Condit Hydroelectric Project Decommissioning
FERC Project No. 2342

Mt. Adams Orchard Replacement Line

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1 INTRODUCTION

1.1 PROJECT DESCRIPTION

PacifiCorp Energy owns and operates the Condit Hydroelectric Project, which was completed in 1913 on the White Salmon River in Skamania County and Klickitat County, Washington. The project is regulated by the Federal Energy Regulatory Commission (FERC) as project number 2342. The project is located approximately 3.3-miles upstream from the confluence of the White Salmon and Columbia Rivers. Project facilities consist of a 125-foot high, 471-foot long concrete gravity diversion dam, an intake structure that directs water into a 13.5-foot diameter by 5,100-foot long wood stave flowline, and through a 40-foot diameter concrete surge tank. The flowline bifurcates inside the surge tank into two 9-foot diameter penstocks that supply water to the powerhouse. The powerhouse contains two double horizontal Francis turbines with an installed capacity of 14,700 kilowatts. The project creates a reservoir, Northwestern Lake, which extends 1.8-miles upstream of the dam and covers approximately 92 acres. The project area is shown in Figure 1-1.

1.2 BACKGROUND

In 1968, a new license was issued by the Federal Energy Regulatory Commission for a 25-year term, which expired on December 31, 1993. In 1991, PacifiCorp Energy filed an application with the FERC for a new license authorizing the continued operation and maintenance of the project. PacifiCorp Energy has since been operating the project pursuant to annual licenses, pending determination by the FERC on the status of PacifiCorp Energy's new license issuance. In 1996, the FERC issued a Final Environmental Impact Statement (FEIS) that analyzed the environmental and economic effects of various relicensing alternatives for the project. The FEIS included a recommendation to approve licensing with mandatory conditions, including provisions for establishing fish passage facilities at the project.

PacifiCorp Energy evaluated the economic impacts of the FERC recommendations contained within the FEIS and determined that the mandatory conditions would render the project uneconomic to operate. In 1997, PacifiCorp Energy requested a temporary abeyance of the relicensing procedure in order to investigate the feasibility of various removal alternatives in collaboration with project stakeholders. PacifiCorp Energy and project stakeholders then commissioned the consulting firm of R.W. Beck, Incorporated, to evaluate removal alternatives. In 1998, R.W. Beck, Incorporated, prepared a summary report of project removal engineering considerations that identified the preferred method and schedule for project removal as well as the expected costs and associated environmental and permit issues. In 1999, the Condit Settlement Agreement was signed by PacifiCorp Energy and project stakeholders. The settlement agreement provides for project removal upon the expiration of an extended license term in accordance with the preferred method identified in the R.W. Beck, Incorporated, summary report. The settlement agreement was amended in 2005 to extend the dates for project removal.

In 2002, the FERC prepared a Final Supplemental FEIS addressing project removal, which updated the 1996 FEIS and assessed the effects associated with approval and implementation of the Condit Settlement Agreement. In March 2007, Ecology issued the Final SEPA Supplemental Environmental Impact Statement (FSEIS) for the project.

September 2002, the U.S. Fish and Wildlife Service issued a Biological Opinion finding no jeopardy to bull trout for ongoing project operations and implementation of the Condit Settlement Agreement. In October 2006, the National Marine Fisheries Services issued a Biological Opinion finding that the proposed dam removal action is not likely to jeopardize the continued existence of salmon and steelhead or destroy or adversely modify designated critical habitat.

1.3 Project Removal Description

PacifiCorp Energy proposes to remove the project in accordance with the amended Condit Settlement Agreement and the Project Removal Design Report. Prior to removing the dam, the City of White Salmon's water supply line that crosses the reservoir needs to be relocated and potential impacts to the Northwestern Lake Bridge which is owned by Klickitat County and is at the upper end of the reservoir need to be addressed.

The proposed method for dam removal involves clearing sediment and debris immediately upstream from the tunnel and then drilling and blasting a 12-foot by 18-foot drain tunnel in the base of the dam to within a few feet of the dam's face. During the month of October, sediment and debris immediately upstream from the dam will be cleared to form a pathway and then the remainder of the tunnel will be blasted to drain the reservoir and flush impounded sediments out of the reservoir as rapidly as possible. Following the final tunnel blast, the drain tunnel will discharge at a rate of 10,000 cubic feet-per-second approximately 25 percent of the estimated peak discharge during the February 1996 flood event on the White Salmon River. This will drain the reservoir in approximately six hours. Rapid draining of the reservoir is expected to mobilize much of the estimated 2.3-million cubic yards of sediment that have accumulated behind the dam since its construction. Previous modeling has indicated that between 1.6- million to 2.2-million cubic yards of sediment will be discharged into the White Salmon River immediately following dam removal and over a number of years as successive high flow events mobilize overbank sediments.

Once the reservoir is drained, the dam will then be excavated and removed along with the flowline, surge tank, and penstocks. Concrete from the dam will either be buried onsite or removed from the site for recycling or disposal. The powerhouse will be left intact. The upstream cofferdam in the White Salmon River present from original dam construction will be removed from the river as soon as practicable after the breach. PacifiCorp Energy expects to complete the dam removal process within one year.

Following project removal, the irrigation water supply intake for the Mount Adams Orchard to the east of the dam will be reconfigured to accommodate a new intake.

Removal of Condit dam is expected to provide the following benefits:

- Anadromous salmonids will be provided access of up to 18 miles of White Salmon River main stem and tributary habitats that have been inaccessible since the early 1900s. Restoration of natural runs of anadromous fish upstream of the project dam is consistent with the fishery management goals of the National Marine Fisheries Service, U.S. Fish and Wildlife Service, Washington Department of Fish and Wildlife, and the Yakima Nation.

- Dam removal offers the greatest potential for full utilization of anadromous fish habitat, including habitat inundated by Northwestern Lake, and therefore, full restoration of anadromous salmonids within the White Salmon River basin.

- Dam removal will benefit wildlife dependent on anadromous fish in the area of the river reach upstream of the present dam.

- Dam removal will provide increased whitewater recreation opportunities. Whitewater recreation is an important and popular use of the White Salmon River and provides income for the local area.

1.4 BACKGROUND

The Mount Adams Orchard currently withdraws irrigation water from Northwestern Lake, the reservoir created by Condit dam. Irrigation water is pumped from the lake at a rate of 0.7 cubic feet-per-second (cfs) or 315 gallons-per-minute (gpm) through a 4-inch diameter pipeline to a holding tank. Since Northwestern Lake will no longer exist once the dam is removed, replacement of the orchard's water intake and pumping system will be necessary. To ensure that an operating system is available following the removal of Condit dam, a new pump intake will be located adjacent to the White Salmon River. The new pump system must be capable of supplying the same flow rate to the orchard as the current system is capable of delivering. New water supply piping extending from the new pump intake elevation to the current pump elevation will be required as part of the irrigation water supply replacement. Modified electrical service will also be required to power the new pumping system.

2 DESIGN & PLAN OVERVIEW

2.1 OVERVIEW

The purpose of this technical memorandum is to summarize engineering the design requirements for the replacement of the Mount Adams Orchard irrigation water supply intake and pump system following removal of Condit dam.

2.2 EXISTING SYSTEM

The existing irrigation pump is a horizontally mounted, end-suction, centrifugal pump driven by a close coupled electric motor. The pump is manufactured by Cornell Pump Company and is designed to pump 315 gpm against 340 feet of head (see Appendix A for existing pump characteristic curve). Table 2-1 contains additional pump and motor name plate data. Figure 2-1 shows the existing pump on the bank of Northwestern Lake. The existing intake is unscreened and constructed of polyvinyl chloride (PVC). The pump and motor are unprotected from the elements and supported on a lumber skid. The inlet pipe is equipped with a hand-actuated primer, and the discharge is equipped with a slanting disc check valve. The normal water surface elevation of Northwestern Lake is 295.0 feet in the Condit project datum, which is equivalent to 304.3 feet NAVD 88.

Table 2-1 Existing Pump and Electric Motor Data

Pump	
Manufacturer	Cornell Pump
Type	Horizontal centrifugal
Flowrate(gpm)	315
Head (feet)	340
Model	2Y40-2
Serial No.	73655
Impeller Diameter	9.36
Motor	
Manufacturer	Klockner Moeller
Horsepower	40
Volts	460
Phase	3
Hertz	60

Figure 2-1 Existing Mount Adams Orchard Irrigation Pump and Motor

2.3 New System Requirements

2.3.1 Pump

The new Mount Adams Orchard irrigation supply pump must be designed to pump 315 gpm with a total dynamic head (TDH) of 493 feet. Based on the original pre-project topography data from 1912, the future river water surface elevation will be approximately 119 feet lower than the existing water surface of Northwestern Lake. In addition, a new section of pipeline approximately 465 feet long will need to be added to connect the existing system to the location of the new pump location adjacent to the White Salmon River downstream of the dam. Table 2-2 summarizes the head loss components of the new proposed system assuming a 5-inch diameter HDPE DR 7.3 transmission pipeline.

Table 2-2 Proposed Pump TDH Components

Total Dynamic Head (TDH) Summary	
Existing pump TDH	340
Additional pipeline	27
Additional minor	7
Additional static head	119
Total	**493**

*Calculation assumed Hazen-Williams Friction Coefficent of 140 and inside pipe diameter of 3.948 inches.

Figure 2-2 illustrates the location of the existing irrigation pump with respect to the Condit dam and a proposed downstream location for a new irrigation pump. Electric power to the new pump (3-phase, 480-volt) will need to be extended from the existing electrical disconnect located in the vicinity of the existing pump. The new power service would follow the new transmission pipeline alignment.

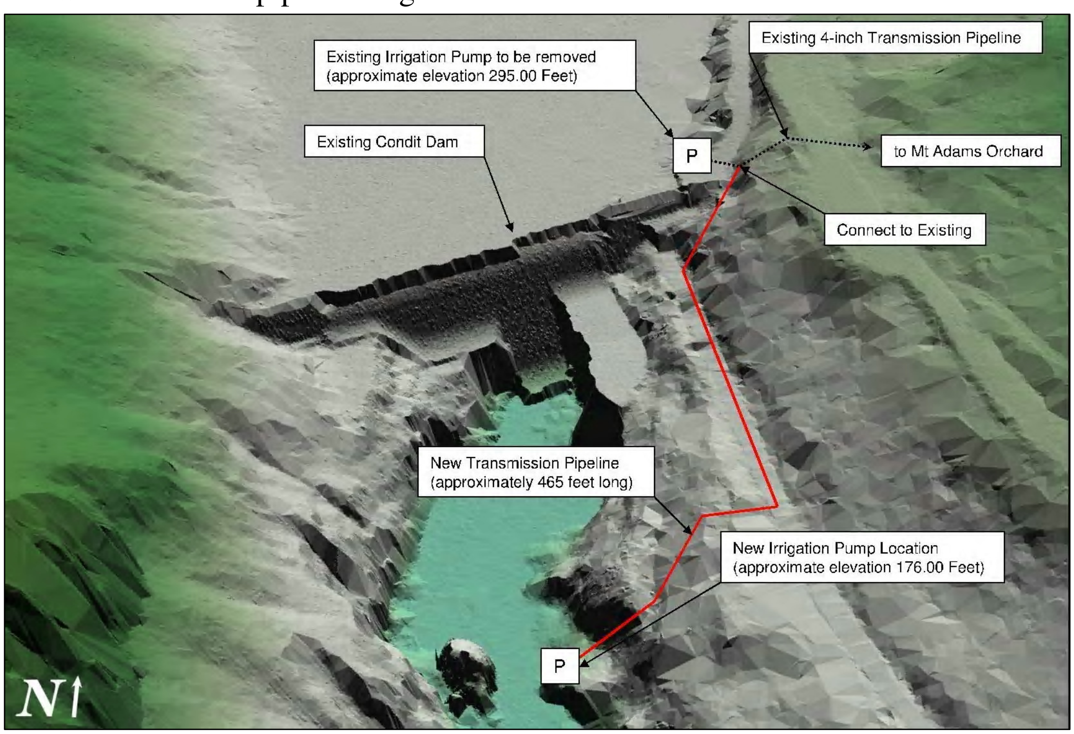


Figure 2-2 Proposed Downstream Location of Irrigation Pump and New Transmission Pipeline

The new irrigation pump will be a skid-mounted multistage centrifugal water pump anchored to a cast-in-place concrete pad. The exact location of the pump will need to be determined in final design. Table 2-3 lists the design requirements of the new pump and motor. The motor must be suitable for outdoor use and located above the flood stage to prevent water damage during river flooding events. Several manufacturers market multi-stage, high head pumps. Appendix B contains a manufacturer's pump characteristic curve and layout that meets the system design criteria.

Table 2-3 Pump and Electric Motor Design Criteria

Pump	
Manufacturer	T&T Pump or equal
Type	Horizontal centrifugal
Flowrate(gpm)	315
Total Dynamic Head	493
NPSHA (feet)	27
NPSHR (feet)	23.1
Nominal Speed (rpm)	3,600
Stages	15
Efficiency (%)	72
Motor	
Manufacturer	TBD
Type	Horizontal
Horsepower	60
Volts	460
Phase	3
Hertz	60

2.3.2 Intake Screen

The intake must be screened to protect fish and other aquatic life and protect the pump. Table 2-4 presents National Oceanic and Atmospheric Administration (NOAA) and Washington Department of Fish and Wildlife (WDFW) criteria for screened intakes.

Table 2-4 Intake Screen Design Criteria

Criteria	Quantity	Units
Maximum water velocity at the screen	0.4	feet-per-second
Maximum opening size	1.75	millimeter (mm)
Screen surface area	1.76	square feet (sf)

A screen with 2.5-square feet of surface area should be provided to meet the above requirements and also account for blocking of the screen that may occur between cleaning.

2.3.3 Break Away Coupling

A break away coupling system should be included to protect the pumping equipment in the event of flooding that brings debris down the river and washes the intake suction line away. Manufacturer's catalog cuts are provided in Appendix B.

2.4 SYSTEM INSTALLATION ALTERNATIVES

2.4.1 Alternative 1 – Permanent Pump and Intake Installation

Under this alternative the new irrigation pump and intake will be installed in a permanent location similar to the existing configuration. The pump and motor will be rigidly mounted on a concrete housekeeping pad on the river bank. The intake pipe will be either fixed or adjustable. The fixed intake pipe will be securely anchored to the river bed and encased in concrete to protect it from damage caused by floating logs and other debris in the river. The adjustable intake pipe can either be rigid or semi-rigid pipe that may be lifted from the water for maintenance or relocated (within the same general vicinity) to accommodate fluctuations in the river level. Both the fixed and the adjustable pump suction pipes will be equipped with a break-a-way coupling to prevent damage to the pump and motor in the event that the pump suction pipe is pulled downstream under high flows and heavy debris.

The fixed intake pipe will be equipped with a cleaning system intake screen. Self-cleaning intake screens protect the pump from organic and inorganic debris that can clog or damage the impeller. Air burst, backwashing, and brush automated cleaning systems are commercially available and are widely used in farm irrigation applications. A brief description of these self-cleaning systems is provided below.

<u>Air Burst Cleaning System</u>

This system consists of a surface-mounted air compressor and small diameter air supply line connected to the inside of the intake screen. Measured air bursts force debris away and scours the screen surface from the inside out. A quick release valve releases a burst of air approximately three times the screen capacity into the intake. An internal airburst distributor then transmits the burst of air evenly across the slots of the intake screen to dislodge foreign material.

<u>Backwashing Cleaning System</u>

The backwash line is plumbed into the discharge side of the pump before the check valve. The screen is continuously cleaned by recirculating between 1.80 to 3.75 percent of the pumped water back into a rotating intake screen. The recommended pressure range for backwashing is 60 to 90 pounds per square inch (psi).

Brush Cleaning System

This system consists of a sealed marine duty submersible hydraulic motor controlled from the surface. Mechanical brushing removes algae, fibrous materials, and can pulverize small accumulated debris on the screen surface and allow clear water to flow through the screen. Power requirements for this type of system are negligible and can sometimes be met with a small photovoltaic solar panel if commercial power is unavailable.

Manual Cleaning System

Since the Mount Adams Orchard irrigation pump and intake system will operate seasonally, another option is to periodically clean the screen manually. This involves physically removing the intake screen from the river. The screen would be lowered by a winch attached to a small jib crane or derrick as shown in the figure below. It is recommended that a screen retrieval system (derrick and chain) be installed to lift the screen out of the water for servicing or when not in use. Figure 2-3 contains a schematic of an intake system and drum screen. A screen with a backwash system is shown in Figure 2-4.

Figure 2-3 Intake System Schematic

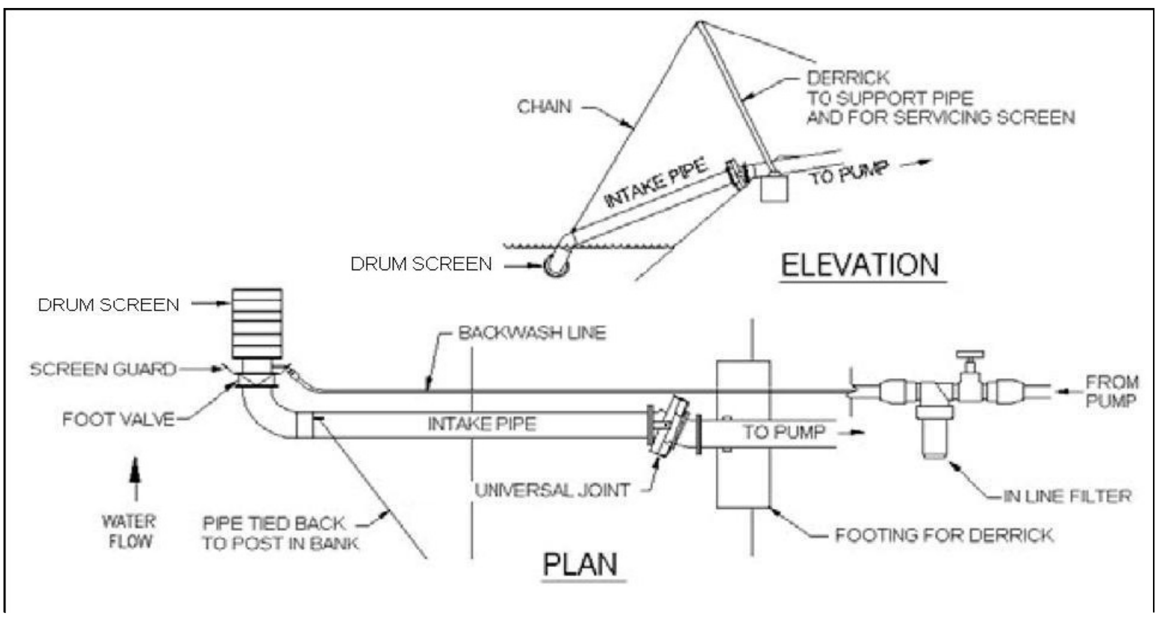


Figure 2-4 Typical Drum Intake Screen

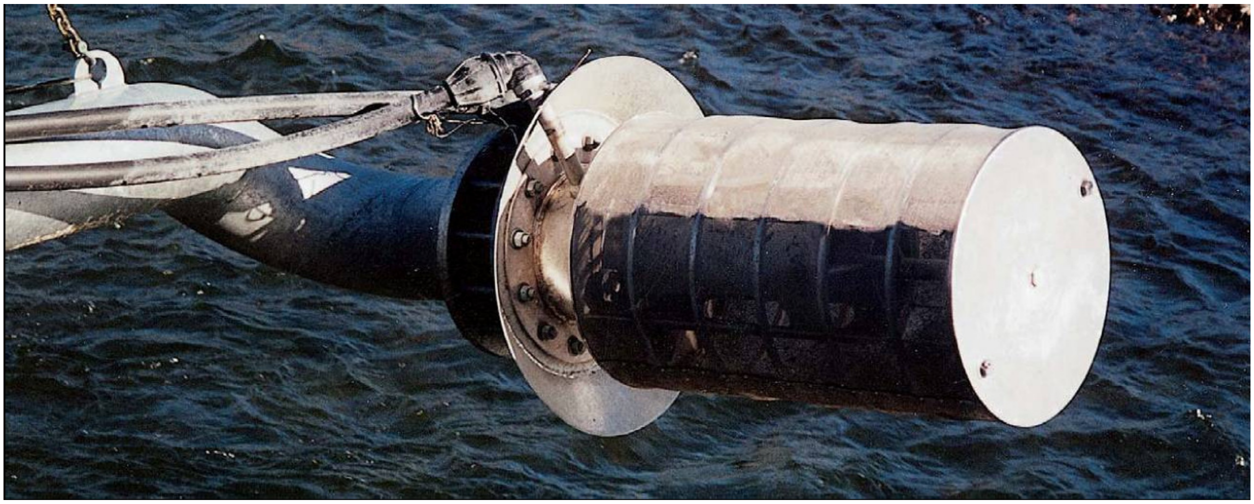


Table 2-5 lists two of the river water intake system manufacturers in the United States.

Table 2-5 Intake System Manufacturers

Company	Web site
Intake Screens	www.intakescreensinc.com
Kleen Screen	http://kleenscreen.com/

Table 2-6 lists a few of the intake screen manufacturers in the United States

Table 2-6 Intake Screen Manufacturers

Company	Web site
Concord Screen	www.concordscreen.com
Johnson Screen	www.johnsonscreens.com
Hendrick Screen	www.hendrickscreenco.com

2.4.2 Alternative 2 – Portable Pump and Intake

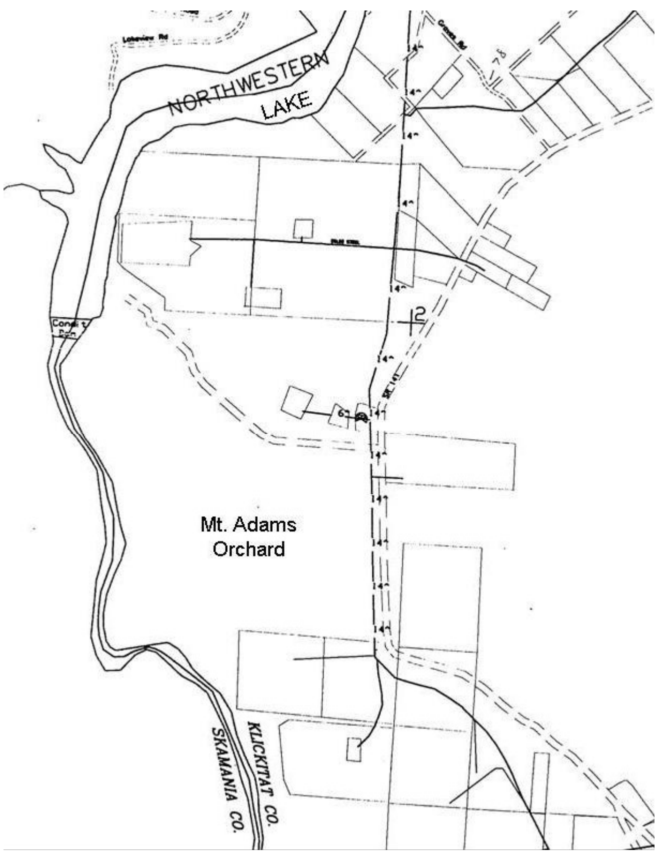
Under this alternative, the pump, flexible suction pipe, and intake screen (manual cleaning) will be trailer mounted and electrically powered with an extension cord. Since it may be some time before the river reaches steady state (silt/sand covering intake and river bank location changing), a portable system allows for locating the system in the best location, based on river geometry, each season. This system will require more adjustment than the previous alternatives, but if the sediment movement in the channel after the decommissioning of the Condit dam is active for several years, this may be the most reliable alternative. The primary disadvantage to this alternative is that permanent vehicle access will need to be constructed along the steep embankment of the river.

2.4.3 Alternative 3 – Connect to the City of White Salmon Potable Water Pipeline

Under this alternative the irrigation water supply to the Mount Adams Orchard will be provided through a connection to the existing 14-inch diameter, potable, water pipeline which is located to the east of the orchard. The route of this pipeline is shown in Figure 2-5. This pipeline is part of the City of White Salmon's water distribution system. The irrigation water would be metered and purchased from the City at the current water billing rate.

The major disadvantage of this alternative is that the City has experienced periodic water shortages. It is possible that the City may not want to grant a permit for this potential service connection. Purchasing the water (even at a wholesale rate) would also be a new and potentially significant expense for the orchard owner.

Figure 2-5 14-inch Potable Water Pipeline Alignment Adjacent to Mount Adams Orchard



2.4.4 Recommended Alternative

Alternative 1, the fixed-concrete, pad-mounted, irrigation pump with semi rigid inlet pipe with a break-a-way coupling is recommended. This system is simple and can be located and designed to deliver the required (current) irrigation flow rate to the orchard from the downstream side of Condit dam. The preferred location of the pump will determine the pump characteristics, horsepower, and electric power requirements as well as the additional length of transmission piping necessary. Options to be considered prior to final design include the following:

- Screen cleaning system
- Enclosure of pump and motor from the elements and vandals
- Alarm system
- Access route to pump system from orchard