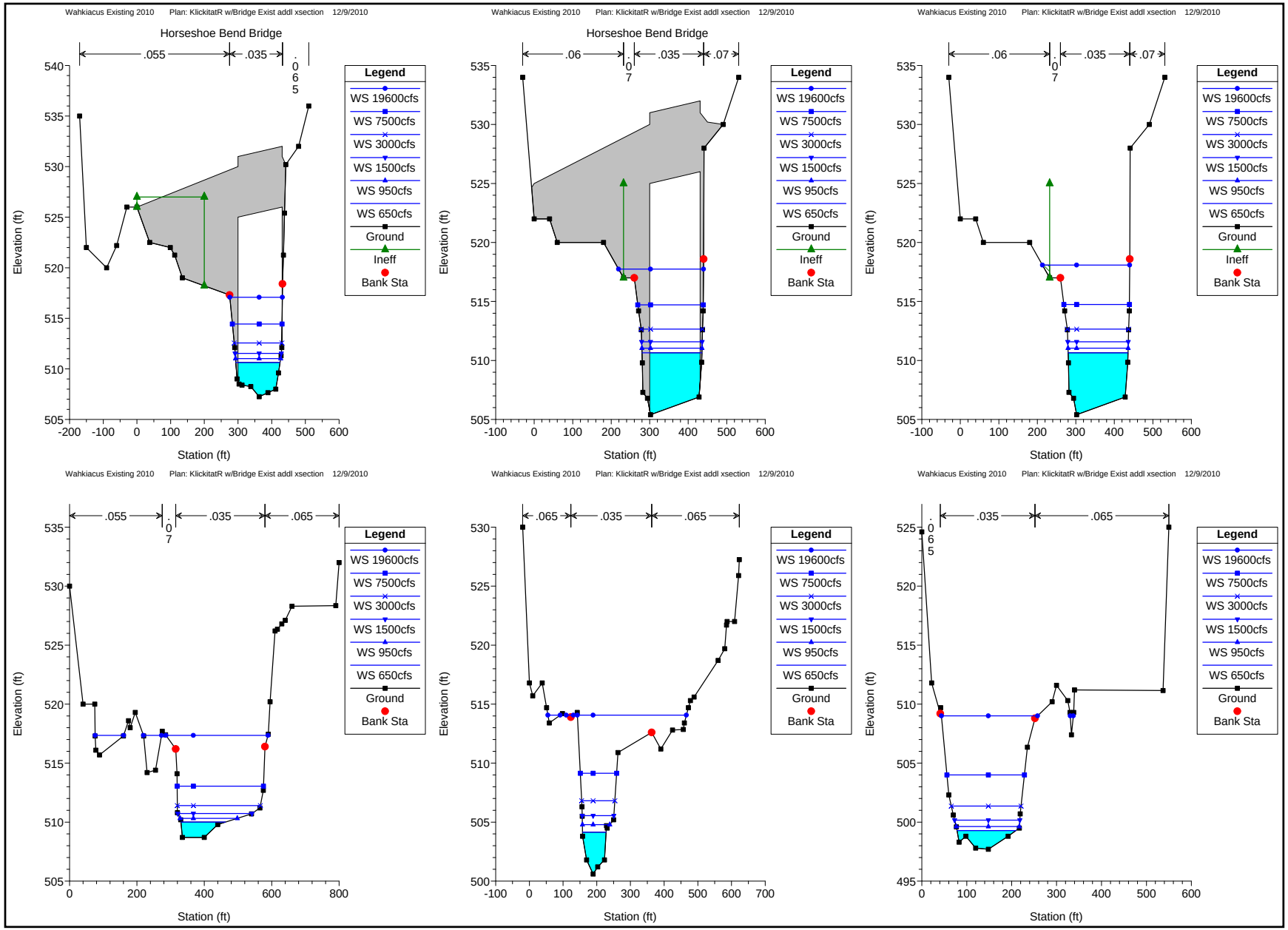
HEC-RAS Plan: KR Exist +xsect River: KLICKITAT RIVER Reach: WAHKIACUS (Continued)

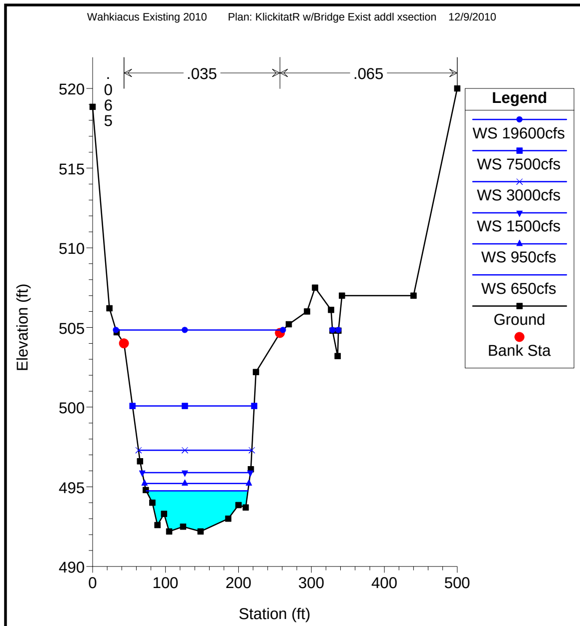
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
WAHKIACUS	17.0938	19600cfs	19600.00	507.25	520.47	516.81	522.16	0.002550	10.60	2008.82	334.51	0.55
WAHKIACUS	17.0875		Bridge									
WAHKIACUS	17.0765	650cfs	650.00	505.40	510.65		510.66	0.000079	0.98	664.67	155.49	0.08
WAHKIACUS	17.0765	950cfs	950.00	505.40	511.04		511.07	0.000126	1.31	726.34	156.20	0.11
WAHKIACUS	17.0765	1500cfs	1500.00	505.40	511.58		511.63	0.000220	1.85	810.70	157.17	0.14
WAHKIACUS	17.0765	3000cfs	3000.00	505.40	512.66		512.80	0.000479	3.06	980.94	159.32	0.22
WAHKIACUS	17.0765	7500cfs	7500.00	505.40	514.74		515.24	0.001207	5.66	1325.57	170.26	0.36
WAHKIACUS	17.0765	19600cfs	19600.00	505.40	518.08		519.70	0.002643	10.22	1944.92	226.63	0.55
WAHKIACUS	17.0293	650cfs	650.00	508.70	510.00	510.00	510.46	0.018579	5.42	119.82	131.80	1.00
WAHKIACUS	17.0293	950cfs	950.00	508.70	510.32	510.32	510.82	0.018209	5.67	167.45	169.67	1.01
WAHKIACUS	17.0293	1500cfs	1500.00	508.70	510.72	510.72	511.30	0.017616	6.08	246.77	219.99	1.01
WAHKIACUS	17.0293	3000cfs	3000.00	508.70	511.40	511.40	512.25	0.015567	7.38	406.53	246.51	1.01
WAHKIACUS	17.0293	7500cfs	7500.00	508.70	513.05	512.82	514.34	0.009866	9.12	822.03	256.15	0.90
WAHKIACUS	17.0293	19600cfs	19600.00	508.70	517.36		518.82	0.003830	9.82	2165.47	441.26	0.64
WAHKIACUS	16.9583	650cfs	650.00	500.60	504.15	502.89	504.36	0.002244	3.69	176.28	70.06	0.41
WAHKIACUS	16.9583	950cfs	950.00	500.60	504.78	503.35	505.07	0.002687	4.26	222.98	81.31	0.45
WAHKIACUS	16.9583	1500cfs	1500.00	500.60	505.55	504.04	505.96	0.003329	5.14	291.60	93.85	0.51
WAHKIACUS	16.9583	3000cfs	3000.00	500.60	506.81	505.59	507.63	0.004492	7.27	412.90	98.56	0.63
WAHKIACUS	16.9583	7500cfs	7500.00	500.60	509.14	508.33	511.18	0.006947	11.48	653.03	107.94	0.82
WAHKIACUS	16.9583	19600cfs	19600.00	500.60	514.06	514.06	516.66	0.008334	13.11	1642.75	381.51	0.92
WAHKIACUS	16.7698	650cfs	650.00	497.70	499.28	499.21	499.69	0.015070	5.11	127.14	130.71	0.91
WAHKIACUS	16.7698	950cfs	950.00	497.70	499.63	499.50	500.09	0.012225	5.43	174.97	140.43	0.86
WAHKIACUS	16.7698	1500cfs	1500.00	497.70	500.17		500.72	0.009462	5.95	251.93	145.10	0.80
WAHKIACUS	16.7698	3000cfs	3000.00	497.70	501.36		502.11	0.006956	6.97	430.70	155.34	0.74
WAHKIACUS	16.7698	7500cfs	7500.00	497.70	504.00		505.17	0.004886	8.65	866.86	172.50	0.68
WAHKIACUS	16.7698	19600cfs	19600.00	497.70	509.01	506.42	510.83	0.003715	10.83	1815.97	220.67	0.65
WAHKIACUS	16.5189	650cfs	650.00	492.20	494.74		494.84	0.001568	2.52	257.49	139.42	0.33
WAHKIACUS	16.5189	950cfs	950.00	492.20	495.21		495.34	0.001637	2.94	322.70	143.19	0.35
WAHKIACUS	16.5189	1500cfs	1500.00	492.20	495.89		496.08	0.001747	3.55	422.21	148.22	0.37
WAHKIACUS	16.5189	3000cfs	3000.00	492.20	497.30		497.64	0.001901	4.71	636.94	155.45	0.41
WAHKIACUS	16.5189	7500cfs	7500.00	492.20	500.07		500.82	0.002244	6.92	1084.00	166.88	0.48
WAHKIACUS	16.5189	19600cfs	19600.00	492.20	504.84		506.38	0.002932	9.95	1980.48	237.27	0.58
WAHKIACUS	16.1108	650cfs	650.00	484.40	486.15	486.15	486.60	0.019584	5.36	121.16	141.06	1.02

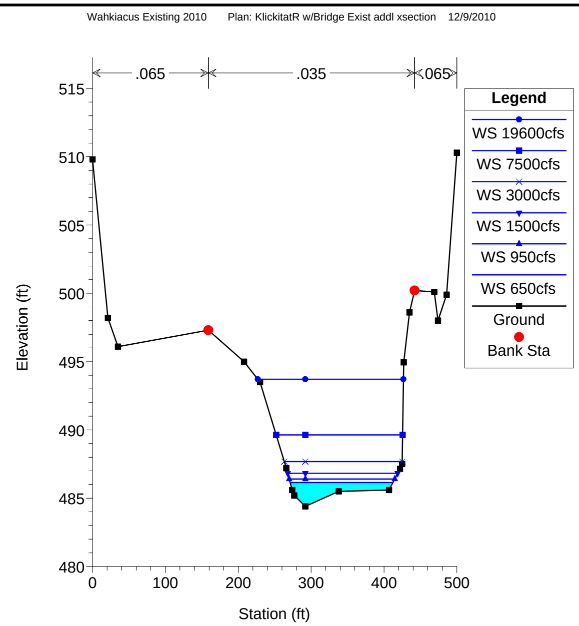
HEC-RAS Plan: KR Exist +xsect River: KLICKITAT RIVER Reach: WAHKIACUS (Continued)

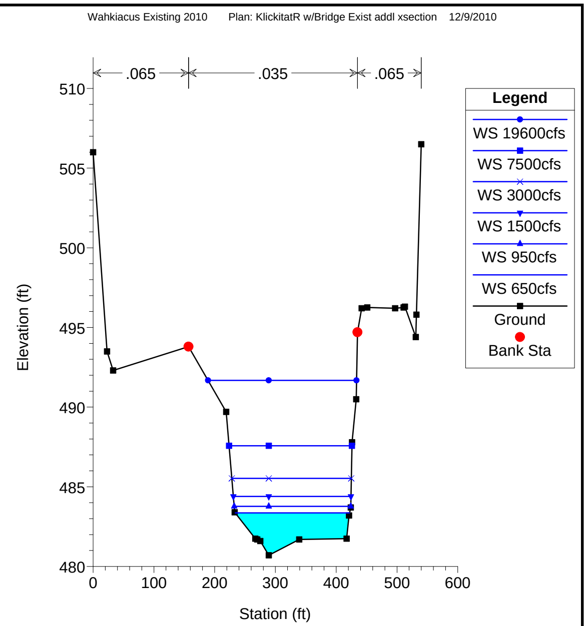
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
WAHKIACUS	16.1108	950cfs	950.00	484.40	486.40	486.40	486.97	0.017994	6.02	157.72	144.81	1.02
WAHKIACUS	16.1108	1500cfs	1500.00	484.40	486.82	486.82	487.55	0.015826	6.84	219.21	150.91	1.00
WAHKIACUS	16.1108	3000cfs	3000.00	484.40	487.68	487.68	488.79	0.014079	8.47	354.04	161.79	1.01
WAHKIACUS	16.1108	7500cfs	7500.00	484.40	489.63	489.57	491.51	0.011041	11.01	681.11	173.46	0.98
WAHKIACUS	16.1108	19600cfs	19600.00	484.40	493.71	493.08	496.59	0.007681	13.62	1438.80	199.75	0.89
WAHKIACUS	16.0000	650cfs	650.00	480.70	483.36	482.32	483.43	0.001260	2.10	309.70	188.06	0.29
WAHKIACUS	16.0000	950cfs	950.00	480.70	483.77	482.55	483.87	0.001292	2.44	389.20	191.87	0.30
WAHKIACUS	16.0000	1500cfs	1500.00	480.70	484.40	482.92	484.53	0.001336	2.95	509.10	193.55	0.32
WAHKIACUS	16.0000	3000cfs	3000.00	480.70	485.53	483.70	485.79	0.001656	4.11	729.47	196.62	0.38
WAHKIACUS	16.0000	7500cfs	7500.00	480.70	487.58		488.25	0.002459	6.59	1138.94	202.18	0.49
WAHKIACUS	16.0000	19600cfs	19600.00	480.70	491.67		493.12	0.003174	9.66	2029.13	244.42	0.59
WAHKIACUS	15.212	650cfs	650.00	467.80	469.61	469.61	470.06	0.019215	5.38	120.87	138.10	1.01
WAHKIACUS	15.212	950cfs	950.00	467.80	469.87	469.87	470.44	0.017836	6.05	157.06	142.15	1.01
WAHKIACUS	15.212	1500cfs	1500.00	467.80	470.28	470.28	471.02	0.016047	6.91	217.17	148.63	1.01
WAHKIACUS	15.212	3000cfs	3000.00	467.80	471.51		472.35	0.008636	7.36	407.50	158.57	0.81
WAHKIACUS	15.212	7500cfs	7500.00	467.80	474.73		475.74	0.003727	8.04	932.42	167.72	0.60
WAHKIACUS	15.212	19600cfs	19600.00	467.80	480.48		481.86	0.002333	9.59	2406.16	464.60	0.52
WAHKIACUS	15.149	650cfs	650.00	462.30	466.87	465.66	467.07	0.002491	3.60	180.52	80.72	0.42
WAHKIACUS	15.149	950cfs	950.00	462.30	467.50	466.17	467.76	0.002527	4.08	233.07	87.36	0.44
WAHKIACUS	15.149	1500cfs	1500.00	462.30	468.42	466.84	468.77	0.002576	4.71	318.25	97.17	0.46
WAHKIACUS	15.149	3000cfs	3000.00	462.30	470.29		470.81	0.002602	5.79	518.56	117.03	0.48
WAHKIACUS	15.149	7500cfs	7500.00	462.30	473.79		474.69	0.002537	7.61	985.78	143.78	0.51
WAHKIACUS	15.149	19600cfs	19600.00	462.30	479.10		481.00	0.002573	11.07	1790.94	159.42	0.56
WAHKIACUS	15.000	650cfs	650.00	460.30	464.66	463.58	464.89	0.003002	3.82	170.05	79.96	0.46
WAHKIACUS	15.000	950cfs	950.00	460.30	465.26	464.10	465.55	0.003000	4.33	219.54	85.49	0.48
WAHKIACUS	15.000	1500cfs	1500.00	460.30	466.16	464.75	466.55	0.003000	5.00	299.94	93.77	0.49
WAHKIACUS	15.000	3000cfs	3000.00	460.30	467.98	466.09	468.57	0.003001	6.17	486.38	110.63	0.52
WAHKIACUS	15.000	7500cfs	7500.00	460.30	471.46	468.90	472.48	0.003004	8.11	925.04	138.87	0.55
WAHKIACUS	15.000	19600cfs	19600.00	460.30	476.67	473.39	478.76	0.003000	11.61	1714.59	163.78	0.60

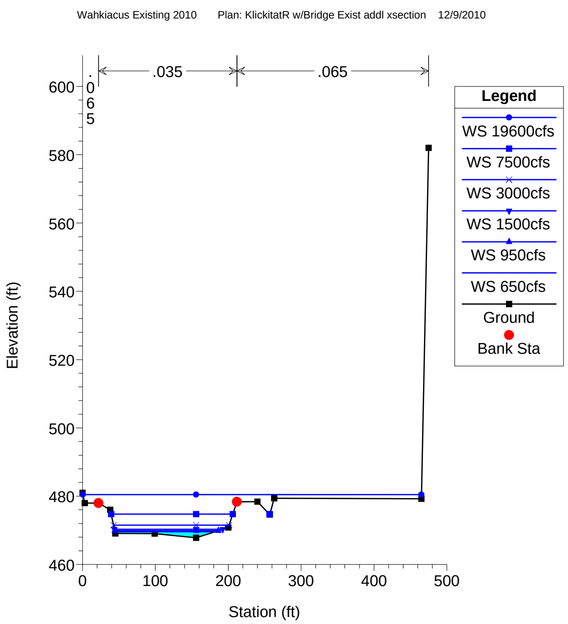

Wahkiacus Existing 2010 Plan: KlickitatR w/Bridge Exist addl xsection 12/9/2010
Channel Bed Estimated
.07
.035
.06
Elevation (ft)
Station (ft)
Legend
WS 19600cfs
WS 7500cfs
WS 3000cfs
WS 1500cfs
WS 950cfs
WS 650cfs
Ground
Bank Sta
Wahkiacus Existing 2010 Plan: KlickitatR w/Bridge Exist addl xsection 12/9/2010
.035
.1
Elevation (ft)
Station (ft)
Legend
WS 19600cfs
WS 7500cfs
WS 3000cfs
WS 1500cfs
WS 950cfs
WS 650cfs
Ground
Bank Sta
Wahkiacus Existing 2010 Plan: KlickitatR w/Bridge Exist addl xsection 12/9/2010
.035
.09
Elevation (ft)
Station (ft)
Legend
WS 19600cfs
WS 7500cfs
WS 3000cfs
WS 1500cfs
WS 950cfs
WS 650cfs
Ground
Bank Sta
Wahkiacus Existing 2010 Plan: KlickitatR w/Bridge Exist addl xsection 12/9/2010
Confluence w/ Swale Creek
.09
.035
.065
Elevation (ft)
Station (ft)
Legend
WS 19600cfs
WS 7500cfs
WS 3000cfs
WS 1500cfs
WS 950cfs
WS 650cfs
Ground
Ineff
Bank Sta
Wahkiacus Existing 2010 Plan: KlickitatR w/Bridge Exist addl xsection 12/9/2010
.055
.12
.035
Elevation (ft)
Station (ft)
Legend
WS 19600cfs
WS 7500cfs
WS 3000cfs
WS 1500cfs
WS 950cfs
WS 650cfs
Ground
Ineff
Bank Sta
Wahkiacus Existing 2010 Plan: KlickitatR w/Bridge Exist addl xsection 12/9/2010
.055
.035
Elevation (ft)
Station (ft)
Legend
WS 19600cfs
WS 7500cfs
WS 3000cfs
WS 1500cfs
WS 950cfs
WS 650cfs
Ground
Ineff
Bank Sta

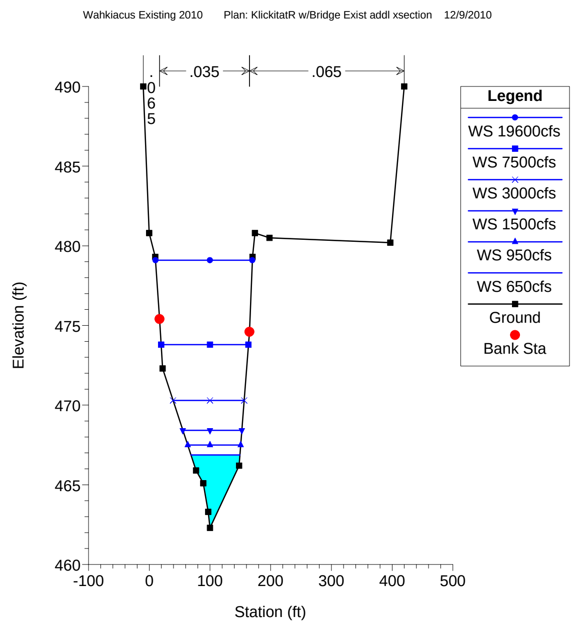

Wahkiacus Existing 2010 Plan: KlickitatR w/Bridge Exist addl xsection 12/9/2010
Horseshoe Bend Bridge
.055
.035
.065
Legend
WS 19600cfs
WS 7500cfs
WS 3000cfs
WS 1500cfs
WS 950cfs
WS 650cfs
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
.06
.07
.065

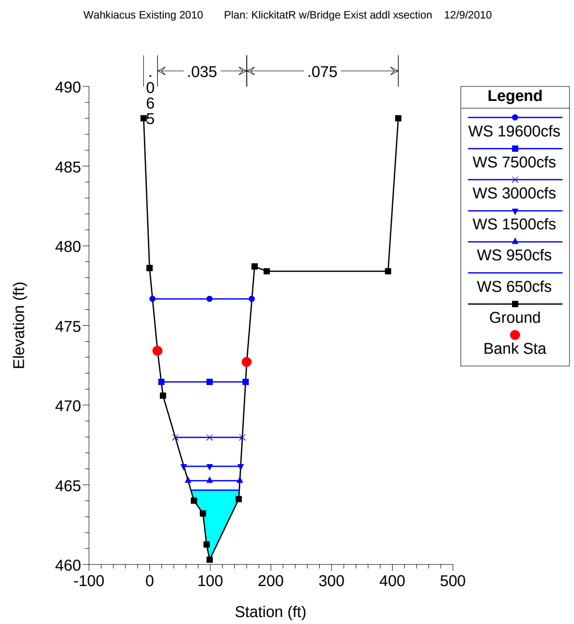

Wahkiacus Existing 2010 Plan: KlickitatR w/Bridge Exist addl xsection 12/9/2010
.065
.035
.065
Legend
WS 19600cfs
WS 7500cfs
WS 3000cfs
WS 1500cfs
WS 950cfs
WS 650cfs
Ground
Bank Sta
Elevation (ft)
490 495 500 505 510 515 520
Station (ft)
0 100 200 300 400 500


Wahkiacus Existing 2010 Plan: KlickitatR w/Bridge Exist addl xsection 12/9/2010
.065
.035
.065
Legend
WS 19600cfs
WS 7500cfs
WS 3000cfs
WS 1500cfs
WS 950cfs
WS 650cfs
Ground
Bank Sta
Elevation (ft)
480 485 490 495 500 505 510 515
Station (ft)
0 100 200 300 400 500


Wahkiacus Existing 2010 Plan: KlickitatR w/Bridge Exist addl xsection 12/9/2010
.065
.035
.065
Legend
WS 19600cfs
WS 7500cfs
WS 3000cfs
WS 1500cfs
WS 950cfs
WS 650cfs
Ground
Bank Sta
Elevation (ft)
480 485 490 495 500 505 510
Station (ft)
0 100 200 300 400 500 600

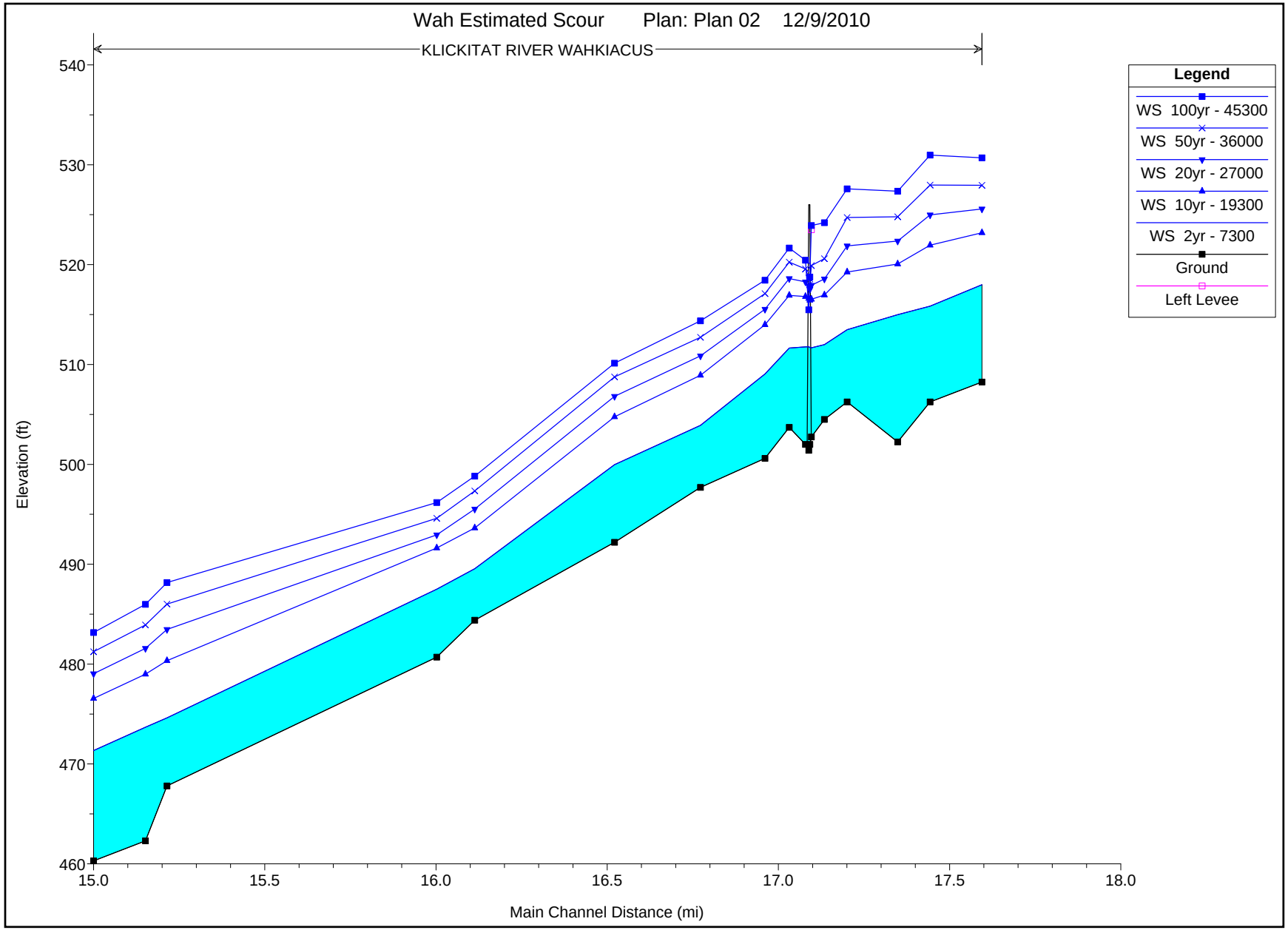

Wahkiacus Existing 2010 Plan: KlickitatR w/Bridge Exist addl xsection 12/9/2010
.065
.035
.065
Legend
WS 19600cfs
WS 7500cfs
WS 3000cfs
WS 1500cfs
WS 950cfs
WS 650cfs
Ground
Bank Sta
Elevation (ft)
460 480 500 520 540 560 580 600
Station (ft)
0 100 200 300 400 500

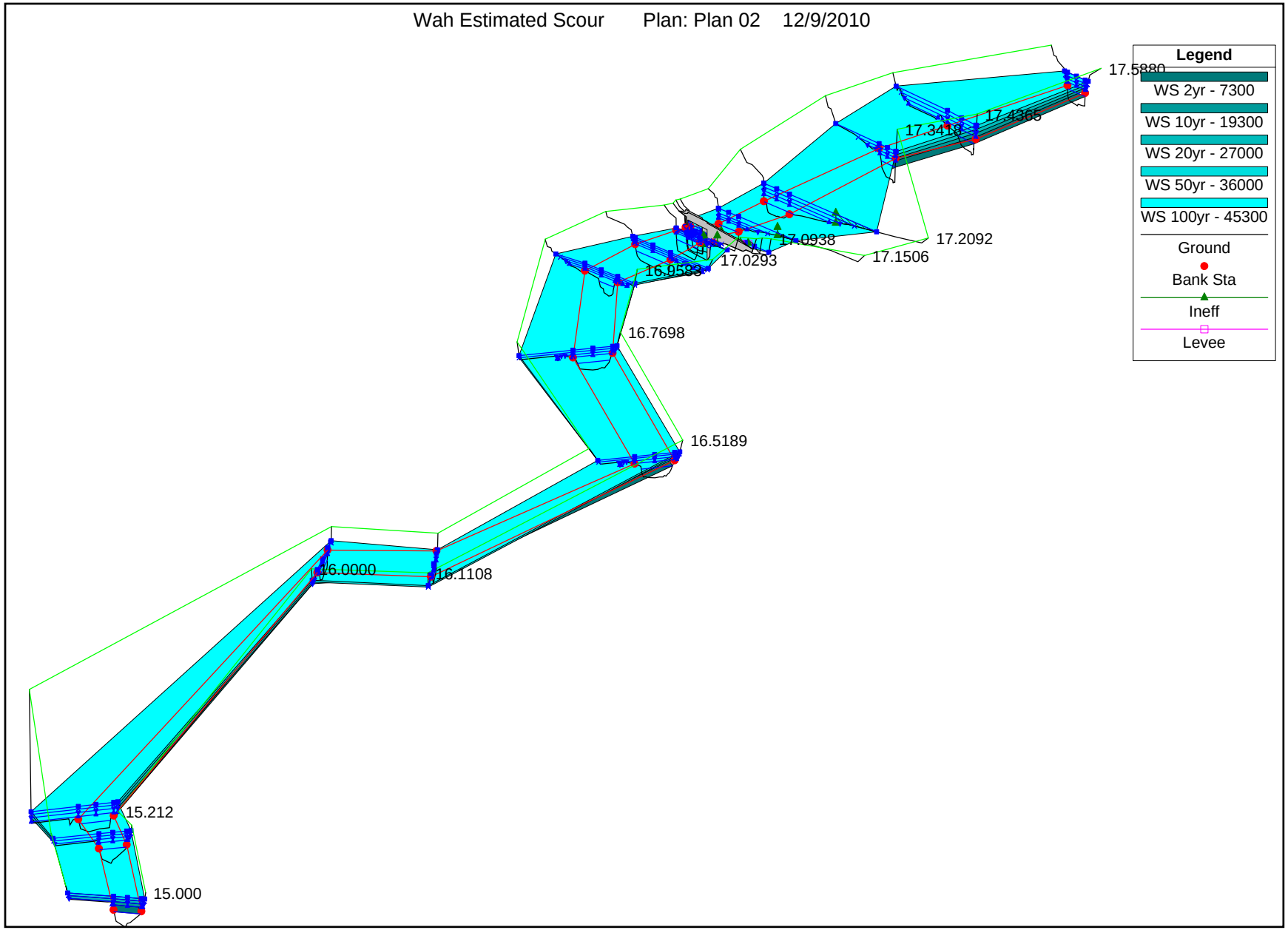

Wahkiacus Existing 2010 Plan: KlickitatR w/Bridge Exist addl xsection 12/9/2010
.065
.035
.065
Legend
WS 19600cfs
WS 7500cfs
WS 3000cfs
WS 1500cfs
WS 950cfs
WS 650cfs
Ground
Bank Sta
Elevation (ft)
460 465 470 475 480 485 490
Station (ft)
-100 0 100 200 300 400 500


Wahkiacus Existing 2010 Plan: KlickitatR w/Bridge Exist addl xsection 12/9/2010
.065
.035
.075
Legend
WS 19600cfs
WS 7500cfs
WS 3000cfs
WS 1500cfs
WS 950cfs
WS 650cfs
Ground
Bank Sta
Elevation (ft)
460 465 470 475 480 485 490
Station (ft)
-100 0 100 200 300 400 500

Appendix D-2

KLICKITAT RIVER AT WAHKIACUS
SCOURED CONDITION


Wah Estimated Scour Plan: Plan 02 12/9/2010
KLICKITAT RIVER WAHKIACUS
Legend
WS 100yr - 45300
WS 50yr - 36000
WS 20yr - 27000
WS 10yr - 19300
WS 2yr - 7300
Ground
Left Levee
Elevation (ft)
540
530
520
510
500
490
480
470
460
15.0
15.5
16.0
16.5
17.0
17.5
18.0
Main Channel Distance (mi)


Wah Estimated Scour Plan: Plan 02 12/9/2010
17.5880
17.4365
17.3418
17.2092
17.1506
17.0938
17.0293
16.9583
16.7698
16.5189
16.1108
16.0000
15.212
15.000
Legend
WS 2yr - 7300
WS 10yr - 19300
WS 20yr - 27000
WS 50yr - 36000
WS 100yr - 45300
Ground
Bank Sta
Ineff
Levee

HEC-RAS Plan: 100yr+scour River: KLICKITAT RIVER Reach: WAHKIACUS

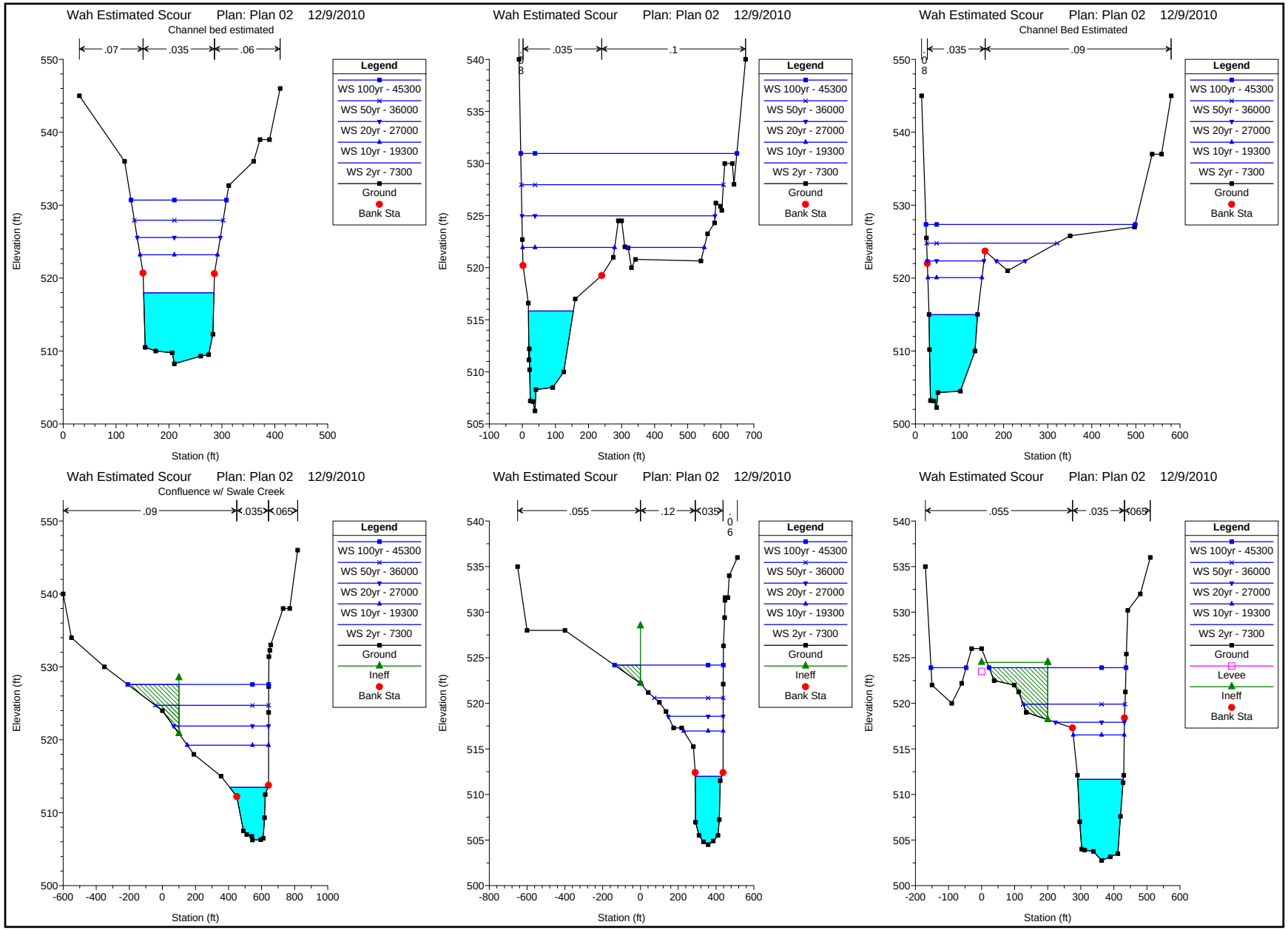
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
WAHKIACUS	17.5880	2yr - 7300	7000.00	508.25	517.99	514.01	518.61	0.001453	6.33	1105.47	132.99	0.39
WAHKIACUS	17.5880	10yr - 19300	17000.00	508.25	523.20	517.65	524.57	0.001756	9.41	1820.48	146.51	0.45
WAHKIACUS	17.5880	20yr - 27000	24000.00	508.25	525.57	519.74	527.53	0.002018	11.24	2180.95	157.23	0.50
WAHKIACUS	17.5880	50yr - 36000	31900.00	508.25	527.94	521.84	530.51	0.002210	12.92	2566.80	167.96	0.53
WAHKIACUS	17.5880	100yr - 45300	38000.00	508.25	530.69	523.34	533.38	0.001929	13.26	3045.31	180.37	0.51
WAHKIACUS	17.4365	2yr - 7300	7000.00	506.25	515.84		516.87	0.003393	8.14	859.50	135.94	0.57
WAHKIACUS	17.4365	10yr - 19300	17000.00	506.25	521.94		522.93	0.002080	8.03	2426.72	512.55	0.48
WAHKIACUS	17.4365	20yr - 27000	24000.00	506.25	524.98		525.89	0.001370	7.94	4095.24	583.75	0.41
WAHKIACUS	17.4365	50yr - 36000	31900.00	506.25	527.97		528.84	0.001021	7.97	5891.68	610.99	0.37
WAHKIACUS	17.4365	100yr - 45300	41300.00	506.25	530.97		531.87	0.000854	8.25	7779.27	653.44	0.34
WAHKIACUS	17.3418	2yr - 7300	7000.00	502.25	514.99		515.70	0.001478	6.78	1032.99	109.99	0.39
WAHKIACUS	17.3418	10yr - 19300	17000.00	502.25	520.06		521.76	0.002300	10.48	1622.86	122.78	0.51
WAHKIACUS	17.3418	20yr - 27000	24000.00	502.25	522.36		524.80	0.002837	12.54	1956.04	194.32	0.57
WAHKIACUS	17.3418	50yr - 36000	31900.00	502.25	524.79		527.83	0.002996	14.09	2568.69	295.83	0.60
WAHKIACUS	17.3418	100yr - 45300	41300.00	502.25	527.36	522.45	530.90	0.002981	15.43	3529.78	474.47	0.61
WAHKIACUS	17.2092	2yr - 7300	7000.00	506.25	513.48		514.19	0.002658	6.77	1059.12	231.06	0.51
WAHKIACUS	17.2092	10yr - 19300	17000.00	506.25	519.26		520.03	0.001212	7.33	3158.42	492.09	0.39
WAHKIACUS	17.2092	20yr - 27000	24000.00	506.25	521.88		522.72	0.001061	7.89	4540.22	575.22	0.37
WAHKIACUS	17.2092	50yr - 36000	31900.00	506.25	524.72		525.58	0.000889	8.18	6080.65	684.52	0.35
WAHKIACUS	17.2092	100yr - 45300	41300.00	506.25	527.59		528.51	0.000798	8.63	7637.40	852.24	0.34
WAHKIACUS	17.1506	2yr - 7300	7300.00	504.50	511.99		513.08	0.003566	8.35	874.13	140.15	0.59
WAHKIACUS	17.1506	10yr - 19300	19300.00	504.50	516.95		519.19	0.003505	12.01	1678.37	209.03	0.64
WAHKIACUS	17.1506	20yr - 27000	27000.00	504.50	518.57	516.28	521.80	0.004255	14.51	2103.39	290.83	0.72
WAHKIACUS	17.1506	50yr - 36000	36000.00	504.50	520.60	518.75	524.64	0.004432	16.37	2755.97	364.53	0.76
WAHKIACUS	17.1506	100yr - 45300	45300.00	504.50	524.19		527.74	0.003040	15.70	4277.00	576.06	0.65
WAHKIACUS	17.0938	2yr - 7300	7300.00	502.75	511.66	508.45	512.46	0.002054	7.15	1020.69	138.31	0.46
WAHKIACUS	17.0938	10yr - 19300	19300.00	502.75	516.53	512.81	518.46	0.002933	11.14	1732.73	154.18	0.59
WAHKIACUS	17.0938	20yr - 27000	27000.00	502.75	517.93	515.01	520.90	0.003985	13.83	1966.92	208.42	0.69
WAHKIACUS	17.0938	50yr - 36000	36000.00	502.75	519.91	517.27	523.69	0.004228	15.70	2425.86	307.93	0.73
WAHKIACUS	17.0938	100yr - 45300	45300.00	502.75	523.91	519.85	527.05	0.002664	14.67	3639.66	520.66	0.60
WAHKIACUS	17.0875		Bridge									
WAHKIACUS	17.0765	2yr - 7300	7300.00	502.00	511.77		512.23	0.001020	5.47	1334.15	157.71	0.33
WAHKIACUS	17.0765	10yr - 19300	19300.00	502.00	516.80		518.02	0.001679	8.86	2179.29	178.82	0.45
WAHKIACUS	17.0765	20yr - 27000	27000.00	502.00	518.27		520.16	0.002274	11.03	2478.72	229.98	0.53
WAHKIACUS	17.0765	50yr - 36000	36000.00	502.00	519.56		522.34	0.002978	13.40	2746.81	252.49	0.61

HEC-RAS Plan: 100yr+scour River: KLICKITAT RIVER Reach: WAHKIACUS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
WAHKIACUS	17.0765	100yr - 45300	45300.00	502.00	520.45		524.34	0.003871	15.88	2931.21	384.67	0.71
WAHKIACUS	17.0293	2yr - 7300	7300.00	503.70	511.64		511.94	0.000899	4.41	1653.92	252.90	0.30
WAHKIACUS	17.0293	10yr - 19300	19300.00	503.70	516.92		517.54	0.000897	6.33	3173.09	403.91	0.33
WAHKIACUS	17.0293	20yr - 27000	27000.00	503.70	518.60		519.48	0.001073	7.59	3945.73	499.87	0.37
WAHKIACUS	17.0293	50yr - 36000	36000.00	503.70	520.25		521.39	0.001226	8.78	4801.21	556.12	0.40
WAHKIACUS	17.0293	100yr - 45300	45300.00	503.70	521.66		523.05	0.001354	9.81	5593.47	565.30	0.43
WAHKIACUS	16.9583	2yr - 7300	7300.00	500.60	509.06	508.23	511.05	0.006850	11.33	644.41	107.62	0.82
WAHKIACUS	16.9583	10yr - 19300	19300.00	500.60	513.98	513.98	516.58	0.008273	13.10	1611.92	365.27	0.91
WAHKIACUS	16.9583	20yr - 27000	27000.00	500.60	515.54	515.35	518.42	0.007633	14.04	2264.52	440.94	0.90
WAHKIACUS	16.9583	50yr - 36000	36000.00	500.60	517.10	516.91	520.28	0.006752	14.97	3023.10	523.87	0.87
WAHKIACUS	16.9583	100yr - 45300	45300.00	500.60	518.44	518.16	521.90	0.006305	15.85	3745.59	556.53	0.86
WAHKIACUS	16.7698	2yr - 7300	7300.00	497.70	503.90		505.05	0.004935	8.60	849.24	171.96	0.68
WAHKIACUS	16.7698	10yr - 19300	19300.00	497.70	508.92	506.34	510.72	0.003716	10.76	1797.54	217.82	0.65
WAHKIACUS	16.7698	20yr - 27000	27000.00	497.70	510.86		513.16	0.003705	12.20	2294.10	291.37	0.67
WAHKIACUS	16.7698	50yr - 36000	36000.00	497.70	512.72	510.25	515.42	0.003591	13.40	3182.37	518.07	0.67
WAHKIACUS	16.7698	100yr - 45300	45300.00	497.70	514.37		517.30	0.003439	14.26	4037.08	522.43	0.67
WAHKIACUS	16.5189	2yr - 7300	7300.00	492.20	499.97		500.70	0.002227	6.84	1067.75	166.48	0.48
WAHKIACUS	16.5189	10yr - 19300	19300.00	492.20	504.75		506.27	0.002934	9.89	1960.12	234.43	0.58
WAHKIACUS	16.5189	20yr - 27000	27000.00	492.20	506.81		508.75	0.002875	11.22	2517.29	303.78	0.59
WAHKIACUS	16.5189	50yr - 36000	36000.00	492.20	508.75		511.08	0.002855	12.44	3315.42	429.72	0.61
WAHKIACUS	16.5189	100yr - 45300	45300.00	492.20	510.13		512.95	0.003088	13.83	3914.96	438.61	0.64
WAHKIACUS	16.1108	2yr - 7300	7300.00	484.40	489.55	489.50	491.41	0.011162	10.94	667.12	172.98	0.98
WAHKIACUS	16.1108	10yr - 19300	19300.00	484.40	493.63	493.01	496.49	0.007662	13.56	1423.16	198.58	0.89
WAHKIACUS	16.1108	20yr - 27000	27000.00	484.40	495.53	494.97	498.92	0.008005	14.77	1827.60	231.50	0.93
WAHKIACUS	16.1108	50yr - 36000	36000.00	484.40	497.34	497.34	501.15	0.008345	15.70	2368.37	405.46	0.96
WAHKIACUS	16.1108	100yr - 45300	45300.00	484.40	498.82	498.82	502.96	0.007521	16.48	2983.02	423.24	0.93
WAHKIACUS	16.0000	2yr - 7300	7300.00	480.70	487.50		488.16	0.002441	6.50	1122.48	201.96	0.49
WAHKIACUS	16.0000	10yr - 19300	19300.00	480.70	491.62		493.04	0.003131	9.57	2015.69	243.57	0.59
WAHKIACUS	16.0000	20yr - 27000	27000.00	480.70	492.94		494.99	0.004089	11.47	2370.76	322.83	0.68
WAHKIACUS	16.0000	50yr - 36000	36000.00	480.70	494.60	492.20	497.07	0.004235	12.68	3017.17	416.03	0.70
WAHKIACUS	16.0000	100yr - 45300	45300.00	480.70	496.17	494.18	498.95	0.003996	13.56	3690.89	441.87	0.70
WAHKIACUS	15.212	2yr - 7300	7300.00	467.80	474.62		475.61	0.003776	8.00	912.93	166.75	0.60
WAHKIACUS	15.212	10yr - 19300	19300.00	467.80	480.34		481.73	0.002380	9.61	2343.77	464.45	0.53
WAHKIACUS	15.212	20yr - 27000	27000.00	467.80	483.48		484.70	0.001596	9.40	3801.40	465.41	0.45
WAHKIACUS	15.212	50yr - 36000	36000.00	467.80	486.01		487.31	0.001410	9.91	4981.25	465.66	0.44

HEC-RAS Plan: 100yr+scour River: KLICKITAT RIVER Reach: WAHKIACUS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
WAHKIACUS	15.212	100yr - 45300	45300.00	467.80	488.17		489.59	0.001348	10.55	5986.49	465.87	0.44
WAHKIACUS	15.149	2yr - 7300	7300.00	462.30	473.68		474.56	0.002537	7.54	968.61	143.35	0.51
WAHKIACUS	15.149	10yr - 19300	19300.00	462.30	478.99		480.87	0.002571	11.00	1773.93	159.12	0.56
WAHKIACUS	15.149	20yr - 27000	27000.00	462.30	481.58	477.24	483.93	0.002519	12.42	2478.17	401.08	0.58
WAHKIACUS	15.149	50yr - 36000	36000.00	462.30	483.93		486.57	0.002434	13.50	3429.72	409.14	0.58
WAHKIACUS	15.149	100yr - 45300	45300.00	462.30	485.98		488.86	0.002381	14.42	4276.54	416.19	0.59
WAHKIACUS	15.000	2yr - 7300	7300.00	460.30	471.34	468.79	472.34	0.003003	8.03	908.63	138.31	0.55
WAHKIACUS	15.000	10yr - 19300	19300.00	460.30	476.57	473.31	478.63	0.003001	11.54	1697.48	163.29	0.60
WAHKIACUS	15.000	20yr - 27000	27000.00	460.30	479.04	475.38	481.70	0.003001	13.16	2252.56	394.59	0.62
WAHKIACUS	15.000	50yr - 36000	36000.00	460.30	481.24	477.60	484.36	0.003001	14.52	3129.55	400.84	0.64
WAHKIACUS	15.000	100yr - 45300	45300.00	460.30	483.17	480.84	486.66	0.003002	15.67	3905.81	406.30	0.65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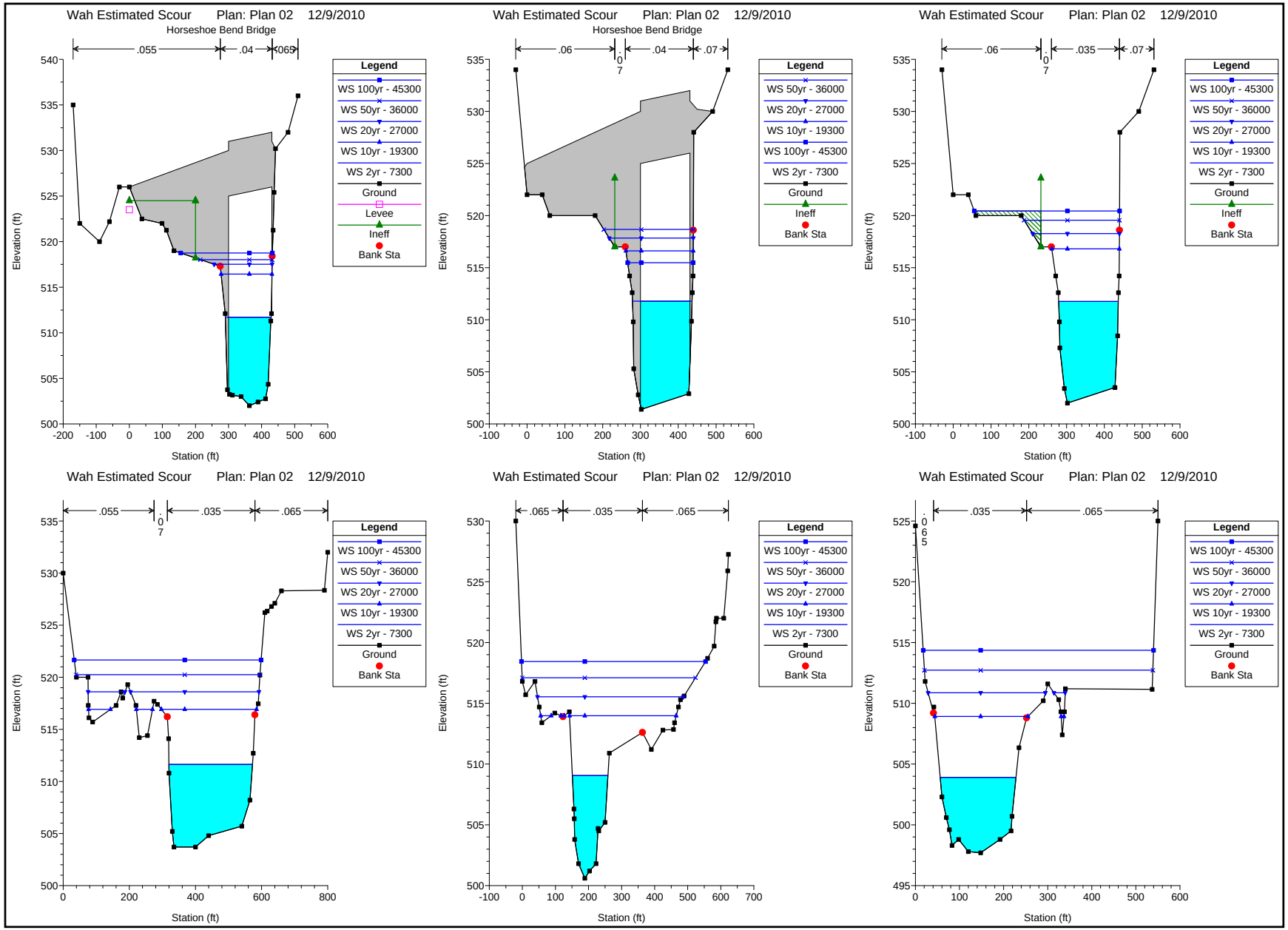
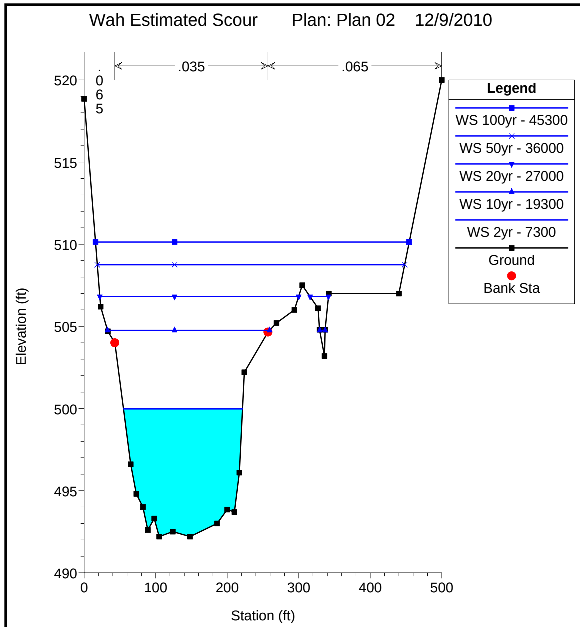
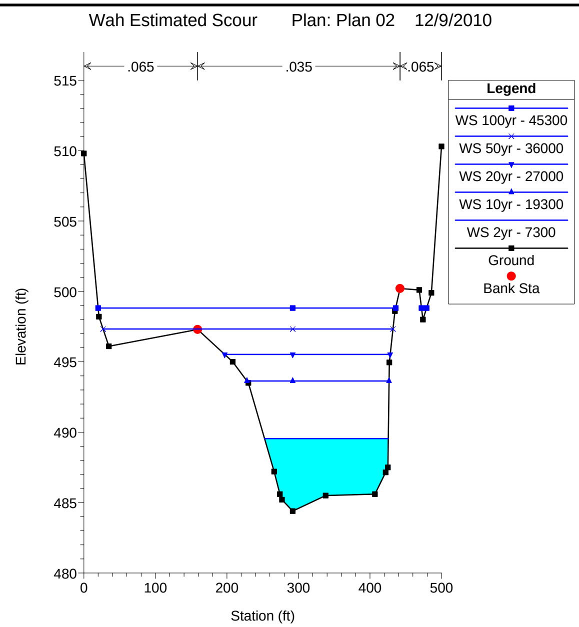
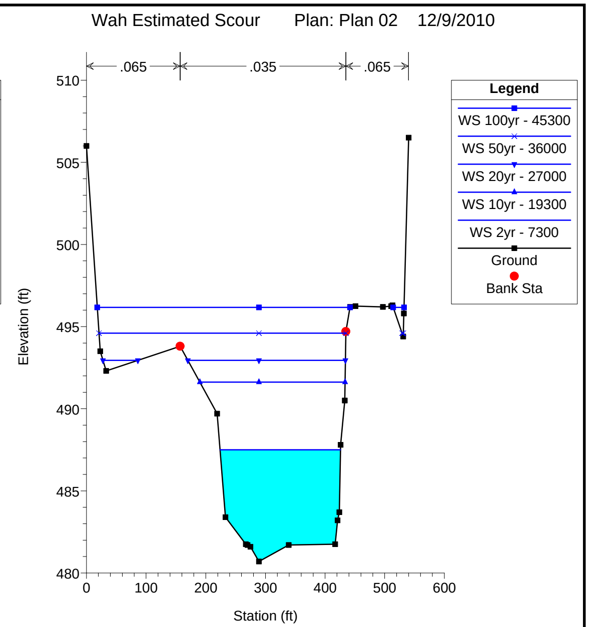
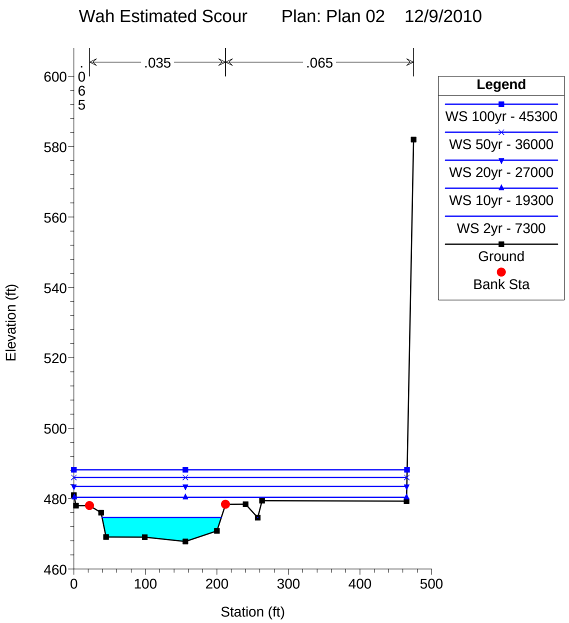
Channel bed estimated
.07
.035
.06
Legend
WS 100yr - 45300
WS 50yr - 36000
WS 20yr - 27000
WS 10yr - 19300
WS 2yr - 7300
Ground
Bank Sta
Elevation (ft)
Station (ft)
Wah Estimated Scour Plan: Plan 02 12/9/2010
.035
.1
Legend
WS 100yr - 45300
WS 50yr - 36000
WS 20yr - 27000
WS 10yr - 19300
WS 2yr - 7300
Ground
Bank Sta
Elevation (ft)
Station (ft)
Wah Estimated Scour Plan: Plan 02 12/9/2010
Channel Bed Estimated
.035
.09
Legend
WS 100yr - 45300
WS 50yr - 36000
WS 20yr - 27000
WS 10yr - 19300
WS 2yr - 7300
Ground
Bank Sta
Elevation (ft)
Station (ft)
Wah Estimated Scour Plan: Plan 02 12/9/2010
Confluence w/ Swale Creek
.09
.035
.065
Legend
WS 100yr - 45300
WS 50yr - 36000
WS 20yr - 27000
WS 10yr - 19300
WS 2yr - 7300
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Wah Estimated Scour Plan: Plan 02 12/9/2010
.055
.12
.035
Legend
WS 100yr - 45300
WS 50yr - 36000
WS 20yr - 27000
WS 10yr - 19300
WS 2yr - 7300
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Wah Estimated Scour Plan: Plan 02 12/9/2010
.055
.035
.065
Legend
WS 100yr - 45300
WS 50yr - 36000
WS 20yr - 27000
WS 10yr - 19300
WS 2yr - 7300
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)

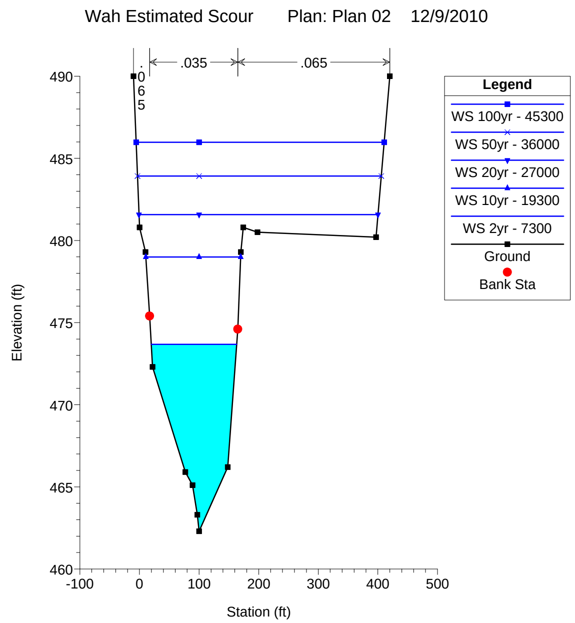

Wah Estimated Scour Plan: Plan 02 12/9/2010
Horseshoe Bend Bridge
.055
.04
.069
Legend
WS 100yr - 45300
WS 50yr - 36000
WS 20yr - 27000
WS 10yr - 19300
WS 2yr - 7300
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Wah Estimated Scour Plan: Plan 02 12/9/2010
Horseshoe Bend Bridge
.06
.04
.07
Legend
WS 50yr - 36000
WS 20yr - 27000
WS 10yr - 19300
WS 100yr - 45300
WS 2yr - 7300
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Wah Estimated Scour Plan: Plan 02 12/9/2010
.06
.035
.07
Legend
WS 100yr - 45300
WS 50yr - 36000
WS 20yr - 27000
WS 10yr - 19300
WS 2yr - 7300
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Wah Estimated Scour Plan: Plan 02 12/9/2010
.055
.035
.065
Legend
WS 100yr - 45300
WS 50yr - 36000
WS 20yr - 27000
WS 10yr - 19300
WS 2yr - 7300
Ground
Bank Sta
Elevation (ft)
Station (ft)
Wah Estimated Scour Plan: Plan 02 12/9/2010
.065
.035
.065
Legend
WS 100yr - 45300
WS 50yr - 36000
WS 20yr - 27000
WS 10yr - 19300
WS 2yr - 7300
Ground
Bank Sta
Elevation (ft)
Station (ft)
Wah Estimated Scour Plan: Plan 02 12/9/2010
.035
.065
Legend
WS 100yr - 45300
WS 50yr - 36000
WS 20yr - 27000
WS 10yr - 19300
WS 2yr - 7300
Ground
Bank Sta
Elevation (ft)
Station (ft)


Wah Estimated Scour Plan: Plan 02 12/9/2010
.065
.035
.065
Legend
WS 100yr - 45300
WS 50yr - 36000
WS 20yr - 27000
WS 10yr - 19300
WS 2yr - 7300
Ground
Bank Sta
Elevation (ft)
Station (ft)


Wah Estimated Scour Plan: Plan 02 12/9/2010
.065
.035
.065
Legend
WS 100yr - 45300
WS 50yr - 36000
WS 20yr - 27000
WS 10yr - 19300
WS 2yr - 7300
Ground
Bank Sta
Elevation (ft)
Station (ft)


Wah Estimated Scour Plan: Plan 02 12/9/2010
.065
.035
.065
Legend
WS 100yr - 45300
WS 50yr - 36000
WS 20yr - 27000
WS 10yr - 19300
WS 2yr - 7300
Ground
Bank Sta
Elevation (ft)
Station (ft)


Wah Estimated Scour Plan: Plan 02 12/9/2010
.065
.035
.065
Legend
WS 100yr - 45300
WS 50yr - 36000
WS 20yr - 27000
WS 10yr - 19300
WS 2yr - 7300
Ground
Bank Sta
Elevation (ft)
Station (ft)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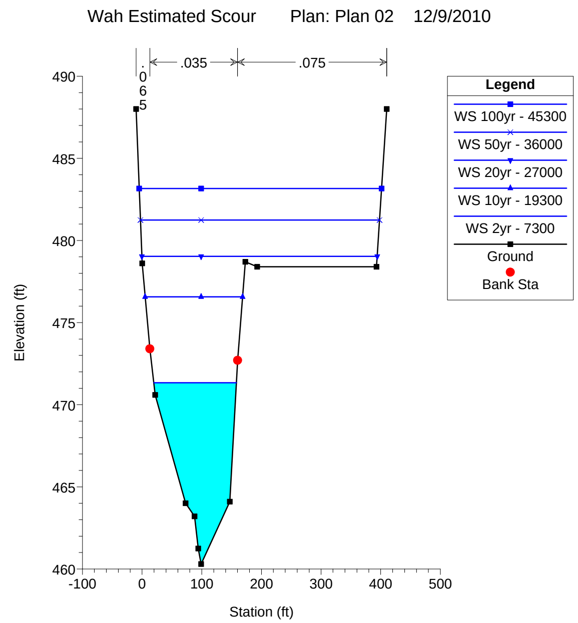
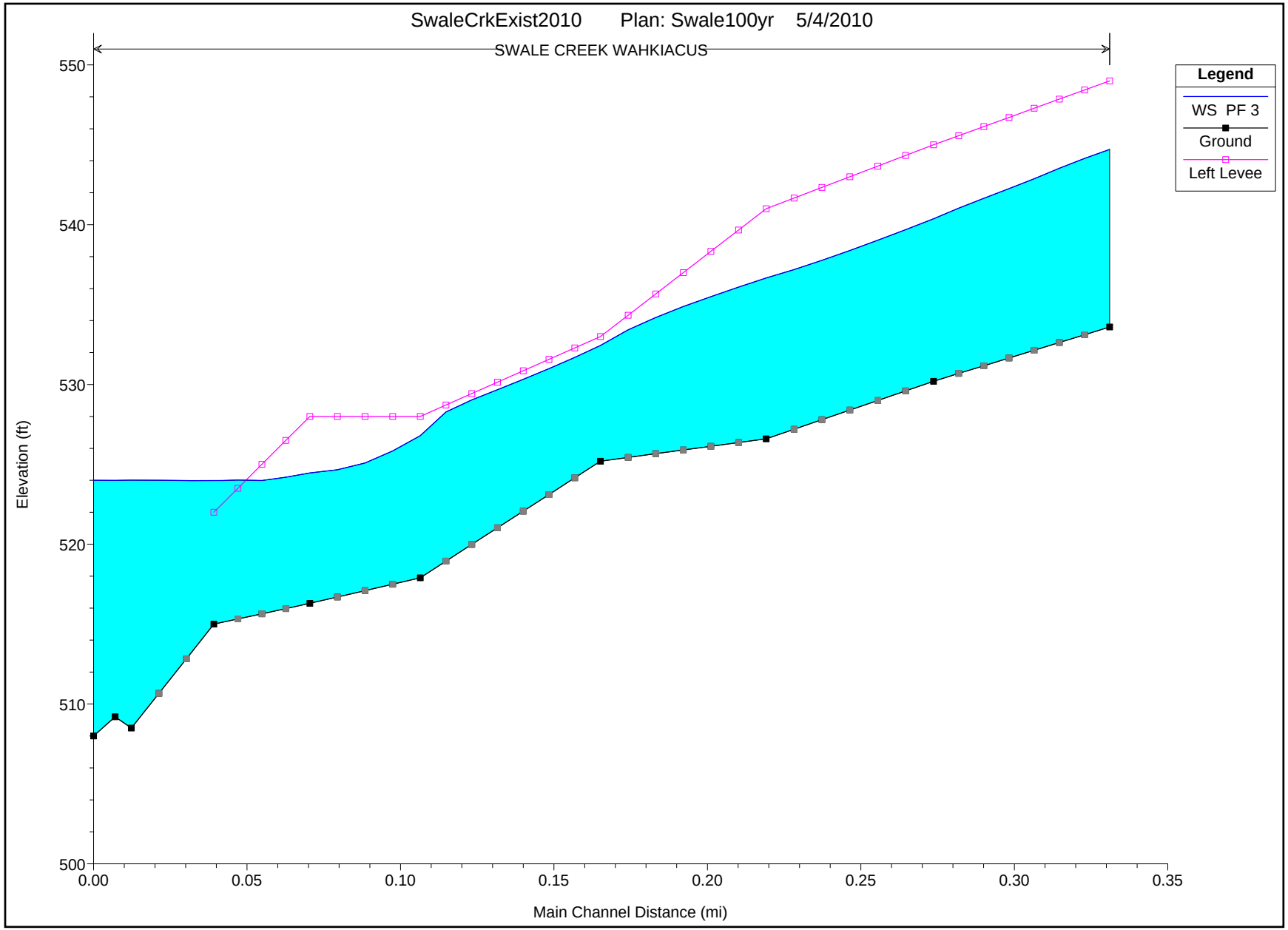
.065
.035
.065
Legend
WS 100yr - 45300
WS 50yr - 36000
WS 20yr - 27000
WS 10yr - 19300
WS 2yr - 7300
Ground
Bank Sta
Elevation (ft)
Station (ft)


Wah Estimated Scour Plan: Plan 02 12/9/2010
.065
.035
.075
Legend
WS 100yr - 45300
WS 50yr - 36000
WS 20yr - 27000
WS 10yr - 19300
WS 2yr - 7300
Ground
Bank Sta
Elevation (ft)
Station (ft)

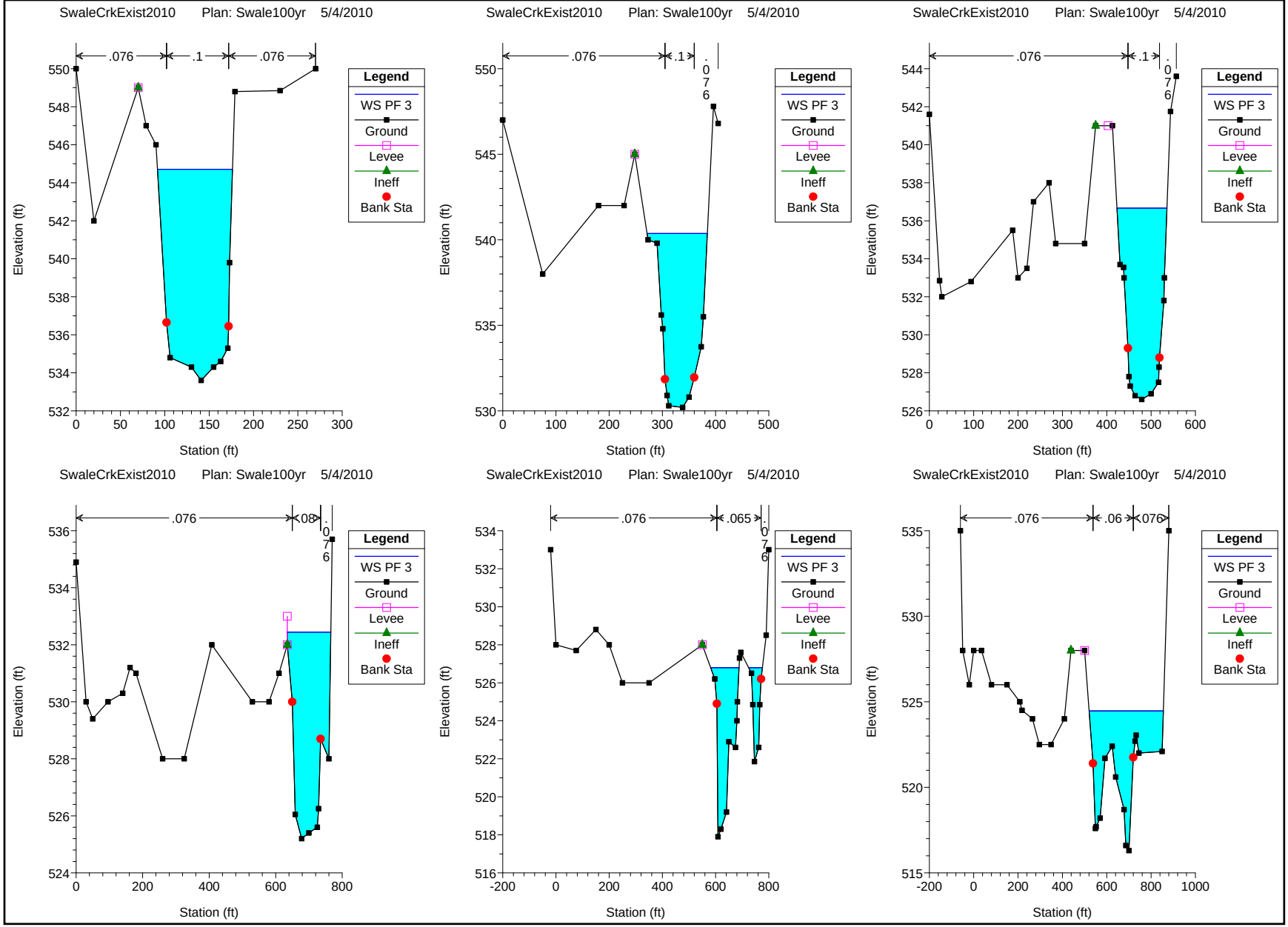
Appendix D-3

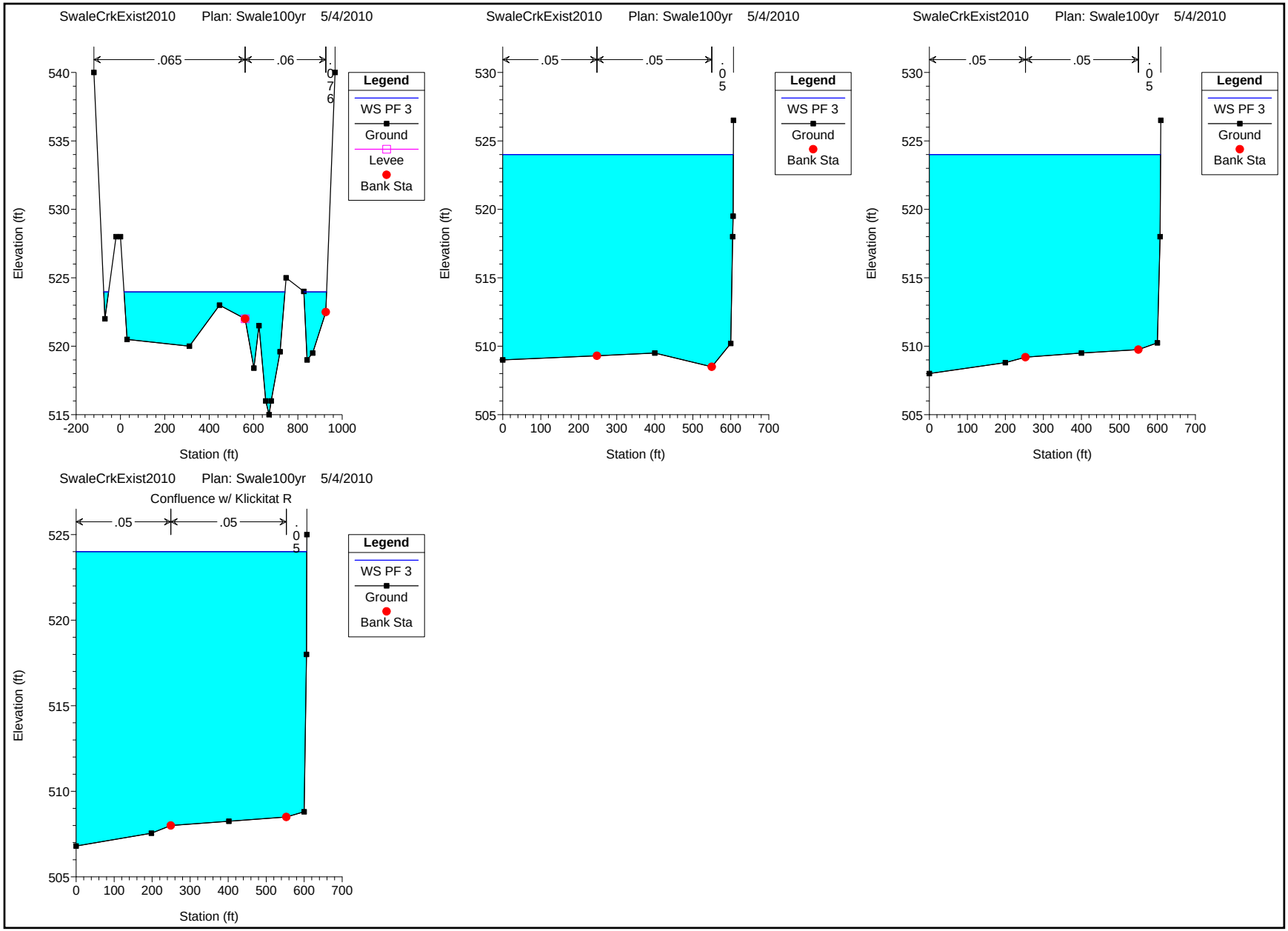
SWALE CREEK AT WAHKIACUS
100-YEAR FLOOD


SwaleCrkExist2010 Plan: Swale100yr 5/4/2010
SWALE CREEK WAHKIACUS
Legend
WS PF 3
Ground
Left Levee
Elevation (ft)
550
540
530
520
510
500
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Main Channel Distance (mi)

HEC-RAS Plan: Swale100 River: SWALE CREEK Reach: WAHKIACUS Profile: PF 3

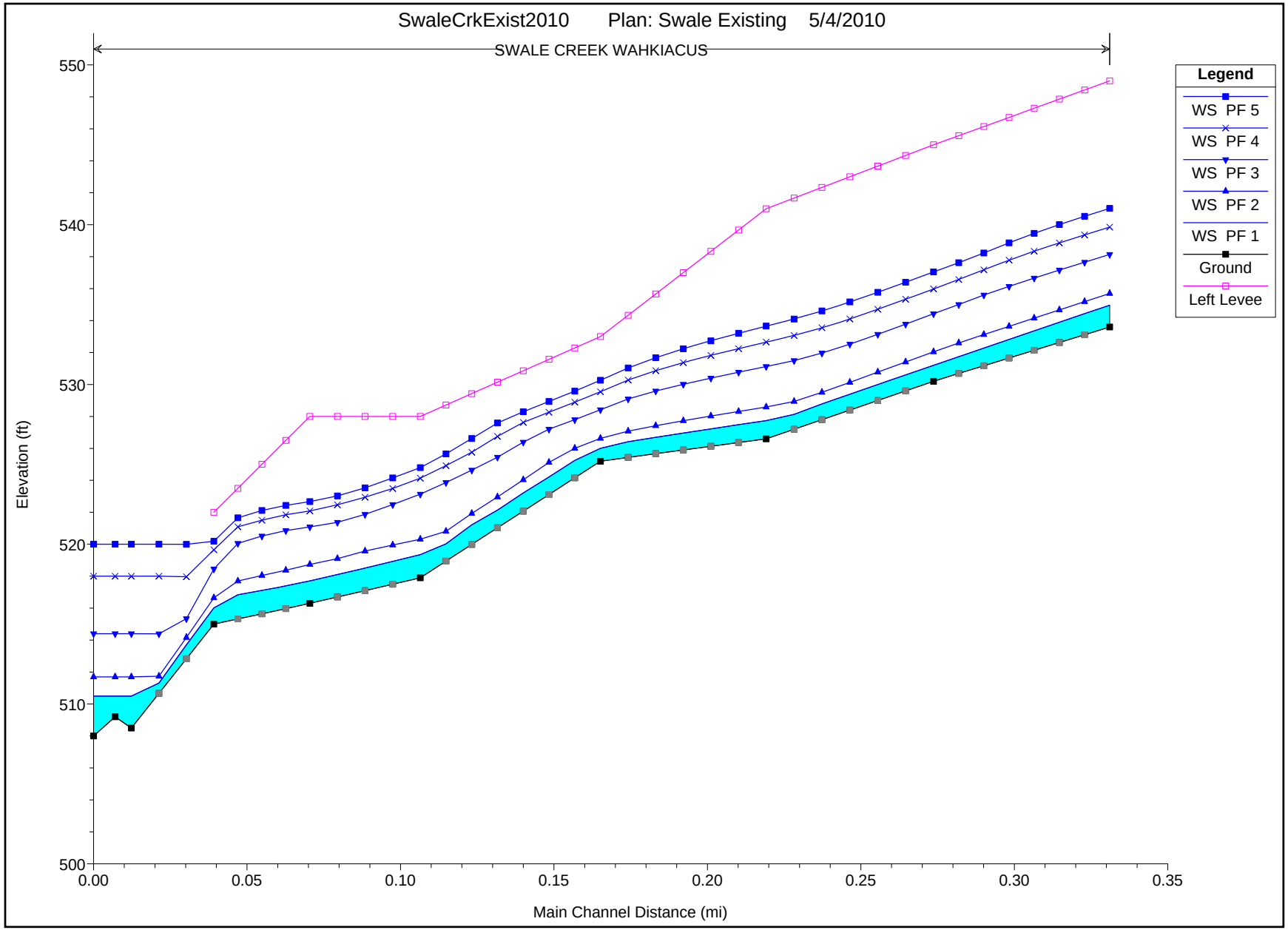
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
WAHKIACUS	0.3311	PF 3	5704.00	533.60	544.71	540.39	545.59	0.012027	7.62	774.14	84.62	0.42
WAHKIACUS	0.2737	PF 3	5704.00	530.20	540.37	537.08	541.34	0.014851	8.24	748.80	113.35	0.47
WAHKIACUS	0.2197	PF 3	5704.00	526.60	536.66	532.85	537.39	0.011388	7.12	850.72	112.76	0.40
WAHKIACUS	0.1657	PF 3	5704.00	525.20	532.44	530.95	533.56	0.018888	8.83	692.68	130.77	0.61
WAHKIACUS	0.1070	PF 3	5704.00	517.90	526.80	525.97	528.24	0.025788	9.66	602.67	158.59	0.80
WAHKIACUS	0.0710	PF 3	5704.00	516.30	524.46	522.93	524.88	0.006222	5.52	1210.43	335.14	0.44
WAHKIACUS	.0397	PF 3	5704.00	515.00	523.97	521.67	524.04	0.001342	2.44	2836.59	850.11	0.20
WAHKIACUS	0.0129	PF 3	5704.00	508.50	524.00		524.01	0.000013	0.66	8940.77	606.64	0.03
WAHKIACUS	0.0076	PF 3	5704.00	509.20	524.00		524.01	0.000013	0.64	8998.05	608.41	0.03
WAHKIACUS	0.00	PF 3	5704.00	508.00	524.00	509.37	524.01	0.000010	0.59	9734.70	606.86	0.03


SwaleCrkExist2010 Plan: Swale100yr 5/4/2010
.076
.1
.076
Legend
WS PF 3
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SwaleCrkExist2010 Plan: Swale100yr 5/4/2010
.076
.1
.076
Legend
WS PF 3
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SwaleCrkExist2010 Plan: Swale100yr 5/4/2010
.076
.1
.076
Legend
WS PF 3
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SwaleCrkExist2010 Plan: Swale100yr 5/4/2010
.076
.08
.076
Legend
WS PF 3
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SwaleCrkExist2010 Plan: Swale100yr 5/4/2010
.076
.065
.076
Legend
WS PF 3
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SwaleCrkExist2010 Plan: Swale100yr 5/4/2010
.076
.06
.076
Legend
WS PF 3
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)


SwaleCrkExist2010 Plan: Swale100yr 5/4/2010
.065
.06
.076
Legend
WS PF 3
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
SwaleCrkExist2010 Plan: Swale100yr 5/4/2010
.05
.05
.05
Legend
WS PF 3
Ground
Bank Sta
Elevation (ft)
Station (ft)
SwaleCrkExist2010 Plan: Swale100yr 5/4/2010
.05
.05
.05
Legend
WS PF 3
Ground
Bank Sta
Elevation (ft)
Station (ft)
SwaleCrkExist2010 Plan: Swale100yr 5/4/2010
Confluence w/ Klickitat R
.05
.05
.05
Legend
WS PF 3
Ground
Bank Sta
Elevation (ft)
Station (ft)

Appendix D-4

SWALE CREEK AT WAHKIACUS
LOW FLOW CONDITION


SwaleCrkExist2010 Plan: Swale Existing 5/4/2010
SWALE CREEK WAHKIACUS
Elevation (ft)
550
540
530
520
510
500
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Main Channel Distance (mi)
Legend
WS PF 5
WS PF 4
WS PF 3
WS PF 2
WS PF 1
Ground
Left Levee

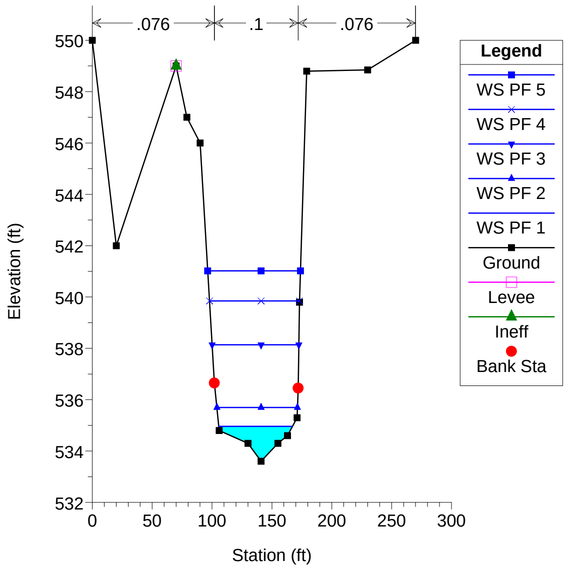
HEC-RAS Plan: SwaleExist River: SWALE CREEK Reach: WAHKIACUS

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
WAHKIACUS	0.3311	PF 1	50.00	533.60	534.96	534.48	534.98	0.012630	1.25	39.95	61.46	0.27
WAHKIACUS	0.3311	PF 2	170.00	533.60	535.70	534.93	535.76	0.011864	1.93	88.14	67.29	0.30
WAHKIACUS	0.3311	PF 3	954.00	533.60	538.14	536.24	538.35	0.011085	3.69	259.47	72.41	0.34
WAHKIACUS	0.3311	PF 4	1800.00	533.60	539.85	537.20	540.19	0.010891	4.72	385.67	75.14	0.36
WAHKIACUS	0.3311	PF 5	2525.00	533.60	541.02	537.91	541.47	0.010976	5.41	475.10	77.42	0.37
WAHKIACUS	0.2737	PF 1	50.00	530.20	531.19	530.70	531.22	0.012723	1.41	35.40	45.63	0.28
WAHKIACUS	0.2737	PF 2	170.00	530.20	532.04	531.17	532.12	0.013113	2.16	78.88	55.94	0.32
WAHKIACUS	0.2737	PF 3	954.00	530.20	534.42	532.74	534.69	0.013554	4.21	235.26	73.03	0.38
WAHKIACUS	0.2737	PF 4	1800.00	530.20	535.98	533.88	536.39	0.013599	5.30	354.91	80.47	0.40
WAHKIACUS	0.2737	PF 5	2525.00	530.20	537.04	534.61	537.56	0.013628	5.98	441.87	84.12	0.42
WAHKIACUS	0.2197	PF 1	50.00	526.60	527.74	527.11	527.75	0.005272	0.93	53.73	66.94	0.18
WAHKIACUS	0.2197	PF 2	170.00	526.60	528.59	527.51	528.62	0.005667	1.52	111.65	69.62	0.21
WAHKIACUS	0.2197	PF 3	954.00	526.60	531.12	528.79	531.28	0.007198	3.20	304.19	83.17	0.28
WAHKIACUS	0.2197	PF 4	1800.00	526.60	532.66	529.76	532.93	0.008284	4.24	437.70	89.88	0.32
WAHKIACUS	0.2197	PF 5	2525.00	526.60	533.65	530.47	534.02	0.009163	4.98	529.35	98.58	0.34
WAHKIACUS	0.1657	PF 1	50.00	525.20	526.01	525.70	526.04	0.013003	1.39	35.95	67.52	0.34
WAHKIACUS	0.1657	PF 2	170.00	525.20	526.63	526.06	526.70	0.011623	2.13	79.70	72.23	0.36
WAHKIACUS	0.1657	PF 3	954.00	525.20	528.42	527.29	528.72	0.015239	4.39	219.79	96.10	0.47
WAHKIACUS	0.1657	PF 4	1800.00	525.20	529.55	528.23	530.01	0.015862	5.53	341.55	110.98	0.51
WAHKIACUS	0.1657	PF 5	2525.00	525.20	530.26	529.00	530.85	0.016525	6.30	421.97	114.91	0.53
WAHKIACUS	0.1070	PF 1	50.00	517.90	519.35	518.87	519.41	0.008871	1.85	27.08	33.20	0.36
WAHKIACUS	0.1070	PF 2	170.00	517.90	520.31	519.48	520.44	0.008143	2.82	60.29	36.08	0.38
WAHKIACUS	0.1070	PF 3	954.00	517.90	523.14	521.47	523.49	0.015799	4.74	201.10	90.46	0.56
WAHKIACUS	0.1070	PF 4	1800.00	517.90	524.14	523.23	524.71	0.017634	6.10	295.21	98.14	0.62
WAHKIACUS	0.1070	PF 5	2525.00	517.90	524.80	523.84	525.56	0.018826	6.99	361.48	102.34	0.65
WAHKIACUS	0.0710	PF 1	50.00	516.30	517.70	517.13	517.77	0.008734	2.11	23.67	26.80	0.40
WAHKIACUS	0.0710	PF 2	170.00	516.30	518.73	517.98	518.82	0.007258	2.37	71.66	59.25	0.38
WAHKIACUS	0.0710	PF 3	954.00	516.30	521.09	519.60	521.24	0.005524	3.17	300.50	130.85	0.37
WAHKIACUS	0.0710	PF 4	1800.00	516.30	522.09	520.51	522.34	0.007219	4.04	450.49	265.42	0.43
WAHKIACUS	0.0710	PF 5	2525.00	516.30	522.67	521.04	522.97	0.007534	4.45	623.66	311.02	0.45
WAHKIACUS	.0397	PF 1	50.00	515.00	516.02	516.00	516.25	0.060429	3.88	12.89	25.26	0.96
WAHKIACUS	.0397	PF 2	170.00	515.00	516.65	516.63	517.08	0.052510	5.28	32.21	35.75	0.98
WAHKIACUS	.0397	PF 3	954.00	515.00	518.46	518.46	519.38	0.042690	7.70	123.94	66.75	1.00
WAHKIACUS	.0397	PF 4	1800.00	515.00	519.66	519.66	520.53	0.044324	7.50	240.15	138.49	1.00

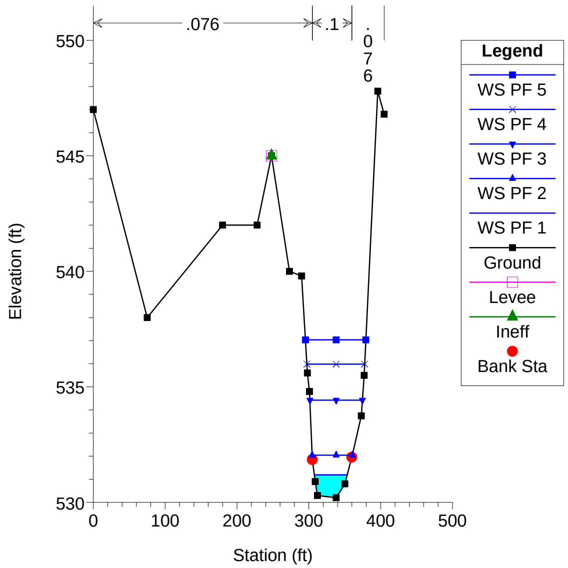
HEC-RAS Plan: SwaleExist River: SWALE CREEK Reach: WAHKIACUS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
WAHKIACUS	.0397	PF 5	2525.00	515.00	520.19	520.19	521.15	0.042163	7.86	321.18	165.98	1.00
WAHKIACUS	0.0129	PF 1	50.00	508.50	510.50	508.95	510.50	0.000003	0.06	784.59	600.19	0.01
WAHKIACUS	0.0129	PF 2	170.00	508.50	511.70	509.23	511.70	0.000004	0.11	1505.30	600.96	0.01
WAHKIACUS	0.0129	PF 3	954.00	508.50	514.40		514.40	0.000012	0.31	3130.32	602.69	0.02
WAHKIACUS	0.0129	PF 4	1800.00	508.50	518.00		518.00	0.000007	0.34	5304.08	605.00	0.02
WAHKIACUS	0.0129	PF 5	2525.00	508.50	520.00		520.00	0.000007	0.40	6515.34	606.07	0.02
WAHKIACUS	0.0076	PF 1	50.00	509.20	510.50		510.50	0.000002	0.05	824.83	600.23	0.01
WAHKIACUS	0.0076	PF 2	170.00	509.20	511.70		511.70	0.000004	0.10	1545.76	601.31	0.01
WAHKIACUS	0.0076	PF 3	954.00	509.20	514.40		514.40	0.000011	0.29	3172.56	603.75	0.02
WAHKIACUS	0.0076	PF 4	1800.00	509.20	518.00		518.00	0.000007	0.33	5351.89	607.00	0.02
WAHKIACUS	0.0076	PF 5	2525.00	509.20	520.00		520.00	0.000007	0.38	6566.36	607.47	0.02
WAHKIACUS	0.00	PF 1	50.00	508.00	510.50	507.19	510.50	0.000000	0.03	1569.47	601.11	0.00
WAHKIACUS	0.00	PF 2	170.00	508.00	511.70	507.43	511.70	0.000001	0.07	2291.28	601.89	0.01
WAHKIACUS	0.00	PF 3	954.00	508.00	514.40	508.08	514.40	0.000006	0.24	3918.77	603.65	0.02
WAHKIACUS	0.00	PF 4	1800.00	508.00	518.00	508.55	518.00	0.000005	0.29	6096.13	606.00	0.02
WAHKIACUS	0.00	PF 5	2525.00	508.00	520.00	508.76	520.00	0.000005	0.35	7308.41	606.29	0.02

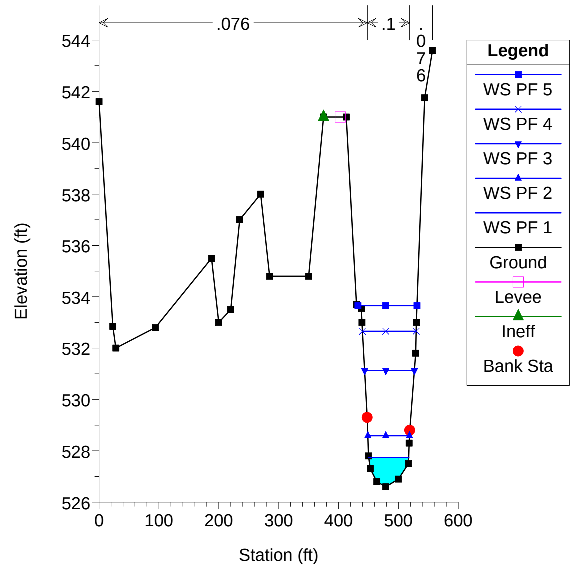
SwaleCrkExist2010 Plan: Swale Existing 5/4/2010



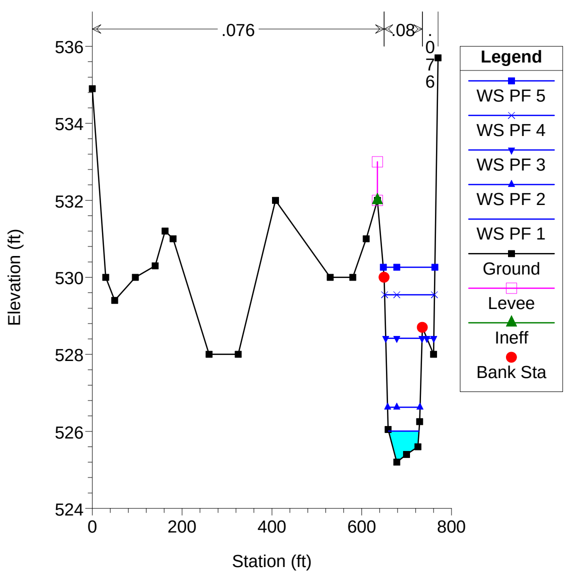
SwaleCrkExist2010 Plan: Swale Existing 5/4/2010



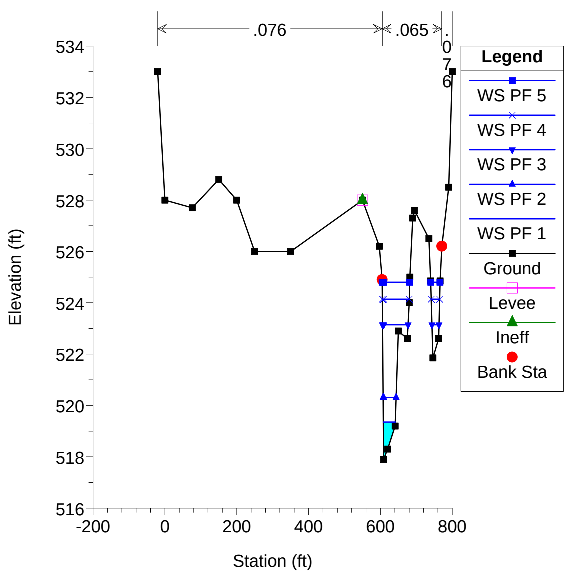
SwaleCrkExist2010 Plan: Swale Existing 5/4/2010



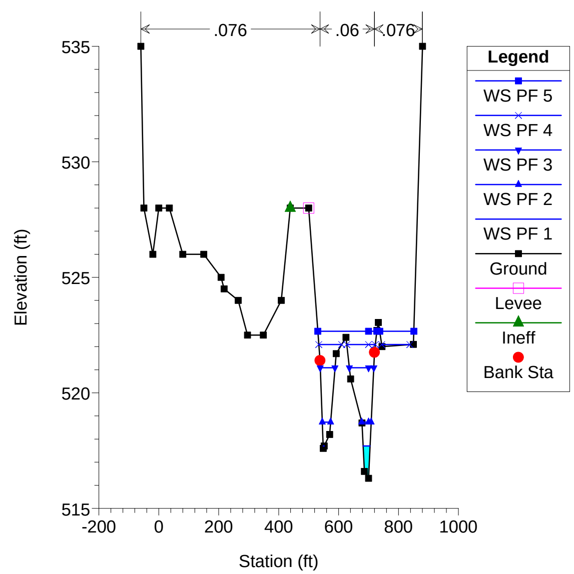
SwaleCrkExist2010 Plan: Swale Existing 5/4/2010

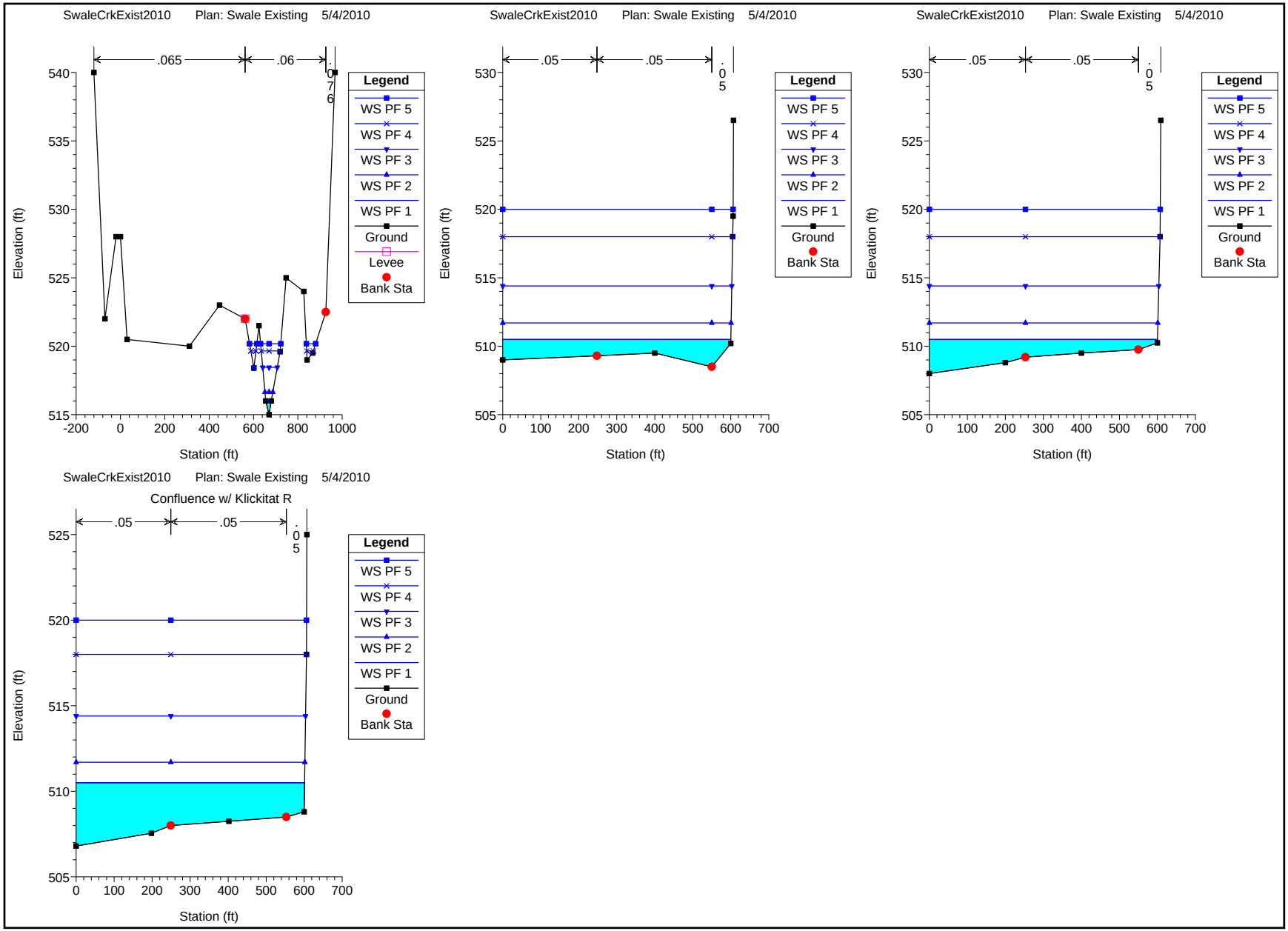


SwaleCrkExist2010 Plan: Swale Existing 5/4/2010



SwaleCrkExist2010 Plan: Swale Existing 5/4/2010




SwaleCrkExist2010 Plan: Swale Existing 5/4/2010
.065
.06
.076
Legend
WS PF 5
WS PF 4
WS PF 3
WS PF 2
WS PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
SwaleCrkExist2010 Plan: Swale Existing 5/4/2010
.05
.05
.05
Legend
WS PF 5
WS PF 4
WS PF 3
WS PF 2
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SwaleCrkExist2010 Plan: Swale Existing 5/4/2010
.05
.05
.05
Legend
WS PF 5
WS PF 4
WS PF 3
WS PF 2
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SwaleCrkExist2010 Plan: Swale Existing 5/4/2010
Confluence w/ Klickitat R
.05
.05
.05
Legend
WS PF 5
WS PF 4
WS PF 3
WS PF 2
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

Outline
Specifications

Wahkiacus Hatchery and Acclimation Facility
Klickitat, Washington

The Confederated Tribes & Bands of the Yakama Nation

Prepared by,
Harbor Consulting Engineers, Inc.
Seattle Washington

Table of Contents

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Division 00 Procurement & Contracting Requirements

SECTION 000101 – Introductory Information

Project Title Page, Table of Contents, list of drawings, list of schedules.

SECTION 001000 – Solicitation

Advertisement and Invitations for Bids, Request for Proposals, Request for Qualifications

SECTION 002000– Instructions for Procurement

Instructions for Bidders, proposers. Supplementary Instructions, scope of Bids, pre-bid meetings, pre-proposal meetings

SECTION 003000 – Available Information

Preliminary Schedules, project schedules, construction schedules, project phasing, sequencing, project milestones. Project budgeting, survey information, Environmental assessment information, existing material Information & Geotechnical Information

SECTION 004000 – Procurement Forms & Supplements

Bid forms, stipulated sum, construction management, cost-plus-fee, Unit price, Design/Build & purchase contract. Proposal forms, stipulated sum, construction management, cost-plus-fee, Unit price, design/Build & purchase contract. Bid security form, allowance Form, Unit Price Form, Alternate Forms, Substitution request form, wage rate form proposed schedule of values from, proposed construction schedule form, proposed work plan form, bid submittal checklist. Bidders Qualifications, proposers' qualification, non-collusion Affidavit Statement, Worker's Compensation Certificate Schedule, Non-segregated Facilities Affidavit, Equal Employment Opportunity Affidavit, Minority Business Enterprise Affidavit, Corporate Resolutions, Governmental Certifications

SECTION 005000 – Contracting Forms & Supplements

Agreement forms such as Stipulated Sum, Construction Management, Cost Plus-Fee, Unit Price, Design/Build, Purchase, Allowances, Unit Prices.

SECTION 005000.1 – SAMPLE FORMS

The following forms are referenced in the Specifications, and, as amended by or otherwise approved by the Owner, will be used in the execution of this Contract.

Form of Agreement
- 005200 AIA form A101 - Standard Form of Agreement Between Owner and Contractor, 2007 edition
  - AIA form A201 General Conditions of the Contract for Construction (2007)
- 006100 AIA document A310 - Bid Bond (1970)
- 006113 AIA document A312 – Performance Bond and Payment Bond (1984)
- 006116 Labor and Material Payment Bond
- 006216 Certificate of Insurance
- 006313 Section 01043 - Request for Information

Architect approved Request for Information form
- 006211 Submittals
- 006286 Contractor initiated form for Daily Construction Reports

Architect approved Submittal Transmittal form
- 004383 Bar Chart Schedule
- 013216 Contractor initiated form for Preliminary and Detailed Construction Schedules
- 004326 Substitutions
- 006325 Architect approved Substitution Request Form
- 006500 Project Closeout
  - AIA form G702 - Applications and Certificate for Payment, 1992 edition
  - AIA form G703 - Continuation Sheets, 1992 edition
  - AIA form G704 - Certificate of Substantial Completion, 2002 edition
  - AIA form G706 - Contractor's Affidavit of Payment of Debts and Claims, 1994 edition
  - AIA form G706A - Contractor's Affidavit of Release of Liens, 1994 edition
  - AIA form G707 - Consent of Surety To Final Payment, 1994 edition
  - AIA form G707A - Consent of Surety To Reduction in or Partial Release of Retainage, 1994 edition

SECTION 006000 – Project Forms

Bond Forms, Certificates and other forms, Clarification & Modification Forms, Closeout forms.

SECTION 007000 – Conditions of the Contract

General Conditions, Supplementary Conditions

SECTION 009000 – Revisions, Clarifications & Modifications

Pre-contract revisions such as Addenda, Bid Revisions & Proposal Revisions, Record Clarifications & Proposals such as Record Proposal Request, Record Change Order Requests

Division 01 General Requirements

SECTION 010000 - GENERAL REQUIREMENTS

Evaluations: Role Division 1 Sections, their preparation & Coordination

SECTION 011000 - SUMMARY

Summary of the Work, this project includes preparatory work and modifications to the existing structures in a phased sequence. Phased construction, purchase contracts, Owner furnished products, access to site & work restrictions.

SECTION 012100 - ALLOWANCE

Provisions for cash allowances including lump-sum, unit cost, contingency, testing & inspection allowances.

SECTION 012200 – UNIT PRICING

Provisions for unit pricing, if required.

SECTION 012300 - ALTERNATES

Provisions for change-of-scope & cost comparison type alternates.

SECTION 012500 – SUBSTITUTIONS

This Section describes product options available to the Contractor, plus procedures for securing approval of proposed substitutions during construction.

SECTION 012600 – CONTRACT MODIFICATION PROCEEDURES

Procedural requirements for changes to the Contract.

SECTION 012900 – PAYMENT PROCEEDURES

Administrative requirements for Contractor's Application for Payments

SECTION 013100 – PROJECT MANAGEMENT & COORDINATION

Administrative requirements for project meetings; preconstruction, pre-installation, and project closeout conferences; RFIs; and project Web sites

SECTION 013200 – CONSTRUCTION PROGRESS DOCUMENTATION

Contractor's Construction Schedule including Gantt charts and CPM schedules; Contractor's reports

SECTION 013300 – SUBMITTAL PROCEDURES

Procedures for Action and Informational Submittals including Delegated-Design Submittals and Submittals Schedule.

SECTION 013543– ENVIRONMENTAL REGULATORY REQUIREMENTS

State and other environmental statutes, ordinances regulations permits and approvals which deal with the prevention of environmental pollution and the preservation of public natural resources that affect

or may affect this Project. This list is not to be considered as all-inclusive, nor shall the absence of a law from this list be construed to relieve the Contractor from complying with such law, to the extent it is applicable to the Contractor.

SECTION 014000 – QUALITY REQUIREMENTS

Quality-assurance and Control requirements, special tests and inspections, and Contractor's quality-control plan.

SECTION 014200 - REFERENCES

Common definitions and terms. Acronyms and trade names of associations, government agencies, and other entities referenced in MasterSpec.

SECTION 014516.13 – CONTRACTOR'S QUALITY CONTROL PROGRAM

Quality Control Program that details the methods and procedures that will be taken to assure that all materials and completed construction conform to contract plans, technical specifications and other requirements, whether manufactured by the Contractor, or procured from subcontractors or vendors. Although guidelines are established and certain minimum requirements are specified herein and elsewhere in the contract technical specifications, the Contractor shall assume full responsibility for accomplishing the stated purpose.

SECTION 015000 – TEMPORARY FACILITIES & CONTROLS

Temporary utilities and facilities for construction support, security & protection. This item shall consist of planning, installing, inspecting, maintaining, and removing temporary erosion and sediment control Best Management Practices (BMPs) as shown in the Contractor's Erosion and Sediment Control Plan or as ordered by the Engineer, to prevent pollution of air and water, and control, respond to, and dispose of eroded sediment and turbid water during the life of the Contract.

SECTION 016000 – PRODUCT REQUIREMENTS

Administrative and procedural requirements for product, material, and equipment selection and handling; warranties; and comparable products.

SECTION 017836 – WARRANTIES & BONDS

This Section specifies general administrative and procedural requirements for warranties and bonds required by Contract Documents, including manufacturers' standard warranties on products and special warranties for the systems.

SECTION 017839 – PROJECT RECORD DOCUMENTS

Throughout progress of the Work of this Contract, the Contractor shall maintain an accurate record of all Project Record Documents including As-Built Drawings, Project Schedule, and Submittals.

SECTION 017700 – CLOSEOUT PROCEEDURES

Contract closeout including Substantial Completion and Final Completion procedures, warranties and final cleanup.

SECTION 017823 – OPERATION & MAINTENANCE DATA

Emergency, operation and maintenance manuals for products and equipment.

SECTION 017839 – PROJECT RECORD DOCUMENTS

Record Drawings, Specifications & Product Data

SECTION 018816 –CONSTRUCTION PHASING & DEWATERING

The site phasing plan will include, but not be limited to, the specific construction activities outlined in this section.

SECTION 018900 – CONSTRUCTION SURVEY

This work consists of furnishing qualified personnel and necessary equipment and material to survey, stake, calculate, and record data for the control of work. The contractor shall provide a detailed survey control plan that identifies the construction and a temporary plan that identifies the temporary bench marks and shall update any changes.

Division 02 Existing Conditions

SECTION 024113 – SITE DEMOLITION

Extent of Work: The extent and location of the "Demolition" work is indicated on the drawings. The work includes the requirements for the removal, wholly or in part and satisfactory disposal of concrete debris, piping, broken pavements and household debris as shown or described within these specifications.

SECTION 024116 – STRUCTURE DEMOLITION

Complete Structure removal. Demolition and removal of buildings and site improvements. Abandoning in-place, Removing below-grade construction. Disconnecting, capping or sealing, and abandoning in-place, removing site utilities. Salvaging items for reuse by Owner.

SECTION 024119 – SELECTIVE STRUCTURE DEMOLITION

Demolition and removal of selected portions of building or structure. Demolition and removal of selected site elements. Salvage of existing items to be reused or recycled. Construction debris shall be hauled to an approved disposal site.

SECTION 028300 – REMOVAL/CONTROL & DISPOSAL OF PAINT WITH LEAD

The removal of lead-based paint and lead-contaminated dust, the permanent containment or encapsulation of lead-based paint, the replacement of lead-painted surfaces or fixtures, and the removal or covering of lead contaminated soil; and all preparation, cleanup, disposal, and post-abatement clearance testing activities associated with such measures.

Division 03 Concrete

SECTION 030130.51 – WET SAND BLASTED CONCRETE

Wet sandblasted finish shall be required for existing concrete where new concrete is to be placed. This surface preparation shall be performed prior to the placement of re-steel and/or concrete forms.

SECTION 031500 – INTEGRAL WATERPOOFING OF CONCRETE

Crystalline waterproofing admixture for concrete. Crystalline waterproofing treatment of construction joints between successive concrete pours. The work of this section applies to concrete in the following locations: Ground water and water contact surfaces.

SECTION 032000 – CONCRETE REINFORCEMENT

Extent of Work: The Work includes the requirements for manufacture, detailing, cutting, bending, transporting and placing of all concrete reinforcement and associated items required or indicated on the drawings. The PIT Tag Antenna: This area will require the use of fiber-reinforced polymer (FRP) material systems. The structural bar cut sheets shall be prepared by an experienced firm in the structural design when using FRP reinforcement.

SECTION 033000 – CAST-IN-PLACE CONCRETE

General building & structural applications; concrete mixtures, formwork, reinforcing, finishing & curing. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

SECTION 033816 – UNBONDED POST-TENSION CONCRETE

Summary of the Work, phased construction, purchase contracts, Owner furnished products, access to site & work restrictions. Section includes post-tensioning reinforcement and accessories and post-tensioning operations including stressing.

SECTION 034000 – PRECAST CONCRETE

Extent of Work: The extent and location of the “Precast Concrete” work is indicated on the drawings. The work includes the requirements for manufacturing, transporting and placing the precast concrete and associated items required or indicated on the drawings. The work may include, but is not limited to, underground handholds and vaults, ecology block, catch basins, deck panels, column and beams or other items approved by the Engineer.

Division 04 Masonry

SECTION 040519.16 – MASONRY ANCHORS & ACCESSORIES

Masonry veneer anchors and ties. Acceptable Manufacturer: Heckmann Building Products Inc., 1501 N. 31st Avenue, Melrose Park, IL 60160 800-621-4140 or 708-865-2403 FAX: 708-865-2640 email: Heckmann@worldnet.att.net. Website: www. heckmannbuildingprods.com. or an approved equal.

04220 SECTION 042000 – UNIT MASONRY

Extent of Work: The extent and location of the "Concrete Unit Masonry" work is indicated on the drawings. The work includes the requirements for providing all items and components of a completed masonry system in conformance with these specifications and the dimensions and sections indicated on the drawings or as established by the Engineer. All masonry work shall be performed by a certified mason contractor who has experience in integral patterns, textures and color of CMUs and CMUs veneer.

SECTION 042200 – CONCRETE UNIT MASONRY

Single-wythe CMU including decorative units.

SECTION 042300 – GLASS UNIT MASONRY

Glass block installed with mortar, glass block installed with spacers and sealant, and glass block grid system.

Division 05 Metals

SECTION 050800 - WELDING

Extent of Work: Provide the welding materials and methods of joining miscellaneous and structural metals. Installer Qualifications: All welders are required to be currently certified by AWS or Washington Association of Building Officials (WABO) for structural welding.

SECTION 051000 – STRUCTURAL STEEL

Extent of Work: The extent and location of the "Structural Steel" work is indicated on the drawings. The work includes the requirements for providing all structural steel and associated work in conformance with these specifications and to the dimensions indicated on the drawings.

SECTION 051200 – STRUCTURAL STEEL FRAMING

Structural steel framing for buildings.

SECTION 053123 – STEEL ROOF DECK

Extent of Work: The extent and location of the "Steel Roof Deck" work is indicated on the drawings. The work includes the requirements for providing all the ribbed steel roof decking with all accessories required, complete and in place.

SECTION 052100 – STEEL JOIST FRAMING

Standard manufactured open-web units, including steel joists, long-span steel joists & joist girders.

SECTION 053100 – STEEL DECKING

Roof, floor & form steel decking.

SECTION 053113 – STEEL FLOOR DECK

Extent of Work: The extent and location of the "Steel Floor Deck" work is indicated on the drawings. The work includes the requirements for providing all galvanized corrugated or ribbed steel floor decking with all accessories required, complete and in place.

SECTION 055000 – METAL FABRICATION

Metal items (not sheet metal) made from iron & steel shapes, stainless steel & non-ferrous metals.

SECTION 055000.1 – VERTICAL TRAVELING SCREENS & SPARE PARTS

This section describes the concept for vertical hydraulic motor driven traveling screens specifically designed for this project. The selected fabricator shall provide detailed shop drawings for the structural and mechanical operational systems.

SECTION 055100 – METAL STAIRS & LADDERS

Steel; with pan, plate & grating treads. Manufacturers shall have a minimum of one year experience in manufacturing metal stairs. Installers shall have a minimum of one year experience in installing prefabricated metal stairs. Welders shall be qualified in accordance with the welding section.

SECTION 055213 – STEEL PIPE HANDRAIL &RAILING

Extent of Work includes preparation, material, fabrication, coating & installation .All exterior handrails and railings exposed to the 100 year flood waters shall be fabricated from schedule 80 pipe.

SECTION 055300 – METAL GRATING

Metal & glass-fiber-reinforced plastic grating.

Division 06 Wood, Plastics & Composites

SECTION 061000 – ROUGH CARPENTRY

Wood framing, furring, grounds, nailers & blocking. Extent of Work: The work includes the requirements for shop or field fabrication, detailing, cutting, transporting and placing of lumber and associated items required or indicated on the drawings. The extent and location of "Rough Carpentry" work is indicated on the drawings.

SECTION 064023 – INTERIOR ARCHITECTURAL WOODWORK

Extent of Work: The extent and location of the "Finish Carpentry" work is indicated on the drawings and includes the installation of all wood trim cabinets, tops, paneling, stairs, ornamental items & other items not specifically described as being installed under other sections of the specifications.

Division 07 Thermal Moister Protection

SECTION 071113 – BITUMINOUS DAMPPROOFING

Hot & Cold applied asphaltic dampproofing.

SECTION 072100 – THERMAL INSULATION

General building insulation installed at project site, excluding roof insulation. Extent of Work: Batt insulation, rigid insulation, vapor barrier/retarders and insulation fasteners.

SECTION 072500 – WEATHER BARRIERS

Building paper and building wrap weather-resistive barriers and flexible flashing.

SECTION 072616 – UNDERSLAB VAPOR RETARDER

Extent of Work: The Work includes the requirements for manufacture and placing of sheeting membrane overlaying gravel fill, and under specified concrete slabs on grade & Cast-In-Place Concrete.

SECTION 074113 – METAL ROOF PANELS

Factory formed lap-seam, exposed fasteners. Standing-seam, concealed fasteners, Batten-seam, horizontal-seam & foamed-and laminated-core metal roof panels.

SECTION 074213 – PRE-FORMED METAL FASCIA

Extent of work includes exposed-fastener, lap-seam metal wall panels, concealed-fastener, lap-seam metal wall panels, metal liner panels, metal soffit panels. Location is indicated on the drawings.

SECTION 076000 – FLASHING & SHEET METAL

Extent of Work: Provide all flashing, sheet metal, fasteners, manufactured reglets and counterflashing, formed roof drainage sheet metal fabrications, formed low-slope roof sheet metal fabrications, formed steep-slope roof sheet metal fabrications, formed wall sheet metal fabrications & flashing.

SECTION 076200 – SHEET METAL FLASHING & TRIM

Custom-fabricated roof & wall flashing and roof-drainage system, and manufactured through-wall flashing & reglets.

SECTION 078413 – PENETRATION FIRESTOPPING

System installed in fire-resistance-rated construction, at exterior curtain walls/floor intersections & smoke barriers.

SECTION 079200 – JOINT SEALANT & WATERSTOPS (THERMAL MOISTURE PROTECTION)

Elastomeric, latex, solvent-release-curing, preformed & acoustical sealants. The work includes the requirements necessary to provide all caulking and sealing as indicated on the drawings and as specified or required for a complete installation. Waterstops: Non-metallic polyvinyl chloride waterstops shall be used on all construction joints for water retaining structures.

SECTION 079500 – EXPANSION CONTROL

For building interiors & exteriors & open aired structures.

Division 08 Openings

SECTION 081113 – HOLLOW METAL DOORS & FRAMES

Hollow-metal doors, frames, anchors & fasteners. Exterior, interior, fire rated, smoke and draft assemblies, finishes, physical performance requirements, anchor system, stops & molding and accessories. Work includes installation and adjusting.

SECTION 083323 – OVERHEAD COILING DOORS

Galvanized-steel, stainless-steel, and aluminum curtain assemblies. Overhead coiling doors to be counterbalanced doors by methods of manufacturer's standard mechanism. Doors to be coiling type, with interlocking slats, complete with anchoring and door hardware, guides, hood, and operating mechanisms, and designed for use on openings as indicated.

SECTION 084113 – ALUMINUM-FRAMED ENTRANCES & STOREFRONT

Storefront framing, entrance doors, and hardware; and framing for window walls, ribbon walls, and punched openings.

SECTION 085113 – ALUMINUM WINDOWS

Stock aluminum windows and all necessary appurtenances. Comply with applicable requirements of AAMA 101. All aluminum windows, components and hardware shall be manufactured or distributed by a single company unless specified otherwise.

SECTION 087100 – DOOR HARDWARE

The extent and location of the Door hardware work is indicated on the drawings. The work includes providing all necessary architectural hardware and specialty items for the proper operation, fastening and locking of doors or other moveable closures.

SECTION 088000 - GLAZING

Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section: Windows, Doors, Glazed curtain walls, Storefront framing, Glazed entrances, Sloped glazing, Skylights, Interior borrowed lights.

SECTION 088300 - MIRRORS

Wall mounted, unframed, silvered flat glass mirrors.

SECTION 089000 – LOUVERS & VENTS

Fixed and adjustable louvers; wall vents. Comply with SMACNA (Sheet Metal and Air Conditioning Contractor's National Association) recommendations for fabrication, construction details and installation procedures, except as shown or specified.

SECTION 089119 – WALL LOUVERS

Comply with SMACNA (Sheet Metal and Air Conditioning Contractor's National Association) recommendations for fabrication, construction details and installation procedures, except as shown or specified.

Division 09 Finishes

SECTION 092900 – GYPSUM BOARD

Interior gypsum board, exterior gypsum board for ceilings and soffits, and tile backing boards & textured finishes. Performance requirements include fire resistance rated assemblies, Sound Transmission Rating (STC), low emitting materials, moisture and mold resistance. Trim, joint treatment, adhesive & fasteners.

SECTION 093000 - TILING

Ceramic mosaic, quarry, paver, and wall tile.

SECTION 095123 – ACOUSTICAL TILE CEILINGS

Mineral-based tile with concealed suspension system, and direct-attached acoustical tile.

SECTION 096500 – RESILIENT FLOORING

Vinyl and rubber sheet floor coverings.

SECTION 096513 – RESILIENT BASE & ACCESSORIES

Resilient base, stair accessories, and molding accessories.

SECTION 099100 - PAINTING

Exterior & interior painting. Section includes surface preparation and the application of paint systems on exterior and interior substrates such as: Concrete, clay masonry, concrete masonry units (CMU), steel, galvanized metal, aluminum (not anodized or otherwise coated), stainless-steel flashing, wood, plastic trim fabrications, exterior siding. Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

Division 10 Specialties

SECTION 101200 – DISPLAY CASE

Illuminated and non illuminated type

SECTION 101400 - SIGNAGE

Exterior & interior signs, letters & plaques. panel signs, illuminated panel signs, room-identification signs.. Qualifications of Sign Fabricator:

SECTION101453 – TRAFFIC SIGNS

Extent of Work: The work includes the requirements for providing manufactured traffic control signs as indicated on the drawings.

SECTION 102113 – TOILET COMPARTMENTS

Steel, stainless-steel, plastic laminate, phenolic-core and solid polymer toilet enclosures, entrance screens & urinal screens

SECTION 102800 – TOILET, BATH & LAUNDRY ACCESSORIES

Standard commercial, institutional & residential units

SECTION 104416 – PORTABLE FIRE EXTINGUISHERS & CABINETS

Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers." Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

SECTION 105113 – METAL LOCKERS

Standard, heavy-duty athletic, open front athletic.

SECTION 107500 - FLAGPOLES

Aluminum, steel, stainless steel & fiberglass flagpoles.

Division 11 Equipment

SECTION 111313 – DOCK BUMPER

Dock bumpers shall be made from resilient, uniform-size, fabric-reinforced rubber pads pressure-laminated between structural steel angles and secured with steel tie rods or bars. Dock bumpers shall be of the size indicated and suitable for mounting directly to a concrete loading dock & include mounting hardware.

SECTION 114000 – FOODSERVICE EQUIPMENT

Commercial food service equipment.

SECTION 115213 – PROJECTION SCREENS

Front & rear projection screens.

Division 12 Furnishings

SECTION 123623.13 – PLASTIC-LAMINATE-CLAD COUTERTOPS

Plastic-laminate countertops.

SECTION 124813 – ENTRANCE FLOOR MATS & FRAMES

Recessed treads with various surfaces; recessed metal frames.

SECTION 124816 – ENTRANCE FLOOR GRILLES

Work includes furnishing and installing grilles, frames and support systems.

Division 13 Special Construction

SECTION 131100 – CONCRETE FORMS

Extent of Work: The Work includes providing the structural support and physical barriers or forms which control the shape and location of the concrete. Also included in this section are the requirements for the removal of the forms and their support.

SECTION 133419 – METAL BUILDING SYSTEMS

Systems consisting of structural framing, roofing &siding panels, and standard components.

Division 14 Conveying Equipment

Division 15 Mechanical

RESERVED FOR FUTURE EXPANSION

Division 16 Electrical

RESERVED FOR FUTURE EXPANSION

Facility Services Subgroup

Division 21 Fire Suppression

SECTION 211200 – STANDPIPE & HOSES

Section includes entire standpipe system from fire department connection to fire hose connection. Factory Mutual System NFPA 14 (National Fire Protection Association) - Installation of Standpipe and Hose Systems.

Division 22 Plumbing

SECTION 220529 – HANGERS & SUPPORTS

Section includes pipe and equipment supports, hangers, anchors, bases sleeves and the sealing of work to adjacent construction.

SECTION 221100 – UNFILTERED WATER SUPPLY SYSTEM

Section includes unfiltered water piping, pumps, valves, valve actuators, fittings, water filters, vertical traveling screen, controls and accessories.

SECTION 223200 – FILTERED WATER SYSTEM

Section includes filtered water piping, pumps, valves, valve actuators, fittings, water filters, vertical traveling screens, controls and accessories.

SECTION 220800 – WELDED STEEL PIPE

Work includes detailing, furnishing, fabricating, shop testing, delivering, installing and testing of welded steel pipe 6” and larger and appurtenances,

SECTION 226119 – COMPRESSED AIR SYSTEM

Section includes compressed air piping, air compressors, valves, fittings, filters, air receivers, controls and accessories that comprise the Compressed Air System. Work includes preparation, trenching and backfilling, installation, interface with other products, erection tolerances, cleaning and testing.

Division 23 Heating Ventilation & Air Conditioning

SECTION 230000 – HEATING, VENTILATION, & AIR-CONDITIONING (HVAC)

Section includes fans, heaters, duct heaters, air conditioning equipment along with controls and accessories that comprise the heating, ventilation and air conditioning system

SECTION 230100 – MECHANICAL WORK-GENERAL

Piping materials and installation instructions common to most piping systems, joining Materials, escutcheons, dielectric fittings, flexible connectors, mechanical sleeve seals, piping Specialties, concrete base construction requirements, non-shrink grout for equipment installations, field fabricated metal and wood equipment supports, installation requirements common to equipment specification sections, mechanical demolition, cutting and patching, touchup painting and finishing.

SECTION 233713– DIFFUSERS, REGISTERS & GRILLES

Work includes: Round ceiling diffusers, rectangular and square ceiling diffusers, perforated diffusers, louver face diffusers, linear bar diffusers, linear slot diffusers, adjustable bar registers and grilles, fixed face registers and grilles & linear bar grilles.

SECTION 236400 – PACKAGED WATER CHILLERS

This section includes cooling water system piping and fittings along with controls and accessories that comprise the cooling system.

Division 25 Integrated Automation

Division 26 Electrical

SECTION 260000 – ELECTRICAL PROVISIONS

The work under this Division includes furnishing all permits, materials, equipment, labor, supervision, tools and items necessary for the construction, installation, connection, testing and operation of all electrical work for this project, as intended by the Contract Documents.

SECTION 260500 – BASIC ELECTRICAL MATERIALS & METHODS

Section includes grounding electrodes and conductors; equipment grounding conductors; bonding methods and materials; conduit and equipment supports; anchors and fasteners; nameplates and labels; wire markers; raceway markers; underground warning tape; sealing and fireproofing of sleeves and annular spaces between conduits, cable trays, wireways, troughs, cable bus, busduct and building element openings.

SECTION 260533 – RACEWAYS & BOXES

Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, electrical connections to equipment, and handholes.

SECTION 260543 – UNDERGROUND DUCTS, HANDHOLES & VAULTS

This Section includes the requirements for trenching, backfilling and installation of underground conduits, ducts and ductbanks, and the design, fabrication, delivery and installation of pull boxes, handholes and manholes.

SECTION 260546 – ELECTRICAL UTILITY SERVICES

Section includes arrangement with Utility Company for permanent electric service; service provisions; and utility metering equipment. Products include but are not limited to: Utility meters, utility meter base, metering transformer cabinet & transformer pad.

SECTION 260573 – SURGE PROTECTION DEVICES

Section includes Surge Protection Devices (SPD) equipment for switchgear, switchboards. The suppression system shall incorporate a hybrid designed Metal-Oxide Varistors (MOV) surge suppressor for the service entrance and other distribution level.

SECTION 260620.13 - SWITCHBOARDS

Section includes main and distribution switchboards, Which includes, but is not limited to Switchboards, device mounts, bus, ground bus, line and load terminations & Utility metering compartment.

SECTION 260620.16 - PANELBOARDS

Section includes distribution and branch circuit panelboards, electronic grade branch circuit panelboards.

SECTION 260900 – WIRING DEVICES

Section includes wall switches, wall dimmers, receptacles, occupancy sensors, multi-outlet assembly, device plates, and decorative box covers.

SECTION 260913 – MOTOR STARTERS

Section includes manual, magnetic and solid state motor starters in individual enclosures. Full-voltage non-reversing starters, combined starters, NEMA 250 enclosure, solid state soft starters, 24 volts DC control voltage, overload protection, combination starters with field quality control and performance requirements.

SECTION 261000 – WIRE & CABLE (600 VOLTS OR LESS)

Section includes building wire; wiring connectors and connections. System description methods, preparation & installation.

SECTION 262716 – CABINETS & ENCLOSURES

Section includes hinged cover enclosures, cabinets, terminal blocks, and accessories

SECTION 262900 – LOW VOLTAGE LIGHTING CONTROL

Section includes switching controls, remote control switching relays, remote switches, remote sensors, power supplies, and relay/dimmer cabinets.

SECTION 263613 – MANUAL TRANSFER SWITCHES

Section includes manual transfer switches in individual enclosures and remote. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience, and with service facilities within 100 miles of Project. Supplier: Authorized or franchised distributor of specified manufacturer with minimum five years documented experience.

SECTION 263623 – SAFETY SWITCHES

Section includes fusible and non-fusible safety switches, fusible switch assemblies, Switch ratings : Horsepower rated for AC or DC as indicated on Drawings.

SECTION 265100 – INTERIOR LIGHTING

Section Includes: Interior lighting fixtures, lamps, and ballasts, Emergency lighting units, Exit signs, Lighting fixture supports, Retrofit kits for fluorescent lighting fixtures.

SECTION 265600 – EXTERIOR LIGHTING

Section Includes: Exterior luminaires with lamps and ballasts, Luminaire-mounted photoelectric relays, Poles and accessories.

Division 27 Communications

SECTION 270000 – COMMUNICATION CIRCUITS

Section includes arrangement with Telecommunications Utility Company for telecommunication service; backboards, cabinets, pathways, termination devices, outlets and premises wiring. Including but not limited to telephone termination backboards, cross connect, 24-port remotely managed

switch, data cable patch panel, optical fiber patch panel, telephone outlet jacks, data outlet jacks, faceplates, unshielded backbone cable, shield backbone cable, optical fiber backbone cable, unshielded horizontal cable, optical fiber horizontal cable, mounting rack, mounting cabinet & ground wire.

SECTION 274000 – VIDEO SURVEILLANCE SYSTEM

Section includes Security cameras, Security control equipment. Fixed cameras, video sensor, submersible cameras, video surveillance, video recording, jacks , connections, faceplates, Cables and accessories.

Division 28 Electronic Safety & Security

SECTION 284000– PROGRAMMABLE LOGIC CONTROL SYSTEM

Programmable logic controller (PLC), Human machine interface (HMI), Uninterruptable power supplies, Ultrasonic level transmitters, Insertion flow meters, Electromagnetic flow meters, and Submersible pressure and temperature transmitters. Materials and equipment shall be standard unmodified products of a manufacturer regularly engaged in the manufacturing of such products. Units of the same type of equipment shall be products of a single manufacturer. Items of the same type and purpose shall be identical and supplied by the same manufacturer, unless replaced by a new version approved by the Architect.

Site & Infrastructure Subgroup

Division 31 Earthwork

SECTION 310000 - EARTHWORK

This work consists of excavation and backfill as required to attain grades shown on the contract documents, as well as for the construction of all concrete and other elements such as pipelines and structural modifications. The work includes preparation of subgrade for building foundations, slabs, walks and pavements, shoring and bracing, sealing foundations, dewatering, excavating, preparing foundations, bedding and backfilling of utility trenches.

SECTION 311000 – SITE CLEARING

Clearing and grubbing as required to permit installation of new construction, vegetation protection, topsoil stripping, and proper disposal of waste materials.

SECTION 311100 – CLEARING, GRUBBING & CLEANUP

The extent and location of the “Clearing, Grubbing and Cleanup” work is indicated on the drawings. The work includes the requirements for clearing, grubbing and cleanup of the areas indicated or as staked by the Engineer. The work is to be accomplished by removing and disposing of trees, brush, downed timber, stumps, roots, rubbish and debris, except such objects as are designated to remain or are to be removed in accordance with other sections of these specifications. The work also includes preservation from damage or defacement of trees, bushes, shrubs, or other objects designated to remain.

SECTION 312000 – EARTH MOVING

Excavating, filling and backfilling, compaction, and grading. Definition of satisfactory and unsatisfactory soils, geotextiles and warning tape. Field quality control.

SECTION 312319 - DEWATERING

Construction dewatering and ground water controls

Division 32 Exterior Improvements

SECTION 321000 – BASE COURSE

Extent of Work: The extent of "Base Course" work is indicated on the drawings. The work includes the requirements for producing, transporting, placing, shaping and compacting base courses of one or more materials in conformance with these specifications and the dimensions and sections indicated on the drawings or within the lines and grades established by the Engineer.

SECTION 321200 – FLEXIBLE PAVING

Includes placement of hot-mixed asphalt paving over prepared subbase and proof-rolling of subbase where indicated on the drawings, submittal of product data for each product specified, wuality assurance by an experienced installer. Also includes application of pavement markings and installation of wheel stops where shown.

SECTION 323116 – FABRICATED SLIDING GATES

Fabricated gate, gate-frame with anchors, and gate operator. ASTM A 276, Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes; ASTM F 593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; ASTM F 594, Standard Specification for Stainless Steel Nuts; American National Standards Institute (ANSI)/American Water Works Association (AWWA): ANSI/AWWA C 561, Fabricated Stainless Steel Slide Gates; American National Standards Institute (ANSI)/American Welding Society (AWS): ANSI/AWS D1.1 Structural Welding Code—Steel

SECTION 329200 – TURF & GRASSES

Seeding, sodded, plugged, and sprigged turf and meadows; planting soils, pesticides, and erosion-control materials; turf renovation; and grass paving.

SECTION 329219.16 – HYDROSEEDING FOR EROSION CONTROL

This work shall consist of the application of seed, fertilizer and mulch with tackifier in areas shown on the plans or as directed by the Engineer in accordance with these specifications. The extent and location of seeding work includes all areas not paved in this project which are disturbed by construction, grading, pavement removal, utility installation and any other of the Contractor's operations or as directed by the Engineer in accordance with these specifications.

SECTION 329300 - PLANTS

Plants, planting soils, pesticides, tree-stabilization materials, edging, planting soils and mulches.

Division 33 Utilities

SECTION 330110 – WATER SUPPLY PIPING

Extent of Work: The extent of "Water Supply Piping" work is indicated on the drawings. The work includes the requirements for providing the system in place complete, including excavation, laying, bedding, backfill, concrete and compaction, all in conformance with these specifications and the dimensions, sections and lines and grades established by the drawings or by the engineer.

SECTION 334000 – STORM DRAINAGE

Extent of Work: The location and extent of Storm Drainage work is indicated on the drawings. The work includes the requirements for providing culverts, storm sewers and storm drainage structures. Storm drain connections will be required for roof drains from new buildings and building additions, storm drainage piping shall be PVC per ASTM D 3034, SDR 35.

SECTION 334700 – FISH CROWDERS

Section includes furnishing and installing Crowder assemblies where indicated on the drawings, including but not limited to: crowder frames, crowder chain drive equipment, and crowder chain drive base and (concrete) anchors.

SECTION 335213 – HYDRAULIC OIL SYSTEM

Section includes hydraulic oil piping and fittings, hydraulic oil power module (pumps, filters and valves), system valves, valve actuators, along with controls and accessories that comprise the hydraulic oil system.

Division 34 Transportation

Process Equipment Subgroup

Division 35 Water & Marine Construction

Division 40 Process Integration

Division 41 Material Processing & Heating Equipment

SECTION 412323 – FISH LIFT BRAIL SYSTEM

Section includes furnishing and installing one (1) Fish Lift Brail assembly, including but not limited to: brail frame, brail winch and associated rigging, and brail support structure and related fasteners.

Division 42 Process Heating, Cooling & Drying Equipment

Division 43 Process Gas & Liquid Handling, Purification & Storage Equipment

Division 44 Pollution Control Equipment

Division 45 Industry Specific Manufacturing Equipment

Division 48 Electrical Power Generation

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SECTION LINE

HWY 142

ORDINARY HIGH WATER

N87°02'48"W 656.61'

KLICKITAT RIVER

DENSE TREES

60 LF ROW

HORSESHOE BEND BRIDGE

N00°03'00"W 668.09'

RIVER MILE 11.0 KLICKITAT RIVER

MAINTENANCE SHOP

TRAILER

RESIDENCE

SHED

WAHKIACUS PARK ROAD

EDGE OF EXIST. ROAD

HORSESHOE BEND ROAD

200 LF KLICKITAT TRAIL ROW

PROPERTY LINE

N87°20'29"W 655.28'

60 LF ROW

SCHILLING ROAD

N00°25'00"W 664.62'

N01°12'45"E 349.99'

SWALE CREEK

LUDLUM PARK WDFW

N87°02'48"W 476.56'

N87°02'48"W 790.48'

S01°12'45"W 349.99'

N87°02'48"W 476.56'

FLOODWAY

PROPERTY LINE

FLOODWAY LIMIT

PRIVATE PROPERTY

EXIST. LEVEE

200 LF KLICKITAT TRAIL ROW

60 LF ROW

KLICKITAT TRAIL

EXISTING SITE PLAN

SCALE: 1" = 50'

REVISED DESCRIPTION	DATE

SCALE: 1:50

CHK BY: MC

DRW BY: BA

REF: X

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WAHKIACUS HATCHERY
YAKAMA KLICKITAT FISHERIES PROGRAM

SITE PLAN
EXISTING FACILITIES

JOB NO. 03006.00

DATE: 10.07.10

SHEET: X OF X

DWG.# FIG 1

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SECTION LINE

HWY 142

KLICKITAT RIVER

ORDINARY HIGH WATER

N87°02'48"W 656.61'

60' ROW

HORSESHOE BEND BRIDGE TO BE DEMOLISHED

NEW COUNTY BRIDGE (BY OTHERS)

N00°03'00"W 668.09'

RIVER MILE 170 KLICKITAT RIVER

DENSE TREES

(8) JUMBO RACEWAYS

RIVER WATER INTAKE

FISHWAY

SPAWNING BLDG.

WATER DISTRIBUTION BLDG.

HATCHERY & MAINTENANCE BLDG.

COVERED STORAGE

FUEL STORAGE 2000 GAL.

VISITOR KIOSK

HORSESHOE BEND ROAD

200 LF KLICKITAT TRAIL ROW

PROPERTY LINE

N87°20'29"W 655.28'

60' ROW

SCHILLING ROAD

N00°25'00"W 664.67'

200 LF KLICKITAT TRAIL ROW

16"ø STL PIPELINE

KLICKITAT TRAIL

60' ROW

MATCHLINE-A SEE SHEET C003

N01°12'45"E 349.99'

WAHKIACUS PARK ROAD

SWALE CREEK

LARGE WOODY DEBRIS (TYP.)

LUDLUM PARK WDFW

WATER CONDITIONING BLDG.

POLLUTION ABATEMENT BASIN

N87°02'48"W 476.56'

FLOODWAY

PROPERTY LINE

(10) COVERED REARING RACEWAYS

(10) COVERED REARING RACEWAYS

MARKING TRAILER PAD, TYP. (12'x40')

APPROX. TOE OF FILL

CHEMICAL STORAGE BLDG.

(5) REARING RACEWAYS

(2) JUMBO RACEWAYS

SECURITY FENCE LINE

FLOODWAY LIMIT

PRIVATE PROPERTY

SHEET PILE LEVEE REINFORCEMENT AT EXIST. LEVEE

MATCHLINE-A SEE SHEET C003

N87°02'48"W 476.56'

N87°02'48"W 656.61'

N87°02'48"W 790.48'

N01°12'45"E 349.99'

Key Plan

CONCEPTUAL DESIGN
SITE DEVELOPMENT PLAN

SCALE: 1" = 50'

50 0 50 100

SCALE IN FEET 1" = 50'

REVISED DESCRIPTION	DATE

SCALE: 1:50
CHK BY: MC
DRW BY: BA
REF: X

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WAHKIACUS HATCHERY
YAKAMA KLICKITAT FISHERIES PROGRAM

SITE DEVELOPMENT PLAN
MAIN HATCHERY

JOB NO. 03006.00
DATE: 10.07.10
SHEET: X OF X
DWG.# FIG 2

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

WATER CONDITIONING BLDG.

POLLUTION ABATEMENT BASIN

HATCHERY & MAINTENANCE BLDG.

COVERED STORAGE

WAHKIACUS PARK

N87°02'48"W 476.56'

PROPERTY LINE

FLOODWAY

(10) COVERED REARING RACEWAYS

(10) COVERED REARING RACEWAYS

MARKING TRAILER PAD, TYP. (12'x40')

APPROX. TOE OF FILL

CHEMICAL STORAGE BLDG.

(5) REARING RACEWAYS

(2) JUMBO RACEWAYS

SECURITY FENCE LINE

FLOODWAY LIMIT

PRIVATE PROPERTY

SHEET PILE LEVEE REINFORCEMENT AT EXIST. LEVEE

60' R/W

SCHILLING ROAD

N00°25'00"W 664.64'

300' KLICKITAT TRAIL ROW

16"ø STL PIPELINE

KLICKITAT TRAIL

60' KLICKITAT TRAIL ROW

MATCHLINE-A SEE SHEET C0.02

RESIDENCE OPTION A

50' T/T

KLICKITAT TRAIL ROW

16"ø STL PIPELINE

SWALE CREEK BRIDGE

100'

75'

SWALE CREEK WATER INTAKE

ORDINARY HIGH WATER

SWALE CREEK

PROPERTY LINE

SCHILLING ROAD

KLICKITAT TRAIL

PROPERTY LINE

N00°13'07"W 2631.02'

TO SECTION 1/4 CORNER

RESIDENCE OPTION B

BORROW AREA FOR HATCHERY FILL

HORSESHOE BEND ROAD

Key Plan

CONCEPTUAL DESIGN
SITE DEVELOPMENT PLAN
SCALE: 1" = 50'

50 0 50 100
SCALE IN FEET 1" = 50'

SCALE: 1" = 50'
CHK BY: MC
DRW BY: BA
REF:

REVISED DESCRIPTION	DATE

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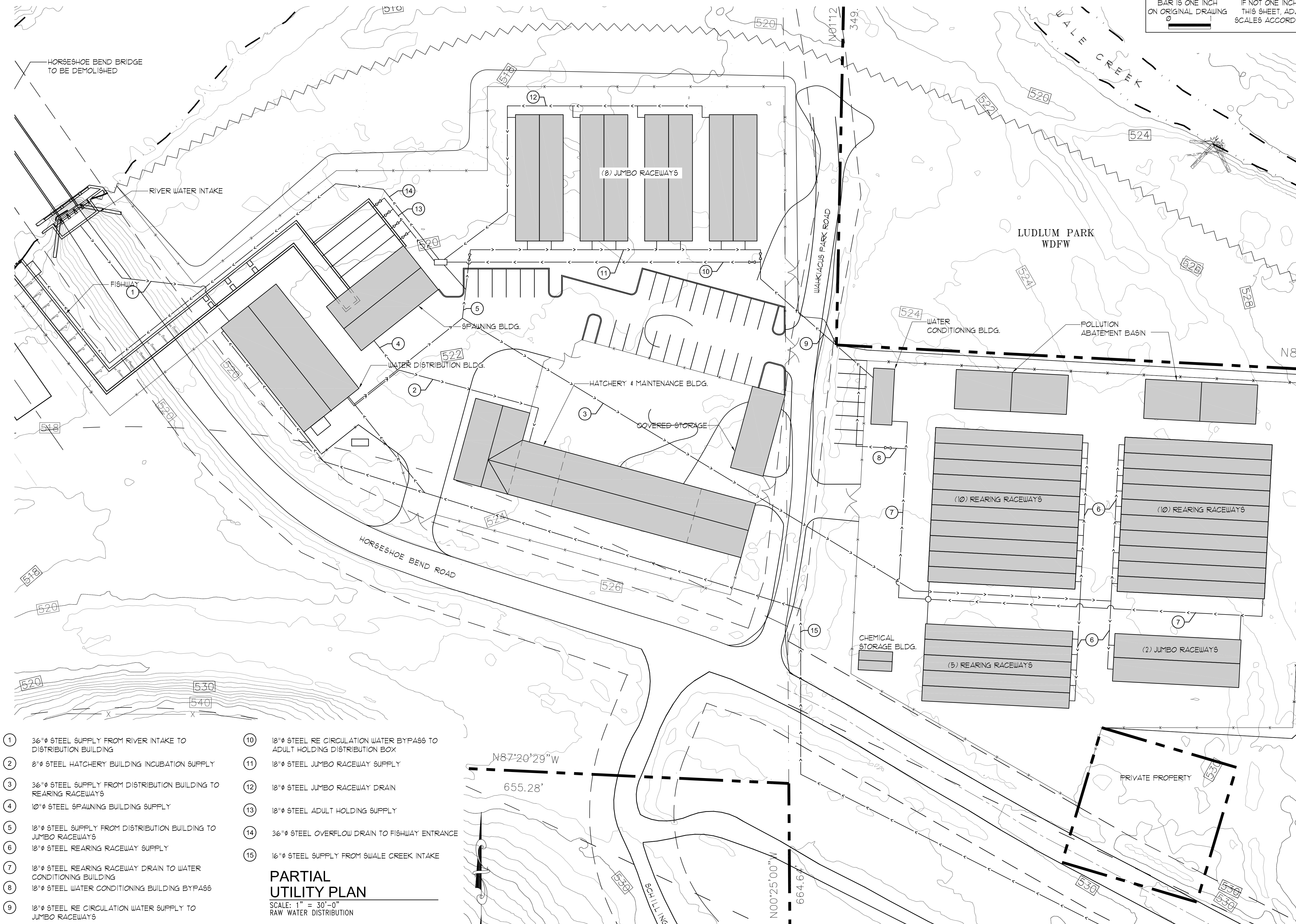
SITE DEVELOPMENT PLAN
HATCHERY RESIDENCE

JOB NO. 03006.00
DATE: 10.07.10
SHEET: X OF X
DWG.# FIG 3

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION



1. 36"ø STEEL SUPPLY FROM RIVER INTAKE TO DISTRIBUTION BUILDING
2. 8"ø STEEL HATCHERY BUILDING INCUBATION SUPPLY
3. 36"ø STEEL SUPPLY FROM DISTRIBUTION BUILDING TO REARING RACEWAYS
4. 10"ø STEEL SPAWNING BUILDING SUPPLY
5. 18"ø STEEL SUPPLY FROM DISTRIBUTION BUILDING TO JUMBO RACEWAYS
6. 18"ø STEEL REARING RACEWAY SUPPLY
7. 18"ø STEEL REARING RACEWAY DRAIN TO WATER CONDITIONING BUILDING
8. 18"ø STEEL WATER CONDITIONING BUILDING BYPASS
9. 18"ø STEEL RE CIRCULATION WATER SUPPLY TO JUMBO RACEWAYS
10. 18"ø STEEL RE CIRCULATION WATER BYPASS TO ADULT HOLDING DISTRIBUTION BOX
11. 18"ø STEEL JUMBO RACEWAY SUPPLY
12. 18"ø STEEL JUMBO RACEWAY DRAIN
13. 18"ø STEEL ADULT HOLDING SUPPLY
14. 36"ø STEEL OVERFLOW DRAIN TO FISHWAY ENTRANCE
15. 16"ø STEEL SUPPLY FROM SWALE CREEK INTAKE

PARTIAL UTILITY PLAN

SCALE: 1" = 30'-0"
RAW WATER DISTRIBUTION

30 0 30 60
SCALE IN FEET 1" = 30'

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING 0 1
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE: 1:30 | CHK BY: X | DRW BY: X | REF: X

REVISED: DATE | DESCRIPTION

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WAHKIACUS HATCHERY
YAKAMA KLICKITAT FISHERIES PROGRAM

SITE UTILITIES PLAN
RAW WATER DISTRIBUTION

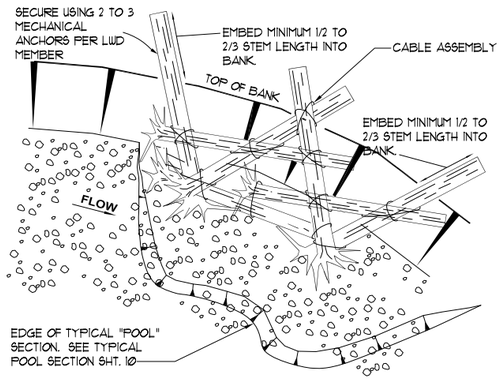
JOB NO. 09006.00
DATE: 10.07.10
SHEET: X OF X
DWG.# FIG 4

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

VERIFY SCALE

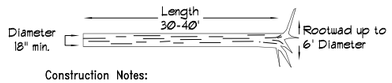
BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY



TYPICAL PLAN

SCALE: NTS
LARGE WOODY DEBRIS JAM



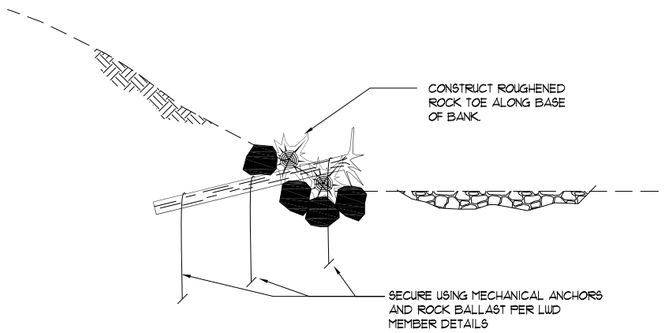
Construction Notes:
1) LWD should have an 18" minimum diameter .
2) Lay LWD parallel to bank in "shingle pattern" first.
3) Lay oblique LWD over completed "shingle pattern".
4) Anchor each LWD with mechanical anchors or rock ballast suited to site conditions.
5) Attach LWD to each other tightly to prevent downstream shifting.
6) Attach oblique LWD using mechanical anchors.

TYPICAL DETAIL

SCALE: NTS
LARGE WOODY DEBRIS

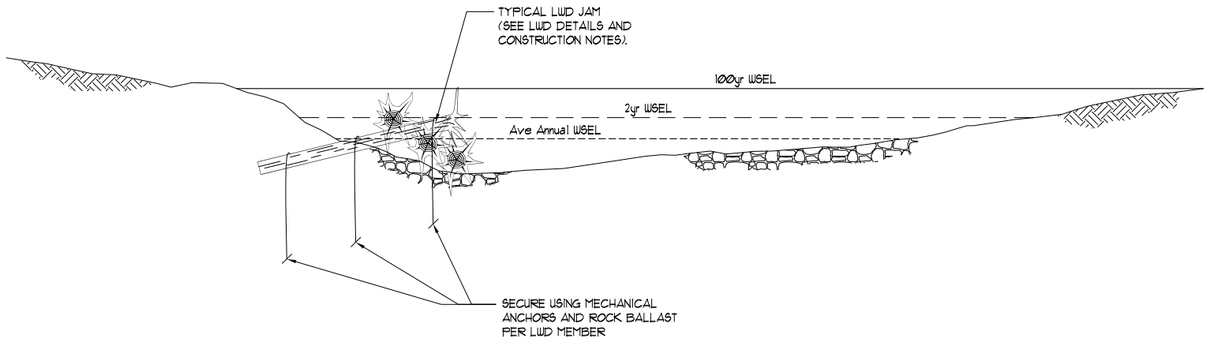
NOTES

- MINIMUM LOG DIAMETER 18 INCHES AT TIP, LOG LENGTH PER TYPICAL DETIAL AND PLACEMENT PER SITE DETAILS.
- EACH LOG BE SHALL SECURED IN PLACE PER DETAILS;
- LOGS THAT ARE NOT BURIED 2/3 OF THEIR STEM LENGTH SHALL HAVE A MINIMUM 2 ANCHORS (ONE AT EACH END).
- BOULDERS USED FOR DEADMAN ANCHORS SHALL BE NO LESS THAN 4-FT MEAN DIAMETER AND BURIED TO MINIMUM DEPTH OF 4-FT. DEPTH OF BURIAL IS FROM TOP OF BOULDER TO COMPACTED GROUND SURFACE. ALL BOULDERS SHALL BE PLACED ON THE UPSTREAM SIDE OF THE LOG THEY ARE SECURED TO.
- ALL MATERIAL USED TO BURY LOGS OR BOULDERS SHALL BE COMPACTED.
- USE MINIMUM 9/16" GALVANIZED CABLE FOR SECURING LOGS TO TREES AND DEADMAN ANCHORS.
- SECURE CABLE TO BOULDERS BY:
  1.) DRILLING THROUGH BOULDER AND ATTACHING PER DETAIL.
  2.) EPOXY ANCHOR EYE BOLTS PER DETAILS.
- VARY ELEVATION OF LWD PLACEMENT BETWEEN HIGH AND LOW WATER.
- CONSTRUCT "CROSS LOG" GRADE CONTROL STRUCTURES EVERY 400 TO 500 FT MINIMUM.



TYPICAL SECTION

SCALE: NTS
LARGE WOODY DEBRIS JAM
WITH ROUGHENED ROCK TOE



TYPICAL SECTION

SCALE: NTS
LARGE WOODY DEBRIS JAM

REVISED DESCRIPTION	DATE

SCALE: AS NOTED
CHK BY: MC
DRW BY: BA
REF:

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WAHKIACUS HATCHERY
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LARGE WOODY DEBRIS JAM
SECTIONS AND DETAILS

JOB NO. 03006.00
DATE: 10.07.10
SHEET: X OF X
DWG.# FIG 5

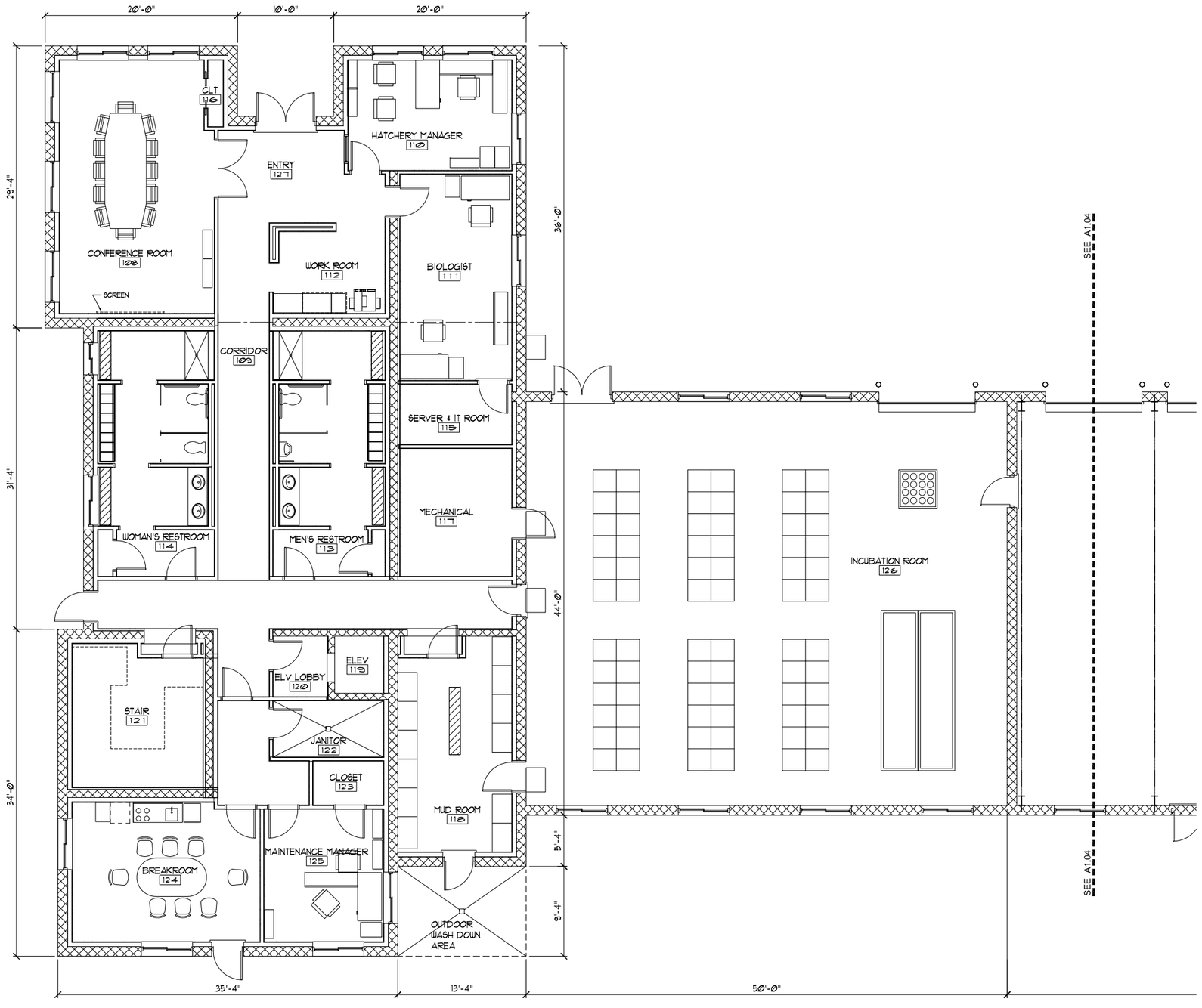
CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

HATCHERY LEVEL 1
ENTRY
CONFERENCE ROOM
CLOSET
WORK ROOM
HATCHERY MANAGER
BIOLOGIST OFFICE
SERVER & IT ROOM
MECHANICAL ROOM
WOMEN'S RESTROOM
MEN'S RESTROOM
JANITOR CLOSET
ELEV.
STAIR
ELEVATOR
ELEVATOR VESTIBULE
CORRIDOR
INCUBATION ROOM
MUD AREA
MAINTENANCE AREA
STORAGE
RESTROOM
CLOSET
TOTAL GROSS AREA 17,608 SF GROSS



FIRST FLOOR PLAN

SCALE: 3/16" = 1'-0"

WEST AREA

2 0 2 4 6 8 10 12 14

SCALE IN FEET 3/16" = 1'-0"

REVISED DESCRIPTION	DATE

SCALE: 3/16"=1'-0"

CHK BY: X

DRW BY: X

REF: X

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WAHKIACUS HATCHERY

YAKAMA KLICKITAT FISHERIES PROGRAM

HATCHERY BUILDING

FIRST FLOOR PLAN - WEST AREA

JOB NO. 09006.00

DATE: 10.07.10

SHEET: X OF X

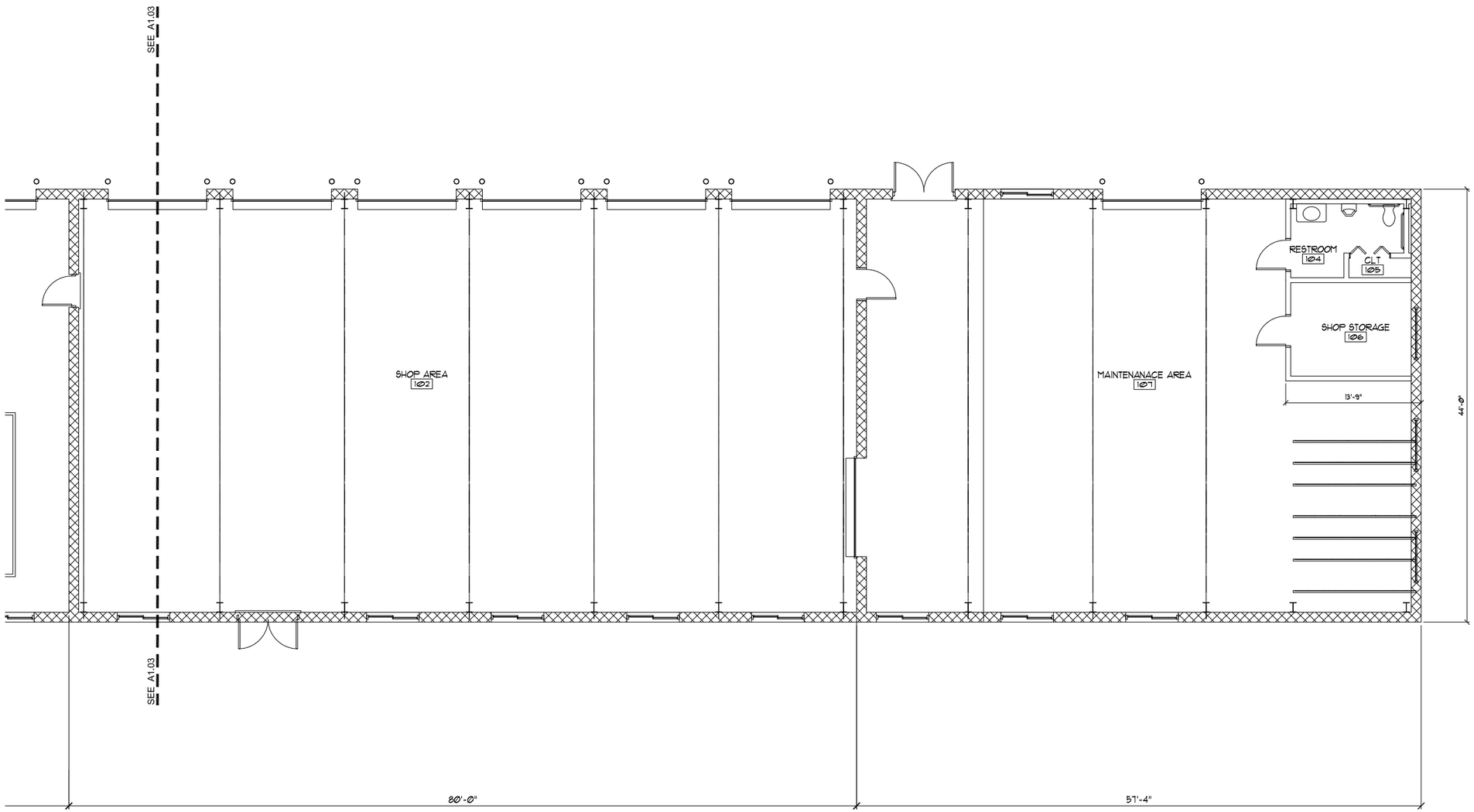
DWG.# FIG 6

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY



FIRST FLOOR PLAN

SCALE: 3/16" = 1'-0"

EAST AREA

2 0 2 4 6 8 10 12 14

SCALE IN FEET 3/16" = 1'-0"

REVISED DESCRIPTION	DATE

SCALE: 3/16"=1'-0"

CHK BY: X

DRW BY: X

REF: X

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WAHKIACUS HATCHERY

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HATCHERY BUILDING

FIRST FLOOR PLAN - EAST AREA

JOB NO. 03006.00

DATE: 10.07.10

SHEET: X OF X

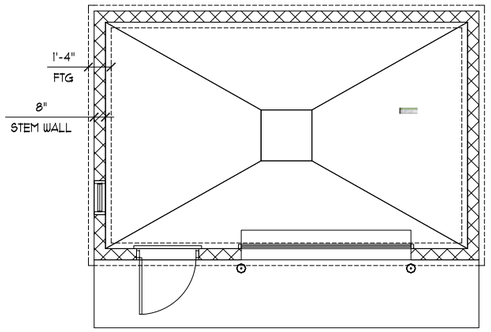
DWG.# FIG 7

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

VERIFY SCALE

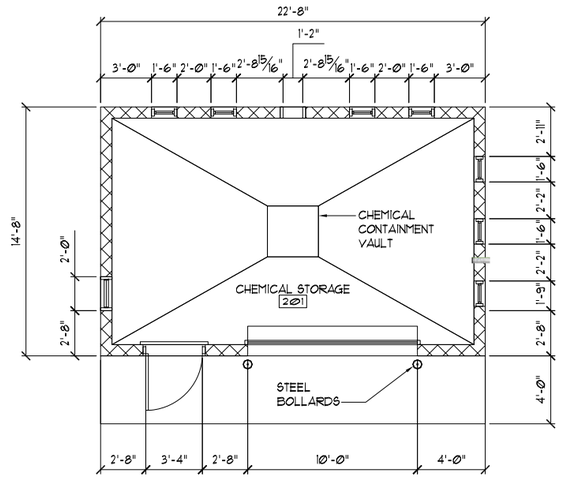
BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY



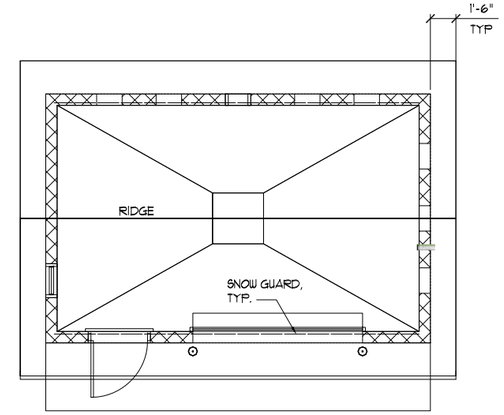
FOUNDATION PLAN

SCALE: 1/4" = 1'-0"



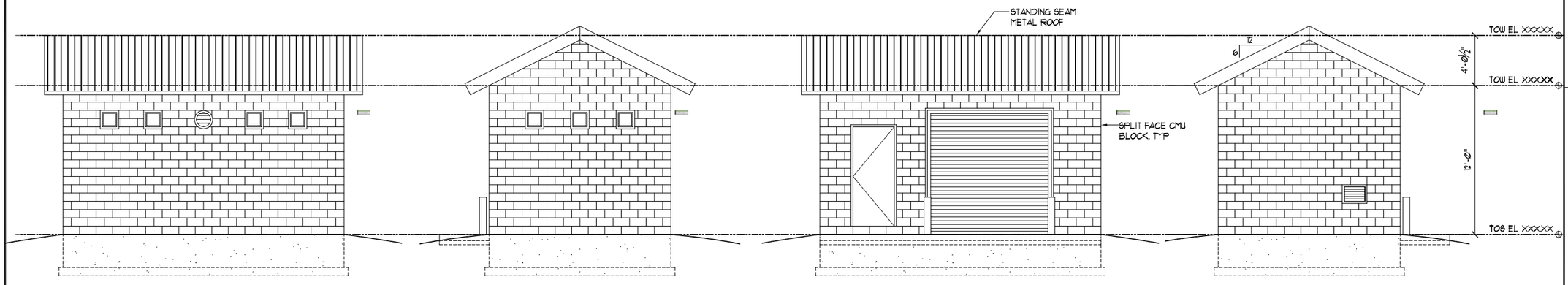
FLOOR PLAN

SCALE: 1/4" = 1'-0"



ROOF PLAN

SCALE: 1/4" = 1'-0"



ELEVATION

SCALE: 1/4" = 1'-0"
NORTH ELEVATION

ELEVATION

SCALE: 1/4" = 1'-0"
EAST ELEVATION

ELEVATION

SCALE: 1/4" = 1'-0"
SOUTH ELEVATION

ELEVATION

SCALE: 1/4" = 1'-0"
WEST ELEVATION

REVISED DESCRIPTION	DATE

SCALE: 1/4" = 1'-0"
CHK BY: X
DRW BY: JVL
REF: X

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YAKAMA KLICKITAT FISHERIES PROGRAM

CHEMICAL STORAGE BUILDING
PLANS AND ELEVATIONS

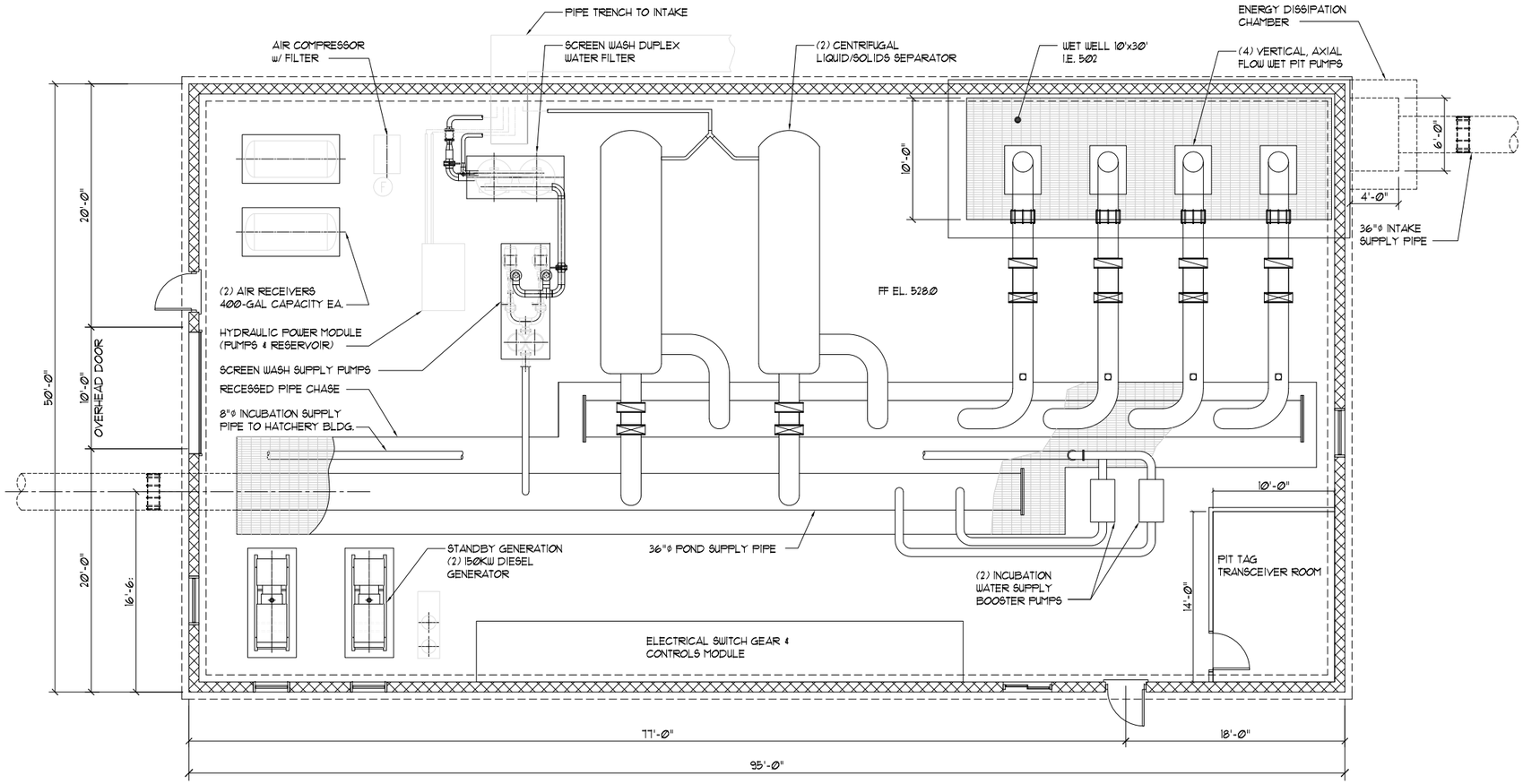
JOB NO. 09006.00
DATE: 10.07.10
SHEET: X OF X
DWG.# FIG 8

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY



PLAN

SCALE: 1" = 10'-0"

BUILDING LAYOUT

REVISED DESCRIPTION	DATE

SCALE: X | CHK BY: X | DRW BY: X | REF: X

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WAHKIACUS HATCHERY

YAKAMA KLICKITAT FISHERIES PROGRAM

WATER DISTRIBUTION BUILDING LAYOUT PLAN

JOB NO. 03006.00

DATE: 10.07.10

SHEET: X OF X

DWG.# FIG 9

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

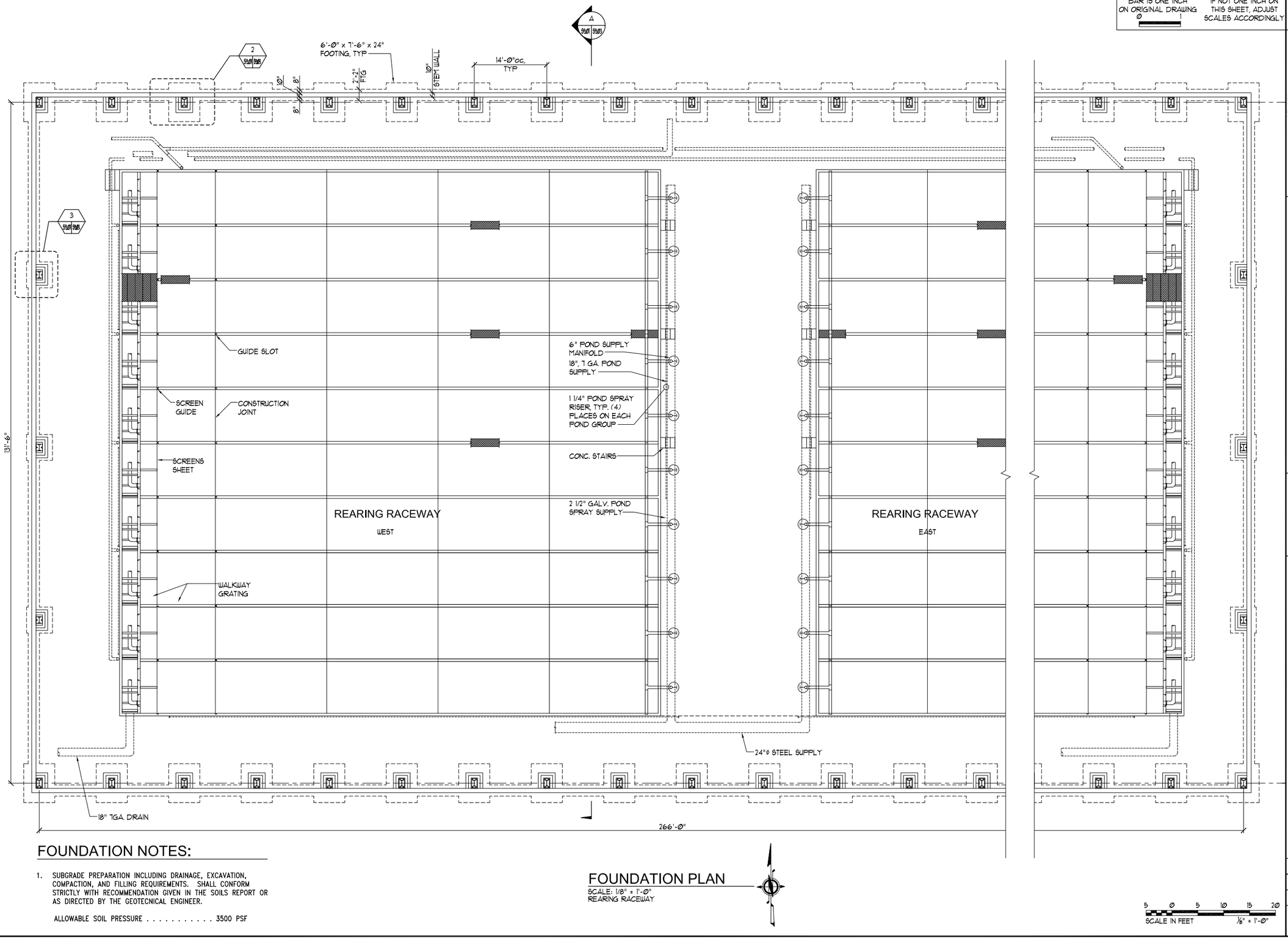
VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE: 1/8"=1'-0"
CHK BY: X
DRW BY: JVL
REF: X

DATE	REVISED DESCRIPTION



FOUNDATION NOTES:

1. SUBGRADE PREPARATION INCLUDING DRAINAGE, EXCAVATION, COMPACTION, AND FILLING REQUIREMENTS. SHALL CONFORM STRICTLY WITH RECOMMENDATION GIVEN IN THE SOILS REPORT OR AS DIRECTED BY THE GEOTECNICAL ENGINEER.

   ALLOWABLE SOIL PRESSURE . . . . . 3500 PSF

FOUNDATION PLAN

SCALE: 1/8" = 1'-Ø"
REARING RACEWAY

5 Ø 5 10 15 20
SCALE IN FEET 1/8" = 1'-Ø"

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WAHKIACUS HATCHERY
YAKAMA KLICKITAT FISHERIES PROGRAM

REARING RACEWAY
FOUNDATION PLAN

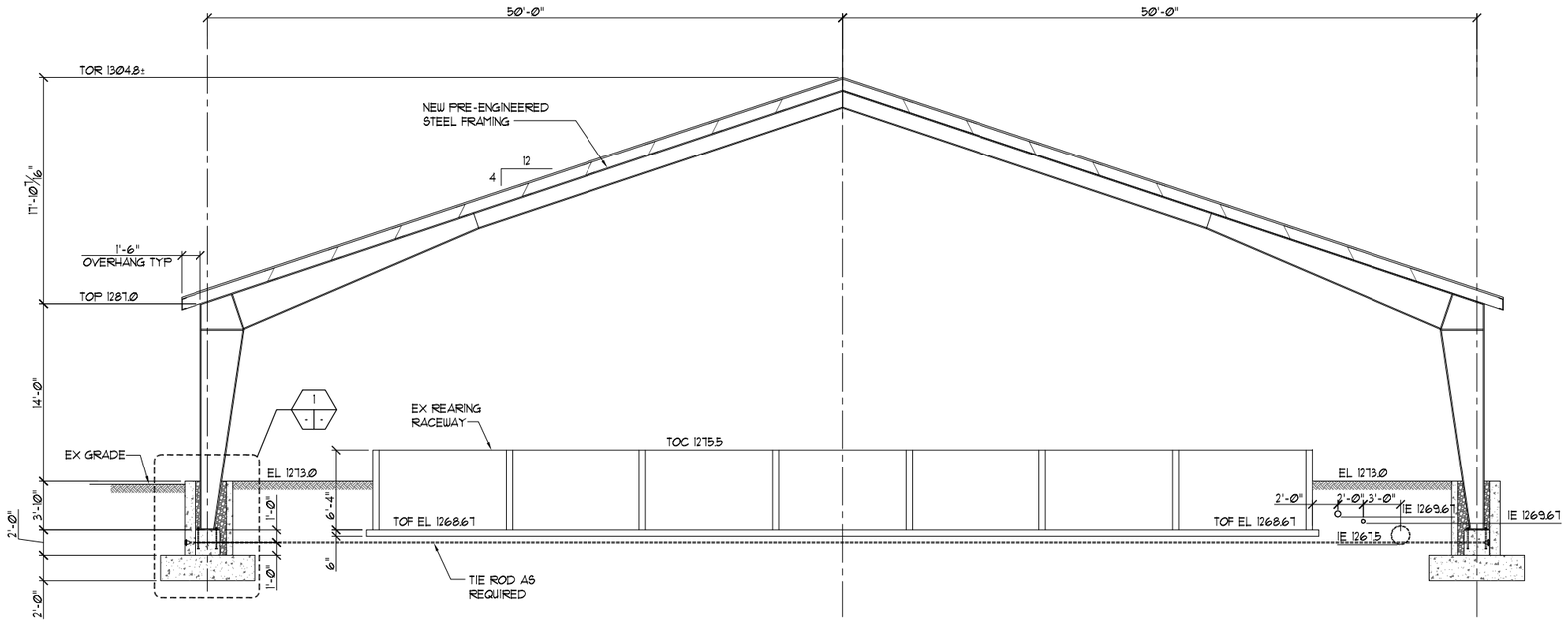
JOB NO. 03006.00
DATE: 10.07.10
SHEET: X OF X
DWG.# FIG 10

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

VERIFY SCALE

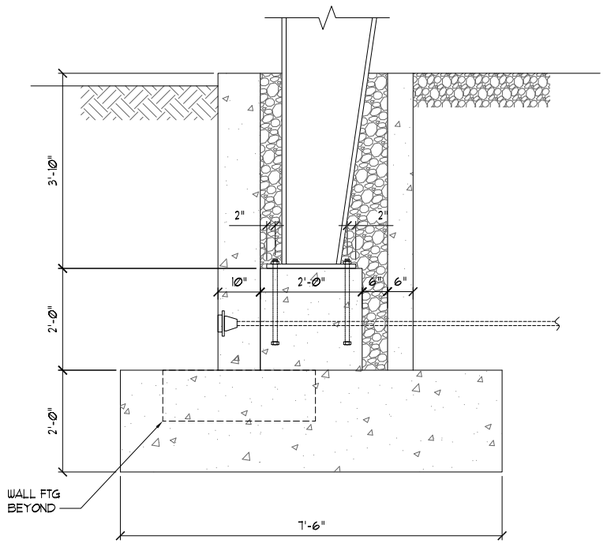
BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY



SECTION

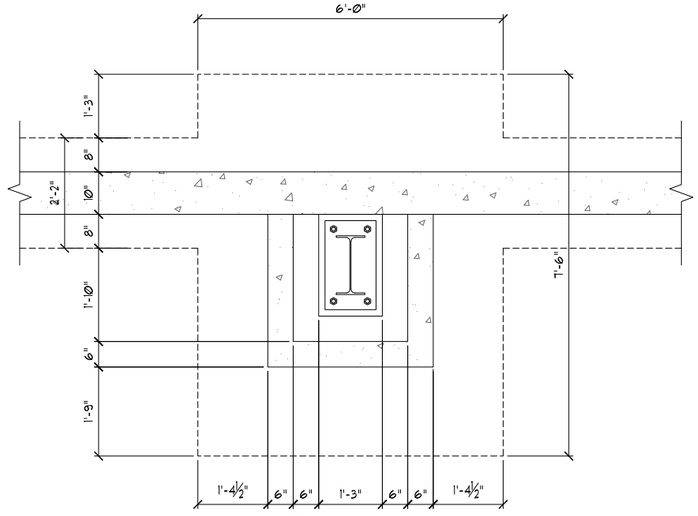
SCALE: 3/16" = 1'-Ø"



DETAIL 1

SCALE: 3/4" = 1'-Ø"

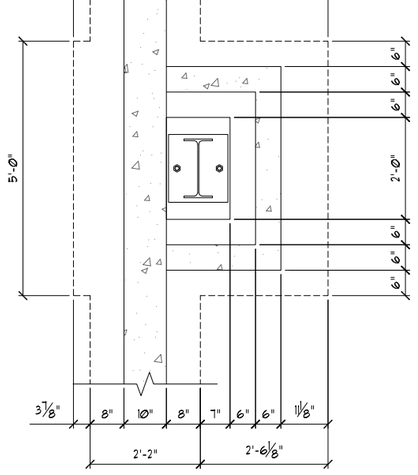
NEW WALL/FTG ASSEMBLY



PLAN VIEW

DETAIL 2

SCALE: 3/4" = 1'-Ø"



PLAN VIEW

DETAIL 3

SCALE: 3/4" = 1'-Ø"

2 Ø 2 4 6 8 10 12 14

SCALE IN FEET 3/16" = 1'-Ø"

1 Ø 1 2 3

SCALE IN FEET 3/4" = 1'-Ø"

REVISED DESCRIPTION	DATE

SCALE: AS SHOWN
CHK BY: X
DRW BY: JVL
REF: X

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WAHKIACUS HATCHERY
YAKAMA KLICKITAT FISHERIES PROGRAM

REARING RACEWAY
SECTION AND DETAIL

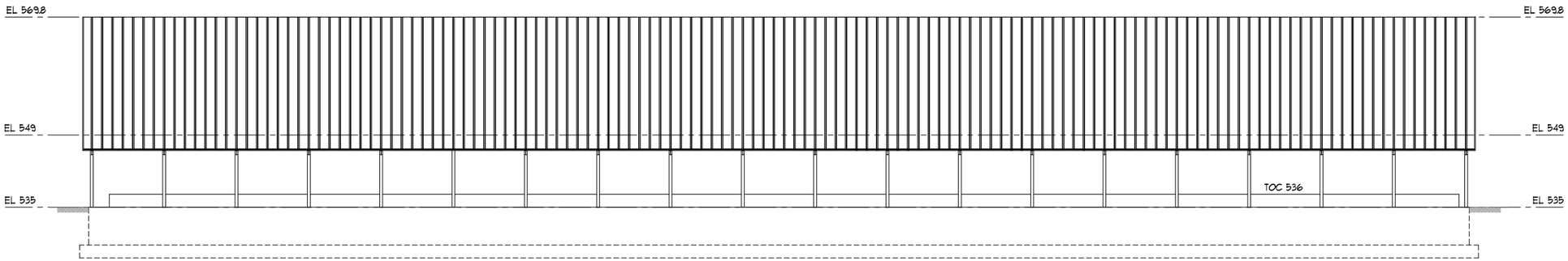
JOB NO. 03006.00
DATE: 10.07.10
SHEET: X OF X
DWG.# FIG 11

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

VERIFY SCALE

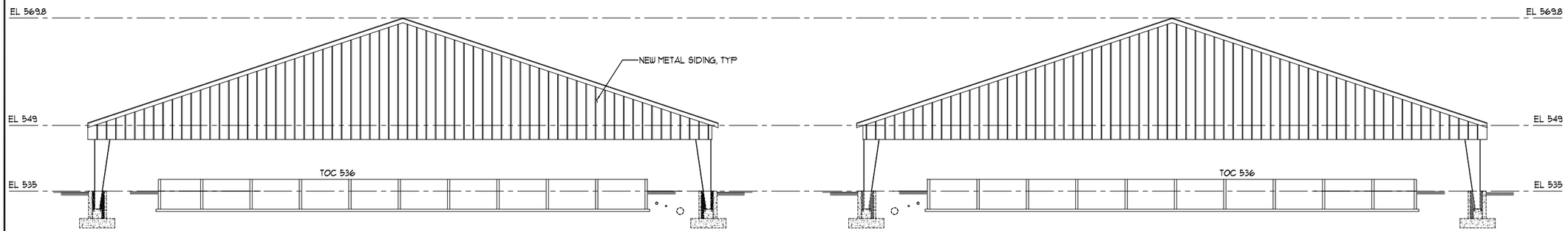
BAR IS ONE INCH ON ORIGINAL DRAWING Ø

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY



NORTH ELEVATION

SCALE: 3/32" = 1'-Ø"

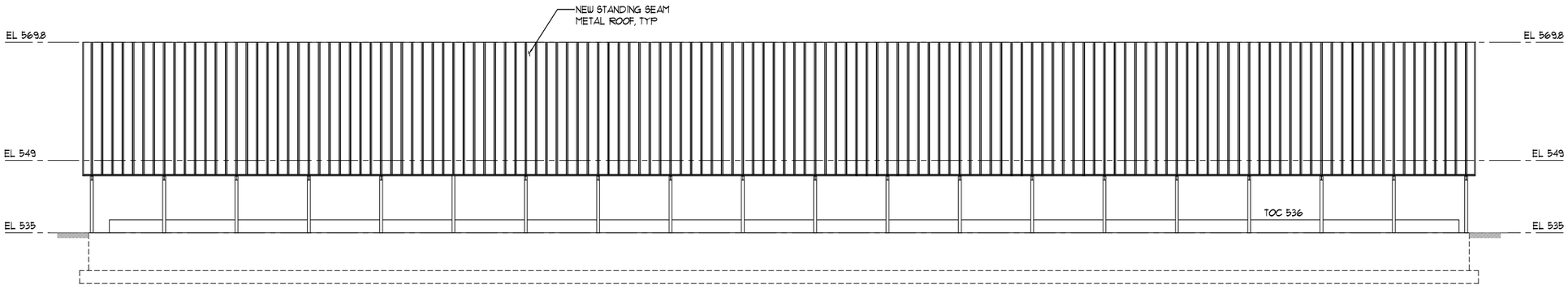


WEST ELEVATION

SCALE: 3/32" = 1'-Ø"

EAST ELEVATION

SCALE: 3/32" = 1'-Ø"



SOUTH ELEVATION

SCALE: 3/32" = 1'-Ø"

REVISED DESCRIPTION	DATE

SCALE: 3/32" = 1'-Ø"
CHK BY: X
DRW BY: JVL
REF: X

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YAKAMA KLICKITAT FISHERIES PROGRAM

REARING RACEWAY
ELEVATIONS

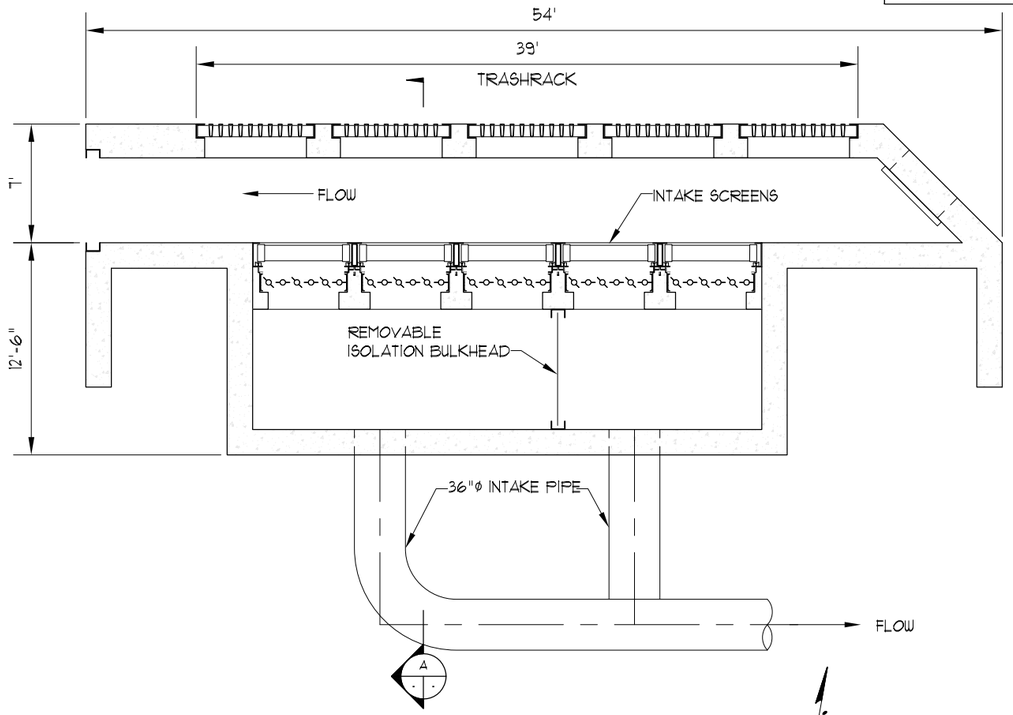
JOB NO. 09006.00
DATE: 10.07.10
SHEET: X OF X
DWG.# FIG 12

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

VERIFY SCALE

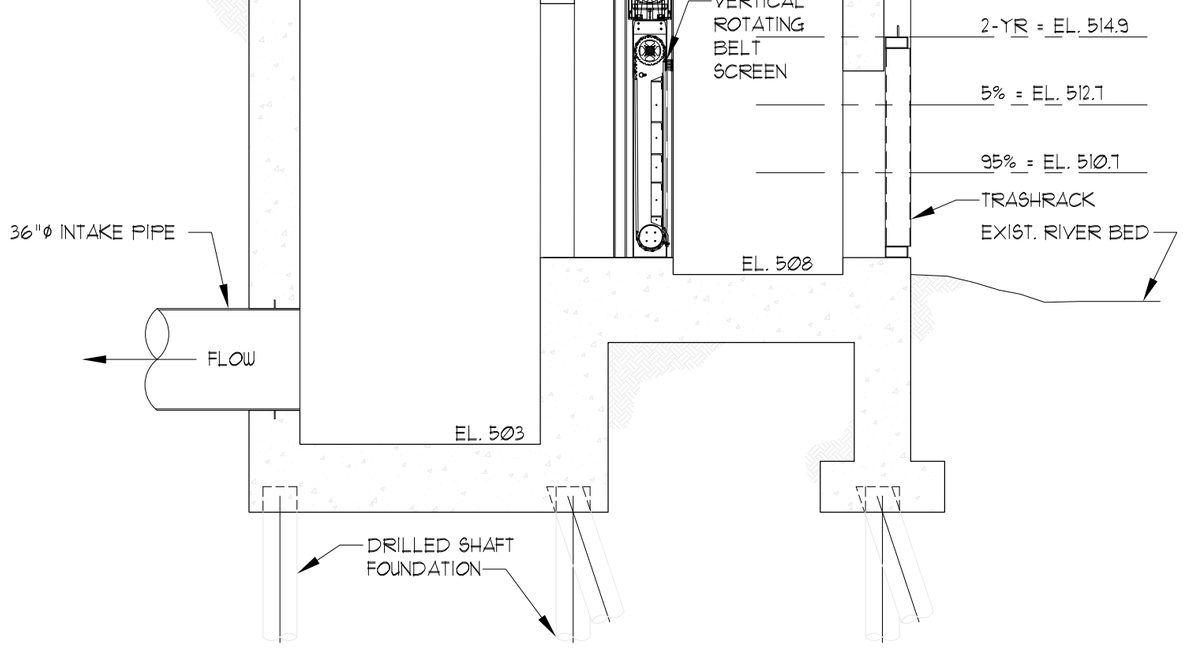
BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY



RIVER WATER INTAKE PLAN

SCALE: 1/4" = 1'-0"



SECTION

SCALE: NTS

A

REVISED DESCRIPTION	DATE

SCALE: AS NOTED
CHK BY: MC
DRW BY: BA
REF: X

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RIVER WATER INTAKE

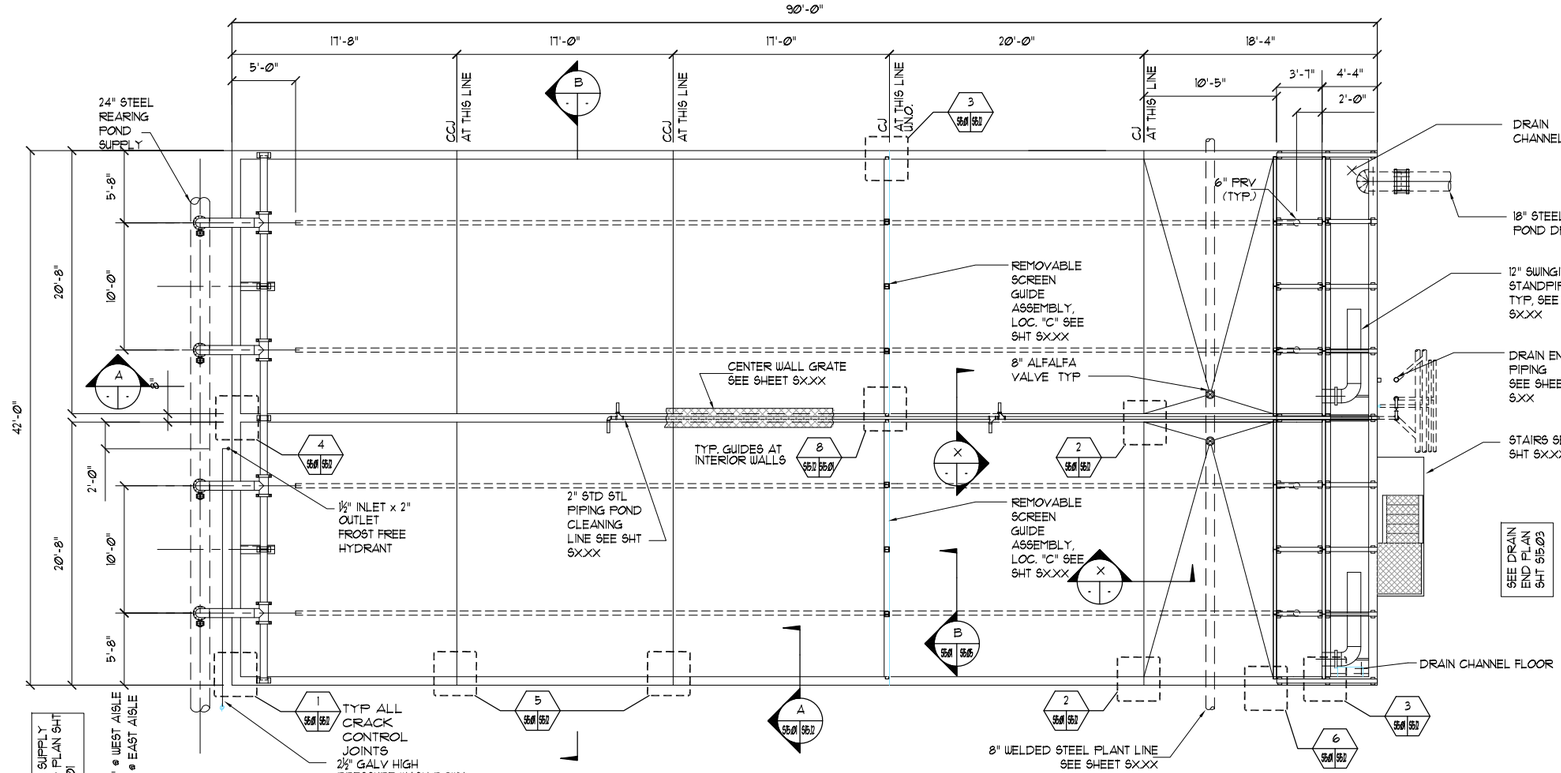
JOB NO. 09006.00
DATE: 10.07.10
SHEET: X OF X
DWG.# FIG 13

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

VERIFY SCALE

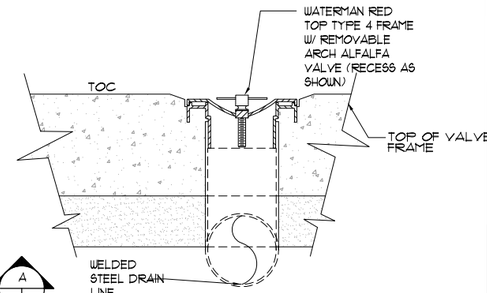
BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

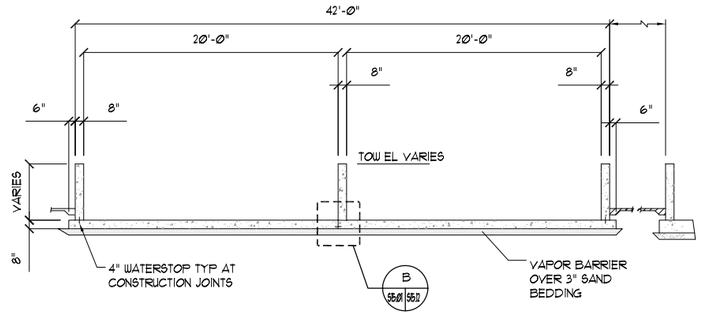


NOTE:
THE FOLLOWING ITEMS ARE NOT SHOWN FOR CLARITY:
1. POND FENCING SEE SHT SXXX
2. GRATING AND GRATING SUPPORTS SEE SHT SXXX
3. CLEANING WATER PIPING SEE SHT SXXX

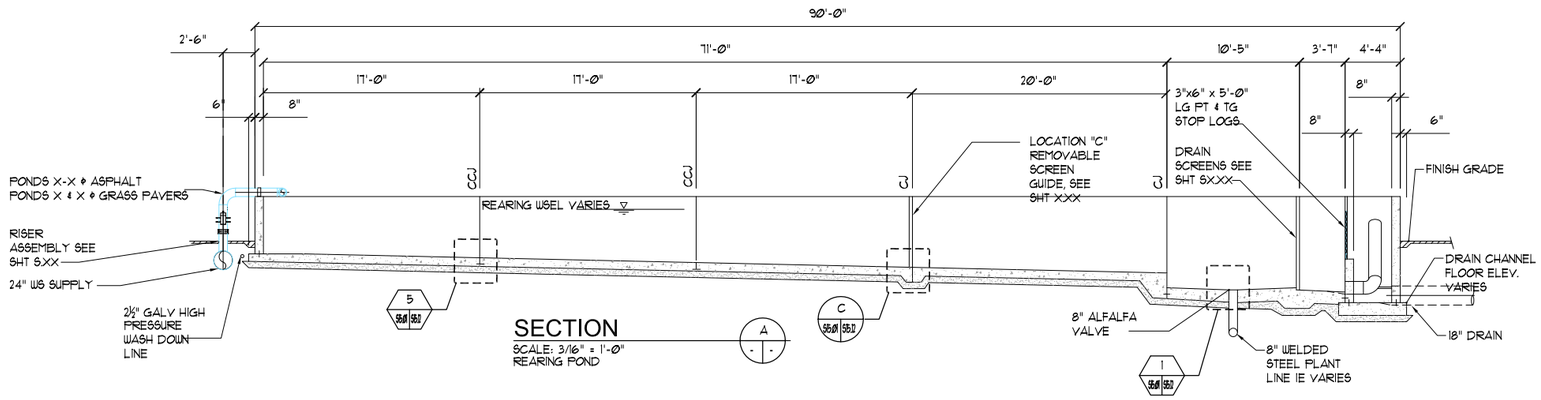
PLAN
SCALE: 3/16" = 1'-Ø"
REARING POND



DETAIL
SCALE: 1 1/2" = 1'-Ø"



SECTION
SCALE: 3/16" = 1'-Ø"
REARING POND



SECTION
SCALE: 3/16" = 1'-Ø"
REARING POND

SCALE IN FEET 1 9 6 3 Ø 1 — 1½" = 1'-Ø"

SCALE IN FEET 2 Ø 2 4 6 8 10 12 14 — 3/16" = 1'-Ø"

REVISED	DESCRIPTION	DATE	CHK BY:	DRW BY:	REF:
SCALE:			X	JVL	X

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WAHKIACUS HATCHERY
YAKAMA KLICKITAT FISHERIES PROGRAM

CONCRETE REARING PONDS
PLANS AND SECTIONS

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

JOB NO. 03006.00
DATE: 10.07.10
SHEET: X OF X
DWG.# FIG 14