PRELIMINARY BRIDGE DESIGN AND CULVERT REMOVAL DRAWINGS AND BID SPECIFICATIONS FOR THE RESTORATION OF FISH PASSGE IN BARNABY CREEK, FERRY COUNTY, WASHINGTON

PREPARED FOR

COLVILLE CONFEDERATED TRIBES
FISH AND WILDLIFE DEPARTMENT
Nespelem, Washington

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In cooperation with:
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TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

1.0 INTRODUCTION

The Water & Natural Resource Group and its alliance contractors were retained by the Colville Confederated Tribes (CCT) Fish & Wildlife Department to prepare design drawings and specifications for design of a bridge crossing and removal specifications of a 90-inch culvert. The project site is located on Barnaby Creek, which is a tributary to the Columbia River, and is located in the eastern portion of the Colville Reservation. The project site is located within Barnaby Creek drainage, north of the town of Inchelium. The proposed project is to replace an existing culvert that is a fish passage barrier with a bridge in the lower reaches of Barnaby creek. This fish passage barrier project was identified, ranked and given a high priority in the Family Forest Fish Passage Program administered by Washington State Department of Natural Resources (DNR). Figure 1 presents a sub-basin map of the Barnaby Creek Watershed. A fish barrier is located approximately 1.5 miles upstream of the confluence with the Columbia River (Lake Roosevelt). The fish barrier is a culvert located on timber land (fee land) owned by the Abell's. As identified by the CCT Fish & Wildlife Department, the primary objective of the project is to mitigate the fish barrier to allow access to adfluvial fish to the upper tributaries of Barnaby Creek. Mitigation efforts proposed, as outlined in the enclosed design drawings consist of 1) removal of the culvert and associated fill material, and restoration of the creek through this section of creek, and 2) removal of a wooden bridge and construction of a new concrete bridge located downstream of the culvert.

The project design presented within this document offers recommended design prescriptions to achieve the objectives identified by the CCT Fish & Wildlife Department within the constraints of the available budget. For the ease of soliciting proposals by the CCT Fish & Wildlife Department for bridge construction and culvert removal, the design recommendations are provided within drawings prepared by the engineering specialists for the each segment of the project. Engineering recommendations provided within the design drawings were developed on existing prefield conditions and limited data collected specific to the project. Subsurface conditions may vary and it is the engineering teams' experience that perfecting design specifications to the 100% level is difficult, as conditions encountered during the construction phase of the project may render field modifications to the recommendations. Construction contractors should expect that field support would be provided by the design team throughout the construction process to address field recommendations and design modifications. The design team would be available to the CCT to provide this support.

The project bridge design recommendations were developed under the following assumptions outlined by the CCT:

1. The bridge is not on a public road.
2. The bridge does not provide access to a residence.
3. No emergency vehicles will be using the bridge on a regular basis.
4. The bridge may be used to haul logs as part of the landowners' forest practices.

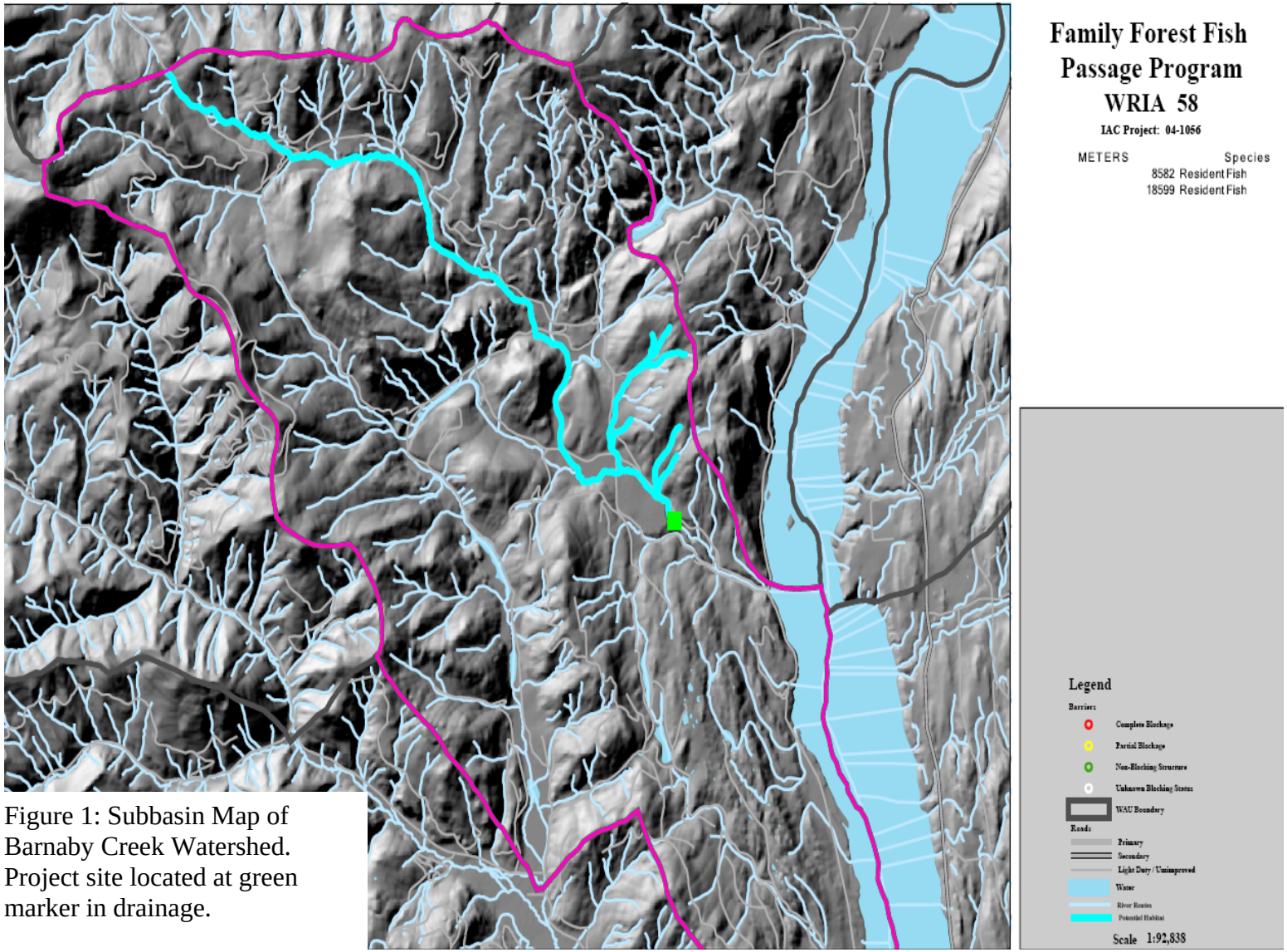

Figure 1: Subbasin Map of Barnaby Creek Watershed. Project site located at green marker in drainage.

Goals/Objectives

Barnaby Creek is a perennial tributary to the Columbia River. The Abell culvert replacement project will eliminate a fish passage barrier on Barnaby Creek which lies in the northeastern portion of the Colville Reservation. This action will provide approximately 17.5 miles of additional stream for fish access with 4.3 miles on the Reservation and the remainder on National Forest lands. Fish species that will benefit include rainbow, (redband and coastal) and eastern brook trout. The project will increase access for all life stages of these species.

A fish passage blockage, in the form of a culvert, is located within Barnaby Creek approximately 1.5 miles upstream of the confluence with the Columbia River. Figure 2 shows the elevated culvert which acts as the blockage for passage. In order to allow access for adfluvial fish to the upper portions of the watershed, the culvert needs to be removed. Access to the property across Barnaby Creek will be required by the installation of a bridge, designed under this project. Because of topography only two alternatives were feasible; bottomless culvert or bridge. Preliminary cost estimates by the CCT indicated that bridging would result in achieving the projects goals for less money. The Colville Confederated Tribe had originally proposed to install the new bridge at the current location of the culvert. However, at the request of the property owner, the new bridge location was moved approximately 200 yards down stream at the location of an existing wood bridge (figure 3). This wooden bridge will need to be removed for construction of the new concrete bridge. After inspection by the project team engineers, the enclosed recommendations for removal of the culvert and design of the bridge were proposed. Design recommendations for the Barnaby Creek Project will aid in access of the upper portions of the watershed to suitable spawning habitat for adfluvial rainbow trout.

Figure 2: Fish blockage at existing culvert located approximately 1.5 miles upstream on Barnaby Creek.

Figure 3: Existing wood bridge located at proposed bridge location. Wooden structure must be removed for installation of new bridge.

In order to complete the above outlined goals and objectives, the following tasks were completed for this project:

Task 1: Conduct an initial site inspection with the CCT representative to determine appropriate exploration methodologies for the geotechnical investigation.

Task 2: Conduct the subsurface soils investigation and complete a survey of the project areas (culvert removal area and bridge replacement area).

Task 3: Prepare a soils investigation report to include soil bearing pressure recommendations for construction of the bridge abutments.

Task 4: Provide design recommendations for the proposed bridge.

Task 5: Provide design drawings for the culvert removal program.

Introduction

The project team has organized this report to present the results of each specific task. For the ease of preparation of bidding documents to be produced by the CCT Fish & Wildlife Department, design recommendations and specifications are presented on the attached sheets within Appendices 1 though 3, which can be removed from this document and utilized in the Request for Proposal/Bid documents. Field adaptation of the designs may be required in the construction phase. The contours shown on the plans were computer generated from the elevation shots taken by Mid-Mountain Surveyors of Republic, Washington. While providing a reference the contours are not entirely accurate as the ground is very undulating and is heavily timbered throughout the area. For purposes of display the contours were generated at one (1) - foot interval.

The subject site is located in the northeast ¼ of the southwest ¼ of Section 15, Township 34 North, Range 36 East within the Barnaby Creek Drainage. The site is located within a steep incised section of the Barnaby Creek drainage forested with cedar and tamarack with some pine and fir. The general area is currently utilized as timber land, with sporadic residential housing in the area.

Task 1: Initial Site Inspection

A representative from the WNR Group conducted a preliminary site visit on November 30, 2004 with Kris Ray of the CCT Fish & Wildlife Department. The purpose of this meeting was to inspect the site conditions for access and to determine the appropriate exploration methodology for the soils investigation portion of the project. Upon review of site conditions, it was determined that utilizing a rubber tire backhoe was sufficient to conduct the field exploration program.

Access to the proposed bridge site is via a dirt logging road from the north valley wall. An existing wood bridge is currently located at the proposed bridge location, which was constructed from planks placed on boulder footing. The bridge deck is currently located approximately 4-feet above the stream.

The valley walls vary in slopes from 20 to 60 degrees and is vegetated with mostly pines and tamaracks. Soils within the drainage consists of colluvium from the bedrock outcrops and glacial deposits near the top of the slopes. Barnaby Creek is approximately 15 to 18 feet wide at the proposed bridge site, with the bank width estimated at 35 to 40 feet. The stream gradient is approximately one to two percent. The stream is incised in a fairly developed channel. The stream bed consists mostly of gravels and cobbles.

Task 2: Conduct Soils Investigation and Conduct Site Survey

The subsurface exploration program was conducted on December 17, 2004 utilizing a rubber-tire Case 580K backhoe. One test pit exploration was completed at each side of the creek where the bridge footings are proposed. The objective of the field exploration program was to gain surface and subsurface information about the soil conditions at the site. The various types of sediments, as well as the depths where characteristics of the sediments changed, are indicated on the exploration logs presented below, and within the Geotechnical Engineering Report attached in Appendix A. This information was collected in order to assist in the engineering design of the bridge.

Subsurface conditions at the project site were inferred from the observations of soil conditions within the two explorations completed at the site. The field exploration indicate that the project site is mantled by a relatively thin (0.5 to 1.0 foot) veneer of loose soil underlain by a medium dense to dense mixture of silt, sand, gravel, and cobble with boulders. The soil is interpreted as "River Alluvium".

The Fill/Topsoil in the vicinity of the site consists of a brown, damp, organic, silty sand in a generally loose condition. This material was typically encountered to a depth of approximately 1-foot below the site grade. Underlying the fill/topsoil was a medium dense to dense, moist to saturated, brown to dark brown mixture of sand, gravel, cobble, and boulders to s depth of 5.5 and 7 feet in TP-2 and TP-1, respectively. Medium dense to very dense silt with gravel was encountered below these granular sediments. The granular sediments are interpreted to be alluvial deposits.

Groundwater seepage was encountered at a depth of approximately 3.5 feet in TP-2 (northeast side of creek). Groundwater conditions will vary dependant on the soil grain size, topography, precipitation, and season. The groundwater conditions at the site should be expected to vary in response to land use and soil conditions, and should be further evaluated at the time of bridge construction.

The existing culvert and proposed bridge locations were also surveyed by Mid-Mountain Surveyors of Republic, Washington. At the culvert location, four cross sections, and a stream profile survey was completed in order to assist with the culvert removal design recommendations. At the proposed bridge location, a plan survey of existing road and bridge locations was completed. In addition, a topographic survey in the vicinity of the proposed bridge location was completed. Survey data was incorporated into the culvert removal, and bridge design plan sheets. Raw survey data is on file at our office.

TABLE 1:
TEST PIT LOGS

TP-1: Located on south side of creek where center-line of new bridge is located.
Note: depth measurements taken at southern TP wall.

Depth (ft)	Soil Description
0 – 1.0	Loose to Medium Dense, Brown, damp, silty SAND with organics and old wood debris (from old bridge). (FILL)
1.0 – 4.0	Dense, brown, moist, cobbly Sand (med-crse) with trace silt, some boulders.
4.0 – 5.5	Dense to Very Dense, brown, moist to wet, cobbly coarse SAND, with some boulders 1 to 2 feet in diameter (see photo 3).
5.5 – 7.0	Same as above, boulders becoming more abundant. Much harder to excavate.
7.0 – 7.5	Dense to Very Dense, dark gray, damp, SILT with trace gravel and sand.
7.5	Very Dense, dark gray, damp, Silt with some gravel and trace sand (HardPan).

TP-2: Located on north side of existing Bridge approximately 10-feet from structure.
Note: depth measurements taken from west side of exploration.

Depth (ft)	Soil Description
0 – 0.5	Loose to Medium Dense, Brown, damp, silty SAND with (Topsoil)
0.5 – 2.5	Medium Dense, moist, brown SAND with some silt and gravel. Roots extending down to 1.5 feet.
2.5 – 5.0	Medium Dense to dense, wet, dark brown, gravelly SAND, with cobbles. Gravels increase with depth and becomes a sandy Gravel. Water seeping into excavation below 3.5 feet. Sidewalls caving below 4 feet.
5.0 – 5.5	Dense, saturated, sandy GRAVEL with some cobbles.
5.5 – 7.5	Medium dense to dense, moist, tannish SILT with sand and gravel grading to a wet to saturated, brown to tan, dense, silty Sand with gravel and cobbles. Some thin gravelly sand lenses which are more saturated. Excavation becoming "sloppy" and caving below 4- feet once water begins seeping from sidewalls.

Task 3: Prepare Soils Investigation Report

An experienced geotechnical engineer from AESI reviewed the data collected from the field investigation and the survey. A Geotechnical Engineering Report specific to the Barnaby Creek Bridge site was prepared for use in the CCT bidding documents. This report is presented in Appendix A and should be used in conjunction with the bridge engineering recommendations drawing presented in Appendix B.

Task 4: Provide Design Recommendations Bridge

John Griffen, P.E., a structural engineer was retained to provide bridge design specifications. An initial evaluation of bridge types was conducted by Mr. Griffen to provide recommendations for a bridge crossing over Barnaby Creek. The project bridge design recommendations were developed under the following assumptions outlined by the CCT:

1. The bridge is not on a public road.
2. The bridge does not provide access to a residence.
3. No emergency vehicles will be using the bridge on a regular basis.
4. The bridge may be used to haul logs as part of the landowners' forest practices

Several Bridge type structures were evaluated and reviewed for the project. These consisted of concrete and metal type bridges for the crossing. The structural engineering evaluation narrowed the bridge selection to two preferred alternatives: 1) precast, prestressed concrete bridge structure, or 2) steel bridge from used rail cars. Although the initial evaluation determined that the initial construction cost would be less for the steel bridge made from rail car, the long range maintenance costs would offset the initial cost savings. Therefore, a prestressed concrete bridge was identified as the most feasible alternative for the site. Specifications for the bridge are presented in Sheets C1 and S1, enclosed in Appendix B.

The precast, prestressed concrete bridge shown on the engineered drawings is based on a tri-deck section fabricated by Central Pre-Mix Prestress Company of Spokane, Washington (contact information presented below). Cost estimates presented below are based on the specifications provided within the engineered drawings and from conversations held by the structural engineer with representatives of Central Pre-Mix. A final cost estimate can be developed after submittal of a complete set of drawings and calculations stamped by a structural engineer to the bridge fabrication company. These drawings should be provided by the installation contractor. The bridge fabrication company will then be required to submit a set of shop drawings to the structural engineer for approval prior to fabrication. Fabrication of the bridge should take approximately 4 to 8 weeks. The CCT will also be required to have the proposed bridge surveyed and staked in accordance with the bridge specifications on sheet C1. The installation contractor should also have the site inspected by the geotechnical engineer immediately after site preparation for the installation of the bridge. The following table lists the approximate costs on elements that will be required for the installation of the bridge.

Task	Estimated Cost
Bridge and Footing Fabrication (1)	$50,000 to $60,000
Structural Engineer review of shop plans	$2,000-$2,500
Geotechnical Inspection of site preparation	$3,000-$3,500
Surveyor to stake in bridge design	$1,200 - $1,800
Site preparation by Installation Contractor	To be bid by CCT

Note (1): estimate from preliminary conversations with Central Pre-Mix Prestress Company, 922 N. Carnahan, Spokane, Washington, 99212.
Contact: Chuck Prussack, VP-Engineering, (509) 533-0262.

Task 5: Provide Culvert Removal Design Drawings and Specifications

As part of the Barnaby Creek Bridge Replacement project an existing 90" corrugated steel pipe is being removed to facilitate fish passage. Don Phelps, P.E., a water resource engineer visited the site and prepared the recommendations for the culvert removal. Approximately 1100 cubic yards of fill material will be removed from the stream crossing and the bed of the stream will be restored to its original grade and alignment as shown on the construction drawings in Appendix C (Sheet 1 and 2). The removed material will be utilized in building the approach fills for the new bridge or disposed of outside the high water mark of the stream.

The new stream banks created from the removal of the fill material, and any disposal areas that are created, will be stabilized and seeded with a native seed mix in accordance with the recommendations of the CCT Fish & Wildlife Department. This reseeding should also occur on any disturbed areas as a result of the replacement, such as the bridge approaches.

Cost estimates to remove the culvert and restore the creek will be solicited by the CCT Fish & Wildlife Department.

4.0 LIMITATIONS

This report presents proposed recommendations from a team of several distinctive engineering experts who have provided recommendations for two phases of the project: 1) bridge design, and 2) culvert removal. Geotechnical engineering recommendations utilized for bridge design were conducted by Bruce Blyton, P.E., of Associated Earth Science, Inc. (AESI). Specifications for the bridge design were provided by a structural engineer, Mr. John D. Griffen Engineers, Inc. of Kirkland, Washington. Mr. Don Phelps, P.E., a surface water engineer provided recommendations for the culvert removal and stream restoration. These engineering recommendations are presented from their respective firms and recommendations are provide under their respective Washington State Engineering licenses. Design recommendations are provided within the constraints of the contract and limitations of budget. This project was undertaken due to a fish blockage caused by a culvert located approximately 1.5 miles up Barnaby Creek. The WNR Group acted as a project manager to coordinate the different tasks required for completion of this project. The WNR Group does not warrant any recommendations provided by the specialists subcontracted for this project.

The WNR Group appreciates the opportunity in assisting the CCT with this project. If you have any questions regarding the design recommendations or other aspects of this project, please contact Mr. Gene St.Godard at 509-953-9395.

Very truly yours,

Water & Natural Resource Group

Eugene N.J. St.Godard, R.G., L.Hg.
Principal Hydrogeologist

APPENDIX A

GEOTECHNCIAL SOILS REPORT
(prepared by AESI, 4/13/05, 22 pages)

APPENDIX B

BRIDGE DESIGN DRAWINGS and SPECIFICATIONS
(completed by John Griffen, PE)
Design Calculations: 5 pages
Topographic Drawing
Sheet C-1: Site Plan
Sheet S-1: Bridge Plans and Details

APPENDIX C

CULVERT REMOVAL PLANS AND SPECIFICATIONS (prepared by Don Phelps, P.E.)
Sheet 1 of 2
Sheet 2 of 2