Summary Background Document for New Capital Hydropower Improvement Project

Project Title: Ice Harbor Intake Gate Hydraulic System Upgrades

Dam and Reservoir Project: Ice Harbor

Estimated Total Cost: $ 3-7 Million

Estimated Schedule for Completion of the Project:

Phase 1a: FY20

Phase 1: FY20

Phase 2: FY21-FY23

Expected Physical Completion: FY2022

Project Background

The Ice Harbor dam and reservoir project's powerhouse contains six hydropower turbine generators. The function of the intake gate hydraulic system is to cut off flow of water through the turbines in the event of failure of the water control equipment. The intake gate hydraulic system can also be used as an emergency closure system to ensure that a unit can be safely shut down if other preventive measures fail to stop water flow into the unit. The intake gate hydraulic system also isolates the scroll cases and turbine water passages for routine inspection and maintenance so that workers can perform these activities safely. The intake gate hydraulic system is designed to close all gates of a main unit in four minutes.

The intake gates and hydraulic actuating system were installed during the original construction in 1961. In 1993 the hydraulic cylinders that lower the gates were changed to a telescopic two-stage type that raises the intake gates higher. Additionally a new larger hydraulic reservoir was installed that is used in conjunction with the existing reservoir, since the new cylinders required a larger volume of oil.

Each main unit has 3 intake gates for a total of 18 gates. The intake gates are continuously held under hydraulic pressure when in the open position, with each gate suspended just above the water passage (see Intake Gate Overview). Two power unit pumps are used to raise the gates back in place (see Photo 1). The pressurizing unit pump restores the pressure to 1600 pounds per square inch (psi) once the system pressure goes below 1000 psi (see Photo 2). Hydraulic accumulators are positioned in Bays 1, 3, and 6 and maintain the system pressure between 1000 and 1600 psi (see Photo 3). A steel position indicator tape provides visual indication of the position of each gate (see Photo 4).

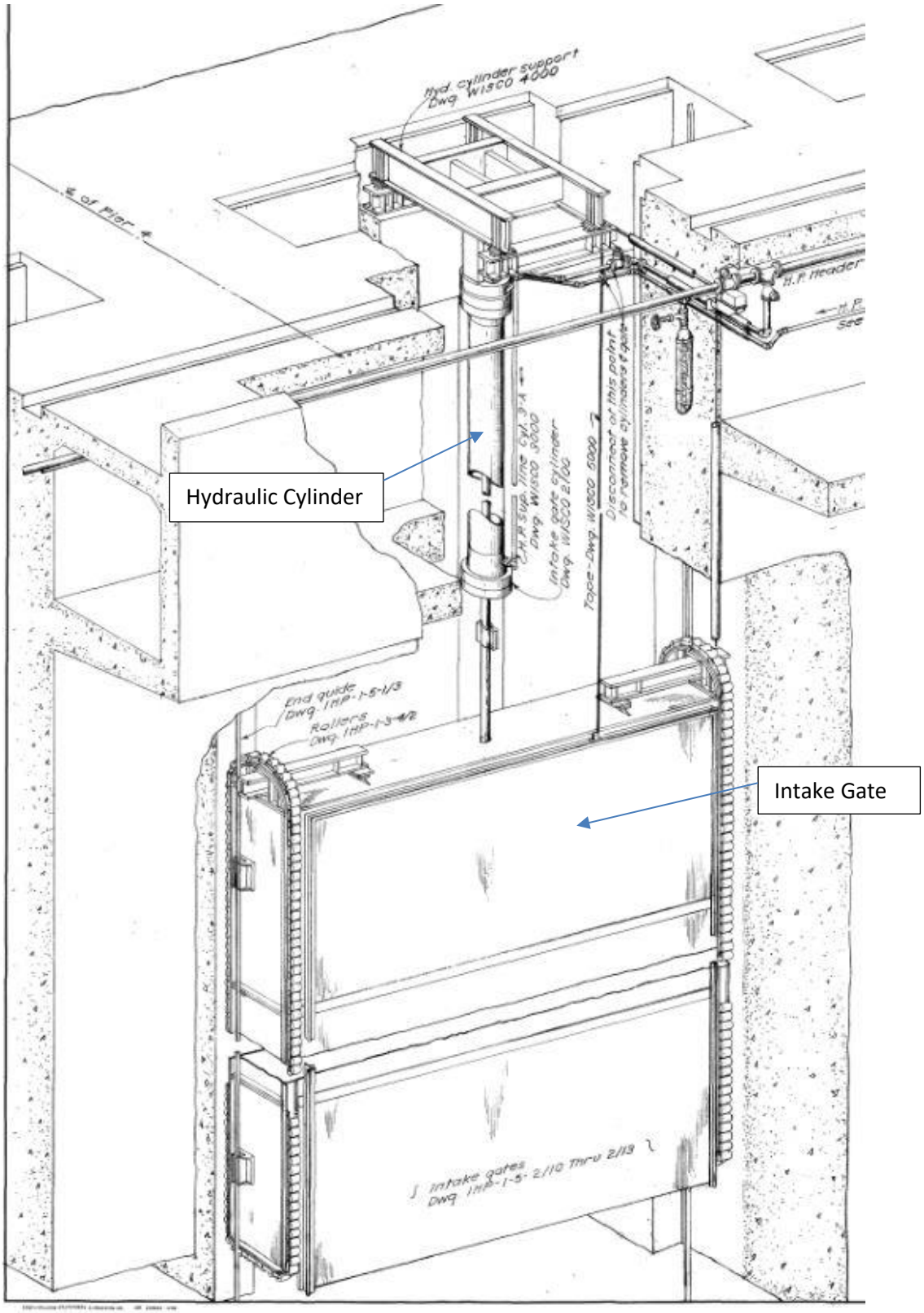

Figure 1: Intake Gate Overview

Photo 1: Power Unit Pumps in Rigging Storage Room

Photo 2: Pressurizing Unit Pump in Rigging Storage Room

Photo 3: Piping and Accumulator in Pipe Gallery

Photo 4: Intake Gate Position on Steel Tape in Pipe Gallery

Project Justification

Starting around 2011, several Trouble Reports (TRs) from shift operators in the Facilities and Equipment Maintenance (FEM) database documented multiple oil leaks, desiccant filter replacements, and remote operation of the intake gate pumps failures. In the last 7 years, there have been two failures of the intake gate hydraulic system where the intake gates dropped while the units were operating. Recently there have been 4 reportable oil spills (July 2017, August 2017, April 2018, and August 2018). Due to these issues, the intake gate hydraulic system annual preventive maintenance has increased to 40 hours (2 persons at 20 hours each). The hydraulic system is increasingly unreliable, this investment improves all facets of the intake gate hydraulic system, by improving seals, spill containment, and oil handling equipment reducing both the likelihood and impact of oil discharge to the river. Upgrades to the equipment restores operational safety to the plant generators by assuring timely response to cut off flow of water through the turbines in the event of failure of the water control equipment.

Strategic Context
This investment is included in the current (2019) System Asset Plan – see page A-21. The budgeted cost of the current business case is approximately 15% higher than the cost outlined in the asset plan. This increase is due to changing the intake cylinder coating from ceramic to chrome, which provides better sealing. This difference increases the forecast spending by approximately 7.5% for each of the two planned construction years (FY21-FY22). This increase will be offset in Walla Walla District's Large Capital budget by schedule adjustments to other projects as part of the annual Large Capital budget target development. The System Asset Plan completion year is FY23, which is consistent with the business case timeline.

Objective(s)
- Restore reliability to the intake gate hydraulic system.
- Reduce the resource demand on project workers for unplanned maintenance.
- Eliminate oil leakage to the maximum extent practicable.
- Upgrade control systems and install redundant features where necessary.
- Include upgrades that will increase the life of the system and lessen the likelihood of leakage.
- Increase worker safety for routine inspection and maintenance
- Minimize environmental risk by restoring reliability to the hydraulic system.

Project Summary
This project will upgrade the intake gate hydraulic system, increase the functional reliability, and reduce environmental risk associated with the operation of the hydraulic system. The Project Manager will coordinate the project schedule to maximize planned outages during the summer and fall time frames. The project includes all materials and labor necessary to return the equipment to acceptable functional level and place it into service. The contract execution is projected to occur in FY21-23.

Proposed Alternatives

Status Quo – Do Nothing, Fix as Fails
Summary: This alternative would require increased time and funding by project staff for more frequent monitoring, reporting, and increased maintenance on the current system. This alternative may increase the number of reportable spills and may damage the main unit if the intake gate drops while the unit is operating.

Rationale for not selecting this alternative: The monitoring, reporting, and maintenance costs will increase. The likelihood of the hydraulic system failure increases resulting in increased safety risks to personnel and the potential of oil leaks.

Alternative 1 – Upgrade Intake Gate Hydraulic System (Recommended)

Summary:
The recommended alternative would upgrade the intake gate hydraulic system. The major features of work are to replace or rehabilitate the existing cylinders, based on economic analysis; Replace all pumps and motors including the pressurizing unit pump and two power unit pumps with their respective motors in the Rigging Storage Room (see Photos 1 and 2) and the hydraulic accumulators in the Pipe Gallery (See Photo 3); Replace all piping, valves, hydraulic control panel, gate control panels, hydraulic intake gate supply pump and motor and other similar components; Add off-line oil filtration and oil sampling ports; Upgrade oil metering equipment and tank level sensors in support of the Oil Accountability Program; Achieve better spill containment where piping connects to hydraulic cylinders above intake gates; and Ensure secondary containment for the 4600 gallon tank is satisfactory.

Rationale for selecting this alternative:
This project will upgrade the intake gate hydraulic system and will increase the reliability of the hydraulic system, necessary to reduce risks of likelihood and severity oil discharge, and restore reliability to the emergency system. Additionally, it will decrease maintenance; improve safe working conditions for project staff; reduce the likelihood of oil leakages; and reduced potential for environmental impacts.

Alternative 2 – Replace Hydraulic System to Provide a Separate System for Each Main Unit (Not Recommended)

Summary:
Remove the existing hydraulic pumps and piping system. Provide separate smaller pumps and accumulators at each of the main units. Oil supply would still come from existing hydraulic reservoirs.

Rationale for not selecting this alternative:
While there may be some merit to exploring this option, the project did not report that there was a problem with the current configuration. Independent hydraulic systems would require additional space and unnecessary redundancy and add complexity to the existing system, as such this option is not feasible.

Process
Phase 1a:

- Investigate all of the identified subsystems and develop a list of recommended alternatives for replacement, rehabilitation, or repair.
- Develop initial design resource needs, project schedule and budgetary cost.
- Phase 1a check-in at 60% completion at Capital Workgroup to review project alternatives.

Phase 1:

- Prepare Plans & Specification for 60% & 90% Design Reviews.
- Prepare contract documents to Biddability, Constructability, Operability, Environmental, Sustainability level.
- Revise/Update total project cost estimate.
- Advertise contract and pre-award acquisition activities.

Phase 2:

- Award and execute the contract.
- Contract administration, submittal reviews, and development of as-built drawings.
- Contract and subagreement closeout.