



Ecohydraulic Design and Post-Project Appraisal of Salmonid Spawning and Rearing Habitat Enhancement Projects on the Lower American River

Chris Hammersmark – cbec eco engineering

Julie Zimmerman – USFWS

John Hannon – USBR

Joe Merz – Cramer Fish Sciences

Tom Gohring – Sacramento Water Forum

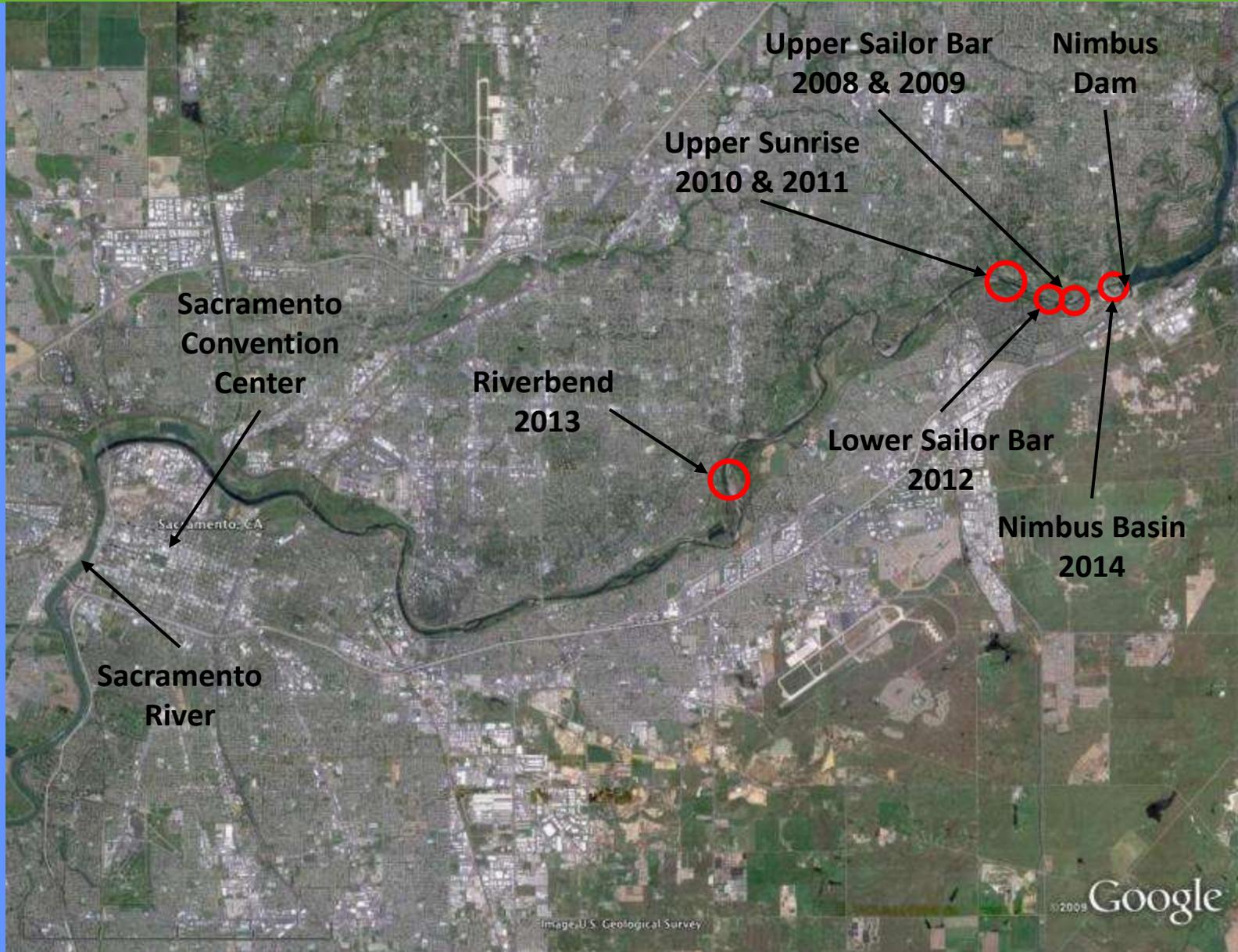
Bay-Delta Science Conference

October 29, 2014

Project Participants

- **Bureau of Reclamation** – project coordination, environmental compliance, permitting, contract management, funding
- **Fish and Wildlife Service** – project coordination, environmental compliance, funding
- **Water Forum** – environmental compliance, coordination, permitting, contract management, funding
- **City of Sacramento** – gravel processing operators
- **Sacramento County Parks** – coordination, permits
- **California State Parks** – access
- **California Dept of Fish and Wildlife (Game)** – instream equipment operators, coordination
- **National Marine Fisheries Service** – coordination, permits
- **Sacramento State University** – physical monitoring
- **Cramer Fish Sciences** – biological monitoring
- **cbec eco engineering** – design and physical monitoring

Gravel Augmentation & Side Channel Projects

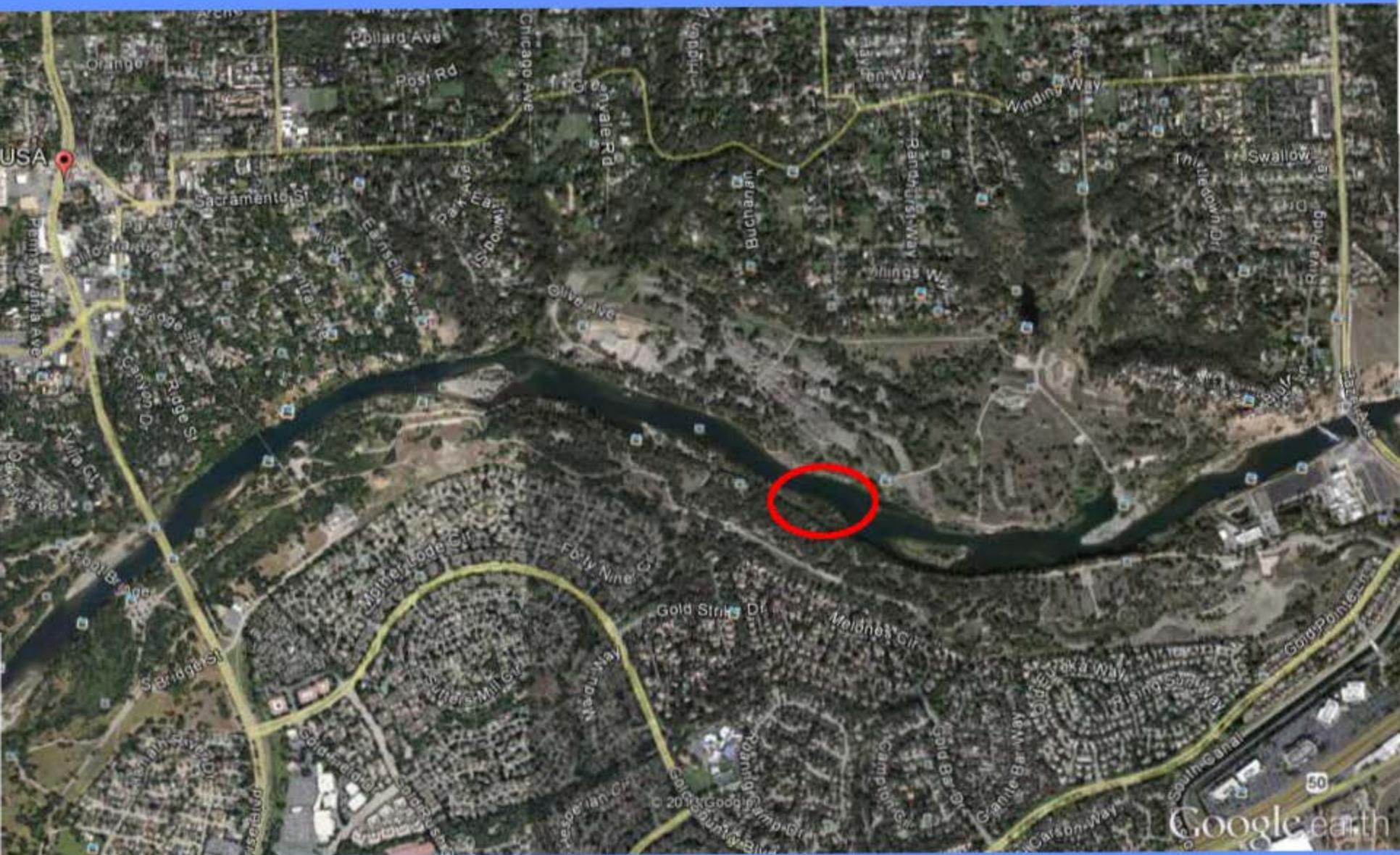


Lower American Gravel Augmentation and Side Channel Creation

Process

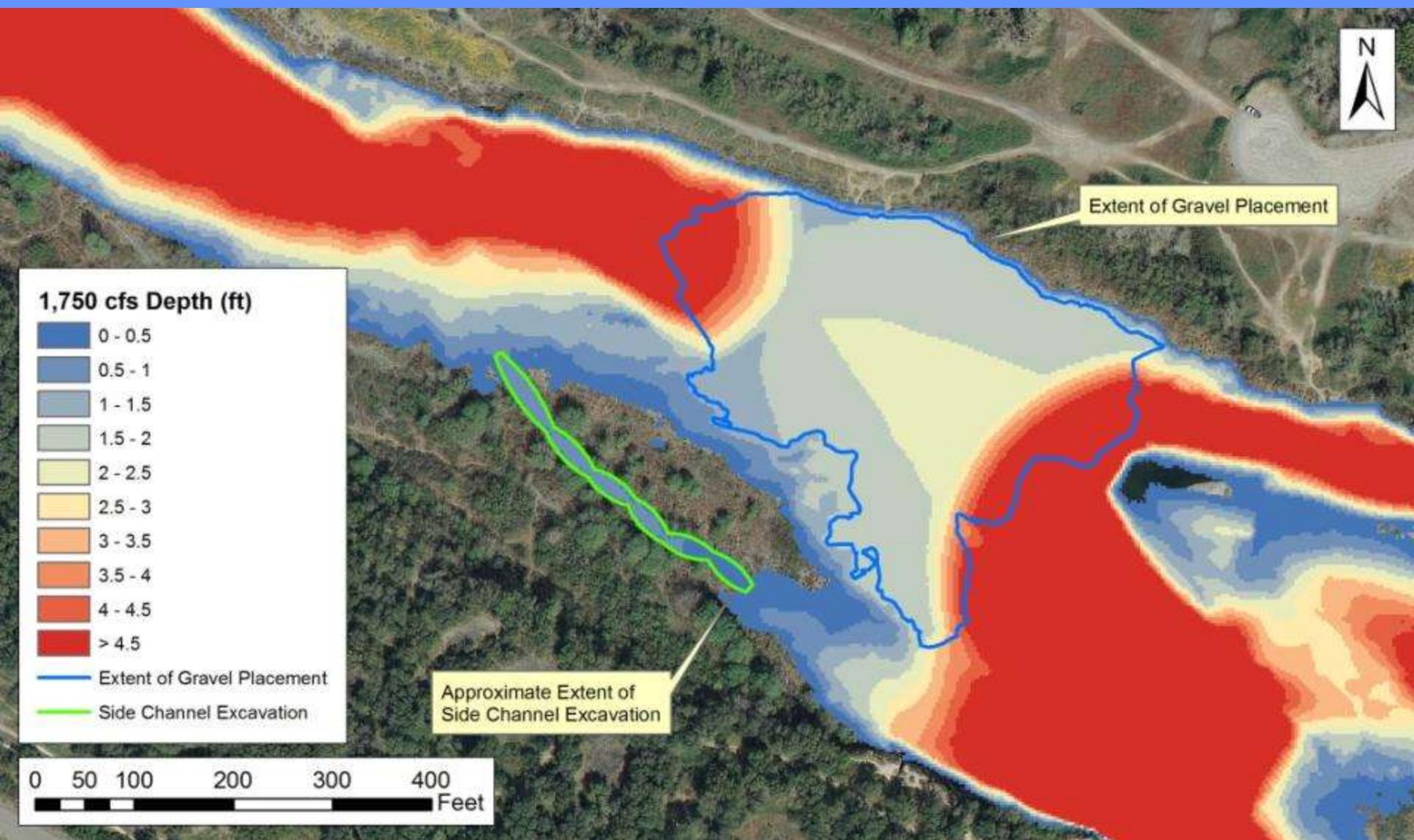
- Select site and specify budget
 - Source and amount of gravel
- Pre-project topographic, bathymetric & hydraulic surveys
- Develop, calibrate & validate 2D hydraulic model
- Iteratively develop design
 - Amount of habitat created
 - Potential for sediment mobility
 - Volume of material
- Produce construction plans
- Build project
- Assess project
 - As-built survey and physical monitoring
 - Biological monitoring

2012 Site – Lower Sailor Bar

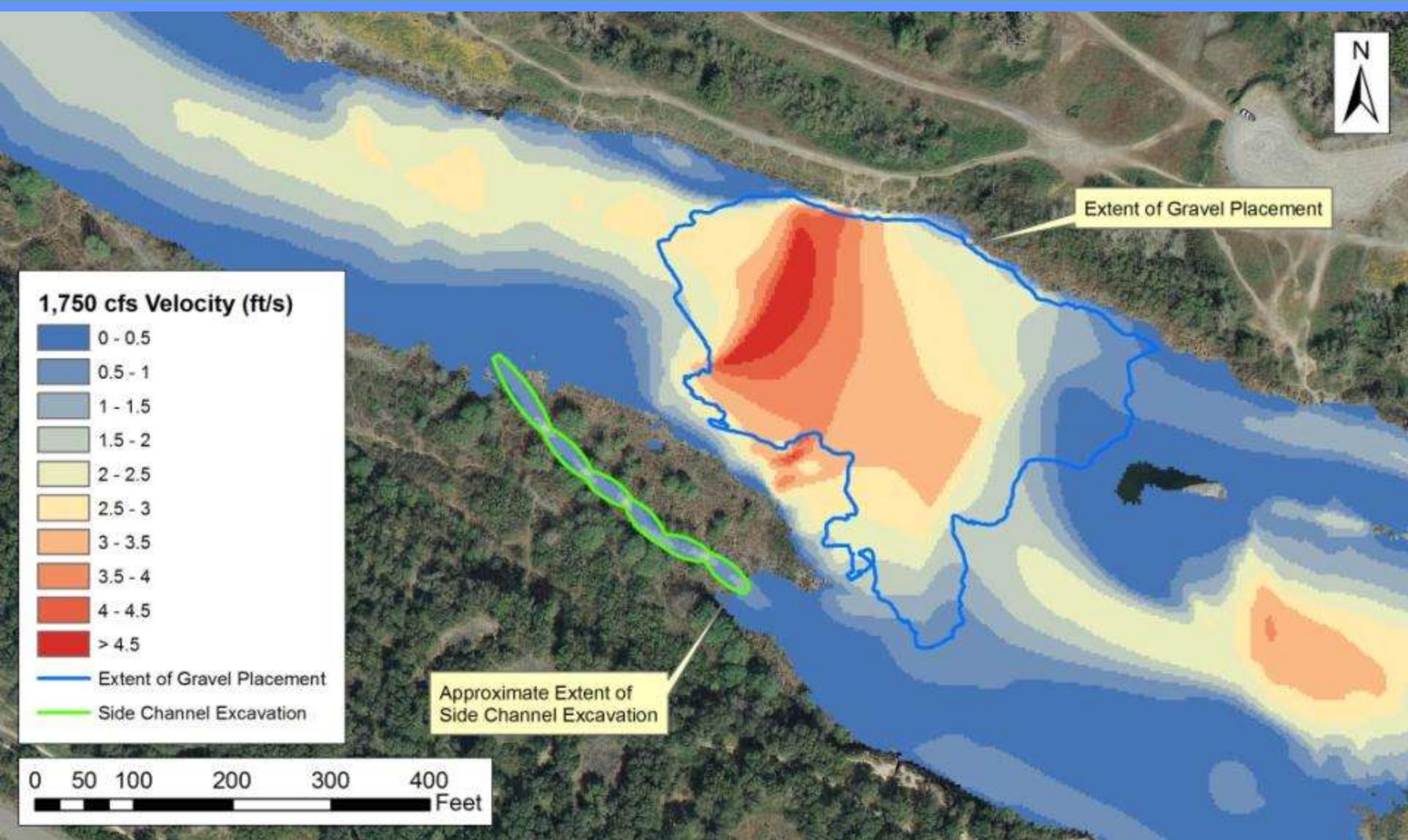


Lower American Gravel Augmentation and Side Channel Creation

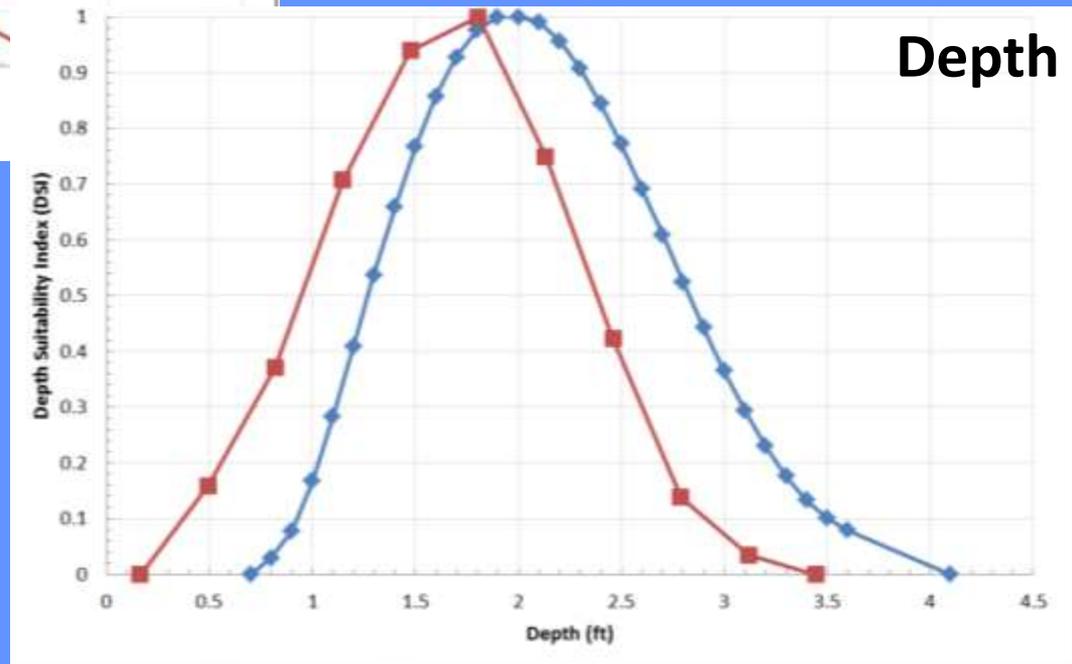
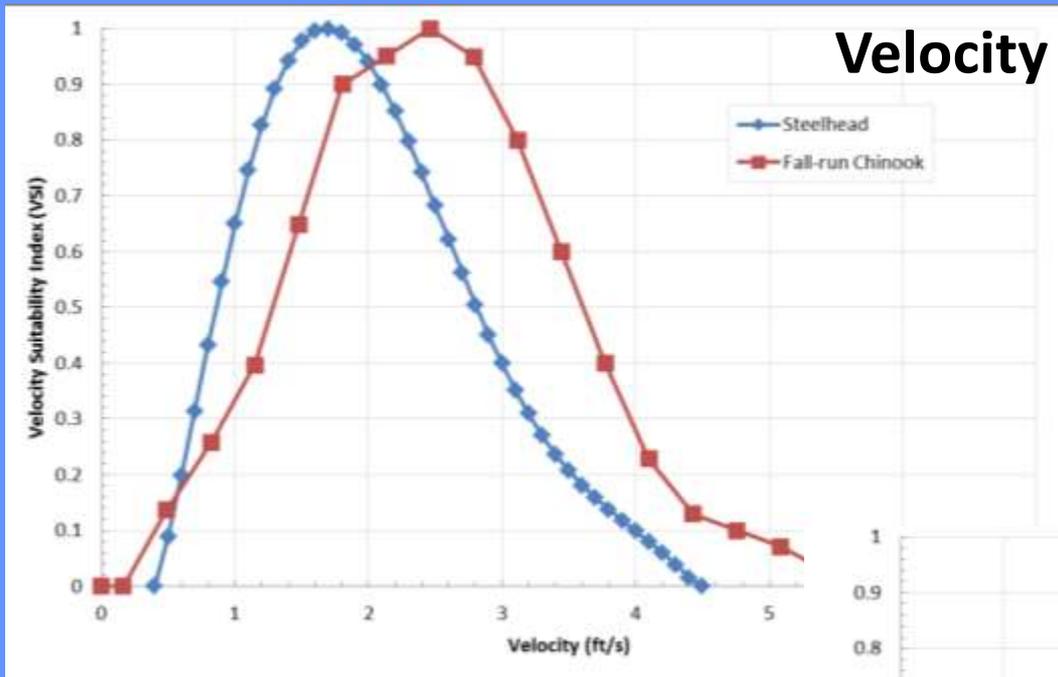
Hydraulic Modeling - Depth



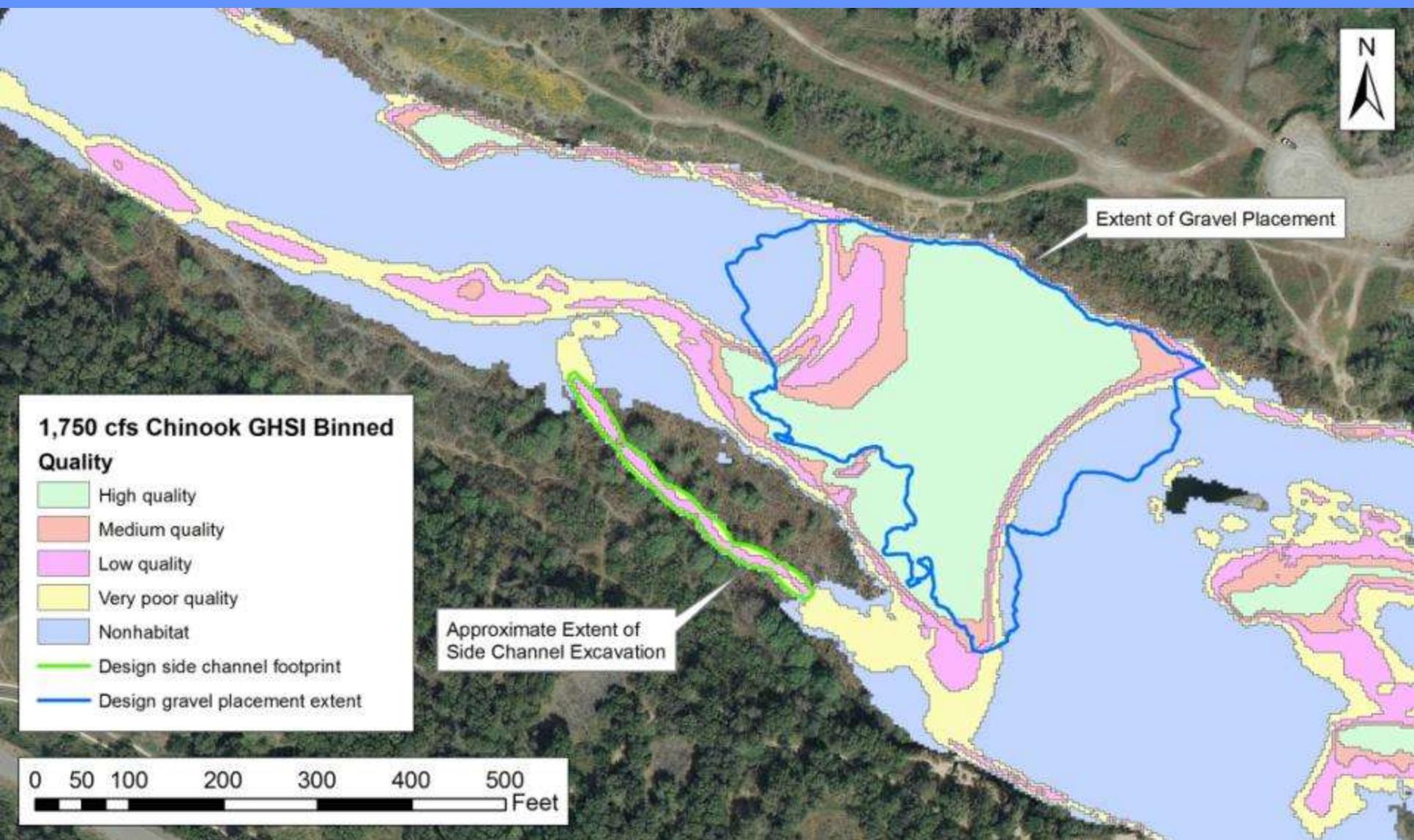
Hydraulic Modeling - Velocity



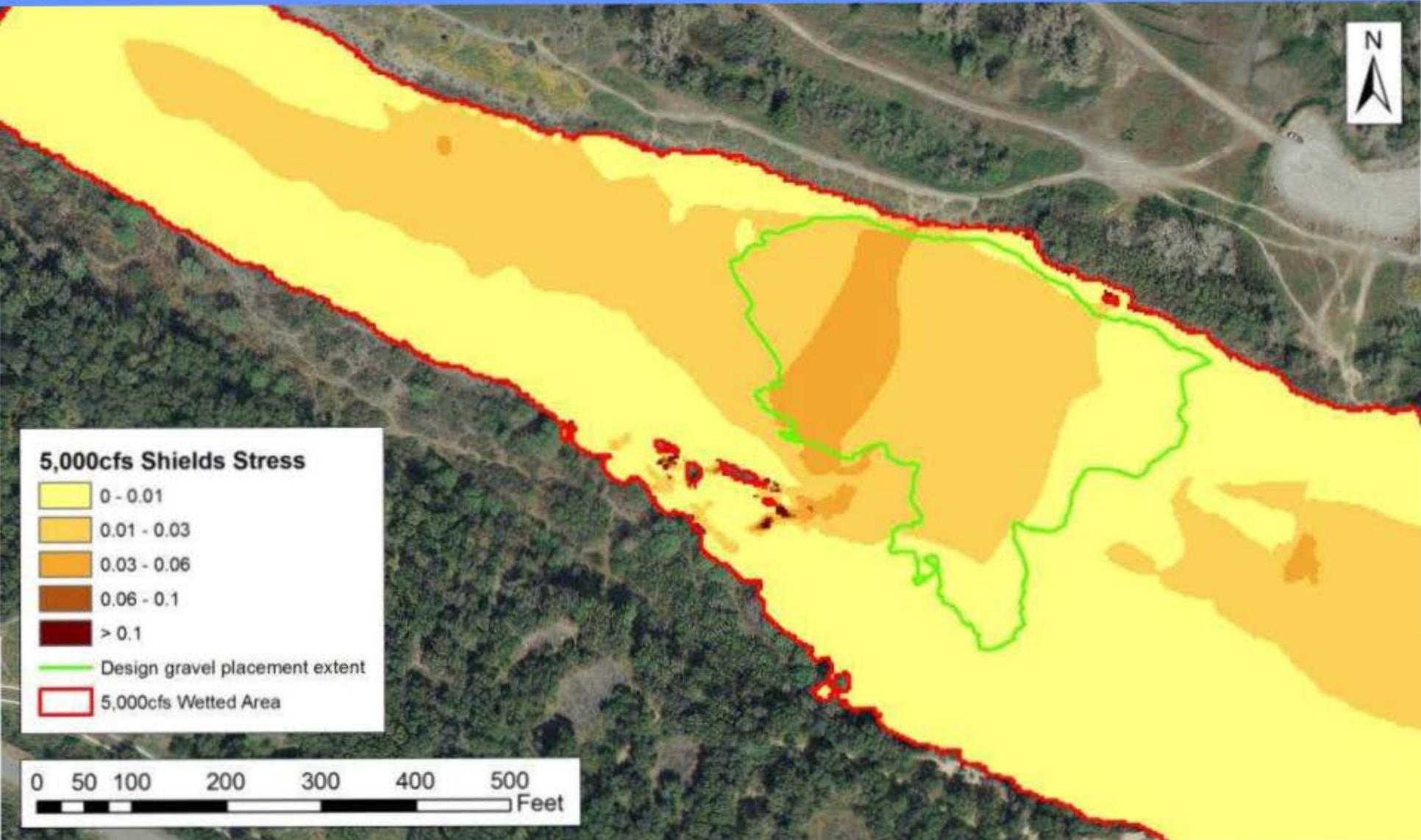
Habitat Suitability Criteria



Design – Habitat Suitability Modeling



Design – Sediment Mobility



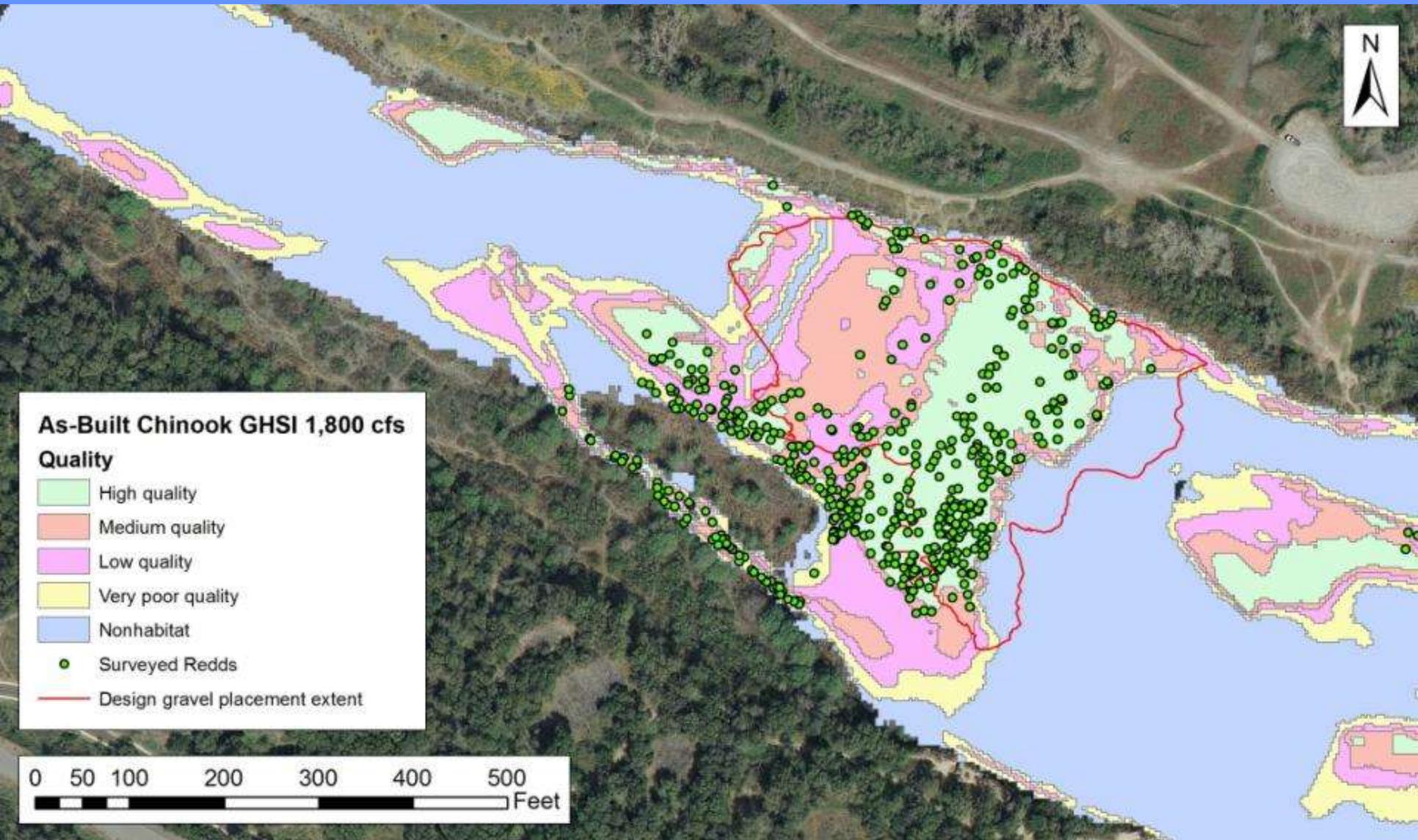
Construction



November 7, 2012 - Utilization

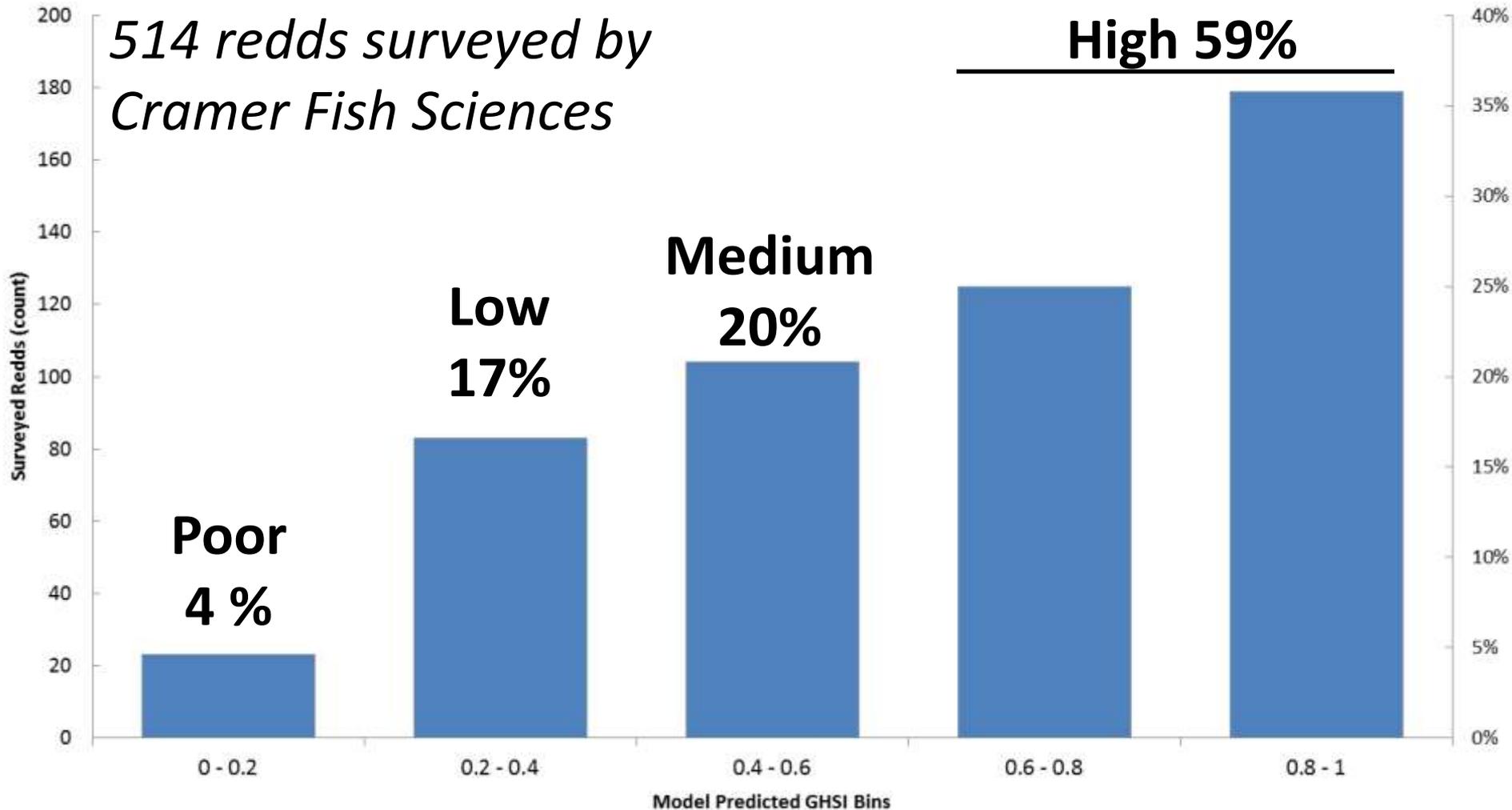


2012 Predicted Habitat & Utilization

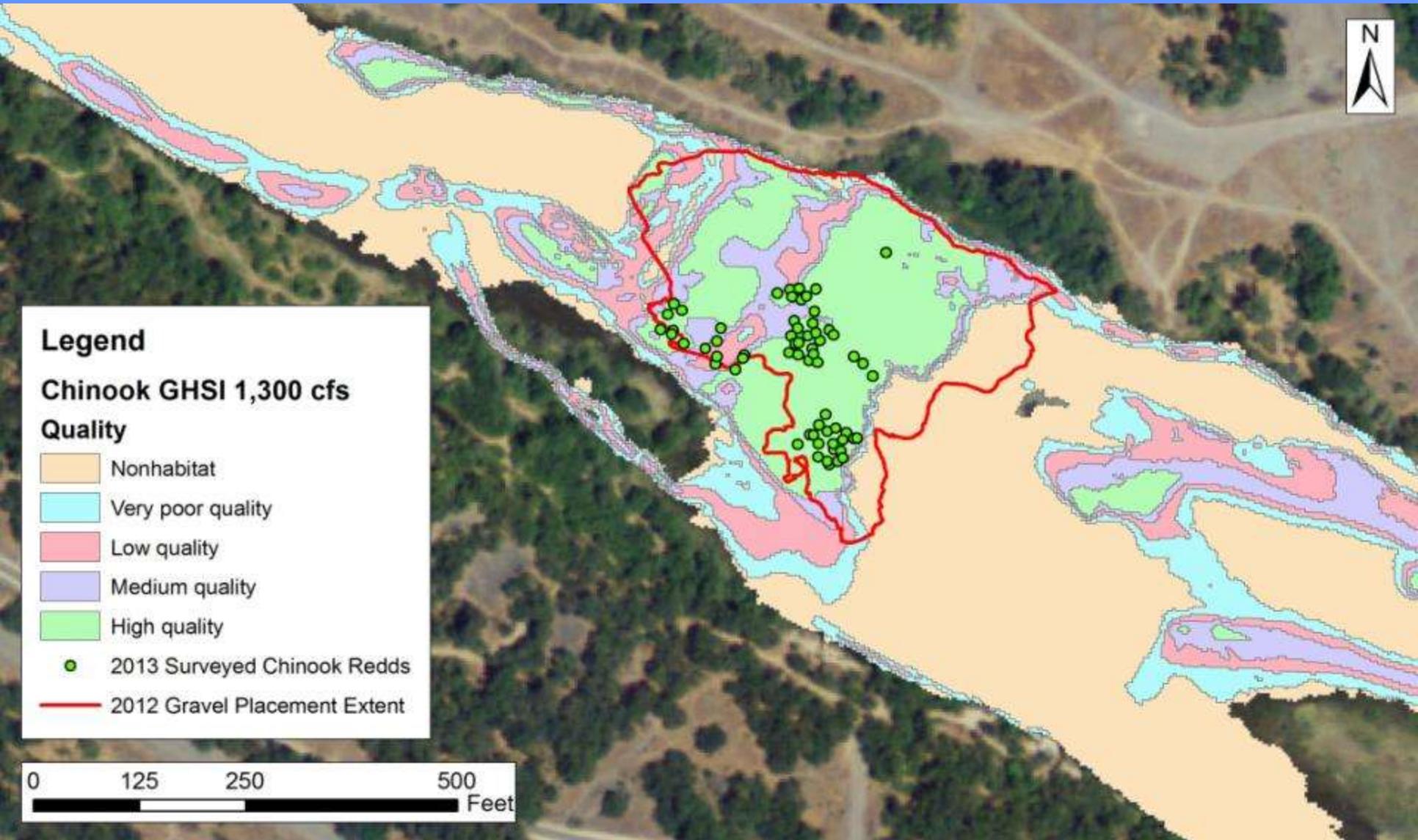


As-Built Modeling – 2012 Predictions

Chinook GHSI Frequency Distribution at 1,800 cfs

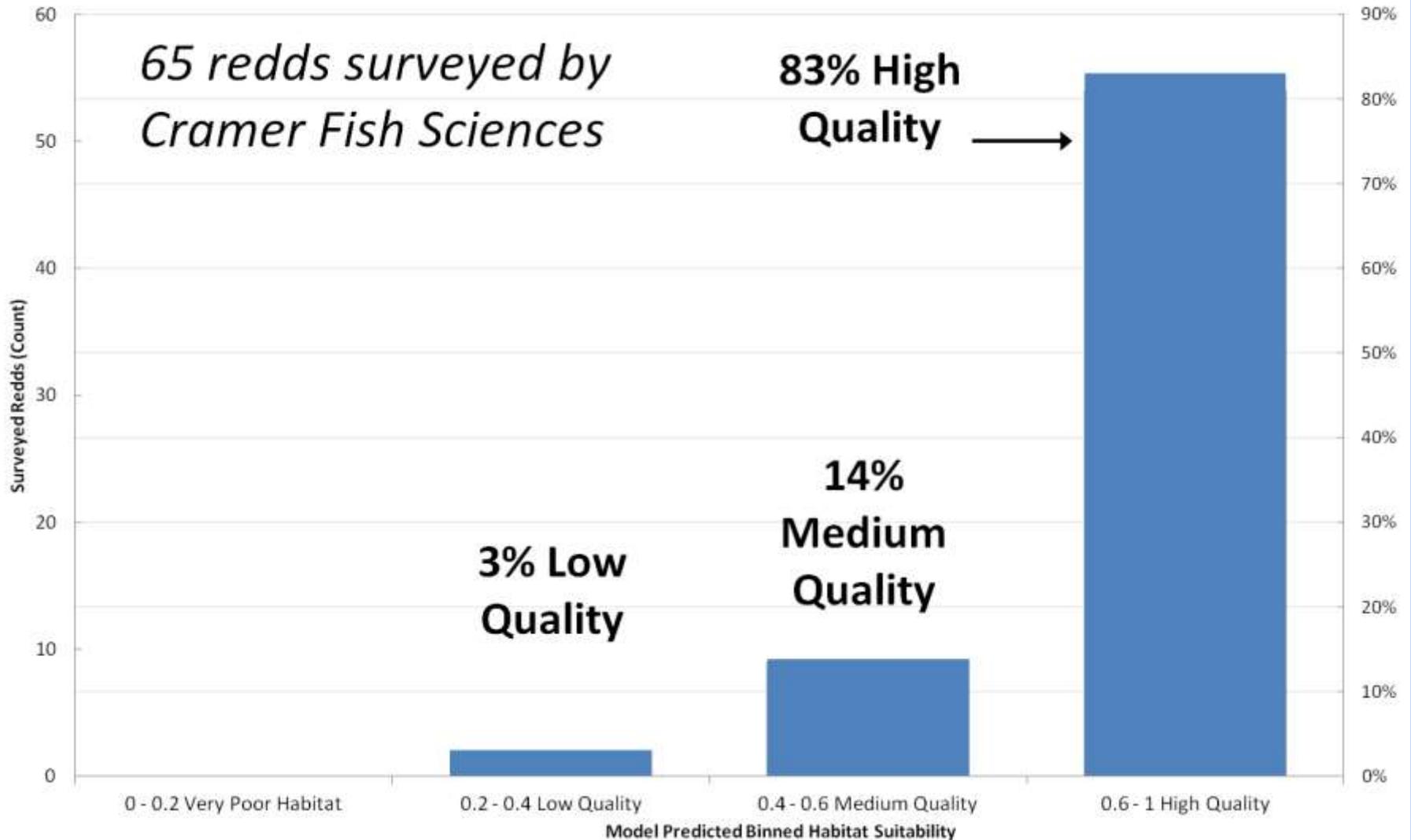


2013 Predicted Habitat & Utilization

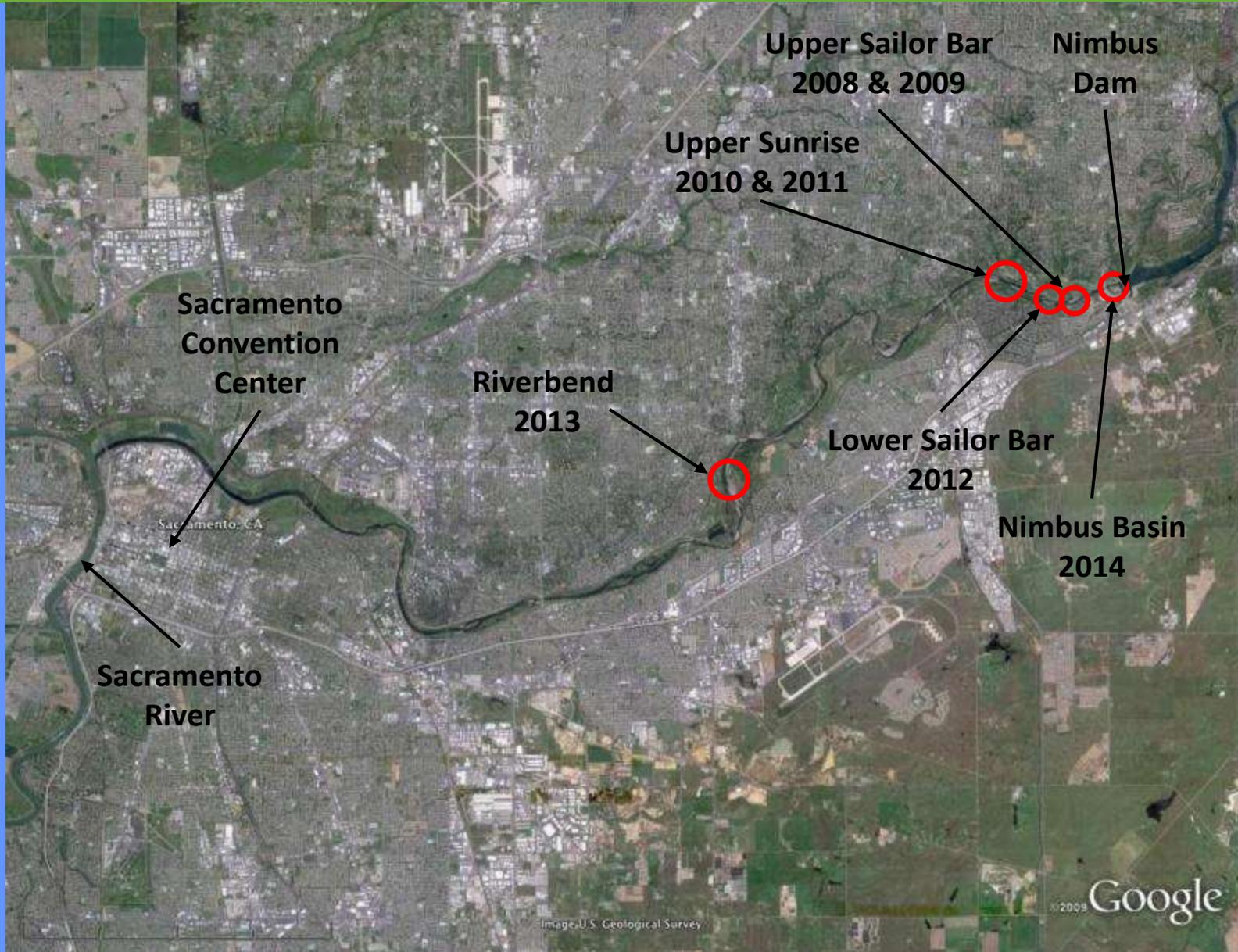


As-Built Modeling – 2013 Predictions

Chinook Redds Frequency Distribution at 1,300 cfs



Gravel Augmentation & Side Channel Projects



2014 Site – Nimbus Basin

Before

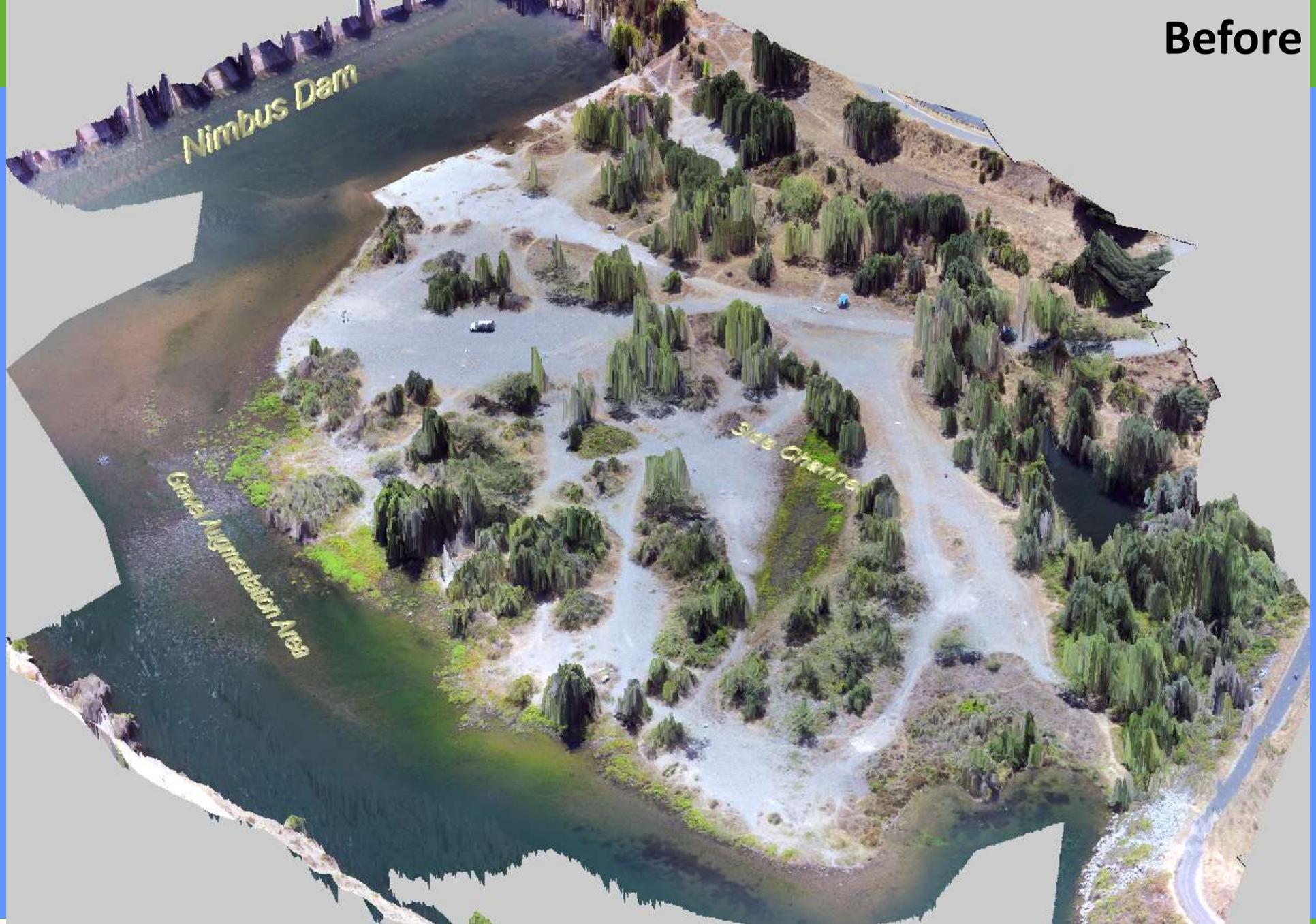


After



Images: John Hannon

Before

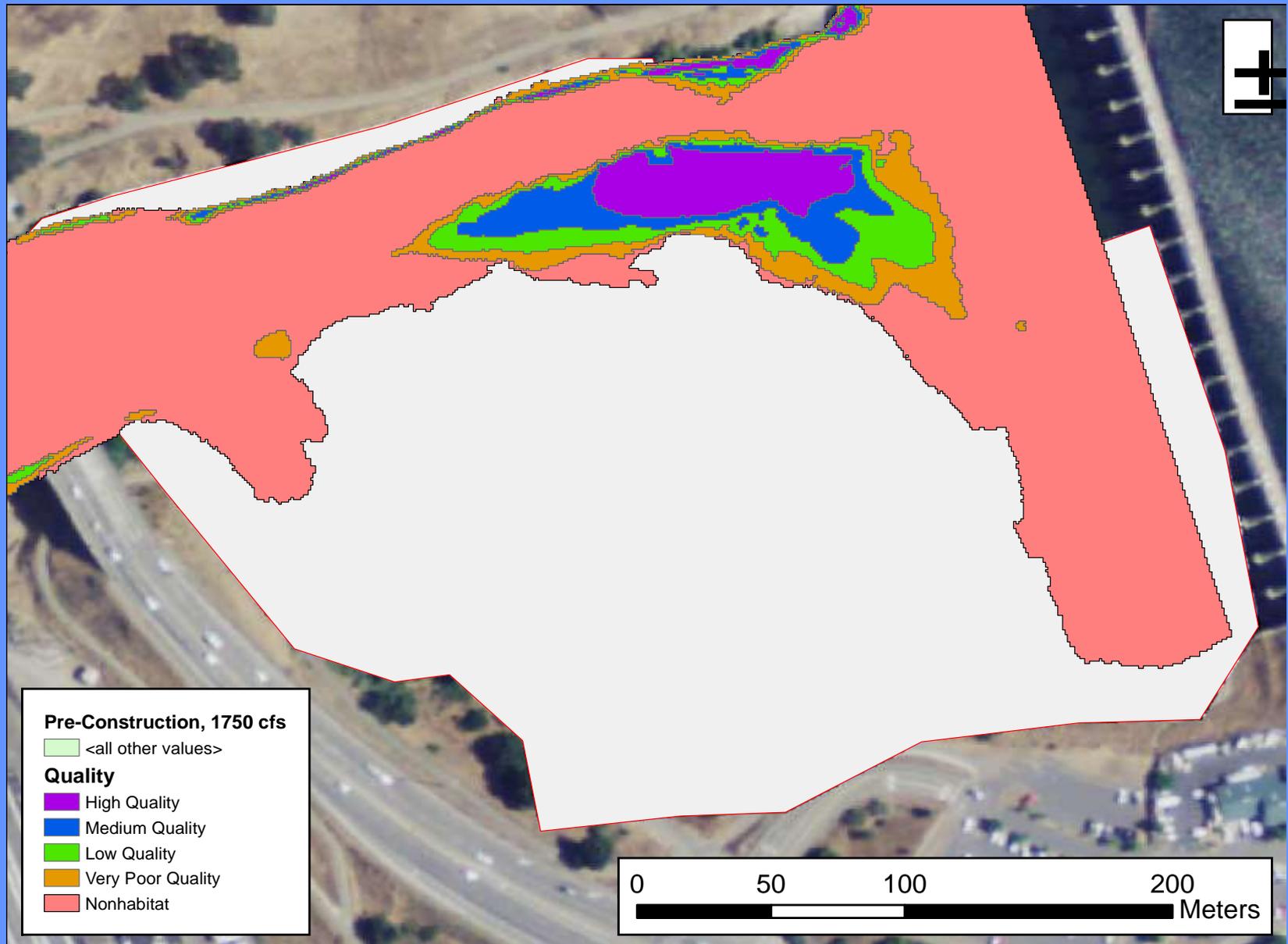


Lower American Gravel Augmentation and Side Channel Creation

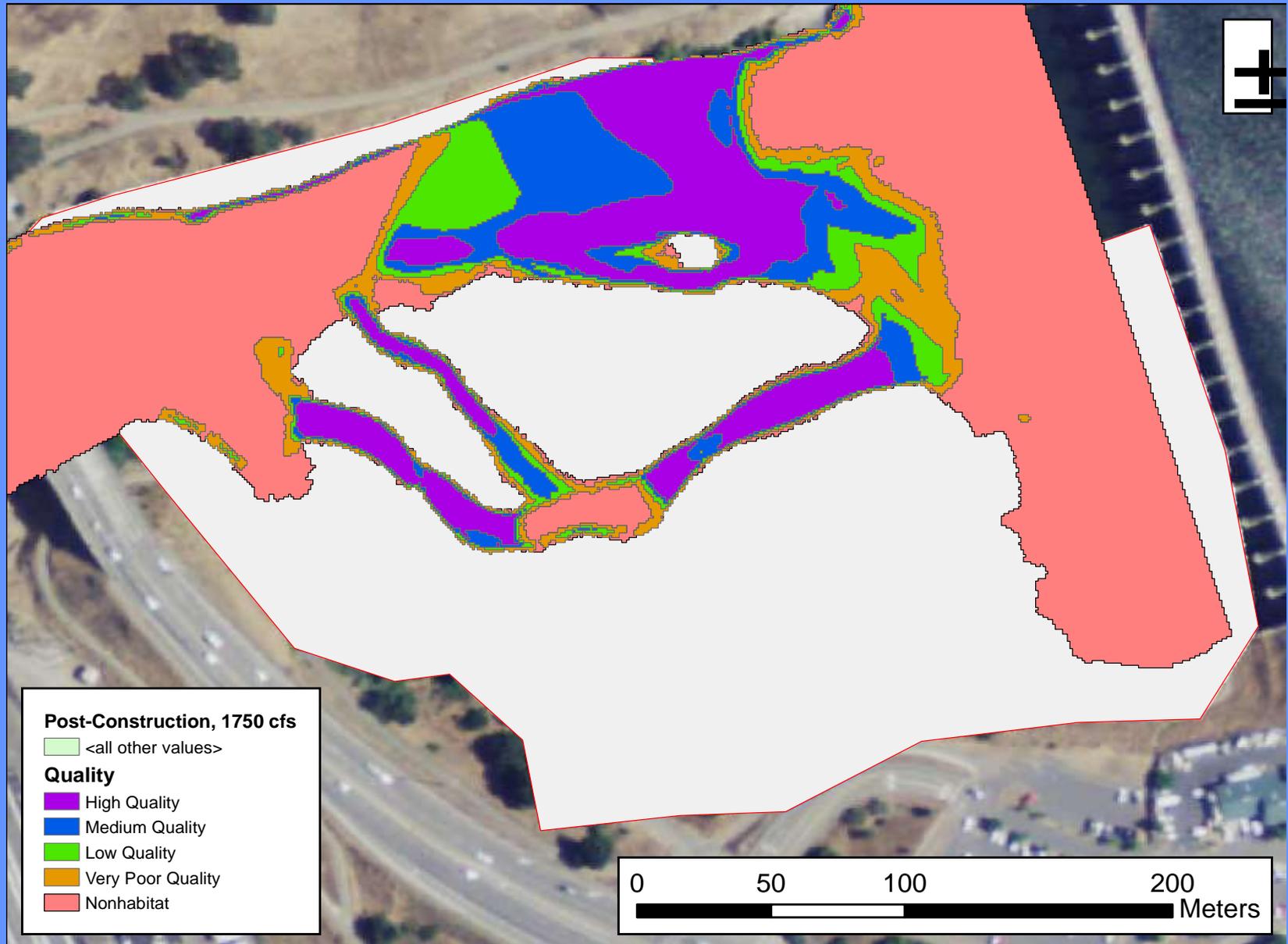
After



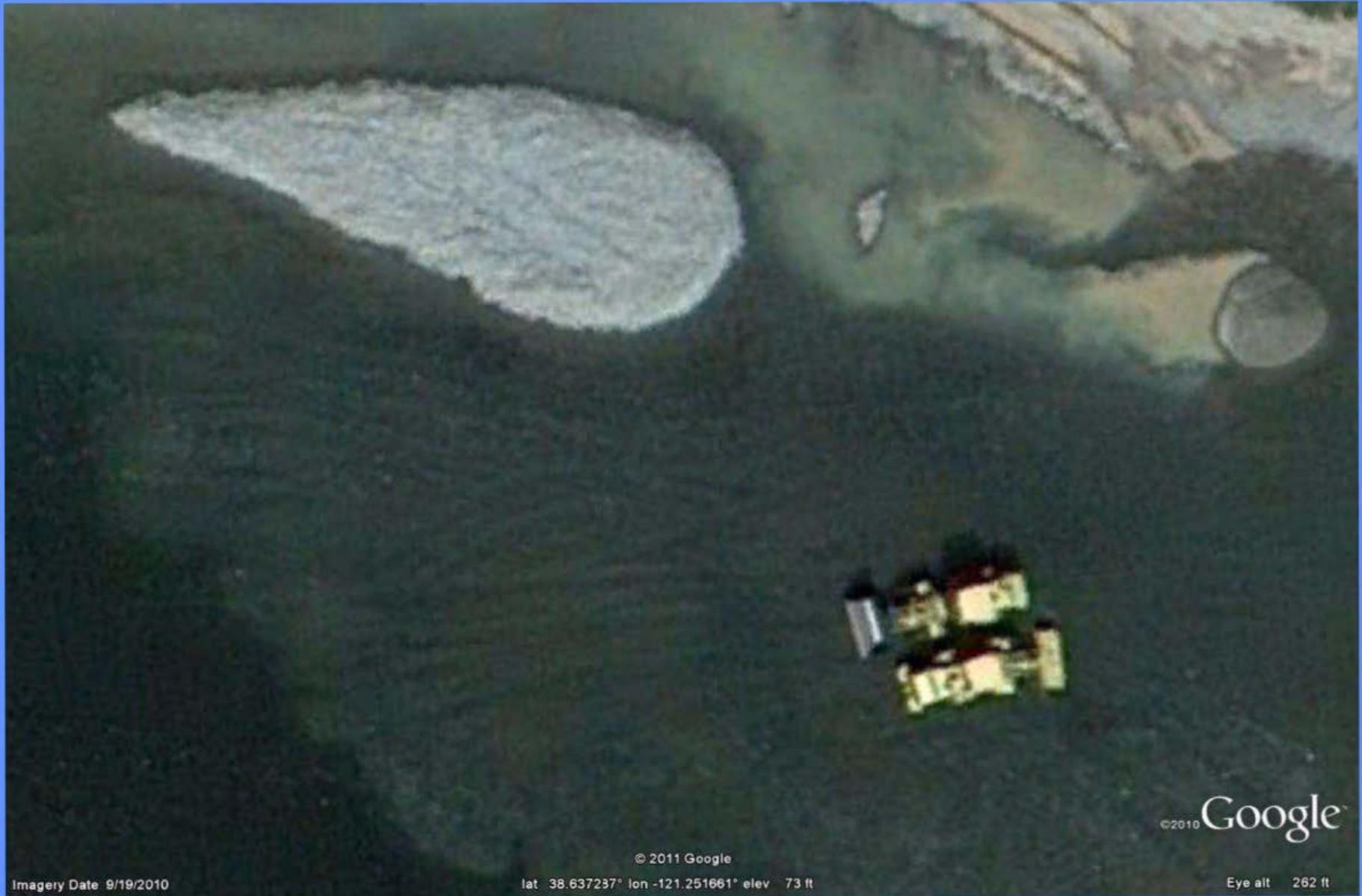
Pre-project - Habitat Suitability



As Designed - Habitat Suitability



Thanks! Questions?



Imagery Date: 9/19/2010

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lat 38.637237° lon -121.251661° elev 73 ft

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Eye alt 262 ft