Evaluate Restoration Potential of Snake River Fall Chinook Salmon Spawning Habitat

BPA Project 2003-038-00

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Project History

▶ Funded in FY2004, start date 1 January 2004

▶ Renewed for FY2005 and FY2006

Background

▶ Less than 20% of historic fall Chinook salmon spawning production areas still available in the Columbia River Basin (BPA Final Report DOE/BP-08104-1; Dauble et al. 2003)

▶ Greatest restoration potential: Little Goose/Lower Granite, Columbia/Snake/Yakima confluences, John Day

▶ Hydrosystem adjustments for restoring fall Chinook salmon spawning habitat

Mainstem Habitat Restoration Opportunities

… only by increasing the amount of *riverine habitat* available for spawning and rearing via operational changes of selected hydroelectric projects.

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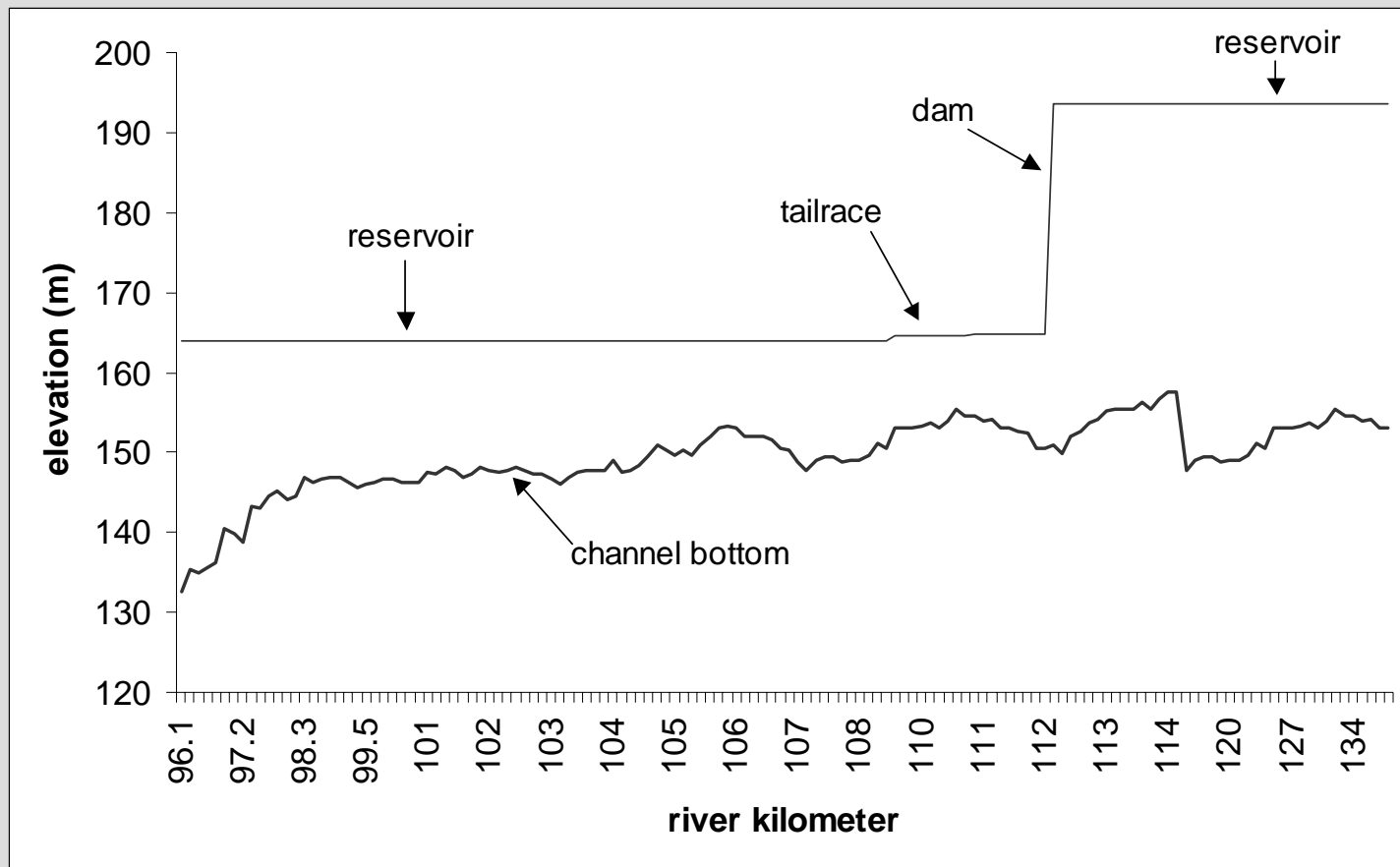
Research Goals

▶ Identify segments, within the hydrosystem, where potentially suitable fall Chinook spawning habitat exists.

▶ Determine adjustments in hydrosystem operations that would be necessary for these segments to function as spawning areas.

General Approach

▶ Acquire knowledge of fall Chinook salmon spawning habitat requirements from a reference site

▶ Compare habitat characteristics of reference site to study sites under a range of hydrosystem operations

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Study Areas and Reference Site

▶ Study Areas

- Ice Harbor Dam tailrace to Columbia River confluence
- Lower Granite Dam tailrace

▶ Types of riverine habitat

- upper reservoir
- tailwater

▶ Reference Sites

- Wanapum Dam tailrace
- Hanford Reach

Wanapum Dam Tailrace Reference Site
2100 redds, 9600 adults, 5 rkm

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Objectives and Approach

► Objective 1: Quantify the physical characteristics defining suitable fall chinook spawning habitat at the upper reservoir and tailwater reference sites

► Approach

- Map spawning areas
- Collect physical characteristic data (physiography, hydrologic regime, channel morphology, hydraulics, water quality)
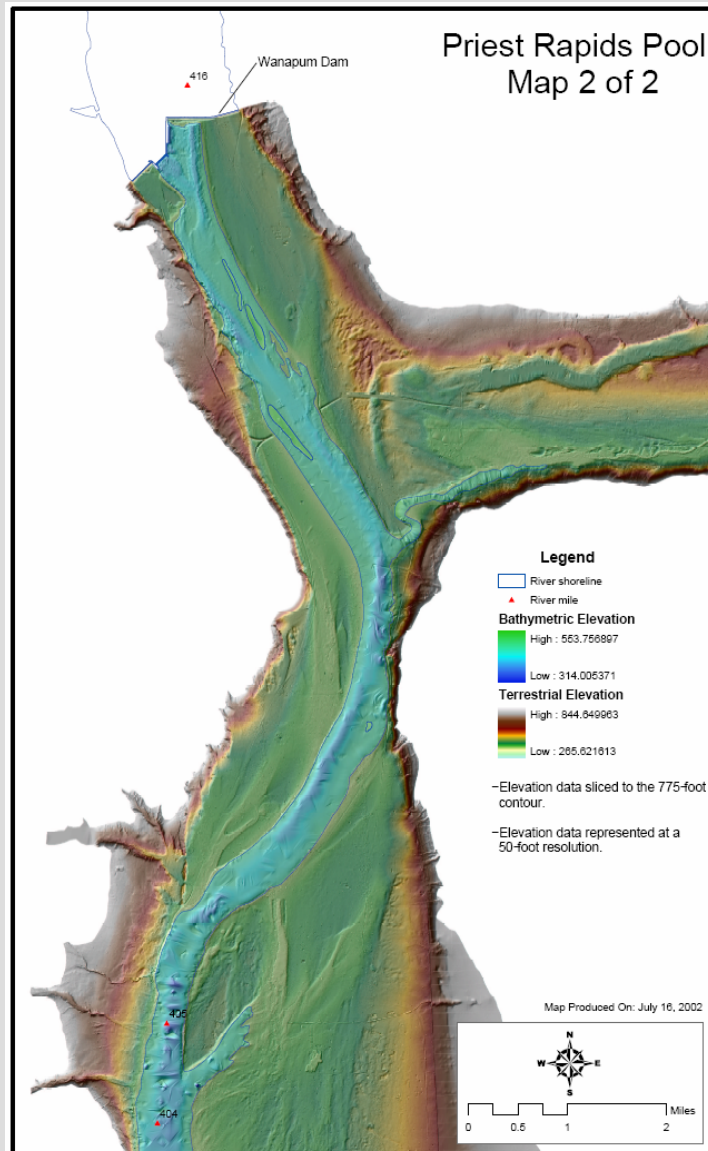- Setup 2D hydrodynamic model

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Objectives and Approach

▶ Objective 2: Quantify the physical characteristics at each of the study sites.

▶ Approach

- Collect physical characteristic data (physiography, hydrologic regime, channel morphology, hydraulics, water quality)

- Setup 2D hydrodynamic model

Objectives and Approach

▶ Objective 3: Quantify the physical characteristics at the study sites under a range of flow conditions

▶ Approach

- Apply 2D model to varying operational scenarios (forebay/tailrace elevations) and water-year types

Objectives and Approach

▶ Objective 4: Determine what changes in hydrosystem operations are required to cause physical characteristics at study sites to resemble those at reference sites.

▶ Approach

● Compare the results from Objectives (1) and (3) to determine the presence and extent of similar characteristics
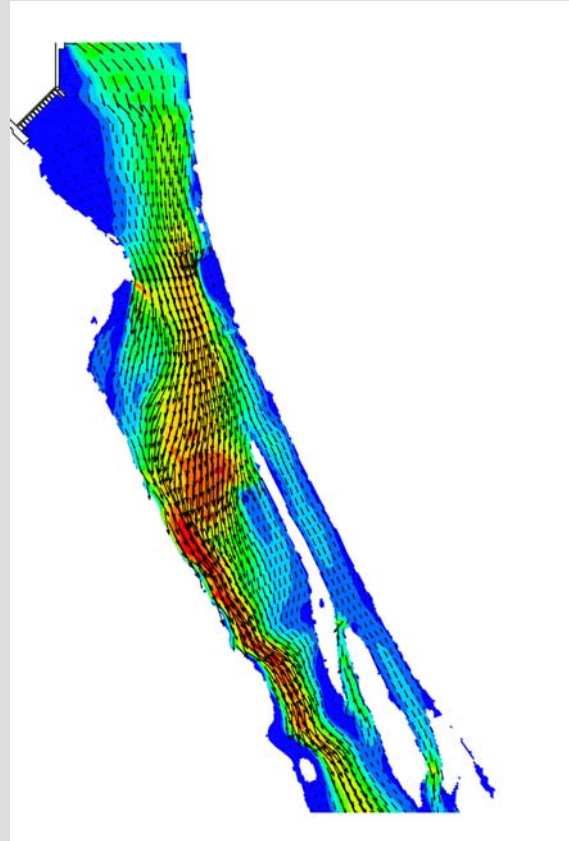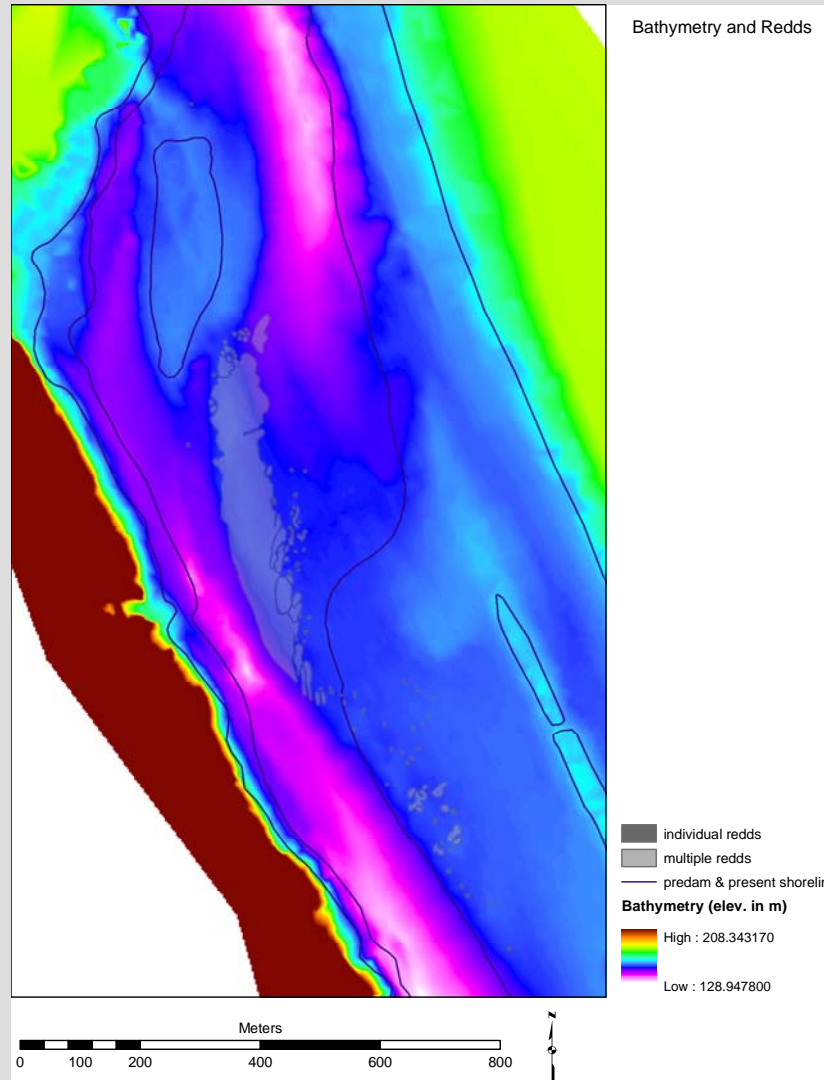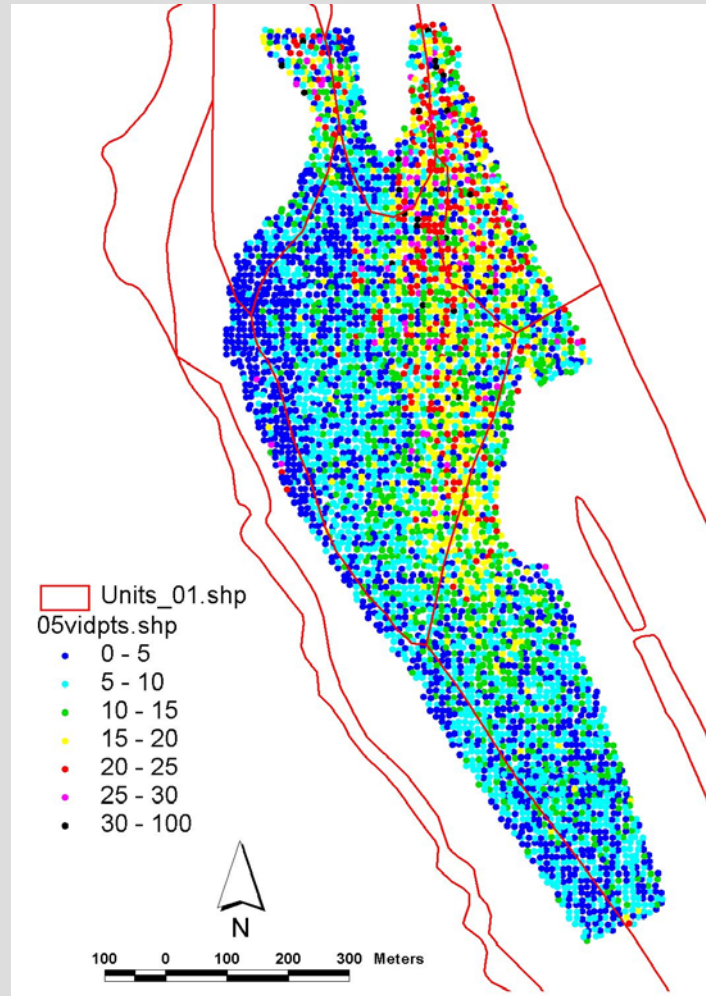
Reference Site Results
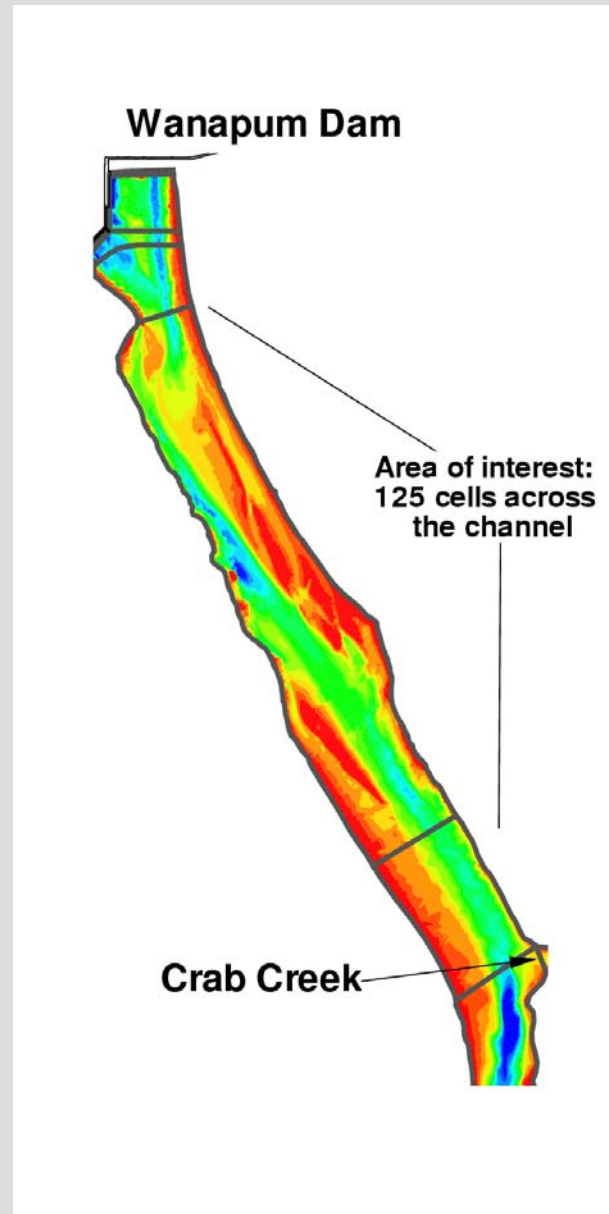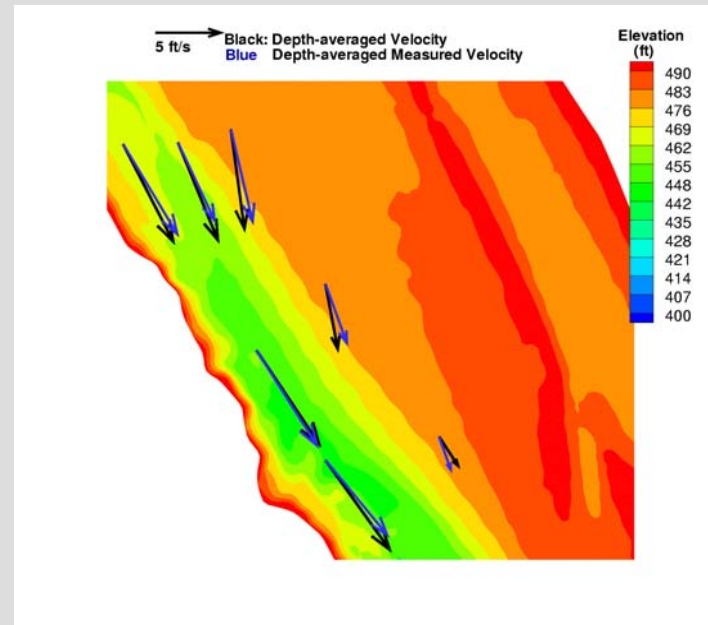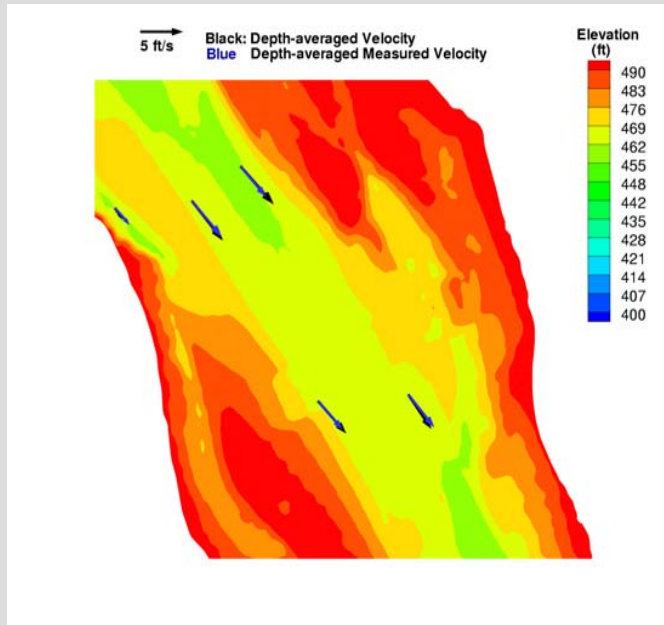
Reference Site Results

Wanapum Dam

Area of interest: 125 cells across the channel
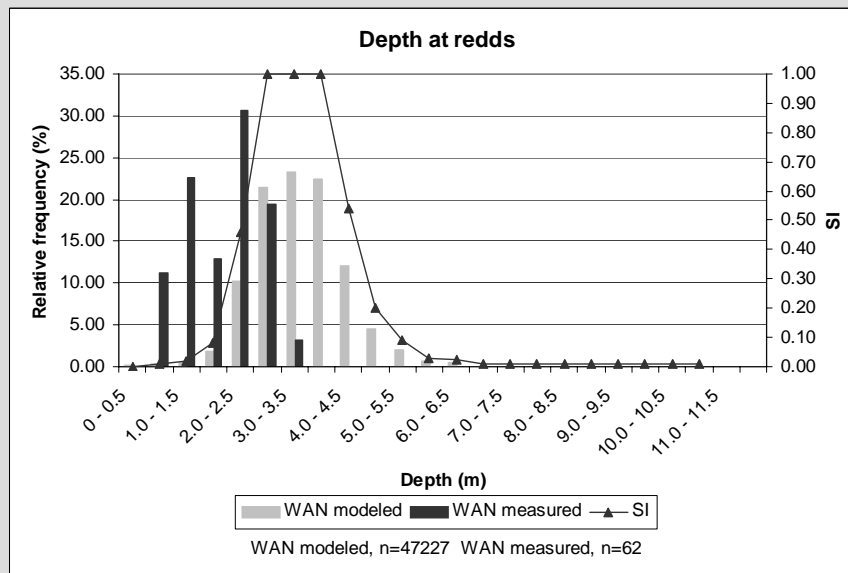
Crab Creek

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Reference Site Results

Reference Site Results

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Reference Site Results

Bathymetry and Redds

individual redds
multiple redds
predam & present shoreline
Bathymetry (elev. in m)
High : 208.343170
Low : 128.947800

Meters

0   100   200   400   600   800

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Reference Site Results

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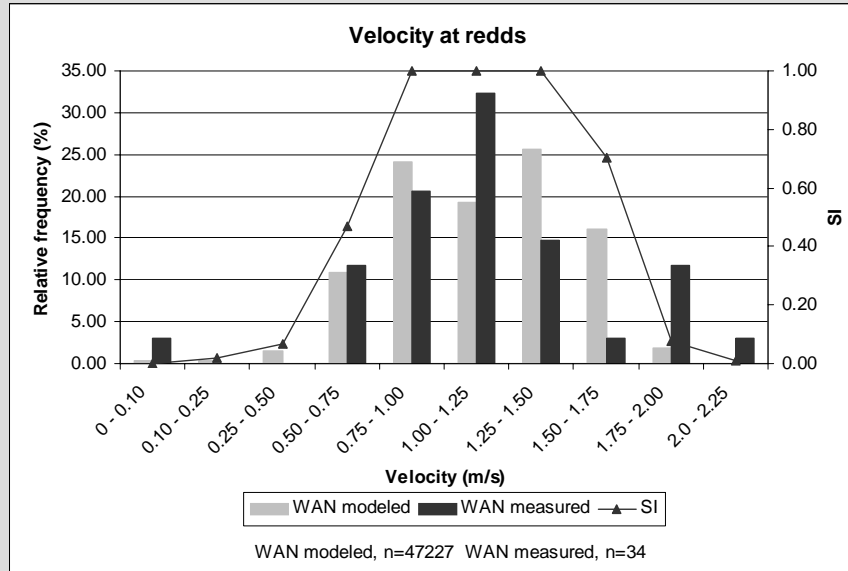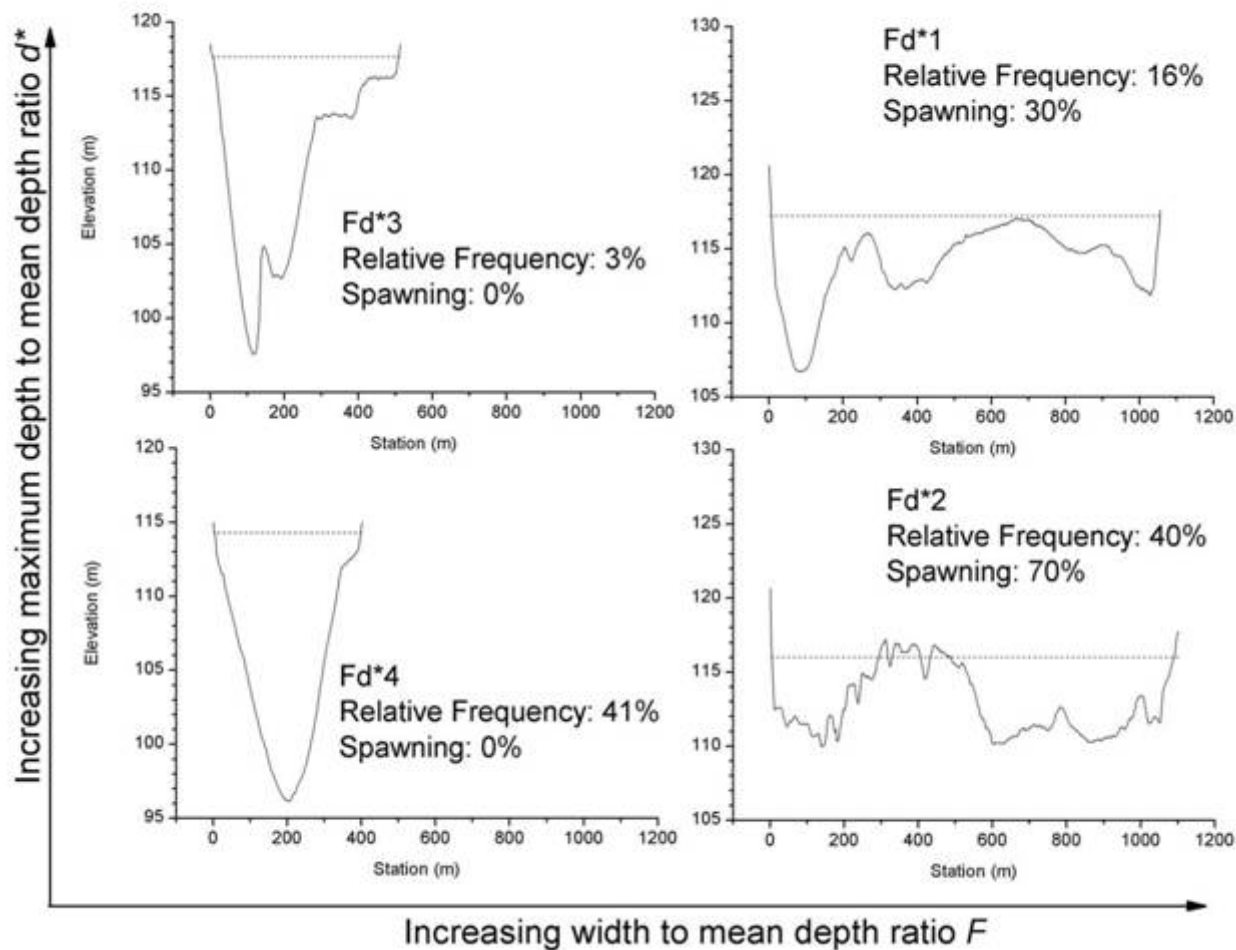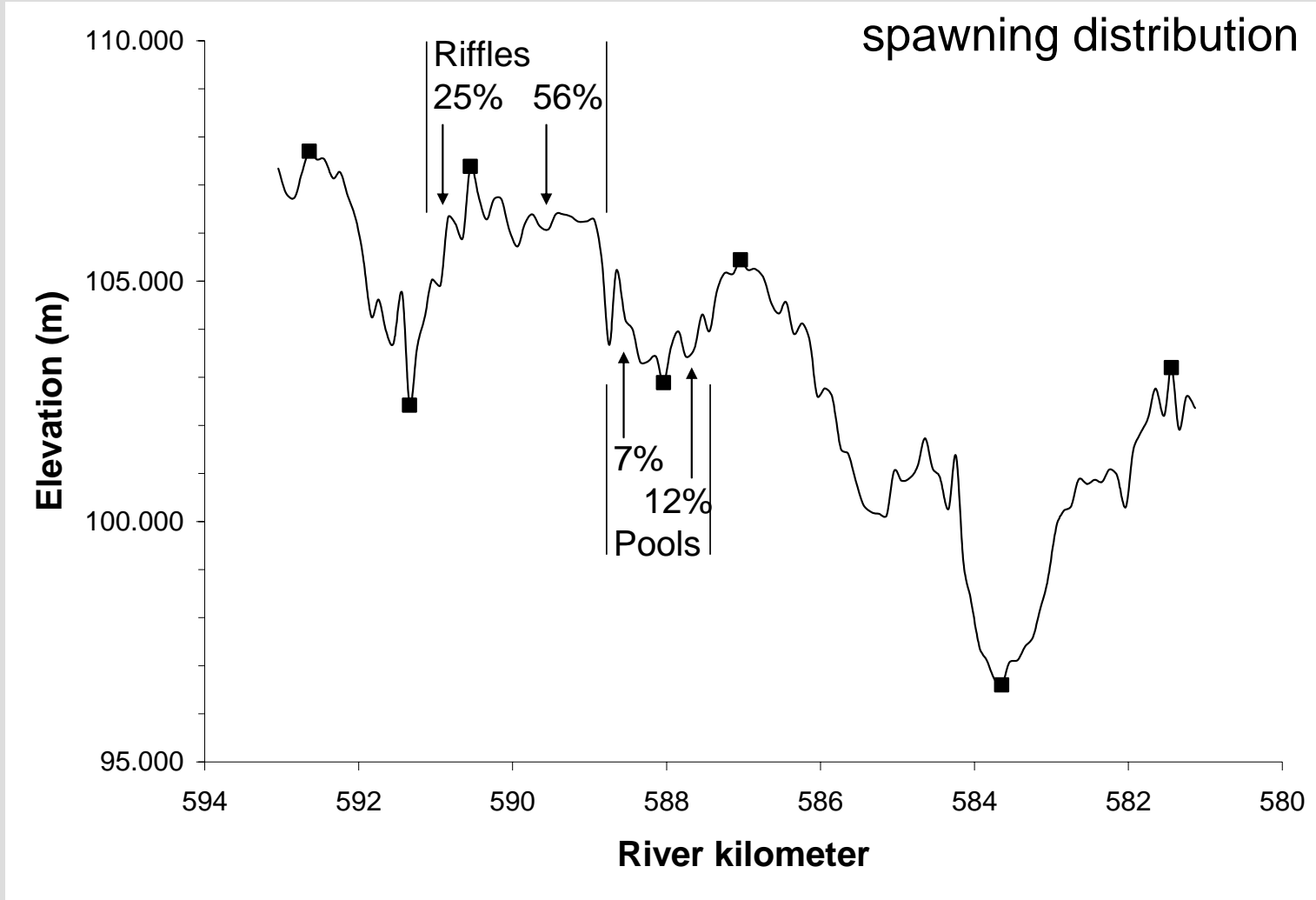# Reference Site Results
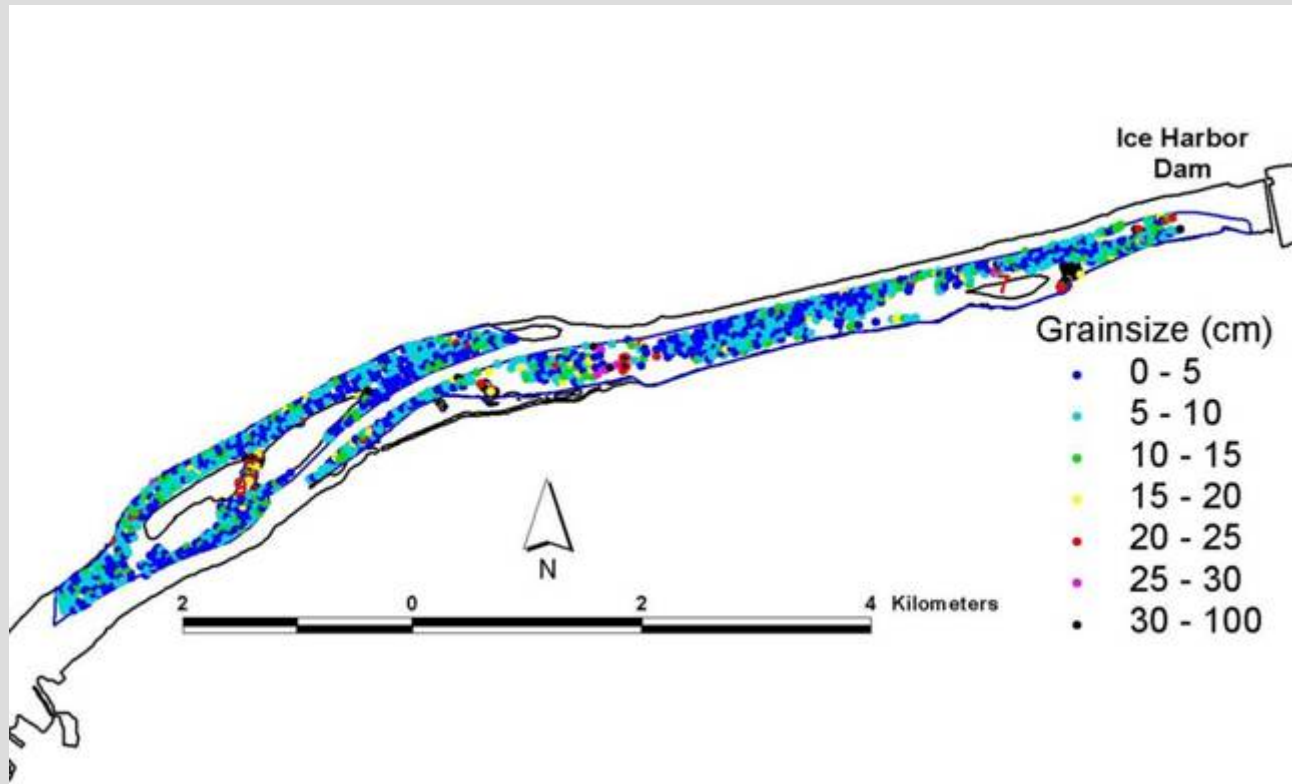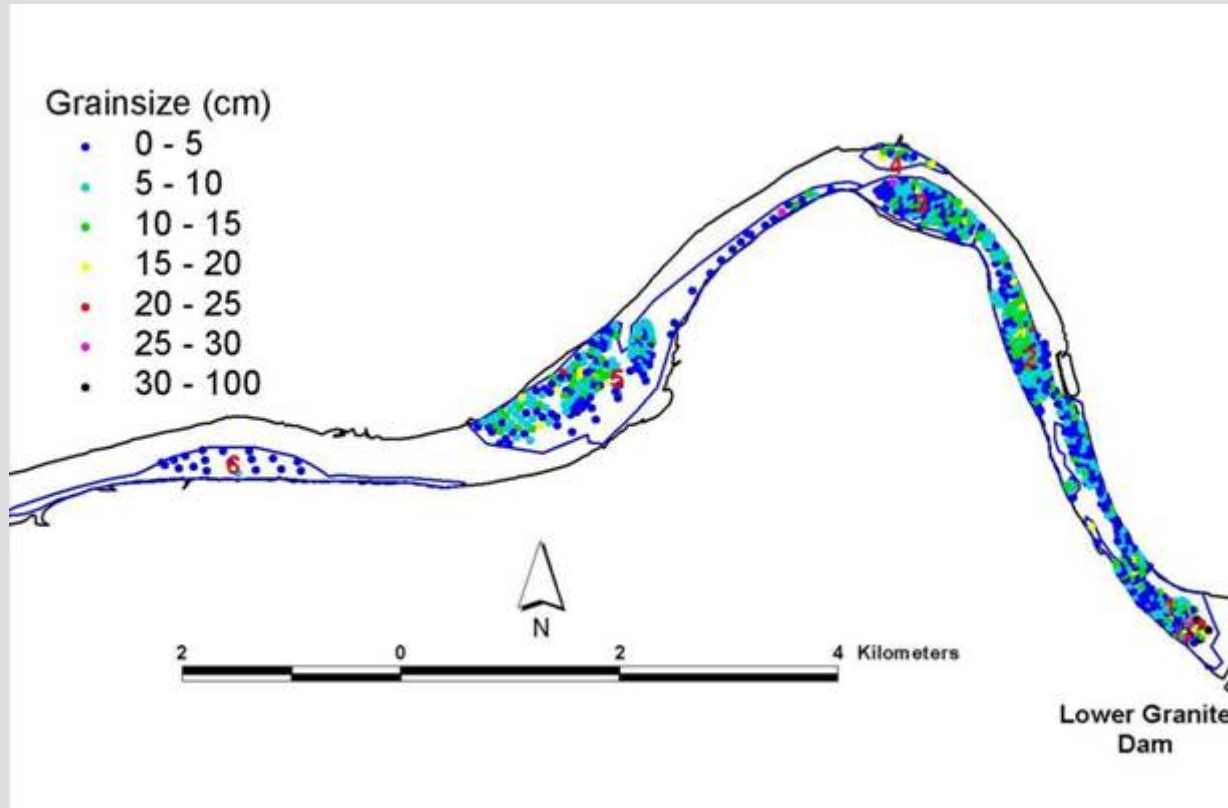
Reference Site Results

Reference Site Results

spawning distribution

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Study Sites Results

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Study Sites Results

Study Sites Results

Bathymetry Surveys of the Ice Harbor Dam Tailrace

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Study Sites Results

Bathymetry Surveys of the Lower Granite Dam Tailrace

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Study Sites Results

Compiled Bathymetry at
Ice Harbor Dam Tailrace

Study Sites Results

Compiled Bathymetry at Lower Granite Dam Tailrace

Study Sites Results

Study Sites Results

Lower Granite Tailrace
Normal Pool Elevation
Normal Year, 50% Discharge Exceedance
Velocity Magnitude, ft/s

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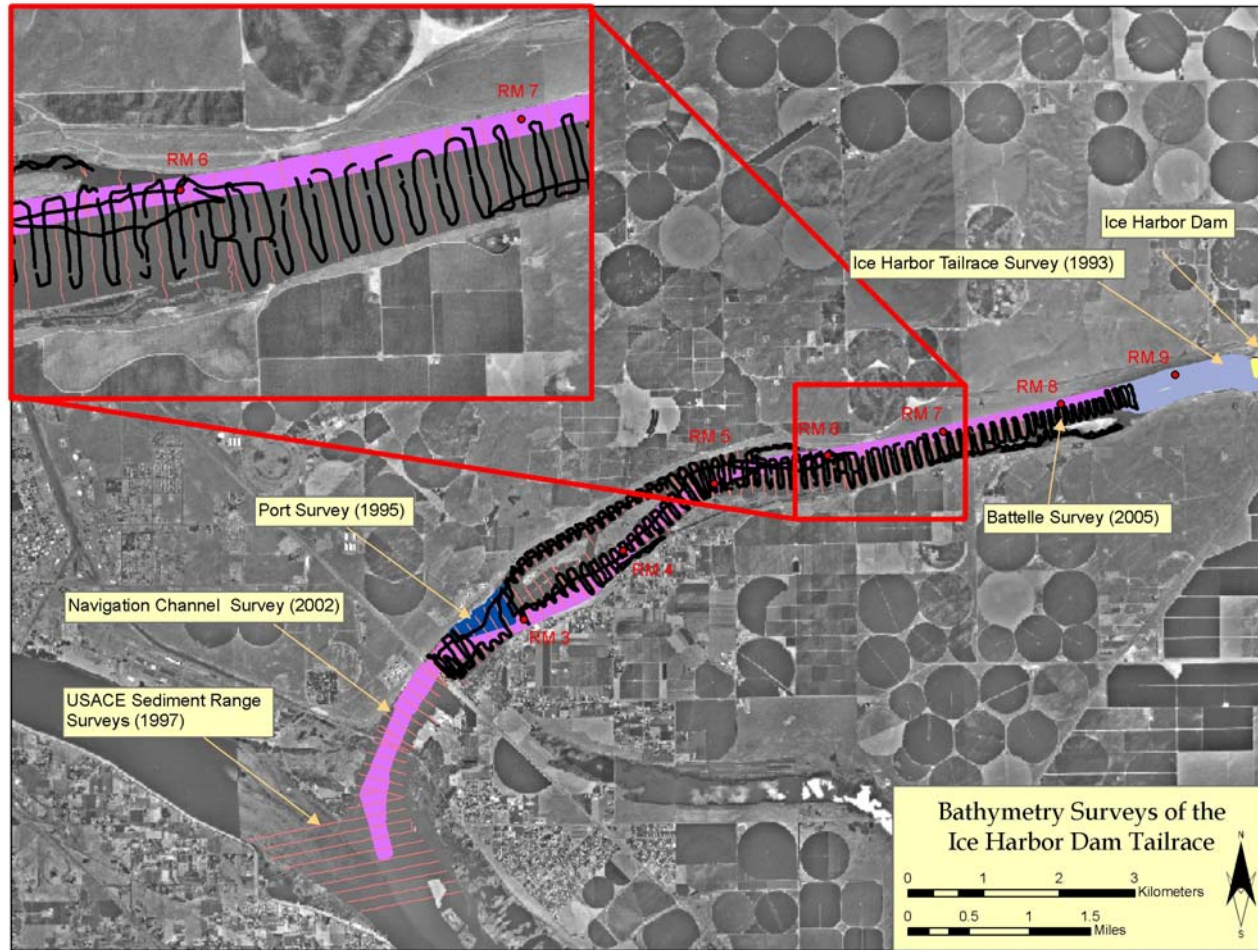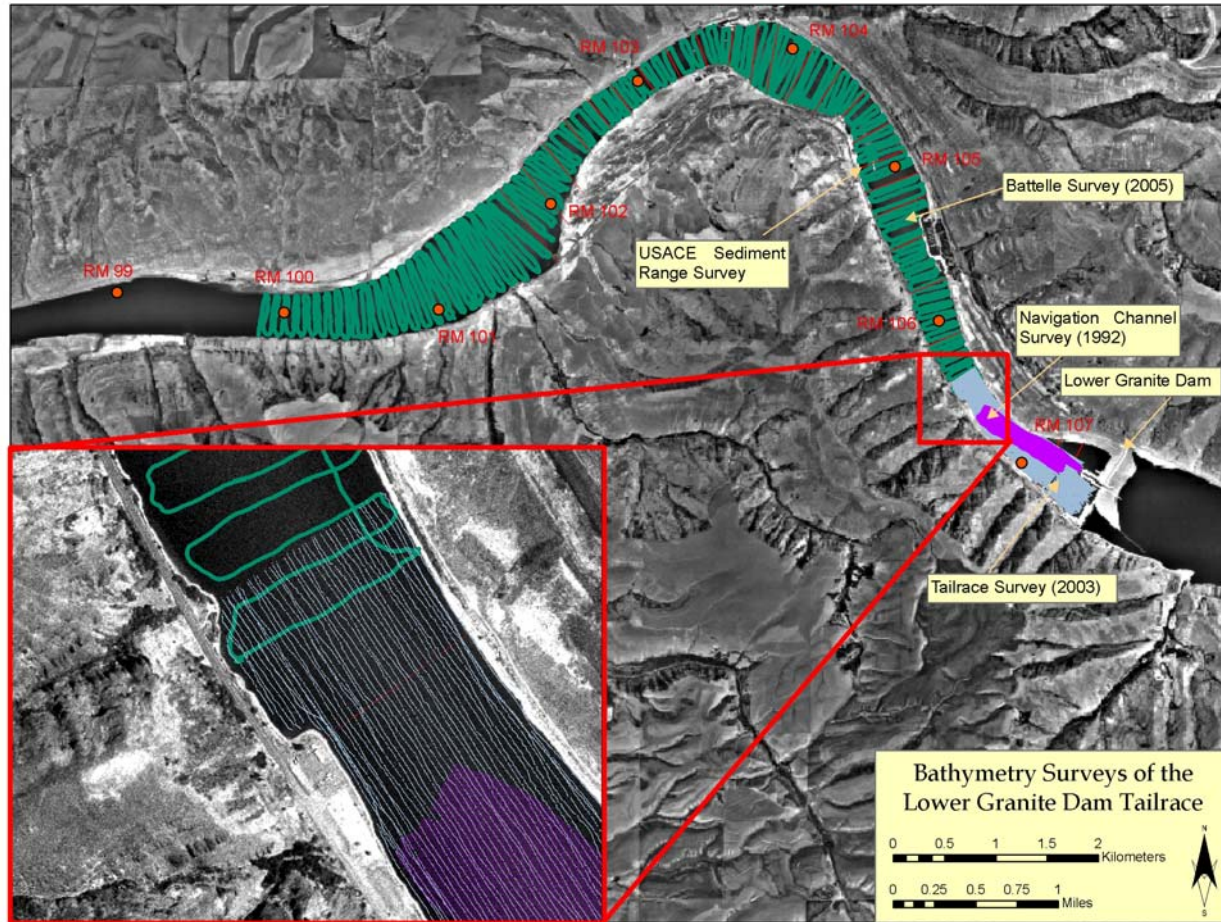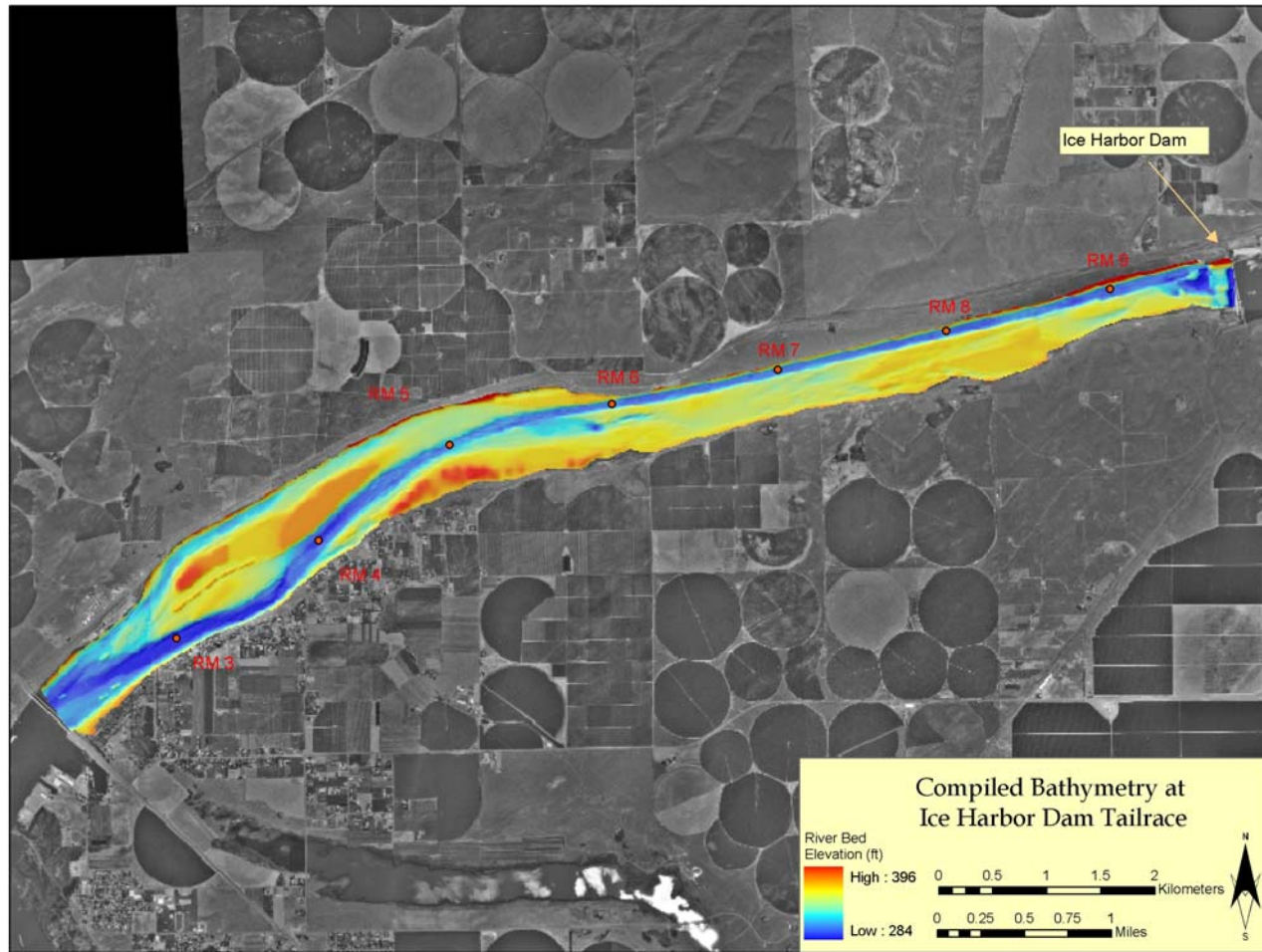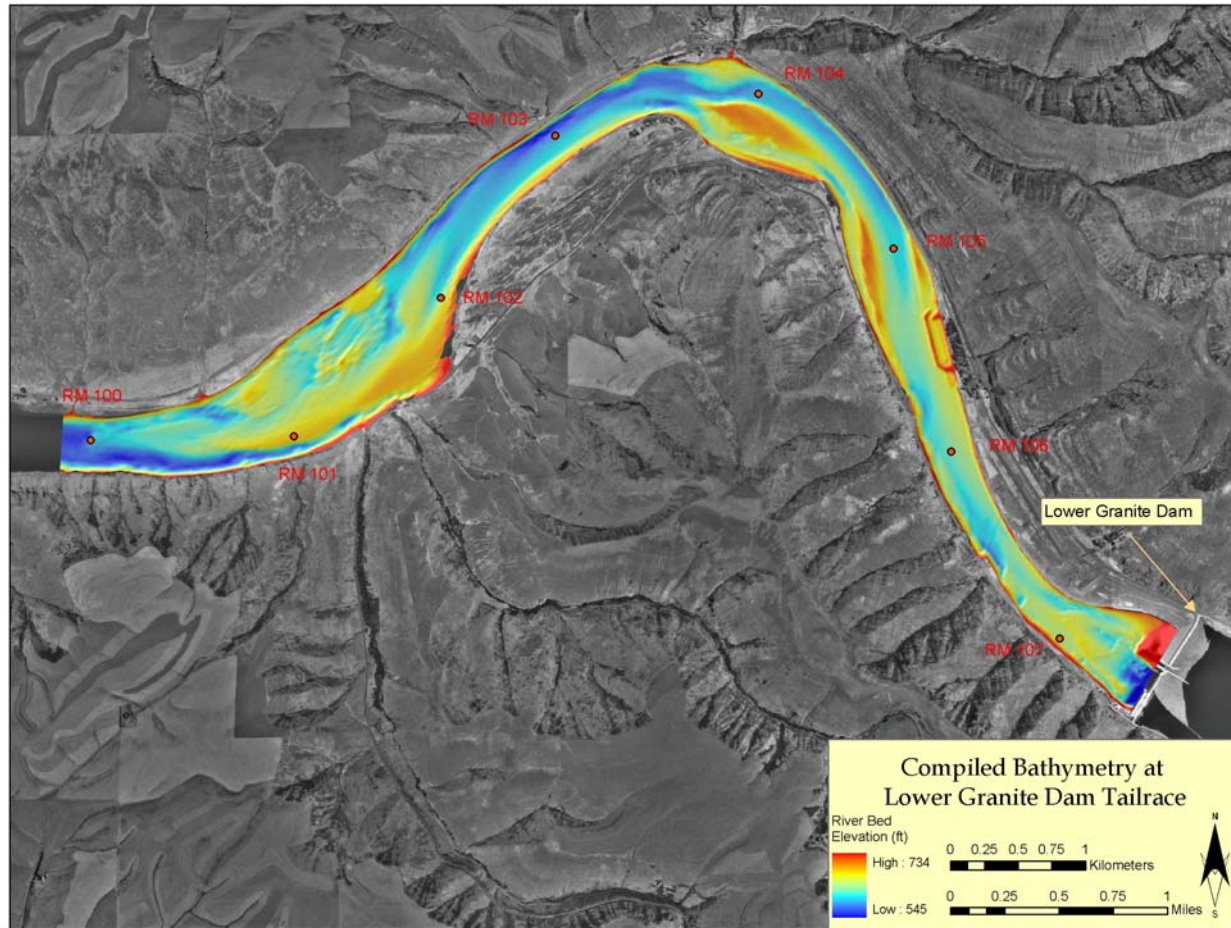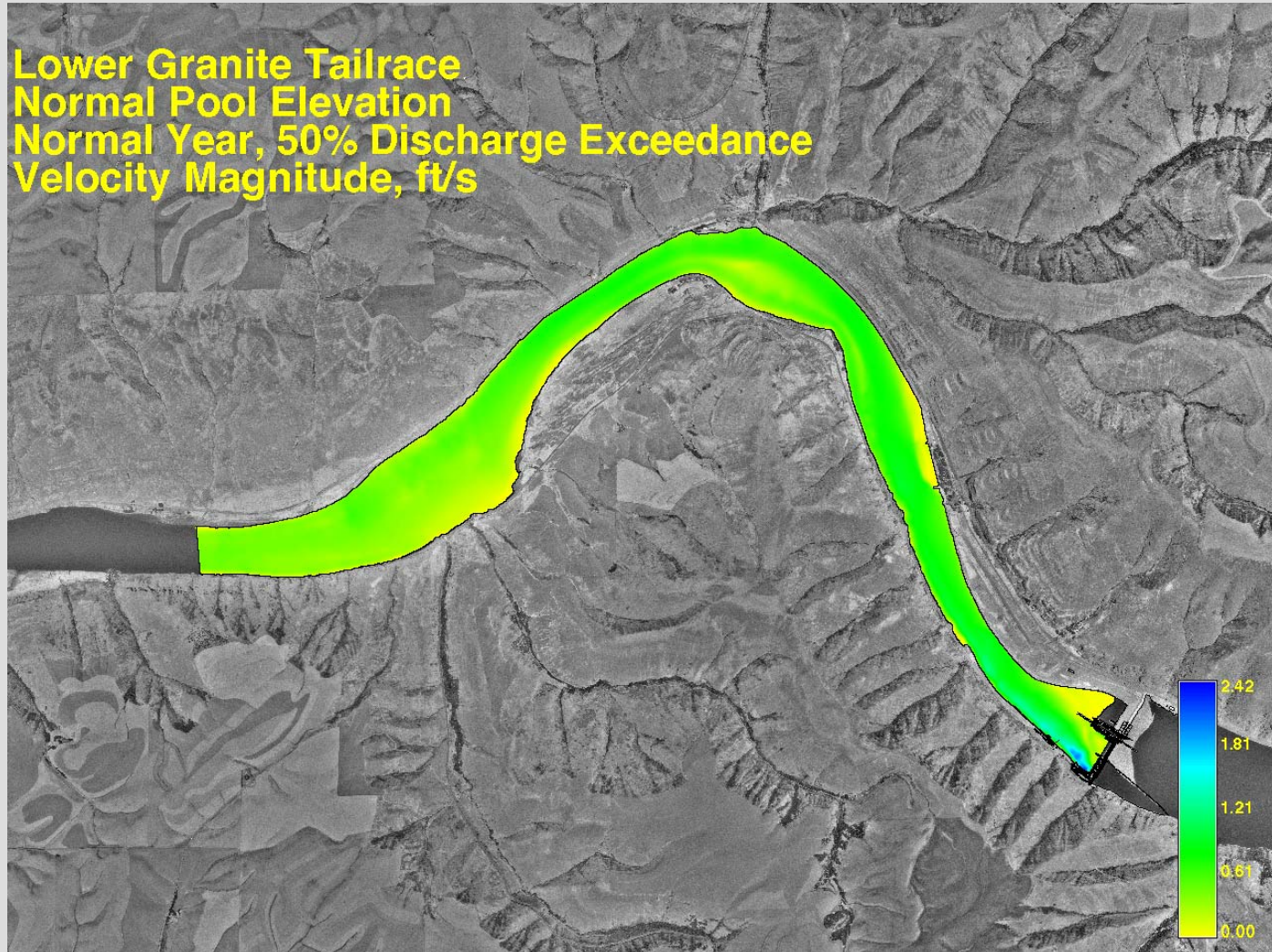
Remaining Tasks

▶ Objective 4: Determine what changes in hydrosystem operations are required to cause physical characteristics at study sites to resemble those at reference sites.

▶ Approach

- Compare the results from Objectives (1) and (3) to determine the presence and extent of similar characteristics

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Expected Results

▶ Location and spatial extent of potential spawning habitat restoration areas for Threatened Snake River fall chinook ESU

▶ Recommendations for adjusting hydrosystem operations to improve fall chinook spawning habitat

▶ Alternative flow scenarios by water-year type