Diversion Dam Volitional Passage Plan

Henry M. Jackson Hydroelectric Project
(FERC No. 2157)

SNOHOMISH COUNTY PUD
PUBLIC UTILITY DISTRICT NO. 1

May 2011

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ACRONYMS AND ABBREVIATIONS

ARC	Aquatic Resource Committee
cfs	cubic feet per second
District	Public Utility District No. 1 of Snohomish County
DDIA	Diversion Dam Index Area
DDVP	Diversion Dam Volitional Passage
FERC	Federal Energy Regulatory Commission
FHM	Fisheries and Habitat Monitoring
fps	feet per second
msl	mean sea level
MW	Megawatt
NMFS	National Marine Fishery Service
PLA	Proposed License Article
PM&E	Protection, Mitigation and Enhancement
RM	river mile
RSP	Revised Study Plan
USGS	United States Geological Survey

1. INTRODUCTION

1.1 Background

The Public Utility District No. 1 of Snohomish County (District) is seeking from the Federal Energy Regulatory Commission (FERC) a new license for the existing 111.8-megawatt (MW) Henry M. Jackson Hydroelectric Project (FERC No. 2157) (Project). The original license expires May 31, 2011. The Project is located on the Sultan River in Snohomish County, Washington, near the City of Sultan. The Project was originally licensed in 1961 and amended in 1981. In 1964, construction of Culmback Dam was completed to create Spada Lake Reservoir - the source of 80% of the drinking water supplied to Snohomish County by the City of Everett. In 1984, construction of the hydroelectric portion of the Project as it exists today was completed. The Project includes a 262-foot high rock-fill dam (Culmback Dam); a 1,870-acre reservoir (Spada Lake or Spada Reservoir) operated for the City of Everett's water supply, fisheries habitat enhancement, hydroelectric power generation, and incidental flood control; a Powerhouse and various other facilities; wildlife mitigation lands; and several developed and undeveloped recreation and river access sites.

On October 14, 2009, the District filed with the FERC a comprehensive settlement agreement (Settlement Agreement) on behalf of itself, National Marine Fisheries Service, United States Forest Service, United States Fish and Wildlife Service, United States National Parks Service, Washington Department of Fish and Wildlife, Washington Department of Ecology, the Tulalip Tribes of Washington, the City of Everett, Snohomish County, the City of Sultan and American Whitewater (collectively referred to as Settlement Parties). The Settlement Agreement resolved among the signatories all issues associated with issuance of a new license for the Project, including reservoir operation, minimum instream flows, process flows, whitewater boating flows, ramping rates, fish passage, fish habitat improvements, wildlife habitat management, marbled murrelet protection measures, recreation, historic properties and license term.

The Settlement Agreement requests that the FERC adopt, without material modification, a set of Proposed License Articles. These Proposed License Articles will implement a complex and interrelated suite of protection, mitigation and enhancement measures that will result in improved resource conditions and ecological processes in the Sultan River over the term of a new license. One of the Proposed License Articles relates to the development of fish passage at the City of Everett's Diversion Dam on the Sultan River.

1.2 DDVP Plan Purpose

The Settlement Agreement's Proposed Aquatic License Article (A-LA 13) provides for the development of this Diversion Dam Volitional Fish Passage Plan (DDVP Plan). The DDVP Plan was developed with the Aquatic Resources Committee (ARC) in consideration of providing fish passage around the Diversion Dam to additional fish habitat upstream on the Sultan River when and if it is needed based on biological monitoring and triggers. Providing access to historical spawning and rearing habitat upstream of the Diversion Dam is expected to increase salmon and steelhead production in the Sultan River by allowing these species to fully utilize

available habitat and potential production capacity. The reintroduction of anadromous salmonids to this reach is also expected to benefit resident rainbow trout and other aquatic and terrestrial species by increasing primary productivity through the addition of marine derived nutrients (i.e., salmon carcasses). The DDVP Plan is to guide the planning, trigger monitoring, and if the monitoring triggers the need for fish passage around the dam, then design and construction of volitional fish passage at the City of Everett's Diversion Dam on the Sultan River, based on the requirements identified in the Proposed License Article.

1.3 Coordination and Integration

1.3.1 District's Role

Upon issuance of the new license and approval of the DDVP Plan, the District will be responsible for implementation. This responsibility will include:

- providing the funding to carry out the measures as described herein;
- coordinating with surrounding landowners regarding land management in or near the Project boundary that may affect or be affected by the measures provided;
- consulting with the ARC;
- monitoring resource effects; and
- reporting to the FERC.

The District's resource specialists and consultants will be involved as needed. Operational staff will be trained on the unique requirements of the DDVP Plan.

1.3.2 Consultation

The District will meet quarterly with the ARC on license implementation measures. As necessary, these meetings will address outstanding issues associated with the implementation of this Plan. Where this Plan requires consultation with or review by the ARC, such involvement will typically occur during these quarterly meetings. The District may consult or seek input from the ARC on an as-needed, issue-specific basis as well.

1.3.3 Resources

Due to the complicated interaction of natural resources and the biological-trigger based approach to constructing fish passage, unintended effects may occur without close monitoring and consideration of resource interactions and other PM&E measures. The District will coordinate the actions of the DDVP Plan with the actions of the various Project resource management plans including the:

- Fisheries and Habitat Monitoring Plan – for cross reference to monitoring components (redd surveys).
- Water Temperature Conditioning Plan – for cross reference to changes in temperature targets with the onset of anadromous fish in the bypass reach.
- Adaptive Management Plan – for cross reference to the process for modifying this Plan within the constraint of the license article based on monitoring results.

- Operating Plan – for cross reference to minimum flow changes with the onset of anadromous fish in the bypass reach.
- Fish Habitat Enhancement Plan – for cross reference to opportunities for further habitat enhancements in the Sultan River for anadromous fish.
- Process Flow Plan – for cross reference to Upstream and Outmigration Flows in the bypass reach once volitional passage is constructed.
- Historic Properties Management Plan – for cross reference to consultation requirements for modification of Diversion Dam. The Diversion Dam and associated structures were determined eligible for listing on the National Register of Historic Places during the conduct of relicensing studies.
- Marbled Murrelet Habitat Protection Plan – for cross reference to steps necessary to identify suitable habitat and/or to potential timing restrictions or other protective measures during modification.

2. DDVP PLAN GOALS AND TRIGGERS

2.1 Standards and Trigger

2.1.1 Upstream Passage

The goal for upstream passage at the Diversion Dam is to provide a means for anadromous species to freely migrate upstream volitionally and of their own accord.

2.1.2 Downstream Passage

Downstream migrants should be guided by flow direction and pass the Diversion Dam unimpeded. Flow guidance should occur unobstructed and free of confusion from flow paths or man made obstructions.

2.1.3 Design Standards

Design for the DDVP improvements will follow a variety of standards listed below based on discipline.

Biological:

- NMFS NW Region Anadromous Salmonid Passage Facility Design, February 2008

Structural:

- International Building Code IBC 2006
- FERC Engineering Guidelines for the Evaluation of Hydropower Projects, Chapter 3
- ACI 318-08 Building Code Requirements for Structural Concrete
- Steel Construction Manual AISC Thirteenth Edition
- ASCE 7-05 Minimum Design Loads for Buildings and Other Structures
- WISHA WAC 296-24 General Safety and Health Standards

Electrical:

- NFPA 70 – National Electrical Code (current regulatory edition)

2.1.4 Trigger Description

The "passage trigger" is initiated when in any one year, the spawning escapement of either Chinook salmon or steelhead trout within the Diversion Dam Index Area (DDIA) equals or exceeds ten percent (10%) of the combined total spawning escapement for either Chinook salmon or steelhead trout within the four (4) index areas of the Sultan River, downstream of the Diversion Dam. These index areas include; the Lower River, Powerhouse, Gold Camp, and Diversion Dam and are depicted on Figure 2-1.

Figure 2-1. Index Areas.

2.2 Limitations

From a regulatory perspective, initiation of the DDVP Plan is subject to the District obtaining the FERC's approval and any other necessary regulatory approval. The District will not begin construction of the Diversion Dam modifications for fish passage until the FERC approves the final design and DDVP Plan, and the District has obtained all necessary permits from federal, state, and local agencies. Additionally, as part of the regulatory approval since the Diversion

Dam has been determined eligible for listing on the National Register of Historic Places, the District will need to consult with the cultural resource representatives of the Washington Department of Archaeology and Historic Preservation, City of Everett, Snohomish County, and the FERC prior to any modifications as required by the Project's Historic Properties Management Plan. Consultation with the cultural resources will begin once the trigger has been initiated.

The District will strive to complete the Diversion Dam modifications no later than two (2) full construction seasons after the FERC's approval of the design and obtaining all necessary permits. Currently the in-water-work period for constructing the improvements is defined as August 1 through August 31. Conceptual development of the options to implement the DDVP Plan has resulted in the concern that two, 1 month in-water construction periods is inadequate time to complete the work. An expansion of the duration of the in-water work window may be required to complete a project of this magnitude within two construction seasons. A more realistic timeframe would expand the in-water-work periods to July 15 and to September 15 with consideration that water handling features such as cofferdams fall outside this window. As part of the preparing final plans for the project the District will consult with federal and state agencies about in water work windows with intent to agree upon a schedule that would allow for construction in two years.

2.2.1 Intermittent Passage during Emergency Everett Water Diversion

Once fish passage is implemented at the Diversion Dam and the escapement of anadromous fish above the Diversion Dam results in the creation of six (6) or more redds in any one (1) year, the District will not reverse flow (divert) or authorize the reverse flow of water from the Sultan River to Lake Chaplain unless required to meet the City of Everett's emergency water supply needs. This restriction would be imposed to eliminate entrainment of juvenile outmigrant fish during diversion from the Sultan River. Emergency conditions occur when water cannot be supplied to the City's storage reservoir, Lake Chaplain, via the Jackson Hydroelectric project and the level in Lake Chaplain declines to the point that it needs to be replenished. Emergency conditions can result from either a drought or a shutdown of flow passage through the hydroelectric project back up to Lake Chaplain to conduct inspection or maintenance. During drought conditions, reverse flow operations may be necessary to meet water supply needs. NMFS has determined that fish entrainment under these conditions may not be a substantial problem because juvenile fish generally do not out-migrate during the time period when drought conditions are likely. It is more probable that difficulties may arise around maintaining upstream passage during drought conditions / reverse flow operations. The upstream fish passage improvements in the DDVP Plan do not allow upstream fish passage while diverting water at the Diversion Dam to Lake Chaplain. If the condition occurs requiring that water be diverted at the Division Dam during the period of upstream fish migration, then an alternating operation scheme would be implemented. Alternating operation would require shutting the sluice gate to divert water for an acceptable period of time, then opening the sluice gate to allow fish passage for an acceptable period of time such that both upstream fish passage and water supply needs are met. Regardless, if this water supply requirement is triggered, the District shall, in consultation with the City of Everett, and NMFS, take appropriate measures to determine acceptable diversion and fish passage durations for protecting Endangered Species Act listed fish.

3. VOLITIONAL PASSAGE STRUCTURE DETAILS

3.1 Operations and Design Criteria

The Diversion Dam is an important part of the City of Everett's water supply that has been integrated into the Jackson Hydroelectric Project. Figure 3-1 "Overall System Schematic" depicts the various components of the passage project and how they relate to the Diversion Dam. In general, water can be diverted from Spada Lake Reservoir to either the Powerhouse via the Power Tunnel or into the Sultan River from Culmback Dam. Flow from the Powerhouse is either released into the Sultan River (after passing through the Pelton Units) or to the Portal 2 Control Structure at Lake Chaplain (through the Francis turbines). The Portal 2 Control Structure regulates water flowing into Lake Chaplain for the City of Everett water use and/or allows flow back to the Diversion Dam through the Diversion tunnel and pipeline to meet minimum flow requirements in Reach 2. Flow in the Diversion tunnel and pipeline can be reversed to allow the City of Everett to divert water directly from the Sultan River as they did prior to development of the Jackson Project Stage II in 1984. Figures 3-2 depicts an overview of the Diversion Dam. The Diversion Dam includes; an ogee spillway section to pass high flow, a sluiceway, which will be modified to include a fishway, an Inlet/Outlet structure for diverting flow to Lake Chaplain or releasing flow into the Sultan River, and a Diversion Spillway which can also be used to release flow back into the Sultan River.

The proposed modifications to provide fish passage around the Diversion Dam includes two options. Both options require lowering the channel through the sluiceway to provide a fishway for passage of fish around the Diversions Dam. Option 1 is depicted in Figure 3-3 and includes a Pool and Chute ladder with a fishway channel extending under the sluice gate to the upstream side of the dam. Option 2 is depicted in Figure 3-4 and is a modification of Option 1 by lowering the fishway channel to the extent that the Pool and Chute ladder is reduced or possibly eliminated altogether. Each of these options is described in greater detail in Section 3.2.

The following sections present the biological criteria, followed by a description of the river hydrology and hydraulic data, the post DDVP flow regime as defined by the Settlement Agreement that would be implemented if the trigger conditions are met (described in section 2.1.4), and various detailed flow scenarios that result from this flow regime and define design parameters regarding flow. These flow scenarios include: the Low Flow Scenario at the 95 percent exceedance condition which defines the low design flow, the Late October Scenario that defines the maximum flow released at the Diversion Dam, the High Flow Scenario at the 5 percent exceedance condition, and the Emergency Flow Scenario when the Diversion Dam must be used to provide flow to Lake Chaplain for the City of Everett water supply and defines the high design flow.

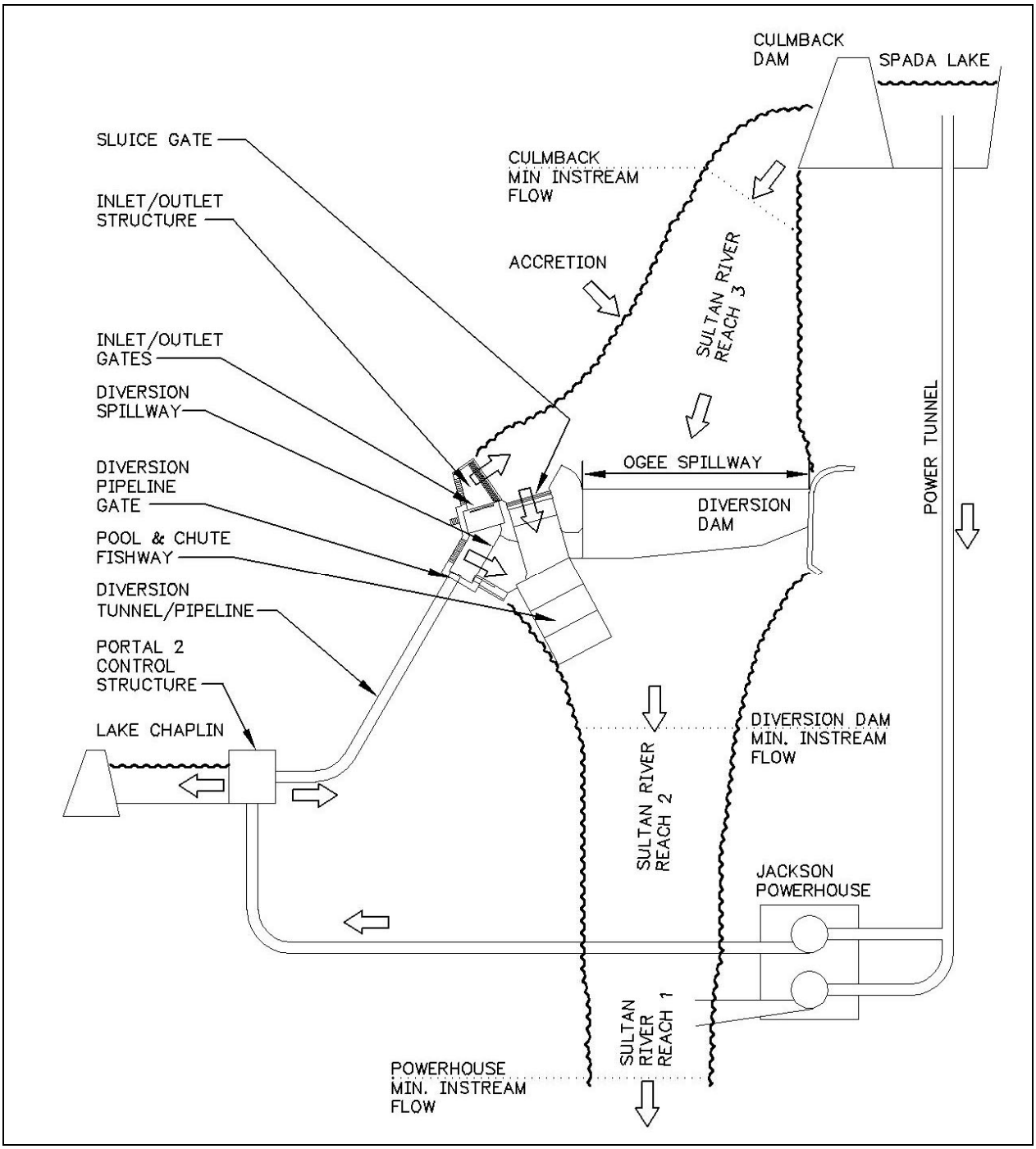

Figure 3-1. Overall System Schematic.

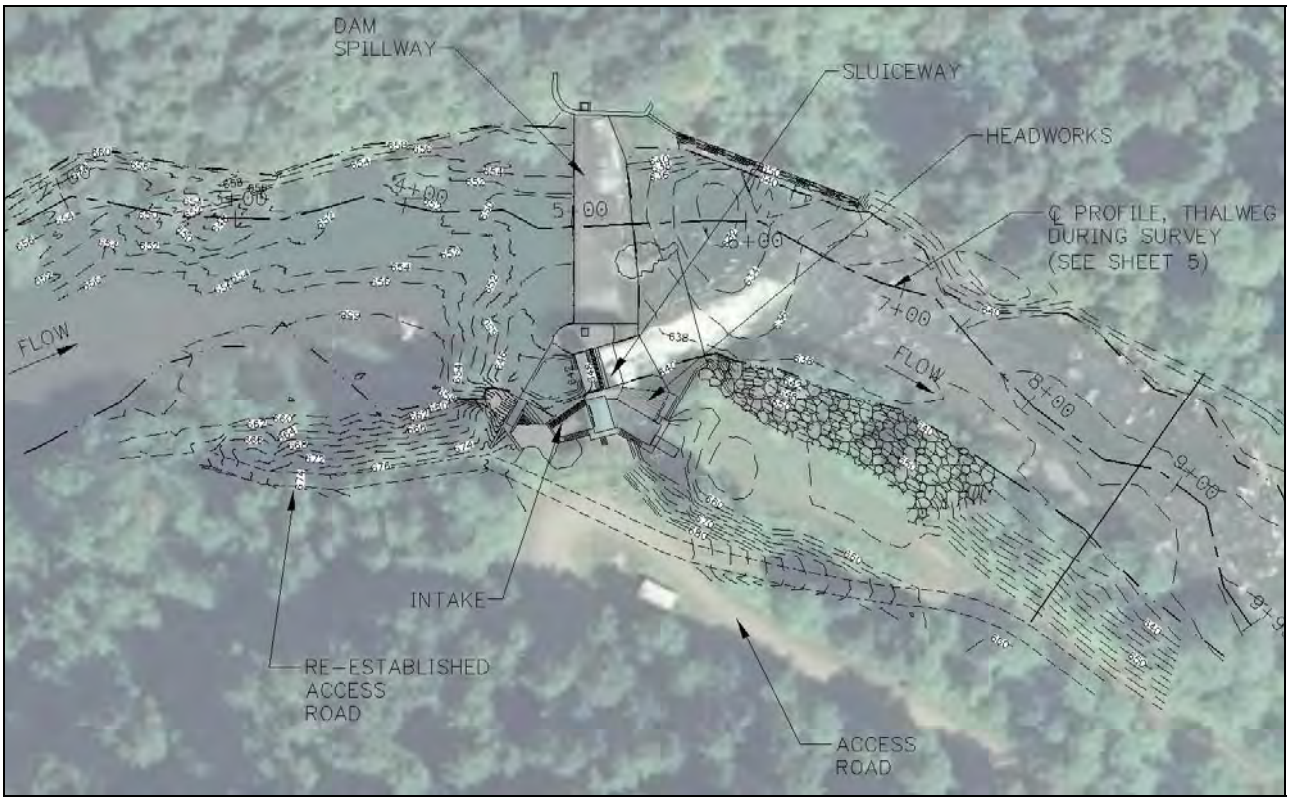

Figure 3-2. Diversion Dam Aerial View.

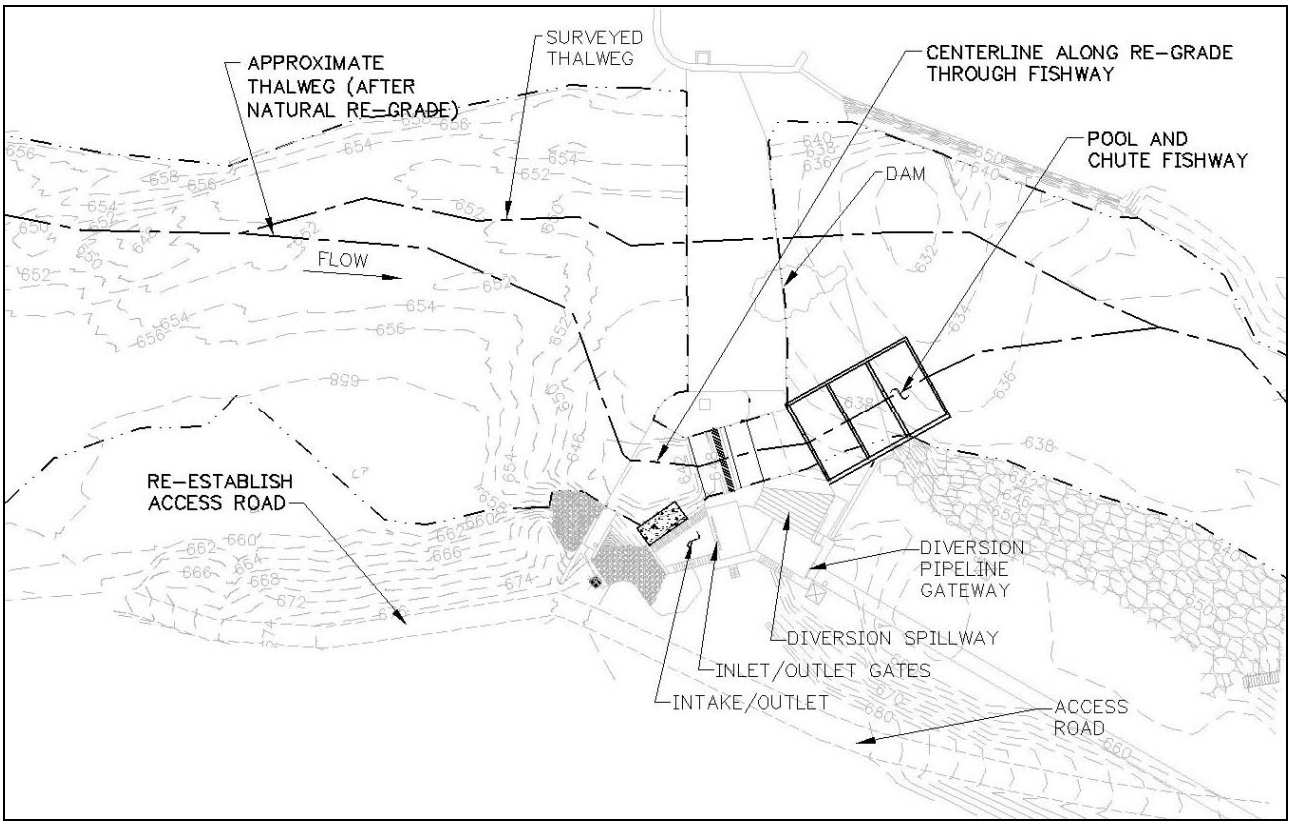

Figure 3-3. Option 1 – Diversion Dam Overall Plan.

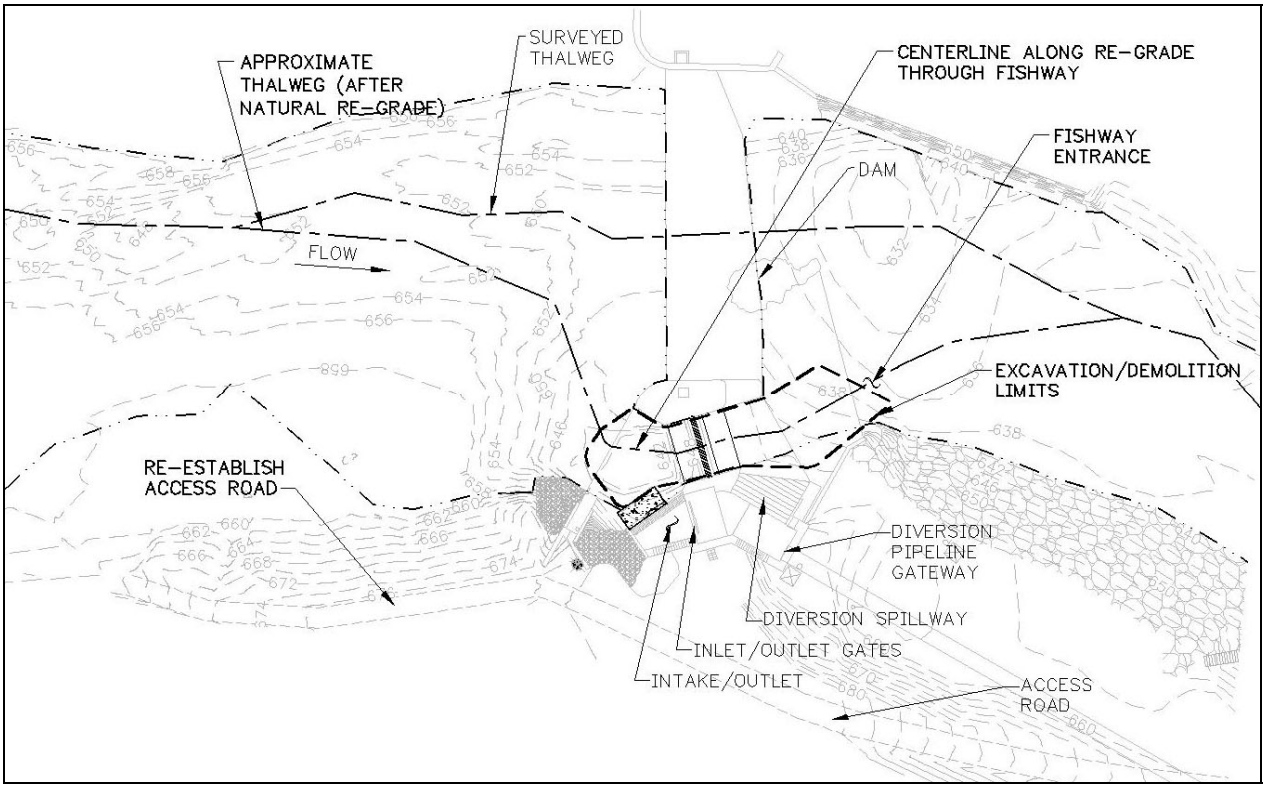

Figure 3-4. Option 2 – Diversion Dam Overall Plan.

3.1.1 Biological Criteria

The anadromous fish species anticipated at the Diversion Dam are coho salmon, Steelhead trout, and Chinook salmon. Table 3-1 presents run-timing of these fish at the Diversion Dam. Resident fish, assumed present at the Dam year round, are also included for consideration.

Table 3-1. Upstream Salmonid Migration Timing

	Upstream Salmonid Migration		
	Coho	Steelhead	Chinook
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

3.1.2 Relevant Fish Passage Design Criteria

Criteria used for configuring the fish passage alternatives include:

- Fish ladder step height of 9 inches (to accommodate resident fish).
- Providing a minimum fish pool volume to limit the energy of water introduced from Lake Chaplain pipeline to 4 foot pound per second. (Volume > 62.4 pcf x Flow, cfs x Head, ft / 4 ft*lbs/sec).
- Pool and Chute fish ladder design is based on "Pool and Chute Fishways Discussion and Design Process" worksheet developed by WDFW and previous design experience (Powers 2001).
- Minimize pool and chute structures by lowering the fishway channel to the maximum extent that is practical (consideration will weight the additional excavation/demolition against constructing pools and chutes).
- Attraction flow for fishway equaling 100 percent of river flow.
- Permanent fish screen (if determined by District to be economically feasible) of a maximum slot size of 0.069 inches or 0.094 inch diameter openings, minimum open area of 27 percent, corrosion resistant material, maximum approach velocity of 0.4 fps.

3.1.3 Hydrology and Hydraulics

The flow at the Diversion Dam is a primary consideration for fish passage design. Flow is highly regulated by the operation of the Jackson Project. Table 3-2 Describes the hydrology of the system and hydraulic design parameters at the dam including; current upstream and downstream water surfaces, 95 and 5% exceedance flows (based on the post DDVP flow regime during the anadromous fish passage season), flood recurrence intervals, and pre-Diversion Dam water surfaces with corresponding estimated flow. The pre-Diversion Dam water surfaces were depicted on the original as-built drawings. These water surfaces were measured in 1929, prior to documented gaging of this reach of the Sultan River. The flow associated with these pre-dam levels was estimated by averaging the flow over a 20-year period (1934 – 1953) for the respective day. These pre-dam conditions are useful when considering possible conditions for lowering the river for fish passage through a modified sluiceway in the dam.

Table 3-2. Diversion Dam Hydrology and Hydraulic Data (historical and based on Post DDVP flow regime).

HYDROLOGY	FLOW (CFS)	UPSTREAM WS EL (FT)	TAILWATER EL (FT)
MINIMUM INSTREAM FLOW - UPSTREAM	20 - 70	656.6 - 656.8	639.2 - 639.3
MINIMUM INSTREAM FLOW - DOWNSTREAM	100 - 200	657.4 - 658.6	639.5 - 638.8
95% EXCEEDANCE FLOW	100	657.4	639.5
5% EXCEEDANCE FLOW	250	658.8	640.0
FLOOD RECURRENCE INTERVAL (YEARS)			
2	1557	660.2	642.6
5	3860	662.2	644.1
10	6820	662.9	645.5
20	11470	665.7	647.2
50	21800	670.8	654.4
100	34600	677.0	659.6
HISTORIC PRE-DAM FLOW	20 YEAR AVERAGE FLOW CFS (1934-1953)	WATER SURFACE EL (FT - NAVD88)	
5/12/1929	1130	643.2	
7/9/1929	473	642.5	
7/18/1929	413	641.9	
USGS GAGING STATION	12137800		

3.1.3.1 Flow Duration Curve

The daily flow duration curve for the post Diversion Dam flow regime is depicted by Figure 3-5. This curve is based on the historical inflows to the system in addition to modeled simulation of the project with consideration of estimated future water consumption by the City of Everett.

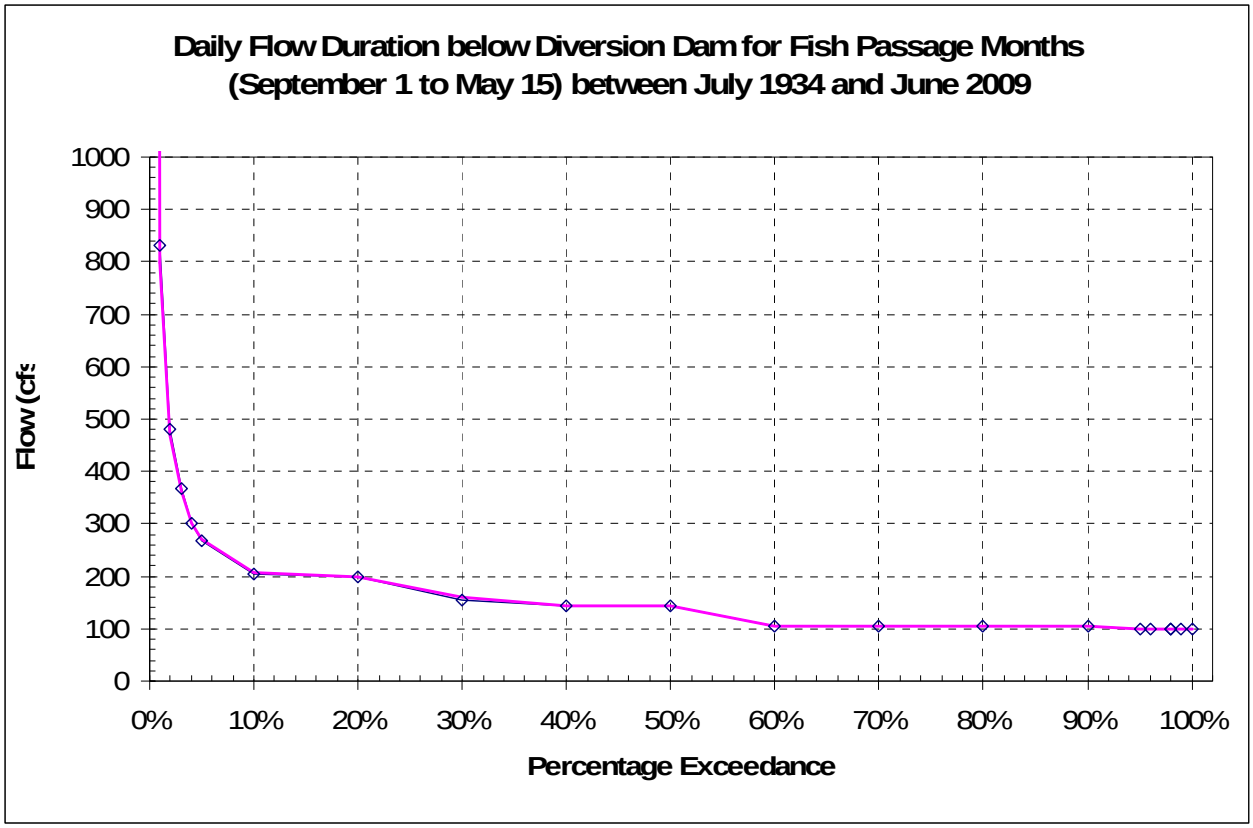

Figure 3-5. Flow Duration Curve.

3.1.3.2 Tailwater Rating Curve

A rating curve was developed for the pool just downstream of the Diversion Dam. This curve, Figure 3-6, is based on the USGS Gage 12137800 downstream rating curve and is adjusted upstream to the dam base with HEC RAS modeling calibrated to observed conditions at the base of the dam.

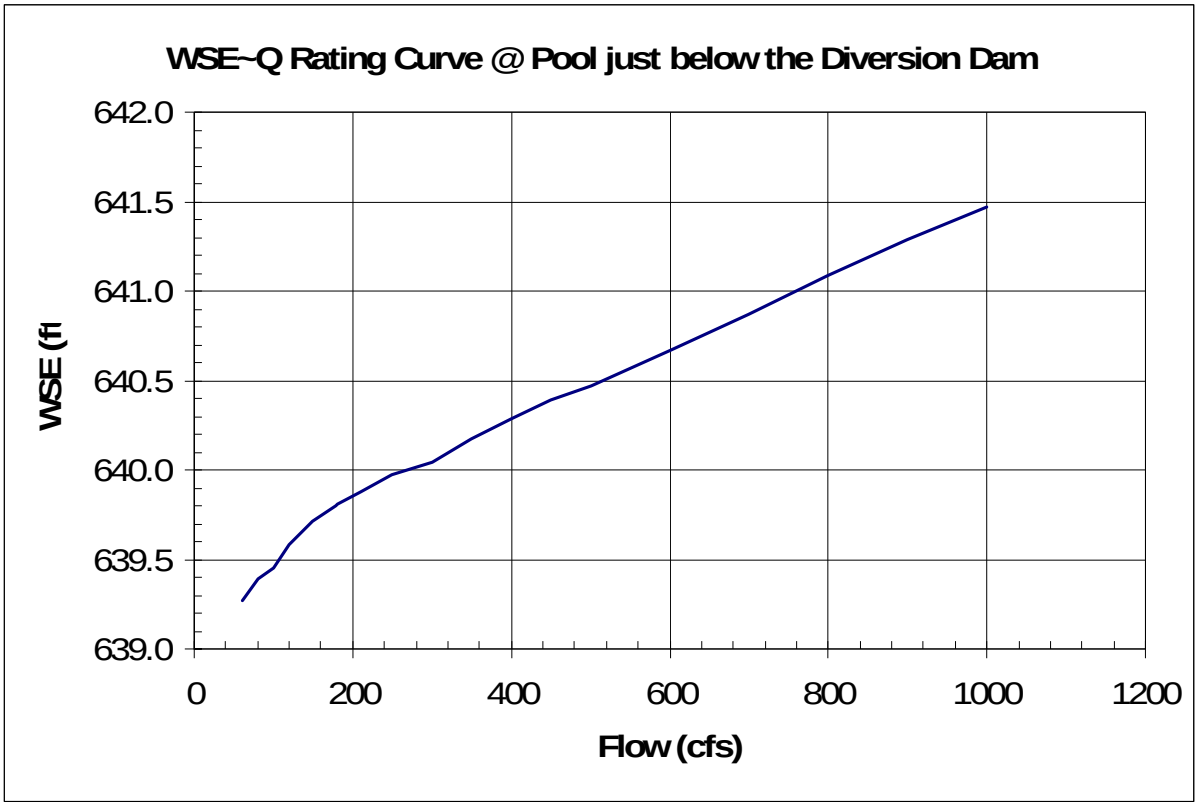

Figure 3-6. Tailwater Rating Curve.

3.1.3.3 Flow Regimes

The post DDVP flow regime set forth in the Settlement Agreement requires that various flow conditions be met within three different reaches of the Sultan River. Reach 1 is downstream of the Jackson Powerhouse. Reach 2 is between the Diversion Dam and the Powerhouse. Reach 3 is between Culmback Dam and the Diversion Dam. In order to meet these flow requirements, flow is released into the Sultan River at Culmback Dam, the Diversion Dam, and at the Powerhouse, in addition to accounting for accretion along each of the reaches from surface runoff and spring water. Figure 3-1 depicts these features and the various flow components. These flow conditions are presented in Table 3-3, which provides a monthly breakdown of the minimum instream flow requirements based on the water level in Spada Lake.

Table 3-3. Post DDVP Flow Regime

<table>
<tr><th></th><th rowspan="2">Min. Instream Flow at Culmback Dam, cfs</th><th colspan="3">Min. Instream Flow - Diversion Dam, cfs</th><th colspan="6">Min. Instream Flow - Powerhouse, cfs</th></tr>
<tr><th></th><th></th><th></th><th></th><th></th><th colspan="5">Drought Conditions</th></tr>
<tr><th></th><th></th><th>Spada Reservoir Above Elv 1415</th><th>Spada Reservoir Between Elv 1415 and Elv 1405</th><th>Spada Reservoir Below Elv 1405</th><th>Non - Drought Condition</th><th>Spada Reservoir Above Elv 1420</th><th>Spada Reservoir Between Elv 1420 and Elv 1415</th><th>Spada Reservoir Between Elv 1415 and Elv 1410</th><th>Spada Reservoir Between Elv 1410 and Elv 1405</th><th>Spada Reservoir Below Elv 1405</th></tr>
<tr><td>January</td><td rowspan="4">20</td><td colspan="3" rowspan="2">100</td><td rowspan="12">300</td><td rowspan="12">300</td><td rowspan="12">275</td><td rowspan="8">250</td><td rowspan="8">225</td><td rowspan="12">200</td></tr>
<tr><td>February</td></tr>
<tr><td>March</td><td colspan="3" rowspan="2">140</td></tr>
<tr><td>April</td></tr>
<tr><td>May</td><td>30</td></tr>
<tr><td>June</td><td>35</td><td colspan="3" rowspan="3">100</td></tr>
<tr><td>July</td><td>40</td></tr>
<tr><td>August</td><td>45</td></tr>
<tr><td>September</td><td>55</td></tr>
<tr><td rowspan="2">October</td><td>65</td><td rowspan="2">200</td><td rowspan="2">175</td><td rowspan="2">150</td><td rowspan="2">275</td><td rowspan="2">250</td></tr>
<tr><td>70</td></tr>
<tr><td>November</td><td rowspan="2">60</td></tr>
<tr><td>December</td><td>20</td><td colspan="3">100</td><td>250</td><td>225</td></tr>
</table>

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3.1.3.4 Design Flow Scenarios

Based on the post DDVP flow regime a number of flow scenarios are developed to illustrate the flow requirements at the Diversion Dam and to help provide an understanding of how the system is operated. Managing flow on the Jackson Project is relatively complicated. Generally, flow is released into the Sultan River at Culmback Dam to meet minimum instream conditions in Reach 3 (above the Diversion Dam). Flow is also diverted from Spada Lake directly to the Powerhouse for generation of hydroelectric power. The Powerhouse flow is discharged directly into the

Sultan River (to Reach 1), and a portion of the discharge flow is supplied to Lake Chaplain through a pipeline. The Powerhouse flow to Lake Chaplain is used to meet the City of Everett's water use and a portion of this flow is passed on to the Diversion Dam to meet minimum instream requirements to Reach 2. If flow to Lake Chaplain cannot be provided via the hydropower diversion (i.e., during an emergency or drought), then additional flow is diverted at Culmback Dam to meet minimum instream flow requirements for all the reaches.

Anticipated operations of the project are depicted in the following series of figures that describe the operational scenarios important for design of the DDVP improvements. Figures 3-7 through Figure 3-10 depict; low flow conditions (95% exceedance), a Late October Condition with moderate flow, high flow (5% exceedance), and an emergency condition when normal Powerhouse recirculation cannot be provided and the majority of the flow required to meet minimum instream requirement is released at Culmback Dam. These flow scenarios define the fish passage design flows:

- The low fish passage design flow is 100 cfs (95% exceedance flow).
- The high fish passage design flow is taken as the emergency flow condition flow of 300 cfs, which exceeds the typical 5 percent exceedance condition of 250 cfs. This more conservative value is used to assure upstream fish passage conditions when minimum instream flow in Reach 1 is provided from Culmback Dam during emergency conditions (drought or hydroelectric project failure).
- The maximum flowrate that needs to be supplied to the Sultan River at the Diversion Dam, to meet minimum instream flow, is 130 cfs and occurs in late October.
- This flowrate is anticipated to be distributed at the dam by supplying 60 cfs through the Inlet/Outlet structure and 70 cfs supplied over the Diversion Spillway.
- The maximum flow for emergency diversions to Lake Chaplain is 190 cfs through the Inlet/Outlet structure.

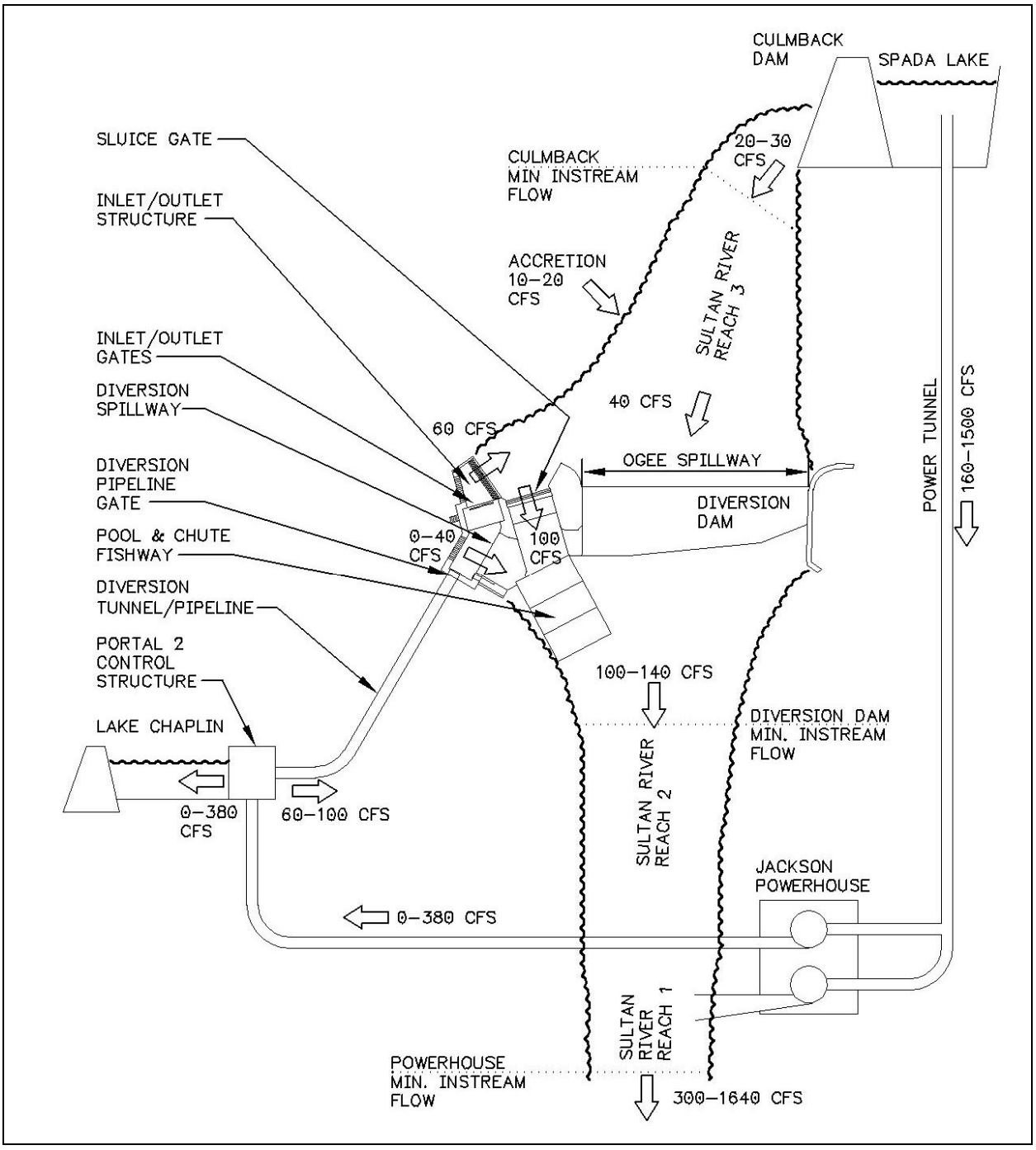

Figure 3-7. Fish Passage Design Flows: Low Flow Scenario.

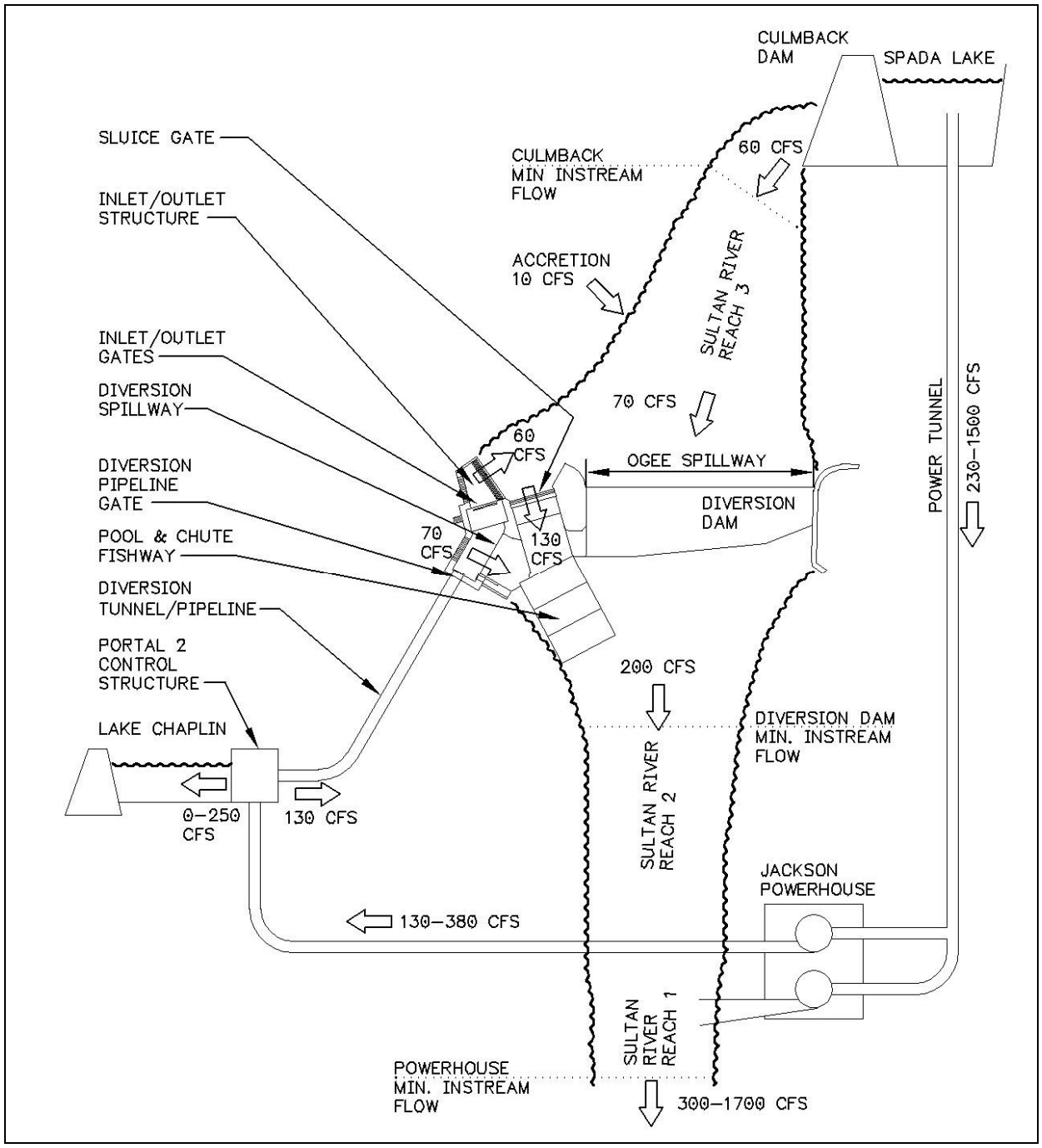

Figure 3-8. Fish Passage Design Flows: Late October Flow Scenario.

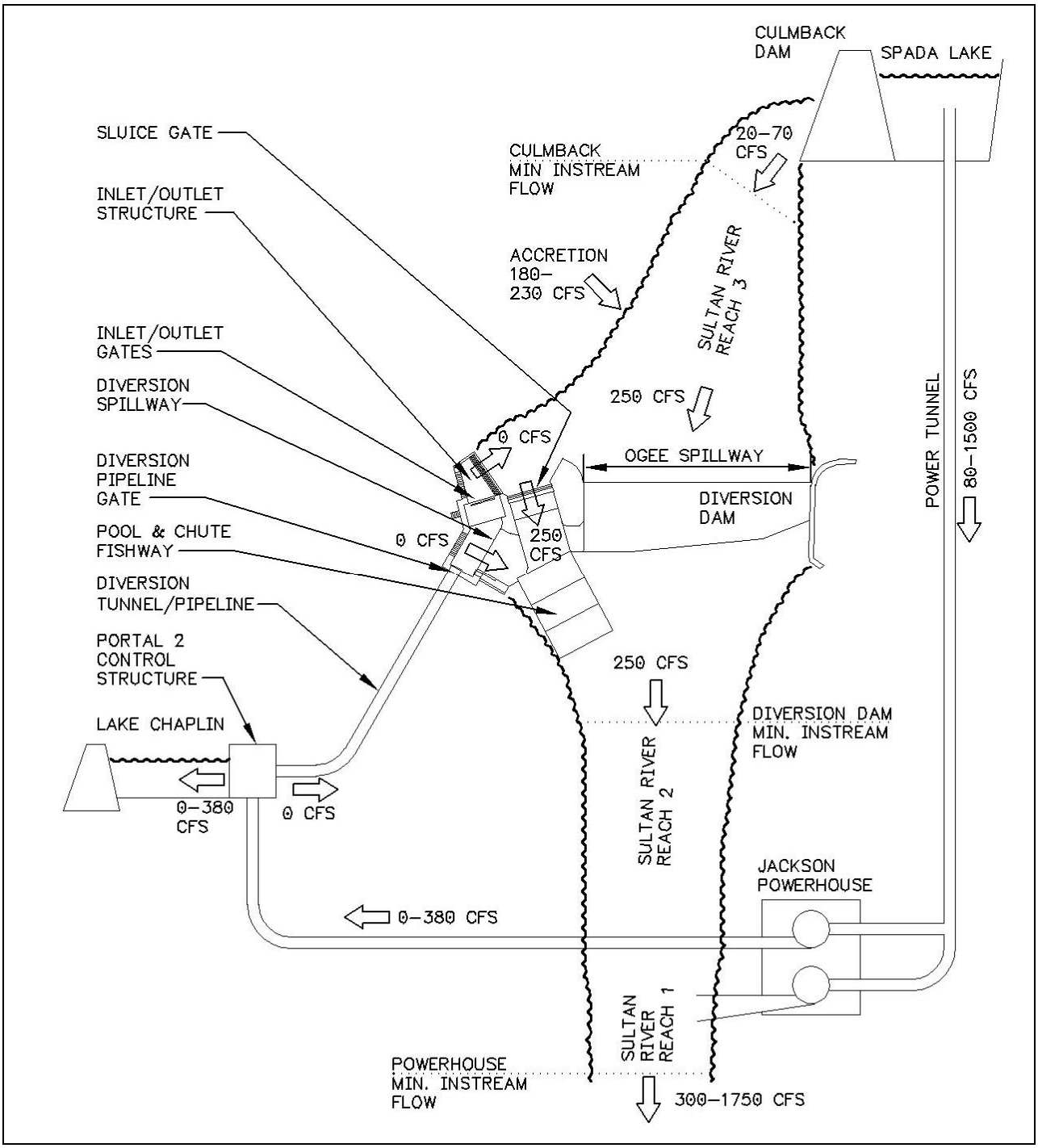

Figure 3-9. Fish Passage Design Flows: High Flow Scenario.

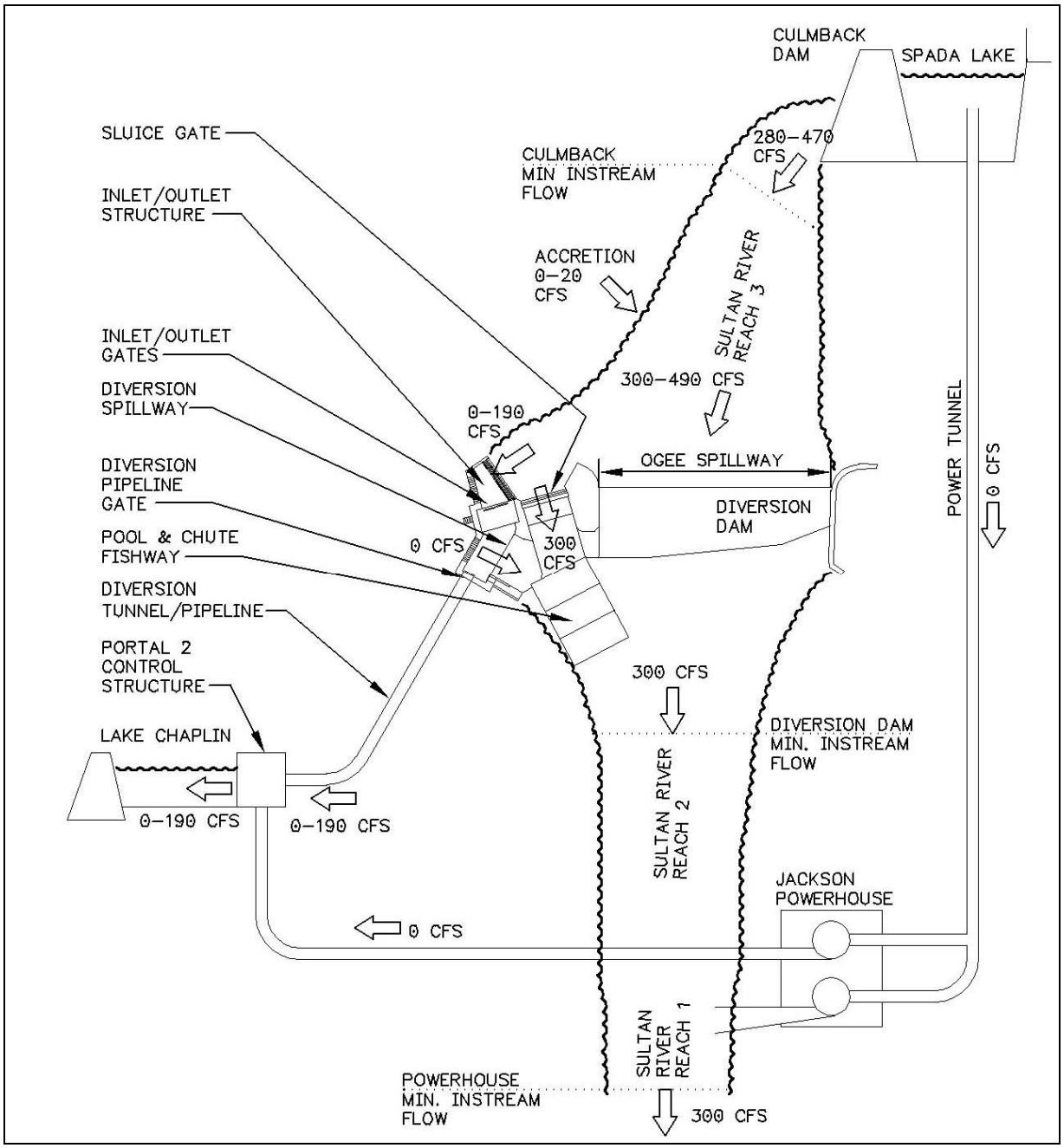

Figure 3-10. Fish Passage Design Flows: Emergency Flow Scenario.

3.2. Upstream Passage Conceptual Plan and Drawings

This section describes the conceptual designs proposed for the Diversion Dam to provide volitional upstream fish passage. The process leading up to this plan considered a number of alternatives. The following sections describe two proposed options for creating a fishway through the existing sluice gate and channel. The sections include a description of the proposed fishways, modifications to the existing sluice gate, impacts on sediment and bedload management, consideration of dam safety, emergency operation to divert water to the City of Everett, and site access concerns.

3.2.1 Fishway

One proposed fishway, Option 1, is a pool and chute ladder through the sluiceway on the right bank of the existing dam. This fishway is depicted on Figure 3-3. Another proposed fishway, Option 2, lowers the sluiceway channel sufficiently to reduce or eliminate the need for the pool and chute fish ladder. This fishway is depicted on Figure 3-4. Both fishway options require lowering the slot through the existing sluiceway and allowing the river channel to naturally degrade upstream. Option 2 is substantially lower and would require more upstream degradation of grade than Option 1. Photo 3-1 depicts the area of the fishway upstream of the Dam, and Photo 3-2 depicts the downstream area. The Tailwater rating curve, Figure 3-5, establishes the lower water level boundary for the fishway design which ranges from a low Tailwater elevation of 639.5 feet msl to a high of 640.0 feet msl.

These concepts were selected after evaluating several alternatives ranging from a 20 foot high vertical slot ladder, cutting slots or holes in the ogee portion of the dam, and modifying the sluiceway. Modifying the sluiceway was selected as the best alternative for fish passage. Normal operation of this fishway utilizes 100 percent of the river flow, which optimizes attraction for upstream migrants and the carrying flow for downstream migrants. The two Options 1 and 2 for modifying the sluiceway will be carried forward into final design, and possibly as alternate construction options.

Photo 3-1. Upstream Fishway Area.

Photo 3-2. Downstream Fishway Area.

3.2.1.1 Four Step Pool and Chute Fishway (Option 1)

Option 1 includes lowering the sluiceway and constructing a 4 step pool and chute fishway leading into the pool on the downstream side of the Diversion Dam. This option requires that the concrete sluiceway channel be cut down 9 feet into rock (adjacent to and through the sluice gate), 2 to 4 feet down in the upstream rock channel, and 2 to 4 feet down into the downstream concrete and rock apron. The depths of concrete and rock along the downstream apron are unknown at this point. Investigative exploration and cores will be performed prior to final design to determine the extents and strength of the existing rock and concrete. Figure 3-11 depicts the fishway plan, Figure 3-12 shows an overall profile, and Figure 3-13 shows a typical cross section of the pool and chute baffle. Figures 3-14 and 3-15 depict sections at the Inlet/Outlet and Diversion Spillway where flow is normally added to supplement river flow.

Several flow arrows are depicted on Figure 3-11. The flow patterns vary depending on the conditions described in Section 3.1. Upstream flow (Flow 1) comes from releases at Culmback Dam and accretion along reach 3 and will range from 40 to 490 cfs. Additive Inlet/Outlet flow (Flow 2) comes from the hydroelectric project as regulated through the Inlet/Outlet gates and ranges from 0 to 60 cfs. Flow through the open sluice gate (Flow 3) will vary between 100 to 300 cfs (if closed the flow will be 0 cfs). Flow over the Diversion Spillway (Flow 4) comes from the hydroelectric project and is the balance of the flow from the Diversion Pipeline with the flow through the Inlet/Outlet gates and ranges from 0 to 70 cfs. Flow at the fishway entrance (Flow 5) is the combination of flows 1, 2, and 4 and will vary between 100 and 300 cfs unless flow is being diverted to Lake Chaplain in which case it will drop to 0 cfs. The diversion Inlet/Outlet

flow (Flow 6) will vary between 0 to 190 cfs during emergency conditions. Ogee spillway flow (Flow 7) will only occur during emergency conditions or during flooding. During emergency conditions, the flow will be at a rate of 300 cfs, while the sluice gate is closed.

Both fishway options require that flow be introduced at the Diversion Dam to meet the instream flow requirements described in Section 3.1. Currently flow is added from the existing intake/outlet structure into the pool on the upstream side of the dam. This location will continue to be used with improvements to discourage fish from trying to enter the intake/outlet structure. This will be accomplished with a fish barrier consisting of weir flow onto a sloped apron to develop sheet flow. A cross sectional view of this velocity barrier, for Option 1, is depicted on Figure 3-14. Flow will also be introduced on the downstream side of the dam over the Diversion Spillway. The Option 1 Diversion Spillway is shown in cross section on Figure 3-15. Both locations are needed to distribute the flow along the fishway so as not to introduce excess flow energy into the fishway pools.

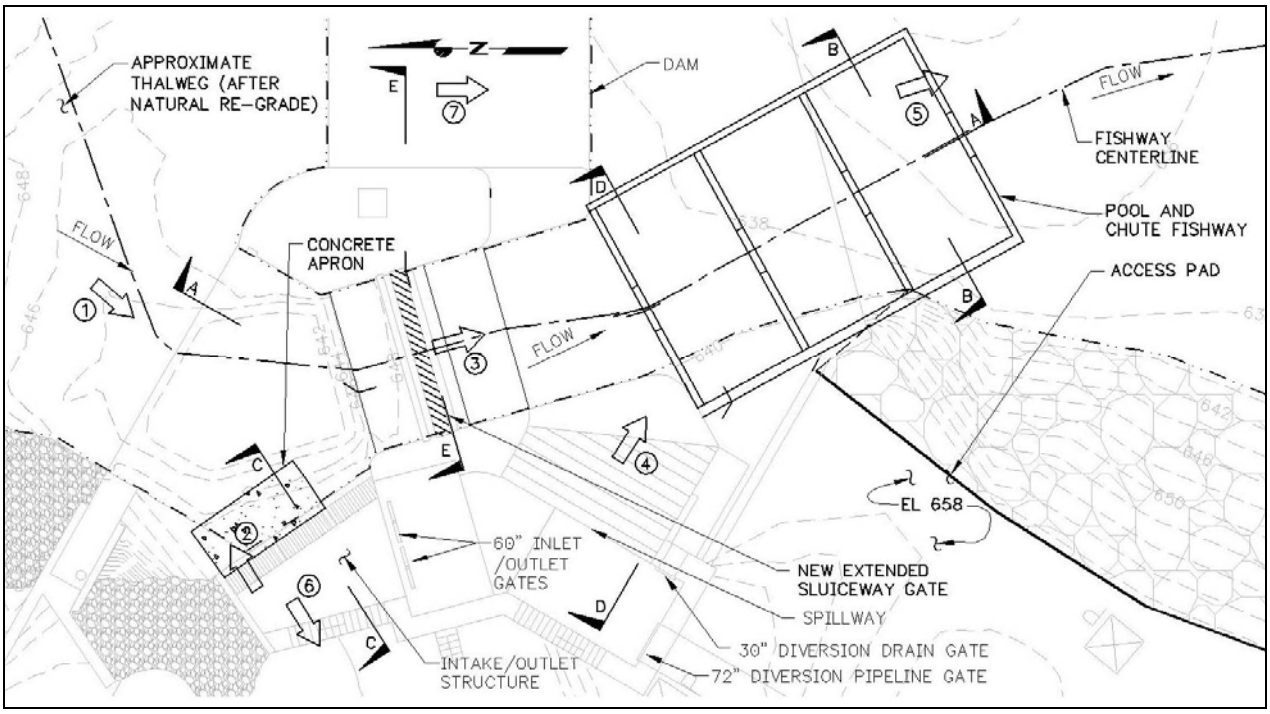

Figure 3-11. Option 1 – Fishway Plan.

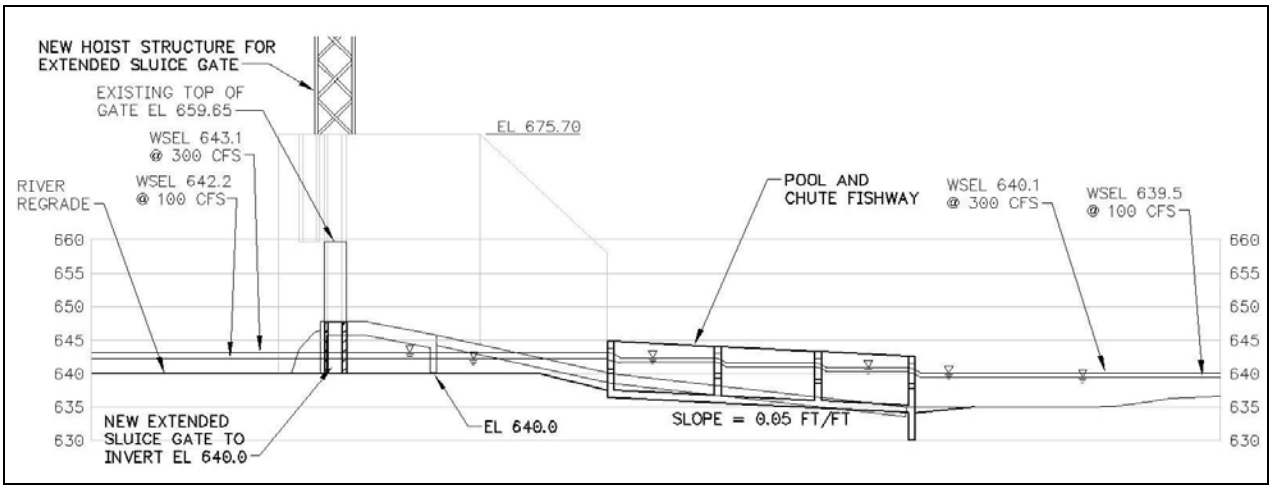

Figure 3-12. Option 1 – Fishway Profile (Section A-A).

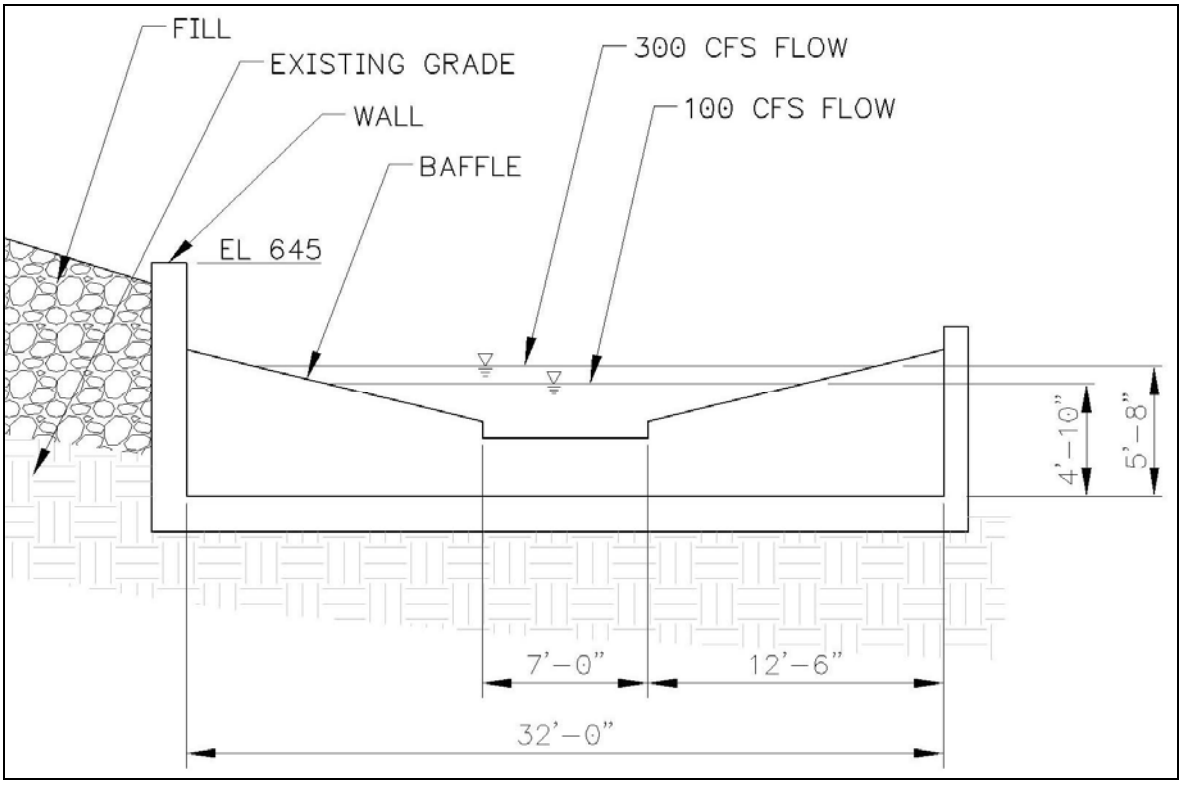

Figure 3-13. Option 1 – Pool and Chute Cross Section (Section B-B).

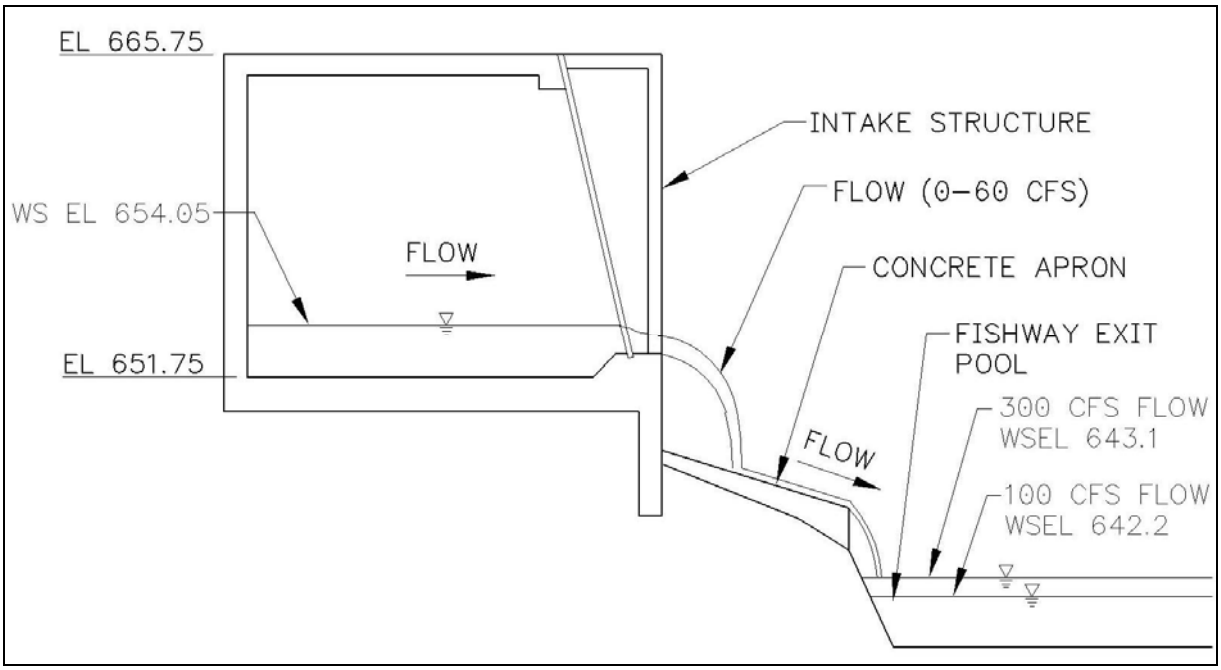

Figure 3-14. Option 1 – Intake/Outlet Cross Section (Section C-C).

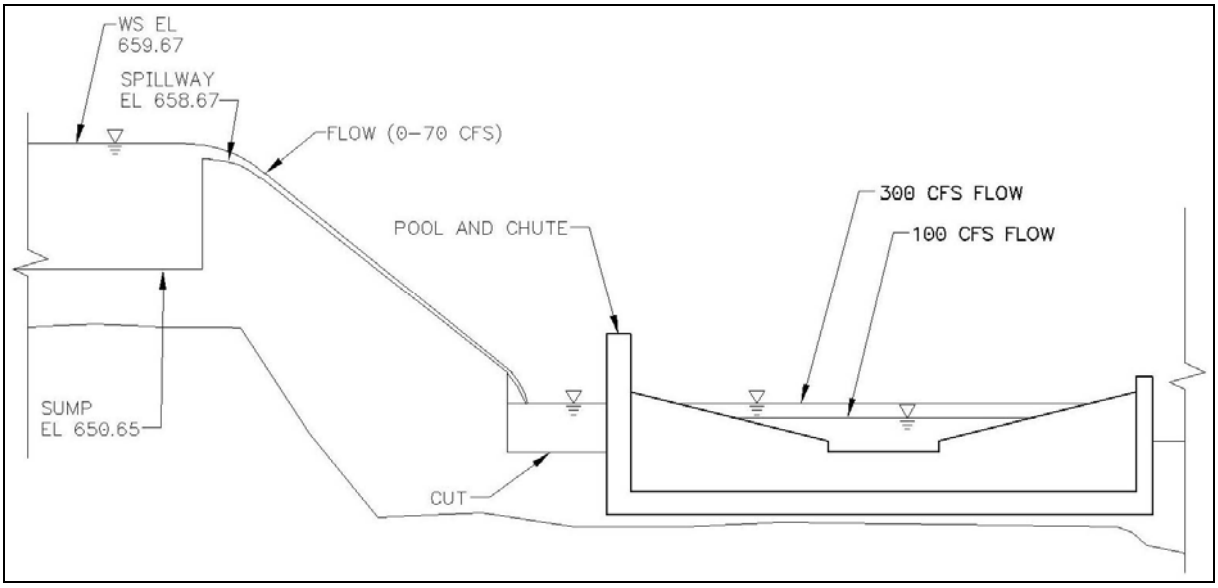

Figure 3-15. Option 1 – Diversion Spillway Cross Section (Section D-D).

3.2.1.2 Reduced Invert Fishway (Option 2)

Option 2 involves up to 3 feet of additional rock excavation in addition to the excavation and demolition required in Option 1. This excavation will be required over the length of the fishway and results in a corresponding reduction in the number of pool and chute steps. This option lowers the fishway invert and reduces or eliminates pool and chute steps. However, lowering the fishway channel requires lengthening the upstream reach that needs to degrade and increasing

the extension of the sluiceway gate. Additional field investigations will be performed during the summer low flow period with the sluice gate raised to evaluate conditions along the sluiceway and the upstream riverbed to better determine the feasibility of this option.

The features for adding flow to the Sultan River at the Diversion Dam for Option 2 are similar to Option 1. A cross sectional view of the Option 2 velocity barrier is depicted on Figure 3-19. Flow will also be introduced on the downstream side of the dam over the Diversion Spillway. The Diversion Spillway and adjacent fishway for Option 2 are shown in cross section on Figure 3-20.

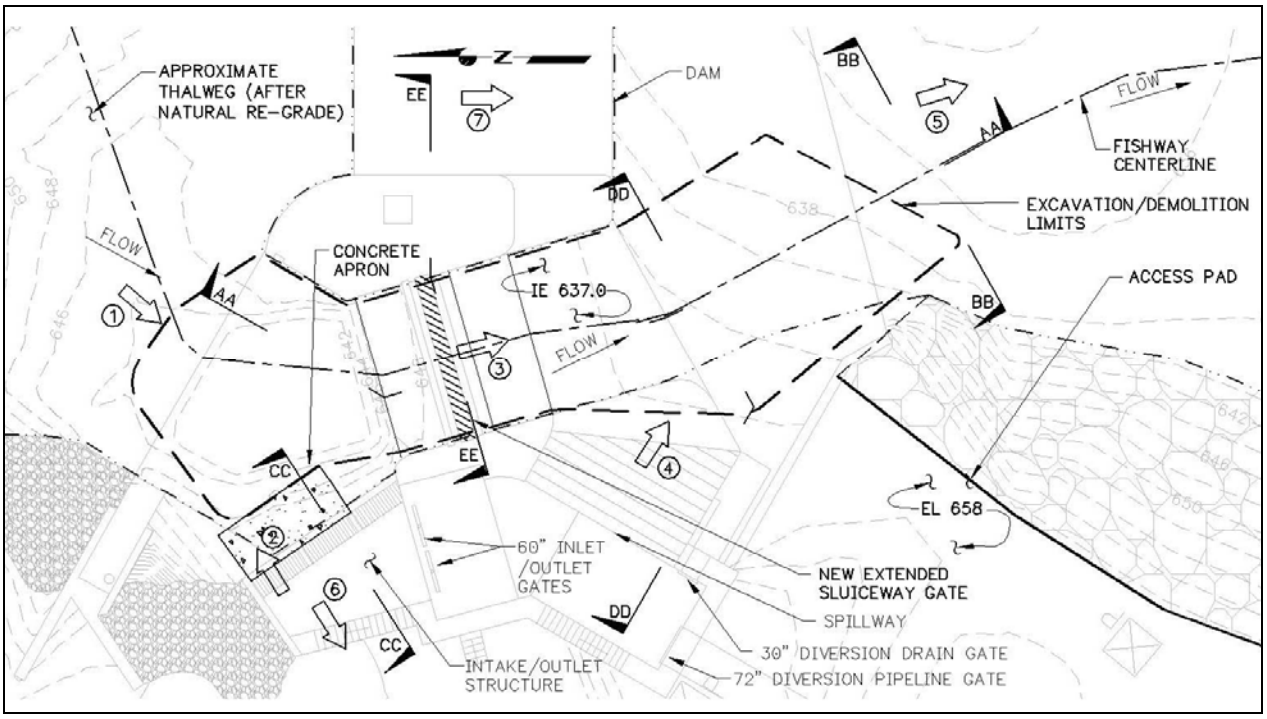

Figure 3-16. Option 2 – Fishway Plan.

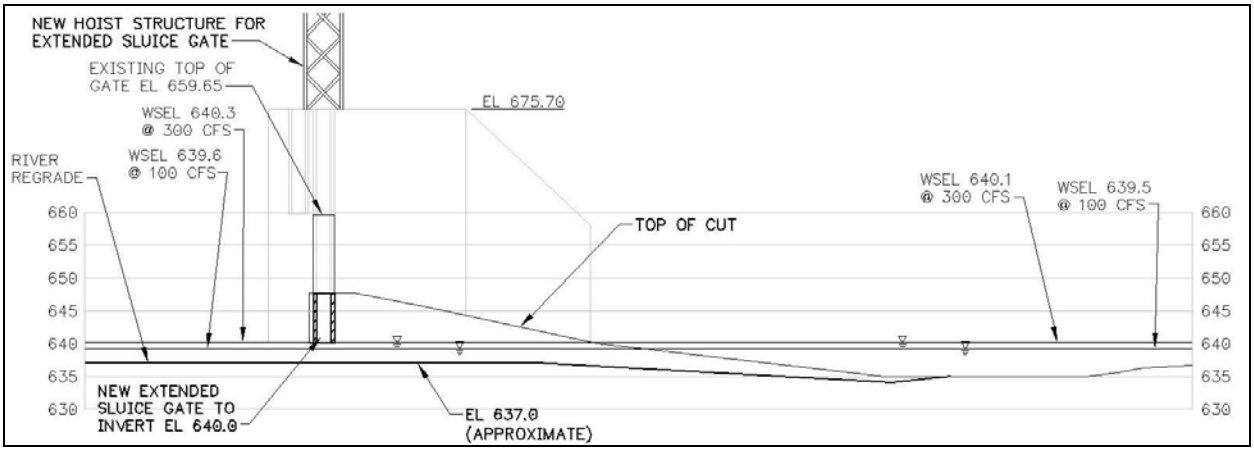

Figure 3-17. Option 2 – Fishway Profile (Section AA-AA).

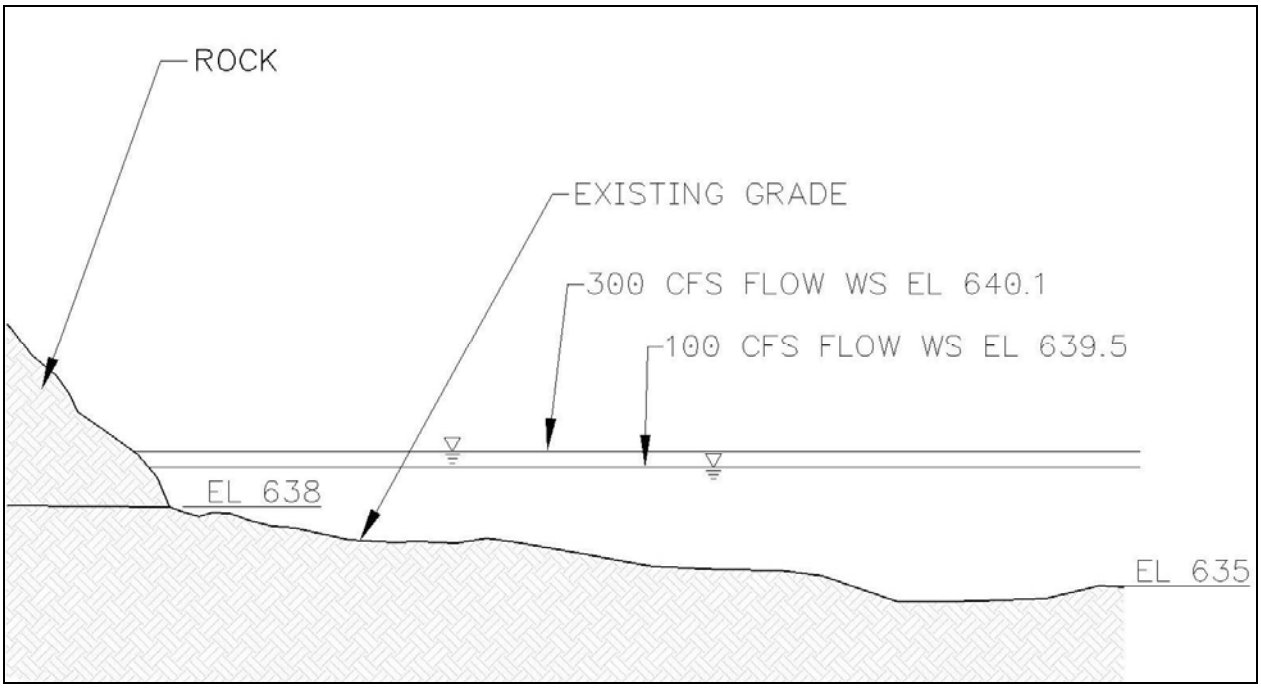

Figure 3-18. Option 2 – Fishway Cross Section (Section BB-BB).

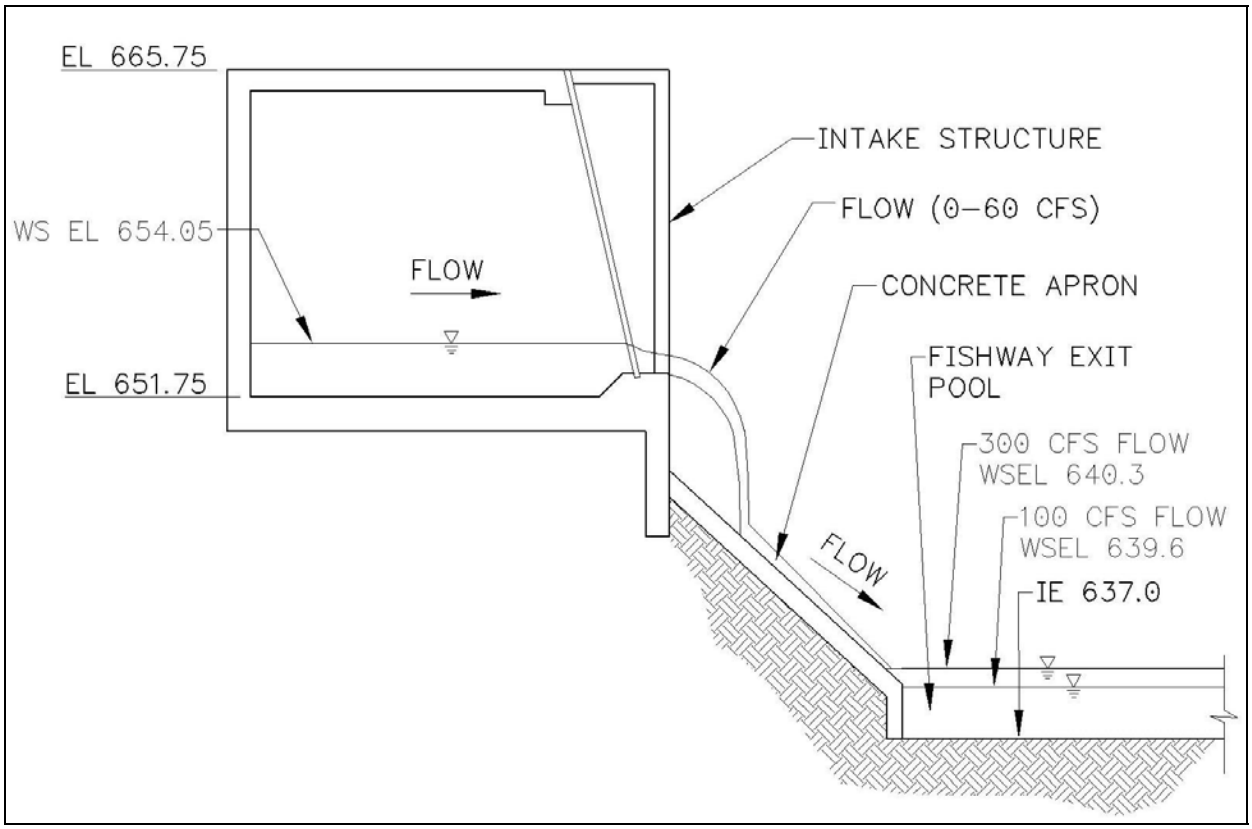

Figure 3-19. Option 2 – Intake/Outlet Cross Section (Section CC-CC).

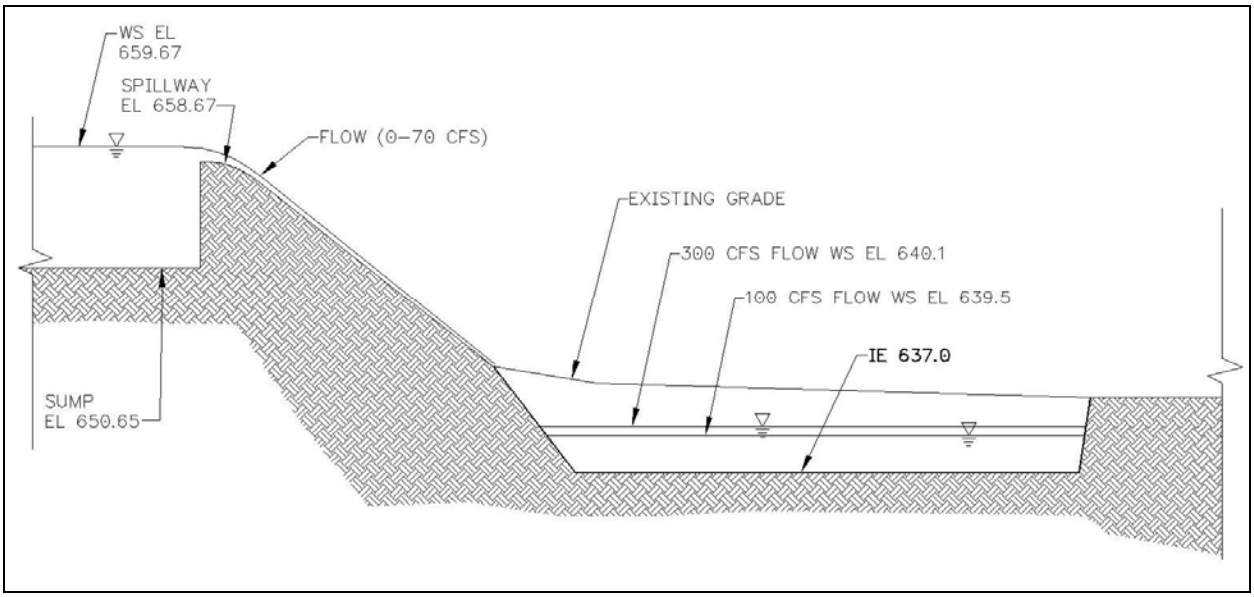

Figure 3-20. Option 2 – Diversion Spillway Cross Section (Section DD-DD).

3.2.2 Sluice Gate

A sluice gate will still be required to backwater the Diversion Dam Intake/Outlet during emergency diversions to the City of Everett water system. The existing gate, with revised crest and invert elevations, is depicted by the cross section in Figure 3-21 for Option 1 and Figure 3-22 for Option 2. To provide fish passage the gate will normally be raised up and out of the flow. Modification to the gate will include renovating and extending the guides, replacing the gate panel, extending the gate frame, and replacing the hoist. The existing guides that are cast into the concrete will also be renovated. Lowering the sluiceway will require new guide slots extending down to the new invert which will be at least 7.7 feet lower for Option 1 and up to 10.7 feet lower for Option 2. The gate panel will need to extend from the lower invert to a crest 1 foot above the existing spillway at an elevation of 659.65. The structure supporting the gate panel will need to be raised to allow the gate panel to be raised out of the flood flow and the hoist upgraded to handle the larger gate panel.

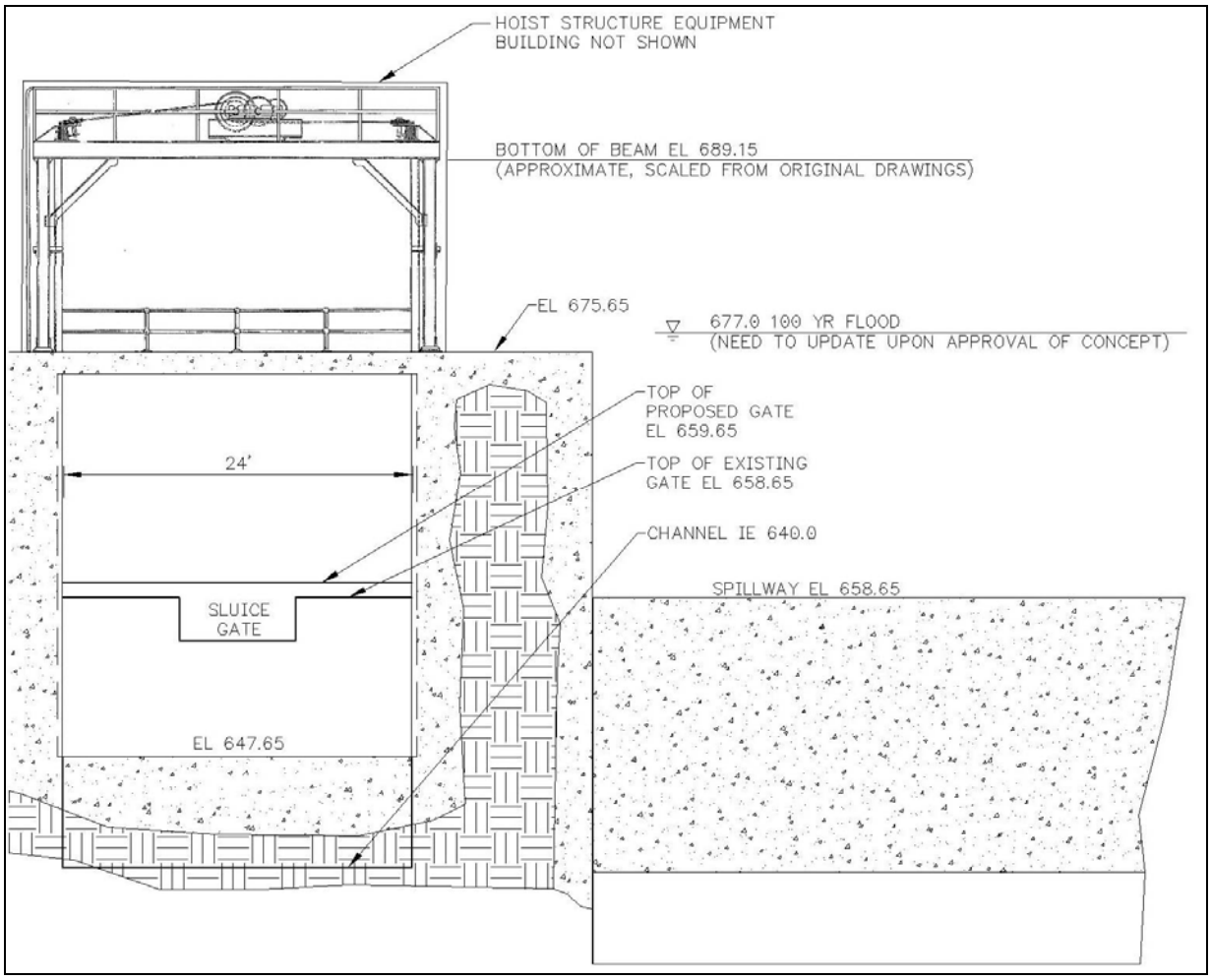

Figure 3-21. Option 1 – Sluice Gate Cross Section (Section E-E).

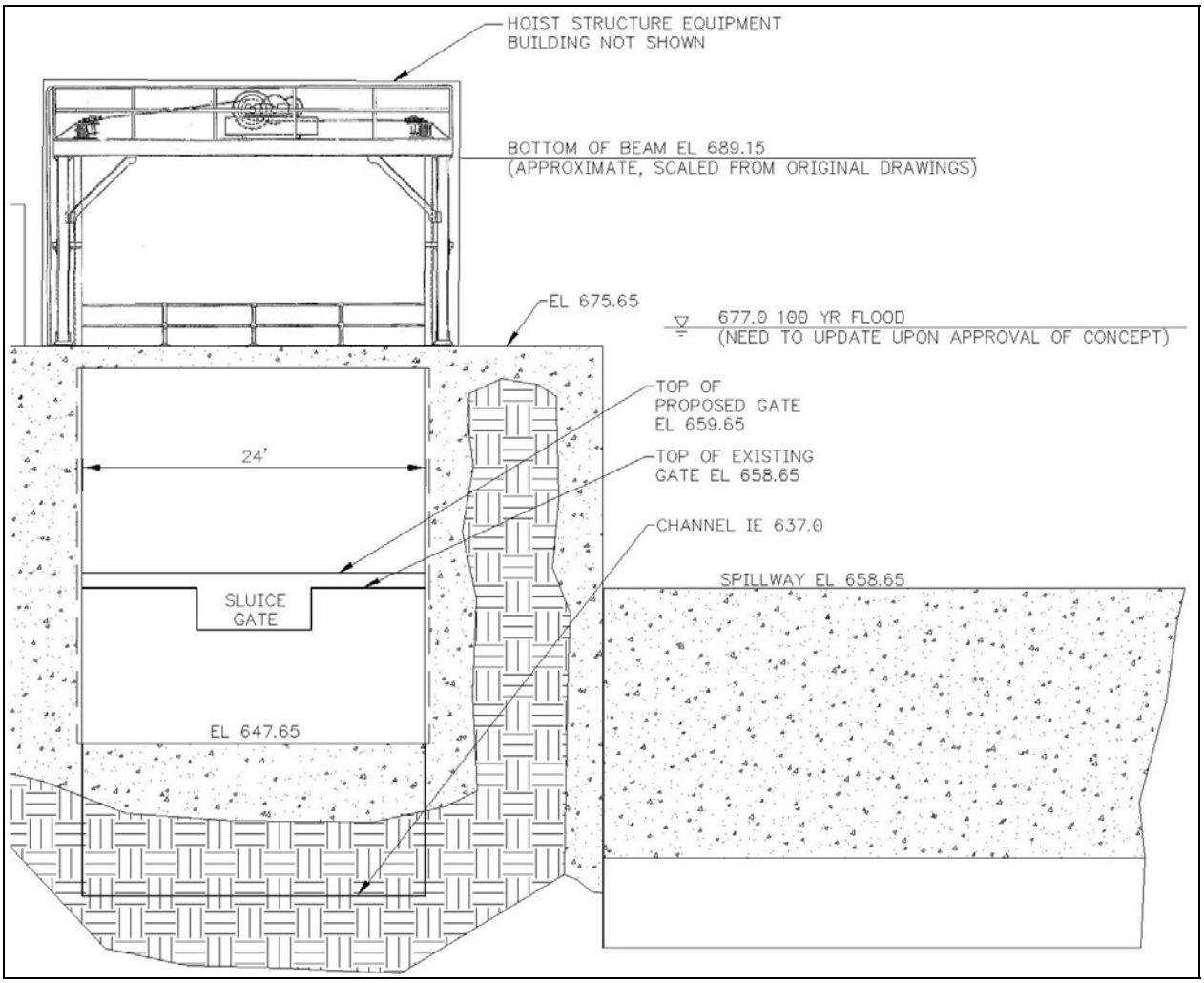

Figure 3-22. Option 2 – Sluice Gate Cross Section (Section EE-EE).

3.2.3 Sediment and Bedload Management

Bedload and sediment accumulate behind the Diversion Dam have historically been managed by operation of the sluice gate during and after high flow events to keep the Intake/Outlet structure clear for operation. Photo 3-3 depicts the pool upstream of the Diversion Dam. During future operation for fish passage the sluice gate will remain open during high flow events and will allow bedload and sediment to pass. The pool and chute structure may accumulate bedload and sediment, but generally this type of ladder does a good job of passing bedload material. If required, the pool and chute ladder could be cleaned with an excavator set on a platform located at the end of an existing road on the right bank of the dam above the fishway.

Whereas lowering the channel as described for the fishway Option 2 will decrease or eliminate the number of pools, it would also require that the upstream reach degrade to a greater degree to achieve conditions that are passable for fish. Generally a 3 percent channel grade is anticipated for the reach upstream of the dam based on the existing grade of the river in the vicinity of the dam. This results in a channel length of about 400 feet degrading with the Option 1 - 4 step pool and chute option and an additional 100 to 200 feet if the channel is lowered an additional 3 feet

for Option 2. The original drawings for the Diversion Dam indicate a thalweg elevation at the dam of 634 compared to a proposed elevation of 637. Therefore either option appears feasible.

Photo 3-3. Upstream of Diversion Dam.

3.2.4 Dam Safety

The Diversion Dam is a relatively small dam founded on rock and impounding a minimal volume of water with no development for miles downstream. The dam is classified as "Low Hazard" by FERC guidelines. A preliminary analysis of the dam performed by R2 indicates that it is not at risk of failure with or without the intended modifications. The analysis of the dam is based on a 100 year flood event considering overturning and sliding with seismic loads considered during a "sunny day" or normal flow condition. Additional analysis will be performed to confirm dam safety during final design.

3.2.5 Emergency Operations for City of Everett Water Diversion

Operation of the Diversion Dam during emergencies (such as a flow shut down through the power conduit for inspection or maintenance or during a drought such that the Spada Lake elevation is below the elevation for safe power operation) may require that the sluice gate be closed to divert water to Lake Chaplain for domestic use by the City of Everett. Diverting water to Lake Chaplain in this manner will result in shutting down the fish passage route provided

through the Diversion Dam. The inability to supply Lake Chaplain through the normal means via the hydroelectric project results in the emergency flow scenario described in Section 3.1.3.2 and depicted on Figure 3-9. This scenario is anticipated to be a rare event that the PUD and City of Everett would endeavor to correct as soon as possible.

Fish passage can still be achieved in this emergency scenario by alternating flows between the fishway and the water diversions. Typically, the volume of water stored in Lake Chaplain is adequate to meet the City's domestic demand for approximately 30 days depending on time of year and demand management strategies employed. When water use is high in the summer (mid-May through August), adult anadromous fish are not present at the dam and emergency diversions would not pose a problem for fish passage. During fall, winter, and spring when water demand is low, the sluice gate could be opened to allow fish passage and closed to allow diversion in a manner that would not result in excessive delay of fish while providing the City of Everett with the necessary diversion flow. Should emergency conditions arise the District will consult with the ARC to determine an operating scheme that meets the City of Everett's water demand and provides for fish passage.

3.2.6 Accessibility

The site is accessible from the right bank next to the gate house and by the downstream side of the dam via an existing access road ending in a new platform located just above the outlet of the sluiceway. Construction and possible future bedload management will require re-establishing an access road to the right bank upstream of the Diversion Dam as shown on Figure 3-3.

3.3 Downstream Passage Conceptual Plan

This section describes the improvements associated with the Diversion Dam for providing volitional downstream fish passage. These improvements are described in the following sections and are organized to discuss normal, emergency downstream passage, and optional permanent Diversion Dam screening for diversions that enhance power production.

3.3.1 Normal Downstream Passage (no water diversion to City of Everett)

Normal downstream passage of fish will occur through the proposed fishway described in section 3.2 for upstream passage. This fishway is a modification of the sluiceway and all the flow from the river above the dam will be passing through the fishway in addition to flow added at the dam. These conditions result in relatively low gradient flow around the dam which will provide volitional downstream passage.

3.3.2 Emergency Condition Downstream Passage (water diversion to City of Everett)

An emergency condition would occur when the hydroelectric project is not operating and instream flow and City of Everett demand is met by releasing flow at Culmback Dam. This is depicted by Figure 3-6. The following sections describe measures proposed to protect fish at the diversion under this emergency operation scenario.

3.3.2.1 Flow Control of Diversion

During emergency operation of the Diversion Dam (while the hydroelectric project is off line) the flow required to maintain minimum instream requirement in all the reaches of the Sultan River will be supplied by releasing water at Culmback Dam. Additionally, flow to meet the City of Everett demand will be released at Culmback Dam and diverted to Lake Chaplain at the Diversion Dam. While diverting in this manner, the slide gate at the Portal 2 Control structure (see Figure 3-1) will regulate flow into Lake Chaplain at a rate of up to 190 cfs with the Diversion Dam Sluice Gate closed (fully lowered). A minimum diversion flow will also be maintained such that the slide gate at the Portal 2 control structure is at least 12 inches open to provide safe fish passage through the slide gate. This slide gate is 60 inches wide by 60 inches high.

With the sluice gate at the Diversion Dam fully lowered, all the Sultan River flow (up to 300 cfs) will pass over the ogee section of the spillway. During periods when anadromous fish are present, the sluice gate could be alternately opened to allow fish passage and closed to allow diversion in a manner that would not result in excessive delay of fish while providing the City of Everett with the necessary diversion flow under emergency conditions. When the sluice gate is opened, to allow for fish passage, the Diversion Pipeline Gate or the Inlet/Outlet Gates would be closed to prevent the pipeline from dewatering through the Intake/Outlet structure with the drop in water level upstream of the Sluice Gate.

3.3.2.2 Temporary Netting and Fish Collection / Transport

During the emergency operation scenario, up to 190 cfs of flow may be diverted to Lake Chaplain while passing 300 cfs over the Diversion Dam. During this operation fish may be entrained in the flow diverted to Lake Chaplain. Entrained fish will be managed by removing them with a temporary net located at the Portal 2 control structure at the west end of the Diversion Tunnel, (Figure 3-1). Entrained fish will be those that can fit through the trashrack at the Diversion Dam intake that has a clear opening of approximately 2 inches. The Portal 2 control structure regulates flow into Lake Chaplain through a slide gate. A temporary net would be deployed on the downstream side of the Portal 2 slide gate to route fish into a live box for transport back to the Sultan River downstream of the Diversion Dam.

3.3.3 Optional Permanent Downstream Passage Improvements

Non-emergency diversion conditions infrequently occur when accretion in the reach above the Diversion Dam (Reach 3) exceeds the minimum level of instream flow required below the Diversion Dam (Reach 2). During these times, if turbidity in the river has not exceeded 20 NTUs, the District has been diverting this excess flow to Lake Chaplain, rather than meet the instream flow demand with water from the hydroelectric project. Operating the project in this manner allows for greater power production by routing all the flow from the Power Tunnel through the high head Pelton Wheel turbines rather than the lower head Francis turbines. Per the Settlement Agreement, this type of diversion would require permanent juvenile fish screening after at least 6 anadromous redds were identified in the reach above the Diversion Dam in a one (1) year period. Should the District choose to exercise this option, the configuration for this type of fish screen has been considered in this plan. Based on recent economic evaluation it is not anticipated that the District will install permanent fish screens as part of the DDVP plan.

One screen option is depicted by Figure 3-23 and Figure 3-24. This option is a 75 cfs capacity, 42 inch diameter cylindrical screen with a 0.069 inch slot opening and sized for an approach velocity of 0.4 fps. The screen would be integrated into the Inlet/Outlet structure at the Diversion Dam as shown. If the District decides to take advantage of this operation of the diversion for increased power production, then this concept and designs will be developed further, discussed with the ARC for concurrence, and submitted to the FERC for approval.

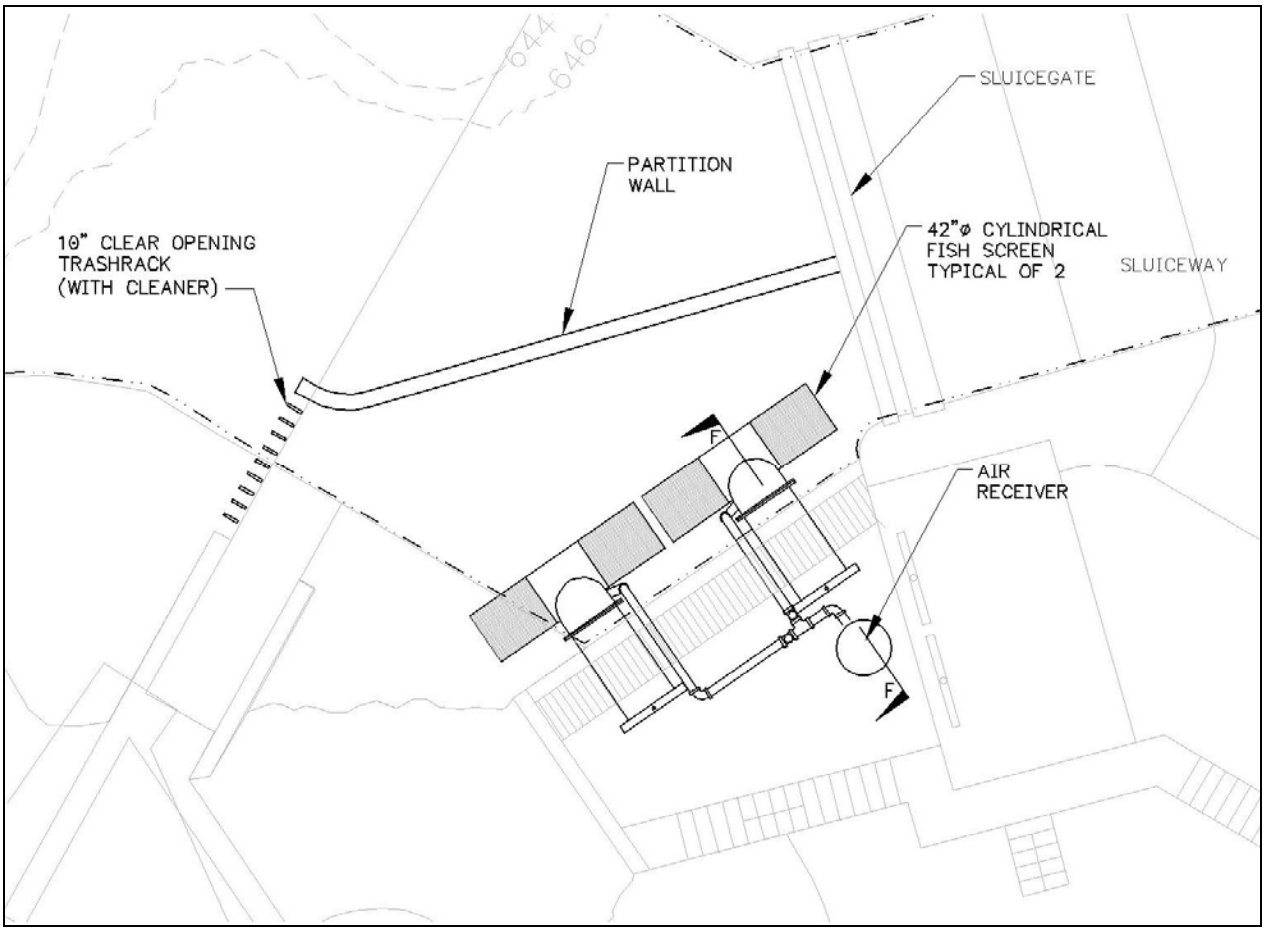

Figure 3-23. Fish Screen Plan View.

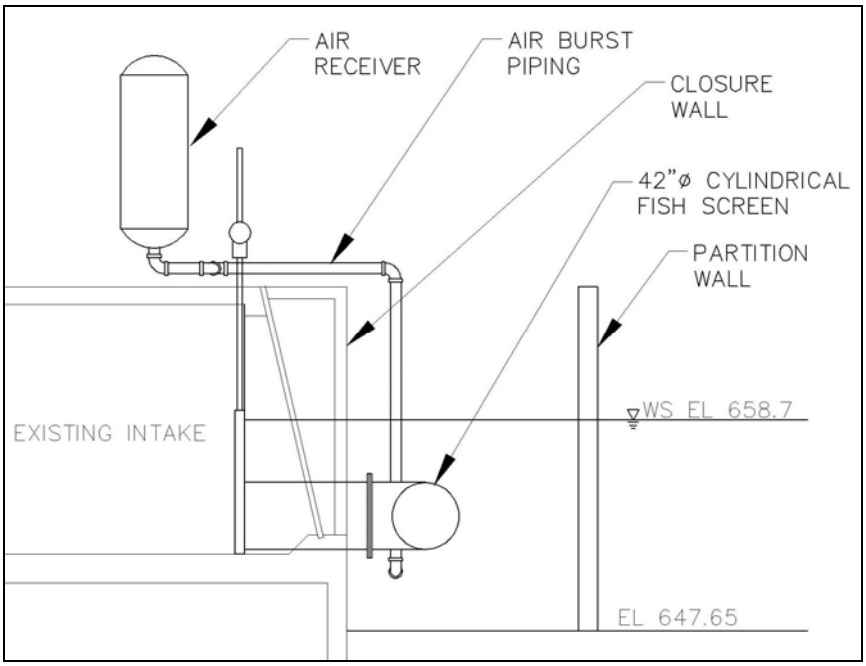

Figure 3-24. Fish Screen Profile View (Section F-F).

3.4 Preliminary Operating Plan

This section is a preliminary discussion of the proposed fish passage operations. The following sections describe the functionality, system controls, maintenance, reliability and survivability of the facility.

3.4.1 Functionality

The function of the proposed fish passage facilities is described by the various components at the Diversion Dam, including: the fishway, sluice gate, intake and intake/outlet control gates, diversion spillway, diversion pipe gate, diversion drain gate, Portal 2 Control Structure, and ogee dam.

The fishway will normally operate at flows between 100 and 250 cfs, corresponding to the 95 and 5 percent exceedance flows during the anadromous fish migration season. The fishway will also need to effectively pass upstream migrants during emergency flow conditions when the Sluice Gate is raised and the flow is 300 cfs. Depth in the fishway will range between 2.2 and 5.0 feet, with a corresponding average velocity between 1.3 to 4 fps through the pools. Hydraulic drops will be limited to 9 inches. Streaming flow velocity through pool and chute fish ladder will be between 5.2 and 8.0 fps.

The sluice gate will normally be raised and out of the way for fish passage. Lowering the sluice gate will occur during emergency operation or maintenance of the fishway. When the sluice gate is lowered, all the river flow will pass over the dam ogee section and over the diversion spillway up to a rate of 300 cfs. Flow in excess of 300 cfs will also pass over the crest of the Sluice Gate.

The Inlet/Outlet structure will typically be perched above the fishway water level with outflow varying between 0 and 60 cfs depending on the river conditions (see flow scenarios in Section 3.1). Flow is limited to 60 cfs to prevent putting excessive flow energy into the adjacent fishway. The Inlet/Outlet structure has a trashrack with approximately 2 inch wide vertical slots. Outflow will spill onto a sloped ramp to serve as a barrier to fish. During diversions to Lake Chaplain, the trashrack will be submerged with the closing of the sluice gate to pass flows of up to 190 cfs.

The diversion spillway (located between the Inlet/Outlet gates and the Diversion Pipeline Gate) will spill flow into the fishway varying between 0 and 70 cfs depending on the river conditions (see flow scenarios in Section 3.1). Flow is limited to 70 cfs to prevent putting excessive flow energy into the adjacent fishway pool. Flow will be spread over the 24 foot width of the spillway to a depth of only a few inches as it enters the adjacent fishway pool. An existing 30 inch square gate that has an invert which matches the invert elevation of the pool behind the Diversion Spillway provides a means to drain this pool for maintenance.

The ogee dam section will pass flood flows, in excess of 6,800 cfs (10 year event), and river flow during emergency operation when the Sluice Gate is closed.

3.4.2 System Controls

Currently the flow added to the Sultan River at the Diversion Dam from the Diversion Pipeline is primarily controlled by a Francis turbine at the Jackson Powerhouse and fined tuned by the slide gate which releases flow into Lake Chaplain at the Portal 2 structure. The flow in the Sultan River is monitored by a level transmitter located upstream of a weir notch in the existing Sluice Gate. This weir provides accurate and repeatable measurements up to flows of about 180 cfs at which point flow begins to spill over the ogee crest and small variations in level correspond to much larger variations in flow. As flow conditions in Reach 3 of the Sultan River vary, the power load on the turbine is varied resulting in a change of flow discharged to the Portal 2 structure. The slide gate releasing water into Lake Chaplain can be adjusted to manage the flow into the Diversion Pipeline which is subsequently released into the Sultan River at the Diversion Dam. Care must be taken while changing flow at the Jackson Powerhouse because rapid changes set up pressure transients in the pipelines, the control program must dampen the effects of these oscillations to prevent unstable operation of the slide gate and errors in the flow measurements.

The modifications at the Diversion Dam will substantially change the way the Sultan River flow is measured at this location. Normal operation will result in a condition with the sluice gate raised and the loss of the relatively simple and accurate hydraulic control point provided by the weir notch in the top of the sluice gate. Flow is intended to be distributed along the Fishway over the Diversion Spillway and the balance of the flow released out the Inlet/Outlet structure. This flow distribution will require throttling flow through the Inlet/Outlet Gates located between the Inlet/Outlet structure and the Diversion Spillway. The throttling is needed to account for the water level difference resulting from the difference in the invert of the Inlet/Outlet structure (elevation 652.7) and the Diversion Spillway crest (elevation 658.7). These gates may need to be modulated as flow added to the Sultan River changes. Flow monitoring will either need to be done at the existing downstream USGS station, which is based on a natural river section and is

not as accurate as the existing control or by developing a new control point possibly at one of the lower Pool and Chute pools if that option is used or at another advantageous point for measuring flow to be identified during final design. Regardless of how flow is measured the new control scheme will take time to calibrate and fine tune during actual operation. In light of this, a one year interim instream flow requirement scheme is requested which allows for instream flow to regulated based on a 1 hour running average with instantaneous flow not dropping below 80 percent of the requirement.

3.4.3 Maintenance

Normally the Diversion Dam and new fish passage facilities should require relatively little maintenance. The control slide gates will need periodic lubrication (4 month interval) and possible repair or replacement every 15 to 20 years as needed. The sluice gate will only be operated during the emergency flow scenario, for maintenance of the fishway, and at least on a 6 month interval to exercise the gate. The sluice gate actuator should be inspected and maintained on an annual basis. The Inlet/Outlet trash rack will require cleaning during emergency flow operation on a frequency dependant on the debris load in the river. The fishway may require maintenance after a flood event of sufficient size to pass bedload. If bedload accumulates in the lower pool and chute portion of the fishway then the sluice gate can be closed and the bedload removed with the aid of an excavator parked on the adjacent platform above. Bedload removal and inspection of the fish way will need to be performed at low flow after flood levels have receded.

3.4.4 Reliability and Survivability

The proposed facility will provide a very reliable means of fish passage with a high rate of survival for fish. Normal operation of the fishway utilizes 100 percent of the river flow, which optimizes attraction for upstream migrants and the carrying flow for downstream migrants. Lowering the sluiceway has effectively eliminated the dam as a barrier thus minimizing the drop that fish need to overcome or experience while passing around the dam.

4. MONITORING

4.1 Hydraulic Monitoring

River flow at the site is monitored by the USGS Gage Station Number 12137800. This station is based on gaging two different locations. The primary location is on the upstream side of the dam, just north of the inlet/outlet structure. The secondary location is across the river approximately 300 feet downstream of the dam. The upstream and primary gage is based on a rating curve with the sluice gate closed and with the existing weir notch. Modifying the dam for fish passage will require that either the downstream gage location be used exclusively or that the upstream gage be relocated and a new rating curve be developed.

4.2 Biological Monitoring

The District monitors escapement in the Sultan River downstream of the Diversion Dam at four (4) discrete index areas. These areas are depicted on Figure 2-1 and include:

- Lower River – a raft based "float" survey commencing at the Trout Farm Road boat launch (RM 2.7) and extending downstream to the confluence with the Skykomish River (RM 0.0)
- Powerhouse – a foot based survey commencing immediately upstream of the Powerhouse at the fish berm (RM 4.5) and extending upstream to RM 5.2
- Gold Camp – a foot based survey commencing upstream of Horseshoe Bend (RM 7.2) and extending upstream to RM 7.5, downstream of the Marsh Creek Slide
- Diversion Dam – a foot based survey commencing at RM 9.2, near Portal 1 and extending upstream to RM 9.7.

Since 1988, these index areas have been monitored annually to track escapement of spring and fall spawning species of anadromous fish and to note relative habitat utilization. Prior to the landslide in the Sultan River near Marsh Creek (RM 7.6) in December of 2011, the Diversion Dam Index Area was well utilized by steelhead trout and Chinook and coho salmon. Continued monitoring will demonstrate the effectiveness of the fish passage modifications at the Marsh Creek slide and provide information relative to the achievement of the passage trigger.

Upon completion of the modifications to the Diversion Dam and implementation of fish passage, the District will establish a fifth index area in the reach upstream. This index area will be located between the Diversion Dam (RM 9.7) and Big Four Creek (RM 11.4). Once established, this index area will be monitored following the same procedures and with the same frequency as the downstream index areas. The data collected within the newly established index area will provide information on the effectiveness of the fish passage modifications at the Diversion Dam and also inform the decision to impose the restrictions to reverse flow operations.

5. REPORTING

5.1 Annual Report

The District shall prepare an Annual Operations Report which will include a section on Sultan River anadromous fish populations. This section will detail historic and current salmon and steelhead abundance (escapement), distribution, and relative use of the river.

5.2 Plan Review and Updates

The District is submitting the DDVP Plan, which includes the Conceptual Drawings, for the ARC to review prior to filing with the FERC. The District will respond to and document all comments provided by the ARC in this consultation process. Final design drawings will be developed in consultation with the ARC and will be submitted for review at the 30, 50, and 90 percent levels of design. The final drawings will be filed with the FERC, including documentation of the ARC comments and consultation process, after the completion of the design.

6. SCHEDULE

6.1 Conceptual Drawings

The conceptual drawings are presented in section 3.3 of this document. License article A-LA 13 requires that the conceptual drawings be filed with FERC within 12 months of the license issuance. Prior to filing the conceptual drawings, and the DDVP Plan, the District will allow a 30 day review period by the ARC. The license is expected to be issued by June 1, 2011, therefore in order to meet these obligations, the DDVP Plan, which includes the conceptual drawings, has been submitted to the ARC for review prior to the license issuance. After the ARC has completed a review of the DDVP Plan and any comments have been agreed upon, and the license has been issued, then the District intends to file the DDVP Plan, including the conceptual drawings, with FERC.

6.2 Final Design Documents

The final drawings are required to be filed with the FERC within six months after the fish passage trigger occurs (described in Section 2.1.4). Prior to this filing the District will prepare detailed final design drawings. These drawings will need ARC consultation at thirty percent (30%), fifty percent (50%), and ninety (90%) design levels. When and if the trigger occurs is difficult to predict. However the six month time frame is a relatively short duration to develop final design drawings with ARC consultation included. The District intends to proceed with the design process and take it up to the 50% level once the DDVP Plan is filed and approved by the FERC.

6.3 Construction

After the final design drawings have been approved by FERC and all the necessary permits have been obtained, the District has two full construction seasons to complete the work. License article A-LA 13 defines the construction season as August 1 to August 31. Conceptual development of the options to implement the DDVP Plan has resulted in the concern that two, 1 month in-water construction periods are inadequate time to complete the work. A significant amount of work needs to b performed in a relatively small area while maintaining minimum instream flow. Constructing and removing the water handling features will require several weeks. An expansion of the duration of the in-water work window may be required to complete a project of this magnitude within two construction seasons. A more realistic timeframe would expand the in-water-work periods to July 15 and to September 15 with consideration that water handling features such as cofferdams and pumping fall outside this window. The District anticipates bidding the work as both Option 1and Option 2 and possibly a hybrid of the two in order to determine the most expedient approach.

7. REFERENCES

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WDFW (Washington State Department of Fish and Game). 2000. Draft – Fishway Guidelines for Washington State. Washington State Department of Fish and Wildlife. Olympia, WA

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APPENDIX A

Proposed License Article

A-LA 13: Diversion Dam Volitional Passage

1. Pursuant to the limitations and schedules prescribed below the Licensee shall provide for the construction, maintenance, and operation of safe, timely, and effective upstream and downstream volitional fish passage at the City of Everett's Diversion Dam through structural modifications to the Diversion Dam or sluice way. The Licensee's obligation to construct, maintain, and operate such fishways is subject to the U.S. Fish and Wildlife Service (Service) and the National Marine Fisheries Service (NMFS) determining, in consultation with the Aquatic Resource Committee (ARC), that spawning escapement of either Chinook salmon or steelhead trout within the Diversion Dam Index Area (DDIA) equals or exceeds in any one (1) year ten percent (10 %) of the combined total spawning escapement for either Chinook salmon or steelhead trout within the four (4) index areas of the Sultan River, downstream of the Diversion Dam ("passage trigger") and the Licensee obtaining any necessary regulatory approvals.

2. Upon the Service and NMFS determining, in consultation with the ARC, that the spawning escapement above the Diversion Dam exceeds six (6) anadromous redds in any one (1) year, the Licensee shall not reverse flow (divert) or authorize the reverse flow of water from the Sultan River into the Diversion Dam outlet pipe unless required for the City of Everett's water supply needs. If this water supply requirement is triggered, the Licensee shall in consultation with the ARC take appropriate measures to protect Endangered Species Act listed fish. Notwithstanding, in the event that the District installs and operates a fish screen at the outlet pipe, the District may resume reverse flow (divert) or may authorize the reverse flow of water from the Sultan River into the Diversion Dam outlet pipe. Such fish screen shall conform to the National Marine Fisheries Service (NMFS) 2008 Anadromous Salmonid Passage Facility Design Manual, prepared by the NMFS Northwest Region Hydro Division, dated February 8, 2008 (NMFS Design Manual).

3. Diversion Dam Volitional Passage Design Drawings

The Licensee's design for modifying the Diversion Dam to provide upstream and downstream volitional fish passage shall conform to the NMFS Design Manual, while continuing to meet the City of Everett's water supply requirements.

4. Schedule for Providing Diversion Dam Volitional Passage

4.1 Within twelve (12) months after license issuance, the Licensee shall file with the Commission the conceptual design drawings and cost estimates of the proposed Diversion Dam modifications required for achieving volitional fish passage, which may include modifications to the Dam's sluiceway or sluice gate

4.2 Within six (6) months after the fish passage trigger prescribed at 1.0 above occurs, the District will file with the Commission the final design for the Diversion Dam modifications and apply for all necessary permits. Prior to filing the final design with the Commission, the Licensee shall prepare detailed design drawings at the thirty percent

(30%)(functional design), fifty percent (50%) and ninety percent (90%) completion stage and consult with the ARC at each stage.

4.3 The Licensee shall not begin construction of the Diversion Dam modifications until the Service and NMFS, in consultation with the ARC, and the Commission approves the final design and plan, and the Licensee has obtained all necessary permits.

4.4 The Licensee shall complete the Diversion Dam modifications no later than two (2) full construction seasons after the Commission approval of the final design and plan and obtaining all necessary permits. For purposes of this prescription for fishways, the construction season is defined as August 1 to August 31.

5. Diversion Dam Volitional Passage Plan

5.1 Within one (1) year after License issuance, the Licensee shall file for Commission approval, a Diversion Dam Volitional Passage Plan (DDVP Plan). The DDVP Plan shall include: (1) the conceptual design drawings and cost estimates of the Licensee's proposed Diversion Dam modifications for achieving upstream and downstream volitional fish passage; (2) the method and schedule for implementing the Diversion Dam proposed modifications in the event that the passage trigger prescribed at 1.0 above occurs; (3) the method and the schedule for monitoring annual spawning escapement within the Diversion Dam Index Area and above the Diversion Dam, as well as, annual spawning escapement within other existing index areas in the Sultan River; (4) the method and schedule for testing and verifying fish passage effectiveness at the Diversion Dam through the use of spawning surveys and/or visual digital recordings; and (5) the program annual monitoring and reporting and ARC consultation requirements.

5.2 The Licensee shall develop the DDVP Plan in consultation with the ARC. The District will allow a minimum of thirty (30) days for members of the ARC to comment and make recommendations before submitting the DDVP Plan to the Commission. When filing the DDVP Plan with the Commission, the Licensee will include documentation of consultation; copies of comments and recommendations; and specific descriptions of how comments and recommendations from the ARC are accommodated by the Licensee's plan. If the Licensee does not adopt a recommendation, the filing will include the Licensee's reasons based upon Project-specific information. Upon Commission approval, the Licensee will implement the DDVP Plan.

The following is from the Settlement Agreement's Joint Explanatory Statement:

L. Article A-LA 13: Diversion Dam Volitional Passage

A PM&E to provide fish passage at the City's Diversion Dam was not included in the License Application, but as a result of Settlement negotiations, the District is proposing to develop and implement a Diversion Dam Volitional Passage Plan ("DDVP Plan") (A-LA 13). The goal of the DDVP Plan is to provide safe, timely, and effective upstream and downstream volitional fish passage at the Diversion Dam through structural modifications to the Diversion

Dam. The District will file the DDVP Plan with the Commission within one year of License issuance, and will implement the plan upon Commission approval. The Settlement Parties currently envision that modifications will involve changes to the sluice slot and gates, although other alternatives will be considered.

The District's obligation regarding volitional passage is subject to (1) the ARC's determination that spawning escapement of either Chinook salmon or steelhead trout within the Diversion Dam Index Area equals or exceeds in any one year 10 percent of the combined total spawning escapement for either Chinook salmon or steelhead trout within the four index areas of the Sultan River downstream of the Diversion Dam, and (2) the District obtaining all necessary regulatory approvals.

Upon the ARC determining that the spawning escapement above the Diversion Dam exceeds six anadromous redds in any one year, the District will not divert flow or authorize the diversion of water from the Sultan River at the Diversion Dam to Lake Chaplain unless required for the City of Everett's water supply needs. Conditions that would require diversion of water at the Diversion Dam would include but not be limited to a "power off" situation where the reservoir is below elevation 1380 for an extended period and an emergency that disables the Jackson Powerhouse water conveyance system to Lake Chaplain. The District estimates that events that disable or preclude the Jackson Powerhouse water conveyance system operation due to low reservoir elevations of Spada Lake will occur no more than two times in 45 years at the City of Everett's current water use rate. The number of events is estimated to increase to 19 times in 45 years at Everett's forecasted water use rate in 2056. The average annual duration of these events is predicted to be 33 days and range from 22 to 43 days. This assessment does not account for any effect of additional conservation measures that the City of Everett might employ under dire drought conditions which would likely reduce the frequency and magnitude of water releases solely from Culmback Dam. If this water supply requirement is triggered, the District, in consultation with the ARC, will take appropriate measures to protect ESA-listed fish. Notwithstanding, in the event that the District installs and operates a fish screen at the outlet pipe, the District may resume the diversion of flow or may authorize the diversion of water to Lake Chaplain from the Sultan River at the Diversion Dam.

Providing access to historical spawning and rearing habitat upstream of the Diversion Dam is expected to increase salmon and steelhead production in the Sultan River by allowing these species to fully utilize available habitat and potential production capacity. The reintroduction of anadromous salmonids to this reach is also expected to benefit resident rainbow trout and other aquatic and terrestrial species by increasing primary productivity through the addition of marine derived nutrients (i.e. salmon carcasses).

APPENDIX B

Consultation Documentation

Presler, Dawn

From: Presler, Dawn
Sent: Wednesday, April 27, 2011 10:12 AM
To: 'Deborah Knight'; 'okeefe@amwhitewater.org'; 'Jim Miller'; 'steven.m.fransen@noaa.gov'; 'Leonetti, Frank'; 'Abby Hook'; 'Tim_Romanski@fws.gov'; 'Loren Everest'; 'Maynard, Chris (ECY)'; 'Applegate, Brock A (DFW)'
Cc: 'mick.matheson@ci.sultan.wa.us'; 'jsklare@ci.everett.wa.us'; Binkley, Keith; Moore, Kim
Subject: FW: ARC Mtg 2/16 - draft meeting summary
Attachments: DDVP to ARC.DOC

I am forwarding the draft DDVP Plan to you all again, in case you misplaced your previous version. Please review and comment on the Plan, if needed, per the direction received at the last ARC meeting.

Dawn

From: Presler, Dawn
Sent: Monday, April 04, 2011 9:51 AM
To: 'Deborah Knight'; 'okeefe@amwhitewater.org'; 'Jim Miller'; 'steven.m.fransen@noaa.gov'; 'Haas, Andy'; 'Abby Hook'; 'Tim_Romanski@fws.gov'; 'Loren Everest'; 'Maynard, Chris (ECY)'; 'Applegate, Brock A (DFW)'
Cc: 'mick.matheson@ci.sultan.wa.us'; 'jsklare@ci.everett.wa.us'; Binkley, Keith; Moore, Kim
Subject: RE: ARC Mtg 2/16 - draft meeting summary

Dear ARC:
Attached is the DRAFT Diversion Dam Volitional Passage Plan for your review. We can discuss any initial questions/comments at the ARC meeting on April 13, and the timeline for review, updating and filing with the FERC.

Dawn Presler
Sr. Environmental Coordinator
Generation Resources

Snohomish County PUD No. 1
PO Box 1107 Everett, WA 98206-1107
Phone: 425-783-1709

Presler, Dawn

From: Presler, Dawn
Sent: Thursday, June 09, 2011 12:03 PM
To: 'Steve Fransen'; 'Leonetti, Frank'; 'Abby Hook'; 'Tim_Romanski@fws.gov'; 'Loren Everest'; 'Maynard, Chris (ECY)'; 'Applegate, Brock A (DFW)'; 'okeefe@amwhitewater.org'; 'Jim Miller'; 'Deborah Knight'
Cc: Binkley, Keith; Moore, Kim
Subject: RE: ARC - final review of plans
Attachments: FINAL_DDVP.pdf

And here is the DDVP.

Please take the next week to review these final plan and provide comments, if any, back to me by June 17 COB. Otherwise, I will take your silence as concurrence with the attached plans and I will file them with the FERC for their approval after the new license is issued. Thanks everyone!

Dawn

From: Presler, Dawn
Sent: Thursday, June 09, 2011 12:01 PM
To: 'Steve Fransen'; 'Leonetti, Frank'; 'Abby Hook'; 'Tim_Romanski@fws.gov'; 'Loren Everest'; 'Maynard, Chris (ECY)'; 'Applegate, Brock A (DFW)'; 'okeefe@amwhitewater.org'; 'Jim Miller'; 'Deborah Knight'
Cc: Binkley, Keith; Moore, Kim
Subject: ARC - final review of plans

Dear ARC Members:
Attached are the final plans to be filed with the FERC after the new license is issued as discussed at the April ARC meeting. Plans include: SCE/LWD, WQ, and WQM. DDVP will come in another email due to size of attachments.

SCE/LWD Plan – Keith updated per discussions at the last ARC meeting and specifically integrates suggestions from Brock and Abby. In addition, the revised version includes an updated map to reflect the relocation of one engineered log jam. We have also modified the naming convention for the ELJ's to be consistent with the plans being prepared by Herrera.

Please take the next week to review these final plans and provide comments, if any, back to me by June 17 COB. Otherwise, I will take your silence as concurrence with the attached plans and I will file them with the FERC for their approval after the new license is issued. Thanks everyone!

Dawn Presler
Sr. Environmental Coordinator
Generation Resources
(425) 783-1709
****
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Everett, WA 98206-1107