Attachment A
PRE-PROPOSAL FORM
Lewis River Aquatic Fund

1. Applicant organization.
Cowlitz Indian Tribe – Natural Resource Department

2. Organization purpose
Mission Statement: To protect, conserve, restore and promote culturally relevant species and landscapes integral to the unique identity of the Cowlitz People. To further educate the community and inspire future leaders and participants in this vision.

3. Project manager (name, address, telephone, email, fax)
Peter Barber, 7700 NE 26th Ave, Vancouver WA 98665, pbarber@cowlitz.org

4. Project Title
Colvin Dam Removal Preliminary Design

5. Summary of Project proposal
Project Goal
The goal of the project is to restore natural sediment transport processes and fish passage to benefit salmonid populations in Colvin Creek and the downstream reaches of lower North Fork Lewis River.

Background
The lower North Fork Lewis River was permanently disconnected from its headwater source of sediment after the completion of Merwin Dam in 1932. The impacts from the construction of Merwin dam have reduced the magnitude of peak flood events, blocked the supply of large woody debris, created a less active channel and cut off the access by migrating salmonid adults to a minimum of 96 miles of upstream spawning/rearing habitat. (Final Technical Reports WTS 3ii, FERC Project. 2004) During the construction of Merwin Dam, a downstream tributary named Colvin Creek was also dammed to create a series of adult holding ponds to provide a water source to the North Fork Lewis River Fish Hatchery. (Pacific Fisherman, 1930) The Washington Department of Fisheries utilized Colvin dam until 1962, when a clogged road culvert (across Hwy 503) failed and caused a massive debris flow which filled the entire Colvin reservoir with sediment, over-topped Colvin dam and destroyed the Lewis River Road crossing just downstream. (Washington Department of Fisheries, 72nd Annual Report 1962) The Lewis River Hatchery water intake and pump station in Colvin Creek was also completely destroyed. Since 1962, Colvin dam infrastructure was effectively mothballed and ignored, even though it continues to restrict sediment transport to the main stem North Fork Lewis River and continues to restrict fish passage to a minimum of 0.5 miles of fish habitat.

The current sediment load downstream of Merwin Dam is limited to inputs by small tributaries and erosion/landslides from the valley walls. The total estimated transport of sediment in the Lower North Fork Lewis River since the construction of Merwin Dam is equal to 35,000-60,000 tons and nearly half of that total amount (est. 33,000 tons) was transferred during the 1933 flood of record. (Final Technical Reports WTS 3ii, FERC Project. 2004) Compared to sediment rich watersheds such as the Grays River, which *annually* transports an estimated 230,000 tons of sediment. (May et al., 2007) The lower North Fork Lewis River below Merwin dam has only limited inputs of sediment via bank erosion and tributary sources, and over time, interruption of sediment transport from the dam is expected to create a *gravel supply-limited condition*, especially in the canyon reaches downstream of the dam. (Final Technical Reports WTS 3ii, FERC Project. 2004)

The proposed Colvin Dam Removal Design project focuses upon restoration of natural processes to enhance physical, biological and chemical processes and the connective linkages that were lost due to dam construction. The underlying approach is based on restoring natural riverine hydrologic and biologic processes. The preliminary design will lead to the ultimate removal of the Colvin Creek dam and restore fish access to 0.5 miles of stream but also supply 120,000-200,000 cubic yards of native alluvium sediment to a minimum of 10 miles of high priority Tier 1 reaches and the top 5 ACC priority reaches of the lower North Fork Lewis River. This project also addresses Aquatic Fund priorities #1 & #3: Priority 1: *Benefit fish recovery throughout the North Fork Lewis River, with priority to Federal ESA-listed species;* and Priority 3*: Enhance fish habitat in the Lewis River Basin-, with priority given to the North Fork Lewis River.* The removal of this relic dam will provide spawning substrate to benefit all fish species inhabiting the North Fork Lewis River, including Chinook, Coho, Chum salmon and winter Steelhead.

6. Project location (including River/Stream and Lat/Long coordinates if available).
The project site is located at Colvin Creek Dam, approximately 633 feet upstream from the Colvin Creek confluence with the North Fork Lewis River (RM 16.2), Cowlitz County, Washington.
Physical address: 4923 Old Lewis River Rd, Woodland, Cowlitz County, WA 98674
Lat 45°56'23.45"N Long 122°36'33.55"W

7. Expected products and results (Please attach any drawings).
The proposed Colvin Dam Removal preliminary design project will utilize the recently completed (Interfluve) conceptual design report and known existing conditions to examine the project site in much greater detail. We plan to hire a local contractor to drive probes through cross-section of sediment deposited upstream of Colvin Dam. Sediment probes will identify depth of refusal and assist in defining underlying features, such as bedrock or boulder formations. Probing the coarse sediments will also increase the accuracy of total impounded sediment. The contractor will also excavate narrow test pits in the deposited substrate upstream of Colvin Dam, to determine the type, size class, quantity and quality of deposited sediment.

Hydrology – Hydrologic analyses will include developing flow trends for the North Fork Lewis River, Colvin Creek, and Cedar Creek. The USGS Gage # 14220500 on the Lewis River at Ariel, Washington provides 92 years of peak flow data. Recurrence interval flows for the North Fork Lewis River will be developed from post dam gage data by fitting annual peak discharges to a Log Pearson Type 3 distribution. Recurrence interval flows will be developed for Colvin Creek and Cedar Creek using USGS regression equations from the USGE Stream-Stats website. The recurrence interval flows will be

Colvin Dam is on the Historic Registry located on the WA Department of Archeological Historic Preservation WIZAARD website and downloaded the Historic Property Inventory Form #12831. The Colvin Dam project site was also discussed with Russell Holter from Department of Archeological Historic Preservation who concluded in an email communication Sept 1, 2015 "Through consultation with WDFW, RCO, and perhaps DNR, we will discuss the eligibility of the structure and whether or not some type of mitigation is warranted."
input into the hydraulic model for the project.

Hydraulic modeling – HEC-RAS 5.0 is proposed for the hydraulic model for this project. HEC-RAS 5.0 provides the opportunity to combine 1-dimensional (1-D) and 2-demensional (2-D) modeling into one project. For this project, it is anticipated that a 2-D area will be placed in the model on the North Fork Lewis River between Colvin Creek and Cedar Creek. The rest of the model domain will be 1-D. The 2-D area will allow for more refined sediment transport calculations near the sensitive Lewis River Hatchery surface water intake and fish ladder.

Sediment Transport – The sediment transport analysis will evaluate the potential of evacuated sediments depositing in the vicinity of the Lewis River Hatchery intake and fish ladder. The thalweg of the North Fork Lewis River is located at the hatchery intake and a depositional bar is located on the opposite side of the river. A hydraulic model run will be developed that includes a portion of the sediment impounded behind Colvin Creek Dam deposited at the confluence of Colvin Creek and North Fork Lewis River. Sediment transport potential will be calculated from hydraulic model output using sediment transport equations. Based on sediment size and 2-D model output, sediment transport potential will be calculated within the 2-D model domain to identify locations where sediment is anticipated to erode and deposit.

Permitting - Cultural/Historical Preservation Assessment
The Colvin Creek Dam has been inventoried and is located on the Historic Registry for the WA Department of Archeological Historic Preservation (DHAP). Interfluve and project staff will meet with DAHP to discuss the eligibility of dam removal and whether or not some type of mitigation is warranted. Permitting staff will also begin communications with WA Department of Ecology, USACE, and WDFW in regards future to permitting requirements as the design for dam removal is being developed.

Preliminary Design Submittal - A preliminary design report will be prepared to document design approach and justification as related to salmon recovery and critical life stages supported by the design. The preliminary design report will include summary of geomorphology, subsurface investigation, hydrology, hydraulics, sediment transport and opinion of probable cost. Preliminary design drawings will be prepared for permit applications including: access, staging, erosion control, woody debris configurations, estimate of materials quantities, and anticipated Colvin Creek channel geometry following dam removal.

8. Benefits of proposed Project
Completion of this preliminary design project is next step to follow the critical path towards the removal of Colvin Dam. This project will create designs to allow fish passage to 0.5 miles of Colvin Creek and address 0, 1 age juvenile rearing, migration, flood refuge and fry colonization benefitting winter Steelhead and Coho populations inhabiting the North Fork Lewis river. During 2002, WDFW staff noted in the Fish Passage ID#91A0004 form an estimated 2,035 square meters (21,904 sq. ft.) of rearing habitat and 1,795 square meter (19,321 sq. ft.) of spawning habitat available in Colvin Creek if fish passage was allowed. Upon dam removal, the existing bed will likely head cut and travel upstream approximately 0.3 miles. We assume the underlying substrates are similar to the relatively clean gravels we see on the surrounding floodplain surface of Colvin Creek – see photos in the Colvin Dam History document and the Colvin Dam Conceptual Design Report. The largest and highest priority of Colvin Dam removal, is the new source of coarse sediment equal to a minimum of 120,000 cubic yards of gravel and cobble. This new source of alluvium to benefit <u>all</u> spawning salmonids stocks returning to the North Fork Lewis River.

9. Project partners and roles.
During 2016, the Cowlitz Tribe has leveraged $5,000 of their own funding with $25,000 of funding support by WA Department of Natural Resources (WADNR) to create a technical memorandum on existing conditions, conceptual alternatives, and complete a final alternative analysis report (see attached) to remove Colvin Dam. WADNR is excited about this project and the future benefits (post dam removal) to State Owned Aquatic Lands (SOAL) located just downstream in the Lower North Fork Lewis River.

As the landowner, the Washington Department of Fish & Wildlife is also intrigued at the idea of removing this relic piece of hatchery infrastructure. The Cowlitz Tribe has been in coordination with WDFW since 2015. Cowlitz staff have initiated the WDFW Right of Entry/Pathways process and identified concerns in regards to proximity to the North Fork Lewis Hatchery in-take, located 400 feet downstream of the Colvin Creek confluence. These concerns will be identified and addressed within the preliminary design report.

10. Attach signed landowner(s) acknowledgment form(s), if applicable (**Attachment C**). See attached.

11. Community involvement (to date and planned).
Cowlitz Tribe received Letters of Support from Clark-Skamania Flyfishers, and the Gifford-Pinchot Task Force. We expect to additional letters of support from CCA, First First, SW WA Anglers, and Northwest Steelheaders. If funding is provided, we plan to host a large outreach event with WDFW staff, Cowlitz County Community Planning & Development, WA Department of Natural Resources – Aquatic Lands, adjacent private landowners and members from the surrounding community to discuss the site conditions and benefits of Colvin Dam removal.

12. Procedure for monitoring and reporting on results.
Monitoring procedures will be developed collaboratively with DNR, WDFW & PacifiCorp during the design phase of the project. Reporting of results will be done using ACC protocols (if existing), or standard SRFB protocols which include a preliminary design report, design drawings, summary of geomorphology, subsurface investigation, hydrology, hydraulics, sediment transport and opinion of probable cost. Preliminary design drawings will be prepared for permit applications including: access, staging, erosion control, woody debris configurations, estimate of materials quantities, and anticipated Colvin Creek channel geometry following dam removal.

13. Project schedule (anticipated start date, major milestones, completion date).

June 2017 Topographic survey, North Fork Lewis River cross-sections, including hatchery intake pipe.

September 2017. Obtain the necessary permits to access the site with an excavator, probe sediment and examine substrate in numerous bulk samples.

October 2017. Modeling: hydraulic and sediment transport analysis.

January 2018. Review of draft preliminary design with workgroup members.

April 2018 Preliminary design report, design drawings, and engineer estimate.

May 2018. Project closeout. Final reporting.

14. Funding requested.
$62,500 PacifiCorp ACC Funds
(contingent upon securing)
$62,500 Salmon Recovery Funding Board during 2017

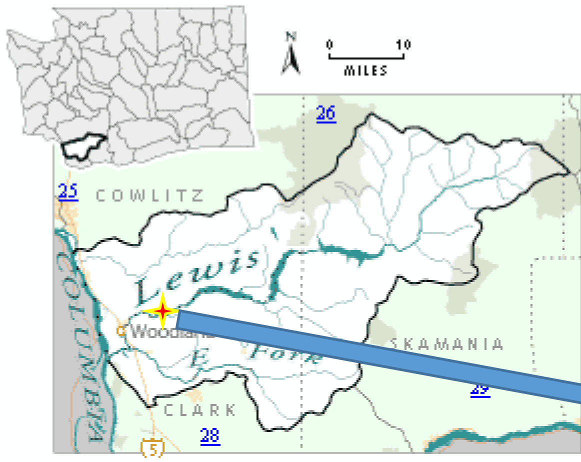
15. Type and source of other contributions (Identify cash (C) and/or in-kind (IK), and status, pending (P) or confirmed (Co)).
$62,500 (C & P) 2017 Salmon Recovery Funding Board

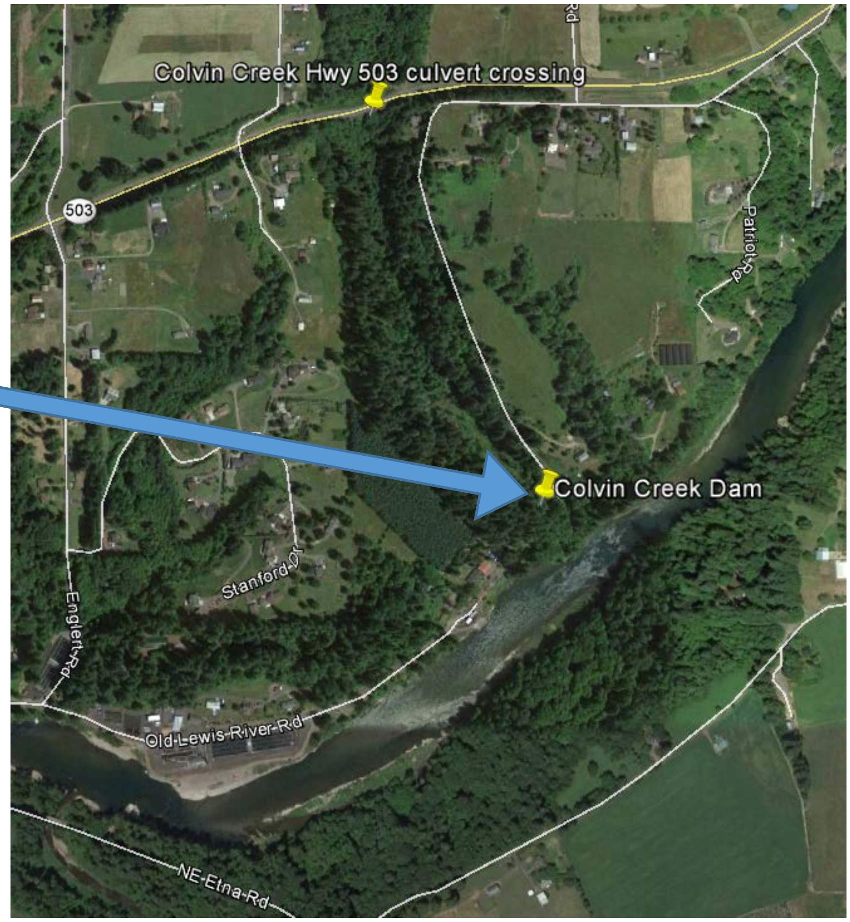
16. If you have technical assistance needs for this project, please briefly describe such needs.
All technical assistance will be provided by Interfluve Inc. The Interfluve principal engineer is Bill Norris (PE). Bill has an extensive historic of removing (8) dams in the United States.

17. If any boating hazards/public safety are an issue please note if any signage requirements. N/A

History of Colvin Creek Dam, Tributary to the North Fork Lewis River (RM 16.2)

Location: Approximately 8 miles east of Woodland, 4 miles downstream of Merwin Dam.





Timeline:

1930-32. Construction of Colvin Dam which fed water into the Lewis River Hatchery being built at the same time.

October 12th, 1962. Columbus Day Storm resulted in numerous downed trees/debris from +90mph winds.*

November 19th & 20th, 1962. Record heavy rain fall in SW Washington, 7-9 inches in 36 hours.*

*Reference: Washington Department of Fisheries, 72nd Annual Report 1962.

Colvin Creek Dam – Approx height: 35 feet, Length: 110 feet, sediment near the crest of the dam, 100% barrier. Steelhead and Coho observed spawning at the base of the dam. If removed, fish access to 0.5 miles of new habitat. WDFW Fish Passage Division Passage Index Score: 15.75

Site History:

The combined impacts of hydropower, hatchery operations, and disconnection of natural sediment transport processes have severely impacted the entire North Fork Lewis River watershed. The operation of the three hydropower dams on the North Fork Lewis River have undoubtedly impacted the lower reaches by decreasing sediment supply, reducing peak flows, resulting in more channel stability, vegetated bars, reduced large woody debris inputs and created a less active channel due to a decreased supply of bedload. The North Fork Lewis River was permanently disconnected from is natural sediment transport processes after the completion of Merwin Dam in 1932 and cut off the access by migrating salmonid adults to a minimum of 53.3 miles of spawning/rearing habitat. Prior to the construction of Merwin Dam, Washington State Division of Fisheries and the Inland Power Company (subsidiary of the Northwestern Electric Co.) agreed upon a compensation plan to mitigate the loss of natural propagation. One component of the plan required the construction of a dam in nearby tributary called Colvin Creek.

During 1930-31, the canyon of Colvin Creek was dammed to create a series of adult holding ponds in addition to providing a water source to the newly constructed Lewis River Fish Hatchery. During the construction of Merwin dam, a fish wheel was installed at the base of the outlet to collect upstream migrating adults. Collected steelhead, coho, fall and spring chinook were trucked downstream 3.5 miles to three holding ponds in the newly formed Colvin Creek reservoir. When the salmonid adults' matured, ripe fish were collected in an artificial spawning channel located near the upstream end of the Colvin pond. Hatchery staff spawned the adults and transported the fertilized eggs to the Lewis River Fish Hatchery facility which had the capacity to rear 30 million fry. At the completion of Merwin Dam, a fishway was constructed near the base of the dam and staff continued to collect adults and place them in the Colvin adult holding pond to support the hatchery supplementation program.

The operation of the three adult holding ponds upstream of Colvin dam continued until the arrival of two fall storms during 1962. The first event occurred on October 12th and was forever known as the Columbus Day storm. The extreme weather produced winds exceeding 100 miles per hour and knocked out power all over the region. During November 19th-20th another large storm passed over SW Washington and 7-9 inches of precipitation was recorded in a 36 hour period. The downed tree limbs and leaves likely clogged the (undersized) Highway 503 Colvin Creek culvert located just a half mile upstream of Colvin Dam. The blocked culvert eventually washed out the entire highway 503 road prism over Colvin Creek and the resulting debris flow filled the entire reservoir, over-topped Colvin dam and knocked out the Lewis River Road crossing just downstream. The Lewis River Hatchery water intake and pump station in Colvin Creek was completely destroyed. The Lewis River Fish Hatchery was out of business for 1-2 years until a new surface water intake was built in the North Fork Lewis River. Since 1962, Colvin dam infrastructure has been effectively mothballed and ignored, even though it continues to restrict sediment and remains a fish passage barrier.

Historic Reference/Documentation:

United States of America, Department of the Interior – Summary of Floods, 1962
FLOODS OF NOVEMBER 19-25 IN SOUTHWESTERN WASH7NOTON By J. H. BARTELLS Two major storms crossed southwestern Washington during the period November 19-25. The first storm, on November 19-21, dropped 4 to 8 inches of precipitation over much of the flood area. The freezing level rose to about 10,000 feet, and runoff from melting snow and the heavy precipitation caused streams to rise rapidly and caused flooding in many of the lower valleys. The second storm, on November 24-25, dropped 3 to 7 inches of precipitation on the already saturated ground and produced flood discharges that were nearly as high; in at least one area, the discharges were higher than those of November 19-20. Web link:
http://pubs.usgs.gov/wsp/1820/report.pdf

From The Daily Chronicle – Centralia, December 6th, 1962

"Bridges Damaged KELSO - The State Highway Department was concerned with repairing washouts on the Lewis River, clearing snow at Spirit Lake and clarifying a call for bids on a new frontage road between the Longview Wye and the Kelso Interchange. Stearns Eason, district highway engineer, said today that the rain damaged Lewis River Highway will be repaired under the extension of the contract of the Fiorito Bros., who are constructing the Woodland Interchange. The most serious damage was done at Colvin Creek near the fish hatchery some seven miles east of the Pacific Highway Nov 27 when about 20,000 cubic yards of road grade were washed down the canyon. Eason said the damage was caused by a plugged culvert which caused the creek waters to back up. "

Web link: http://www.newspapers.com/newspage/25398013/

Reference: Washington Department of Fisheries, 72nd Annual Report 1962.

Page 84

Physical Damages to Hatcheries in 1962

Some very extreme weather conditions were experienced in 1962. On October 12, violent winds throughout the state isolated many stations by felling timber across roadways. Power supplies to many of the hatcheries were knocked out, with some stations operating on auxiliary power for over two weeks' time.

On November 19 and 20 extremely heavy rains, up to 9.3 inches in 36 hours in some areas, caused extreme

Page 86

control. The same flood and weather caused a washout of a state highway fill above the Lewis River Hatchery water supply reservoir on Colvin Creek. The earth from a large state highway fill moved down into, and completely filled the Colvin Creek reservoir and broke the main hatchery water supply line. The county road below the Colvin Creek Dam was also washed out, and a large delta of mud and debris was deposited in the Lewis River near the main pumping station. This situation has put the Lewis River station out of business as a hatchery and rearing unit, for at least the better part of a year. Plans are underway to move the pumping station downstream, away from the muddying influence of Colvin Creek.

Pg. 76 Annual Report 1963.

Lewis River Hatchery

Removed rotted old hatchery building in preparation for new smaller modern unit.

Contracted for new pump station to replace pump station put out of operation by river delta formed by the March, 1962 Colvin Creek washout.

Reference: Washington Department of Fisheries, 72nd Annual Report 1962

Page 85 – Note spelling error- Calvin Creek instead of Colvin Creek

Calvin Creek reservoir was filled with mud and debris from washed out highway fill.

Current – Summer 2015

Reference: Washington Department of Fisheries, 72nd Annual Report 1962. Page 85.

Flood damaged area below Calvin Creek Dam near the Lewis River salmon hatchery. Flood occurred in November, 1962.

Current – Summer 2015

8/2015 These juveniles are from a private landowner who operates a remote site incubator (RSI) upstream of the Hwy 503 crossing. Each winter, he receives 5,000 eyed coho eggs from the North Fork Lewis Fish Hatchery. If Colvin dam was removed, Colvin Creek could be immediately populated by a natural origin strain of spawning NF Lewis Coho salmon.

Abundant spawning gravels in the trapped sediment behind Colvin Dam.

HISTORIC PROPERTY INVENTORY FORM

12831

State of Washington, Department of Community Development
Office of Archaeology and Historic Preservation
420 Golf Club Road SE, Lacey Post Office Box 48343
Olympia, Washington 98504-8343 (360) 407-0752

IDENTIFICATION SECTION 8-338

Field Site No.______ OAHP No.______ Date Recorded 2/20/01
Site Name Historic Colvin Creek Coffer Dam
Common Colvin Creek Coffer Dam
Field Recorder Simon Geerlofs and Michele O'Doherty
Owner's Name Washington Department of Fish and Wildlife
Address 111 Merwin Hatchery Court
City/State/Zip Code Ariel, WA 98603-9727

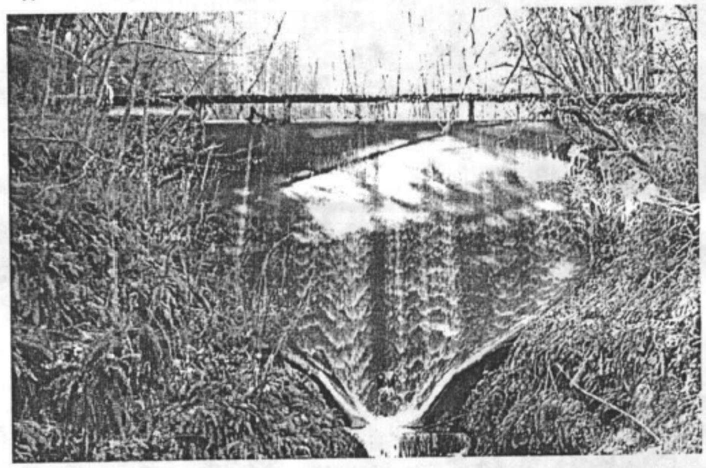
Status
X Survey/Inventory
☐ National Register
☐ State Register
☐ Determined Eligible
☐ Determined Not Eligible
☐ Local Designation

PHOTOGAPHY
Photography Neg. No. N/A (Digital)
Roll No. & Frame No. 1111
View of Coffer Dam
Date 2/20/01

Classification: ☐ District ☐ Site ☐ Building (s) X Structure ☐ Object
District Status ☐ NR ☐ SR ☐ LR ☐ INV
Contributing ☐ Not Contributing ☐
District/Thematic Nomination Name______

LOCATION SECTION

Address Ariel, Washington
City/Town/County/Zip Code Ariel, Cowlitz County, 98603
Twp 5 N Range 2 E Section 7 ¼ Section NW ¼ ¼ Section NW
Tax No./Parcel No. * Acreage______
Quadrangle or Map Name USGS Ariel Quadrangle, 7.5 Minute
UTM References Zone 10 Easting 530311 Northing 5087275
Plat/Block/Lot *
Supplemental Map(s)______



DESCRIPTION SECTION

Materials & Features/Structural Types
Building Type Coffer Dam
Plan______
Structural System Concrete
No. of Stories N/A

Roof Type
☐ Gable ☐ Hip
☐ Flat ☐ Pyramidal
☐ Monitor ☐ Other (*specify*)
☐ Gambrel
☐ Shed

Cladding (exterior wall surfaces)
☐ Log
☐ Horizontal Wood siding
☐ Rustic/Drop
☐ Clapboard
☐ Wood Shingle
☐ Board and Batten
☐ Vertical Board
☐ Asbestos/Asphalt
☐ Brick
☐ Stone
☐ Stucco
☐ Terra Cotta
☐ Concrete/Concrete Block
☐ Vinyl/Aluminum Siding
☐ Metal (*specify*)
☐ Other (*specify*)

Roof Material
☐ Wood Shingle
☐ Wood shake
☐ Composition
☐ Slate
☐ Tar/Built-Up
☐ Tile
☐ Metal (*specify*)
☐ Other (*specify*)
☐ Not Visible

Foundation
☐ Log X Concrete
☐ Point & Pier
☐ Stone
☐ Brick
☐ Not Visible

High Styles/Forms (*check one or more of the following*)
☐ Greek Revival
☐ Gothic Revival
☐ Italianate
☐ Second Empire
☐ Romanesque Revival
☐ Stick Style
☐ Queen Anne
☐ Shingle Style
☐ Colonial Revival
☐ Beau Arts/Neoclassical
☐ Chicago/Commercial Style
☐ American Foursquare
☐ Mission Revival
☐ Spanish Colonial
☐ Tudor Revival
☐ Craftsman/Arts & Crafts
☐ Bungalow
☐ Prairie Style
☐ Art Deco/Art Moderne
☐ Rustic Style
☐ International Style
☐ Northwest Style
☐ Commercial Vernacular
☐ Residential Vernacular (*see below*)
☐ Other (*specify*)

Integrity (Include detailed description in Description of Physical Appearance)

	Intact	Slight	Moderate	Extensive
Change to plan	X	☐	☐	☐
Changes to windows	☐	☐	☐	☐
Changes to original cladding	☐	☐	☐	☐
Changes to interior	☐	☐	☐	☐
Other (*specify*)				

Vernacular House Types
☐ Gable front
☐ Gable front and wing
☐ Side gable
☐ Cross gable
☐ Pyramidal/Hopped
☐ Other

NARRATIVE SECTION

12831

Study Unit Themes (*check one or more of the following*)

☐ Agriculture
☐ Architecture/Landscape Architecture
☐ Arts
☐ Commerce
☐ Communications
☐ Community Planning/Development
X Conservation
☐ Education
☐ Entertainment/Recreation
☐ Ethnic Heritage (*specify*)______
☐ Health/Medicine
☐ Military
☐ Politics/Government/Law
☐ Religion
☐ Science and Technology
☐ Special Movements/Organizations
☐ Transportation
X Other (*specify*) Industry
X Study Unit Sub-Theme (*specify*) Hydroelectric Power; Aquaculture

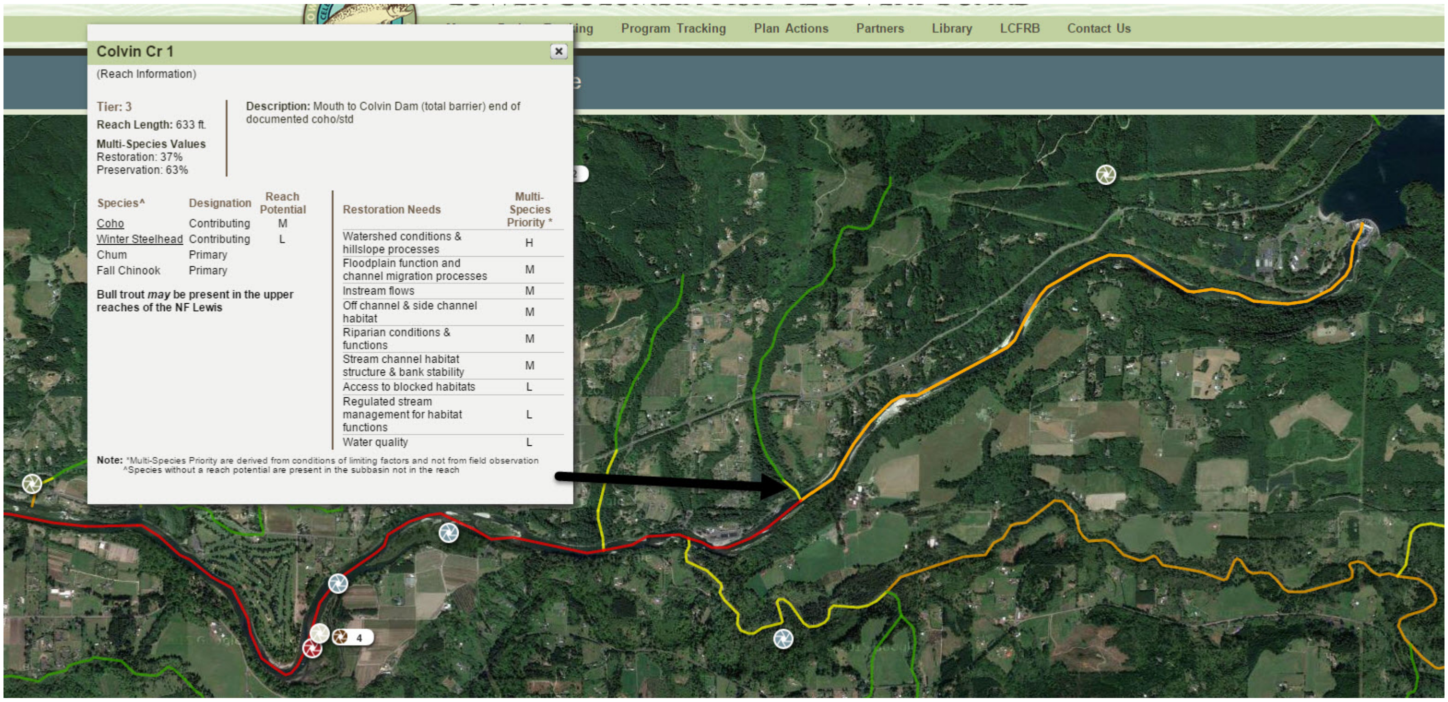
Statement of Significance
Date of Construction ca. 1930 Architect/Engineer/Builder Unknown
☐ In the opinion of the surveyor, this property appears to meet the criteria of the National Register of Historic Places.
☐ In the opinion of the surveyor, this property is located in a potential historic district (National and/or local).

The Lewis River Fish Hatchery is located two miles downstream from Ariel (Merwin) Dam. PacifiCorp's predecessor company built this hatchery in 1930-1932, at the same time as the Ariel Project (EA Engineering, Science & Technology 2000:4-11; Rice 1996:168). The hatchery was expanded and revised ca. 1980 and has been excluded from the Ariel Dam Historic District.

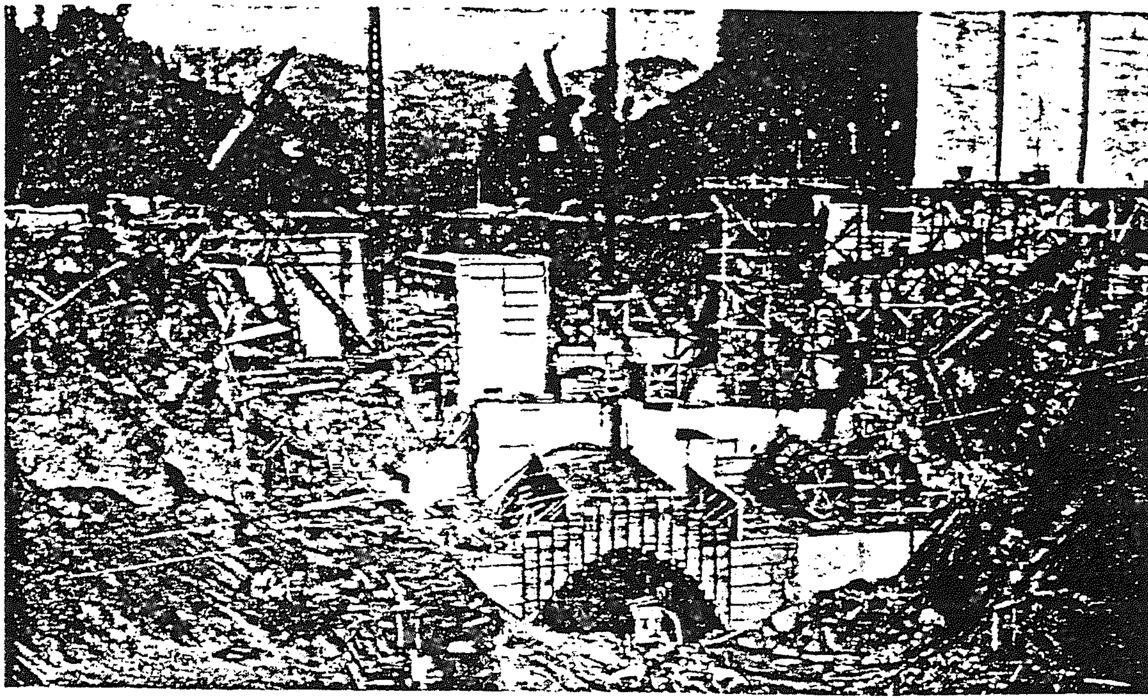
Description of Physical Appearance

Historically this coffer dam restrained the waters of Colvin Creek, allowing diversion to the Lewis River Hatchery. Colvin Creek is located about 600 feet east of the Lewis River Hatchery. Their was once a road that accessed the creek from the hatchery, but this road has crumbled into the creek bed. The coffer dam and intake structure on Colvin Creek is located just upstream from where this road crumbles. The dam was constructed ca. 1931 and once provided the Lewis River hatchery with water. The dam is concrete, approximately 35 feet tall and 40 feet across. The steel intake structure is located at the top of the dam, on a line with the water level of the creek. The dam is no longer in use.

The hatchery's water demands are currently being met by pumping water out of the Lewis River by means of a pump located near the westernmost of the hatchery's four rearing ponds.


Program Tracking
Plan Actions
Partners
Library
LCFRB
Contact Us
Colvin Cr 1
(Reach Information)
Tier: 3
Reach Length: 633 ft.
Multi-Species Values
Restoration: 37%
Preservation: 63%
Description: Mouth to Colvin Dam (total barrier) end of documented coho/std
Species^ | Designation | Reach Potential
Coho | Contributing | M
Winter Steelhead | Contributing | L
Chum | Primary
Fall Chinook | Primary
Bull trout may be present in the upper reaches of the NF Lewis
Restoration Needs | Multi-Species Priority *
Watershed conditions & hillslope processes | H
Floodplain function and channel migration processes | M
Instream flows | M
Off channel & side channel habitat | M
Riparian conditions & functions | M
Stream channel habitat structure & bank stability | M
Access to blocked habitats | L
Regulated stream management for habitat functions | L
Water quality | L
Note: *Multi-Species Priority are derived from conditions of limiting factors and not from field observation
^Species without a reach potential are present in the subbasin not in the reach


Parcel: EG0603002
Address:
Account: R002246 (Link to Parcel Data)
Owner: STATE DEPT FISH
Neighborhood: 78 - LEWIS RIVER FRONT
Use Code: 906 - 20.01 - 50.00 ACRES
Tax Code: 920
Taxable Values:
Land: $1,280
Buildings: $0
Market Values:
Land: $1,280
Buildings: $0
LEWIS RIVER RD
ENGLERT RD
6-T5N-R2E
OLD LEWIS RIVER RD
STANFORD DR
7-T5N-R2E
Account R002246
Parcel EG0603002
Jurisdiction COWLITZ COUNTY
Owner STATE DEPT FISH
32.16 Acres
Mailing Address 4404 LEWIS RIVER RD
WOODLAND, WA 9867
Abbreviated Property Reference SECT,TWN,RNG:6-5N



The Ariel Dam on the Lewis River, viewed from below. When the structure is completed the water level above the dam will stand at the line of trees seen on the upper right. The arch in the foreground will be covered by water when the dam is complete and the fish trap will be constructed on the face of the powerhouse, which will rise above the arched tunnel.

Can Lewis River Salmon Be Saved?

Elaborate Protective Works Provided in An Effort to Prevent Extermination of Runs by Hydro-Electric Dam Project at Ariel

Seeking to save the valuable salmon runs of the Lewis River, Wash., from extinction as result of hydro-electric development of that stream by the Inland Power Co., a subsidiary of the Northwestern Electric Co., quite the most notable program of fish-protective works ever undertaken in a similar situation is now being consummated along the Lewis.

The undertaking is admittedly experimental. Its success is still problematical and years must elapse before it can be demonstrated whether runs of salmon, entirely blocked from their natural spawning grounds, can be saved under conditions as they exist on the Lewis River, where there are a number of problems which render the task peculiarly difficult and complicated.

Program Comprehensive

The Inland Power Co. project on the Lewis calls for the construction of a number of dams. The first of these, a 175-ft. obstruction being built at Ariel, about 15 miles from the confluence of the Lewis with the Columbia, alone would totally destroy the salmon runs of the stream, as it is of such height as to make it impossible to pass the fish above the dam, while there is little or no spawning in the Lewis and its tributaries below Ariel.

Granting of construction rights for the dam was predicated upon acceptance by the power company of a program of fish protection worked out by the Washington State Division of Fisheries under the authority of Sec. 6, Chap. 90, Wash. Laws of 1923. This program was accepted in November 1929 at a conference between Charles R. Maybury, director of fisheries and game, Charles R. Pollock, supervisor of fisheries, S. F. Rathbun, supervisor of game and game fish, William Dunstan, his assistant, and L. E. Mayhall, superintendent of hatcheries, representing the state; U. B. Gilroy, engineer, representing the Bureau of Fisheries; and Lyman Griswold, consulting engineer, John A. Lang, counsel, and J. E. Yates, engineer, representing the power interests.

While the artificial system cannot hope to compensate for the loss of natural propagation, and may not prove practicable at all, it still represents a most comprehensive effort. In it Mr. Pollock and his experts and advisors have attempted to anticipate every contingency and to meet the multiple and perplexing problems in as effective a manner as possible. The permit requires that a minimum stream flow of 760 second feet be permitted past the dam except at periods when the stream flow is less than this amount, in which case water equal in volume to the natural flow of the stream shall be released.

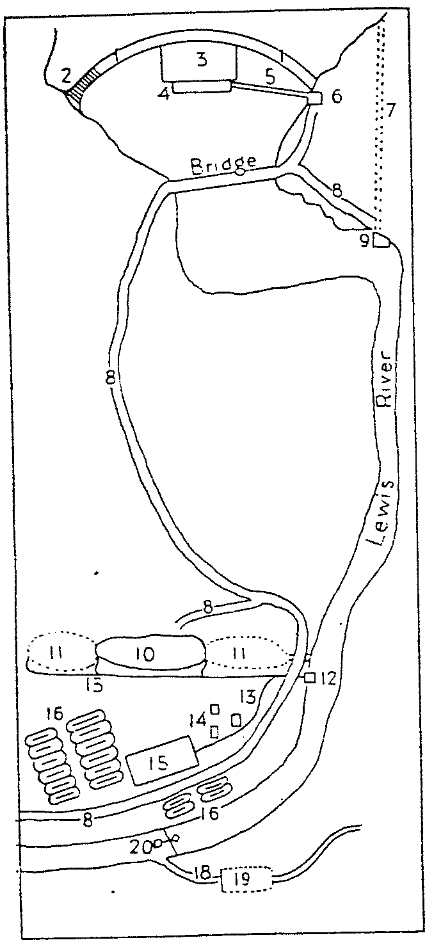
Power Company Amenable

The Inland Power Co. and the Northwestern Electric Co. have shown a more sympathic attitude toward the rights of established industry and a greater willingness to expend money and effort for the protection of the salmon runs than has been evidenced in in any similar instance in the Pacific Northwest. The entire cost of the planning and construction of the fish protective works has been borne by the company, and the work has been done in the most complete and substantial manner, without stint, and with a view to permanence. The program follows a provision of law which permits a power company to erect and maintain a hatchery system in a case where it is impracticable to pass fish over an obstruction. The power interests in this case have carried out the state's program, and have obligated themselves to maintain and operate the system in perpetuity.

Problem Is Four-Fold

The problem of saving the Lewis River salmon falls into a number of phases: first, protection of the fish during the period of construction of the dam; second, propagation and distribution of the offspring of the runs; third, entrapment of fish and their propagation after the completion of the dam; fourth, up-building of salmon runs in the tributaries of the Lewis below Ariel.

At the dam, which is a construction project of primary character, the stream was diverted during the period of construction through a 1,000-ft. tunnel 26 by 30 ft. At the outlet end of the tunnel a Columbia River fishwheel was installed. This wheel, which has a radius of 40 ft. and a width of 15 ft., catches the fish as they attempt to enter the tunnel. Raising them from the water, it chutes them into a 1,000 gal. welded steel tank which is supported in the river by a float containing two of



LEWIS RIVER WORKS IN DETAIL
1, the Ariel dam; 2, spillway; 3, powerhouse; 4, future fish trap; 5, flume by which fish will pass to 6, loading station; 7, diversion tunnel; 8, roads; 9, fish wheel, taking fish during construction; 10, Colvin Creek holding pond; 11, future holding ponds; 12, pumping station; 13, pipelines; 14, hatchery residences, etc.; 15, hatchery building; 16, rearing ponds; 18, Cedar Creek; 19, Cedar Creek racks, and 20, ferry.

these tanks. A motor-driven pump flows 300 gals. of water per minute through the tank. The capacity of the tank is from 100 Silver salmon down to the smaller numbers for the larger Chinooks.

When a sufficient number of salmon have been taken by the wheel and placed in the tank, its lid is closed and the entire tank is raised by a derrick 60 ft. through the air and placed on a specially-designed motor truck on a road high above the tunnel. As soon as the tank is raised from the water, the float is shifted to bring the second tank under the chute from the fish wheel.

Fish Transporting Plan

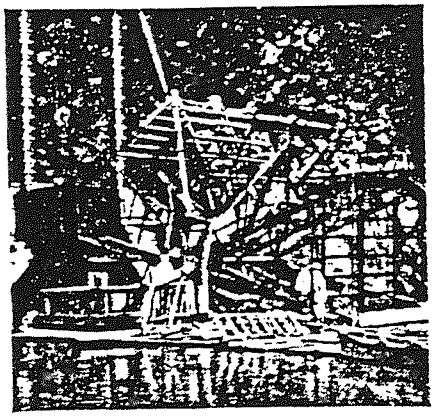
Once placed on the truck, the tank is immediately clamped down and two 2-in. hose connections are made in the bottom of the tank. These enable a water circulating pump mounted under the truck to maintain a constant circulation of water in the tank, moving 200 gals. of water per minute. The truck is also equipped with an air compressor which operates through a pressure storage tank. From this the air passes through a pressure-regulating valve in the cab of the truck and thence into the water line just in front of the water pump impeller. Thus the air is carried through the pump, where it is thoroughly mixed with the water before the latter is driven back into the tank. The truck carries a tank of compressed oxygen for use in case of engine breakdown.

From the time the water flow is shut off from the tank where it rests in the float at the fish wheel until circulation and aeration are established on the truck is only three minutes. Immediately the water connections are established, the truck starts with its load of fish and water downstream a distance of 3.5 miles to Colvin Creek, a tributary of the Lewis, where holding ponds have been established.

During the low water period early this fall the flow of water through the tunnel was not of sufficient velocity to operate the fishwheel. However, this same low velocity made it possible for the fish to pass through the tunnel, which they did without hestitation. Periodical counts at the upstream end of the tunnel led to an estimate that 18,000 spawning salmon passed through the bore before it became necessary to operate the fishwheel.

Holding Ponds Established

Passing now to the second phase of the problem, the propagation and distribution of the fish, we return to the holding ponds on Colvin Creek. The fish taken at the Ariel Dam are largely in "green" condition, reaching that point some time in advance of the time when they will "ripen" and be ready to



FISH WHEEL
working at the outlet to the Ariel Dam tunnel. It scoops up the salmon and chutes them into steel tanks, one of which is seen on the left, being raised to the motor truck waiting 60 ft. above.

spawn. In some cases this time will approximate six months, but usually it will be much shorter. The canyon of Colvin Creek has been dammed to create a large, deep pond. Later two other similar ponds will be provided. The truck carrying the tank of fish runs down a special road to the pond and the fish are discharged through a gate valve directly into the water. They are held in this artificial lake until ready to spawn, when they will enter an enclosure at the upper end. The gravel bottoms of these enclosures are underlaid with perforated pipes through which artificial springs rise through the stones, making ideal artificial spawning beds to aid the attraction of the salmon. The ripe fish are taken as they enter these enclosures and spawned, the fertilized eggs being taken about a quarter of a mile to the hatchery constructed at the old Reno post office.

Hatchery a Model One

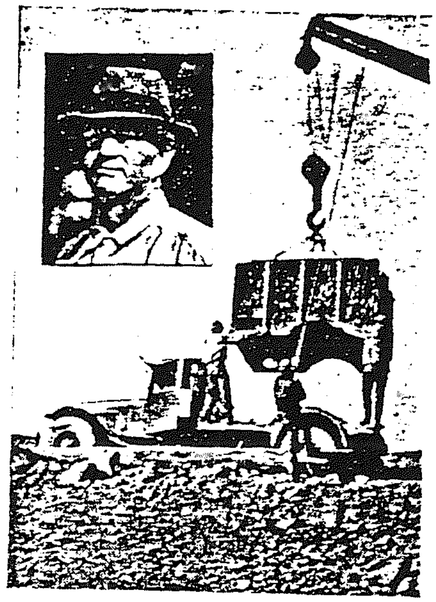
The water supply for the hatchery, and an auxiliary supply for the holding ponds, is furnished by two 75 h-p pumps established on a concrete platform on the bank of Lewis River. These pumps can throw 3,000 gals. per minute. Sixteen-inch pipe lines run from them to the holding ponds, so the flow of Colvin Creek can be augmented if necessary, and also to the hatchery troughs and rearing ponds. The pumps are established in a house built on a concrete pier and draw from a concrete sump tank 3 ft. below the stream bed.

The hatchery is a large, model establishement with a capacity for 30,000,000 fry. It is constructed of concrete to the level of the windows, is 72 by 112 ft. in dimensions, and all piers under the troughs are of concrete. Adjacent to it on either side of the road which runs through the hatchery grounds to the Ariel Dam are standard rearing ponds of the type employed at all Washington state hatcheries. Provision has been made for sufficient of these ponds to care for the entire capacity of the hatchery.

To Trap Fish At Dam

The third phase of the problem, operation of the system after the completion of the dam, differs from the foregoing description of the process only in the manner in which the fish are taken. Instead of being caught in a fishwheel at the outlet of the tunnel—which will be closed next May—the upstream migrants will be taken in a trap built into the face of the power house below the dam. This trap will be similar to the first step of a model fish ladder. It will be situated above the tailrace of the power house so that the fish in fighting the main flow of the stream in the tailrace will find the low falls from the trap. This device is adjustable to the level of the stream, and so far as is known represents the first instance in which fish protective works have been made an integral part of a great dam, being planned into it from the beginning. Once in the trap, the fish follow a flume to the rock bank, where they will pass into the steel tank, will be loaded onto the truck and transported to the holding ponds as is being done at present. This complicated system of entrapment and transportation must be maintained and operated perpetually and at practically all seasons of the year.

In order to make the most of the lower tributaries of the Lewis River, a very large rack and egg-taking station has been established on Cedar Creek, which flows into the Lewis from the left bank immediately opposite the hatchery. The stream now supports a small run of salmon, which will be built up by fingerling releases, the returning salmon being spawned for the hatchery. Construction of this rack is characteristic of the care which has been used throughout the project. The piers are of concrete on piling foundations, with sheet piling capped with concrete footings running across the entire stream bed and keyed into bedrock with concrete on the abutments.



A TANK OF FISH

taken by the fish wheel, being placed on the truck for transportation to the holding ponds 3.5 miles downstream. Insert: John Mayhall, in charge of the Lewis River work for the State Division of Fisheries.

Further downstream the power company has purchased five acres on another small creek, where salmon will be planted from the runs resulting from artificial propagation. All property for this plant, the Cedar Creek racks, the hatchery, the holding ponds and other auxiliaries has been purchased by the power company and deeded to the state. All construction has been done by the power company under the direction of the state, this extending to the hatchery residence and a ferry across the Lewis to the mouth of Cedar Creek.

The Washington Division of Fisheries has been represented on the ground by John Mayhall, a veteran employe of the department, who has inspected and supervised all construction and has directed operations of the works in full.

Alaska Troller License Law Void; B. C. Confiscation Appealed

The Alaska territorial law fixing a license fee of $250 on non-resident troll fishermen was held invalid by Judge Frank H. Rudkin in the U. S. circuit court of appeals at San Francisco Nov. 25, when he sustained the appeal taken by the Trolling Vessel Owners Association in the case of Wood Freeman vs. The Territory of Alaska from decision of the Juneau federal court.

The appellate court held that the law was invalid in that it conflicted with a congressional measure making Alaska waters open to citizens of the United States. The $250 license fee for non-resident trollers was contrasted with a $1 fee assessed to resident trollers. The $250 fee was collected in a few cases during the past season, but for the most part non-resident trollers avoided its payment by not fishing within Alaska territorial waters.

The law was attacked in an action filed in the Alaska court by the Trolling Vessel Owners Association in the name of Mr. Freeman, its president, seeking a restraining order against the license law. The case was dismissed on demurrer by the Alaska court, and appeal was taken to the appellate division.

In initiating this action and in carrying it through to successful adjudication, the Trolling Vessel Owners Association has done the entire fishing industry a service in clarifying a hitherto somewhat ambiguous situation.

Trollers to Appeal Confiscation

Appeal to the supreme court of Canada of the decision of the Victoria admiralty court confiscating four American trolling vessels seized in Canadian waters during the past summer was ordered by the Trolling Vessel Owners Association late in November.

As the statutory limit for perfection of an appeal had lapsed at that time, it was necessary to ask the court for special dispensation.

The aspects of the cases in which confiscation of the "May", Capt. B. O. Knutsen; "Tillie M.", Capt. C. C. Jebsen; "Sunrise", Capt. L. Sandberg; and "Queen City", Capt. John Thorgerson, was ordered are distinctly interesting. Justice Archer Martin held that the treaty of 1818, under which American fishing vessels were guaranteed the privilege of entering Canadian waters in stress of weather or to secure wood and water, does not apply to the Pacific Coast of Canada. Justice Martin cited the language of the treaty, in which the United States renounced "any liberty heretofore enjoyed or claimed" for fishing in Canadian territorial waters in exchange for such anchorage privileges; and he said, "on this Pacific Coast there never was any such 'liberty heretofore enjoyed or claimed' " at the time the treaty was negotiated. Furthermore, he said that the treaty excluded the northwest coast of America, "which was then almost wholly *terra incognita*."

If the Canadian supreme court sustains this view, American fishing craft will be without rights or protection on the coast of Canada, save under those general provisions of international law applying to all vessels and designed primarily for large ships.

As in the case of the appeal of the Alaska law, the entire American fishing industry is vitally interested in this action of the Trolling Vessel Owners Association, which may serve to clear up an anomalous situation—one which might occasion grave hardship and misunderstanding.

GIFFORD PINCHOT TASK FORCE

Main: 4506 SE Belmont Street, Suite 230A, Portland, OR 97215 • 2700 E Evergreen Boulevard, Vancouver, WA 98661
(503) 222-0055 • www.gptaskforce.org

Mr. Peter Barber
Restoration Ecologist
Cowlitz Indian Tribe
7700 26th Ave.
Vancouver WA 98665

June 1, 2016

Mr. Barber,

The Gifford Pinchot Task Force supports the efforts of the Cowlitz Tribe to remove the Colvin Dam on Colvin Creek near its confluence with the North Fork Lewis River. These efforts would support our joint goals to protect and sustain wild populations of salmonids in Washington's South Cascades.

As we understand, the structure has been idle for decades and has trapped gravel and sediment that would otherwise enhance the spawning habitat on the Lewis River. Removing the dam would open up a half mile of spawning habitat on Colvin Creek above the dam and release spawning gravel into the lower 15 miles of the Lewis River before its confluence with the Columbia. The improved habitat would benefit all fish species in the North Fork, including Chinook, Coho, Chum salmon and Steelhead.

We support the Tribe's proposal to the Washington State Salmon Recovery Funding Board to create a preliminary plan for removing the structure.

Sincerely,

Matt Little

Matt Little
Executive Director

Mr. Peter Barber
Restoration Ecologist
Cowlitz Indian Tribe
7700 26th Ave.
Vancouver WA 98665

June 17, 2016

Dear Mr. Barber:

I am writing today in support of the efforts of the Cowlitz Tribe to remove the Colvin Dam on Colvin Creek near its confluence with the North Fork Lewis River. Removal of the Colvin Dam and the accompanying restoration of the stream channel will provide access to more than a half mile of spawning habitat for Chinook, Coho, and Chum salmon, as well as Steelhead, and support a collaborative effort to protect and sustain wild populations of salmonids in Washington's South Cascades.

Colvin Creek is a relatively small, forested watershed whose headwaters are largely protected public lands. The dam, itself, is one of several pieces of defunct infrastructure that now clutter this small stream. Preliminary studies indicate that removal of the dam and abandoned box culverts upstream will provide spawning and refuge habitat for salmonids and restore riverine processes, including establishing a more natural sediment transport regime that will provide spawning gravel to the lower 15 miles of the Lewis River.

American Rivers supports the Tribe's proposal to the Washington State Salmon Recovery Funding Board. We hope Washington will also choose to support this restoration effort.

Sincerely,

Serena S. McClain
American Rivers

CLARK-SKAMANIA FLYFISHERS
PO BOX 644
VANCOUVER, WASHINGTON 98664
WWW.CLARK-SKAMANIA-FLYFISHERS.ORG

SAVE A NATURAL RESOURCE – RELEASE ALL WILD FISH

Mr. Peter Barber
Restoration Ecologist
Cowlitz Indian Tribe
7700 26th Ave.
Vancouver WA 98665

Mr. Barber

Clark-Skamania Flyfishers is in full support of efforts by the Cowlitz Tribe to remove the Colvin Dam on Colvin Creek near its confluence with the North Fork Lewis River. The 80-year-old structure has been idle for decades and has trapped significant amounts of sediments that would otherwise replenish the spawning habitat on the Lewis River. Removing the dam would open up a half mile of spawning habitat in Colvin Creek and release spawning gravel into the lower 15 miles of the Lewis River before its confluence with the Columbia. The improved habitat would benefit all fish species in the North Fork, including Chinook, Coho, Chum salmon and Steelhead.

CSF supports the Tribe's proposal to the Washington State Salmon Recovery Funding Board to create a preliminary plan for removing the structure.

Regards
Steve Jones
President

Colvin Creek Dam Removal Conceptual Design Report

SUBMITTED TO
Cowlitz Indian Tribe
1055 9th Ave, Suite B
Longview, WA 98632

PREPARED BY
Inter-Fluve, Inc.
501 Portway Ave., Suite 101
Hood River, OR 97031

June 2016

Colvin Creek Dam Removal Conceptual Design Report

SUBMITTED TO
Cowlitz Indian Tribe

June 2016

Table of Contents

List of Tables

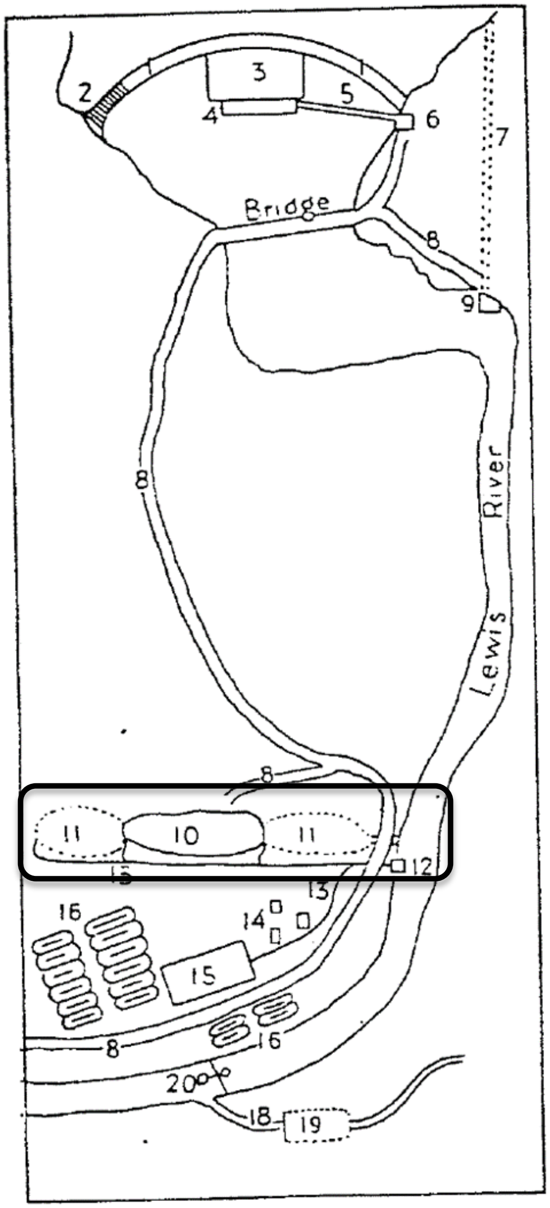
1. Introduction

Colvin Creek is a small tributary to the North Fork Lewis River (NFLR) near Woodland, WA. A long history of human modifications to the lower portion of Colvin Creek has resulted in the exclusion of anadromous salmonids to the Creek for over 70 years (Pacific Fisherman, 1930). Acting as a barrier to both fish passage and sediment transport to the NFLR, the concrete dam is no longer in use.

1.1 PROJECT BACKGROUND & SITE HISTORY

The Colvin Creek dam was originally built to provide a holding pond and water source for the Lewis River Fish Hatchery in the early 1930s, in order to mitigate the effects on salmon runs of the newly-constructed Merwin Dam, near Ariel, WA (Pacific Fisherman, 1930). The Merwin Dam blocked as much as 174 miles of potential anadromous fish habitat in the upper Lewis River (PacifiCorp, 2005) and cut off sediment supply to the lower Lewis River.

The concern for anadromous salmonid populations during the construction of Merwin Dam was considered one of the "most notable program[s] of fish-protective works ever undertaken…" (Pacific Fisherman, 1930). During construction, these attempts to preserve salmon runs included the use of a diversion pipe and fish wheel, that scooped upstream salmon migrants (attempting to return to their natal streams for spawning) and placed them into one of two holding tanks. Once the tanks were at capacity, they were loaded onto a truck that took them 3.5 miles down the road to Colvin Creek, which had been impounded by a 33-foot-high concrete dam (Colvin Dam) to create a large holding pond. Considered to be technologically innovative at the time, there were artificial spawning beds developed upstream of the reservoir mimicking characteristics of ideal spawning habitats; gravel substrates were underlain with perforated pipes providing clean flowing water. As fish became ready to spawn, they migrated upstream in Colvin Creek where they were artificially spawned and the fertilized eggs were harvested and transferred to the Lewis River Fish Hatchery down the road for rearing (See Figure 1 for a schematic from 1930). This process continued after the construction of Merwin Dam, where fish were moved to the Colvin Creek holding pond and their eggs were reared in the hatchery. Hatchery fingerlings were released into tributaries below Merwin Dam on the lower Lewis River, such as Cedar Creek (across the Lewis River from Colvin Creek). As it was dammed up, fingerlings were not released into Colvin Creek.



LEWIS RIVER WORKS IN DETAIL

1, *the Ariel dam*; 2, *spillway*; 3, *powerhouse*; 4, *future fish trap*; 5, *flume by which fish will pass to* 6, *loading station*; 7, *diversion tunnel*; 8, *roads*; 9, *fish wheel, taking fish during construction*; 10, *Colvin Creek holding pond*; 11, *future holding ponds*; 12, *pumping station*; 13, *pipelines*; 14, *hatchery residences, etc.*; 15, *hatchery building*; 16, *rearing ponds*; 18, *Cedar Creek*; 19, *Cedar Creek racks, and* 20, *ferry*.

Figure 1. Schematic from Pacific Fisherman (1930) article "Can Lewis River Salmon be Saved?" in which the construction of Merwin Dam, the Lewis River Fish Hatchery, and the Colvin Creek holding ponds were discussed.

The Old Lewis River Road formerly crossed Colvin Creek Channel approximately 200 feet upstream of the confluence with the NFLR. Built between 1909 and 1919, a portion of the Colvin Creek channel was filled in and a culvert placed under the road fill. This likely blocked anadromous fish passage prior to Colvin Dam construction.

The holding ponds on Colvin Creek were used and maintained by WDFW / Department of Fisheries until a large flood in November 1962 washed out the Highway 503, upstream of Colvin Dam. Debris, including road fill filled the Colvin Creek reservoir, rendering it unusable (as it has remained since). The flood also broke the Lewis River Hatchery's water supply pipeline, washed out Old Lewis River Road, downstream of Colvin Dam, and deposited a delta at the mouth of Colvin Creek that blocked (or limited) water pumping into the Lewis River Hatchery. Subsequently, the water pump station on the Lewis River was moved to be outside of the potential effects from mud deposited at the delta, and Highway 503 was rebuilt (Department of Fisheries Annual Report 1962). Today, concrete rubble and debris persists in the channel of Colvin Creek from the 1962 flood.

1.2 WATERSHED DESCRIPTION

From its headwaters at 2100 feet above sea level, Colvin Creek extends approximately 3.5 river miles downstream to its confluence with the Lewis River (at approximately NFLR, RM 16.2). The forested watershed is relatively small, at approximately 1.75 square miles, with ownership of the upper watershed is comprised primarily of public lands (WA DNR). Private ownership along the river occurs in the lower watershed (surrounding Highway 503) while the most downstream portion of the river channel is on land owned by WDFW.

Similar to the Lewis River, which originates high in the Cascades on the slopes of Mt. Adams and Mt. St. Helens, Colvin Creek is a snow-dominated system. High flows occur as a result of winter rains, rain-on-snow events, and spring/summer snowmelt, with base flows typically occurring in the late summer and early fall.

Flows in the Lewis River are regulated by the Lewis River hydro-system, which consists of 3 dams on the mainstem Lewis River. Though not directly affecting downstream water movement in Colvin Creek, which flows into the Lewis River below the most downstream dam, the three dams and their respective reservoirs are: Swift Dam #1 (RM 47.9), Yale Dam (RM 34.2), and Merwin Dam (RM 19.5). Merwin Dam acts as a complete barrier to all anadromous fish passage, blocking up to 80% of the historically available habitat (LCFRB 2010). Below Merwin Dam, the lower North Fork flows through a deep canyon, within which Colvin Creek is located, until it opens to a broad alluvial valley at RM 12. Tidal influence within the Lewis River extends up to RM 11.

Anthropogenic effects to the Colvin Creek watershed include the Colvin Dam, Highway 503 and the Old Lewis River Road running adjacent to Colvin Creek, agricultural and timber activities in the upper watershed, and the siting of residential buildings and uses within close proximity to the Creek. In addition, stand replacing fires, which burned large portions of the Lewis River basin in the early 20th century, including parts of the Colvin Creek watershed, have also likely had lasting effects on basin hydrology, sediment transport, soil conditions, and riparian function.

1.3 ECOLOGICAL AND BIOLOGICAL CONSIDERATIONS

The effects of dams on the ecology and morphology of rivers are well documented (Baxter 1977, Ward and Stanford 1979, 1987; Armitage 1984; Petts 1984). Dams can cause dramatic changes in the riverine environment, not only in the impoundment area, but also in the river channel above and below the impoundment (Ward and Stanford 1983, Ligon et al. 1995). The most pronounced changes occur within the impoundment and downstream where regimes, natural transport of sediments and nutrients, flow and temperatures are altered. In general, habitat within the impoundment shifts from a free-flowing stream, which favors lotic plants and animals, to a lake for which those species are not adapted. Rivers function as a continuum in which the riverine and surrounding riparian communities exchange water, nutrients, sediment and food (Vannote 1980). The complex physical, chemical and biological relationships along a river system are disrupted or severed by dams.

Overall reduction in habitat diversity within the impoundment results in the loss of species diversity and a greater abundance of those organisms tolerant of altered conditions (Allen 1995). Stream invertebrates and fishes are replaced by more tolerant or adaptable species typically associated with reservoir or lake environments (Cole 1983, Li et al., 1987, Ross 1991, Kanehl et al., 1997).

1.3.1 Fish Use

Current fish use of Colvin Creek has been significantly reduced as a result of Colvin Dam limiting passage upstream of RM 0.1. Habitat evaluations of the Creek by WDFW personnel for fish passage evaluations determined that good quality trout habitat existed downstream of the dam (1997) while habitat upstream of the dam provided excellent anadromous fish habitat, though it was inaccessible due to Colvin Dam.

Salmonid fishes in the lower Lewis River, which will likely provide the stocks to repopulate Colvin Creek once passage is possible, include Chinook, Coho, and Chum salmon and Steelhead, and Sea-run Cutthroat. All species but Cutthroat Trout are listed as Threatened or Endangered on the Endangered Species List. As there is presently limited salmonid use of Colvin Creek, the ESA-listed fish populations discussed below will refer to stocks present in the Lewis River.

LOWER COLUMBIA RIVER CHINOOK SALMON

Three populations of Chinook salmon within the Lower Columbia River Ecologically Significant Unit (ESU) are present in the Lewis River subbasin. Fall runs consist of both Fall Chinook (tule) and late-Fall Chinook (brights). Both Fall-run populations are primarily naturally-produced, and are considered to be at significant risk of extinction (LCFRB 2010). As such, they are both designated as a Primary (high priority) population for population recovery efforts. The spring Chinook run in the Lewis River is included within the Lower Columbia River ESU - though the population includes both artificially propagated hatchery-reared stock and wild-type spawners. However, hatchery impacts may still include detrimental genetic effects of interbreeding of wild salmon with hatchery produced fish as well as contributing to the potentially adverse ecological interactions between hatchery and wild fish, through predation and/or competition (LCFRB 2010).

Apart from the relatively large and highly viable fall-run population in the Lewis River, production in the ESU appears to be predominantly hatchery-driven with few identifiable native, naturally reproducing populations (LCFRB 2010). Remaining natural production areas for spring Chinook in Washington are very limited and hatchery-origin fish typically comprise a large fraction of the spawners in natural production areas.

Adults enter the lower Columbia River from March through June, well in advance of spawning in August and September. Spring Chinook are "stream type" salmon that generally rear as juveniles in the river for a full year after hatching. Thus, most juveniles emigrate from freshwater as yearlings, typically in the spring of their second year. Most Chinook salmon remain at sea from 1 to 5 years (more commonly 2 to 4 years) and return to spawn at 3 to 6 years of age (LCFRB 2010).

LOWER COLUMBIA RIVER COHO SALMON

Two runs of Lower Columbia River ESU Coho Salmon are present within the Lewis River. Lower Columbia River coho are typically categorized into early and late returning stocks. Early-returning (Type S) coho enter the Columbia River in mid-August and begin entering tributaries in early September, with peak spawning from mid-October to early November. Late-returning (Type N) coho pass through the lower Columbia from late September through December and enter tributaries from October through January. Most spawning occurs from November to January, but some spawning ranges to February and as late as March. Eggs incubate over late fall and winter and juveniles typically rear in freshwater for more than a year. Most juvenile coho migrate seaward as smolts in April – June, typically during their second year. Coho salmon typically spend 18 months in the ocean before returning to fresh water at age 3 (LCFRB 2010).

Both Type-S and Type-N stocks include wild and artificially-propagated hatchery returns as a result of the Lewis River Coho Programs, and both stocks are included within the Lower Columbia River Coho ESU. Coho historically spawned in all accessible lower Columbia River tributaries, including large, productive runs of early and late Coho on the Lewis River, but the run now consists of very few wild fish. In fact, it is possible that some native coho populations are now extinct, but that this loss is masked by the presence of naturally spawning hatchery fish. The impacts of the hatcheries may include detrimental genetic effects of interbreeding of wild salmon with hatchery produced fish as well as contributing to the potentially adverse ecological interactions between hatchery and wild fish, through predation and/or competition (LCFRB 2010).

LOWER COLUMBIA RIVER STEELHEAD TROUT

Lower Columbia River Distinct Population Segments (DPS) of steelhead trout populations in the Lewis River consist of both summer and winter populations, which include both wild and hatchery/artificially propagated fish. The abundance and productivity of naturally-spawning summer and winter steelhead are very low for both North Fork and East Fork Lewis populations. Diversity of many summer and winter steelhead populations in the Lower Columbia River DPS has been reduced by historical hatchery effects, although not to the degree as has been seen in Chinook and Coho salmon.

Summer steelhead enter fresh water from May to October, enter freshwater in a sexually immature condition, and require several months in fresh water to reach sexual maturity and spawn. Winter steelhead enter fresh water from November to April as sexually mature individuals that spawn shortly thereafter. Other than freshwater entry and migration timing, both races have similar life histories. All steelhead are late winter or spring spawners. Steelhead typically spend 1-3 years in freshwater before migrating to the ocean for the first time. In the lower Columbia River, emigration of steelhead smolts generally occurs from March to June, with peak migration usually in April or May (LCFRB 2010).

LOWER COLUMBIA RIVER CHUM SALMON

Lower Columbia River ESU Chum salmon are present in the lower Lewis River and the EF Lewis River. Adult chum salmon primarily return to the Columbia River in late fall from mid-October through November and spawn from early November to late December. Chum fry emigrate downstream soon after emergence which typically occurs from March through May. Chum salmon do not typically have substantial freshwater rearing time. Juveniles use the Columbia River estuary to feed from February through June before beginning long-distance oceanic migrations. Adults typically return from the ocean to spawn at 3 to 5 years of age.

Though the Columbia River historically produced large numbers of chum salmon, current extinction risks are estimated to be very high in nine of eleven Washington populations of chum salmon (LCFRB 2010). Diversity has been substantially reduced by the loss of many populations and by genetic bottlenecks due to low abundance within the remaining populations. However, hatchery production of chum salmon has been limited and effects on diversity are thought to have been relatively small.

1.3.2 Sediment Transport

Dams reduce flow velocities and the mechanical ability of water to transport nutrients and products of erosion. Both fine organic and inorganic suspended sediment and larger bed load are deposited in the impoundment behind the dam instead of transporting downstream as part of the normal geomorphic process. Algae, aquatic plants, insects and fish depend on gravel, cobble and boulder substrates for attachment sites, hiding places and stable nest material. Fine sediment deposition upstream of dams changes streambed substrate particle size and composition, covers gravel and cobbles, and fills interstitial spaces between substrate particles (Waters 1995). The covering of the stream bottom by a thick layer of sediment reduces habitat diversity or heterogeneity and represents a loss of functional living space for benthic, or bottom-dwelling organisms.

Dams accumulate large amounts of fine sediment upstream of the structure, filling in habitats and simplifying channel cross-section (Ligon et al 1995). Because benthic macroinvertebrate abundance is correlated with substrate complexity and populations are more abundant in gravel and cobble matrices, deposition of fine sediment can be detrimental to invertebrates (Minshall 1984, Waters 1995).

Dams also affect sediment composition downstream of dams. With sediment deposited upstream of a dam, river flows become sediment-starved (Kondolf, 1997). As such, the energy that normally carries sediment downstream in an undammed river becomes available to move sediment after the water flows over the dam. This increase in available energy results in a coarsening of sediments downstream of dams.

2. Existing Conditions

A site map is provided in Figure 2. The site has been broken down into four reaches. Reach 1 is located downstream of Colvin Dam and extends to the confluence with the NFLR. Reach 2 is located within the hydraulic influence of the dam and extends upstream of the dam to the lower pond abutments referenced in Figure 2. Reach 3 is upstream of the lower pond abutments and downstream of Highway 503. Reach 4 is upstream of Highway 503.

2.1 SEDIMENT CHARACTERIZATION

Field sampling of existing streambed substrates included pebble counts of surficial substrate at 6 locations to provide an initial characterization of sediment for conceptual design. A more in-depth characterization will be conducted in subsequent design phases. The locations of the samples are shown in Appendix A.

Pebble counts measure the number of particles from the stream bed surface – or armor layer – which are within various size classes. A region of the streambed is identified in the field from which 100 particles are randomly, yet systematically, selected by hand and measured. Data are recorded as number of particles passing pre-defined size ranges. The result is a gradation of the surficial material as percent smaller – versus number of particles within the size classes.

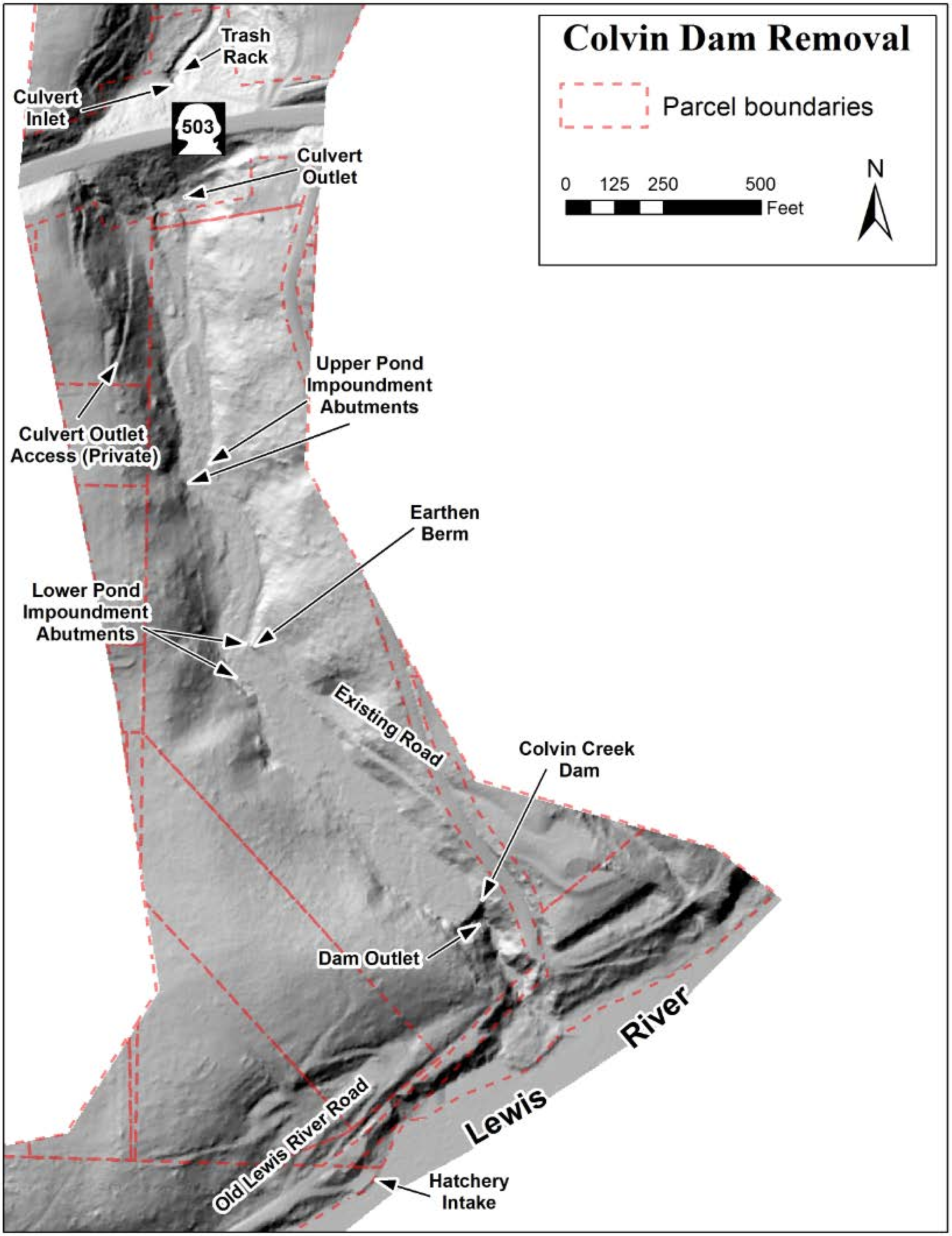


Figure 2. Site Map

The pebble count data are summarized in Appendix A. Pebble counts in Colvin Creek display the sediment size trends associated dammed stream reaches documented by Kondolf (1997) where coarsening of sediments occur downstream of dams. This concept has broader implications for the NF Lewis River where dams have cut off the sediment supply to the lower NFLR. Colvin Creek is the first tributary of significant size located downstream of the NFLR dams. As such, dam removal on Colvin Creek will provide an important sediment source to benefit ecology of the NFLR.

2.2 CONFLUENCE

The photograph in Figure 3 shows the NFLR looking downstream at the confluence with Colvin Creek. The Colvin Creek confluence is on the right in the photo, downstream of the fallen fir tree. The Lewis River Hatchery intake and pump house (white structures) can be seen further downstream on the right bank above the fallen fir tree. Wolman pebble counts on the bar in bottom right hand portion of Figure 3 indicate an average size class in the gravel range. Pebble count data is summarized in Appendix A.

Figure 3. Confluence of NFLR and Colvin Creek

The photograph in Figure 4 shows the confluence location and riprap that is located on the right bank. This location corresponds to the pumping station location identified on the schematic of Lewis River Works associated with Merwin Dam construction (Figure 1). It is suspected that the riprap is a remnant of the old pumping station. The 1962 Washington Department of Fisheries annual report states:

> The same flood and weather caused a washout of a state highway fill above the Lewis River Hatchery water supply reservoir on Colvin Creek. The earth from a large state highway fill moved down into, and completely filled the Colvin Creek reservoir and broke the main hatchery water supply line. The county road below the Colvin Creek Dam was also washed out, and a large delta of mud and debris was deposited in the Lewis River near the main pumping station. This situation has put the Lewis River station out of business as a hatchery and rearing unit, for at least the better part of a year. Plans are underway to move the pumping station downstream, away from the muddying influence of Colvin Creek.

Figure 4. Confluence and Existing Riprap

The Old Lewis River Road concrete box culverts are still located between the Colvin Creek Dam and the confluence with the NFLR. The photograph in Figure 5 displays overlying soil and upland vegetation that has subsequently established over the abandoned box culvert. Figure 6 shows two additional abandoned concrete box culverts that are partially buried downstream of the culvert shown in Figure 5. The volume of steel reinforced concrete associated with these abandoned culverts is estimated to be 200 cubic yards. Upstream of the backwater influence of NFLR, Reach 1 is defined by relatively coarse substrate size that is typical of stream reaches located downstream of dams that may be characterized as sediment starved. Wolman pebble counts indicate an average grain size in the cobble size range in Reach 1 of Colvin Creek. Wolman pebble count data is summarized in Appendix A.

Figure 5. Abandoned Box Culvert, Downstream of Colvin Dam

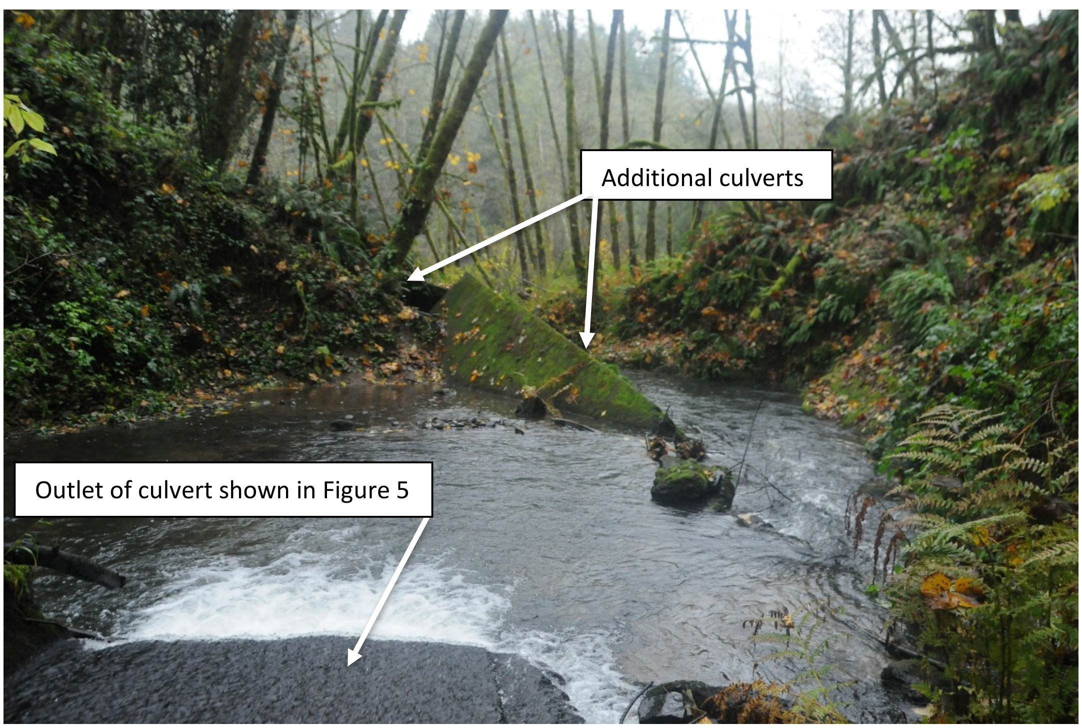


Figure 6. Additional Abandoned Box Culverts

2.3 COLVIN DAM AND ITS IMPOUNDMENT

Figure 7 displays the downstream face of Colvin Dam and bedrock drops located downstream of the dam. The square hole in the face of the dam near the bottom extends approximately 28 feet in the upstream direction. It is likely that the square channel was used as outlet works to periodically drain the reservoir when this dam functioned as a water supply reservoir. The square channel provides an estimate of the length (parallel to stream flow) of the dam at its base. This length dimension (parallel to stream flow) tapers up to approximately 6 inches at the dam crest, with a 3-foot wide walk way along the crest.

Figure 7, Colvin Dam

The existing dam has piped outlet that discharges approximately 10 feet below the existing impoundment surface. The piped outlet penetrates the dam and appears to be connected to a boxed screen (Figure 8) at the upstream face of the dam. This was likely the supply line when the dam functioned as a water supply reservoir. The existing dam is a gravity structure that relies on its mass to resist sliding and overturning. The width of the dam (perpendicular to stream flow) at its crest is approximately 110 feet, and the width at the base is approximately 12 feet. The Colvin Dam volume of steel reinforced concrete is approximately 930 cubic yards.

Reach 2 is located within the Colvin Dam impoundment. Valley slopes within the impoundment are vegetated with second-growth, mixed conifer and hardwood stands. The valley bottom is dominated by forbs and shrubs. A significant number of downed trees are apparent within the impoundment.

Figure 8. Dam Crest and Box Screen

Based on observed sediment size classes and surveyed slope of the channel, the hydraulic (backwater) influence of the dam extends approximately 900 feet upstream. An unimproved access road extends from Old Lewis River Road down to the upper end of the impoundment where the floodplain is partially filled with an earthen berm and abandoned concrete dam abutments are located (Figure 10). The abandoned dam abutments appear to have impounded the holding ponds referenced in Figure 1. Based on sediment size observations, historical information and corresponding field observations, we are fairly confident that Colvin Dam's impounded sediment volume ends at the earthen berm and lower abandoned concrete dam abutments, as shown in Figure 2.

The Colvin Dam impoundment is completely filled with sediment as can be observed from the photographs in Figure 8 and Figure 9. Probing rods were pushed through the impounded sediment until firm substrate ('refusal') was found beneath. The top of the refusal layer was surveyed to allow for estimation of the depth and volume of upper-strata sediment. The upper-strata sediment accounts for the fine fraction of sediment estimated within the impoundment. Due to the upstream

Figure 9. Colvin Dam Impoundment, looking upstream.

road fill failure in the 1960's,the refusal depths likely indicate the top of the debris flow accumulation that resulted from that event. Based on refusal depths and the site survey, the upper-. strata, fine grained sediment volume is estimated to be 6,600 cubic yards. Pebble counts were not performed in the Colvin Dam impoundment.

The site survey was used to estimate impounded sediment volumes. A straight line profile was projected from the bedrock downstream of the dam to the existing channel grade between the Lower Pond Impoundment Abutments. The projected profile is shown on the drawings provided on Sheet 1 in Appendix B. Surveyed cross section locations are shown on the Sheet 1 plan view in Appendix B. An anticipated grade was developed for each surveyed cross section based on the projected profile, valley side slopes, and a typical stream section as shown on Sheets 2 through 5 of Appendix B. Using the average end-area method to calculate the total impounded volume results in approximately 122,000 cubic yards of impounded sediment. Subtracting out the upper-strata, fine

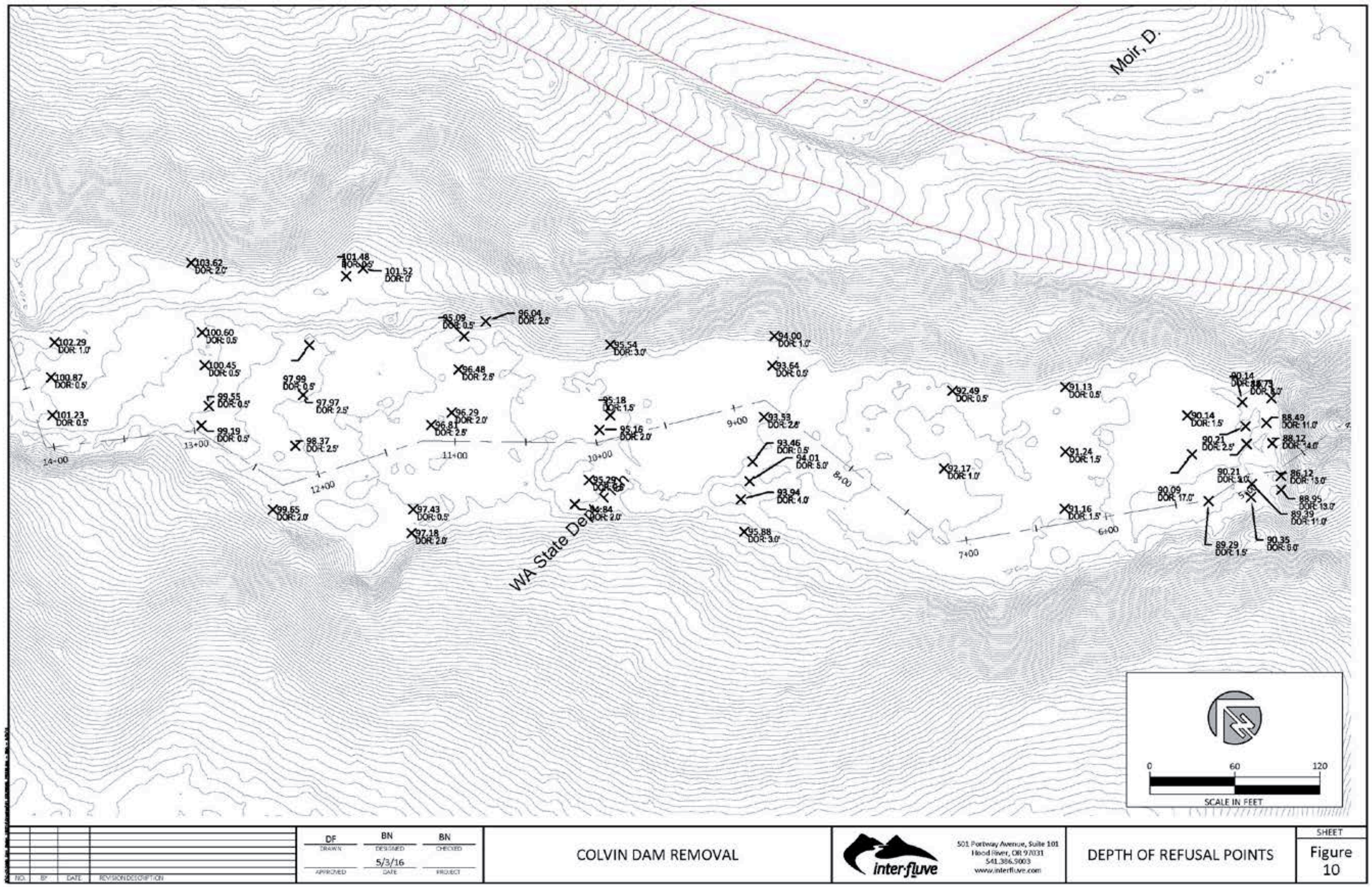


Figure 10. Surface Elevations and Depth of Refusal

grained sediment of 6,600 cubic yards, results in approximately 115,000 cubic yards of sediment that is assumed to be mostly within the gravel-cobble size range.

Figure 11. Earthen Berm and Abandoned Concrete Dam Abutment.

2.4 HOLDING POND IMPOUNDMENTS

Two pairs of abandoned concrete abutments have been identified at the locations shown on Figure 2. Keyways located within these abutments suggest supports spanned the channel and planks were placed on the supports to form a dam. These abutments appear to be the dams that formed the holding ponds identified in Figure 1. The holding pond abutments are located in Reach 3, which is located upstream of the Colvin Dam impoundment and downstream of Highway 503.

Reach 3 is a meanders within the confines of Colvin Creeks valley walls. Valley slopes are forested with second-growth, mixed conifer and hardwood stands. Valley bottom vegetation is primarily mixed hardwood stands with a native shrub and forb understory. Several pieces of large wood were observed in the channel within Reach 3. Substrate in Reach 3 falls within gravel and cobble size classifications, with sand interspersed. Wolman pebble count data is summarized in Appendix A.

Figure 12. Highway 503 Road Fill and Culvert Outlet

Reach 3 extends up the Highway 503 road fill and culvert. The Highway 503 road fill is purported to be Lewis River cobble and surface observations appear to verify the cobble fill material. The Highway 503 culvert has a perched outlet and minimal flow depth which creates a low flow barrier to fish passage. The culvert is also very steep and appears to be a velocity barrier at higher flows. There are also several corrugated metal pipes (CMP) that are intended to convey surface drainage around the road fill. Figure 12 shows one such drainage pipe. None of the CMP surface drainage pipes appear to be conveying flow, and several headcuts were observed within the road fill. It is likely that the CMP was originally installed to reduce moisture content in the road fill to improve stability.

Figure 13. Highway 503 Culvert Outlet and Failed Surface Drainage Pipes

2.5 UPSTREAM OF HWY 503

Reach 4 extends approximately 300 feet upstream of the Highway 503 culvert inlet. Figure 13 provides a photograph of the H-pile trash rack that is located approximately 20 feet upstream of the culvert inlet. The trash rack is an important element to avoid plugging of the culvert inlet and excessive headwater elevations upstream of the road fill. With the road fill likely being constructed from rounded, porous material, excessive headwater could lead to piping losses in the road fill and road fill failure as occurred in the November 1962 flood. Vegetative conditions in Reach 4 are poor. Most of the ground surface is covered in Himalayan blackberry with some alder and big leaf maple overstory located near the upstream extents of the reach. Substrate in Reach 4 falls in the gravel size class. Detailed Wolman pebble count data is provided in Appendix A.

Figure 14. H-Pile Trash Rack Located Upstream of HWY 503 Culvert Inlet

3. Project Goals and Objectives

This project considers the removal of Colvin Creek Dam to restore fish passage. Project goals and objectives are provided to guide the design process and will be used to help establish design criteria that can be used to measure project success. Project goals and objectives are listed as follows:

- Restore geomorphic process to Colvin Creek and improve sediment supply to the NF Lewis River.
- Avoid adverse impacts to Lewis River Hatchery intake and fish ladder.
- Stabilize Colvin Creek profile, remove relic infrastructure, retain and sort gravel through large wood placements.
- Provide fish passage to the extent practicable.

4. Conceptual Alternatives

Conceptual alternatives have been developed based on project goals and objectives. The alternatives are made up of project elements that are included with dam removal, two project elements that are additive options, and a no action alternative. Conceptual alternatives are evaluated on how well they meet project goals and objectives.

4.1 COLVIN DAM REMOVAL

The Colvin Dam removal includes two additional project elements that are considered essential. The two additional project elements that are included with the alternative are removal of the abandoned concrete box culverts and placement of large wood in the Colvin Creek stream channel from the confluence with the NFLR to the Highway 503 culvert outlet.

4.1.1 Passive Verse Active Sediment Removal

The Colvin Dam watershed land use is comprised of forest land, agriculture and rural residential. There is no existing or historical industrial development in the watershed. As such, it is highly unlikely that impounded sediments are contaminated. Dam removals with uncontaminated sediments are typically good candidates for passive sediment transport where the impoundment is removed and sediments are released through natural sediment transport processes of the stream. It is assumed that passive removal is preferred since release of Colvin Dam sediments can help compensate for sediment trapped by main stem dams on the NFLR.

Active sediment removal where sediments are loaded into trucks, hauled and disposed at another location is not considered a viable alternative for this dam removal. Active sediment removal is not a viable alternative since the sediment release to the lower NFLR will provide a long-term ecological benefit. Furthermore, active removal would likely be cost prohibitive. Active removal of the 120,000 cubic yards of sediment impounded by Colvin Dam could easily cost over one million dollars and the benefit of sediment release to the lower NFLR would be lost.

4.1.2 Dam Removal Description

Colvin Dam removal would include dewatering impounded sediments to the extent practicable to allow for dam removal without water and sediment flowing into dam demolition operations. A surface water diversion would reduce turbidity delivered to the NFLR during construction and allow for efficient construction operations. A conveyance pipe is recommended to keep the diverted water outside construction operations within the narrow Colvin Creek canyon. The conveyance pipe would tend to act as a siphon, but the siphon would be susceptible to breaking and loosing conveyance. As such, a pumped diversion operated with float switches would provide a reliable surface water diversion method for construction. An electric pump is preferred, that is powered by a temporary electric service or a diesel generator if the temporary electric service is not available.

Colvin Dam removal would be accessed using the same road that was likely used to build the dam. An existing road grade descends down the easterly valley slope from the Old Lewis River Road to the Lower Pond Abutments (Figure 2). The Colvin Dam would be accessed from the Lower Pond Abutments through the dam impoundment. The next step following access to the Lower Pond Abutments would be to install a diversion pipe and excavate a sump near the Lower Pond Abutments to collect surface water for a pumped diversion. With surface water diverted, the former water delivery pipe, 10 feet below the dam crest, could be cleared to reduce the water table by approximately 10 feet at the upstream face of the dam. Settling basins installed in the dewatered channel, downstream of the abandoned culverts, would reduce turbidity of flows that infiltrate downstream of the surface water diversion. Dam demolition would begin after the surface water diversion and settling basins are installed.

Dam demolition is anticipated to be performed with an excavator equipped with a hydraulic hammer. The dam demolition would be performed from the upstream face of the dam for safety purposes to avoid falling concrete rubble. It is anticipated that sediment would be excavated to access the dam for demolition purposes and side cast upstream in the impoundment as demolition operations proceed. Side cast material will need to be pushed upstream in the impoundment to make room of more side cast material as demolition operations and access road progressively descend to the base of the dam. Dam Removal concept drawing is provided in Appendix C.

DAM REMOVAL ANTICIPATED BENEFITS

- Colvin Dam removal will restore geomorphic process to Colvin Creek and improve sediment supply to the NFLR.
- Removes relic infrastructure.
- Restores fish passage to lower Colvin Creek.

DAM REMOVAL FEASIBILITY CONCERNS

- Sedimentation at the Lewis River Hatchery intake and fish ladder could affect hatchery operations. Potential for sedimentation at the hatchery intake and fish ladder will be addressed as part of the preliminary design.
- Dam removal could result in channel downcutting upstream of the impoundment. Colvin Creek large wood placements are proposed with this alternative, to address concerns for the stability of Highway 503 road fill and improve habitat conditions.

4.1.3 Removal of Abandoned Concrete Culverts Description

The abandoned concrete box culverts located downstream of Colvin Dam are a relic of Old Lewis River Road that was washed out in the November 1962 flood. These abandoned culverts are located where Colvin Creek transitions from a confined canyon to the backwater influence of the NFLR. These culverts artificially narrow the channel and will interfere with channel morphology following dam removal. The abandoned culverts may also impede fish passage following dam removal. As such, they are recommended to be part of the dam removal design.

The abandoned culverts can be accesses following dam demolition by using dam demolition debris material for access down the channel. The dam's demolished concrete material will form a debris pile in the channel downstream of the dam and can easily be leveled and used to access the abandoned culverts. The demolished concrete would be removed from the channel from the downstream extent of culvert demolition and trucked back up the channel to the access used for dam demolition.

CULVERT REMOVAL ANTICIPATED BENEFITS

- Culvert removal will help restore geomorphic process to Colvin Creek.
- Removes relic infrastructure.
- Removes a potential fish passage impediment downstream of Colvin Dam.

CULVERT REMOVAL FEASIBILITY CONCERNS

- Soil and vegetation currently being supported by abandoned culverts will require removal prior to culvert demolition.

4.1.4 Colvin Creek Large Wood Placements Description

Colvin Creek large wood placements will serve to sort sediment, provide habitat, and stabilize grade in Reach 3, upstream of the dam impoundment. Stabilizing grade in Reach 3 is an essential project element to reduce the potential for channel downcutting that could affect the Highway 503 culvert and road fill following dam removal. Large wood placements in Reach 3 will improve habitat conditions and help retain upstream sediment as downstream reaches are in the process of transporting sediments currently impounded by Colvin Dam. Reach 3 large wood placements would be implemented during dam removal construction.

Wood placements in Reach 2, the impoundment reach, may or may not be necessary, depending on how much wood is trapped within the impoundment and how the former channel is exhumed following dam removal. The impoundment may be occupied by an abundance of large wood that was washed in during the 1962 flood when the Highway 503 road fill failed. It is assumed that if new wood placements are not necessary, exhumed wood will still need to rearranged one or more years following dam removal, depending on how quickly impounded sediments are transported out of the reach.

Reach 1 of Colvin Creek is currently bedrock and large cobble. Large wood placed in this reach will help to retain smaller grained sediment sizes after impounded sediments have transported through this reach to provide long-term habitat benefits. Large wood in Reach 1 will help maintain grade above the bedrock contacts currently observed downstream of the dam. Wood placements in Reach 1 would be implemented as the abandoned concrete box culverts are demolished and removed.

COLVIN CREEK LARGE WOOD ANTICIPATED BENEFITS

- Large wood placements will sort sediment and help restore geomorphic process to Colvin Creek.
- Large wood placements will help stabilize Colvin Creek profile as well as improve habitat conditions.

COLVIN CREEK LARGE WOOD FEASIBILITY CONCERNS

- Large wood placements in the Colvin Dam impoundment will require a multi-year construction approach since impounded sediment will not be evacuated in the same construction season as dam removal.

4.2 ADDITIVE OPTIONS

There are two options that could be added to the Dam Removal Alternative. These options include log jams placed on the NFLR and retrofitting the Highway 503 culvert to improve fish passage. Both these options require more information to determine if they should be considered viable options.

4.2.1 North Fork Lewis River Log Jams Description

Log jams located on the NFLR will help sort sediment and influence sediment transport to help avoid sedimentation at the Lewis River Hatchery Intake. The log jams would be located to effectively narrow the NFLR at its confluence with Colvin Creek and at the Lewis River Hatchery intake. Figure 14 displays three log jams shown as brown squares with a 40 feet by 40 feet footprint. The log jam height would correspond with the water surface elevation of a flood event estimated to represent NFLR dominant discharge. The NFLR log jams' effectiveness in influencing

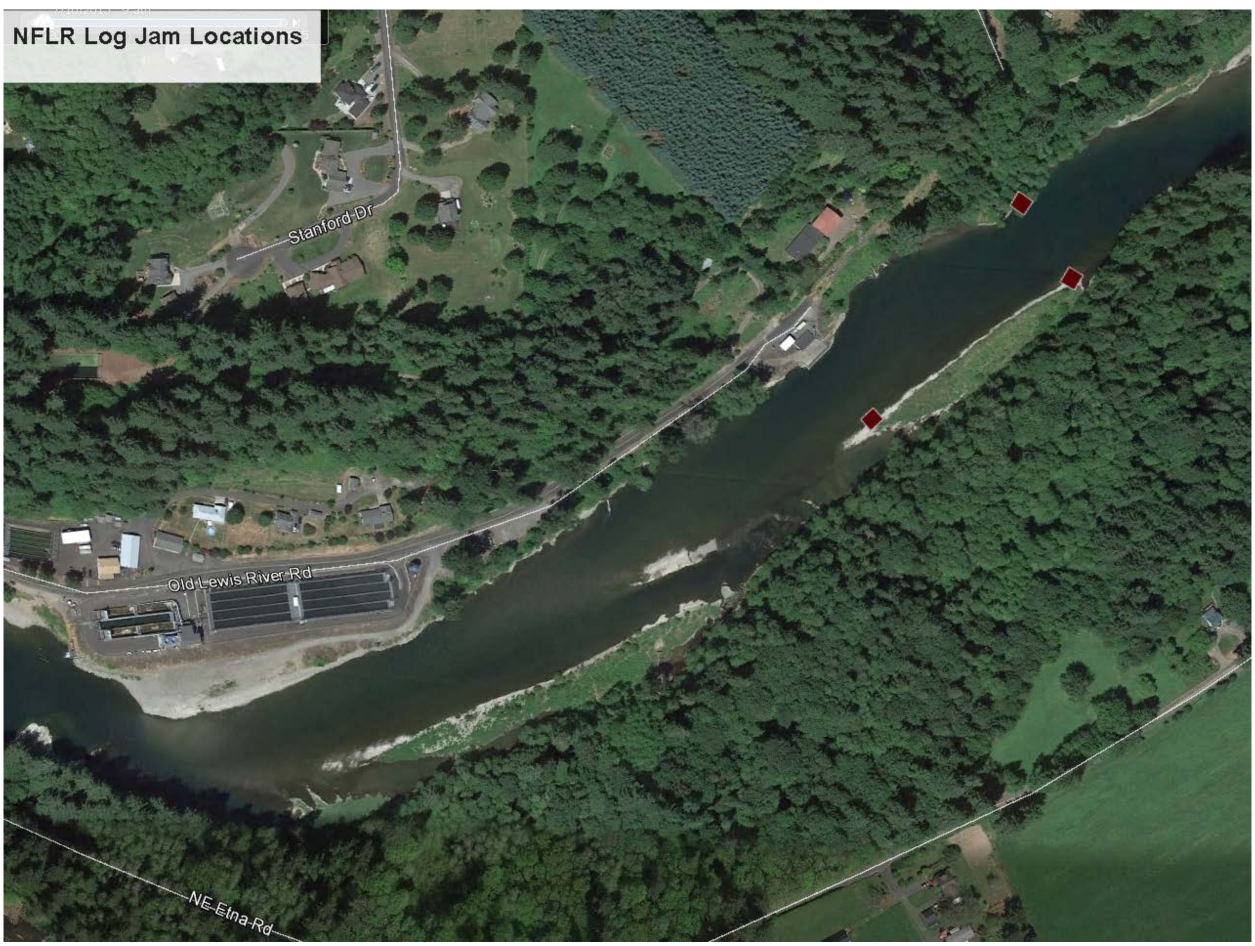


Figure 15. NFLR Log Jams, Source: Google Earth

sediment transport will be evaluated at preliminary design. It is assumed that log jams located on the NFLR left bank bar would be accessed from Etna Road.

NFLR LOG JAMS ANTICIPATED BENEFITS

- Log jams will sort sediment, they should improve sediment transport at key locations in the NFLR, and improve habitat conditions.

NFLR LOG JAMS FEASIBILITY CONCERNS

- The NFLR log jams require hydraulic modeling and sediment transport analysis of the Lewis River. These are items that will be included in the preliminary design.

4.2.2 Highway 503 Culvert Retrofit for Fish Passage

The Highway 503 culvert is 305 feet long with a slope of 3.5%. It is an elliptical multiplate corrugated metal pipe with a height of 7.5 feet and a width of 6.0 feet. The culvert outlet is perched approximately 8 inches. It has a 0% passability rating as recorded in the Washington Department of Fish and Wildlife (WDFW) Fish Passage and Diversion Screening Inventory Database. A series of H-pile (Figure 13) form a trash rack approximately 20 feet upstream of the culvert inlet.

The trash rack is also a barrier to fish passage if not maintained, but it is critical to the stability of the Highway 503 road crossing. The road fill appears to be river cobble, which is rounded and porous. If the culvert inlet plugged with debris, water would begin to rise on the upstream side of the road fill, and increase subsurface flow through the road fill. The road fill could fail as a result.

Retrofitting the existing Highway 503 culvert would involve backwatering the outlet and adding baffles or weirs to modify depths and velocities to meet fish passage criteria. Adding baffles would decrease culvert capacity and increases in headwater elevation at flood flows are a likely result. Reductions in culvert flow capacity would depend on the height and spacing of baffles. Higher baffles and reduced spacing would tend to reduce capacity. The existing culvert is relatively steep. At 3.5% slope, baffles would need to be relatively high and spaced fairly close together. Lang (2008) recorded headwater elevation increases of up to 10% in circular culvert laboratory flume experiments. Increases in headwater elevation resulting from culvert retrofit needs to be evaluated for its effect on stability of the Highway 503 road fill.

HIGHWAY 503 CULVERT RETROFIT ANTICIPATED BENEFITS

- Improve fish passage to 1.3 miles of upper Colvin Creek.

HIGHWAY 503 CULVERT RETROFIT FEASIBILITY CONCERNS

- Culvert capacity will be reduced, which may influence the stability of the road fill prism.
- Maintenance frequency of clearing the trash rack upstream of the inlet would need to be increased to maintain fish passage.

4.3 NO ACTION ALTERNATIVE

The no action alternative may be detrimental to recovery of ESA listed fish populations. Colvin Creek is the first tributary of significant size located downstream of Merwin Dam and can deliver sediment to the lower NFLR, which has had all of its sediment supply cut off from upstream, main stem dams. Algae, aquatic plants, insects and fish depend on gravel, and cobble substrates for attachment sites, hiding places and stable nest material. Colvin Creek could deliver sediment to approximately 16 miles of the lower Lewis River if Colvin Dam were removed. Furthermore, the presence of Colvin Dam as a fish migration barrier has deemed any improvements to fish passage at the Highway 503 crossing as unnecessary. With Colvin Dam removed, fish passage at Highway 503 will become a higher priority. With Colvin Dam in place, fish passage at Highway 503 will not be a concern.

NO ACTION ANTICIPATED BENEFITS

- Low monetary cost.

NO ACTION FEASIBILITY CONCERNS

- Feasibility of the no action alternative is not a concern, but there are negative consequences as discussed above.

4.4 OPINION OF ALTERNATIVES COST

An opinion of probable costs for the Dam Removal alternative and Options A and B is provided in Table 1. No cost is assumed for the No Action alternative.

Covin Dam Removal Concept Design Opinion of Probable Cost

Alternative	Activity	Unit of Measure	Unit	Cost	Total
Dam Removal Alternative	Mobilization and Demobilization	LS	1	$100,000	$100,000
	12-inch Welded Joint HDPE Diversion Pipe	LF	1,400	$40	$56,000
	Power Supply and Pump	LS	1	$30,000	$30,000
	Dewatering sediment control - TESC, SPCC	LS	1	$15,000	$15,000
	Excavation	CY	2,000	$9	$18,000
	Reinforced Concrete Demolition	CY	1,200	$175	$210,000
	Large wood	EA	180	$800	$144,000
	Large wood ballast	EA	180	$800	$144,000
	Revegetation	Acre	4	$20,000	$80,000
	Construction costs				$797,000
	Additional Design				$80,000
	Permitting				$25,000
	Construction oversight				$30,000
	Construction cost with 15% contingency				**$916,550**
Option A - NFLR Log Jams	Mobilization and Demobilization	LS	1	$20,000	$20,000
	Access	LS	1	$10,000	$10,000
	Large wood	EA	80	$800	$64,000
	Large wood ballast	EA	80	$800	$64,000
	Construction costs				$158,000
	Additional Design				$40,000
	Permitting				$15,000
	Construction oversight				$15,000
	Construction cost with 15% contingency				**$181,700**
Option B - Culvert Retrofit	Mobilization and Demobilization	LS	1	$12,000	$12,000
	12-inch Welded Joint HDPE Diversion Pipe	LF	600	$40	$24,000
	Power Supply and Pump	LS	1	$30,000	$30,000
	Highway 503 Pipe Crossing	LS	1	$15,000	$15,000
	Dewatering sediment control - TESC, SPCC	LS	1	$5,000	$5,000
	Install Baffles	LS	1	$100,000	$100,000
	Construction costs				$174,000
	Additional Design				$20,000
	Permitting				$10,000
	Construction oversight				$10,000
	Construction cost with 15% contingency				**$200,100**

Table 1. Opinion of Probable Cost

4.5 PREFERRED ALTERNATIVE

Colvin Dam removal is the preferred alternative since it provides the most habitat gain. This alternative not only restores fish passage it also restores geomorphic function to lower Colvin Creek. The dam removal alternative provides sediment to the NFLR downstream of dams that have cut off sediment supply.

Further analyses are required to address the applicability of NFLR log jams and Highway 503 fish passage. The preliminary design will include hydrologic analyses, hydraulic modeling and sediment transport analyses to evaluate the affect NFLR log jams have on sediment released from Colvin Dam. A geotechnical consultation will be required to consider if the potential for increased headwater elevation at the Highway 503 culvert has the potential to destabilize the cobble road fill.

5. References

Allen, J. (1995). Stream ecology: structure and function of running waters. London, UK: Chapman and Hall.

Baxter, R. (1977). Environmental effects of dams and impoundments. Ann. Rev. of Ecol. and Systematics 8: 255-283.

Cole, R.A., Weigmann, D.L., Relationships Among Zoobenthos, Sediments, and Organic Matter in littoral zones of Western Lake Erie and Saginaw Bay, Journal of Great Lakes Research, 1983.

Kanehl, P., Lyons, J., & Nelson, J. (1997). Changes in the habitat and fish community of the Milwaukee River, Wisconsin, following removal of the Wollen Mills Dam. N. Am. J. Fish. Mgmt 17:387-400.

Kondolf, M. (n.d.). ., Hungry Water. Effects of Dams and Gravel Mining on River Channels, Environmental Management, Vol. 21, No. 4 pp 533-551, 1997.

Lang, M., Cashman, E., Influence of Fish Passage Retrofits on Culvert Hydraulic Capacity, Final Report for California Department of Transportation (CalTrans), 2008.

Li, H., Schreck, C., Bond, C., & Rexstad, E. (1987). Factors influencing changes in fish assemblages of Pacific Northwest streams. In W. Matthews, & D. Heins (Ed.), Community and Evolutionary Ecology of North American Fishes (pp. 193-202). Univ.Oklahoma Press, Norman.

Ligon, F., Dietrich, W., & Trush, W. (1995). Downstream ecological effects of dams: a geomorphic perspective. Bioscience , 45(3), 183-192.

Lower Columbia Fish Recovery Board. Final Washington Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan. 2010.

Minshall, G.W., Aquatic Insect-Substratum Relationships. The Ecology of Insects, ed. V.H. Resh and D.M. Rosenberg, New York: Praeger Special Studies, Praeger Scientific Publishers, 1984.

Pacific Fisherman. "Can Lewis River Salmon Be Saved?" Dec. 1930: 30-32.

PacifiCorp, Biological Evaluation of USFWS Listed, Proposed, and Candidate species as Related to PacifiCorp and Cowlitz PUD's Lewis River Hydroelectric Projects, 2005.

Ross, S. (1991). Mechanisms structuring stream fish assemblages: are there lessons from introduced species? Environmental Biology of Fishes, 30, 359-368.

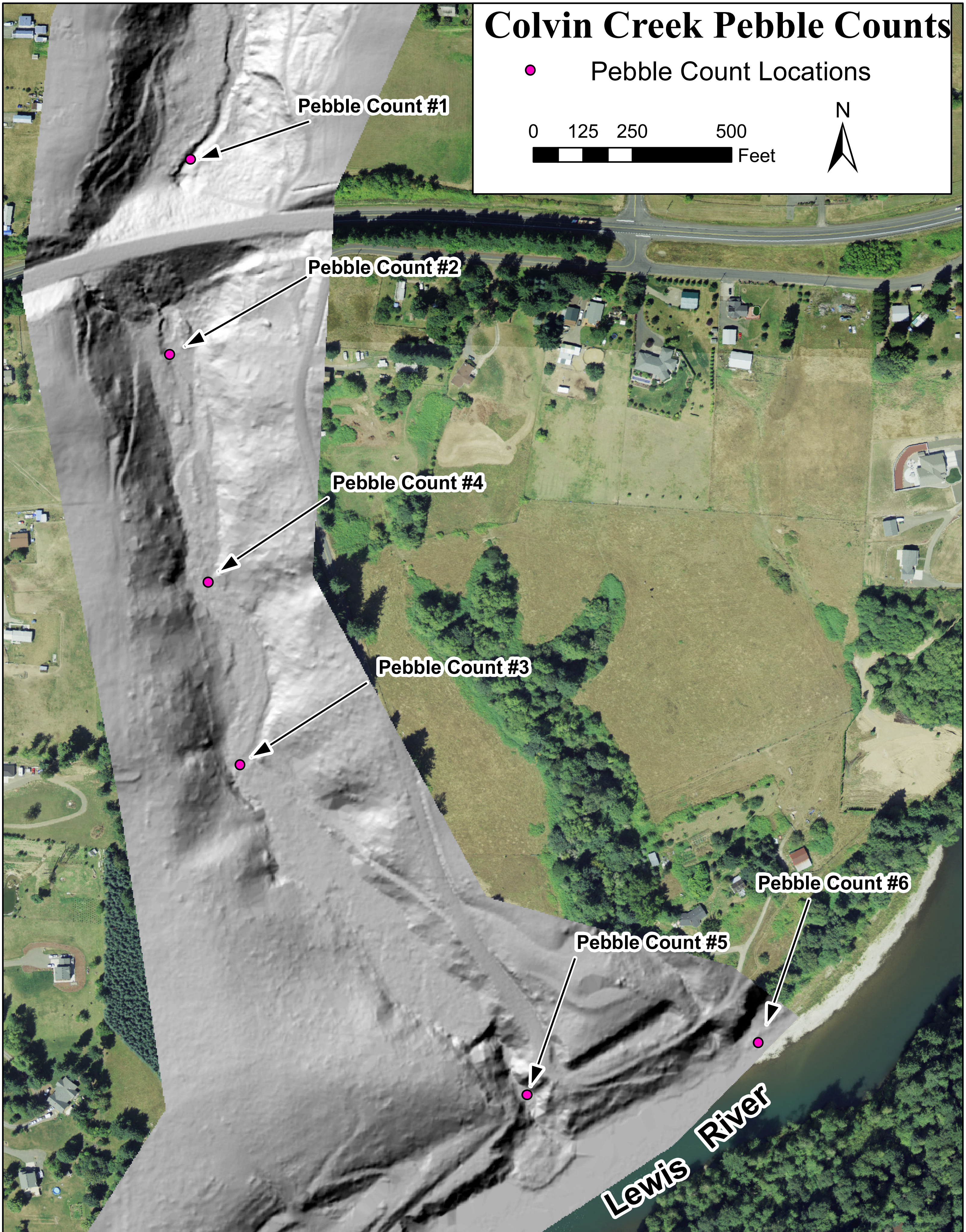
Vannnote, R.L., Minshall, G.W., Cummins, K.W., Sedell, J.R., Cushing, C.E., The River Continuum Concept, Canadian Journal of Fish and Aquatic Science, 1980.

Ward, J. V., & Stanford, J. (1983). The serial discontinuity concept of lotic ecosystems. In T. Fontaine, & S. Bartell (Eds.), Dynamics of lotic ecosystems. Ann Arbor Science Publishers.

Washington Department of Fish and Wildlife (WDFW). Fish Passage and Diversion Screening Inventory Database Site Description Report. 2015. WSDOT Project Site ID 990089. Data collected in 1997 and 2002. WDFW Region 5.

Washington Department of Fisheries. Annual Report. 1962.

Waters, T.F., Sediment in Streams: Sources, Biological Effects and Control. American Fisheries Society, Bethesda, MD. 1995.


Colvin Creek Pebble Counts
Pebble Count Locations
0
125
250
500
Feet
N
Pebble Count #1
Pebble Count #2
Pebble Count #4
Pebble Count #3
Pebble Count #5
Pebble Count #6
Lewis River

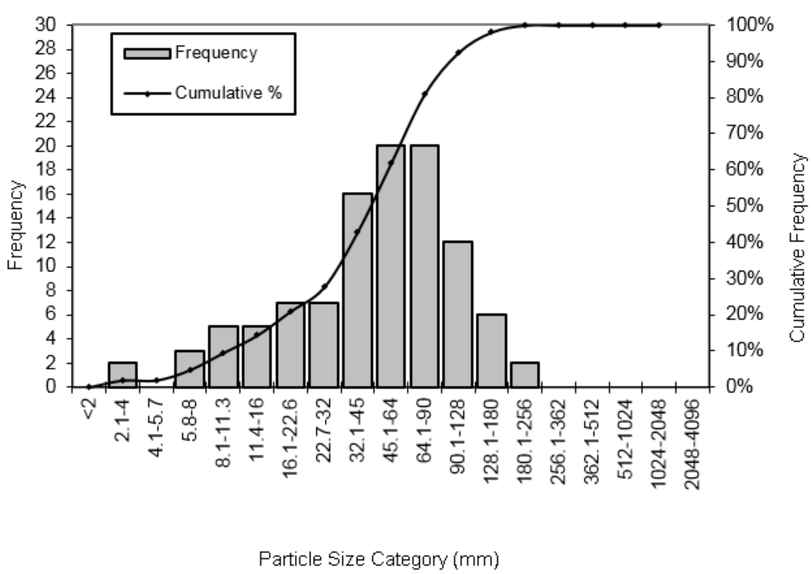
PC 1 (US of Road Fill)

Material	Size Range (mm)	Count	Item %	Cumulative %
Sand	<2		0%	0%
Very Fine Gravel	2.1-4	2	2%	2%
Fine Gravel	4.1-5.7	0	0%	2%
Fine Gravel	5.8-8	3	3%	5%
Medium Gravel	8.1-11.3	5	5%	10%
Medium Gravel	11.4-16	5	5%	14%
Coarse Gravel	16.1-22.6	7	7%	21%
Coarse Gravel	22.7-32	7	7%	28%
Very Coarse Gravel	32.1-45	16	15%	43%
Very Coarse Gravel	45.1-64	20	19%	62%
Small Cobble	64.1-90	20	19%	81%
Small Cobble	90.1-128	12	11%	92%
Large Cobble	128.1-180	6	6%	98%
Large Cobble	180.1-256	2	2%	100%
Small Boulder	256.1-362		0%	100%
Small Boulder	362.1-512		0%	100%
Small Boulders	512-1024		0%	100%
Small Boulder	1024-2048		0%	100%
Small Boulder	2048-4096			
	Total	105	100%	

Material	Percent Composition
Sand	0%
Gravel	62%
Cobble	38%
Boulder	0%
Bedrock	0%

Size Class	Size percent finer than (mm)
D5	2
D16	16
D50	64
D84	86
D95	109

* Assumed linear interpolation



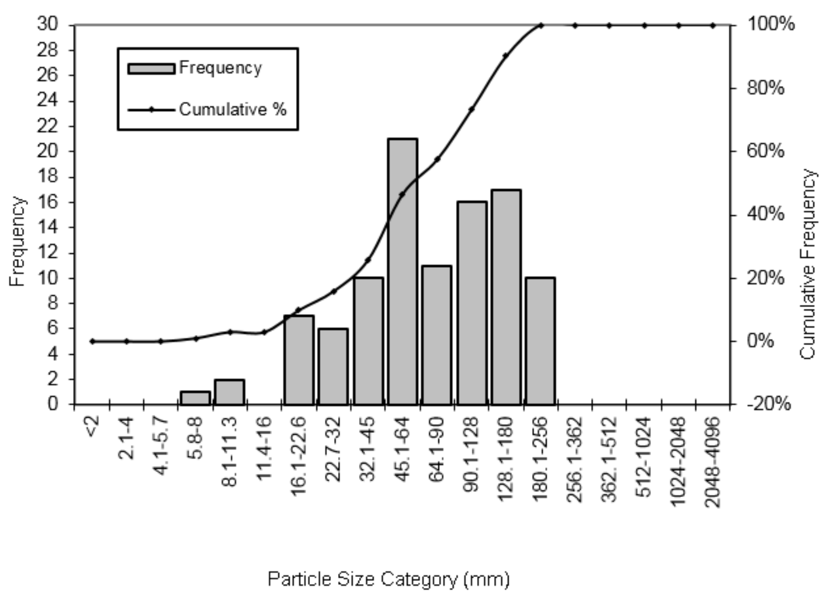
PC 2 (Just DS of Road Fill and Cuvlert outlet)

Material	Size Range (mm)	Count	Item %	Cumulative %
Sand	<2	0	0%	0%
Very Fine Gravel	2.1-4	0	0%	0%
Fine Gravel	4.1-5.7	0	0%	0%
Fine Gravel	5.8-8	1	1%	1%
Medium Gravel	8.1-11.3	2	2%	3%
Medium Gravel	11.4-16	0	0%	3.0%
Coarse Gravel	16.1-22.6	7	7%	10%
Coarse Gravel	22.7-32	6	6%	16%
Very Coarse Gravel	32.1-45	10	10%	26%
Very Coarse Gravel	45.1-64	21	21%	47%
Small Cobble	64.1-90	11	11%	57%
Small Cobble	90.1-128	16	16%	73%
Large Cobble	128.1-180	17	17%	90%
Large Cobble	180.1-256	10	10%	100%
Small Boulder	256.1-362	0	0%	100%
Small Boulder	362.1-512	0	0%	100%
Small Boulders	512-1024	0	0%	100%
Small Boulders	1024-2048	0	0%	100%
Small Boulder	2048-4096	0	0%	100%
	Total	101	100%	

Material	Percent Composition
Sand	0%
Gravel	47%
Cobble	53%
Boulder	0%
Bedrock	0%

Size Class	Size percent finer than (mm)
D5	0
D16	28
D50	72
D84	161
D95	195

* Assumed linear interpolation



Colvin

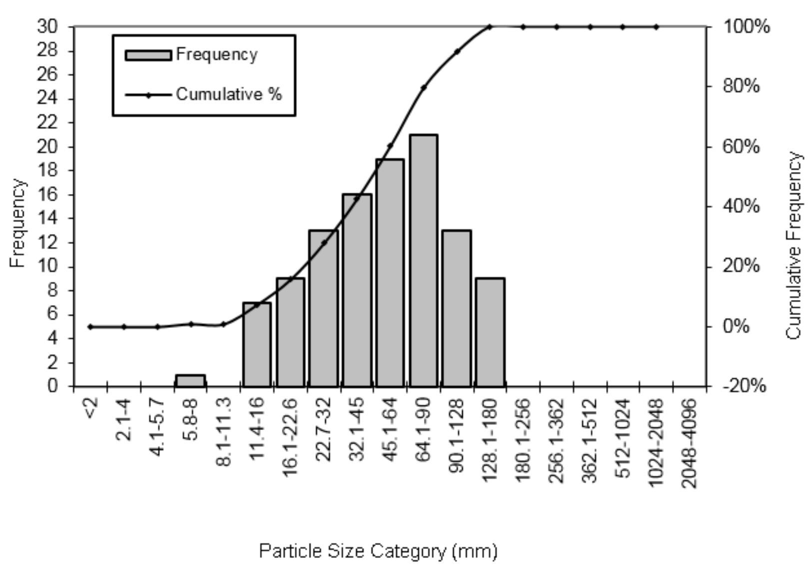
PC 3 (Furthest DS pebble count- near old DS abutments)

Material	Size Range (mm)	Count	Item %	Cumulative %
Sand	<2		0%	0%
Very Fine Gravel	2.1-4		0%	0%
Fine Gravel	4.1-5.7		0%	0%
Fine Gravel	5.8-8	1	1%	1%
Medium Gravel	8.1-11.3	0	0%	1%
Medium Gravel	11.4-16	7	6%	7%
Coarse Gravel	16.1-22.6	9	8%	16%
Coarse Gravel	22.7-32	13	12%	28%
Very Coarse Gravel	32.1-45	16	15%	43%
Very Coarse Gravel	45.1-64	19	18%	60%
Small Cobble	64.1-90	21	19%	80%
Small Cobble	90.1-128	13	12%	92%
Large Cobble	128.1-180	9	8%	100%
Large Cobble	180.1-256		0%	100%
Small Boulder	256.1-362		0%	100%
Small Boulder	362.1-512		0%	100%
Small Boulders	512-1024		0%	100%
Small Boulder	1024-2048		0%	100%
Small Boulder	2048-4096			
	Total	108	100%	

Material	Percent Composition
Sand	0%
Gravel	60%
Cobble	40%
Boulder	0%
Bedrock	0%

Size Class	Size percent finer than (mm)
D5	2
D16	9
D50	49
D84	90
D95	111

* Assumed linear interpolation



Colvin

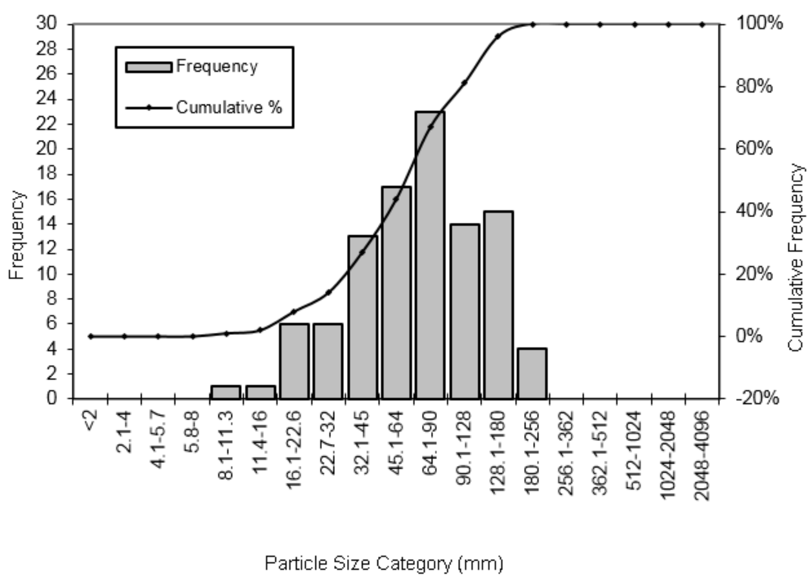
PC 4 (mid-way colvin creek, between PC 2 and 3)

Material	Size Range (mm)	Count	Item %	Cumulative %
Sand	<2		0%	0%
Very Fine Gravel	2.1-4	0	0%	0%
Fine Gravel	4.1-5.7	0	0%	0%
Fine Gravel	5.8-8	0	0%	0%
Medium Gravel	8.1-11.3	1	1%	1%
Medium Gravel	11.4-16	1	1%	2.0%
Coarse Gravel	16.1-22.6	6	6%	8%
Coarse Gravel	22.7-32	6	6%	14%
Very Coarse Gravel	32.1-45	13	13%	27%
Very Coarse Gravel	45.1-64	17	17%	44%
Small Cobble	64.1-90	23	23%	67%
Small Cobble	90.1-128	14	14%	81%
Large Cobble	128.1-180	15	15%	96%
Large Cobble	180.1-256	4	4%	100%
Small Boulder	256.1-362	0	0%	100%
Small Boulder	362.1-512	0	0%	100%
Small Boulders	512-1024	0	0%	100%
Small Boulders	1024-2048	0	0%	100%
Small Boulder	2048-4096		0%	100%
	Total	100	100%	

Material	Percent Composition
Sand	0%
Gravel	44%
Cobble	56%
Boulder	0%
Bedrock	0%

Size Class	Size percent finer than (mm)
D5	0
D16	31
D50	44
D84	138
D95	177

* Assumed linear interpolation



Colvin

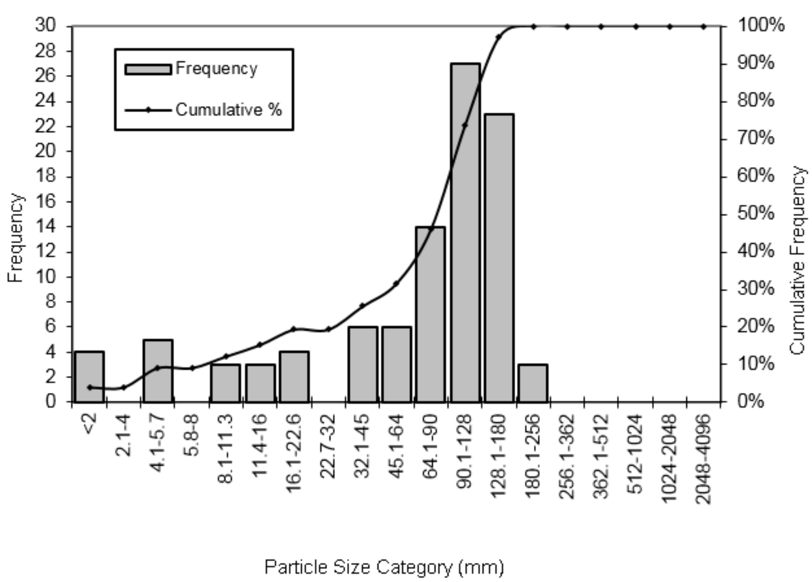
PC 5

Material	**Size Range (mm)**	**Count**	**Item %**	**Cumulative %**
Sand	<2	4	4%	4%
Very Fine Gravel	2.1-4	0	0%	4%
Fine Gravel	4.1-5.7	5	5%	9%
Fine Gravel	5.8-8	0	0%	9%
Medium Gravel	8.1-11.3	3	3%	12%
Medium Gravel	11.4-16	3	3%	15.3%
Coarse Gravel	16.1-22.6	4	4%	19%
Coarse Gravel	22.7-32	0	0%	19%
Very Coarse Gravel	32.1-45	6	6%	26%
Very Coarse Gravel	45.1-64	6	6%	32%
Small Cobble	64.1-90	14	14%	46%
Small Cobble	90.1-128	27	28%	73%
Large Cobble	128.1-180	23	23%	97%
Large Cobble	180.1-256	3	3%	100%
Small Boulder	256.1-362		0%	100%
Small Boulder	362.1-512		0%	100%
Small Boulders	512-1024		0%	100%
Small Boulders	1024-2048		0%	100%
Small Boulder	2048-4096		0%	100%
	Total	98	100%	

Material	**Percent Composition**
Sand	4%
Gravel	28%
Cobble	68%
Boulder	0%
Bedrock	0%

Size Class	**Size percent finer than (mm)**
D5	4
D16	17
D50	96
D84	151
D95	176

* Assumed linear interpolation



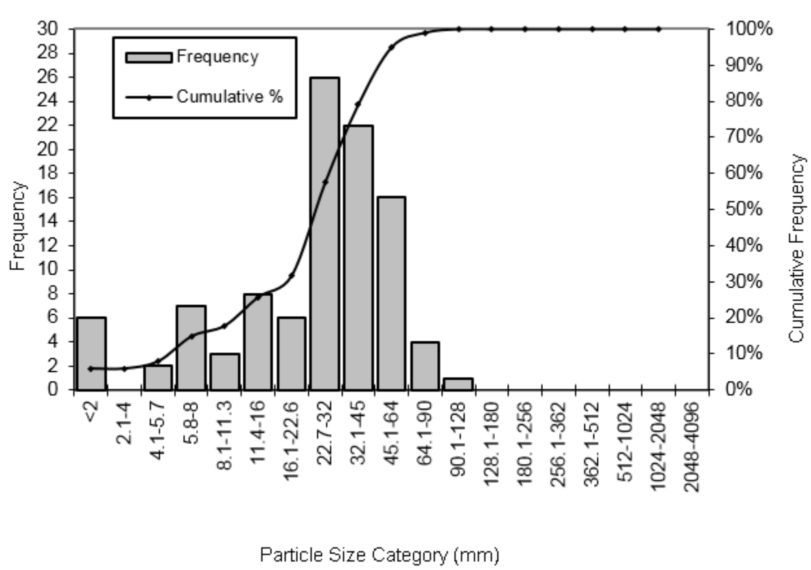
Colvin
PC 6

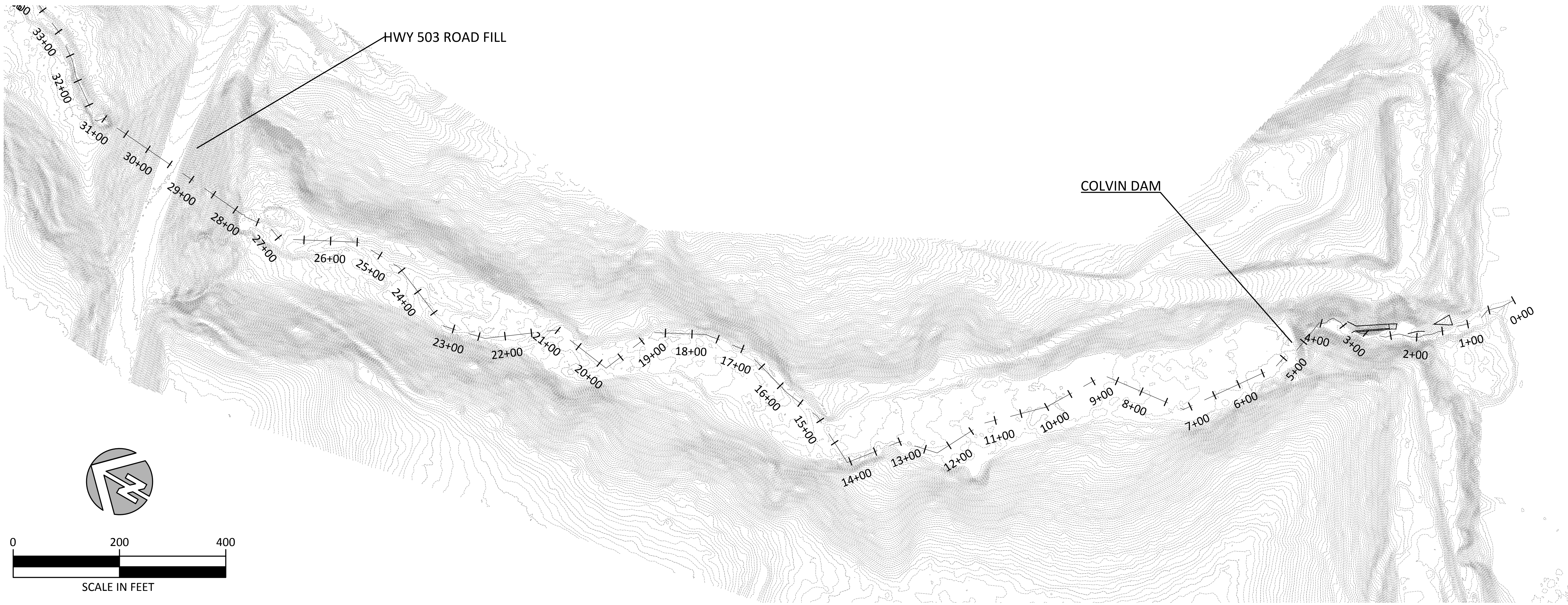
Material	Size Range (mm)	Count	Item %	Cumulative %
Sand	<2	6	6%	6%
Very Fine Gravel	2.1-4	0	0%	6%
Fine Gravel	4.1-5.7	2	2%	8%
Fine Gravel	5.8-8	7	7%	15%
Medium Gravel	8.1-11.3	3	3%	18%
Medium Gravel	11.4-16	8	8%	26%
Coarse Gravel	16.1-22.6	6	6%	32%
Coarse Gravel	22.7-32	26	26%	57%
Very Coarse Gravel	32.1-45	22	22%	79%
Very Coarse Gravel	45.1-64	16	16%	95%
Small Cobble	64.1-90	4	4%	99%
Small Cobble	90.1-128	1	1%	100%
Large Cobble	128.1-180	0	0%	100%
Large Cobble	180.1-256	0	0%	100%
Small Boulder	256.1-362		0%	100%
Small Boulder	362.1-512		0%	100%
Small Boulders	512-1024		0%	100%
Small Boulder	1024-2048		0%	100%
Small Boulder	2048-4096			
	Total	101	100%	

Material	Percent Composition
Sand	6%
Gravel	89%
Cobble	5%
Boulder	0%
Bedrock	0%

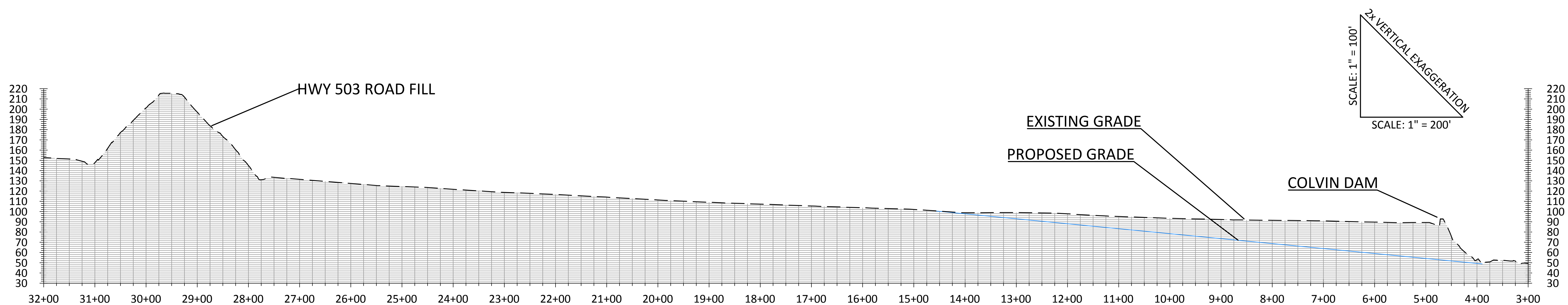
Size Class	Size percent finer than (mm)
D5	2
D16	9
D50	29
D84	51
D95	64

* Assumed linear interpolation





SITE PLAN



LONGITUDINAL PROFILE THROUGH COLVIN CREEK

NO.	BY	DATE	REVISION DESCRIPTION

DF		
DRAWN	DESIGNED	CHECKED
	5/3/16	
APPROVED	DATE	PROJECT

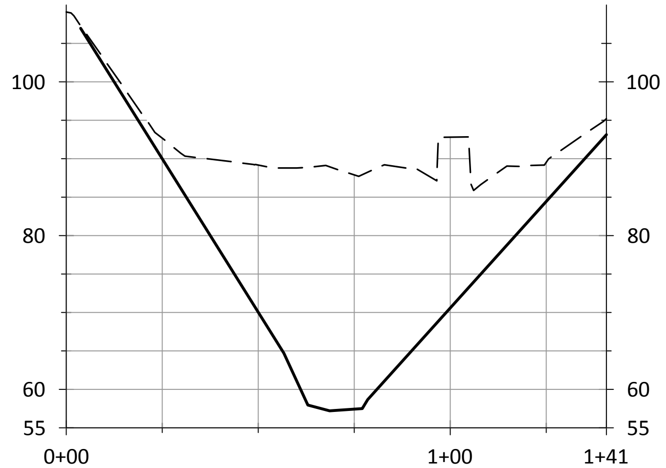
COLVIN DAM REMOVAL

inter·fluve

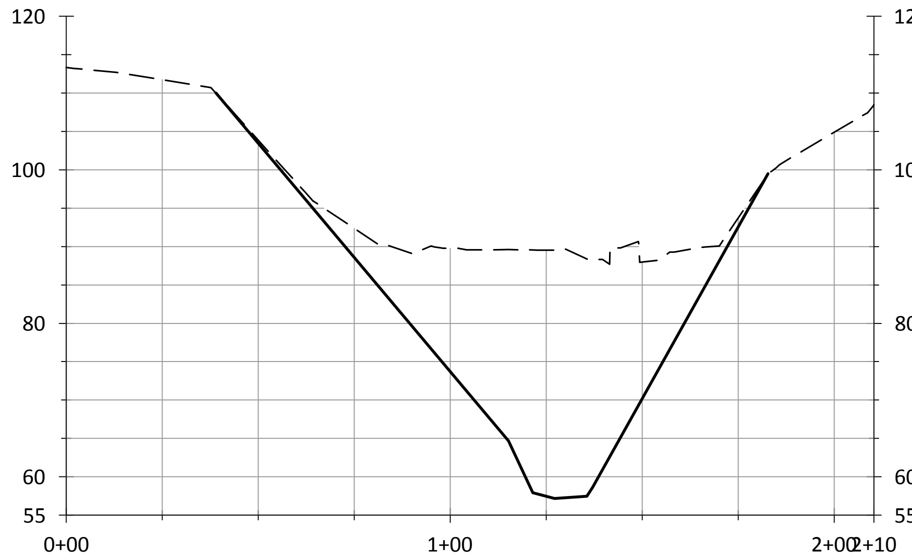
501 Portway Avenue, Suite 101
Hood River, OR 97031
541.386.9003
www.interfluve.com

DAM REMOVAL- - ACCESS AND STAGING

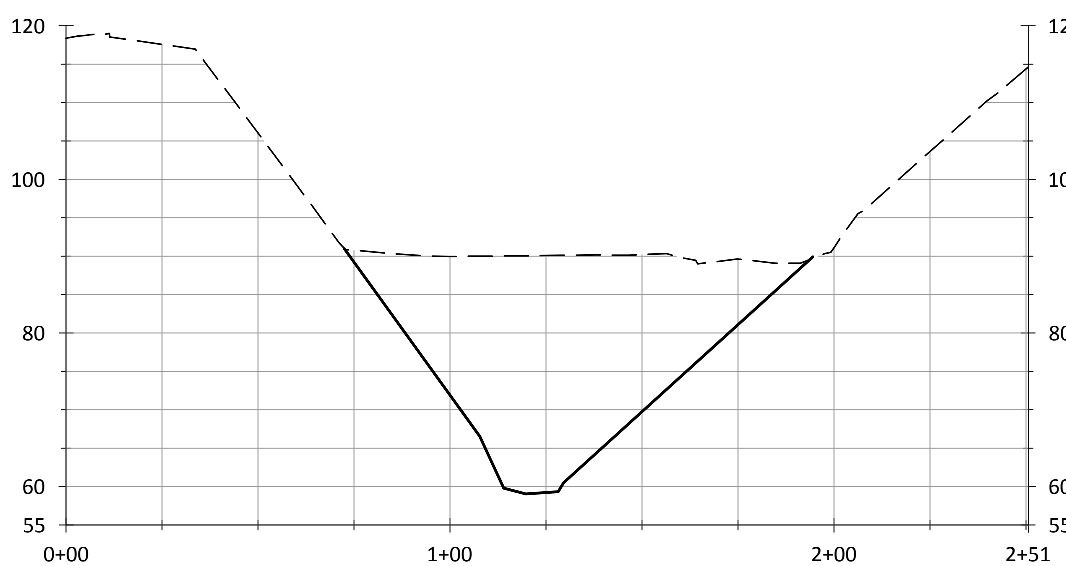
SHEET
1 OF 5



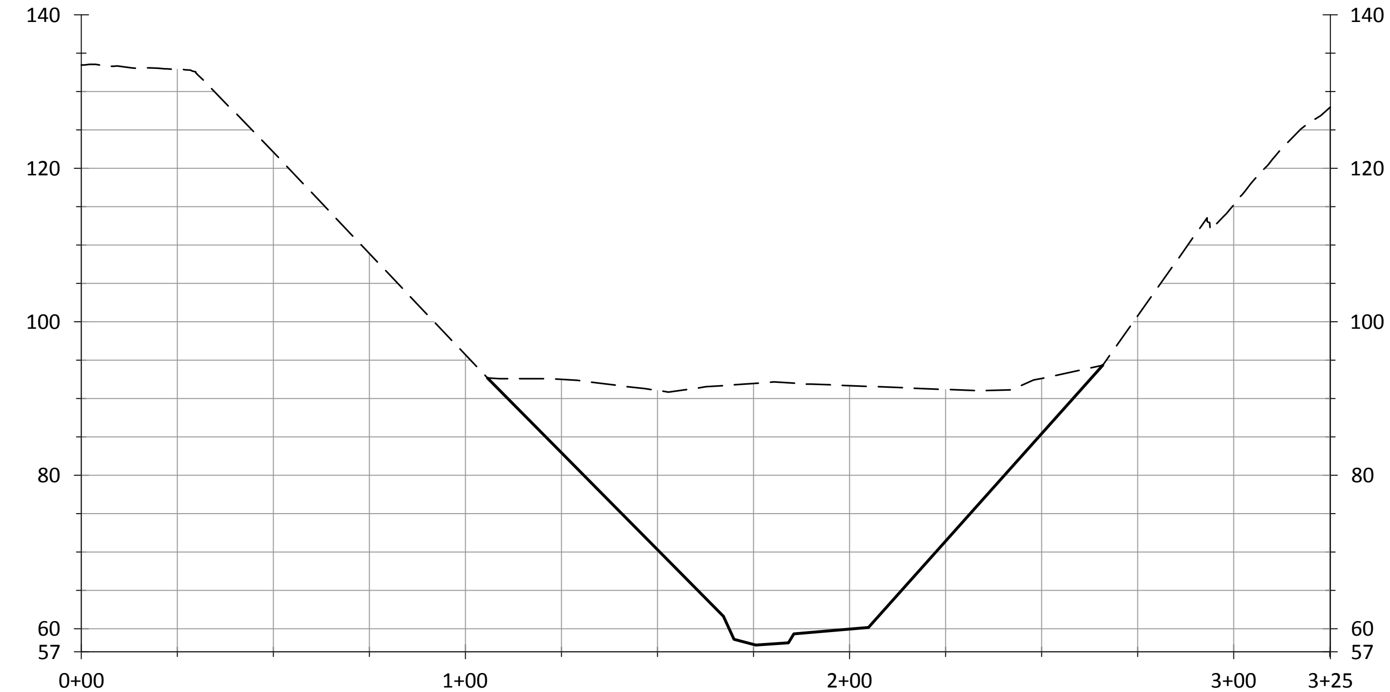
4+72.47



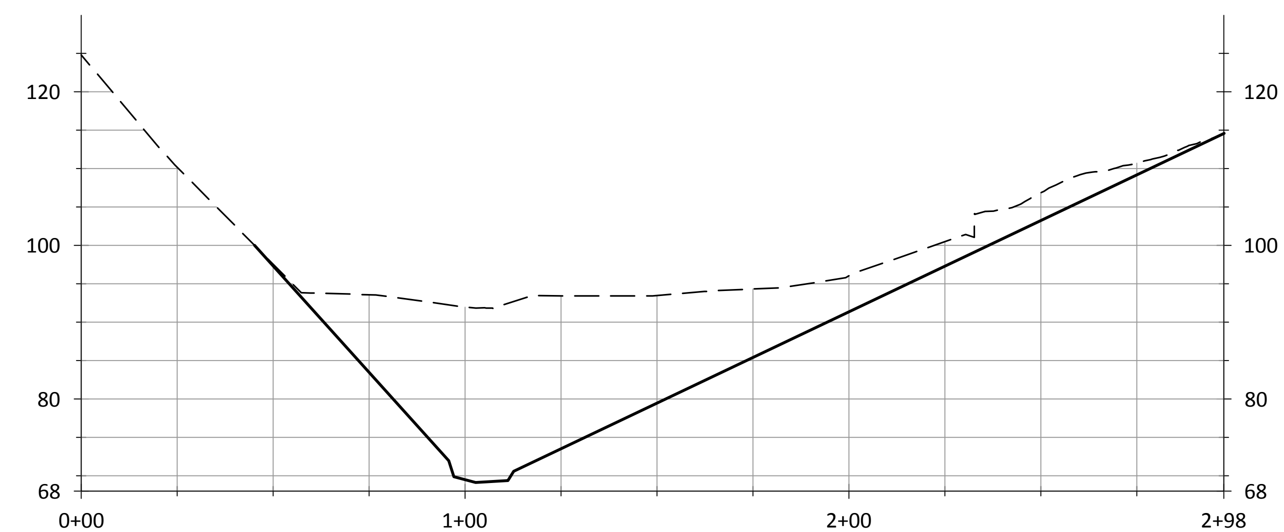
4+85.27



5+49.07



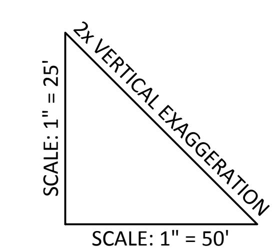
7+11.97



8+70.07

EXISTING GRADE

ANTICIPATED GRADE



NO.	BY	DATE	REVISION DESCRIPTION

DF
DRAWN | DESIGNED | CHECKED

5/3/16
APPROVED | DATE | PROJECT

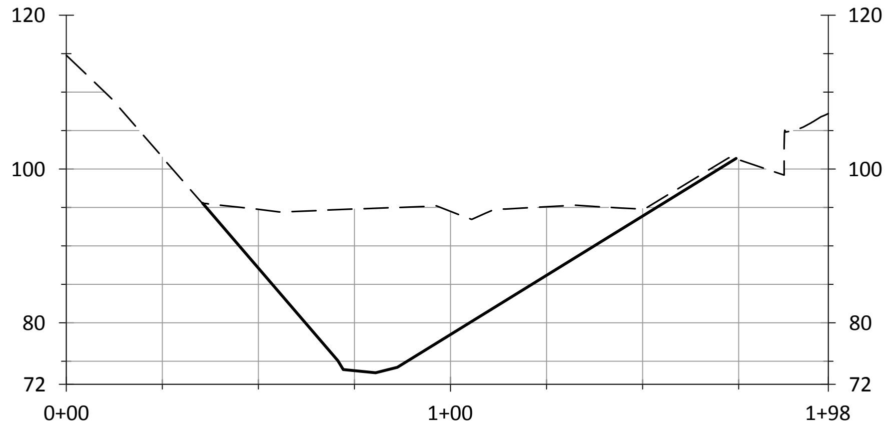
COLVIN DAM REMOVAL

inter·fluve

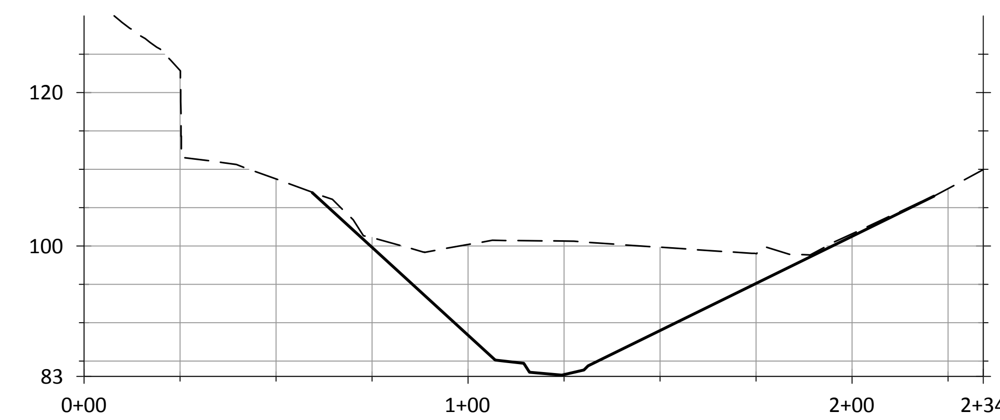
501 Portway Avenue, Suite 101
Hood River, OR 97031
541.386.9003
www.interfluve.com

CROSS SECTIONS

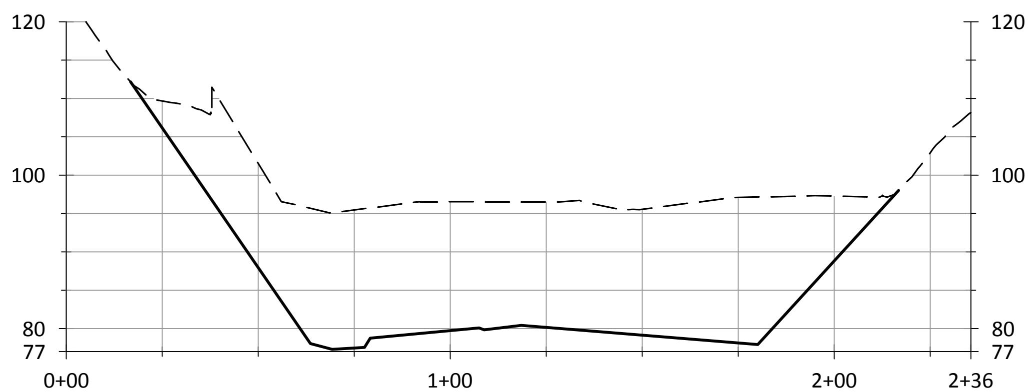
SHEET
2 OF 5



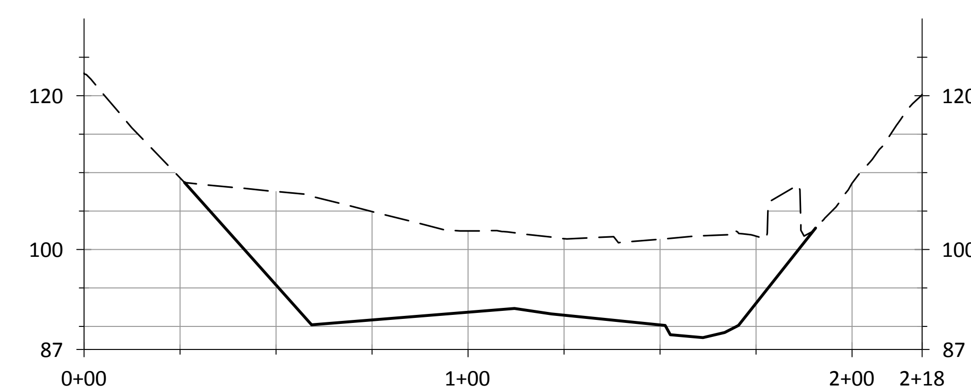
10+0016



13+01.03



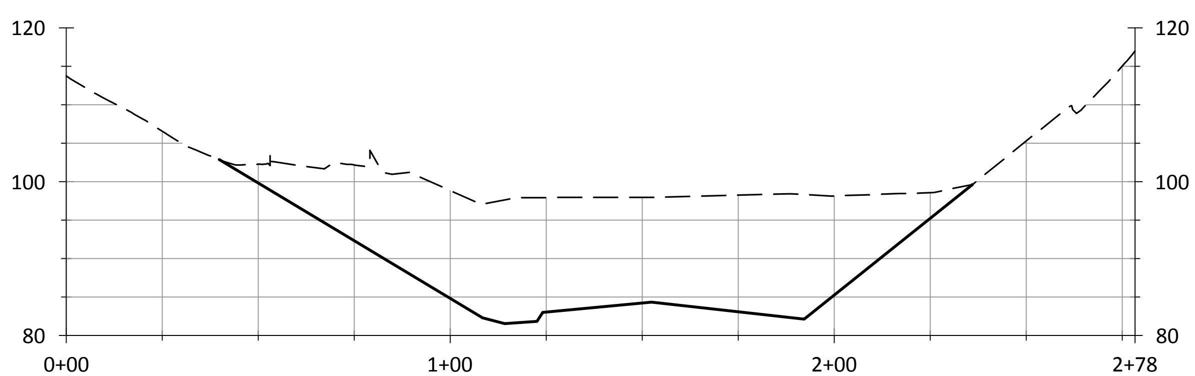
11+12.69



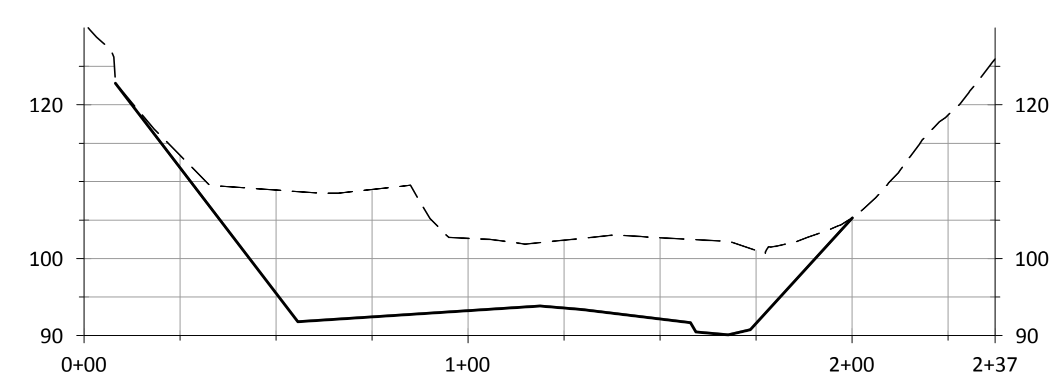
14+66.20

EXISTING GRADE

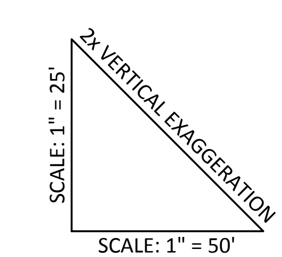
ANTICIPATED GRADE



12+28.18



15+18.71



NO.	BY	DATE	REVISION DESCRIPTION

DRAWN	DESIGNED	CHECKED
DF		
APPROVED	DATE	PROJECT
	5/3/16	

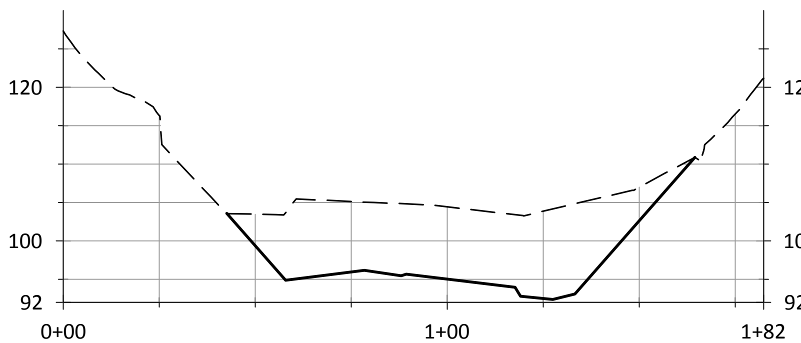
COLVIN DAM REMOVAL

inter·fluve

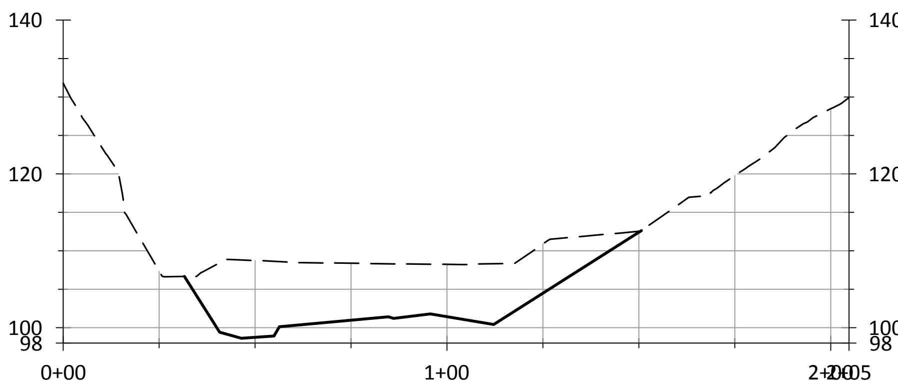
501 Portway Avenue, Suite 101
Hood River, OR 97031
541.386.9003
www.interfluve.com

CROSS SECTIONS

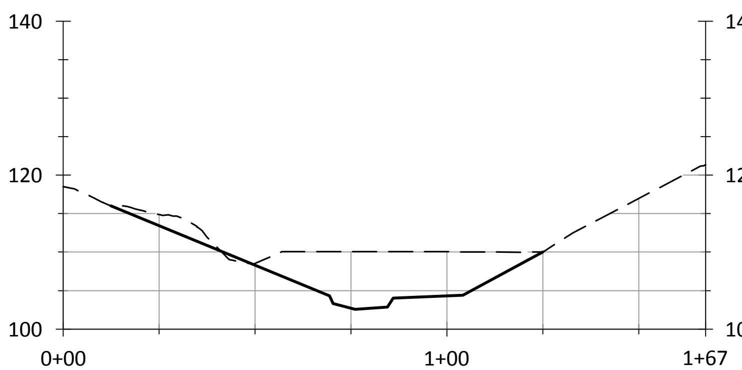
SHEET 3 OF 5



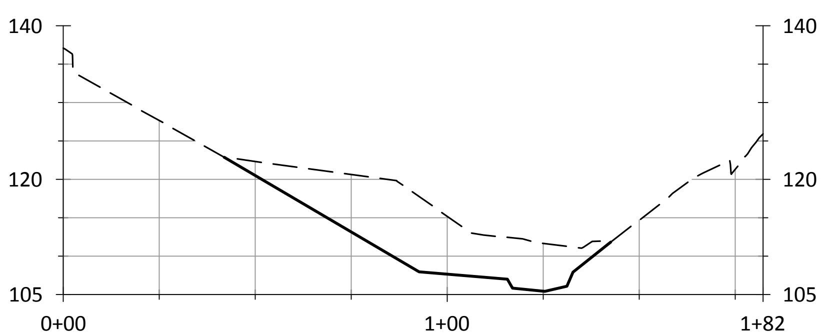
15+81.90



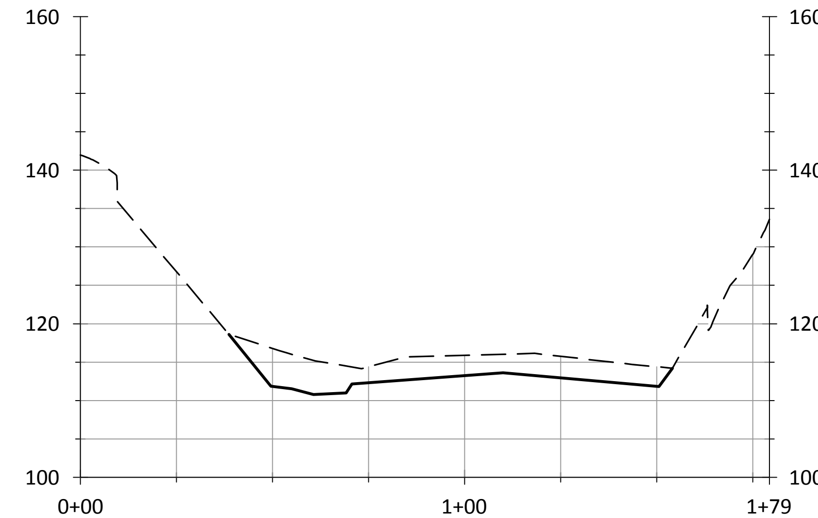
17+69.74



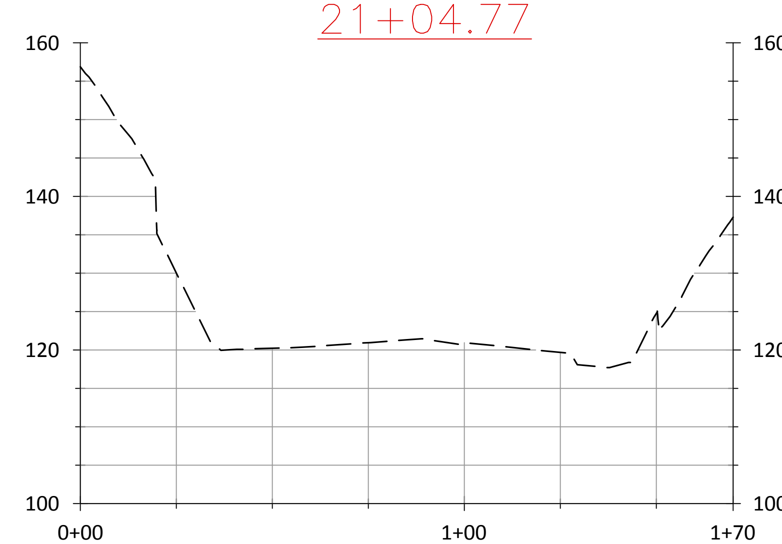
18+71.70



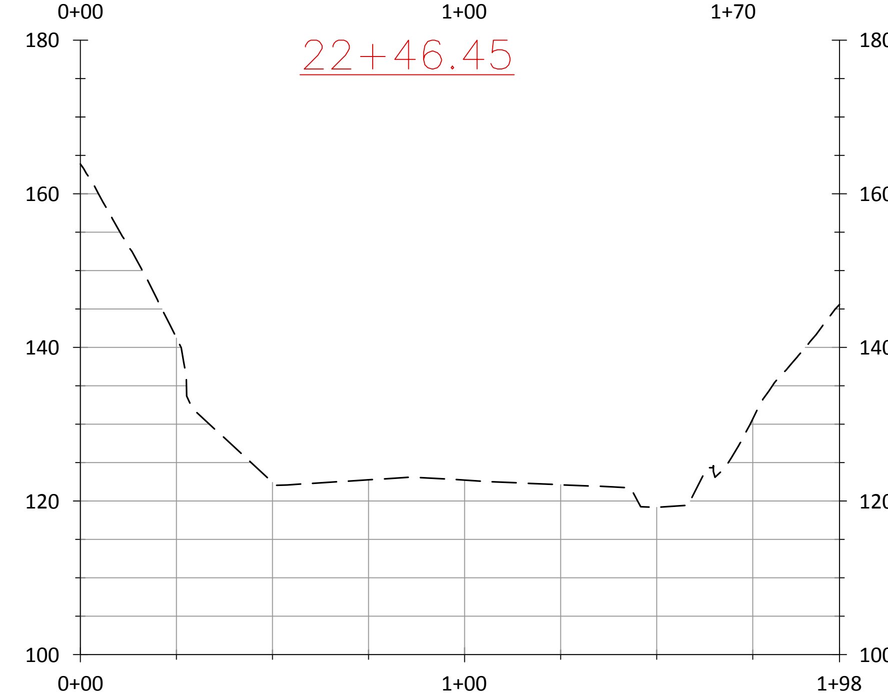
19+91.42



21+04.77



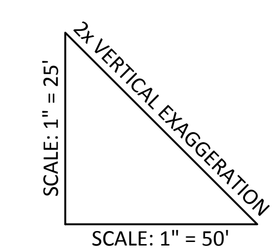
22+46.45



23+20.96

EXISTING GRADE

ANTICIPATED GRADE



NO.	BY	DATE	REVISION DESCRIPTION

DF
DRAWN | DESIGNED | CHECKED

5/3/16
APPROVED | DATE | PROJECT

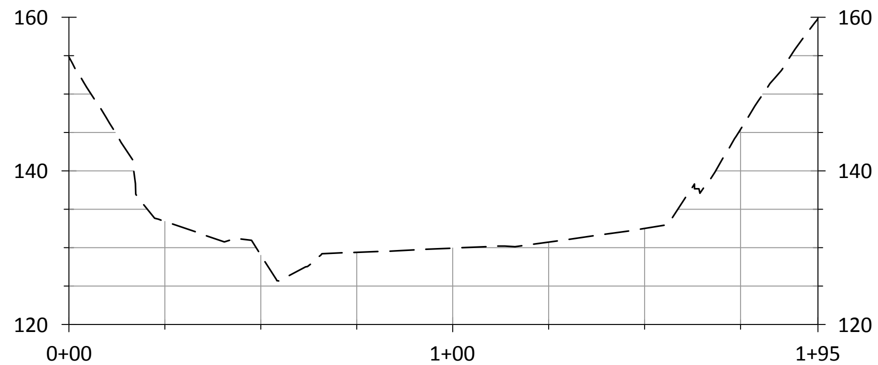
COLVIN DAM REMOVAL

inter·fluve

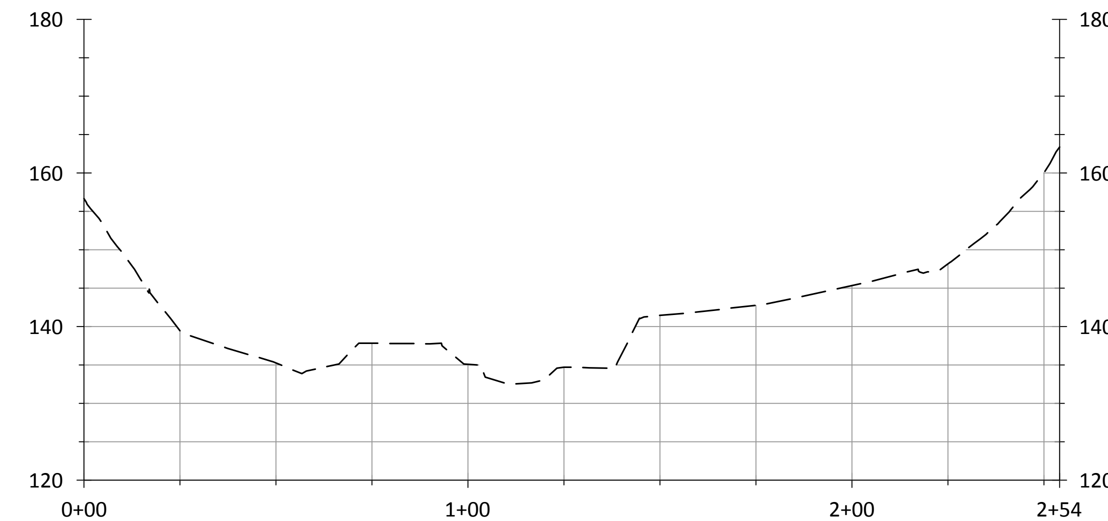
501 Portway Avenue, Suite 101
Hood River, OR 97031
541.386.9003
www.interfluve.com

CROSS SECTIONS

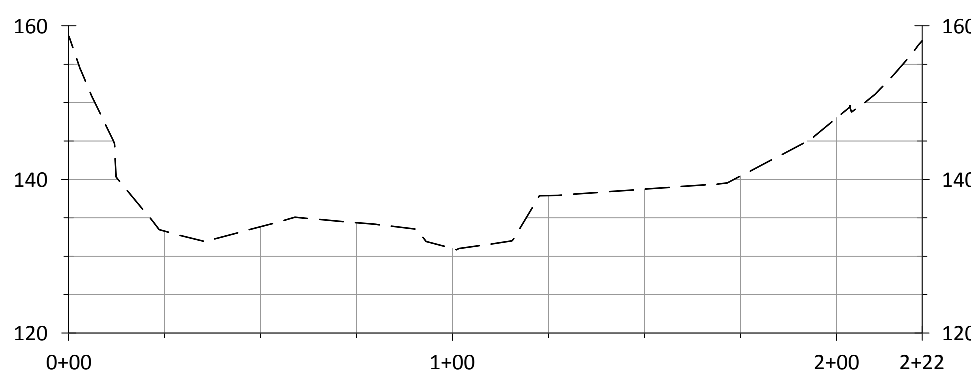
SHEET
4 OF 5



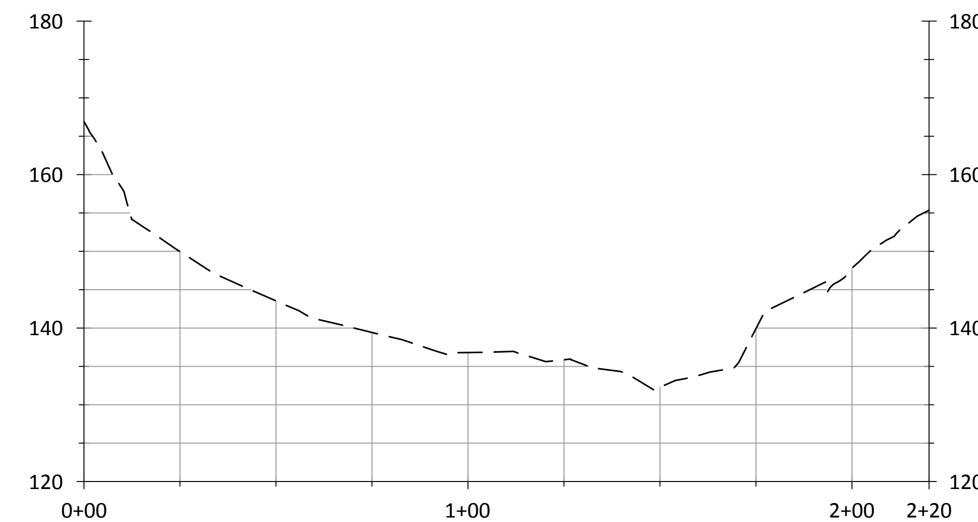
25+56.87



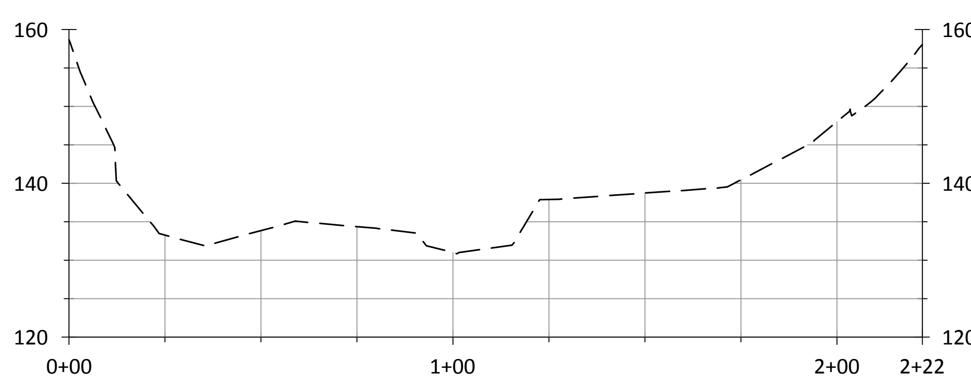
27+29.47



26+85.26



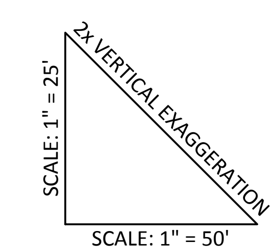
27+66.44



26+85.26

EXISTING GRADE

ANTICIPATED GRADE



NO.	BY	DATE	REVISION DESCRIPTION

DF
DRAWN | DESIGNED | CHECKED

5/3/16
APPROVED | DATE | PROJECT

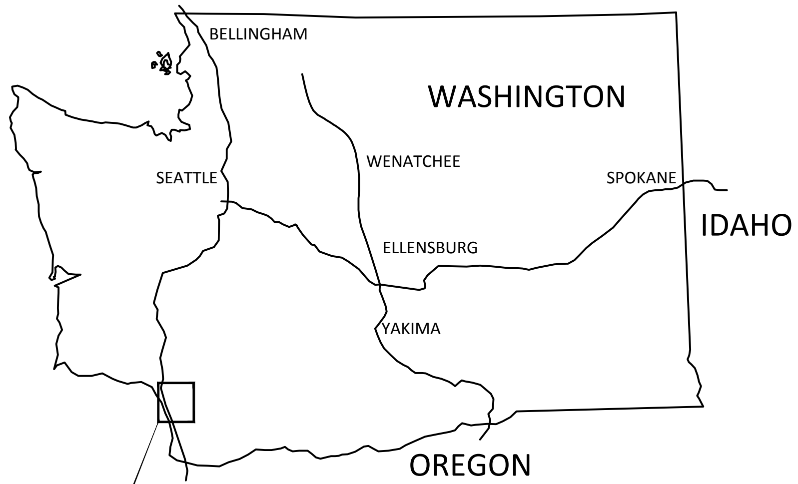
COLVIN DAM REMOVAL

inter·fluve

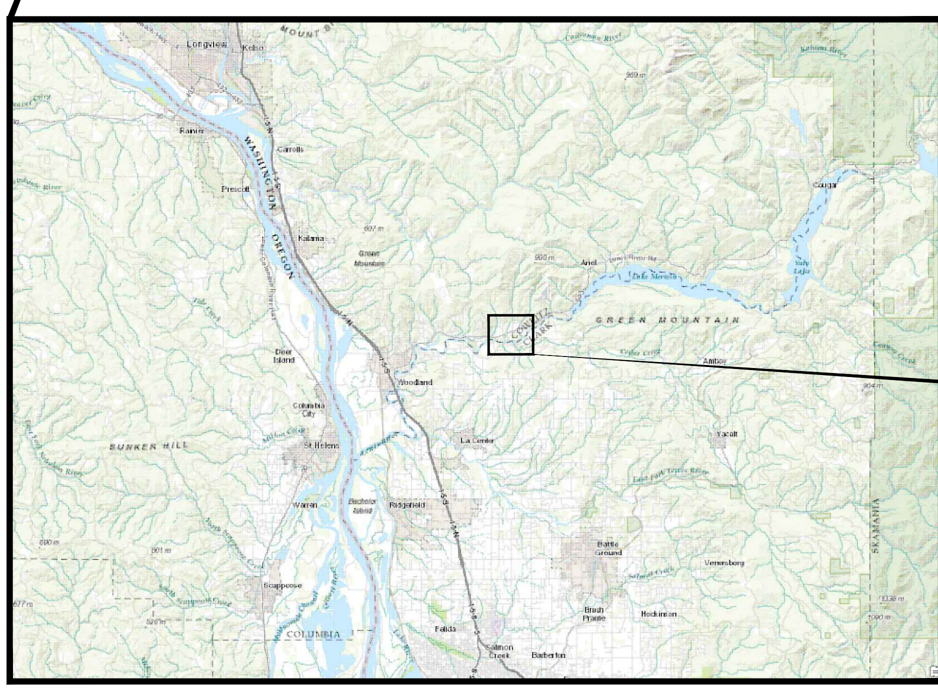
501 Portway Avenue, Suite 101
Hood River, OR 97031
541.386.9003
www.interfluve.com

CROSS SECTIONS

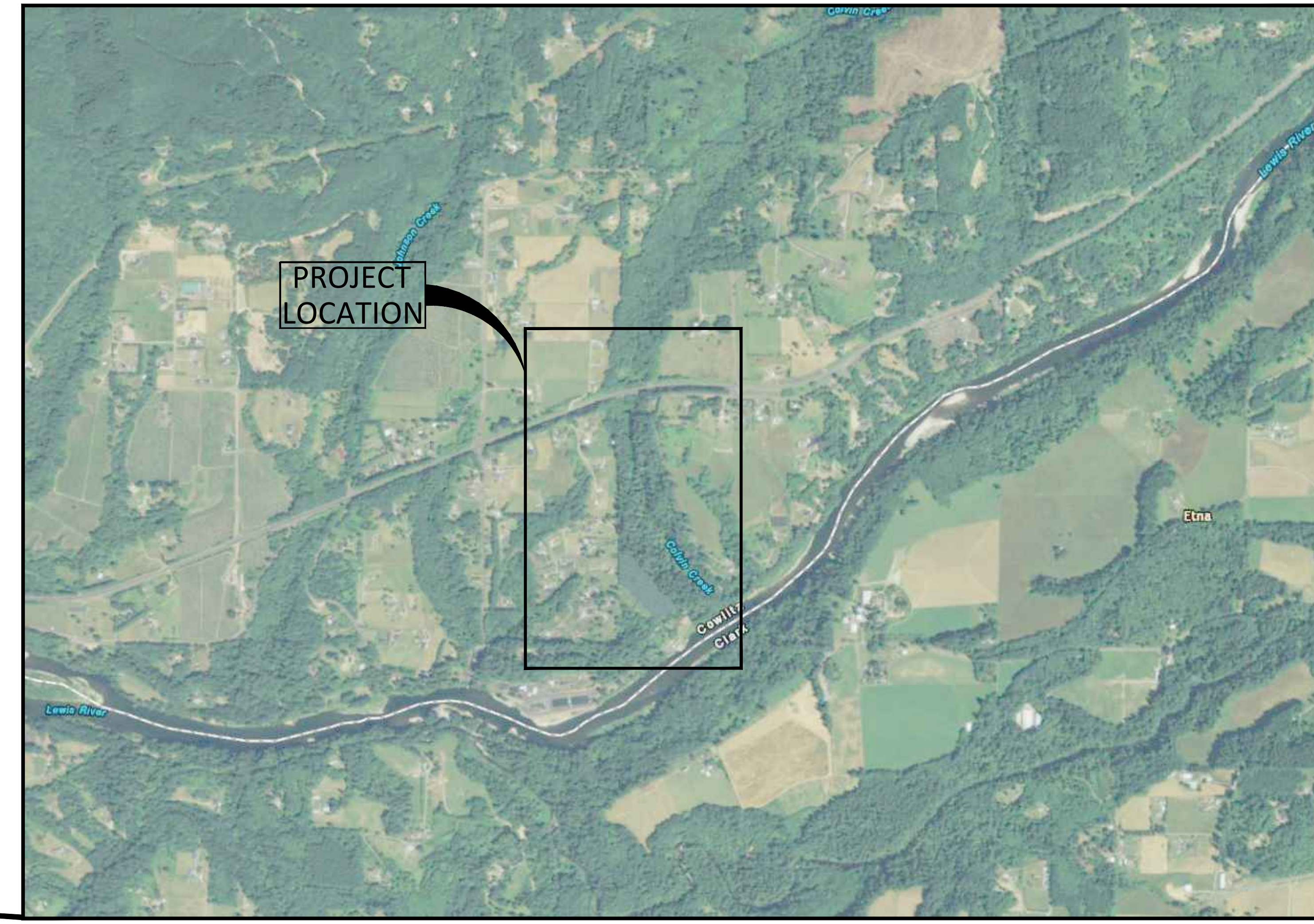
SHEET
5 OF 5



LOCATION MAP
STATE OF WASHINGTON



VICINITY MAP
NOT TO SCALE



SITE MAP
NOT TO SCALE

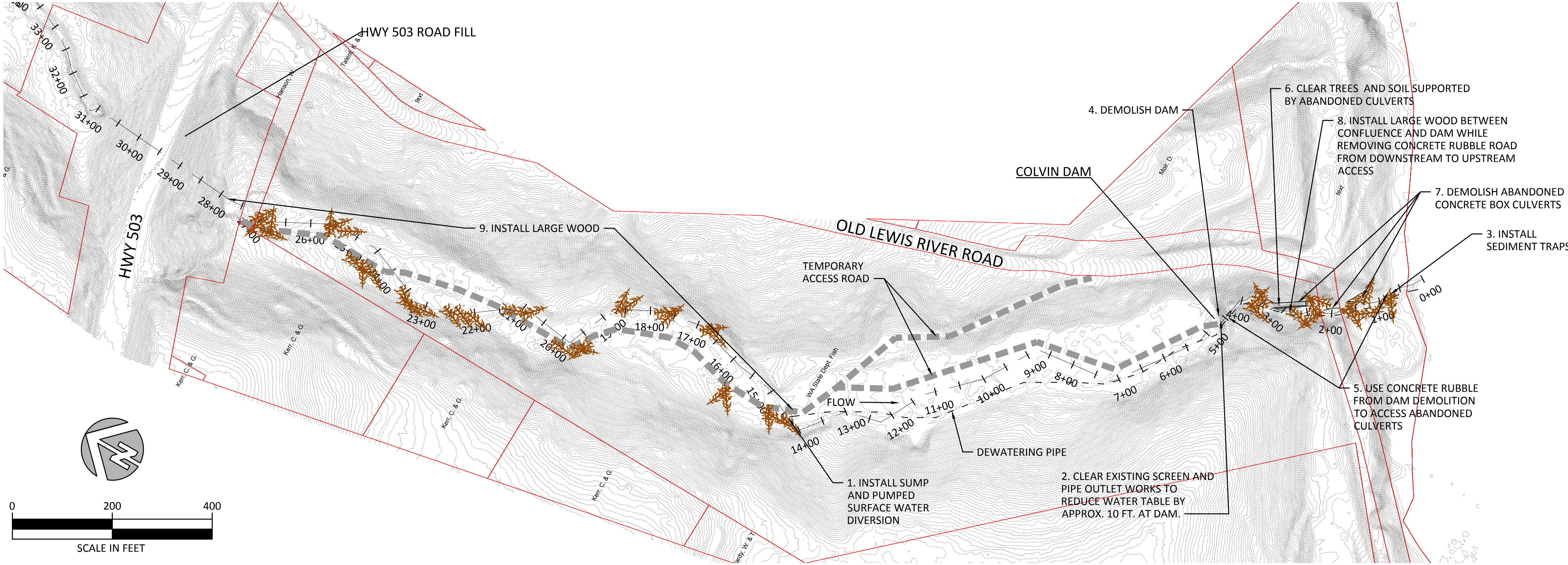
NO.	BY	DATE	REVISION DESCRIPTION			
				DF		
				DRAWN	DESIGNED	CHECKED
					5/3/16	
				APPROVED	DATE	PROJECT

COLVIN DAM REMOVAL

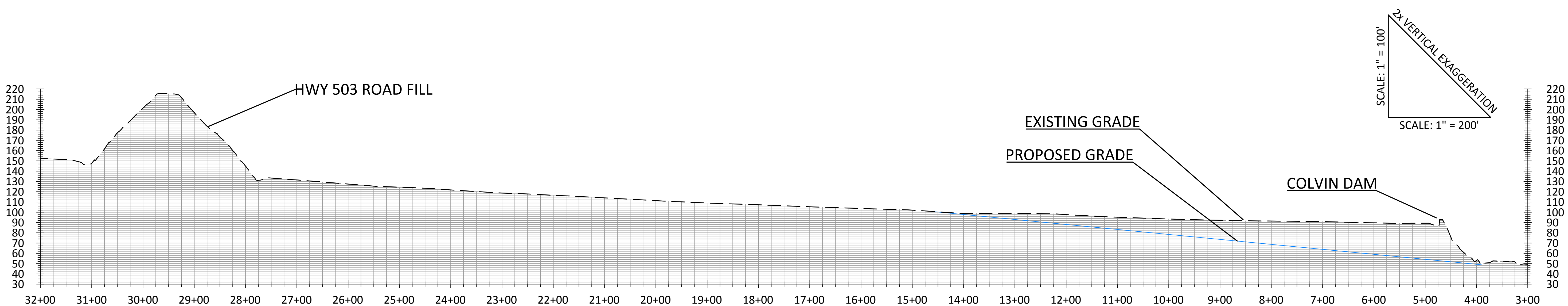
inter·fluve
501 Portway Avenue, Suite 101
Hood River, OR 97031
541.386.9003
www.interfluve.com

COVER AND PROJECT LOCATION

SHEET
1 OF 2



SITE PLAN



LONGITUDINAL PROFILE THROUGH COLVIN CREEK

NO.	BY	DATE	REVISION DESCRIPTION

DF — DRAWN | DESIGNED | CHECKED
5/3/16 — APPROVED | DATE | PROJECT

COLVIN DAM REMOVAL

inter·fluve
501 Portway Avenue, Suite 101
Hood River, OR 97031
541.386.9003
www.interfluve.com

DAM REMOVAL- - ACCESS AND STAGING

SHEET 2 OF 2