DRAFT PROPOSAL
2005 PROJECT YEAR

A.TITLE: Direct Injury and Survival of Fish Passing Through Turbines at Ice Harbor Dam, Snake River, Washington

B. Project Leader: **POC Mark Smith (COE)**

C. Study Code:

1.0 D. ANTICIPATED DURATION 2005-2006

E. Submission Date: **August 2, 2004**

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2.0 GENERAL BACKGROUND AND PURPOSE

Several project survival studies utilizing radio tags and PIT tags have been conducted at Ice Harbor Dam in the past few years. These recent studies have sometimes yielded conflicting results. Spillway survival in spring, which appeared high (approximately 98%) in 1999, was low (approximately 88%) in 2002. Summer spillway estimates were low in both years, about 88%. Powerhouse survival (turbine and bypass combined) was estimated to be high (approximately 98%) in 2001. Studies in 2003 and 2004 were designed to assist in portioning survival at ICH. Understanding baseline turbine survival as a part of Project survival is important to overall project operations at ICH.

Turbine units at ICH are also very similar to other Projects and collection of biological information within that particular "family" of turbine units will prove beneficial to operations at multiple dams.

2.1 Site Description

Ice Harbor Dam (IHR) is the first dam on the Snake River upstream from it's confluence with the Columbia River. IHR is a high priority in 2005 because of implementation of a Removable Spillway Weir. It has six turbine units and 10 spillway bays, along with a navigation lock and an earthfill section. Standard-length Submersible Traveling Screens (STSs) are present in all turbine intake bays.

2.2 Specific Objectives

1. Determine fish direct fish survival under two operating points with a precision of ±3%, 90% of the time. Survival estimates will include immediate, 24 hour, and 48 hour estimates.
2. Determine fish injury and types for fish passing turbines at two operating points.

Turbine operations will be at two varied flow levels, which will be determined with the use of hydraulic modeling.

3.0 TASK DETAILS

The contractor will release fish directly into the test unit and recapture fish shortly after passage for initial analysis of fish condition, injury type, and estimate direct survival.. The specific release location has not been finalized, but it is anticipated that a release hose will be attached to a frame and lowered into the operating gate slot within the "B" intake. The release location will likely be at mid-depth (below the tip of the STS) near the center, horizontally, of the B slot.

3.1 Study Design

There are two primary components, which affect fish using any exit (passage) route: direct and indirect effects. Direct effects are manifested immediately after passage (*e.g.*, instantaneous fish mortality, injury, loss of equilibrium) and indirect effects (*e.g.*, predation, disease, physiological stress) may occur over an extended period or distance after passage. This study will estimate direct effects of passage by introducing a known number of tagged live fish into the test unit, recapturing them immediately after passage, enumerating the alive and dead fish, and then carefully examining the condition of each fish.

Treatment fish will be accompanied with the release of control fish near the draft tube of the test unit..

Juvenile salmonid smolts used in the study will be obtained from a hatchery. Fish will be transported from the hatchery via truck to the study site and held in tanks with a 200 or 600 gal capacity. The fish transport tank will be equipped with a recirculation system and supplemental oxygen supply. All fish holding tanks/pools would be supplied continuously with ambient river water and be equipped with degassing units (if necessary). Fish would be held a minimum of 24 h prior to tagging to alleviate handling and transport stress, and to acclimate them to ambient river conditions at IHR.

3.2 Sample Size Requirements

One of the main considerations is to release an adequate number of fish such that the resulting survival estimates would be within a specified precision (ε) level. The sample size is a function of recapture rate (P_A), expected passage survival ($\hat{\tau}$) or mortality ($1-\hat{\tau}$), survival of control fish (S), and the desired precision (ε) at a given probability of significance (α). In general, sample size requirements decrease with an increase in control survival and recapture rates. Only precision (ε) and α levels can be strictly controlled by an investigator. Based on the results of turbine survival experiments from other sites on the Columbia River Basin, a sample size of approximately 350 fish per treatment release should be sufficient, and 350 fish for control releases. This number assumes study results ≥98% control survival, recapture rate of 98%, and expected passage survival of 95%. This should be sufficient to attain a precision level (ε) of ≤±3%, 90% of the time. We project that approximately 1050 (700 treatment, 350 controls) fish would be needed.

Past experience has suggested that the sample sizes can be adjusted as a study progresses because the results are available daily. If recapture and control survival rates are higher than initially assumed, the sample size can be reduced. Conversely, if the values of these parameters are lower than initially assumed, then the sample size must be increased to achieve the specified statistical precision.

3.3 Release Conditions

Treatment fish will be released through a pipe (may be multiple locations) positioned in the upstream gate slot. The Corps proposed that the release pipe be secured to the steel frame that supports the STS in the middle gate slot. Because of width constraints adjacent to the steel support frame, there may not be sufficient room to deploy the standard 6 in diameter steel pipe. Final design and dimension of the release pipe is to be addressed by

the Corps. These same dimensions will be used for the control release pipe. The terminus of the release pipes will be oriented downstream.