Driscoll Island Cold Water Refuge

Preliminary Design Report

Cascade Columbia Fisheries Enhancement Group

May, 2013

Pacific Hydraulic Engineers & Scientists, PLLC
P.O. Box 722, Vashon, WA 98070 *206.799.4801* *ezapel@pacificengineers.com*

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Funded by:

Salmon Recovery Funding Board

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P.O. Box 722, Vashon, WA 98070 206.799.4801 ezapel@pacificengineers.com

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Pacific Hydraulic Engineers & Scientists, PLLC
P.O. Box 722, Vashon, WA 98070 206.799.4801 ezapel@pacificengineers.com

Project Introduction and Objectives

Introduction and Project Objectives

The Driscoll Island Cold Water Refuge project is located on Driscoll Island, a property owned and managed by the Washington Department of Fish & Wildlife (WDFW) in the Oroville, Washington area. Purchased in 1974, with Pittman-Robertson Federal Aid funds, the 260-acre Driscoll Island Wildlife Area became the focal point of Canada goose management in the Oroville area. Since the arrival of Europeans, Driscoll and Eyhott Islands have been farmed and/or grazed. Prior to the Europeans, the islands were inhabited by Native Americans for camping and gathering of such foods as freshwater mussels and fish. Dan Driscoll first settled on Driscoll Island in 1869; in fact one of the cabins he built is still standing on the island. Public access is available as the Island is used as a hunting area and as wildlife habitat, with a substantial portion of the property leased for agricultural hay production, which is consistent with its historical use.

With funding provided by the Salmon Recovery Funding Board, the Driscoll Island Cold Water Refuge project proposes to address factors, such as decreased habitat refuge, loss of habitat diversity, and elevated water temperatures that have inhibited the productivity of juvenile salmonids within the Similkameen and Okanogan Rivers. The project intent is to develop historical meander bend channels on Driscoll Island into hydraulically connected thermal refuge channels for juvenile salmonids produced in the local reaches of the Similkameen and Okanogan Rivers during the summer. Chinook salmon spawn in the Okanogan and Similkameen Rivers and steelhead spawn in their tributary streams near Driscoll Island. These fish emerge from the stream gravels in spring, with summer Chinook juveniles rearing for several months prior to outmigration in that same year, and steelhead rearing entirely through the summer and winter until the following spring (or beyond) prior to outmigration. Some rearing occurs within the Driscoll Island reach. However, water temperatures in the mainstem channels regularly rise above the lethal limit for salmonids for several weeks during summer, creating conditions for very poor survival of these fish[1]. By tapping the groundwater table beneath Driscoll Island and feeding one or more, small, cool flowing channels during summer, the project hopes to provide a thermal refuge for salmonids until fall when the mainstem water temperatures cool.

The Driscoll Island site was identified as an ideal location for such experimental cool water refuge channels due to the presence of spawning adult salmonids, a relatively large land base owned by the WDFW, and the projects consistency with WDFW's mission and goals as outlined in the Driscoll Island Wildlife Area Plan.t. The site is also advantageous, since the groundwater resource in the Oroville area had already been identified by the Colville Confederated Tribe (CCT) as a valuable cool-water resource that might be tapped to improve fish survival. The Study was to focus on identification of potential

[1] Washington Department of Ecology, 2011. Columbia River Instream Atlas Project, Washington Department of Fish and Wildlife, Final Report – Appendix G WRIA 49 Okanogan. Olympia, WA.

Pacific Hydraulic Engineers & Scientists, PLLC
P.O. Box 722, Vashon, WA 98070 206.799.4801 ezapel@pacificengineers.com

channel alignments, deploy groundwater observation and monitoring equipment, and develop preliminary designs and construction cost estimates for implementation. Two potential channels on Driscoll Island were identified as part of this study, and groundwater availability and thermal quality were evaluated through a one-year observation period. Both of the channels occupy relict meander bends, and both could provide several thousand linear feet of cool-water habitat for native juvenile fish.

Existing Conditions and Geologic Setting

Driscoll Island is a land feature located near Oroville, Washington at the confluence of the Okanogan and Similkameen Rivers. It forms an isolated separation between the channels of the two rivers upstream of their confluence, and is located at the downstream end of Lake Osoyoos, a glacial remnant lake at the south end of the Okanogan valley spanning the border between the United States and Canada. The Island is formed by a connecting channel between the Similkameen River to the west and Okanogan River to the east, and the final junction of the two main channels of the rivers several miles downstream. The Island is wholly located within the historical channel migration zone of the Okanogan River, and there is abundant landform evidence that the channel has passed back and forth through the island over millennia since the last glaciation retreated, leaving old relic meander bends on the surface of Driscoll Island (Figure 1). The valley foundation is evidently comprised of bedrock overlain by alluvium deposited by the two rivers and continuously reworked by geomorphic processes. Channel gradients is fairly flat for about 20 river miles downstream of Lake Osoyoos, then steepens at what is presumably a historical glacial moraine deposit or bedrock lens to continue flowing to the south to join the Columbia River near Brewster, Washington.

As a result of the historical channel migration and reworking of alluvial deposits, Driscoll Island is underlain by highly permeable sand, gravel, and silt deposits that provide abundant groundwater[2]. This project is intended to take advantage of this groundwater resource to provide an over-summer thermal refuge to juvenile salmonids emerging from spawning grounds in and around Driscoll Island in both the Okanogan and Similkameen Rivers. The main flow in the Okanogan and Similkameen Rivers rises to relatively high temperatures during summer, typically in excess of the lethal limit for salmonids. Thermal refuge is in short supply in this reach of the Okanogan River system, as most side tributaries dry up in summer and the lack of groundwater inflow from the valley-forming bedrock mountain ranges is insignificant. The groundwater aquifer beneath Driscoll Island is likely charged by outflows from the Lake Osoyoos water table and perhaps additional subsurface flow from the Similkameen River to the west. The cooling effect of the alluvial deposits is significant, as documented in this study and in others by Colville Tribal staff and the Washington Department of Fish & Wildlife and the Washington Department of Ecology (WADOE).

[2] Montgomery Water Group, et. al. 1995. Initial Watershed Assessment Water Resources Inventory Area 49 Okanogan River Watershed, open File Report 95-14. Kirkland, WA.

Pacific Hydraulic Engineers & Scientists, PLLC
P.O. Box 722, Vashon, WA 98070 206.799.4801 ezapel@pacificengineers.com

Project Scope

This project is intended to support the objectives of the Colville Tribes and the WDFW in re-establishing or enhancing juvenile salmonid over-summering habitat and to provide refuge during high flow periods. The Okanogan River mainstem is limited in available cool-water habitat for juvenile and adult salmonids during the mid- to late-summer periods following the snowmelt freshet. As a result, salmonid fry survival is low within this Oroville reach relative to tributary habitat areas and to other reaches of the Okanogan where localized cool groundwater or surface water inputs are available. In reaches such as the Oroville section of the river where there are no cool-water tributary streams into which juvenile fish can escape, entire age cohorts can be lost in many years as the water warms above the lethal limit for salmonids (~20^{o}C).

The scope of this project includes the following major tasks:

- Groundwater Data Collection – including groundwater level & temperature over a one-year period from April 2012 to June 2013 to determine groundwater availability and characteristics
- Preliminary Refuge Channel Design – for either gravity flow or pumped flow conditions
- Groundwater Delivery System Design – for either gravity flow or pumped flow conditions
- Feasibility Refuge Channel Design – for preferred groundwater delivery system

A scoping and project kick-off meeting, and two design summary meetings mid-way through the design project were included in the scope, though not specified in the list above.

Project Schedule

The project commenced in April 2012, and is expected to carry forward through June 2013. Major tasks and expected completion dates are listed below.

- Groundwater Data Collection – Initiated April 2012, completed June 2013
- Preliminary Refuge Channel Design – initiate following spring freshet and high river flows, after first groundwater data download occurs (between June and August 2012), completed following second groundwater data download at the end of summer low flow (between August and October 2012)
- Groundwater Delivery System Design – initiate following second data download at end of summer low flow, completed January 2013
- Feasibility Refuge Channel Design – initiate following selection of preferred groundwater delivery system design (January 2013) after third groundwater data download in mid-winter low flow period, completed before spring freshet (about April 2013)

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P.O. Box 722, Vashon, WA 98070 206.799.4801 ezapel@pacificengineers.com

Data Collection

Topographic Survey Data

A variety of sources were utilized to develop survey mapping for Driscoll Island and the Okanogan and Similkameen River channels, including LiDAR, ground surveys, and aerial photogrammetric images.. The mapping data shown in the Conceptual Design drawing was developed from previous topographic survey and aerial photographic mapping by Erlandsen Associates for the Cascade Columbia Fisheries Enhancement Group (CCFEG) prior to this particular study. In addition, a level survey was conducted of the approximate alignments of the proposed channels to verify existing aerial topographic survey mapping data.

Groundwater Data Collection – Pump Drawdown Tests

Pump drawdown tests were conducted by PHES, CCFEG and CCT staff in two locations on 3 May 2011, one each near the downstream ends of the two proposed channels. Test pits approximately 15 feet long x 5 feet wide were excavated using a backhoe, and a 3" trash pump was used to evacuate flow from the pits. Measurement of flow rate was accomplished using trash cans of a known volume (approximately 35 gallons), filled over a recorded time period (1 minute) with water drawn from the test pit. The recharge rate was estimated by recording the recovery time of the groundwater surface in the test pit to its former elevation and dividing the total pumped volume by recovery time. Each test was repeated at least three times to ensure reasonable repeatability and to provide an average recharge rate. These repeated results were averaged and then extrapolated roughly to provide an estimated groundwater inflow to the proposed refuge channels per linear foot of channel length. Field observation data from the pump tests are provided in Table 1 below.

Table 1

Field Pump Drawdown Tests – Driscoll Island habitat channels (5/3/2011)

Channel & Test Pit Number	Test Number	Infill rate (gallons/time)	Calculated Infill Rate (gal/min)	Perimeter (ft)
East – Test Pit #1	1	150 gal/6:47 min	22.1 gpm	38 ft
	2	220 gal/9:09 min	24.0 gpm	38 ft
	3	220 gal/10:25 min	21.1 gpm	38 ft
	4	235 gal/9:15 min	25.4 gpm	38 ft
		Average Refill Rate (gpm/linear ft)	**0.6 gpm/lf**	
West – Test Pit #2	1	325 gal/9:32 min	34.1 gpm	32 ft
	2	315 gal/9:18 min	33.9 gpm	32 ft
	3	435 gal/12:50 min	33.9 gpm	32 ft
		Average Refill Rate (gpm/linear ft)	**1.1 gpm/lf**	

Results showed that recharge rate in Channel 2 (East) average about 0.6 gallons per minute per linear foot of perimeter. Recharge rate in Channel 1 (West) average about 1.1 gallons per minute per linear

Pacific Hydraulic Engineers & Scientists, PLLC
P.O. Box 722, Vashon, WA 98070 206.799.4801 ezapel@pacificengineers.com

foot of perimeter. For conservative design purposes, we have assumed a groundwater delivery rate not in excess of 0.5 gpm per linear foot for both channels.

Groundwater Data Collection – Groundwater Level Recorders

Groundwater availability and characteristics were determined using several temporary groundwater monitoring wells installed along the proposed alignments of each of the two refuge channel options (Channel 1 West, and Channel 2 East), and in existing well casings used for irrigation. Groundwater level and temperature were recorded using data loggers installed in these wells (See Figure 2 for data logger locations). We recognize that data loggers installed in existing wells will not record a continuous data set reflective of the actual groundwater surface, as pumping operations will draw down the phreatic surface in the groundwater aquifer in the vicinity of the wells.

The Colville Confederated Tribes' Fish & Wildlife Department provided four Global Water Systems data loggers for use on this project. In addition, PHES provided six ONSET water level and temperature recorders on a leased basis to this project. Data loggers were not available for installation at the time of the April 20 well head installation, and instead were installed on May 10 after they became available. The data loggers provide continuous water level records by measuring the pressure at the instrument created by the water column depth above the instrument and the ambient atmospheric pressure. Water levels are calculated by correcting for ambient atmospheric pressure (obtained from weather records for the Oroville and Omak airports over the monitoring period), and correlating the pressure reading to the elevation of the fixed monitoring wellhead and the depth of the instrument below the wellhead.

Water level records from the data loggers were corrected to a common arbitrary datum correlated with the Okanogan River channel at the existing ford crossing on the northeast corner of Driscoll Island. The continuous recording water level monitoring data loggers showed that the groundwater level varies with the water levels on the Okanogan and Similkameen River channels which bound Driscoll Island on the east and west (Groundwater Data Plots 1 through 3). Groundwater elevations roughly track the river levels with very little lag time (though the very gradual rise and fall of the river water levels make it difficult to establish precise correlative information). In Channel 1 (West), it appears that the net north-south groundwater gradient develops quite quickly once Similkameen flows decline but prior to the rise in Similkameen River water temperatures (GW Data Plot 2 and 4). In Channel 2 (East), there appears to be less positive north-south groundwater gradient (GW Data Plot 3), though there does appear to be a small, but useful net north-south gradient developing as Okanogan River temperatures begin to rise (GW Data Plots 3 and 4).

Also, the data loggers demonstrated that the groundwater supply generally remained cool; at least several degrees (Celsius) lower than the surface flow in either of the rivers. For example, when the Okanogan River water temperature was running 20.0 to 21.0 degrees Celsius, the groundwater temperature generally did not exceed 14 degrees Celsius (Groundwater Data Plot 4). One exception to this characteristic was noted at groundwater well GW 4 at the upstream end of Channel 2, though this may be an artifact of the very open and unshaded location of the monitoring well, which was made of black ABS pipe subject to considerable solar gain which may have elevated the water temperature inside

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P.O. Box 722, Vashon, WA 98070 206.799.4801 ezapel@pacificengineers.com

the well head. In the other well locations, the well heads were generally shaded, and the groundwater temperature was not nearly as high as the adjacent river channel. At the time of the August 2012 data downloads, groundwater well heads GW 2, GW 3, and GW 5 were not accessible due to high groundwater levels and submerged well heads. Also, the data logger in the GW 5 well was discovered to have been damaged and data could not be retrieved during the October 2012 data download.

Surface Water Data Collection – USGS Discharge and Stage Data

Spot observations of groundwater levels prior to and during the spring freshet show that there is a net groundwater table gradient coincident with the water surface profile in the Okanogan River channel to the east (See Data Plots 1 and 2 below), but the gradient reverses to the west following the decline of the Similkameen River flows. These spot observations also show that there is generally a groundwater gradient from east to west, toward the Similkameen River channel (See Data Plots 3 and 4). Groundwater well data also show that the groundwater levels in both potential channels track the river water levels closely.

USGS gage data for the observation dates show the following data:

Table 2
Okanogan River and Similkameen River flows

Date	Okanogan River Discharge (cfs)	Similkameen River Discharge (cfs)
20 April, 2012	~2,000*	2,000
9 August, 2012	1,120	1,500
30 October, 2012	<700**	1,080

*Backwater effects from Similkameen River affect gage reading
**USGS gage data not available

The net gradient toward the Okanogan River appears to be present during the freshet, even though the backwater effect of the Similkameen River on the Okanogan River gage is not a factor at Similkameen flows less than about 1,500 cfs. However, this net gradient appears to reverse following the freshet.

Since it appears groundwater gradients roughly track the average slope of the Okanogan River channel and Similkameen River water surfaces, we expect that groundwater will flow from upstream to downstream in both channels. However, the rate of flow will be a function of the refuge channel hydraulic roughness and the gradient available. More detailed examination of potential surface water gradients through the length of both channels following the 30 October 2012 and 5 June 2013 data downloads showed that the groundwater gradient in the East channel is less than that in the West channel during the warmest period of the summer, in fact there appears to be little positive gradient toward the Okanogan River channel in the east channel. Groundwater data suggests that the East channel will require either supplemented water from the established wells to develop adequate gradient to flow to the Okanogan River or an upstream (north end of Driscoll Island) infiltration gallery and buried delivery pipeline. However, the West channel will likely flow readily with strong gradient toward the Similkameen River.

Pacific Hydraulic Engineers & Scientists, PLLC
P.O. Box 722, Vashon, WA 98070 206.799.4801 ezapel@pacificengineers.com

Conceptual Design

Design Criteria

The following channel design criteria were assumed for purposes of this study.

- Refuge habitat water temperature maximum 20°C
- Gravity delivery of groundwater flow preferred
- Refuge must be available at all times either or both the Similkameen or Okanogan River water temperatures exceed 20°C
- Refuge must be accessible to juvenile salmonids emerging from the Similkameen or Okanogan Rivers
- Constructed refuge channel/s must provide for low maintenance in future
- Constructed refuge channel/s must persist well into the future and will not infill with sediment to the extent that its performance is hindered for the life of the project (up to 20 years)

Conceptual Design Alternatives

Conceptual design alternatives were fairly well defined at the outset of this study, as the project goals and objectives had previously been defined; to provide cool groundwater accessible to the Similkameen and Okanogan River channels in the proximity of Driscoll Island. However, the major unknown parameters included the availability of groundwater, the character of the groundwater that is available, and the means of delivery of this groundwater to the Okanogan and Similkameen Rivers or tributaries.

Alternative 1 was comprised of constructing small tributary channels to both the Okanogan and Similkameen Rivers emanating from Driscoll Island and fed by groundwater. This alternative would utilize either gravity collection of groundwater by exfiltration, or pumped extraction and delivery of this water to the tributary channels. A key data gap for this alternative was the available gravity gradient from upstream to downstream in these small tributary channels, and the sustainable exfiltration rate at which these channels could be fed by gravity. Detailed drawings were not produced for this alternative, given that the ability to deliver groundwater via pipeline to either river channel at virtually any location desired.

Alternative 2 was comprised of delivery of groundwater directly to the Okanogan and Similkameen Rivers from the groundwater table within Driscoll Island. This alternative would utilize either pumped extraction of groundwater from Driscoll Island, or gravity extraction using up-gradient infiltration galleries and gravity pipeline to the discharge point or points. A key data gap for this alternative was the maximum sustainable groundwater extraction rate at which flow could be withdrawn from the resource without exhausting the available water or raising its temperature through increased infiltration of surface water surrounding Driscoll Island. The necessary dilution required toreduce the average water temperatures in either the Similkameen or the Okanogan River channels, given the typical flow rates in

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P.O. Box 722, Vashon, WA 98070 206.799.4801 ezapel@pacificengineers.com

those channels, had not yet been established. Conceptual drawings of Alternative 2 (Figures 3 and 4) were developed to illustrate the layout and typical configuration of the refuge channel.

Alternative Selection

An alternatives selection and data presentation meeting was held with the WDFW and CCFEG at the Winthrop field office of WDFW on 27 February 2013. Groundwater data collected over the course of the previous year were presented to show that the groundwater availability and characteristics were suitable for development of the resource to meet the basic project objectives. The groundwater data also showed that groundwater gradients were favorable to the development of Alternative 2. Recommendations for further development of the Alternative 2 concept were made, and stakeholders expressed support for further investigation, with some additional details and clarifications. Specifically, the meeting provided the following questions or comments regarding the development of refuge channels on Driscoll Island.

1. Beavers may attempt to colonize the habitat channels, rendering them potentially ineffective
2. Long term maintenance must be minimal
3. The groundwater extracted by these channels must not adversely impact irrigation water availability on the Island
4. The presence of these channels must not adversely impact the sharecropper's operations on Driscoll Island
5. The excavated soil from these channels must be contained or treated to reduce or eliminate the transmission of weeds into agricultural areas of the Island
6. The habitat channels must not infill with fine sediment excessively or rapidly over time
7. Habitat channels should not subject juvenile fish to inordinate or excessive predation by birds or mammals
8. Deposition and treatment of excavated spoils are a concern, given the large volume expected
9. Slope stability of the habitat channel must be ensured, perhaps using vegetation and structural measures
10. The habitat channels must not result in conversion of current agricultural land to other uses

Each of these concerns was discussed[3] and approaches to resolve them were suggested and informal responses to these comments and concerns were provided[4]. The group generally agreed with the recommendation to carry Alternative 2 forward to preliminary design once these issues were addressed.

[3] Washington Department of Fish & Wildlife, 2013. Okanogan District Team Meeting Agenda and Meeting Notes. Winthrop, Washington, February 27, 2013.

[4] PHES & CCFEG, 2013. Memorandum For Record: Driscoll Island Refugia Channel Design – Responses to WDFW Comments from Presentation 27 February 2013. Leavenworth, Washington, March 11, 2013.

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Subsequent discussions with WDFW staff led to a recommendation by CCFEG to implement a pilot project on the west channel only to evaluate the viability of the measures determined necessary to determine viability of the conceptual design. WDFW later provided formal comments via letter to CCFEG[5]. In particular, the following responses to WDFW's formal comments are generally summarized below:

- Property conversion – The proposed project does not anticipate any change to current use of the lands on Driscoll Island. The proposed channels are located on areas currently not in agricultural use which are apparently too wet and soft for hay production. Hunting activity could be enhanced with construction of the proposed channels if waterfowl are attracted to the open water areas.
- Excavated materials – The proposed design has been modified since WDFW's review to move spoil areas to locations not currently under agricultural production. The total impact areas have been reduced by creating higher berms and narrowing the footprint of spoil piles. In addition, a proposed pilot project approach as described in the 'Recommendations' section below would create only a small length of the west channel only, in order to evaluate weed management measures and channel performance. The CCFEG intends to take an active management role in limiting harmful weed growth and establishing planting schemes that enhance, rather than detract from desirable vegetative cover.
- Impacts on current irrigation and sharecropper – The CCFEG does not at this time recommend using well water to support the refuge channel flow. If this is proposed at some time in the future, this issue will be addressed.
- Predation - With regard to predation, CCFEG and other WDFW staff also recognized that, even though predation losses may occur in these channels, their presence would enhance survival of juvenile salmonids in this reach regardless, since water temperatures are almost always lethal currently in the summer, and any available cool water habitat will increase survival in spite of potential predation losses. In addition, the increased diversity of fauna provided or encouraged by the development of these internal channels on Driscoll Island will be a net positive impact on wildlife resources for the Island.
- Beaver activity - Though beaver activity is inevitable, it is not clear that they would attempt to dam the refuge channels. Since the refuge channels would be at groundwater level, and would rely on natural infiltration of that groundwater to generate any positive current downstream, any adverse gradient generated by a dam or even partial blockage would result in exfiltration of flow back into the groundwater table. Without a positive gradient in the downstream direction in response to a dam or other structure creating head drop over a very short distance, it is not clear that beavers would instinctually attempt to build a dam. Rather it is more likely they would utilize the channel for transportation to and from food sources obtained from riparian vegetation.

[5] Washington Department of Fish & Wildlife, 2013. Driscoll Island Cold Water Refugia Project, Similkameen River, Okanogan Subbasin, April 19, 2013.

- Project longevity and maintenance requirements – The proposed project has been designed to require minimal maintenance until vegetation has been established. In addition, stability of channel banks has been addressed in the design through the use of cottonwood toe logs, soil stabilizing cover fabric (jute) that will decompose once root structure of riparian plantings becomes established. The cottonwood toe logs will sprout and host the growth of multiple fast-growing cottonwood trees alongside the channel.
-

Preliminary Design

Preliminary design of the proposed refuge channels includes a plan layout of two channels; Channel 1 West, and Channel 2 East, typical cross sections showing construction of the channel work, a longitudinal profile through the length of each channel (up to the terminus of Phase 1 work only), and any phasing of construction that might be advantageous. As discussed above, pump tests conducted in 2011 demonstrated that the groundwater table on Driscoll Island is extensive, recharge occurs rapidly, and groundwater flow rates are high. In addition, observations from the groundwater level data loggers show that the groundwater level on the Island is closely correlated with the water levels in the adjacent Okanogan River channel on the east side of the Island and the Similkameen River channel on the west side of the Island. Groundwater well data and river stage gage data also show that a good positive gradient is available from north to south on Driscoll Island, roughly corresponding to the natural fall of the Okanogan River channel, which runs along the east side of Driscoll Island.

Sheet 2 of the Preliminary Design Drawings illustrates the proposed channel locations and alignments. Preliminary design of the channel assumes an inflow rate of approximately 5 gallons per minute per 10 linear feet of channel (conservatively lower than observed recharge rate), and a channel profile roughly approximating the existing river water surface profile in the Okanogan River channel. Initial estimates of channel configuration for both channels suggests that a 4 to 5 foot bottom width and 6 to 18 inch depth would be adequate to develop maximum groundwater inflow while maintaining sufficient surface gradient to force flow through the length of the channels. Based on soil composition determined during the test pit excavation for the pump tests, constructed channel side slopes should not exceed 1V:3H without structural support. In addition, extensive plantings of the slopes will be required for stabilization and to provide shade for the groundwater channel water volume.

We assumed for the preliminary design that Channel 1 would be constructed in two phases, with the first phase channel about 1160 feet long, and the second phase channel extending another 930 feet upstream, if the first phase proves successful. Similarly, we assumed that Channel 2 would be constructed in two phases, with the first phase channel about 650 feet long, and the second phase channel extending another 490 feet upstream if the first phase is successful as designed. These dimensions might provide as much as 23 cfs flow rate at the confluence of Channel 1 with the Similkameen following completion of the first phase channel, and about 7.3 cfs flow rate at the confluence of Channel 2 with the Okanogan River following completion of the first phase channel. Flow rate will increase when the second phase of both channels is constructed, though likely not linearly with

Pacific Hydraulic Engineers & Scientists, PLLC
P.O. Box 722, Vashon, WA 98070 206.799.4801 ezapel@pacificengineers.com

the additional channel length. Design calculations assume a preliminary Manning's channel roughness factor of about 0.030 for the bed and 0.050 for the riparian planting areas on the banks.

A typical plan and profile view of the Channel 1 is shown in Sheet 3, with the proposed first and second phases of construction indicated by red and magenta shading, respectively. Sheet 4 shows several typical channel cross sections, and Sheet 5 shows proposed spoil area footprint for excavated soil from the channel. A typical plan and profile view of Channel 2 is similarly illustrated on Sheet 6, with typical sections on Sheet 7 and excavation spoil areas on Sheet 8.

The Preliminary Design assumes that the downstream portion of these channels would be constructed as simply and inexpensively as possible in the first phase of implementation. No materials would be transported off-site, and all excavated materials would be spoiled as near the work are as practical. Excavated materials will be isolated from actively managed leased agricultural land on Driscoll Island to reduce opportunity for weed growth and optimize weed management activities. Spoils will be spread in low berms immediately adjacent to the excavated channels on one side of the channel to the extent practical, leaving the opposite channel bank more accessible to foot and vehicle traffic.

In the first phase of implementation, both channels would be constructed in such a way as to rely entirely on gravity flow to collect and move groundwater downstream to their confluence with the Similkameen and Okanogan Rivers. In the first season of operation or perhaps two, the performance of this design can be evaluated, and design changes to the second phase channel implementation can be made in an adaptive design process. Given the lower net apparent groundwater gradient in Channel 2 (East), we expect that it may be necessary to supplement flow either with pumped flow from the large agricultural well located between Channel 1 and Channel 2. A distribution irrigation pipeline crosses Channel 2 just north of the end of the proposed first phase implementation terminus (highlighted on Sheet 6), and it may be possible to simply connect a flow supply line directly to that existing distribution pipeline. Alternatively, WDFW engineers have suggested that an infiltration gallery might be constructed to the north of the proposed upstream terminus of the second phase implementation of Channel 2 and the collected flow pressurized to a very low head by the gravity fall from the infiltration gallery to the head of the second phase channel terminus. Typical details and possible location for this infiltration gallery is shown on Sheet 9.

Construction Cost Estimates

A Preliminary Design-level construction cost estimate has been prepared for this project. It can be used for planning purposes, recognizing that the cost contingency of +30% should cover unexpected or additional details not known at the time of this study, and a typical cost escalation factor of 3% per year for up to three years from the date of this study. In particular, this contingency factor is intended to cover the potential issues with difficult access (the project area is only accessible by fording the east channel), the necessity of trucking in slope stabilization and riparian planting materials (including the many large cottonwood logs required here), and difficult excavation due to soft and wet underfoot conditions. Table 3 provides detailed Phase 1 construction cost estimates for Channel 1 and Channel 2,

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P.O. Box 722, Vashon, WA 98070 206.799.4801 ezapel@pacificengineers.com

assuming both will be constructed in the same year, and assuming construction start in 2014. Note that Phase 1 assumes a total of 1160 linear feet of channel would be constructed for Channel 1, and 650 linear feet for Channel 2. Alternately, a pilot channel section could be constructed during the first phase instead, to accommodate funding limitations and permit an evaluation period for various treatments and to gauge performance of the project. The total estimated cost for full implementation of the proposed Phase 1 project for both channels, including a ***30% contingency*** and 3% cost escalation from 2013 to ***2014***, is approximately ***$424,000***. If only one channel is constructed, the estimated cost in 2014 would be approximately $307,000 for Channel 1 alone, and approximately $115,000 for Channel 2 alone.

Maintenance and Monitoring Requirements

Project design recognizes that there will be a requirement for maintenance and monitoring (M&M) of these Phase 1 channels for several years following construction to evaluate the relative success of the concept. Verification of the performance of the proposed project will guide the implementation of additional excavation to extend these channels to provide additional habitat. Maintenance will likely include weed control and protection of riparian plantings. Monitoring will include water temperature and flow relative to the Okanogan and Similkameen River channels. We recognize that this effort will require some labor during key periods of the growing season and throughout the year. CCFEG will provide labor and materials to conduct the proposed maintenance and monitoring effort.

Major M&M items are summarized as follows:

- Invasive weed control and eradication in disturbed areas will likely be needed immediately after construction and thereafter each month during the growing season
- Riparian planting maintenance will likely be required each month through the growing season to control invasive vegetation and maintain proper survival of native vegetation
- Beaver colonization will be likely, and their vegetation food supply preferences will have to be noted and considered when designing future planting schedule and varieties to avoid excessive damage
- Water temperature will be monitored at several locations in the proposed channels with a continuous data logger system to gauge efficacy of groundwater inflows in holding temperatures below the main Okanogan and Similkameen River channels
- Dissolved oxygen will be measured monthly at several locations in the proposed channels at key times throughout the day to gauge the effects of organic decomposition on water quality

Summary & Recommendations

The objective of the Driscoll Island cool water refuge channel Preliminary Design study is to develop a design for implementation of up to 2 groundwater channels to the Okanogan and Similkameen Rivers

Pacific Hydraulic Engineers & Scientists, PLLC
P.O. Box 722, Vashon, WA 98070 206.799.4801 ezapel@pacificengineers.com

within Driscoll Island. These channels would provide refuge to juvenile steelhead and salmon for rearing and over-summering in this characteristically limited mainstem reach. The groundwater fed channels would provide water temperatures and rearing habitat with water temperatures below the lethal limit of 20°C, which is typically experienced for several weeks during the summer throughout both the Similkameen and Okanogan River channels. The anticipated benefit is to boost survival of juvenile salmon and steelhead, and in turn increase escapement to this reach of the Okanogan River. In addition, these channels may provide habitat for additional vertebrate and invertebrate species and increase habitat diversity on Driscoll Island, which is managed as a wildlife area by the Washington Department of Fish & Wildlife.

We recommend that the first phase of only the west channel or a pilot section of the proposed first phase channel development be constructed to evaluate the performance of groundwater fed channels of this type on the Driscoll Island property. A period of evaluation of at least two summer seasons should be implemented to monitor key environmental parameters and assess the need for design changes, if any, that might benefit implementation of future phases of these groundwater channels. The groundwater observations and characteristics determined as part of this study suggest that there is high potential for success in providing a cool water refuge for native fish in this particular location. However, this evaluation period will permit observation of key environmental parameters and the response of the native flora and fauna to the construction of such channels in order to gauge effectiveness of the project. In particular, we will be interested in the response of native desirable vegetation growth on excavation spoils, the amount of weed or undesirable vegetation growth in disturbed areas, the success of riparian plantings and methods, and the effectiveness of weed control measures. Test plots of excavation spoils with various treatments would also permit evaluation of the use of these spoils for enhancement of agricultural land on the Island. Additionally, this evaluation period would permit the examination and estimation of suspended sediment deposition rates within the annually flooded area of the channels. And of highest interest will be the evaluation of utilization of the newly constructed cool water refuge by native fish. These key observations will help to guide future continued implementation of additional phases of this project and others throughout the Okanogan River mainstem.

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Tables

Table 3

Channel 1 (West) and Channel 2 (East) Phase 1 Preliminary Design-level Construction Cost Estimates

Driscoll Island Coll Water Refugia Channels
Preliminary Design (30% Design Level) Construction Cost Estimates
Pre-Construction Costs

Feature	Quantity	Unit Of Measure	Aggr. Rate (2013 rates)		Overhead (2.0 mult.)	Profit (12%)	Subtotal Cost
1. Engineering - Final Design Construction Plans and Specifications	72.0	Hrs	$55		$110.00	$20	$13,306
2. Engineering - During Construction	120.0	Hrs	$40		$80.00	$14	$16,128
Subtotal							**$29,434**

Project Direct Cost

Feature	Quantity	Unit Of Measure	Labor Hrs / Unit	Crew (Means)	Labor Hrs	Mat. Rate	Material	Labor Rate	Labor	Equip. Rate	Equipment	Other	Materials City Adjust. (Wenatchee)	Installation City Adjust. (Wenatchee)	Subtotal Cost	(Bare) Equivalent Unit Cost
1. Mobilization																
Equipment, machinery, facilities	1.0	lump sum	0.000		0.00	$0.00	$0.00	$0.00	$0.00	$15,000.00	$15,000.00		1.0000	1.0180	$15,270.00	$15,270.00
Subtotal					**0.00**		**$0.00**		**$0.00**		**$15,000.00**				**$15,270.00**	
PHASE 1 CONSTRUCTION	**(NOTE: This phase consists of construction of downstream portion of Channels 1 (West) and 2 (East))**															
2. Channel Construction 1 (West Channel) 1160 linear feet																
Excavate & spoil on either top of bank - open cut 1V:3H (assume 2 cyd excavator)	7100	yd ^{3}	0.025	B-12S	177.50	$0.00	$0.00	$0.61	$4,331.00	$1.53	$10,863.00		1.0700	1.1150	$16,941.31	$2.39
Lower Bank Stabilization cottonwood logs (assume harvested on site - min 12" diam x 30 ft ave length) 2 lifts 24"high each side	160	Ea.	0.500	B-12C	80.00	$35.00	$5,600.00	$58.54	$9,366.40	$43.77	$7,003.20		1.0700	1.1150	$24,244.10	$151.53
Jute fabric soil stabilization	6400	yd ^{2}	0.010	B-80A	64.00	$0.60	$3,840.00	$0.35	$2,240.00	$0.11	$704.00		1.0700	1.1150	$7,391.36	$1.15
Disposal of exavation spoils (assume double swing to lift up to spoil area + dozing)	7100	yd ^{3}	0.031	B-10W	220.10	$0.00	$0.00	$1.33	$9,443.00	$1.43	$10,153.00		1.0700	1.1150	$21,849.54	$3.08
Riparian and Floodplain Planting (assume 1500 plants per acre @ $5.00 each in 1 gallon containers)	3800	Ea.	0.387	2Clab	1470.60	$5.00	$19,000.00	$13.60	$51,680.00	$0.00	$0.00		1.0700	1.1150	$77,953.20	$20.51
Seeding	108.0	M.sf.	0.154	B-66	16.64	$17.00	$1,836.81	$6.90	$745.53	$4.75	$513.23		1.0700	1.1150	$3,368.89	$31.18
Subtotal					**2030**		**$30,276.81**		**$77,805.93**		**$29,236.43**				**$151,748.40**	
3. Channel Construction 2 (East Channel) 650 linear feet																
Excavate & spoil on either top of bank - open cut 1V:3H (assume 2 cyd excavator)	1300	yd ^{3}	0.025	B-12S	32.50	$0.00	$0.00	$0.61	$793.00	$1.53	$1,989.00		1.0700	1.1150	$3,101.93	$2.39
Lower Bank Stabilization cottonwood logs (assume harvested on site - min 12" diam x 30 ft ave length) 2 lifts 24"high each side	90	Ea.	0.500	B-12C	45.00	$35.00	$3,150.00	$58.54	$5,268.60	$43.77	$3,939.30		1.0700	1.1150	$13,637.31	$151.53
Jute fabric soil stabilization	2400	yd ^{2}	0.010	B-80A	24.00	$0.60	$1,440.00	$0.35	$840.00	$0.11	$264.00		1.0700	1.1150	$2,771.76	$1.15
Disposal of exavation spoils (assume double swing to lift up to spoil area + dozing)	1300	yd ^{3}	0.031	B-10W	40.30	$0.00	$0.00	$1.33	$1,729.00	$1.43	$1,859.00		1.0700	1.1150	$4,000.62	$3.08
Riparian and Floodplain Planting (assume 1500 plants per acre @ $5.00 each in 1 gallon containers)	1100	Ea.	0.387	2Clab	425.70	$5.00	$5,500.00	$13.60	$14,960.00	$0.00	$0.00		1.0700	1.1150	$22,565.40	$20.51
Seeding	30.8	M.sf.	0.154	B-66	4.75	$17.00	$524.23	$6.90	$212.77	$4.75	$146.48		1.0700	1.1150	$961.49	$31.18
Subtotal					**580**		**$10,614.23**		**$23,803.37**		**$8,197.78**				**$47,038.50**	

Project Indirect Cost

Feature	Subtotal Cost	Direct	Field O/H	Home Office	Profit	Bond	Insurance	Subtotal Cost	Sales Tax	Total Cost
			12.50%	3%	8%	1%	1%		7.70%	
1. Mobilization	$15,270	$15,270	$1,909	$458	$1,411	$190	$190	$19,429	$1,496	$20,925
2. Channel Construction 1 (West Channel) 1160 linear feet	$151,748	$151,748	$18,969	$4,552	$14,022	$1,893	$1,893	$193,077	$14,867	$207,944
3. Channel Construction 2 (East Channel) 650 linear feet	$47,039	$47,039	$5,880	$1,411	$4,346	$587	$587	$59,849	$4,608	$64,458
Total	**$214,057**							**$272,355**	**$20,971**	**$293,326**

Project Total Cost

	2013	2014	2015	2016	2017.00
escalation per year		3%	3%	3%	3%
Total Construction Cost (**+30% CONTINGENCY**)	$381,324	$392,764	$404,547	$416,683	$429,184
Total Engineering & Project Owner Cost	$29,434	$30,317	$31,226	$32,163	$33,128
Total	**$411,000**	**$424,000**	**$436,000**	**$449,000**	**$463,000**

Figures

Figure 1 – Driscoll Island Aerial Photo (Google Earth, ca. 2011)

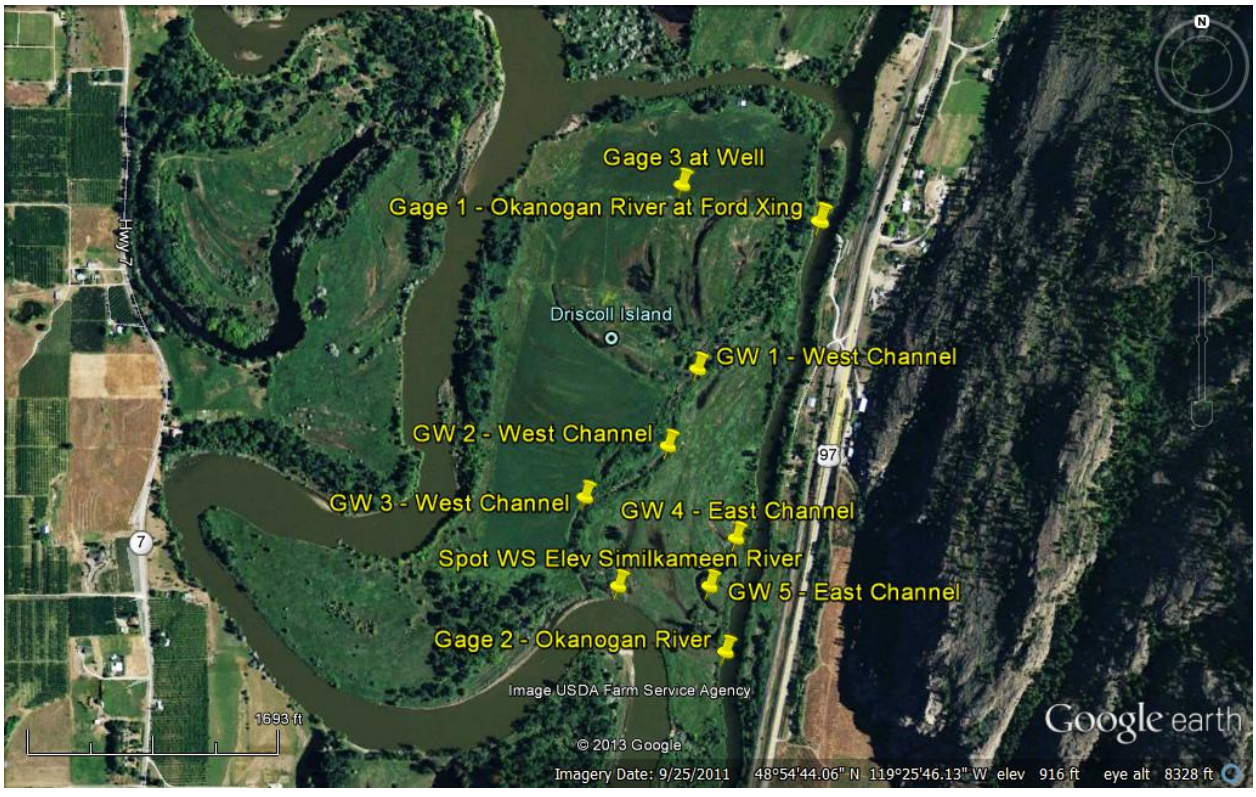


Figure 2 – Driscoll Island Groundwater and Surface Water Recording Data Loggers (Google Earth)

Figure 3 – Driscoll Island Groundwater Channels Conceptual Design Phase 1 (shown in red hatching) and Phase 2 (shown in magenta hatching)

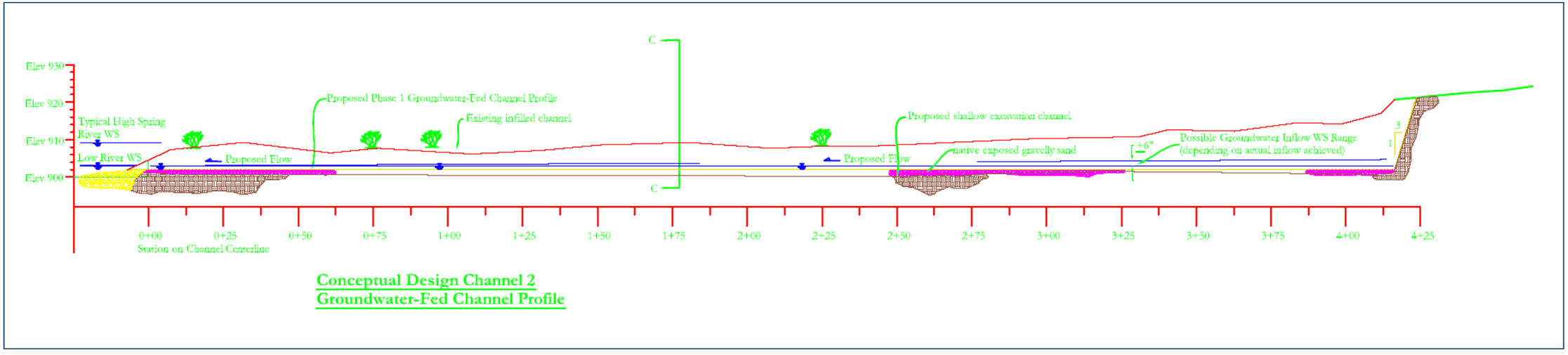


Figure 4 – Driscoll Island Groundwater Channels Conceptual Design Typical Profile

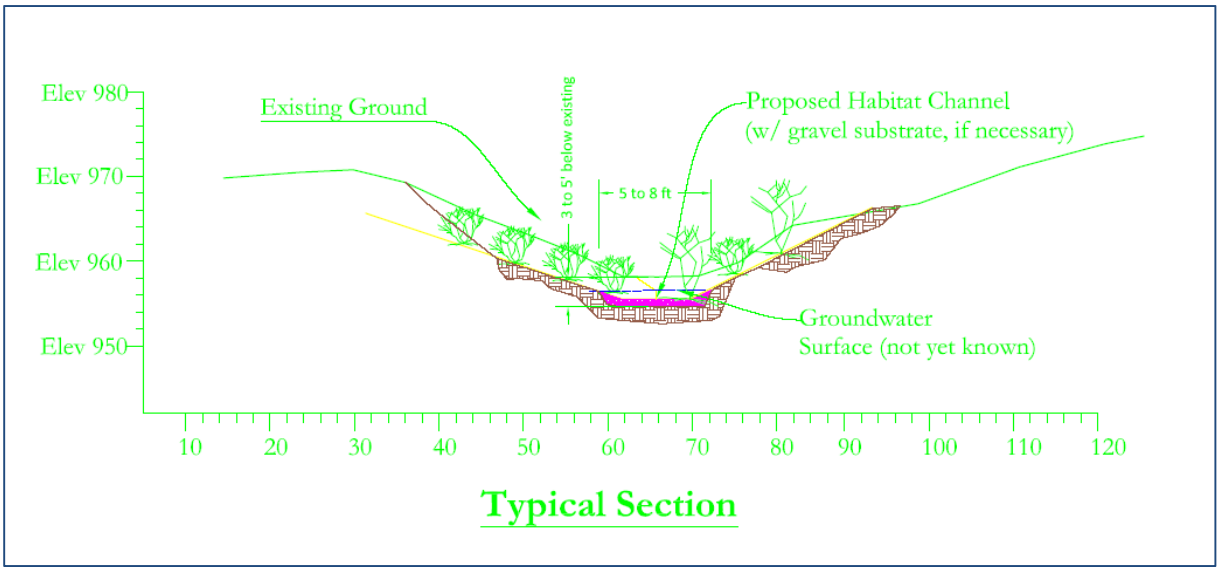
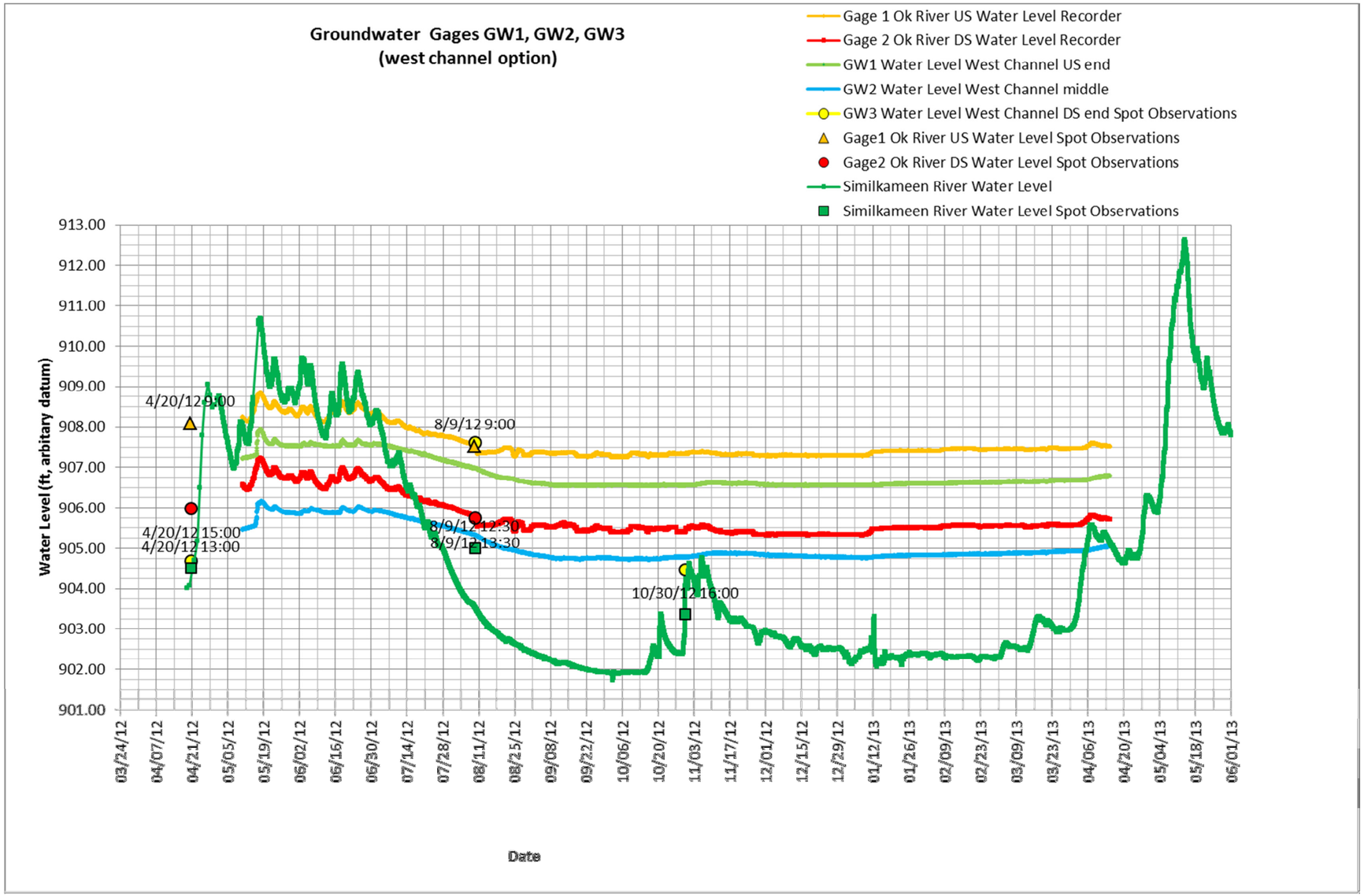
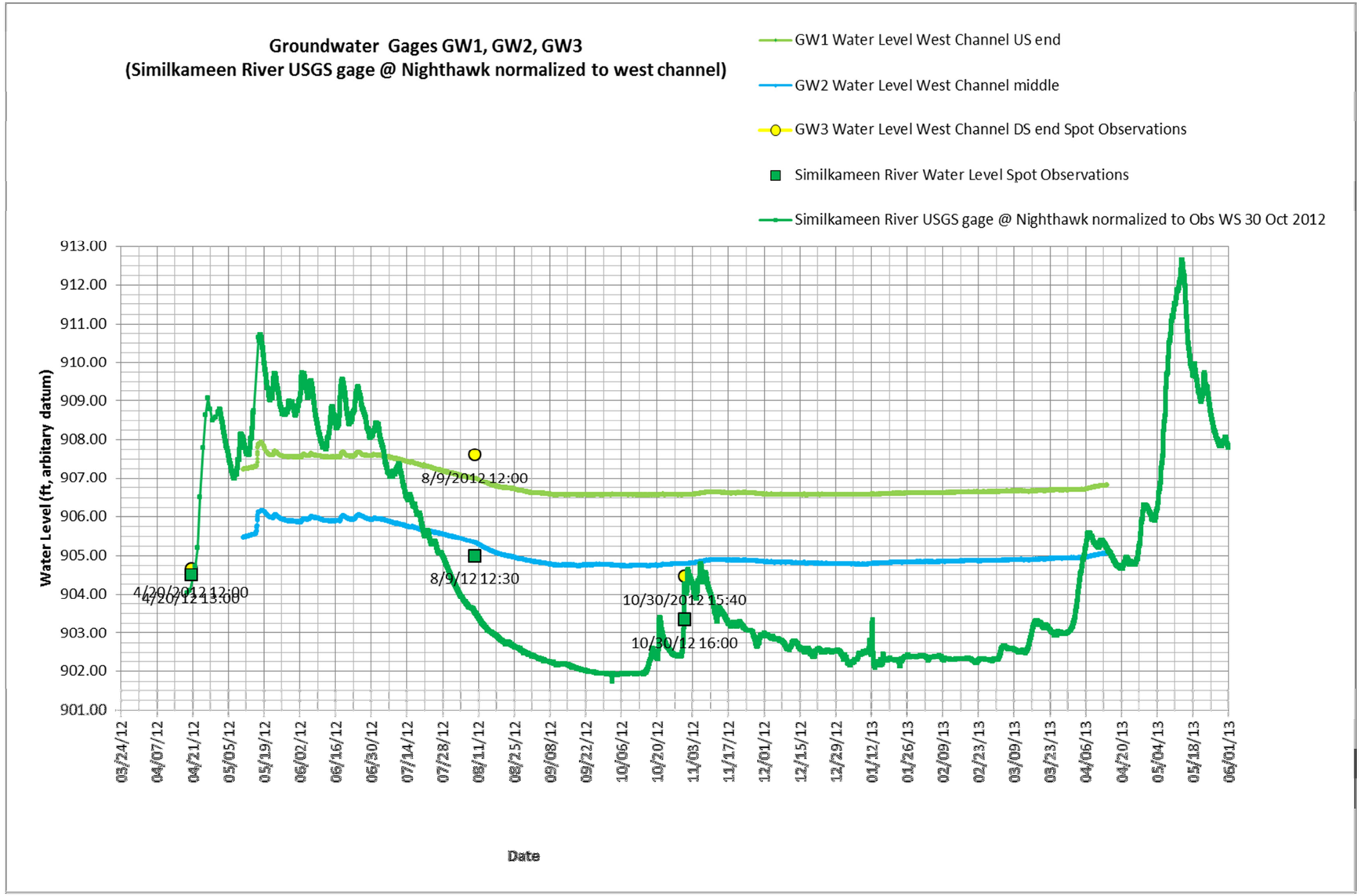


Figure 5 – Driscoll Island Groundwater Channels Conceptual Design Typical Cross Section

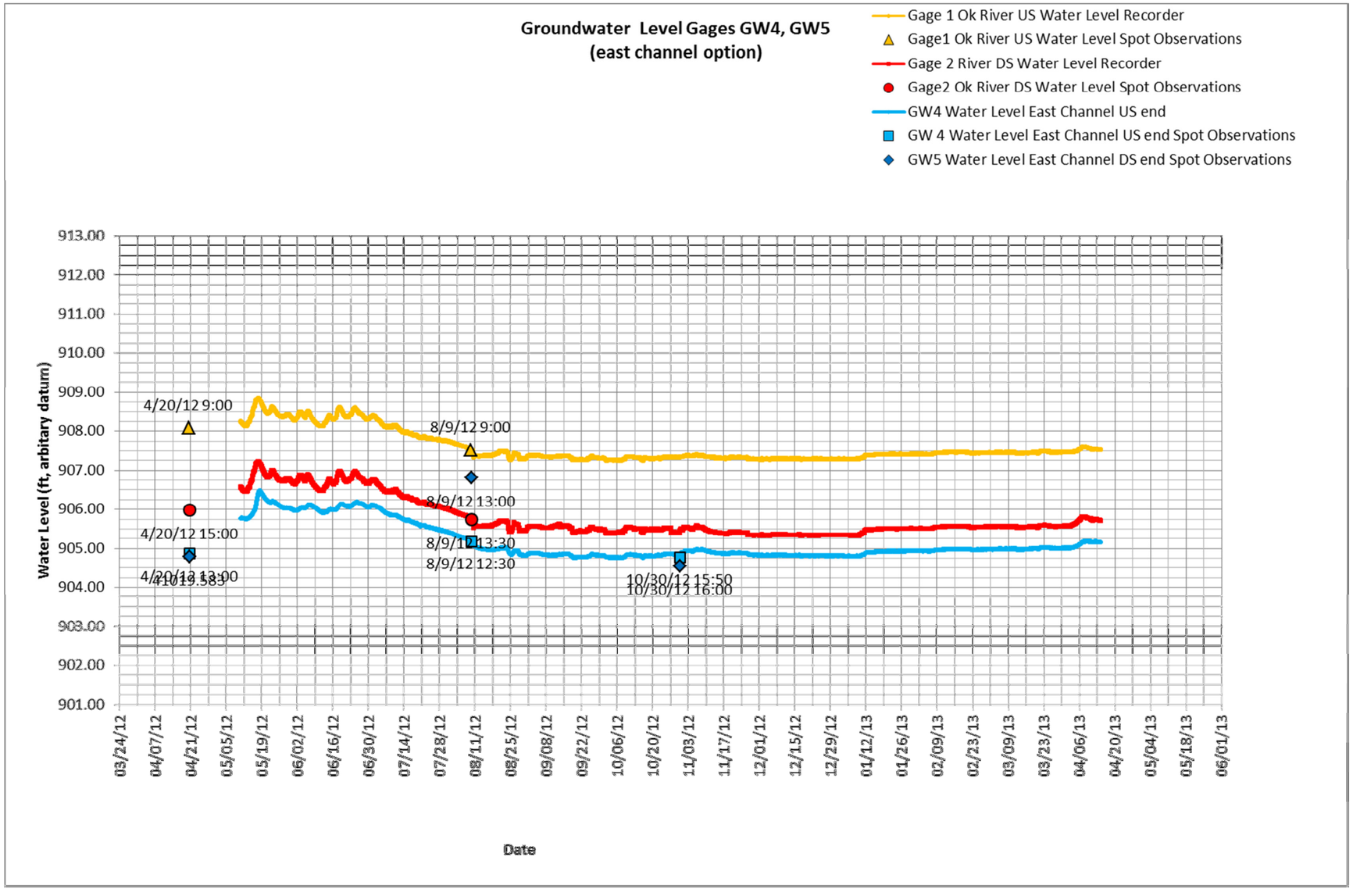
Groundwater Data



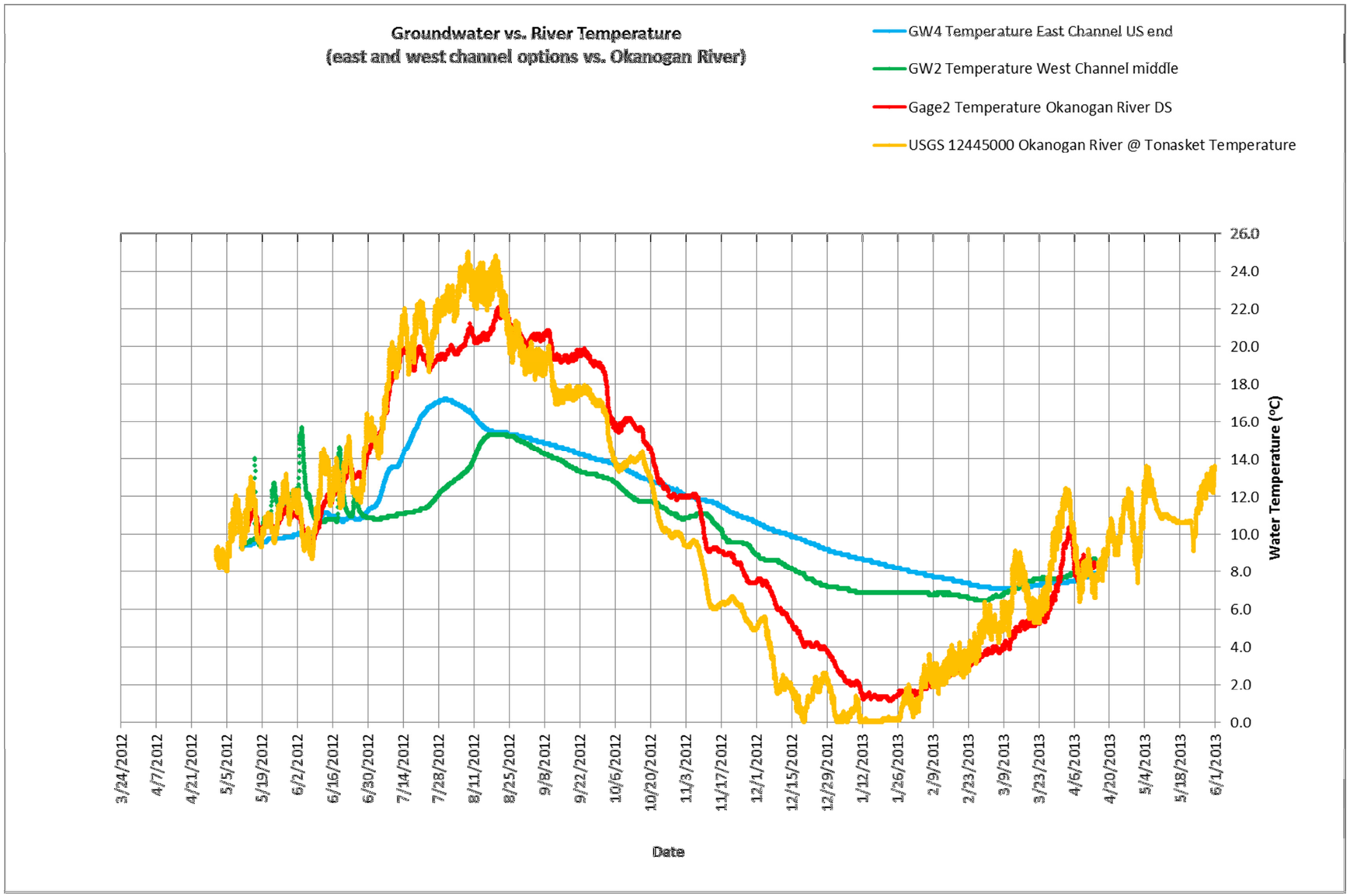
Data Plot 1 – Groundwater level in Channel 1 (West) compared to Okanogan and Similkameen River water levels



Data Plot 2 – Groundwater levels in Channel 1 compared to Similkameen River water level

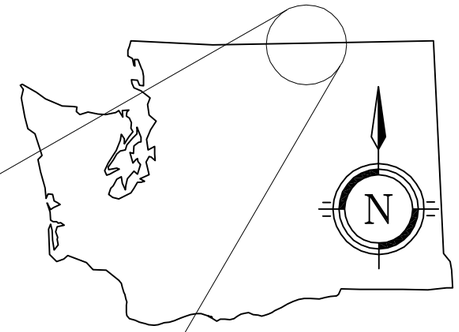


Data Plot 3 – Groundwater levels in Channel 2 compared to Okanogan River water level



Data Plot 4 – Groundwater temperatures in Channels 1 (West) and 2 (East) compared to Okanogan and Similkameen River water temperatures

Preliminary Design Drawings



NOTES:
Images provided by Google ca. 2013
and Okanogan County ca. 2008
Driscoll Island Coordinates:
Latitude 48° 54' 33" N
Longitude 119° 25' 43" W
Driscoll Island owned by WDFW

Cascade Columbia Fisheries Enhancement Group	
Okanogan/Similkameen Thermal Refugia Driscoll Island Cold Water Refugia Channels Vicinity Map	
Pacific Hydraulic Engineers & Scientists, PLLC	
Date: 20 May 2013	Sheet: 1

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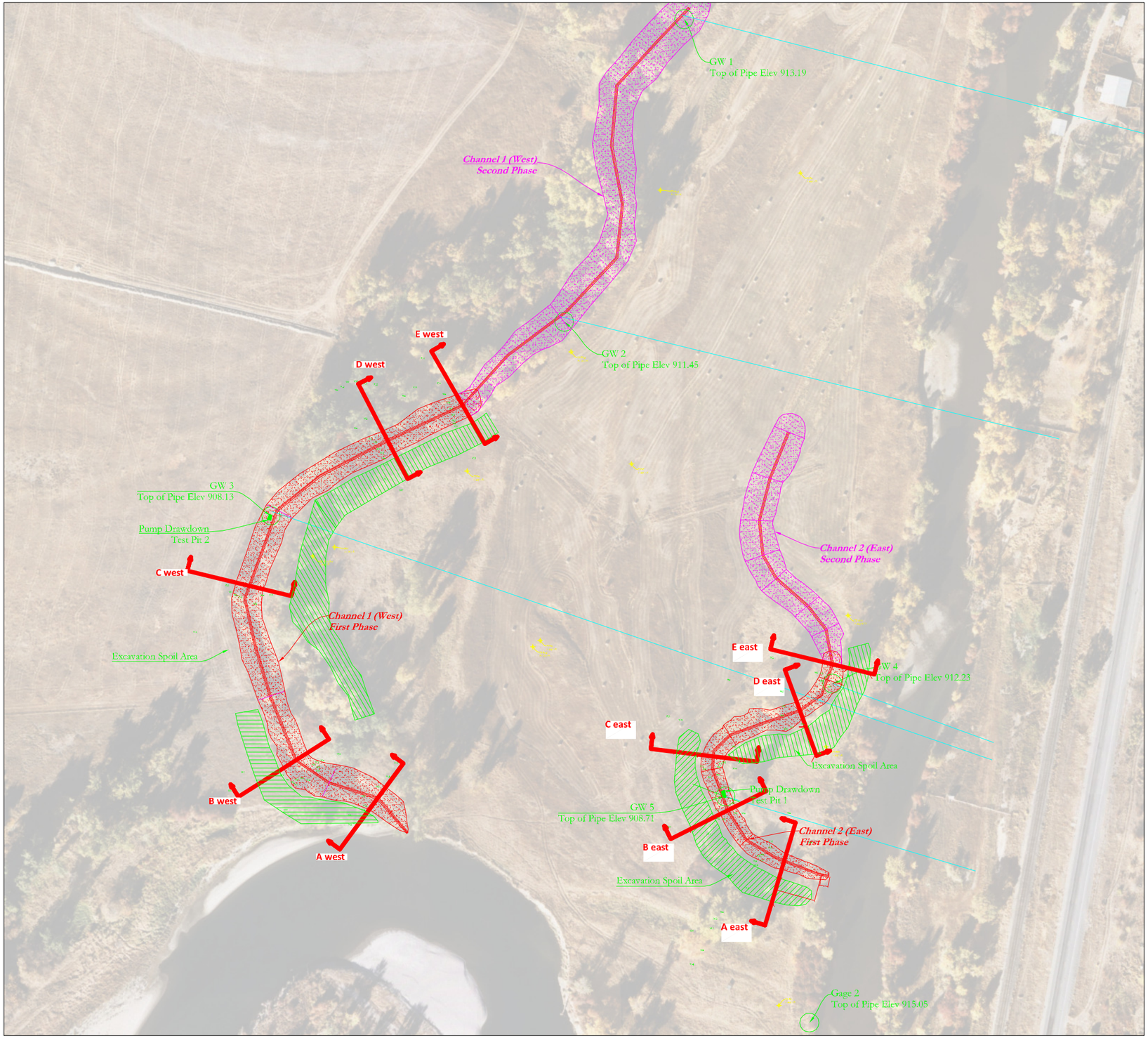

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N

NOTES:

1) Topographic survey data provided by Erlandsen Associates, based on photogrammetric data collected from aerial photography and ground control
2) Excavation limits estimated from surveyed topography
3) Constructed slopes may be modified to accomodate stability - estimated slopes shown
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LEGEND

- Phase 1 Channel Excavation
- Phase 2 Channel Excavation
- Excavation Spoils Limits

200 0 200 400

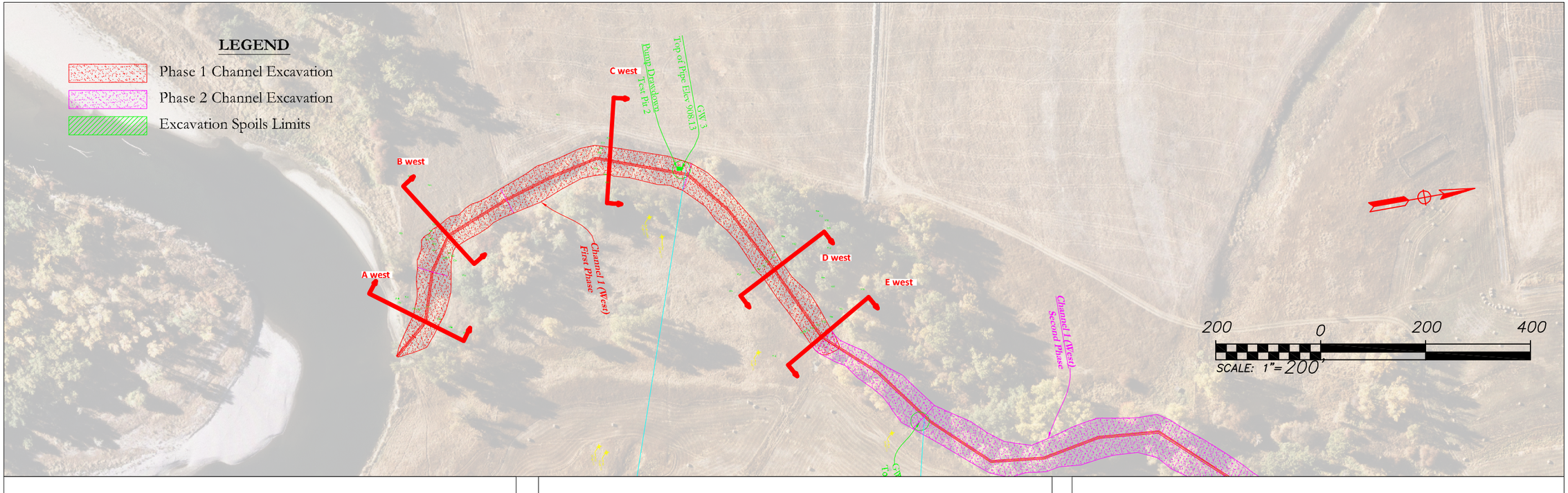
SCALE: 1"=200'

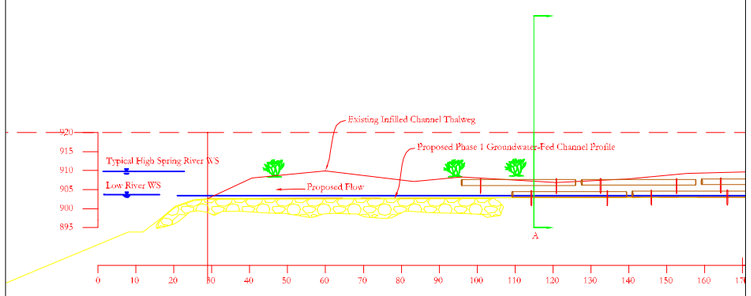
Cascade Columbia Fisheries Enhancement Group

Okanogan/Similkameen Thermal Refugia
Driscoll Island Cold Water Refugia Channels
Phase 1 - Plan View Project Area

Pacific Hydraulic Engineers & Scientists, PLLC

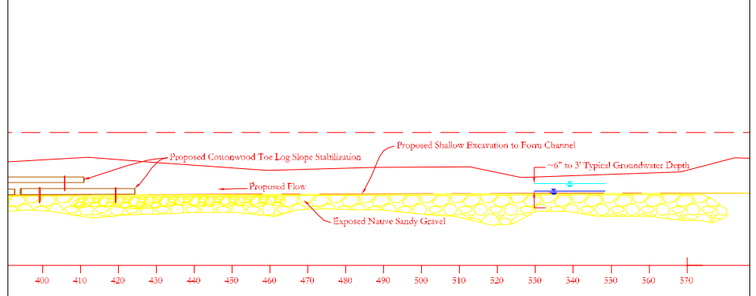
Date: 20 May 2013 | Sheet: 2





Channel 1 Profile
(at confluence with Similkameen River)

40 0 40 80
SCALE: 1"= 40'



Channel 1 Profile
(typical channel features)

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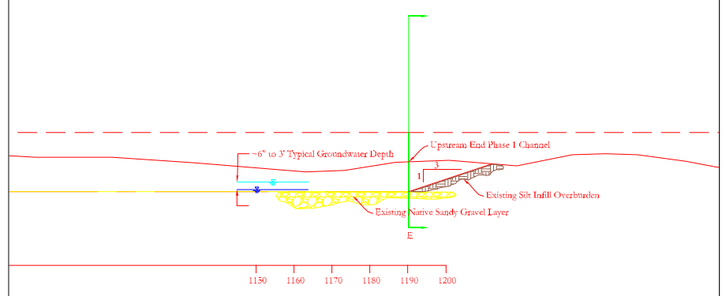
SCALE: 1"= 40'



Channel 1 Profile
(at Phase 1 terminus point)

40 0 40 80
SCALE: 1"= 40'

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Okanogan/Similkameen Thermal Refugia
Driscoll Island Cold Water Refugia Channels
Channel 1 - Plan and Profile

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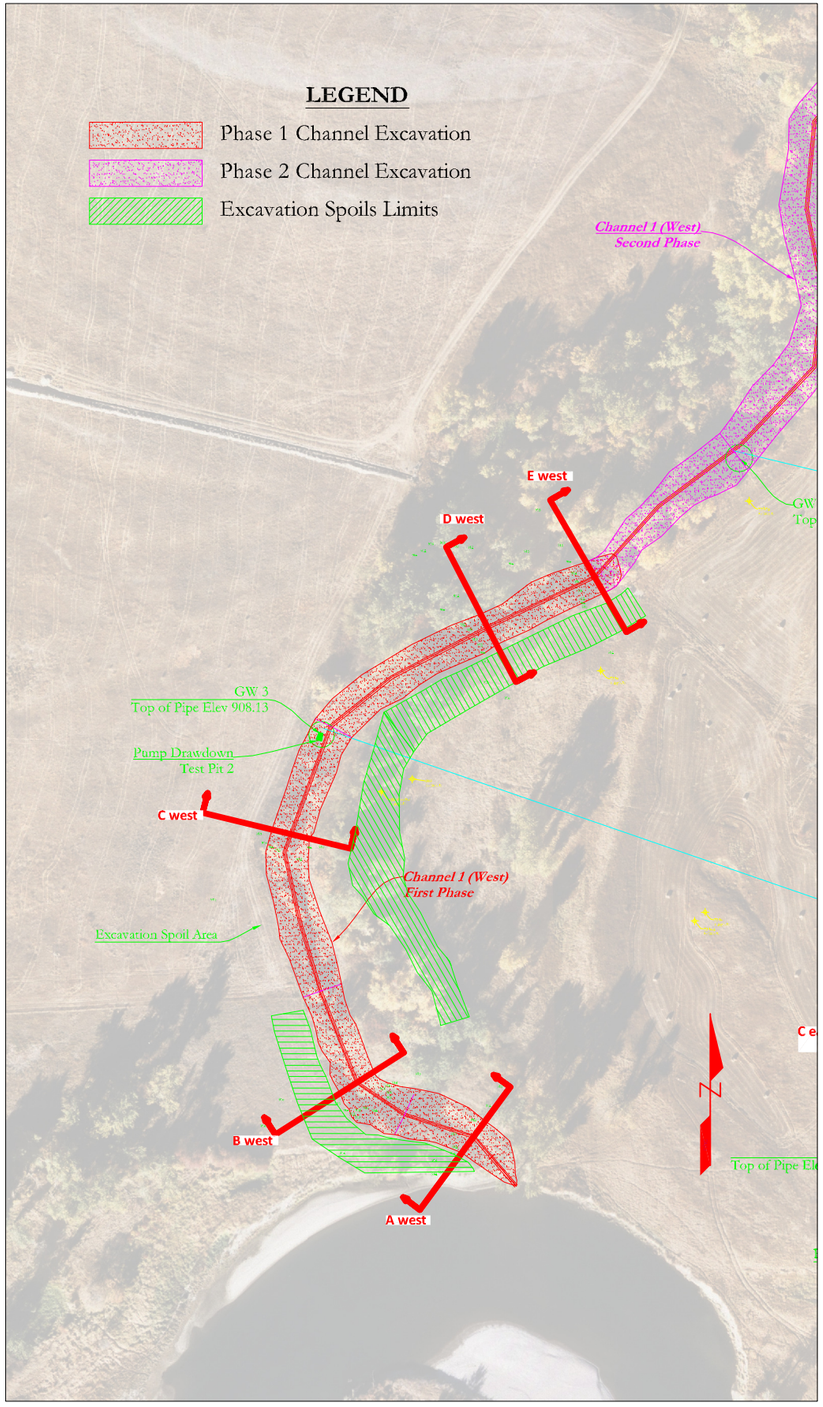
Date: 20 May 2013 | Sheet: 3



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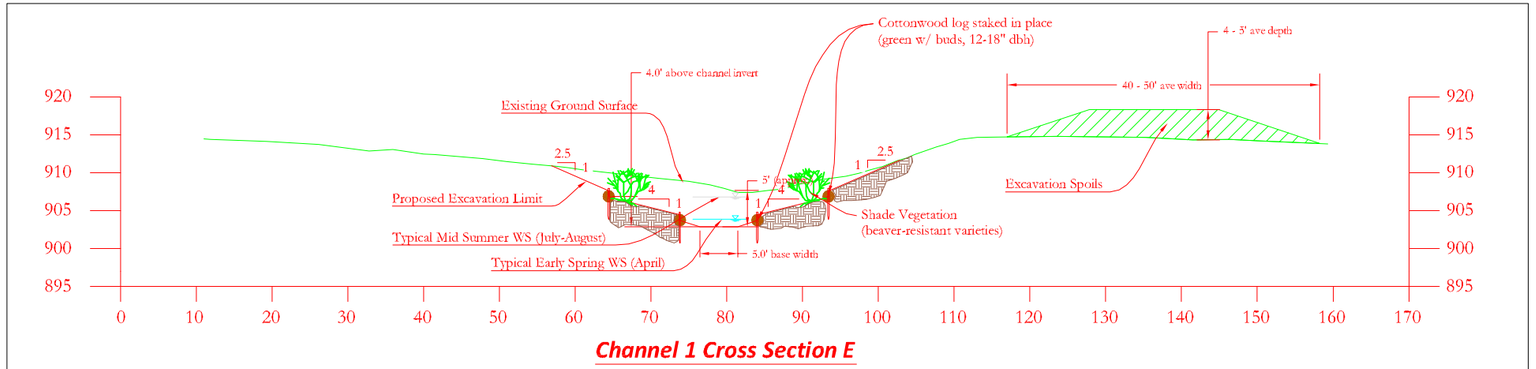
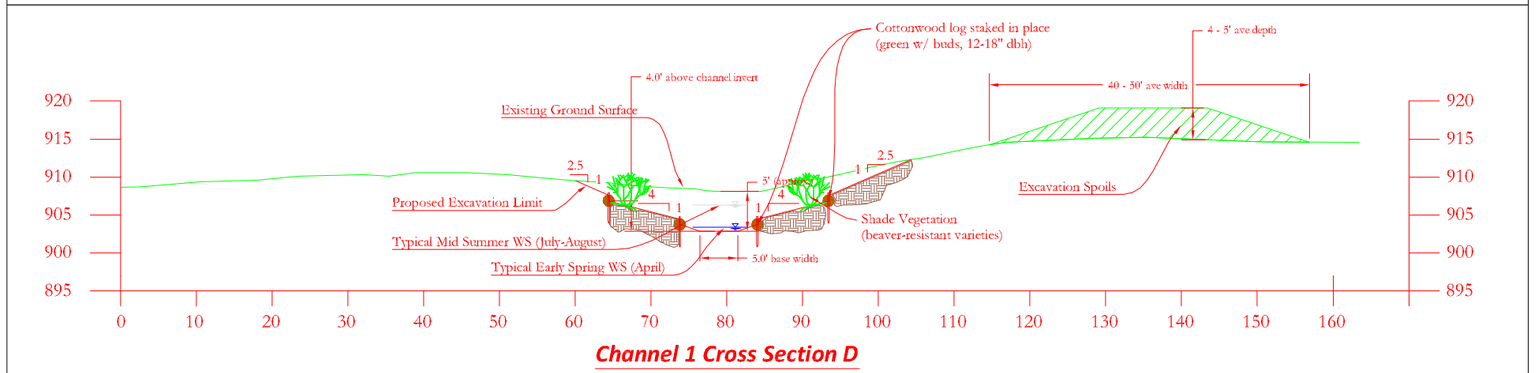
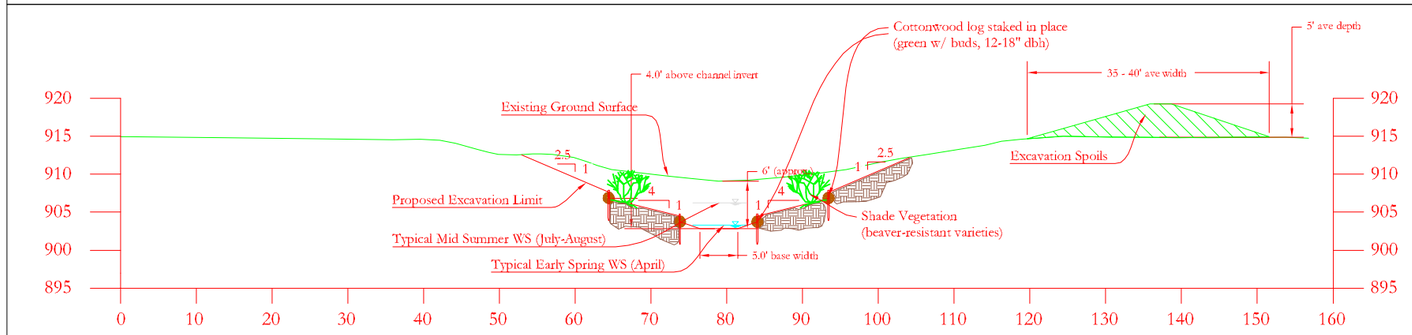


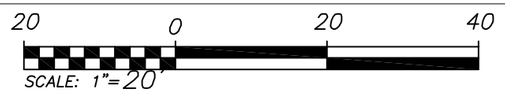
Channel 1 Cross Section E



Channel 1 Cross Section D



Channel 1 Cross Section C



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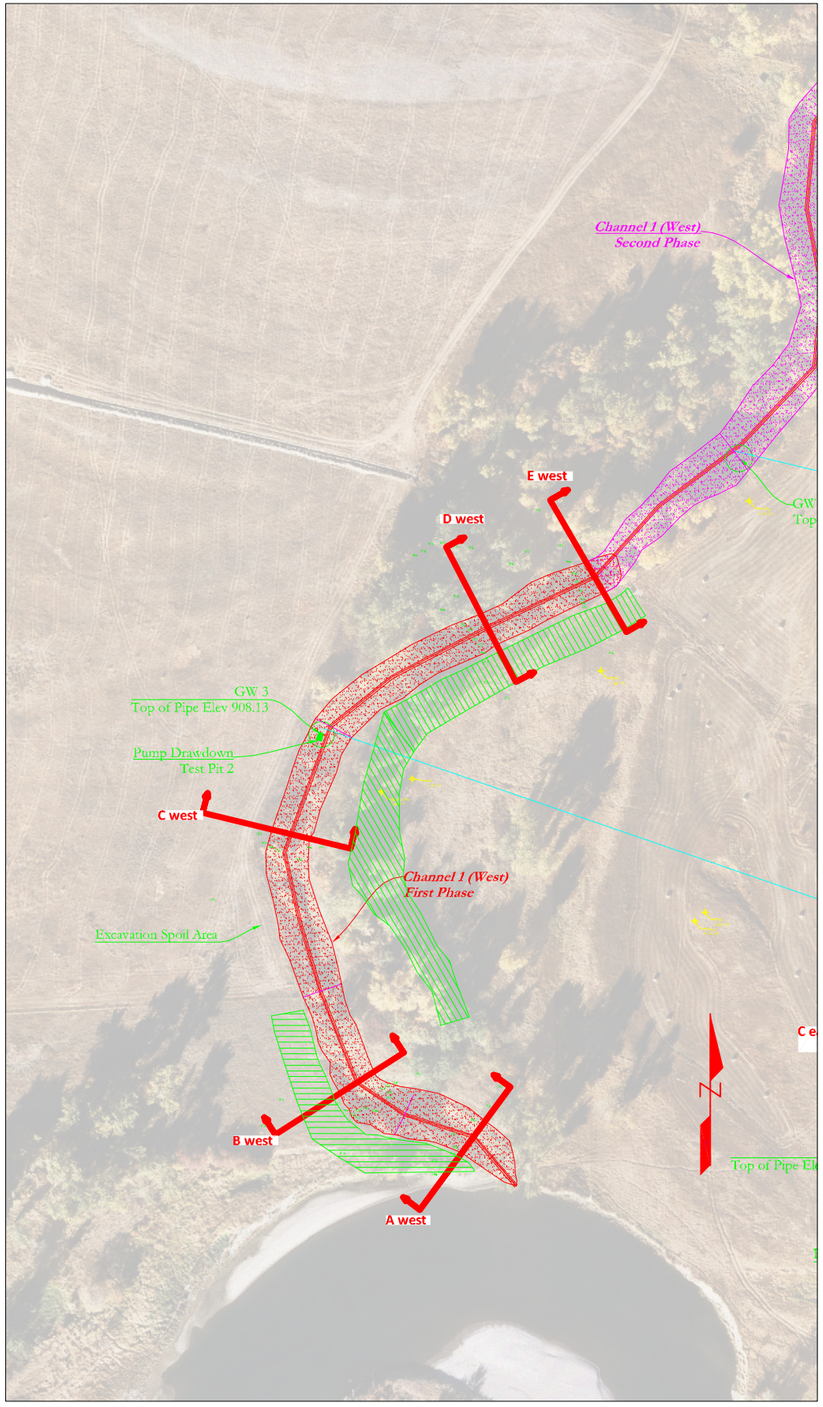
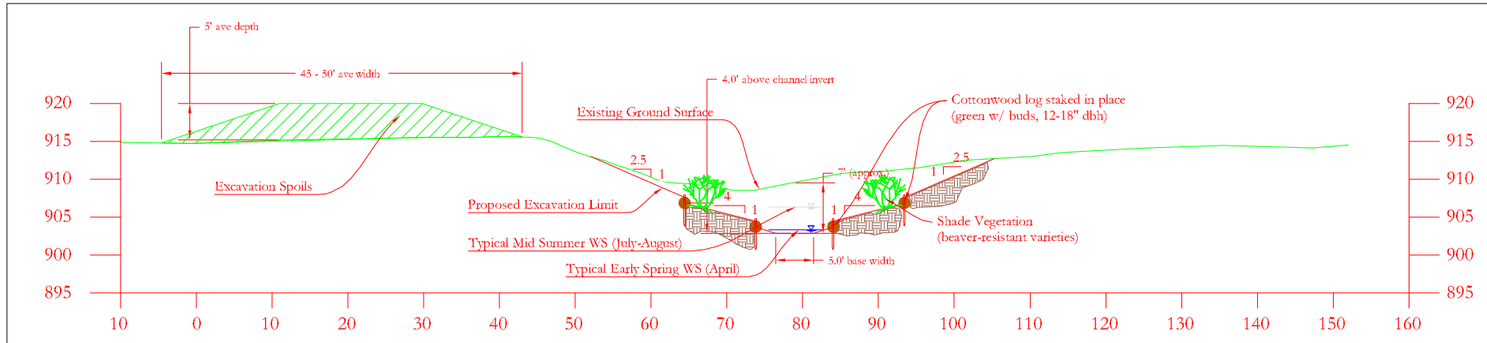
Cascade Columbia Fisheries Enhancement Group

Okanogan/Similkameen Thermal Refugia
Driscoll Island Cold Water Refugia Channels
Channel 1 - Typical Cross Sections

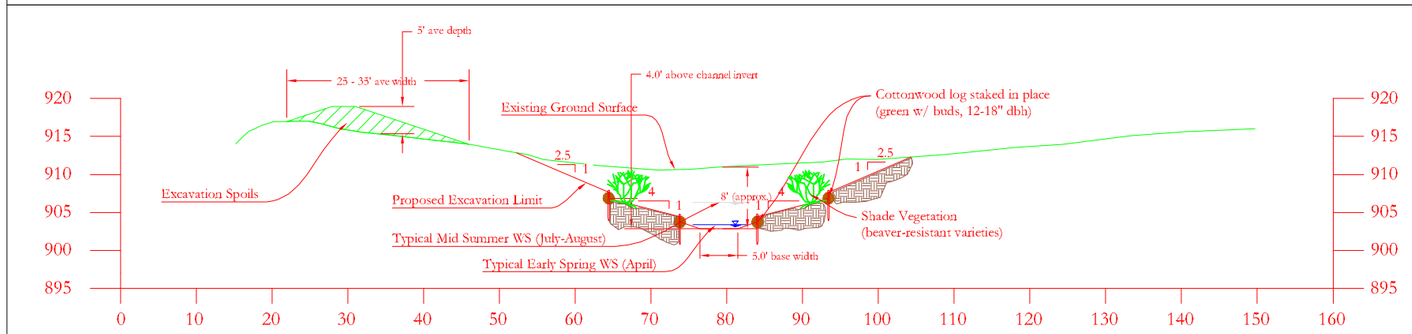
Pacific Hydraulic Engineers & Scientists, PLLC

Date: 20 May 2013 | Sheet: 4





Channel 1 Cross Section B



Channel 1 Cross Section A

LEGEND

- Phase 1 Channel Excavation
- Phase 2 Channel Excavation
- Excavation Spoils Limits

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Cascade Columbia Fisheries Enhancement Group	
Okanogan/Similkameen Thermal Refugia Driscoll Island Cold Water Refugia Channels Channel 1 - Typical Cross Sections	
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Date: 20 May 2013	Sheet: 5

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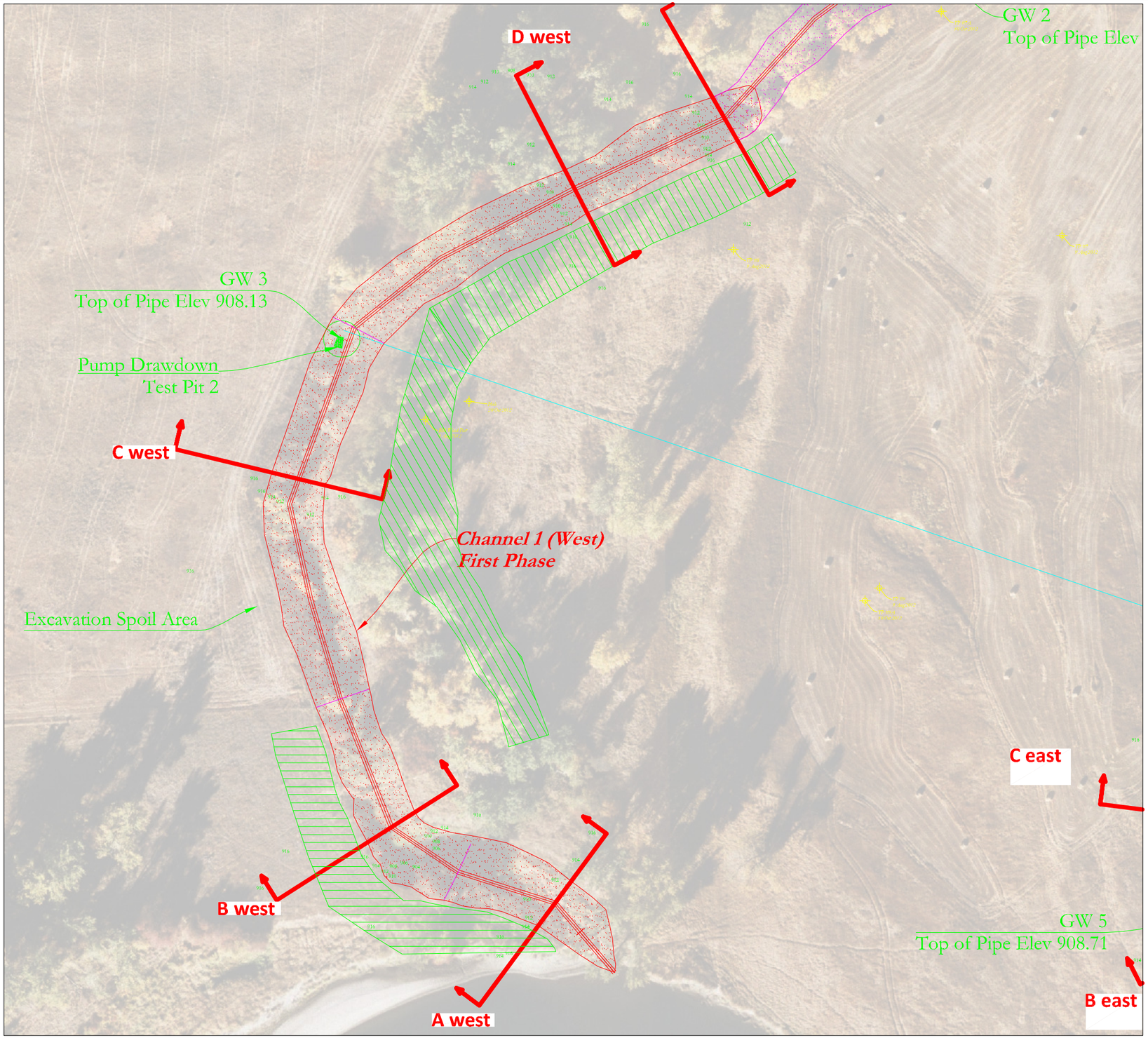

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LEGEND

- Phase 1 Channel Excavation
- Phase 2 Channel Excavation
- Excavation Spoils Limits

100 0 100 200

SCALE: 1"= 100'

Cascade Columbia Fisheries Enhancement Group	
Okanogan/Similkameen Thermal Refugia Driscoll Island Cold Water Refugia Channels Channel 1 - Excavation Spoils Limits	
Pacific Hydraulic Engineers & Scientists, PLLC	
Date: 20 May 2013	Sheet: 6

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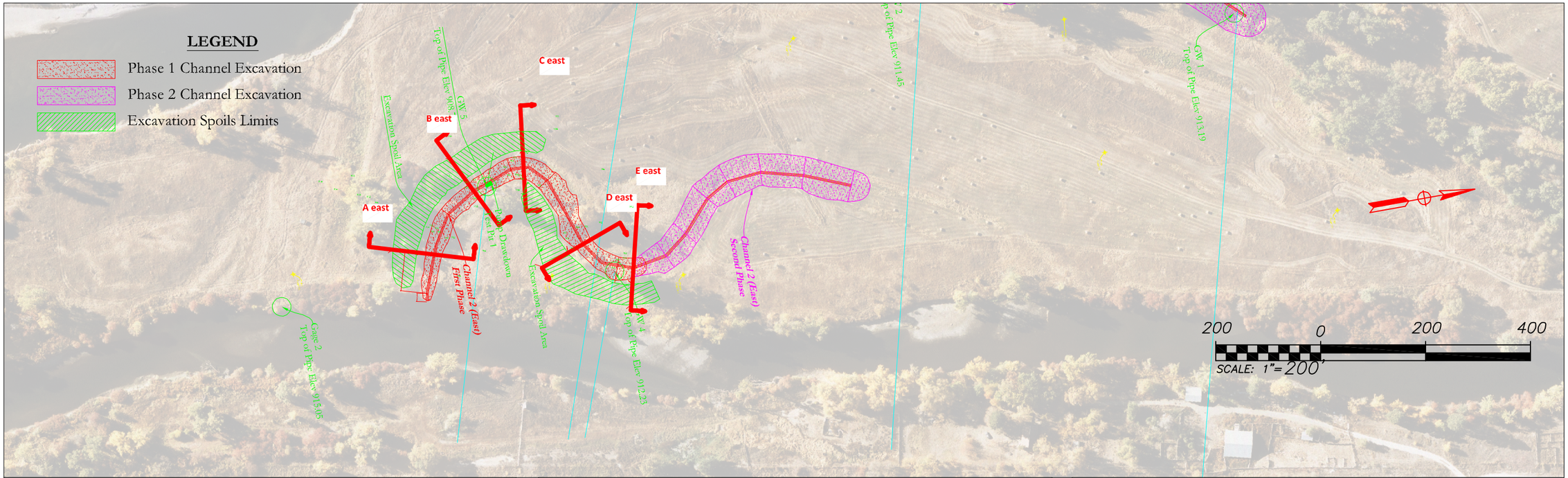

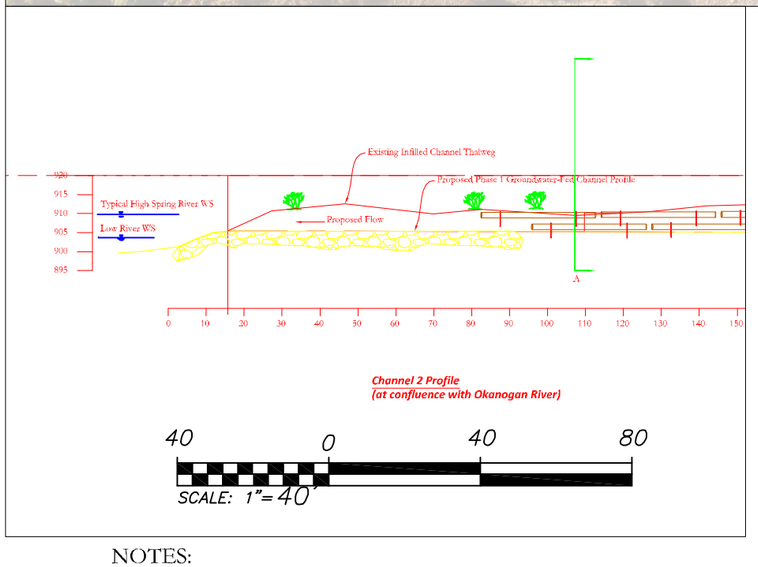

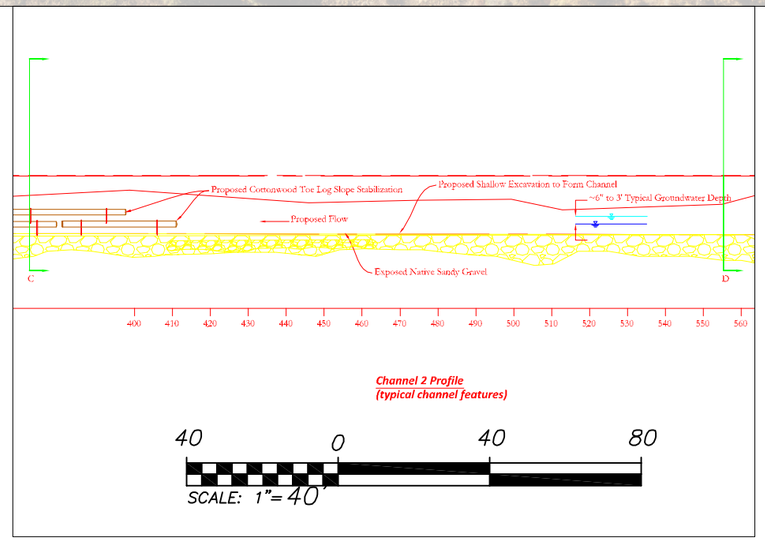

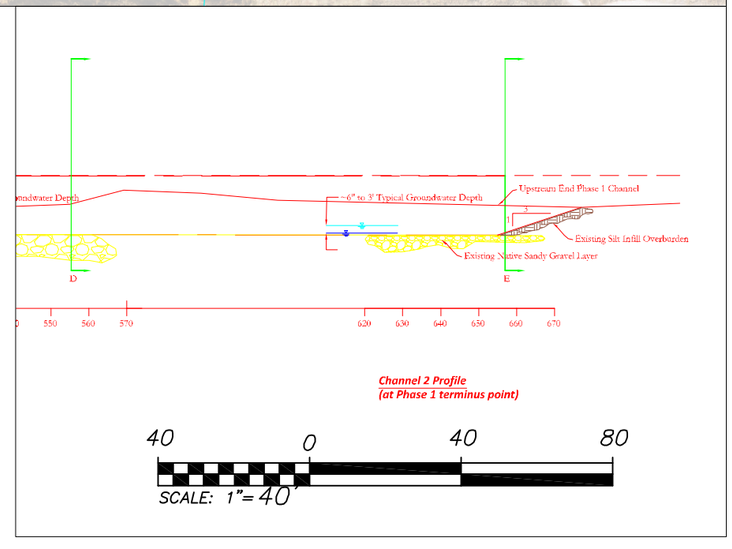

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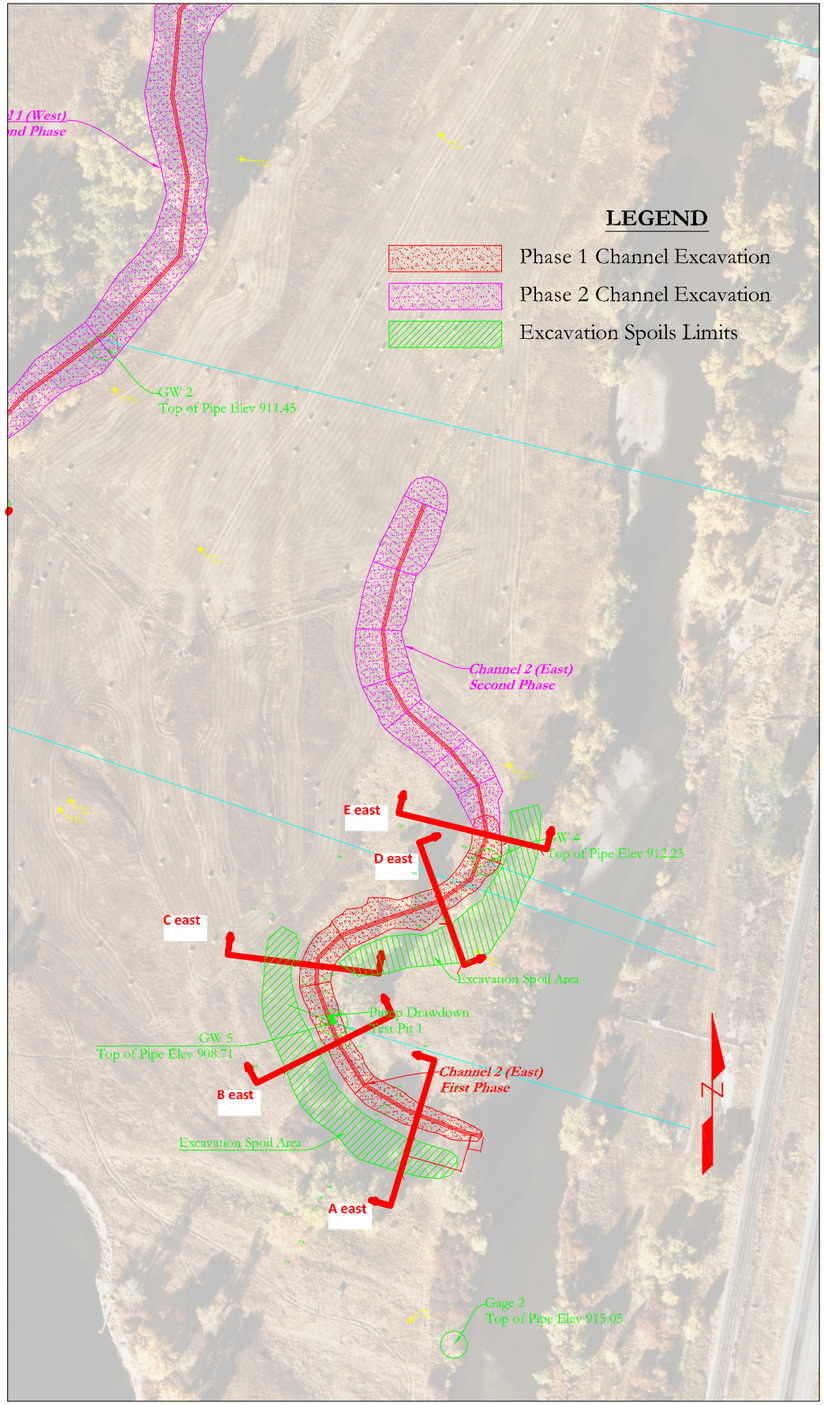
Cascade Columbia Fisheries Enhancement Group

Okanogan/Similkameen Thermal Refugia
Driscoll Island Cold Water Refugia Channels
Channel 2 - Plan and Profile

Pacific Hydraulic Engineers & Scientists, PLLC

Date: 20 May 2013 | Sheet: 7



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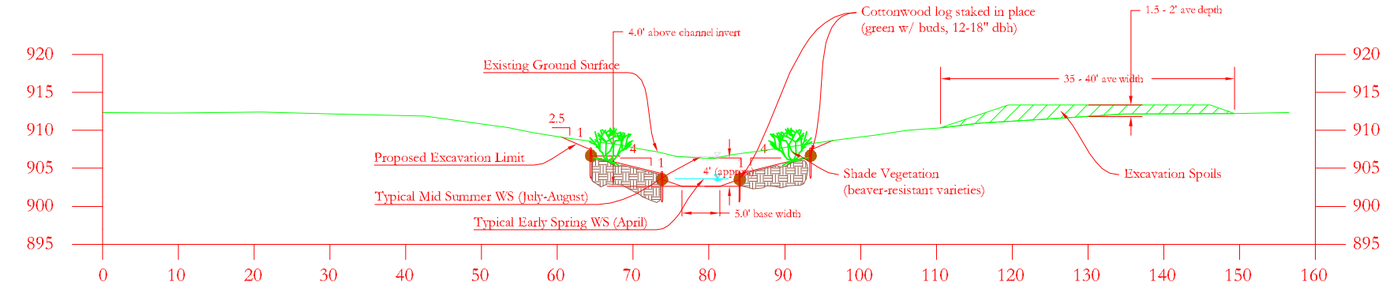
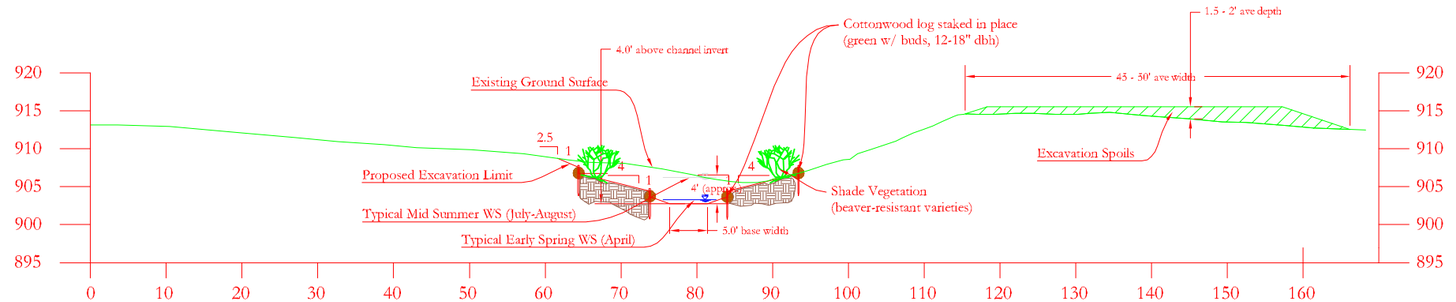
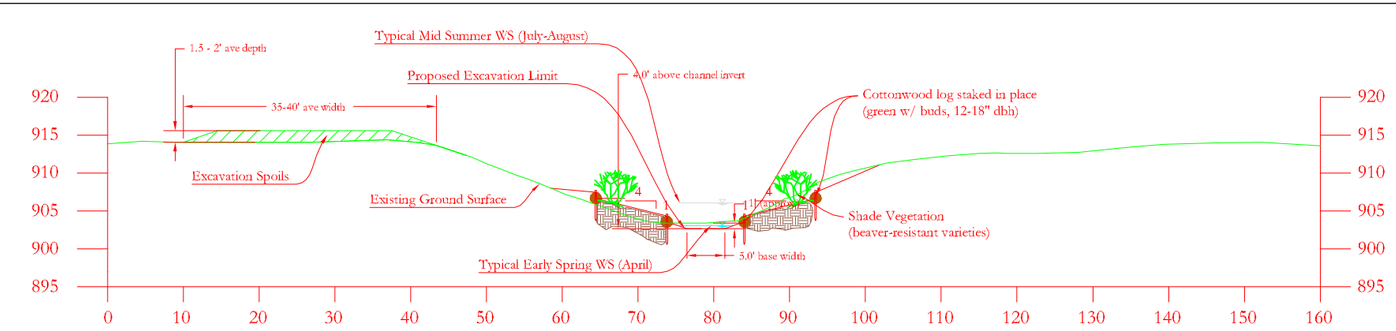


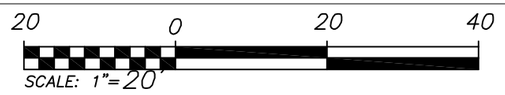
Channel 2 Cross Section E



Channel 2 Cross Section D



Channel 2 Cross Section C



NOTES:

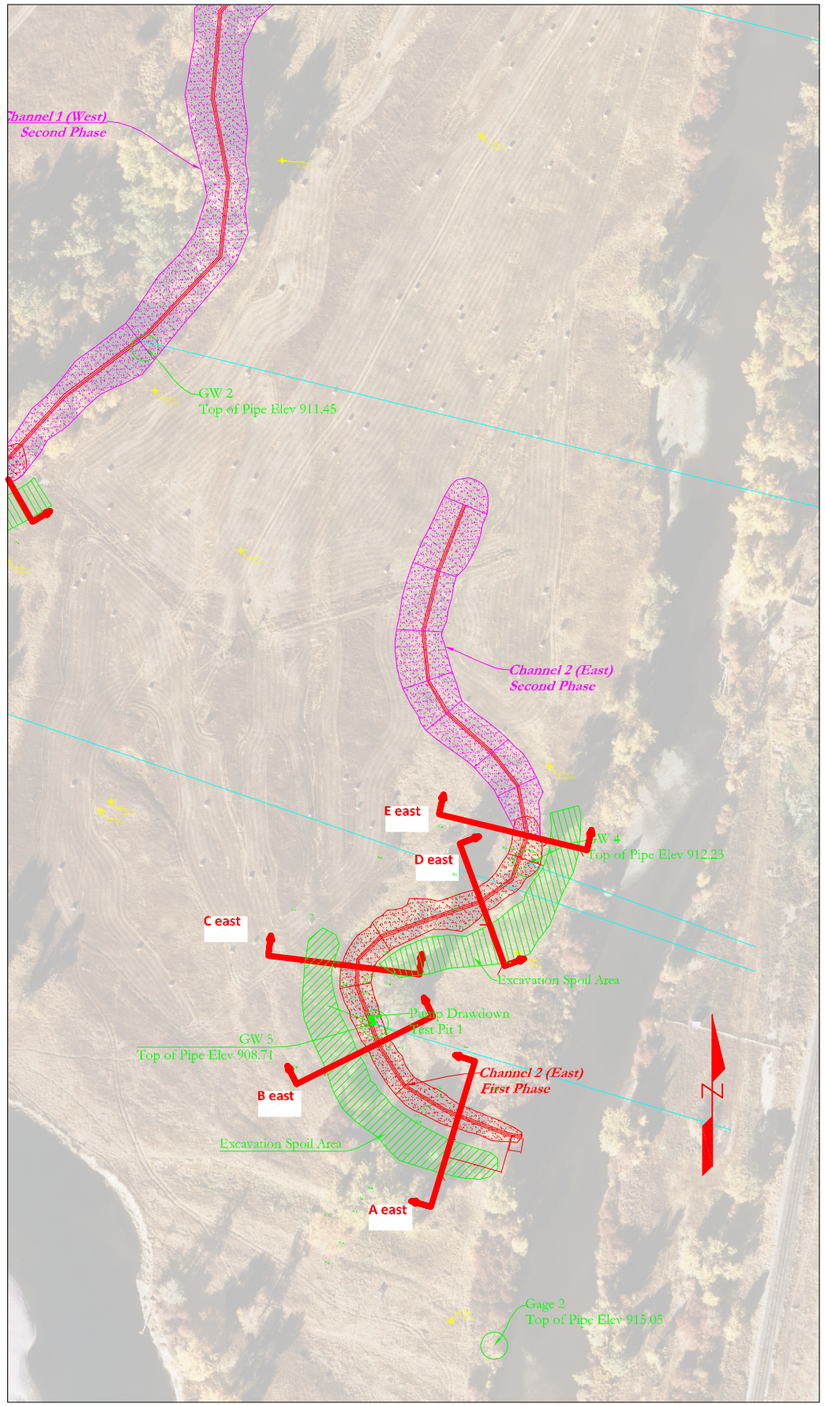
1) Topographic survey data provided by Erlandsen Associates, based on photogrammetric data collected from aerial photography and ground control
2) Excavation limits estimated from surveyed topography
3) Constructed slopes may be modified to accomodate stability - estimated slopes shown
4) Plant species and planting configuration to be determined in final design
5) Final channel dimensions may change, depending on localized conditions encountered during construction and on funding availability
6) Excavated spoils shown in green hatching to be cast up on natural berm and shaped to raise berm, but not spread into agricultural fields

Cascade Columbia Fisheries Enhancement Group

Okanogan/Similkameen Thermal Refugia
Driscoll Island Cold Water Refugia Channels
Channel 2 - Typical Cross Sections

Pacific Hydraulic Engineers & Scientists, PLLC

Date: 20 May 2013 | Sheet: 8



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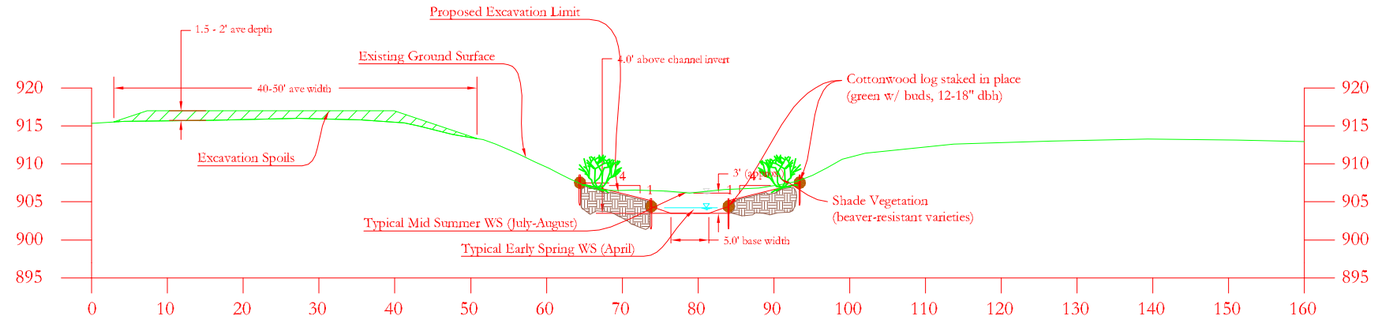
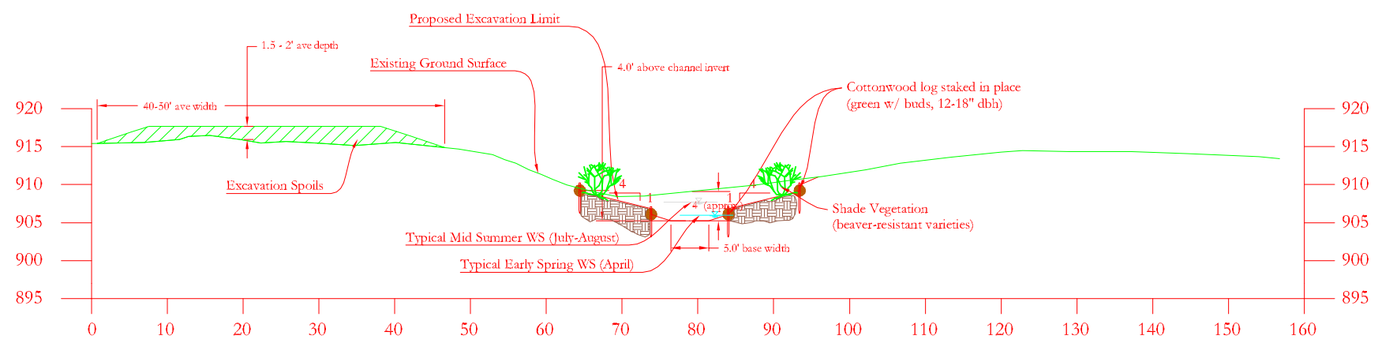


Channel 2 Cross Section B



Channel 2 Cross Section A

LEGEND

- Phase 1 Channel Excavation
- Phase 2 Channel Excavation
- Excavation Spoils Limits

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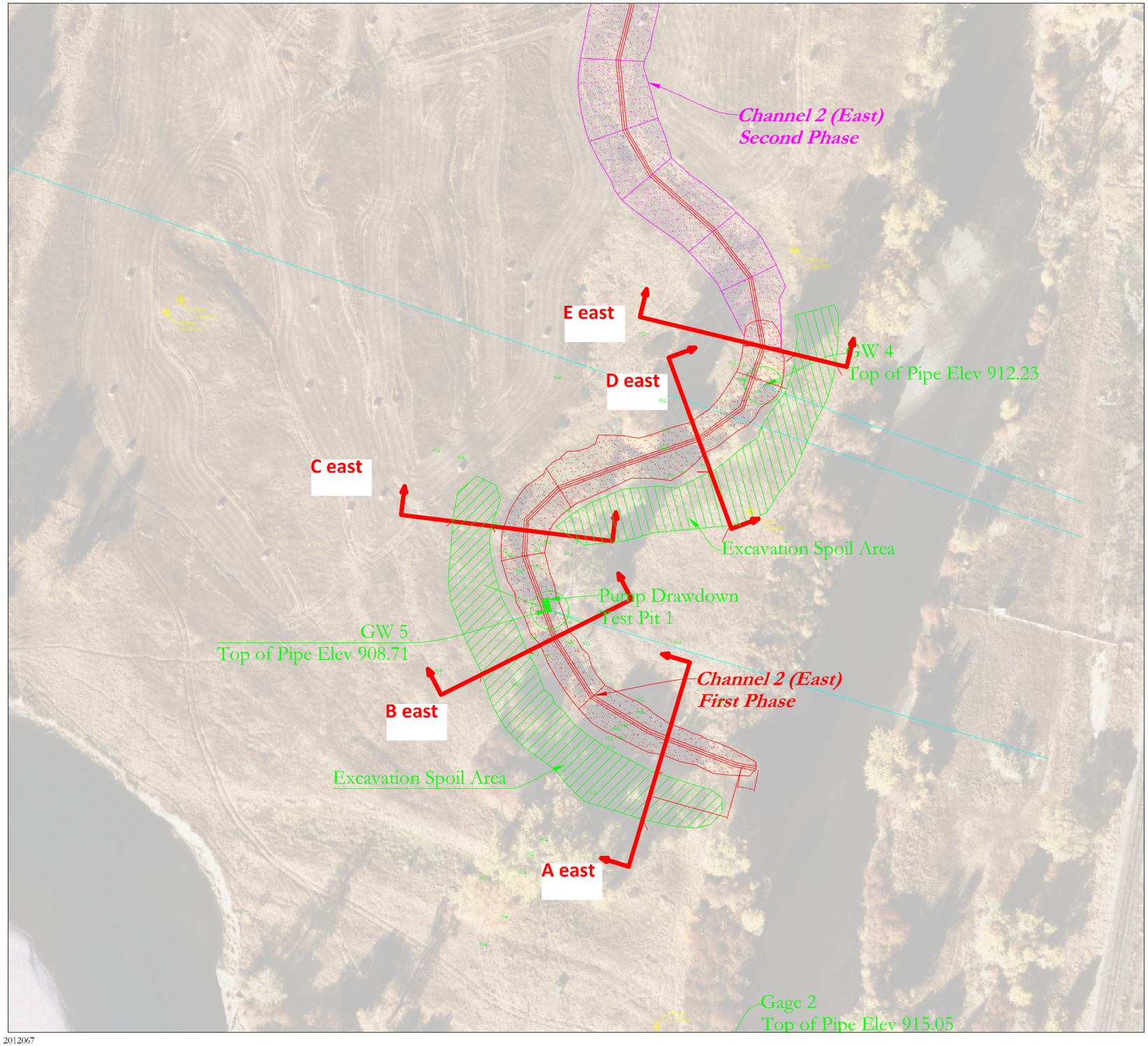
Cascade Columbia Fisheries Enhancement Group

Okanogan/Similkameen Thermal Refugia
Driscoll Island Cold Water Refugia Channels
Channel 2 - Typical Cross Sections

Pacific Hydraulic Engineers & Scientists, PLLC

Date: 20 May 2013 | Sheet: 9



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6) Excavated spoils shown in green hatching to be cast up on natural berm and shaped to raise berm, but not spread into agricultural fields
7) Proposed Phase 1 construction limits shown in red hatching
8) Proposed future Phase 2 construction limits shown in magenta hatching

LEGEND

- Phase 1 Channel Excavation
- Phase 2 Channel Excavation
- Excavation Spoils Limits

100 0 100 200

SCALE: 1"= 100'

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Cascade Columbia Fisheries Enhancement Group	
Okanogan/Similkameen Thermal Refugia Driscoll Island Cold Water Refugia Channels Channel 2 - Excavation Spoils Limits	
Pacific Hydraulic Engineers & Scientists, PLLC	
Date: 20 May 2013	Sheet: 10

Appendices

State of Washington

Department of Fish and Wildlife

Methow Field Office – 350 Bear Creek Rd, Winthrop WA 98862

Okanogan District Team Meeting Agenda

February 27, 2013
Methow Wildlife Area Headquarters, Winthrop, WA
0930-1200

1. Introductions

Present = Habitat: Ken Bevis, Carmen Andonaegui, Gina McCoy. Wildlife = Scott Fitkin, Justin Haug, Dale Swedberg, Tom McCoy, Mike Dehart. No Fish Program or Enforcement able to make it. Jeri Timms, Trout Unlimited, Jason Lundgren, Cascade Columbia Fisheries Enhancement Group, Ed Zapel, consultant to CCFEG.

2. Hot Topics

Outcome of Okanogan County Commissioners meeting w/ WDFW on 2/25? No news to share.

3. Habitat

Projects on WDFW lands – Restoration Goals Team update – Gina McCoy
Since DTm approved report last time, report has been looked at w/ Wildlife Mgt program in Oly and comments were positive. Substance good and approved by management. Moving towards being amendment to WL Area plans. Will be usable as tool to work w/ prospective partners and our goals for our lands. This concept could be applied to other WL lands via WL area and staff. Could vary by area to help us move towards project development. This is a screening document. Not sure if there is a timeline to go public? It has been released to the Watershed Action Teams. Methow RGT now approved by CAG. Gina will work on edits. This complements Conservation Pathway process recently announced. Dtm can revise and add to it. This was first iteration.

Program reorganization status – Carmen – Habitat program is working towards becoming Area based – overhaul based on business oriented strategies. Reorg officially in effect at end of June. With Ken's departure, his FTE will be moved to Wenatchee. Lynda is working 50% on Forest Practices. Graham Simon can cover some areas including Lake Chelan. Habitat Bio position for Wenatchee was advertised today. Watershed Steward will not be replaced.

4. Cascade Columbia Fisheries Enhancement Group

- Briefing from Jason Lundgren on what CCFEG is and how they operate. RFEGs are sponsored by WDFW and can be considered an arm of our agency. Jason gave an update on numerous projects.

CCFEG projects proposed for WDFW lands. These include:

- Methow Planting – funded for several sites from a SRF board grant co written w/ Ken last year. Riparian plantings on old Ag fields alongside river. Will work w/ Methow Natives (Rob Crandall) as contractor through CCFEG and WDFW.

- Silver Side channel – CCFEG working w/ WDFW and USFWS on planning grant for this coming fish funding cycle. Gina has been in on this so far and wants to emphasize an ecosystem approach. Grant proposal to fish funders would be for design of first phases of large restoration project. USFWS restoration group (Robes Parrish) is working on this too.

- Twisp to Carlton River Assessment – concurrent w/ Silver proposal, CCFEG is looking to request funding for a larger scale assessment of the Methow River in this area that would enable large scale restoration in the future. This would tee up future projects and would give a solid overview of the river setting that includes Silver reach. This has not been done to this level of detail (yet) on this stretch of the Methow.

- Groundwater monitoring – Silver, Burns Garrity, Lewisia Rd – proposal to put staff gauges and pizza groundwater monitoring stations in key locations going to PUD small project grant proposals. CCFEG will help Gina.

- Driscoll Planting – complete but will need some follow up – along top of seriously eroding bank planted pines and cottonwood for about 600 feet last year. Funded by small Community Salmon fund grant written by Bevis (before Jason) for the RFEG.

- McLoughlin Falls (Wilson SRF acquisition) - $36,000 left over in this grant for "weed control" that could be used for a riparian planting. Upcoming meeting on-site on 3/18/13 w/ WDFW, Colvilles, CCFEG to discuss possibilities for projects on old Wilson Ranch. Opportunities include side channel that could be opened up, plantings, maybe remove rock blocking side channel. Justin pointed out the WL program may need all or part of the 36k for work on the site. Project possibilities include pilings, plantings, and??

- Driscoll Island (Okanogan River): Presentation to District Team on Driscoll Island Cold Water Refugia proposal.

  Ed Zapel and Jason Lundgren presented information from groundwater wells gathered last year indicating a good gradient on the island that might lead to a successful groundwater fed channel. This assessment work was funded by a SRF grant that was vetted through the District Team last year. Good discussion w/ staff, esp. engineer Gina McCoy re: their proposal.

  SRF funded 18 month project to do monitoring and planning for potential constructed cold water refugia channels in WDFW owned island. Water temps are the main limiting factor identified for Okanogan steelhead. Cross channel project successful in moving water into east channel and creating spawning habitat for summer Chinook. There are relict channels on the island, including two substantial existing sloughs, vegetated around them that would need to be slightly deepened to function w/ water in them. Groundwater is almost at the surface in many places. Presented project outline and are still collecting groundwater data. Alternatives are being developed that could/will be brought to SRF/Trib funding cycle this year, by CCFEG in cooperation w/ WDFW, for construction of preferred alternative. CCT crew helped put in wells. East and west channels had approx 5-8 gal/min groundwater (GW) as verified w/ well pipes and HOBO loggers. During May freshet and Aug low flow shows good temp and GW amounts. River levels in Okanogan east and Similkameen show gradient in GW to river. Looks like it could drive a lot of flow through the channels. Temp looks good for fish. Gradient gets stronger as river level falls. Gradient more pronounced in west channel. Alternatives for two augmented channels could be: 1. All gravity feed. 2. Gravity feed augmented w/ wellwater pumping to many points or 3. GW pump to head of channel. Gina – How about groundwater "gallery" like we have seen proposed on other WDFW sites? Zapel – that might be feasible and should be looked into. We need to evaluate possible infiltration gallery. West channel has good gradient and likely wouldn't need flow augmentation. East channel GW effect weaker, and may not have enough GW flow in summer to overcome hot river water.

Phasing would involve Phase I construction of lower portions of both channels – about 1100 feet west, 500 feet east. Would be a lot of dirt removed. If it is successful, both channels could be extended in Ph II.

Concerns voiced by Swedberg (and others):

- Beavers, they will be there. Response – beavers need flow gradient and it is thought that any beaver dams would be low, and not insurmountable to juvenile fish, for whom the project would be. "Beaver taught salmon to jump". Manageable.
- Long term – needs to be sustainable and not requiring too much ongoing maintenance
- Irrigation – impacts to well waters?
- Sharecropper – what sort of effects on Driscoll?
- Weeds? Including Reed canary grass? Will it overwhelm the channels and make reveg difficult w/ anything but Reed canary?
- Sediment – will the project clog up?
- Avian and mammalian predation on fish? Will it become a trap?
- Excavated material – this may be a big issue. There will be a lot of dirt removed from the channels. Proposal is to spread it on the island. Is this tenable to managers? 10,000 cubic yards is a lota dirt.
- Instability of channels? How to keep from sloughing in. Ken asked about using logs in the channels. Could they be a part of stabilizing the channel? Brush bundles?
- Real Estate Conversion issues?

WDFW need to compile substantive comments back to CCFEG re: these issues in light of the new "Conservation Strategy".
Jason committed to doing this. Sounded like Gina may be the lead on this for WDFW?

Jeri Timms – Trout Unlimited is looking to work w/ us (CCFEG?) on switching diversion from groundwater to surface in river b/c of warmer water in river. Could be a part of the project.

5. Wildlife:

Methow WLA: Tom McCoy – Methow Winter Trail success – got tremendous amount of use. Reported in various press including newspapers, and magazines including a snowshoe publication. Methow WLA snow plow was key to keeping access available. People did not complain about Disco pass requirement. Verbal comments were positive. One thing people want is to be able to take dogs on trails.
Volunteers did grooming work. We provided the sled. Methow Valley Sport Trails Assoc provided groomer attached to our snow mobile. Also created snow trail into Pearrygin State park. Good success for MWLA.

Sinlahekin WLA - Justin Haug
Timber operation underway. Delays, machinery issues, trees on the ground needing to be moved. Only 7 loads have moved. Goal to get down trees out this season. Unit looks good, but 40-50 loads waiting on ground to be moved.
New agricultural lease on Wilson – will transition fields to new crops.
Stack of leases and permits need to be signed and go to Ephrata.

Dale Swedburg, - New role. Dale is the new "Complex Manager" for Okanogan County Wildlife Areas. He will work w/ all of the WL areas and Access personnel here on issues. Will help get new Sinlahekin mgr, provide continuity, institutionalize Prescribed Burn program. Other duties will be determined how Dale can best help rest of program with various issues.

Scott Fitkin/Jeff Heinlen – Deer surveys, wolf meeting, wolverines and lynx and….. No report, as Scott had to leave before we got to him.
Wolf management meeting 2/28 in Omak.

Wildlife Area Staff: Firefighter training. 45 pounds 3 miles in 45 minutes. March 6. Recurrent training.

DTm opinion: Short Mountain properties Scott pointed out importance of this parcel to east west connectivity. Good conservation property that has been in our radar for a long time. Apparently this landowner has approached us in past. Scott recommends we should proceed on land protection here. Dale – this property is important to statewide connectivity issues. Landowners need to help us move the ball. Gina – Be careful we don't string landowners along. Ken/Dale, if project is supported in region and with staff, we should work on it. District Team supports this proposed protection project – either CE or acquisition. Outcome of meeting b/t Okanogan County Commissioners and WDFW will help determine if staff takes time to write grants etc on this one in near term.

6. Fisheries - Bob Jateff/ Jeff Korth - Bevis spoke for them..
Steelhead season opens Friday, 3/1 on Methow.

   Bridge one access site discussions – watering will be a challenge. CAMP design and will work w/ access staff to maintain the plantings.

7. Enforcement – no report.

8. Bevis departure. He has accepted a position w/ WADNR as the Stewardship Fish and Wildlife Biologist for the Small Forest Landowner Office. Last day w/ DFW 3/31. He will not be replaced. FTE will be used to fill Area Habitat Bio position in Chelan County. Bevis gave heartwarming departure speech emphasizing the important work we do, the pride of being a part of WDFW, and encouraged the Okanogan District Team to continue to function so well. We are one of the well-functioning DTms in the state, largely because a succession of Team leaders have persisted in calling meetings and keeping notes. Keep up the good work!!!

   New District Team Leader is Connie Iten. She was unanimously elected.

   Next meeting date, TBD.

   Meeting adjourned at 12:15.

11 March, 2013

MEMORANDUM FOR: Record

SUBJECT: Driscoll Island refugia channel design - Responses to WDFW comments from presentation 27 February 2013

1. On Wednesday, 27 February, Cascade Columbia Fisheries Enhancement Group and Pacific Hydraulic Engineers presented to WDFW's regional habitat biologists and directors the results of groundwater monitoring on Driscoll Island, near Oroville as it relates to construction of potential thermal refugia channels on the Island for juvenile salmonids during peak summer water temperatures. Jason Lundgren of CCFEG provided background information on the Driscoll Island project and other current and planned projects, while Ed Zapel of PHES provided the results of the detailed groundwater monitoring program at Driscoll Island.

2. The WDFW staff attending provided comments and recommendations on the Driscoll Island project via a summary brief following the meeting and presentation[1]. Responses to WDFW comments and recommendations, as well as clarifications of notes are provided in line-item format below.

    - Clarification – East and west channels were shown to have infiltration rates of (conservatively) 5 – 8 gpm per linear foot of channel, as verified with field pump drawdown tests. Groundwater wells showed only the groundwater level and temperature.

    - Concerns – Beavers: additional response concludes that highly permeable substrate will prevent more than an almost imperceptible fall across any beaver dams, as groundwater will shortcircuit the dam and simply pass into reach below dam. Also, beavers respond to the noise of falling water to trigger instinct to build dam. With little or no falling water, its not clear they will attempt to dam the channel. Agree that the problem is likely manageable, but with that said, Phase 1 will require active monitoring to determine beaver effects/impacts.

    - Concerns – Long Term Sustainability: Agree that project needs to be sustainable long term., and that maintenance is not preferable. Should Phase 1 channels be shortened to reduce first-time investment until maintenance need is determined?

    - Concerns – Irrigation Well Impacts: Both channels are well downstream of the large well near the head of the Island; consequently we anticipate no impact there. Proximity to mid-island well should be monitored closely. However, the highly permeable substrate and apparently large groundwater gradient, combined with irrigator's

[1] Washington Department of Fish & Wildlife, 27 February 2013. Okanogan District Team Meeting Agenda, Winthrop, WA.

observation of very little drawdown during pumping operation suggests that well drawdown is not likely a problem.

- Concerns – Sharecropper's Operations: The relic channels are not currently farmed, therefore no direct loss of farmable land should occur. Spoil from excavation will need to be either spread or piled. Material may or may not be suitable for farming, however, design will try to minimize impacts on currently farmed ground.

- Concerns – Weeds: Agree that weed growth will need to be monitored and controlled to minimize impacts to farming operations. Project design will need to try to account for potentially aggressive growth of undesirable vegetation and take steps to minimize impact or prevent infestation to the greatest practical degree.

- Concerns – Sediment: Agree that sediment deposition over time as a result of backwatering from the spring freshet flows is a concern. Phase 1 project should show whether that might be a potential problem. Suggest not investing in Phase 2 or Phase 3 extension of pilot channels until this issue is proven to be a problem or not a problem in Phase 1.

- Concerns – Avian and Mammalian Predation on Fish: Agree that predation may result in impacts to juvenile fish populations. However, there are no refugia channels in this reach of the Okanogan and Similkameen Rivers at present, hence existing summer water temperatures are likely to cause considerable mortality to juvenile fish in the present condition. If these channels increase juvenile fish populations, even in slight increments, the net benefit to the fishery is considerable, even if predation results in high mortality. Mortality outside these thermal refugia is a near-certainty under existing conditions. At least they would have a chance, if however slight, with these implemented.

- Concerns – Excavated Material: Excavation volumes for Phase 1 have not yet been verified. However, the amount is really not extreme; channels will be excavated a depth of maximum three to five feet over a width of up to 25 feet. Could use material to build berm immediately adjacent to channel, or spread thin across adjacent crop fields.

- Concerns – Instability of Channels: Sloughing is a concern, given the soft saturated character of the underlying substrate demonstrated during the pump drawdown tests. Suggest that design, as a minimum, consider no standing slopes greater than 1V:3H. In addition, slopes will have to rely on both vegetation and possibly structural measures to minimize settlement and slumping. These structural measures may include brush bundles, large anchored wood/logs, coir logs staked to slopes, etc.

- Concerns – Conversion of Real Estate: This project does not propose to change the land use of Driscoll Island from agricultural crop land held under lease by private farmers.

- Recommendations – Changing Current Irrigation Source from Well to Surface Water: We agree that this would likely be a good idea, provided that the application of warmer surface water to this potentially highly permeable land surface may adversely impact groundwater resource temperatures. However, confirmation of effects would require a pilot project to test the theory. Suggest this could be accomplished via a pilot installation of a cylindrical screen in the east channel above the ford in the reach controlled by the cross channel weir and ford.

3. Will await more detailed comment from WDFW to finalize design of Phase 1 plans.

STATE OF WASHINGTON
DEPARTMENT OF FISH AND WILDLIFE
1550 Alder St. N.W. • Ephrata, Washington 98823 • (509) 754-4624 FAX (509) 754-5257

April 19, 2013

Jason Lundgren, Executive Director
Cascade Columbia Fisheries Enhancement Group
316 Washington Street, Suite 401
Wenatchee, WA 98801

RE: Driscoll Island Cold Water Refugia Project, Similkameen River, Okanogan Subbasin

Dear Jason,

The Washington Department of Fish and Wildlife (WDFW) appreciates your presentation on the Driscoll Island Cold Water Refugia Project proposal on February 27, 2013, to the WDFW Okanogan District Team. As we have discussed, WDFW finds there are significant concerns with the proposal; those concerns are provided below. As a result, the Region 2 Program Managers and the Regional Director determined not to approve further development of this project at this time. However, our recommendation is not solely based on our concerns with respect to the technical aspects of your proposal; given available staff and time, WDFW could continue to work with you on an examination of restoration opportunities on the Driscoll Island property, but Lands Services staff are not available presently or in the very near future. This same limitation extends to development of restoration projects on WDFW lands in Region 2 generally.

It is our hope that in the future, WDFW will have the capacity to reengage with you on this project to address our concerns or that we will have the opportunity to work with your organization on another proposal for salmon habitat restoration work on this or other WDFW properties.

Real Estate Services Review – The Driscoll Island Wildlife Area was purchased in 1975 through the Washington State Recreation and Conservation Office (RCO) and described as such:

RCO funding for Driscoll Island Fund #75-606: This project was approved for the purchase of 236 acres of land on Driscoll Island of the Eyhott Island chain located in the channels of the Okanogan and Similkameen Rivers south of Oroville. Ownership of the land would provide public hunting for upland game, waterfowl and deer. Land would also provide excellent natural trails and opportunity for public bird watching and wildlife photography. Grazing will be used as a management tool. Foot access only is available to the site via a private railway footbridge crossing.

The property is currently being used for before-described recreational purposes as well as the production of alfalfa. Grazing has been halted on the island due to the risk of having cattle isolated on the island for several months during spring high flows of the Okanogan and Similkameen Rivers. The footbridge mentioned at the time of purchase has since been decommissioned and plans are to construct a new access bridge when funding becomes available.

WDFW comments on the project proposal:

1. **Property Conversion** – The purchase of Driscoll Island was intended to provide additional hunting and fishing opportunities to the citizens of Washington State. The implementation of the project, as well as the final product, must not limit the public use of the island for its intended purposes. It must be written within the proposal that all actions before, during and after the project will not negatively impact the public's use of the property.

2. **Excavated Material** – One of the most serious concern with the project as proposed is the plan to spread the estimated approximately 10,000 cubic yards of dredged material on lands adjacent to the channel. This would cover a significant portion of ground immediately adjacent to the channel project. It is still unclear: how this material is going to be placed adjacent to the channel; if the spoils (hydric soils) can propagate vegetation and if so, how the inevitable weed infestations (esp. reed canary grass) are going to be controlled; and to what extent native vegetation will be negatively affected by the construction and wasting of spoils onsite. Additionally, calculations show that 10,000 cubic yards would cover approximately 6 acres 1 foot deep. This kind of disturbance/ground cover over existing native vegetation including riparian vegetation is unacceptable in that mitigation would be difficult if not impossible.

3. **Impacts on Current Irrigation & Sharecropper Issues** – Different options to augment flows within the channel includes using existing wells and water rights that were granted for agricultural use, which are currently being used by the sharecropper, . This gives rise to a number of issues:

    1) Does providing well water to the channel affect irrigation of the existing crops on the island;

    2) What exactly will be expected of the sharecropper in terms of responsibility for the irrigation system - i.e. if the pump fails who pays for a new one; will the sharecropper be expected to manage the flow of

water; when the sharecropper irrigates, does it best meet the needs for flows within the channel?

3) There are obvious water right issues associated with using the well water: type of use; appurtenant land changes; etc. These issues will need to be addressed and tracked.

4. **Predation** - There is a concern on the part of WDFW that avian and mammalian predation on juvenile salmonids will be significant within the cold water refugia channels. This concern must be addressed in the project proposal.

5. **Beaver** – Beaver activity, e.g., damming, channel construction, cutting and removal of riparian vegetation within the channels will be inevitable. This concern needs to be addressed in the project proposal.

6. **Project Longevity** – This project must be self-sustaining, requiring little to no maintenance once the project is completed. Channel stability and siltation are two concerns that could influence the longevity of the project. Both these issues need to be addressed in the proposal. It's unclear what measures will be implemented to reduce the potential of instability along the channel banks. The project should outline methodology to reduce this risk. It is also unknown whether or not siltation within the cold-water refugia channel will become problematic after high-flow events. WDFW would like reassurance that these issues will not affect the long-term success of this project.

Again, WDFW appreciates your interest in developing salmon restoration projects on WDFW lands and look forward to working with you on such projects when the opportunities exist. WDFW's Wildlife Program will be updating the 6-Year Wildlife Area Management Plans in the upcoming year. The Wildlife Area Management Plans represent an opportunity to incorporate salmon restoration project development into the Wildlife Area Plans. We welcome your participation in this upcoming process.

Sincerely,

Dennis Beich. Regional Director, Region 2
Washington Department of Fish and Wildlife

cc: Carmen Andonaegui, WDFW
Matt Monda, WDFW
Jeff Korth, WDFW