

EROSION AND SEDIMENT CONTROL PLAN



ENLOE HYDROELECTRIC PROJECT (FERC PROJECT NO. 12569)

DECEMBER 2008



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1.0 INTRODUCTION

The Public Utility District No. 1 of Okanogan County (District) proposes to restore hydropower generation at Enloe Dam on the Similkameen River, approximately 3.5 miles northwest of Oroville, Washington. The current Federal Energy Regulatory Commission (FERC) license application (FERC Project No. 12569) proposes building new hydropower infrastructure on the east bank, opposite from the decommissioned facilities on the west bank.

This Erosion and Sediment Control Plan (ESCP) has been developed to provide measures to address or mitigate erosion and provide sediment control during construction of proposed hydropower generation facilities. Construction activities include:

- improvements to existing dam and spillway;
- construction of intake canal;
- penstock intake;
- penstocks;
- powerhouse;
- tailrace; and
- access roads.

This Plan has been developed in consultation with the Washington Department of Ecology (Ecology), U.S. Fish and Wildlife Service (FWS), Washington Department of Fish and Wildlife (WDFW), National Marine Fisheries Service (NMFS), Washington Department of Natural Resources (WA DNR), Bureau of Land Management (BLM), and the Colville Confederated Tribes (CCT).

This document has been prepared based on Project information currently available, and will need to be updated when a contractor is chosen and more final construction plans are in place. This Plan addresses temporary erosion and sediment control measures that may be employed during construction activities. Permanent erosion and sediment control measures related to facility operations will be developed following submittal and approval of the Final Design. Finally, activities related to the former powerhouse located on the western side of the Similkameen River and the Side Channel Enhancement project are under consideration and will be covered under a separate process.

2.0 PROPOSED PROJECT DEVELOPMENT

The Public Utility District No. 1 of Okanogan County (District) proposes to restore hydropower generation at Enloe Dam on the Similkameen River. The previous project, a 3.2-MW hydropower facility sited on the west bank of the Similkameen River, was located 800 feet downstream of Enloe Dam and was decommissioned in 1958.

The Final License Application (FLA) filed with FERC on August 22, 2008 proposes building new hydropower generation facilities on the east bank, opposite from the decommissioned facilities on the west bank. The proposed site is nearer to the dam which offers renewable energy development, environmental, and constructability advantages. The proposed 9.0 MW facility has a footprint that is about half the size of the existing facilities while providing nearly three times the generating capacity of the existing decommissioned plant and about twice the average annual energy output.

The proposed project arrangement reduces the length of river affected by diversion of a portion of streamflow through the powerplant. Relocating the tailrace further upstream and closer to the falls provides for better circulation of water to the pool at the base of the falls, which provides a cool-water refugia for fish using the Similkameen River. Construction access is also improved since the east bank of the river is readily accessible from existing roads and there is sufficient room to build necessary access road spurs for construction and maintenance of the facilities.

The proposed construction activities include the construction and/or improvements to the crest gates, construction of intake channel, penstock intake, penstocks, powerhouse, tailrace, access road, and recreation area. These modifications are shown in Figure 1 and Figure 2 and described in detail in Section 4.

3.0 EXISTING SITE AND FACILITY CONDITIONS

Enloe Dam is located on the Similkameen River 8.8 miles upstream from its confluence with the Okanogan River in Oroville in north central Washington. From Princeton, BC to Palmer Lake, WA (at 1,160 feet), the Similkameen River valley is in a predominately wide, flat-bottomed, low-gradient (dropping approximately 1.5 feet per thousand feet) U-shaped valley reflecting geologically recent glaciation. Downstream of Palmer Lake the river takes an abrupt northward turn into a narrow, steep valley that descends at a gradient of about 2.4 feet per thousand to Shanker's Bend at the upstream end of the Enloe impoundment. At this point the river channel turns southeast towards Enloe Dam and onwards to Oroville. Prior to dam construction the river channel narrowed and steepened considerably to a gradient of approximately 7 feet per thousand (including the drop over Similkameen Falls). As a consequence, the resulting impoundment is very narrow, long and sinuous. Below Similkameen Falls the river descends at a gradient of about 2.8 feet per thousand feet over the lower 8.7 river miles into Oroville.

3.1 SOILS

Most of the soils present within or adjacent to the FERC boundary are classified as Nighthawk loam or Nighthawk extremely stony loam. Soils present in the areas of proposed construction consist of Nighthawk extremely stony loam.

Nighthawk extremely stony loam soils are generally formed in glacial till. These soils are deep and well-drained. Nighthawk extremely stony loam soils with 8 to 25 percent slopes (134) are characterized by medium runoff and present a high to very high erosion hazard. When slopes reach 25 to 65 percent (135) these soils are characterized by rapid to very rapid runoff and present a high to very high erosion hazard.

Relative soil classification locations are presented on Figure 3. The code numbers presented on Figure 3 refer to Natural Resource Conservation Service (NRCS) designations and are taken from the Soil Survey of Okanogan County Area, Washington (NRCS 2007).

Some of the soils present adjacent to the Similkameen River present high to very high erosion potential. Nighthawk extremely stony loam soils that occur on slopes in excess of 8 percent (134 and 135) have a high to very high erosion hazard. Nighthawk extremely stony loam soils are present upstream of Shanker's Bend, adjacent to portions of Shanker's Bend, and on either side of the river adjacent to the dam, and proposed intake location. Landslide or mass wasting hazards are most likely to occur in these areas, however no signs of recent instability were noted during December 2006 geological field investigations (Christensen Associates 2007).

A complete description of site soils and their characteristics are presented in Exhibit E.6 in the FLA.

3.2 GEOLOGY

Along the narrow valley section of the Similkameen River downstream of Palmer Lake and upstream of the Enloe impoundment, the uplands are composed primarily of Triassic-Permian metasedimentary and metavolcanic rocks of the Kobau Formation, interspersed with Jurassic metavolcanic, intrusive, and sedimentary rocks, Eocene conglomerate and Eocene intrusive dacite. Much of the valley and sideslopes are mantled in Quaternary glacial drift (Stoffel 1990).

In the immediate vicinity of the impoundment, highly deformed Triassic/Permian metamorphic rocks of the Kobau and Spectacle Formations are unconformably overlain by Jurassic/Cretaceous metaconglomerate and metavolcanic rocks of the Ellemeham Formation. These in turn are unconformably overlain by Eocene sandstone and conglomerate, and the latter are again unconformably overlain by Quaternary glacial drift, colluvium, and alluvial deposits (Villalobos 1982).

Within the impoundment itself, from Shanker's Bend downstream to approximately 1600 feet above the dam, the Similkameen River lies at the boundary of the Kobau and Ellemeham Formations; between 1600 feet above and 1000 feet below the dam the river flows over Eocene sandstone and conglomerate. Enloe Dam is located above the Similkameen Falls on resistant granitic-clast conglomerate. Downstream of the dam and falls the river again flows over Triassic/Permian metamorphic rocks of the Kobau and Spectacle Formations (Villalobos 1982).

3.3 TOPOGRAPHY

Topography in the Project Vicinity has been significantly affected by glaciation and is moderately steep and rugged. In the lower part of the river canyon, steep slopes adjacent to the river are interspersed with relatively flat benches of alluvial or glacial origin. The upper portions of the river canyon are steep and rocky. The mountains of the Okanogan Highlands lie to the east and the North Cascades to the west. Elevations range from 1,000 feet at the mouth of the Similkameen River at Oroville, to over 3,600 feet at the summit of surrounding mountains. In the area of the proposed construction adjacent to the eastern side of the existing dam and spillway, the topography is steep and rugged with exposed bedrock. Trees and other vegetation are sparse.

3.4 CLIMATE

The climate in the lower Similkameen River Basin is typical of eastern Washington, with cool, moist winters and hot dry summers. The Cascade Mountains act as a barrier to the movement of maritime and continental air masses, creating the generally dry conditions observed in the Project Vicinity. Average annual precipitation is approximately 11 inches. River flows peak in late spring to early summer when warm temperatures melt the extensive winter snowpacks at the higher elevations in the basin. Low flows occur in mid-winter when cold temperatures minimize runoff.

3.5 VEGETATION

The deep gorge cut by the river traverses steep, sparsely vegetated rocky hills. Shrub-steppe vegetation communities dominate the lower elevations of the Similkameen River Canyon. The most prevalent species include sagebrush and bitterbrush, with an understory of cheatgrass, bluebunch wheatgrass, and associated herbaceous species. Moist draws and seasonally flooded areas support deciduous trees and shrubs including black cottonwood, willow, water birch, mountain alder, Douglas hawthorn, and red-osier dogwood. The steepest slopes and draws above the river are sparsely vegetated with scattered ponderosa pine and deciduous shrubs, such as smooth sumac and serviceberry.

3.6 SURFACE AND GROUNDWATER DRAINAGE

Surface water drainage consists mainly of runoff that originates in high elevations from snowmelt in spring and early summer and rain events. Surface drainages consisting of intermittent streams and gullies are present on both sides of the river in and adjacent to the project area.

Groundwater in this subbasin is primarily supplied from glacial and alluvial deposits in the lower valley areas. The Similkameen River once flowed southward through the valley now occupied by Palmer Lake and Sinlahekin Creek. During the last glaciation the river was rerouted through several temporary channels until it finally settled into its current channel as the glacier retreated. Glacial and alluvial deposits in the original channel and the temporary channels are several hundred feet thick with moderate to high yield aquifers (ENTRIX 2006). The alluvial and glacial deposits are comprised largely of fine sand, silt and clay, with some thin lenses of coarse sand and gravel. Permeability and yields in this unit can be quite high (PNRBC 1977).

In contrast, where there is a lack of glacial or alluvial deposits, scarce groundwater is available in a second unit, which consists chiefly of metamorphic, granitic, and consolidated sedimentary rock with low permeability and porosity. This unit is important to the regime of surface streams draining it however, and provides small supplies to many wells and springs in the region (PNRBC 1977).

During low flow periods, there is very little flow added to the river between the USGS flow station at Nighthawk (RM 15.8) and the Ecology flow station at RM 5.0, indicating that groundwater discharge is not a significant contributor to flow in the lower Similkameen River.

3.7 ADJACENT WATERWAYS

Upstream of the dam and within the FERC boundary, several intermittent streams that drain into the Similkameen River are located within the project area. During periods of snowmelt and heavy rain, these intermittent streams would discharge into the Similkameen River. Just downstream of the dam, Ellemeham Draw drains into the Similkameen River from the west.

3.8 EXISTING FACILITY CONDITIONS

Presently, remains of the original Enloe Hydroelectric Project powerhouse are located against a steep face on the west bank. The powerhouse has deteriorated and has been vandalized.

Two unpaved roads shown in Figure 2 provide access to the dam site: Enloe Dam Road and the old Oroville-Tonasket Irrigation District (OTID) Ditch Road.

- Enloe Dam Road is a county road, designated by Okanogan County as an unmaintained primitive road. Due to its steep grade, deep ruts and loose gravel surfacing the road is only suitable for careful use by vehicles with four-wheel drive.
- Currently, the OTID Ditch Road provides access for Oroville Golf Club personnel to reach an irrigation pump upstream of Enloe Dam, as well as informal access for recreationists, ranchers, agencies, tribes, and the District.

On a terrace northeast of the east dam abutment stand trees planted in rows where houses occupied by operators of the hydroelectric facility once stood. Stone walls and concrete foundations are all that remain of the razed structures. Further downstream, below the dam, is an intake channel excavated in rock that once diverted water to an original powerhouse predating the Enloe Hydroelectric Project powerhouse on the west bank of the river. Concrete foundation remains mark the location of the earlier building. Further downstream directly across the river from the existing powerhouse is a steel tower that once anchored a wooden footbridge by which operators reached their workplace from the houses upstream.

Proposed activities including construction of the new powerhouse and related infrastructure, access road improvements, and recreation area improvements are described in Section 4.0.

4.0 PROPOSED CONSTRUCTION ACTIVITIES

4.1 CREST GATES

The proposed project includes restoring the functionality of the flashboards on the crest of the existing spillway by retrofitting crest gates. These gates would be 5 feet high, and would increase the water level upstream of the dam and the hydraulic head available for power generation. Due to the curvature of the crest, the steel flap gates would be installed in short straight sections with flexible connections. The gates would be raised by air bladders installed between the gate and the spillway crest. Two small piers would be added to the spillway crest to divide the crest into three gated sections and provide air intakes for the spillway overflow. The location of the crest gates is presented on Figure 1.

4.2 INTAKE CHANNEL

An intake channel would divert a portion of the streamflow from the Similkameen River to the penstock intake structure that serves the proposed new powerplant. The canal is designed to be wide and shallow at the upstream end to minimize disturbance to existing sediment in the reservoir, and deep at the penstock intake structure to provide adequate submergence.

The intake channel would carry inflow from the river intake structure to the penstock intake structure. The canal would be a 190 foot long unlined trapezoidal cross section canal excavated in rock. The canal would taper from about 120 feet wide and 8 feet deep at the riverbank to about 30 feet wide and 26 feet deep at the penstock intake structure.

Depending on rock bedding and jointing, benching and rock bolting may be required during the excavation, to ensure long term stability of the side slopes. Some grouting may also be required to control seepage losses through joints in bedrock that forms the east abutment of the dam. The location of the intake channel is presented on Figure 1.

4.3 PENSTOCK INTAKE

The penstock intake would be located at the downstream end of the intake canal, in a rock cut through the east abutment of the dam. The intake would be a 35 foot long by 30 foot wide reinforced concrete gravity type structure founded on bedrock and connected to two steel penstocks.

Two bell-mouthed entrances and transitions within the structure to the circular diameter of the penstocks would provide for smooth flow into the penstocks during plant operation, with adequate submergence and minimal hydraulic losses. Trashracks would be provided to protect the turbine water passages from blockage by debris. The

trashracks would be 22 feet high by 12.5 feet wide and would be constructed either from steel or high density polyethylene (HDPW) supported by a steel frame. A one-inch clear spacing is proposed between trashrack bars to prevent adult resident fish in the reservoir and small debris from entering the intake. A motorized trashrake mounted on a monorail would be provided to remove accumulated trash and debris.

Two vertical-lift wheeled gates, approximately 10 feet high by 8.5 feet wide, would be provided for emergency closure at rated flow. Two bulkhead gate slots located upstream of the main gates, would be provided for dewatering of the main gates for maintenance. An enclosure on top of the intake structure would house the gate hoists and controls. The location of the penstock intake is presented on Figure 1.

4.4 PENSTOCKS

Two above-ground steel penstocks, 8.5 feet in diameter and approximately 150 feet long, would slope steeply from the intake to the powerhouse and would carry water to the turbines. The penstocks would be supported on concrete saddles and by concrete anchor blocks at the penstock bends. Both the exterior and interior of the penstock would be protected against corrosion. The locations of the penstocks are presented on Figure 1.

4.5 POWERHOUSE

The proposed powerhouse location is sited in an alcove on the east bank of the Similkameen River about 230 feet downstream of the east abutment of Enloe Dam and 140 feet upstream of Similkameen Falls.

The reinforced concrete powerhouse structure would be about 70 feet long and 30 feet wide and would house two vertical axis Kaplan turbine/generator units, controls, switchgear and a repair bay. The reinforced concrete substructure would be founded in an open rock excavation in bedrock that outcrops in the banks of the river and the broad terrace upstream of the falls. To accommodate a large fluctuation in tailrace water level, the powerhouse walls would be of reinforced concrete to El. 995 feet. Above this elevation, the walls would be structural steel with insulated metal cladding. The repair bay and laydown area would be located at the east end of the powerhouse, with a floor elevation of approximately El. 995 feet.

A concrete training wall constructed at the west end of the powerhouse would separate the powerhouse and tailrace channel from the stilling basin area downstream of Enloe Dam. The location of the powerhouse is presented on Figure 1.

4.6 TAILRACE

The tailrace channel would convey water a distance of about 180 feet from the powerhouse to the Similkameen River, downstream of the Similkameen Falls. It would be an unlined steep-sided trapezoidal channel excavated in rock by controlled blasting

techniques. The channel width would taper from about 40 feet at the powerhouse to about 20 feet at a distance of about 75 feet downstream of the powerhouse. Downstream of this point, to the river, the channel width would be 20 feet. The invert of the channel would be about 30 to 40 feet below the existing rock terrace on the east side of Similkameen Falls. The location of the tailrace is presented on Figure 1.

4.7 ACCESS ROADS

The District proposes to work with the County to vacate Enloe Dam Road to public use and provide access by rehabilitating the OTID Ditch Road. The Enloe Dam Road would be maintained for use only by the District to provide maintenance access.. It would be gated at the Loomis-Oroville Road intersection.

No public vehicle access would be provided beyond the proposed parking and recreation area shown on Figure 1; access beyond this point would be limited to authorized vehicles for security reasons. The OTID Ditch Road would be improved to a single lane gravel road with several turnouts within line of sight for use by larger construction traffic and recreation vehicles. The location of the OTID Ditch Road is presented on Figure 2 and is divided into Segments A through E.

Segment A refers to the portion of the OTID Ditch Road from its intersection with the Loomis-Oroville Road to a point just past the FERC boundary. Segment B refers to the existing roadway, which is normally flooded during periods of high water and thus would be abandoned to a point downstream of the inundated riparian area. Segment C would be reconstructed over the abandoned irrigation canal as the primary Project access road. Segment C crosses several small gullies in short lengths of elevated concrete flume. These gullies would be crossed by embankments constructed with excavated rockfill from the project. Segment C would travel along the ditch for 1530 feet before descending 475 feet to an existing spur road to rejoin Segment B (to be abandoned) at a point beyond the inundated riparian area. Segment D would continue from that point 1375 feet to terminate public access at a proposed recreation site near the dam, as illustrated in Figure 1 and Figure 2.

The headworks and the east abutment of the dam would be accessible to the District from a 400 foot long section of road (Segment E) that would run east then south along the east side of the intake channel then turn west to cross the penstock intake structure to end at a turnaround area near the east abutment of the dam.

District vehicle access to the penstocks, powerhouse and tailrace downstream of the dam would be developed by realigning and widening an existing road that runs south along the east bank of the river downstream of the dam to a point about 500 feet downstream (also Segment E). At this location the road would turn back upstream and a 230 foot long section of new road would run along the east side of the tailrace channel to the new powerhouse.

4.8 RECREATION AREA IMPROVEMENTS

Recreation area improvements include the access road improvements as described above, improvements to the existing boat ramp, and completion of an improved park-like area near the dam that includes a parking area and vault toilet. A vehicle and trailer parking area will be located a few yards away from the improved boat ramp.

These improvements are described in detail in the Recreation Management Plan (RMP).

5.0 GENERAL EROSION AND SEDIMENT CONTROL MEASURES

Best Management Practices (BMPs) are incorporated into this ESCP to prevent erosion and protect water quality, provide dust control, minimize loss of native vegetation, protect wildlife, protect cultural resources, and to protect and minimize potential adverse impacts to wetlands and water bodies. The following BMPs are taken from the Washington Department of Ecology, *Stormwater Management Manual for Eastern Washington* (WDOE 2004). BMPs are described in detail in the above referenced document, which is made a part of this plan by reference. Additionally, each BMP is briefly described in this document and is also described in the Storm Water Pollution Prevention Plan (SWPPP). This Plan may be further modified during permit consultation with FERC. The Contractor will implement approved BMPs during construction to control off-site discharge of pollutants. As required by Ecology, inspection of BMPs will be conducted by a Certified Erosion and Sediment Control Lead (CESCL).

To ensure that identified and unidentified cultural resources are not disturbed or destroyed, ground disturbing activities will commence only after actions described in the Cultural Resources Programmatic Agreement (PA) and Historic Properties Management Plan (HPMP) have been completed. Ground disturbing activities will be conducted with the oversight of the Historic Properties Management Plan Coordinator (HPMPC).

Construction activities including installation and maintenance of BMPs covered in this Plan would start in the winter of 2011 and carry on through the fall of 2013. Construction of power facilities is planned to take about 18 months. Road access improvements, installation of a temporary cofferdam, and construction of the training wall (both described in the Construction Sediment Management Plan [CSMP]) would be carried out prior to a three month shutdown during the first winter. Most of the site excavation and concrete construction would be conducted during the 2012 construction season, with installation of electrical and mechanical equipment occurring in fall and through the winter of 2012. When the plant is substantially complete it would be tested and commissioned and would be scheduled to commence operations in early spring.

Installation of the crest gates would be carried out during the fall of 2013 when river flows are low. The new power plant would be used to draw down the reservoir to an elevation just below the crest of the spillway. During this time, a temporary siphon would be installed on the spillway crest to maintain downstream flow in the event of an unplanned plant outage.

5.1 CONSTRUCTION ACCESS BMPS

Access roads will be stabilized with gravel to minimize tracking of sediment onto public highways. The public roadways will be cleaned thoroughly as required. Sediment will be

removed from roads and will be disposed of in accordance with appropriate waste disposal regulations. At a minimum, road approaches will be constructed as directed by the engineer and in conformance with BMP C105 and BMP 107 as described below:

Stabilized Construction Entrance (BMP C105) – To stabilize construction entrances and reduce the amount of sediment transported onto paved roads by vehicles or equipment, stabilized pads of quarry spalls will be constructed at entrances to construction sites. Construction entrances must be stabilized wherever traffic will be leaving a construction site and traveling on paved roads or other paved areas within 1,000 ft. of the site. Specifications on the design and installation of construction entrances can be found in *Stormwater Management Manual for Eastern Washington* (Ecology 2004).

Construction Road/Parking Area Stabilization (BMP 107) – Construction laydown areas, parking (both temporary and permanent), and access roads must be stabilized immediately after grading to reduce erosion caused by traffic. A six-inch depth of two-to-four inch crushed rock base and crushed surfacing course will be applied. Areas will be graded to promote runoff into adjacent vegetated areas.

5.2 CONTROL INSTALLATION BMPS

Temporary sediment barriers are designed to reduce water velocity and intercept suspended sediment conveyed by sheet flow, while allowing runoff to continue down gradient. These installations limit sediment transport out of the construction area. Temporary sediment barriers will be installed at the following locations immediately after initial ground disturbance:

- adjacent to roadways, drainages, wetlands (dry or wet), springs (dry or wet), impoundments (dry or wet), and other sensitive resources where topography will direct sediment into these resource areas;
- around soil or spoil piles, where necessary (e.g., adjacent to flowing drainages); and
- where requested by the CESCL to prevent significant sediment transport
- into adjacent resource areas.

Prior to starting any construction activities and/or before any land disturbing activities are started appropriate sediment barriers will be installed. Sediment barriers will be placed at the bottom of slopes and will be located at least 6 feet from the toe of the slope, where possible, in order to increase ponding volume. The ends of each sediment barrier will be turned upslope to capture sediment.

Sediment barriers will be placed above the ordinary high water mark of active stream channels in a manner that will not hinder construction activities. The ends of each sediment barrier will be turned upslope to capture sediment. If silt fences or straw bale

sediment barriers are placed across the construction area, provisions will be made for traffic flow. A gap approximately 15 feet wide, will be provided along the silt fence or straw bale row, with the ends of the sediment barrier turned slightly upslope. Across the gap, a driveable earth berm will be installed and maintained immediately upslope of the sediment barrier (upturned ends of the sediment barrier will tie into the driveable earth berm).

If sediment builds up to greater than 40 percent of barrier capacity, the accumulated sediment will be removed or spread on an approved sediment disposal site. Damaged or undermined sediment control barriers will be repaired or replaced as described in this plan. Primary control of sediment discharge from this activity will be achieved with the BMPs listed below.

Straw Bale Barrier (BMP C230) – Straw bale sediment barriers consist of a row of tightly abutted straw bales placed perpendicular to the runoff direction with the ends of the barrier turned upslope. Such barriers are typically one bale high, placed on the fiber-cut edge (ties not in contact with the ground) in a 4-inch-deep trench, and anchored securely with two wooden stakes driven through each bale. Excavations will be conducted in areas determined not to be culturally sensitive. In culturally sensitive areas, the HPMPC will determine if monitoring is necessary. Soil will be placed and compacted along the toe of the uphill side of the straw bale barrier. If a dugout area cannot be excavated due to the presence of rocky material, the Contractor will install the straw bale so that the bale will not be undermined. Only straw bales that are certified to be free of noxious weeds will be used. The Contractor will acquire weed-free straw and provide the appropriate documentation.

Silt Fence (BMP C233) – Silt fence composed of commercial filter fabrics with sufficient strength to prevent failure will be provided and installed by the Contractor. The height of the silt fence will not exceed 36 inches above the ground. The fabric will be cut from a continuous roll of fabric with splices only at the support posts. When splicing sections, at least a 6-inch overlap of fabric will be secured and wrapped to the post(s). Support posts will be a maximum of 10 feet apart. Silt fences will be constructed at the base of slopes adjacent to the new access roadway and the river. They will also be installed downslope of all disturbed areas.

The bottom edge of the silt fence will be embedded in a trench excavated approximately 4 inches wide by 6 inches deep and refilled with compacted soil, unless on-site constraints dictate otherwise (e.g., rock). As described above, excavations will be conducted in areas determined not to be culturally sensitive. In culturally sensitive areas, the HPMPC will determine if monitoring is necessary. If a trench cannot be excavated, the Contractor will secure the bottom edge of the silt fence so that it will not be undermined. Silt fences will be attached to supporting posts by staples or wire. As determined by the CESCL, a wire fence may be used instead of wooden support posts to provide additional strength on hillsides.

Sandbags – Sandbags may be used as dikes or sediment barriers to control sediment in drainage swales. Sandbags can be strategically placed to control runoff, dissipate runoff energy, and catch sediment.

5.3 SOIL STABILIZATION BMPS

Exposed and unworked soils will be stabilized by application of effective BMPs that protect the soil from the erosive forces of raindrops, flowing water and wind. From October 1 through June 30, no soils will remain exposed and unworked for more than five days. From July 1 to September 30, no soils will remain exposed and unworked for more than ten days. This stabilization requirement applies to all soils on site, whether at final grade or not.

Soils will be stabilized at the end of the shift before a holiday or weekend if needed based on the weather forecast. Applicable practices include, but are not limited to, temporary and permanent seeding, sodding, mulching, plastic covering, erosion control fabrics and matting, soil application of polyacrylamide (PAM), and dust control.

Selected soil stabilization measures will be appropriate for the time of year, site conditions, estimated duration of use and the water quality impacts that stabilization agents may have on downstream waters or ground water. Soil stockpiles must be stabilized and protected with sediment trapping measures.

Seeding may be used throughout the project on areas that have reached final grade or that will remain unworked for more than 30 days.

BMPs to be employed in stabilizing soils include:

Mulching (BMP C121) – Mulching is an erosion control practice that uses hay, straw, or wood fibers placed on the soil surface for temporary soil stabilization. In addition to stabilizing soils, mulching can reduce the speed of stormwater runoff, aid in plant growth, and retain moisture in the soil after an area has been planted. Mulch, consisting of weed-free straw, wood fiber, or an approved equivalent, may be applied to disturbed soils to minimize the effects of wind or rain on exposed soils. During rainy conditions, mulch reduces the impact of rainfall in initiating erosion and slows the down slope velocity of surface flow.

Mulch will be required in the following areas:

- within 100 feet of flowing streams;
- slopes of 30 to 40 percent with less than 70 percent surface cover; and
- slopes of 0 to 30 percent with highly wind erodible soils and less than 70 percent surface cover, as directed by the CESCL or other qualified personnel.

If reclamation and seeding is deferred more than 10 days after final grade restoration, all disturbed slopes above waterbodies and wetlands will be temporarily stabilized by applying 3 tons of dry straw mulch per acre for a minimum distance of 100 feet above the edge of the waterbody or wetland.

After final restoration and seeding, mulch will be applied to all dry sandy sites, slopes greater than 8 percent, and all slopes within 100 feet of waterbodies to control erosion. Mulch will be spread over the area to a visible coverage of at least 75 percent of the ground surface and at a rate of 2 tons of dry straw (or functional equivalent) per acre.

Temporary and Permanent Seeding (BMP C120) – Following final recontouring of the project site and installation of permanent erosion control measures, the project site will be seeded with a seed mix that is native and appropriate for the local conditions. Due to the dispersed nature of this project, the CESCL, in conjunction with the District, will determine specific revegetation requirements (including seed mixtures and soil amendments) for each site. The project site will be seeded within 6 working days of final grading in accordance with recommended seeding dates, weather and soil conditions permitting. Slopes steeper than 3:1 will be seeded immediately after final grading in accordance with recommended seeding dates, weather permitting.

Prior to seed application, the seedbed will be prepared to depth of 3 to 4 inches using appropriate equipment to provide a firm, smooth seedbed that is free of debris. Seed may be applied using drilling methods, hydroseeding, or broadcast seeding methods. For broadcast and hydro-seeding, the seedbed will be scarified to ensure sites for seeds to lodge and germinate. The seed will be applied and covered uniformly per local soil conservation authorities' recommendations for the seed mixture being applied.

Seed will be purchased in accordance with the Pure Live Seed (PLS) specifications for seed mixes and used within 12 months of testing. PLS is an agricultural industry standard that omits dust, chaff, and empty seed, weed and other crop seed in the calculation of the weight and value of purchased seed. Specifics on the calculation of PLS can be found at <http://www.dot.state.tx.us/mnt/wildflower/pls/explanation.htm>. Legume seed will be treated with a species-specific inoculate per manufacturer's specifications.

Matting/Netting (BMP C122) – Where determined necessary by the CESCL, erosion control matting will be installed along steep slopes (greater than 33 percent) after final grade restoration to reduce rain impacts on soils, to control erosion, and to stabilize steep slopes.

As it is unrolled, matting will be anchored to prevent stretching of the material and inadequate ground contact. Anchoring is critical in the success of the matting and netting. For stream bank installations, mats will be laid parallel (upper mat overlapping lower mat in a shingle pattern) to the waterbody to a point above the top of the bank. Native materials (e.g., rocks, logs, etc.) may be used in conjunction with the matting to aid in bank stabilization.

During regular erosion control monitoring, erosion control matting must be inspected for washouts, adequate staking, and loss of matting. Damaged or undermined matting will be repaired or replaced, as necessary.

Dust Control (BMP C140) – During all excavation, road construction, and construction activities, dust generation will be limited by clearing only those areas where immediate activities are planned. Original ground cover will be maintained, wherever possible. When dust is generated during site construction activities, dust will be mitigated by irrigating the area until the surface is wet and dust is suppressed. All water sources to be used for dust control will be approved by the District prior to their usage. If necessary, appropriate permits will be obtained. To prevent the carryout of mud onto public streets, a stabilized construction entrance (BMP C105) will be employed, as described above.

5.4 SLOPE PROTECTION BMPS

Fill and cut slopes will be part of the construction activities on the site. These will include access ramps, permanent and temporary fill and excavation slopes. Slopes will be constructed in accordance with applicable codes and regulations.

Cut and fill slopes shall be constructed in a manner that will minimize erosion. Slopes exceeding 100 feet in length will be terraced. No more than five acres of slopes will be exposed at any given time. All surface runoff will be routed away from exposed slopes using curbs and interceptor dikes, and conveyed to the base of the slope using slope drains. Slopes will be track walked when at finish grade or whenever they will be left unworked for 30 days or more. Final stabilization BMPs will be installed within two days of slope completion.

Temporary erosion control measures will be installed where needed immediately following significant soil disturbance and will be maintained throughout the course of construction. In general, temporary erosion control measures will be removed during cleanup activities after permanent erosion control measures have been installed. Permanent erosion control measures are designed to minimize erosion and sedimentation after construction until revegetation efforts have effectively stabilized the construction area.

BMPs to be employed for slope stabilization include:

Waterbars (BMP C203) – Waterbars are utilized in various forms (e.g., rolling dips on access roads, driveable berms across travel ways, waterbars on slopes, etc.) during project construction and after final grade restoration. Waterbars are intended to intercept water traveling down a disturbed slope and divert water off disturbed soil into stable, well-vegetated, or adjacent rocky areas.

Waterbars will be installed near the base of slopes adjacent to wetlands and drainages, except at those specific sites (e.g., terrain slopes away from a canal) where, in the judgment of the CESCL, waterbars are not necessary to prevent discharge of sediment

into sensitive resources. The general spacing for temporary and permanent waterbars is as follows:

- 300 feet for slopes of 5 to 15 percent
- 200 feet for slopes of 15 to 30 percent
- 100 feet for slopes greater than 30 percent

The CESCL can modify the final spacing of waterbars in the field. Waterbar spacing is based on a site-specific evaluation of the project site and standard construction protective measures. This spacing takes into account the soils, timing of construction, and area of disturbance anticipated for construction of the project. Except for site-specific situations as determined by the CESCL (e.g., extremely long slopes with highly erodible soils), waterbars will not be constructed on slopes with less than a 5 percent gradient.

Earthen waterbars will be constructed of existing suitable material and compacted to increase durability. Alternatives to waterbars may include a series of tightly abutted straw bales, excelsior logs, or abutted burlap bags filled with native sand/soil. The installation angle will be 2 to 8 percent down slope (as measured by a hand-held clinometer or level) and will extend to, or slightly beyond, the edge of the disturbed construction area, but within the boundaries of the project area.

Where possible, waterbars will discharge into stable, non-erosive (vegetated or rocky) receiving areas. In isolated instances where waterbars discharge into unstable or highly erosive areas without rock or vegetation, flow energy dissipators or “J-hook” shaped sediment barriers may be positioned at the waterbar outlet. Additionally, in highly erodible soils, the spacing between waterbars may be decreased to further slow the velocity of water. Whenever feasible, waterbars will be sited so that they do not drain into sensitive resource areas (e.g., cultural sites, rare plant sites, drainages, waterbodies, wetlands, etc.).

The General Contractor will regularly inspect and repair waterbars during construction to maintain their effectiveness. Waterbars worn down by heavy construction traffic or filled with sediments will be repaired, as needed, and sediment will be spread on the disturbed area uphill of the waterbar.

Check Dams (BMP C207) – Where determined necessary by the CESCL, the General Contractor will install check dams in bar ditches or other intermittent drainages to minimize the transport of sediment from the construction zone. Check dams will be constructed of staked straw bales or stacked sand bags just inside the drainage area edge. The center of the structure will be lower than the ends to channel water and create a sediment dump immediately upstream of the structure. The structure, and any deposited sediment, will be removed following final restoration of the site.

Surface Roughening (BMP C130) – Surface roughening involves tracking ground surface with heavy machinery creating a series of shallow depressions running parallel

to the ground surface contours. Surface roughening assists in controlling erosion by reducing the speed of storm water runoff, increasing infiltration, and trapping sediment.

5.5 MAINTENANCE OF BMPS

Temporary and permanent erosion and sediment control BMPs shall be maintained and repaired as needed to assure continued performance of their intended function.

The CESCL will inspect sediment control BMPs weekly or after runoff producing storm events during the dry season and daily during the wet season. Maintenance activities will be completed within 24 hours of the inspection. An inspection and maintenance report will be prepared following each inspection. Specific maintenance requirement for each BMP will be performed according to the maintenance guidelines in the Washington State Department of Ecology's Stormwater Management Manual, Eastern Washington.

Temporary erosion and sediment control BMPs shall be removed within 30 days after final site stabilization is achieved or after the temporary BMPs are no longer deemed necessary by the CESCL. Trapped sediment shall be removed or stabilized on site. Disturbed soil resulting from removal of BMPs or vegetation shall be permanently stabilized.

The General Contractor and the CESCL will review daily the location of silt fences and drainage swales where active construction is occurring to ensure that silt fences and swales are properly located and functioning. If any turbid discharges are observed, the Construction Manager will be notified immediately and corrective actions will be prescribed. Where deficiencies exist, additional BMPs shall be installed as directed by the CESCL.

5.6 PROJECT MANAGEMENT

The construction of sedimentation and erosion control features are planned to proceed in the following sequence of activities:

- Install filtration best management practices (BMP);
- Install gravel access (ingress/egress) road;
- Construct and install diversion structures;
- Excavate area;
- Construct facilities;
- Finish grade;
- Re-vegetate and landscape; and
- Remove BMPs when no longer required.

The sequence and methods planned must be reviewed periodically and adjusted as necessary to minimize and control disturbed areas.

6.0 SITE SPECIFIC EROSION AND SEDIMENT CONTROL MEASURES

Implementation of erosion and sediment control measures using the BMPs described in Section 5.0 were developed in consultation with the Ecology, WDFW, FWS, NMFS, WA DNR, BLM, and the CCT.

General guidelines to be followed during construction activities include:

- Minimize the area of and duration of soil disturbed;
- Protect exposed soil from rainfall and overland flow and implement revegetation or other soil stabilization procedures as soon as possible;
- Reduce the velocity of overland flow across areas of exposed soil using approved erosion control measures;
- Divert water drainage pathways away from construction areas or areas of exposed soil;
- Provide temporary containment areas or settling basins to control the runoff and to filter out sediment before discharge, if necessary;
- Whenever possible, schedule major land disturbing activities during the dry season (May 1 – September 30);
- Conduct all operations in a manner to preserve the landscape outside of the construction area and avoid disturbance or destruction of the natural areas surrounding all planned construction areas;
- Stockpiled soil including topsoil and/or other excavated material will be placed where rainfall, overland flow, and runoff will not intercept the stockpiled material and cause further erosion and transport of sediment into surface water bodies;
- If encountered during excavation activities, topsoil will be segregated and stockpiled for re-use during revegetation activities;
- Where applicable, soil excavations will have a minimum slope of 1 (vertical) to 2 (horizontal);
- All temporary erosion and sediment control measures will be maintained until construction activities are completed and there is no longer potential for erosion.

6.1 CREST GATES

As described in Section 4.0, the proposed project includes restoring the functionality of the flashboards on the crest of the existing spillway by retrofitting crest gates. These gates would be 5 feet high, and would increase the water level upstream of the dam and the hydraulic head available for power generation. These modifications would not cause any potential erosion during construction; however, during operations the increased reservoir water level could potentially cause erosion of the stream banks. Potential erosion of stream banks is discussed in the CSMP.

It is anticipated that the crest gates will be installed during the dry season following completion of the remainder of the infrastructure. Surface water would then be diverted through the penstock intake so that water would not spill over the dam during installation of the crest gates.

If heavy machinery is to be used for the installation of the crest gates, appropriate erosion controls will be employed as appropriate and measures to limit destruction of vegetation and the surrounding landscape will be undertaken as described above.

6.2 INTAKE CHANNEL

Construction of the headworks and intake canal may require blasting to install the intake canal into the existing bedrock. Potential erosion and sediment control measures that will be employed include:

- Placement of temporary sediment barriers such as straw bale barriers, silt fences, or sandbags along the downslope edge of these work areas so that rock dust, rock fragments or other material subject to erosion will not impact surface water as described in Section 5.0.

If dust is generated during blasting and/or excavation activities, sprinkling or irrigation may be used to decrease the production of dust.

Stormwater runoff from slopes to the east of the headworks and intake canal work area could flow into the construction work area and would require control and disposal. All stormwater entering the construction area from the east would be diverted to the temporary sediment barriers described above.

Dewatering of the intake canal will be conducted as described in the CSMP. Silt curtains/gunderbooms will be used to minimize the spread of construction-related turbidity that may be created. If necessary, de-watering water will be discharged into an above ground containment structure.

Location of potential sediment control measures are presented on Figure 1.

6.3 PENSTOCK INTAKE

Construction of the penstock intake may require blasting into the existing bedrock for installation at the downstream end of the approach channel. Potential erosion and sediment control measures that will be employed include:

- Placement of temporary sediment barriers such as straw bale barrier, silt fence, or sandbags along the downslope edge of these work areas so that rock dust, rock fragments or other material subject to erosion will not impact surface water.

If dust is generated during blasting or and/or excavation activities, sprinkling or irrigation may be used to decrease the production of dust.

Location of potential sediment control measures are presented on Figure 1.

6.4 PENSTOCKS

If any earthwork including soil removal or excavation is required for the installation of concrete saddles and anchor blocks, temporary erosion controls will be employed. Potential erosion and sediment control measures that will be employed include:

- Placement of temporary sediment barriers such as straw bale barrier, silt fence, or sandbags along the downslope edge of these work areas and/or adjacent to surface waters so that soil or other materials subject to erosion will not impact surface water.

Location of potential sediment control measures are presented on Figure 1.

6.5 POWERHOUSE

It is anticipated that earthwork including soil removal and excavation is required for the construction of the Powerhouse. The area surrounding the Powerhouse is characterized by rock benches and outcroppings with a thin layer of soil in some areas.

Potential erosion and sediment control measures that will be employed during construction of the powerhouse include:

- Placement of temporary sediment barriers such as straw bale barrier, silt fence, or sandbags. It is anticipated that temporary sediment barriers will be placed in strategic locations so that soil or other materials subject to erosion will not impact surface water.

Location of potential sediment control measures are presented on Figure 1.

6.6 TAILRACE

Construction of tailrace will require blasting into the existing bedrock. Potential erosion and sediment control measures that will be employed include:

- Placement of temporary sediment barriers such as straw bale barrier, silt fence, or sandbags. It is anticipated that temporary sediment barriers will be placed in strategic locations so that rock dust, rock fragments or other material subject to erosion will not impact surface water.

If dust is generated during blasting or and/or excavation activities, sprinkling or irrigation may be used to decrease the production of dust.

Stormwater runoff from slopes to the east of the tailrace work area could flow into the construction work area and would require control and disposal. All stormwater entering the construction area from the east would be diverted to the temporary sediment barriers described above.

Location of potential sediment control measures are presented on Figure 1.

6.7 ACCESS ROADS

The new access roads will be stabilized with gravel to minimize tracking of sediment onto public highways. The public roadways will be cleaned thoroughly as required. Sediment will be removed from roads and will be disposed of in a controlled sediment disposal area. At a minimum, road approaches will be constructed as directed by the engineer and in conformance with BMP C105 (Stabilized Construction Entrance) and BMP 107 (Construction Road/Parking Area Stabilization) as described in Section 5.0.

Erosion control measures to be employed during construction of the access roads include:

- Placement of temporary sediment control barriers including check dams, straw bale barriers, and silt fences perpendicular to flow lines or where drainage ditches discharge, or in areas where discharge is occurring during storm events. It is anticipated that the entire downgradient side of the roadway (between the roadway and the river) will contain a silt fence to intercept all potential flow paths to the river during construction activities. At a minimum, silt fencing will be installed where ditches discharge into drainage pathways.
- Areas of exposed soil and areas of cut-and-fill will be stabilized using measures described in Section 5 such as mulching, temporary or permanent seeding, and/or matting or netting. Stone or crushed rock may also be placed on disturbed areas and on access roads during the construction phase.

Location of potential sediment control measures are presented on Figure 1 and Figure 2.

6.8 RECREATION AREA IMPROVEMENTS

Completion of Recreation Area improvements may result in unstable soils during the construction phase. Erosion control measures to be employed during construction of these improvements include:

- Placement of temporary sediment barriers such as straw bale barrier, silt fence, or sandbags in areas subject to erosion so that exposed or unstable soils will not impact surface water.
- Areas of exposed soil and areas of cut-and-fill will be stabilized using measures described in Section 5 such as mulching, temporary or permanent seeding, and/or matting or netting. Stone or crushed rock may also be placed on disturbed areas during the construction phase.

Location of potential sediment control measures are presented on Figure 1.

6.9 MATERIAL LAYDOWN AREA

The repair bay and laydown area associated with the powerhouse and future site operations will be located at the east end of the powerhouse. Other potential laydown areas to be used during construction activities are presented on Figure 1.

All material laydown areas will be appropriately graded and graveled to minimize erosion. All surface water will be diverted to avoid disturbed or unstabilized areas and will be directed toward temporary sediment barriers such as straw bale barrier, silt fence, or sandbags so that sediment-laden runoff does not leave the site.

Soil and gravel stockpiles should be located in areas so that natural drainage patterns are not affected or blocked and so that overland flow is diverted around the location of the stockpiles. All stockpiled materials will be protected from wind and rain erosion by plastic sheeting or seeding/mulching, if possible.

6.10 REVEGETATION AND SOIL STABILIZATION

During the construction phase, soil stabilization procedures will be followed as described in Section 5.0.

Following completion of construction activities, all areas that have been disturbed will need be revegetated. The majority of these areas that require revegetation include the material and laydown areas. Areas that were cleared down to bedrock or that originally consisted of bedrock or solid rock will not require revegetation.

As summarized in Section 5.0, following installation of permanent erosion control measures, the project site will be seeded with a seed mix that is native and appropriate

for the local conditions. Due to the dispersed nature of this project, the CESCL, in conjunction with the District, will determine specific revegetation requirements (including seed mixtures and soil amendments) for each area. As described in the SWPPP, the project site will be seeded within 6 working days of final grading in accordance with recommended seeding dates, weather and soil conditions permitting. Slopes steeper than 3:1 will be seeded immediately after final grading in accordance with recommended seeding dates, weather permitting.

Prior to seed application, the seedbed will be prepared to depth of 3 to 4 inches using appropriate equipment to provide a firm, smooth seedbed that is free of debris. For broadcast and hydro-seeding, the seedbed will be scarified to ensure sites for seeds to lodge and germinate. The seed will be applied and covered uniformly per local soil conservation authorities' recommendations for the seed mixture being applied. A range drill will be used on many of the disturbed sites; however, broadcast or hydro-seeding may also be used at double the recommended seeding rates.

Seed will be purchased in accordance with the Pure Live Seed (PLS) specifications for seed mixes and used within 12 months of testing. PLS is an agricultural industry standard that omits dust, chaff, and empty seed, weed and other crop seed in the calculation of the weight and value of purchased seed. Specifics on the calculation of PLS can be found at <http://www.dot.state.tx.us/mnt/wildflower/pls/explanation.htm>. Legumes seed will be treated with a species-specific inoculate per manufacturer's specifications.

6.11 INSPECTIONS AND WATER QUALITY MONITORING

Inspections and water quality monitoring activities will be conducted as specified in the National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permit to be completed for the site construction activities.

All BMPs and sediment and erosion control measures placed on-site must be inspected, maintained, and repaired by the CESCL and General Contractor as needed to assure continued performance of the intended function. Whenever inspection and/or monitoring reveals that BMPs are inadequate to fulfill their intended purpose, the BMP will be modified or replaced in a timely manner. Additionally, the ESCP will be updated to document these modifications.

Inspections will be carried out as follows: routine inspections must be performed by the CESCL at least weekly and within 24 hours after a rain event greater than 0.5 inches in a 24 hour period. All weekly written reports will include active construction activities as well as restored areas until re-vegetation is established. All inspections will be documented using the "Routine Inspection Form" provided in the SWPPP.

If site water is discharged into the Similkameen River or other surface water body, water quality monitoring will be conducted by the CESCL or general contractor. Water quality monitoring will include measurement of turbidity, and pH (if concrete work or engineered soils are present) at all of the identified site discharge points after each 24-hour rainfall

events of 0.5 inches or greater or if site discharge is observed. If turbidity at any of the site discharge points exceed the water quality standards (WAC 173-201A), then the Contractor shall make appropriate adjustments to the erosion control measures and update the ESCP. Turbidity will be measured with a HACH 2100P portable turbidity meter or equivalent and reported in Nephelometric Turbidity Units (NTUs).

Specifically, turbidity will not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU. Any time that sampling indicates that turbidity is 250 NTU or greater, the permittee shall notify Ecology by phone within 24 hours of analysis.

During all site inspections, the CESCL will visually monitor for turbid water or off-site sedimentation. The CESCL will check for potential BMP improvements if sediment is accumulating off-site, or if the discharge appears turbid. The CESCL will be responsible for confirming that no turbid water or sediment leaves the site.

7.0 REFERENCES

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Legend

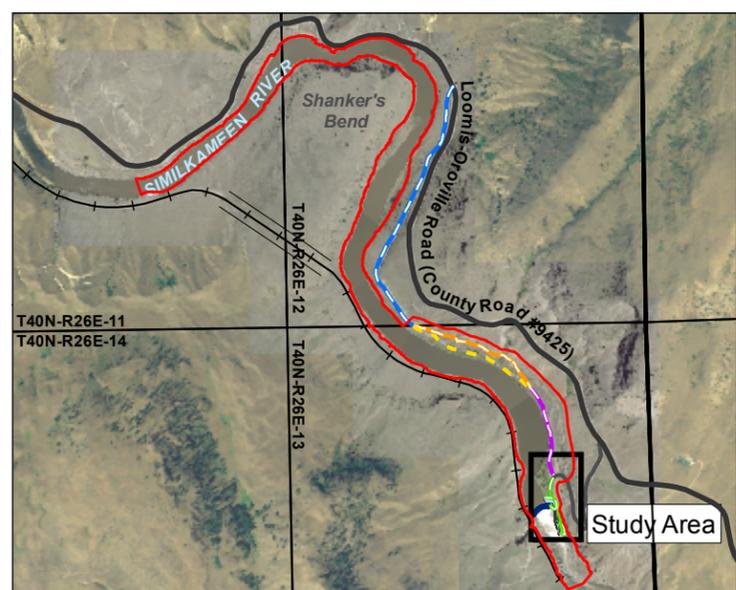
- Potential Areas of Silt Fence Placement
- Potential Location of Temporary Sediment Barrier
- Boat Launch
- Enloe Dam
- FERC Boundary
- Potential Area for Water Containment
- Proposed Recreation Area
- Potential Material Laydown Areas
- Access Road Segment D: Existing Public Access Road.
- Access Road Segment E: PUD Access Only.

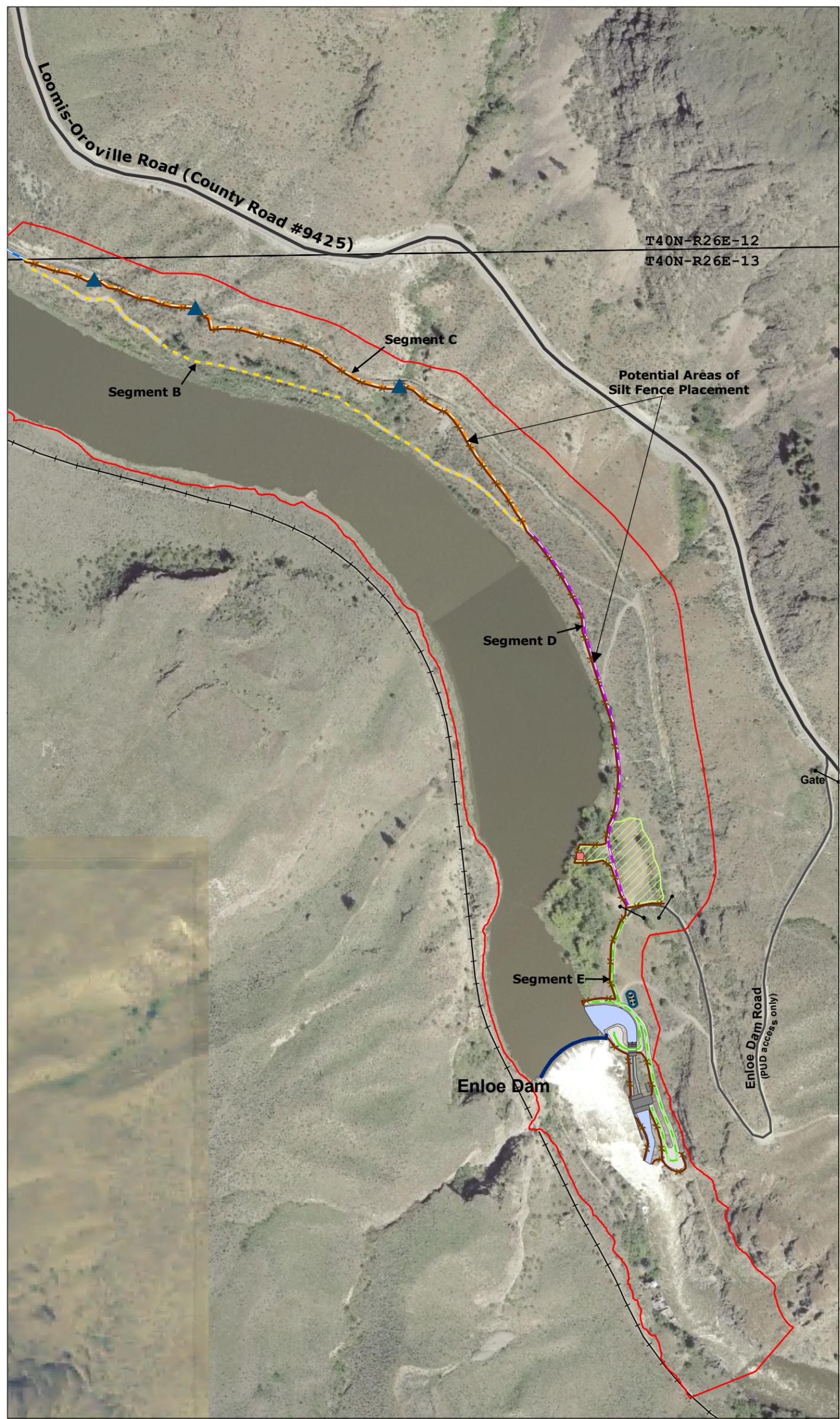


Image sources: USDA National Agriculture Imagery Program, 2005 and PUD No. 1 of Okanogan County, 2006.

Enloe Dam Licensing Project

Figure 1
Locations of Erosion & Sediment Control Measures for Powerhouse and Related Infrastructure





Legend

- Potential Areas of Silt Fence Placement
- Potential Location of Temporary Sediment Barrier
- Boat Launch
- Enloe Dam
- FERC Boundary
- Potential Area for Water Containment
- Proposed Recreation Area
- Loomis-Oroville Road
- Abandoned Railroad
- Railroad Tunnel
- Existing Enloe Dam Road (PUD Access Only)
- Access Road Segment A: Existing Public Access Road.
- Access Road Segment B: Existing Road to be Abandoned.
- Access Road Segment C: Proposed New Road with Pullouts. Pullout locations to be determined.
- Access Road Segment D: Existing Public Access Road.
- Access Road Segment E: PUD Access Only.

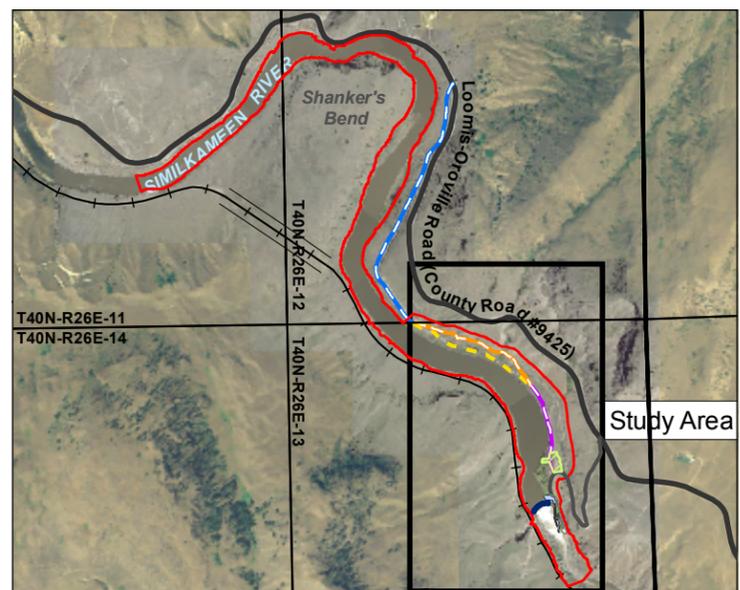


Image sources: USDA National Agriculture Imagery Program, 2005 and PUD No. 1 of Okanogan County, 2006.

Enloe Dam Licensing Project

Figure 2
Locations of Erosion & Sediment Control Measures for Access Roadways



