

Spawning and Rearing Habitat Restoration (gravel)

CVPIA 3406 b(13)

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Overview of Spawning and Rearing Habitat Restoration Program b(13)

- Restore and replenish spawning gravel and rearing habitat lost from the construction and operation of CVP dams
- Gravel augmentation is an ongoing activity
- Other CVPIA provisions and agencies place gravel on both CVP and non-CVP streams

**B13 actions are limited to three CVP streams
Sacramento, American, and Stanislaus Rivers**

Why Gravel?

- Provides
 - Spawning habitat for salmonids
 - Rearing habitat for salmonids
 - Habitat for aquatic insects
 - Food for salmonids and other species



Gravel Blocked by Dams



B13 Streams

LEGEND

CVP-Related Facilities

- River
- Canal / Tunnel
- Lake / Reservoir / Dam
- City

*B13 actions are limited to these CVP streams

Upper Sacramento River

Keswick Dam

Red Bluff Diversion Dam

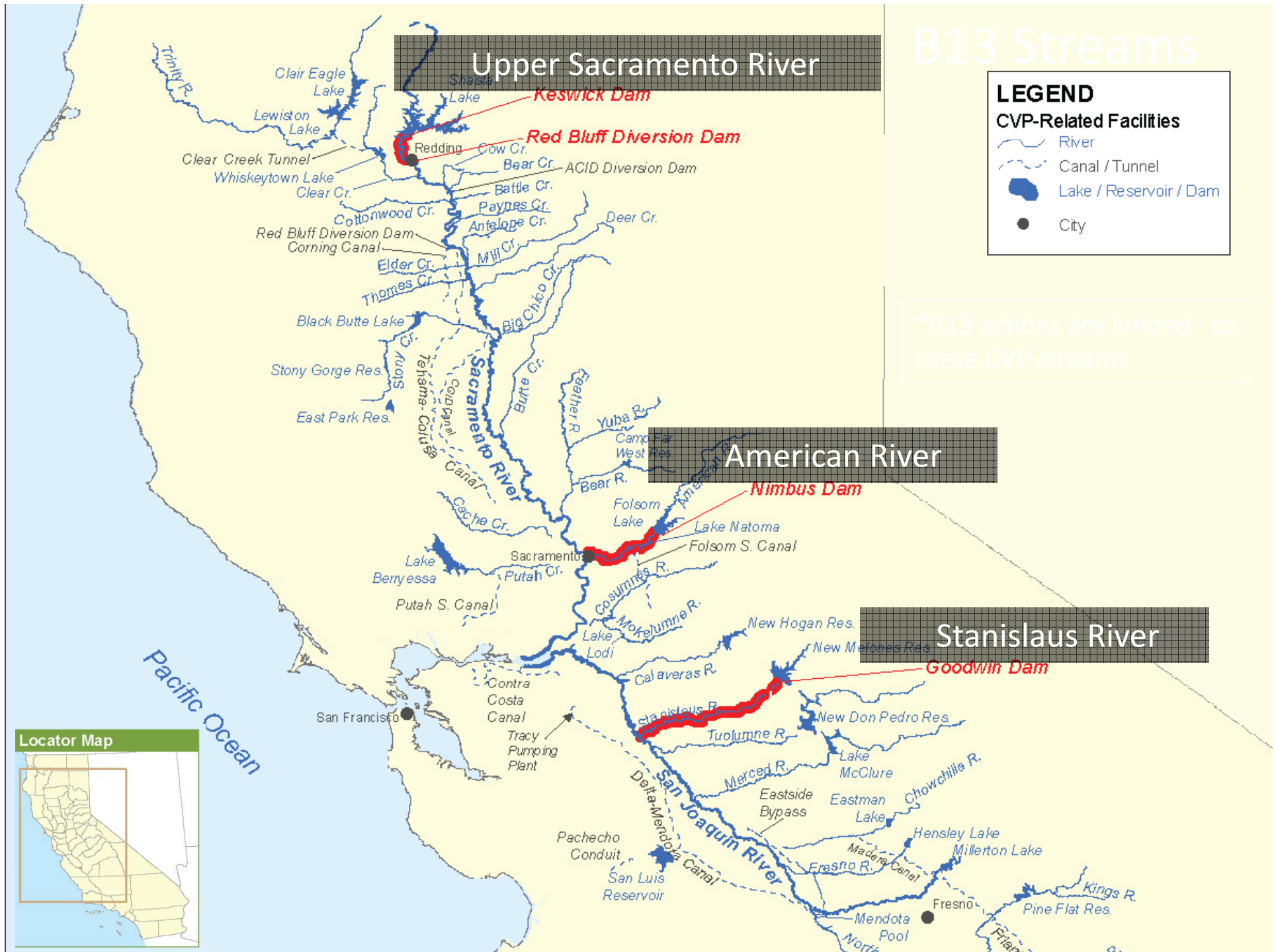
American River

Nimbus Dam

Stanislaus River

Goodwin Dam

Locator Map



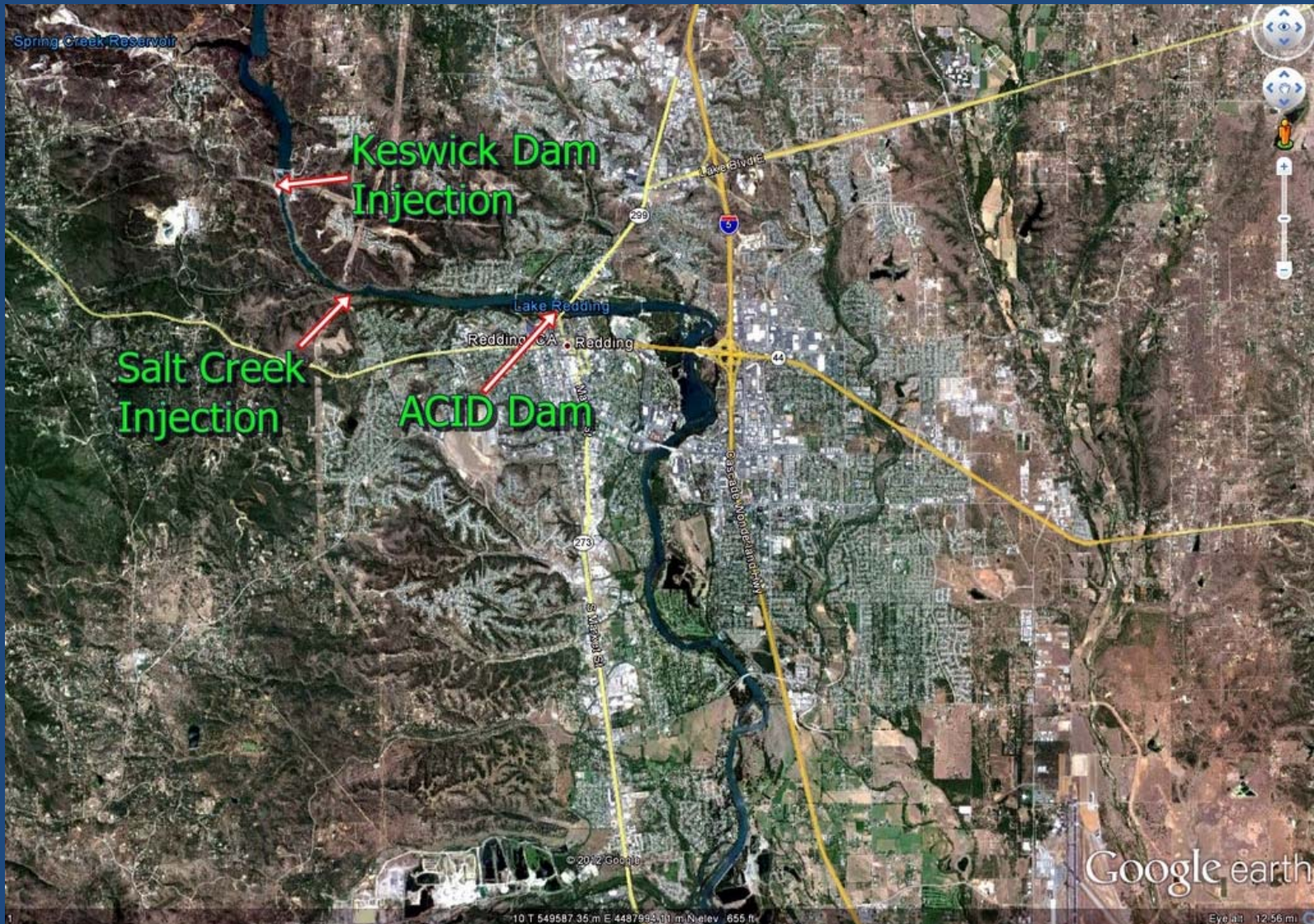
2011 Gravel Additions

- Sacramento River – 5,000 tons of gravel added at Keswick Dam
- American River – 20,770 tons of gravel at upper Sunrise
- Stanislaus River – 5,000 tons of gravel added in Goodwin Canyon

\$900,000 spent in 2011

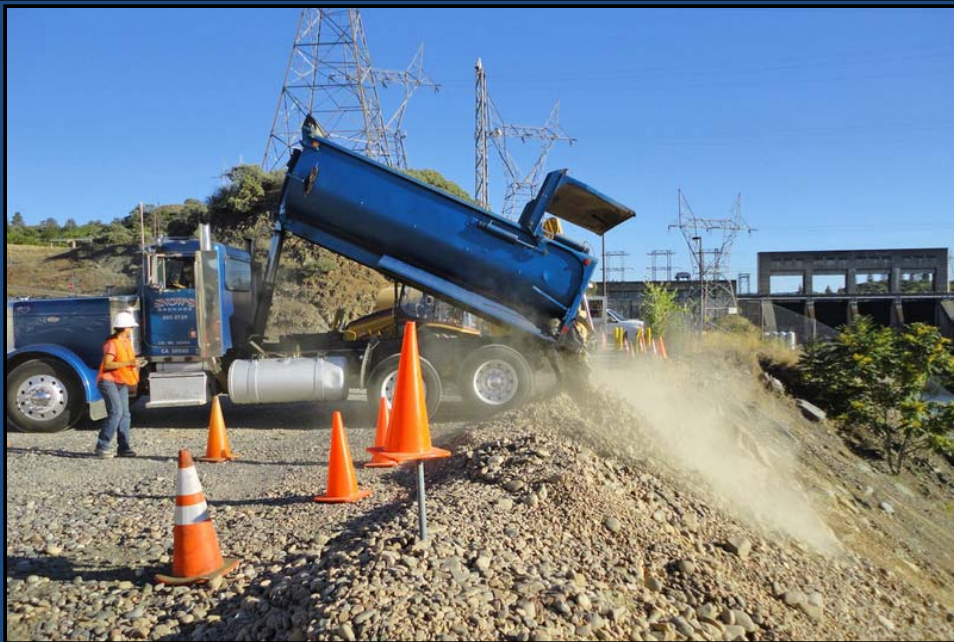
\$1,000,000 planned for 2012

Sacramento River – recent spawning gravel injection sites



Sacramento River Keswick Dam Gravel Injection

- 5,000 tons in 2011
- 10,000 tons in 2012 + scoping and NEPA for new project sites



Winter Chinook Spawning Distribution

Reach	Miles below Dam	2001 - 2011 distribution	yearly average	% distrib
Keswick to A.C.I.D. Dam.	3	2,678	296	42
A.C.I.D. Dam to Highway 44 Bridge	5.5	2,081	203	33
Highway 44 Br. to Airport Rd. Br.	19	1,526	152	24
Airport Rd. Br. to Balls Ferry Br.	27	75	7	1
Balls Ferry Br. to Battle Creek.	32	10	1	0
Battle Creek to Jellys Ferry Br.	36	6	1	0
Jellys Ferry Br. to Bend Bridge	45	10	1	0
Bend Bridge to Red Bluff Diversion Dam	60	0	0	0
Red Bluff Diversion Dam to Tehama Br.	74	11	1	0
Tehama Br. To Woodson Bridge	85	0	0	0
Woodson Bridge to Hamilton City Br.		0	0	0
Hamilton City Bridge to Ord Ferry Br.		0	0	0
Ord Ferry Br. To Princeton Ferry.		0	0	0
Total		6,397	661	100

Adaptive Management – Sac River

- Early gravel placements distributed gravel through downstream areas
- Monitoring showed spawning concentrated near dam, particularly for endangered winter Chinook which rely on the cool water near the dam
- Recent projects focused placement near the dam where fish are present and gravel recruitment has been most curtailed

Stanislaus River Goodwin Canyon Salmonid Habitat Restoration



Stanislaus River - 2011

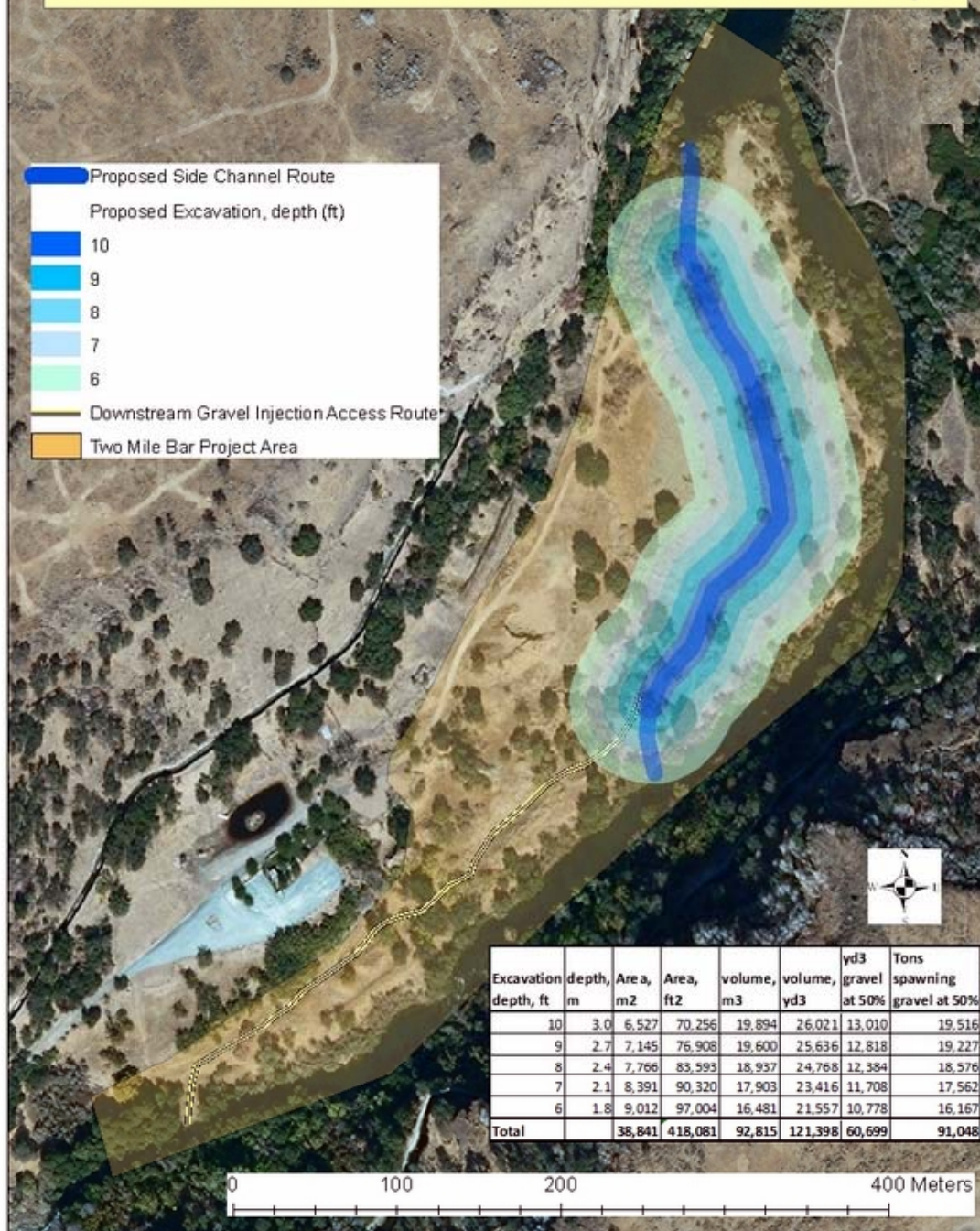
- 5,000 tons of gravel placed in Goodwin Canyon
- ~70% transported downstream during high flows



Stanislaus River – Goodwin Canyon



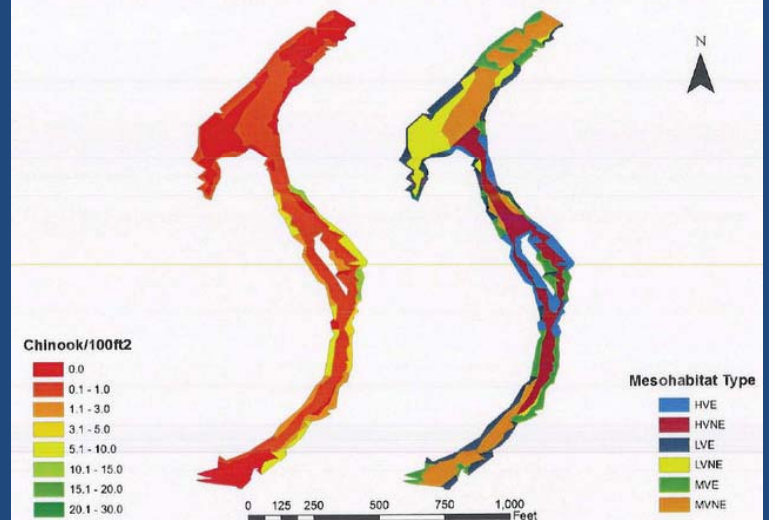
Stanislaus River - Two Mile Bar Salmonid Habitat Restoration Project



Stanislaus River -2012

- Two Mile Bar
 - Side Channel
 - Floodplain
 - Gravel
 - Multi-year project
 - RPA actions

Chinook Density and Mesohabitat Distribution at Two Mile Bar, May 26th, 2008 (657 cfs)



Stanislaus River 2012

- Float Tube Pool
- Augment 2004 placement
- Upstream most spawning area
- Using habitat builder (sluice)
- 3,000 tons planned



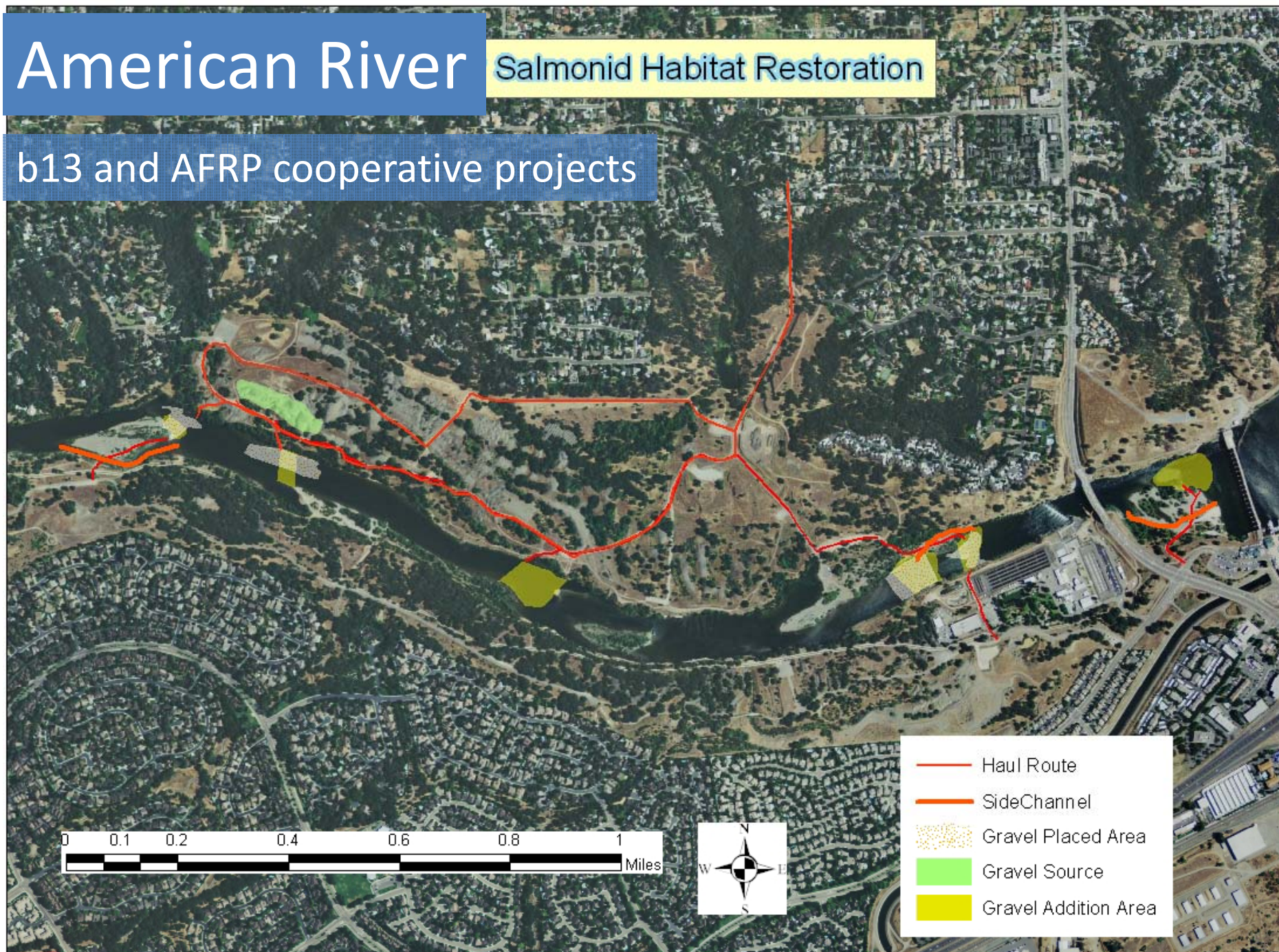
Adaptive Management - Stanislaus

- Experimental gravel mixes showed higher egg survival in smaller sized gravel
- Modified gravel mix to include a higher proportion of smaller sized material
- Increased emphasis on rearing habitat based on monitoring showing rearing habitat limitations

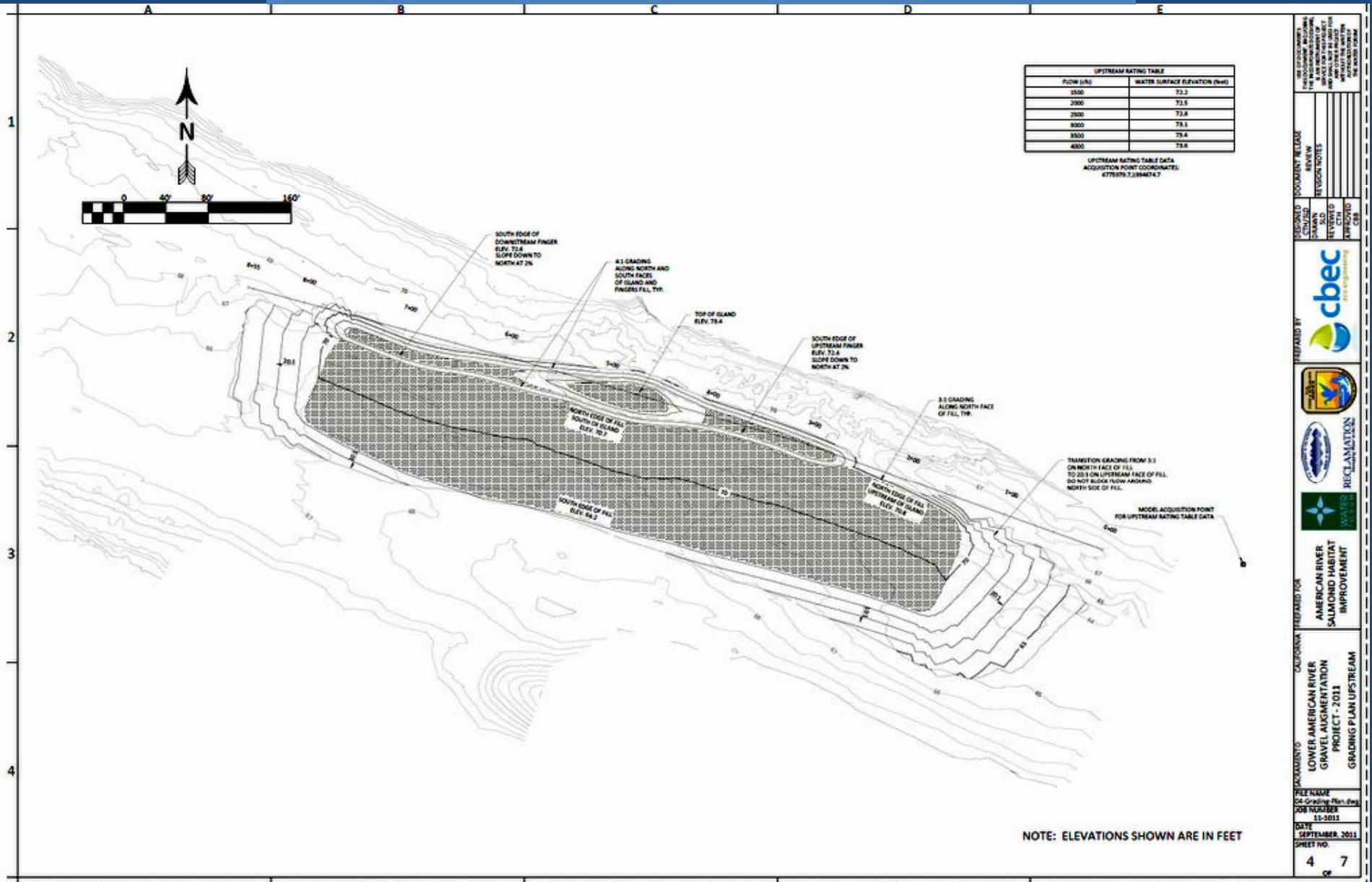
American River

Salmonid Habitat Restoration

b13 and AFRP cooperative projects



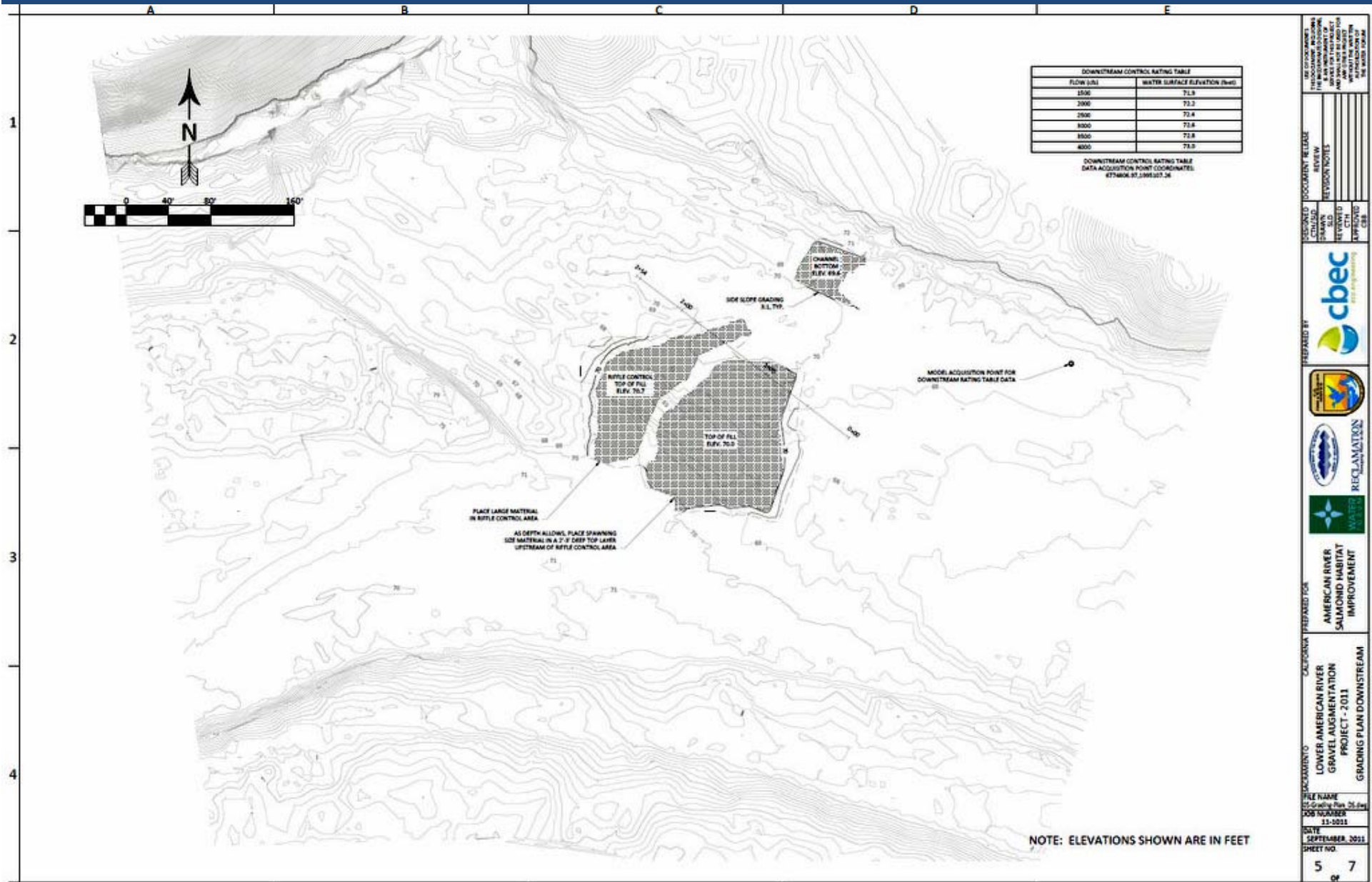
Upper Sunrise Gravel Placement Design



Upper Sunrise Gravel Placement



Upper Sunrise Side Channel Gravel Placement Design



Upper Sunrise Side Channel Site



American River, Mile 21, Upper Sunrise

Before

Side channel rewatered by
adding large gravel in
incised area of channel

Spawning Gravel,
island, and woody
material added

After



Sorting Dredger Tailings for Placement
into American River



Gravel Placement at Upper Sunrise



Woody Material Placement at
Upper Sunrise



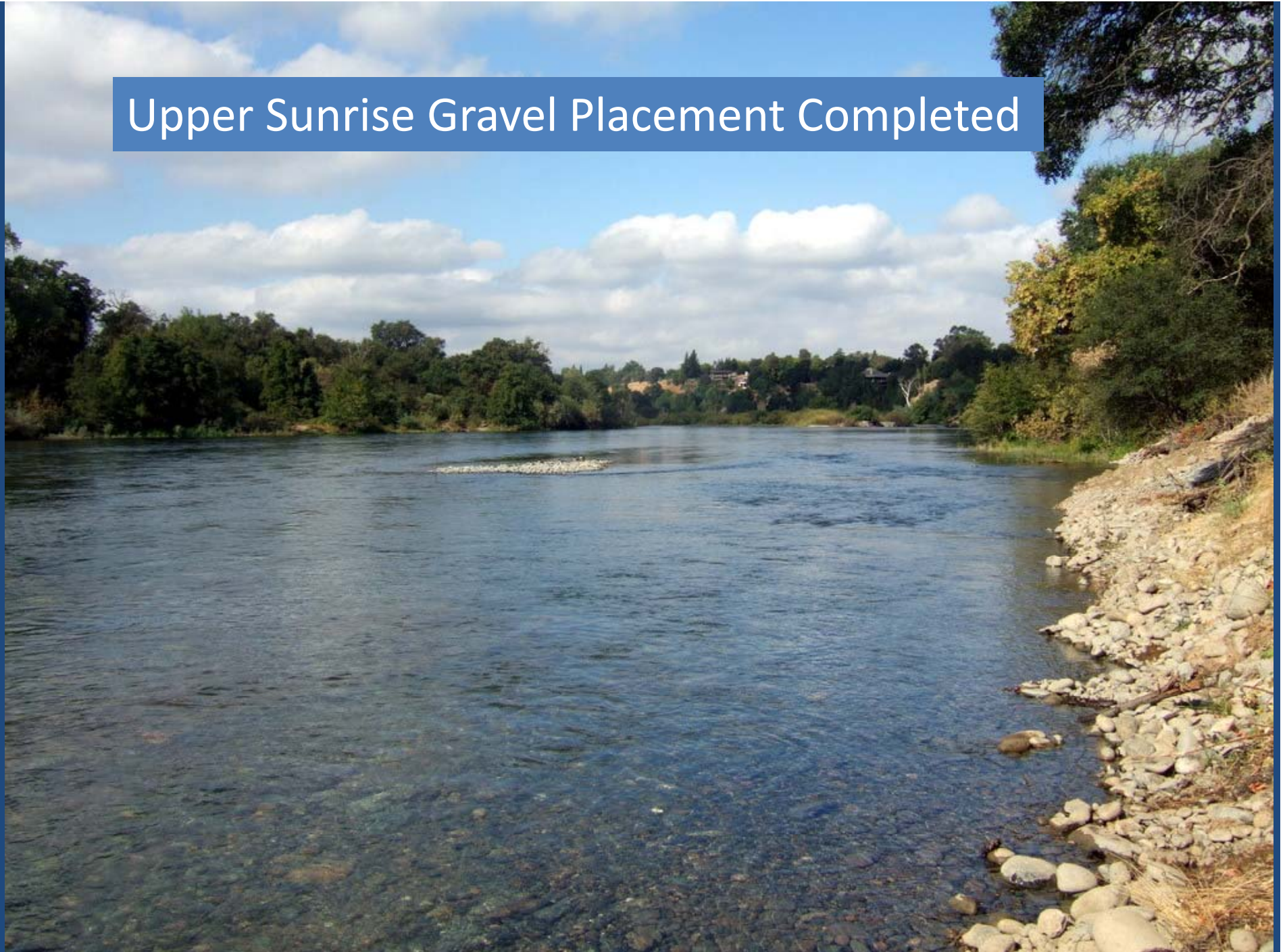
Upper Sunrise Side Channel
Restoration in Progress



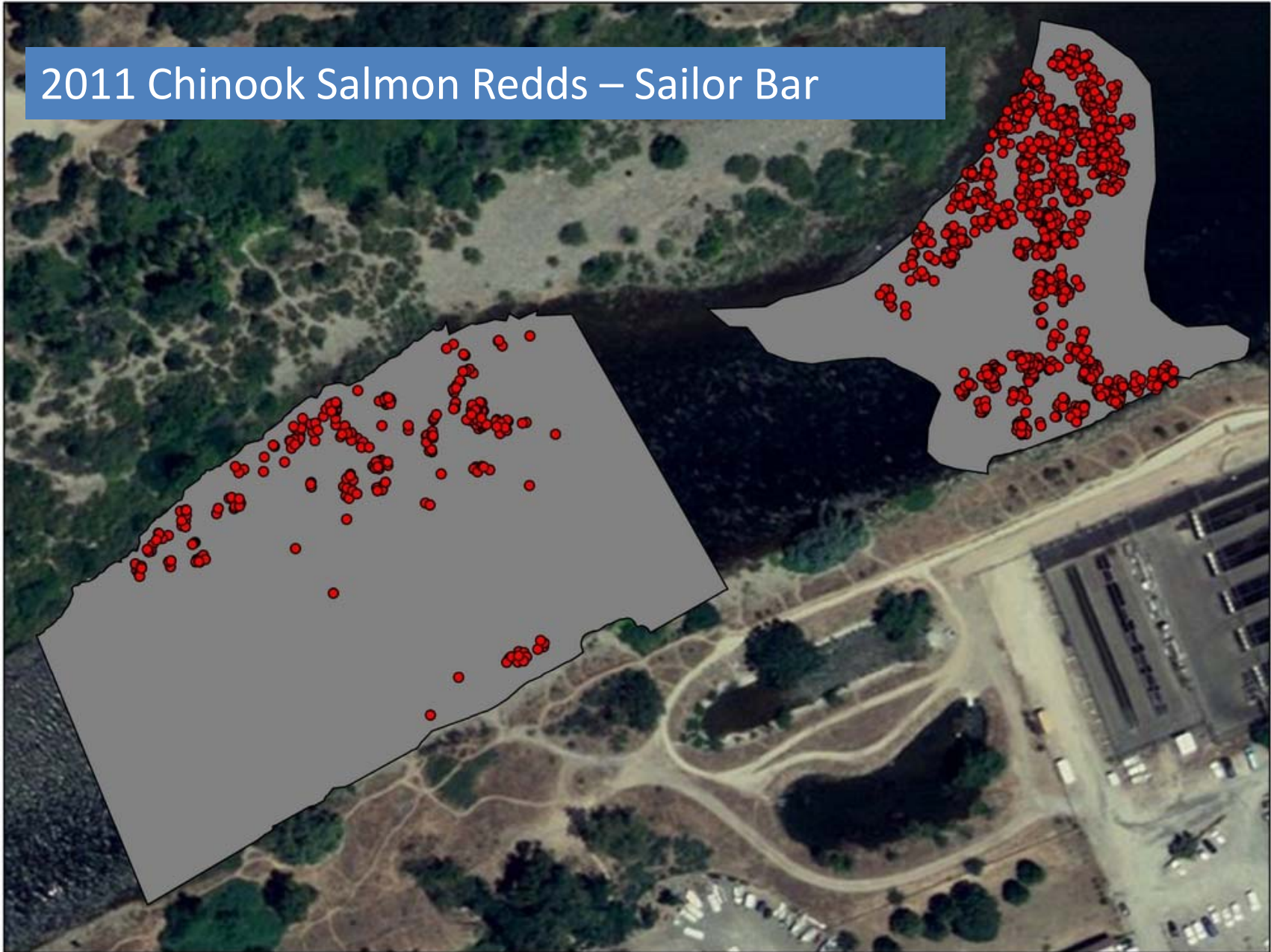
Upper Sunrise Side Channel Completed



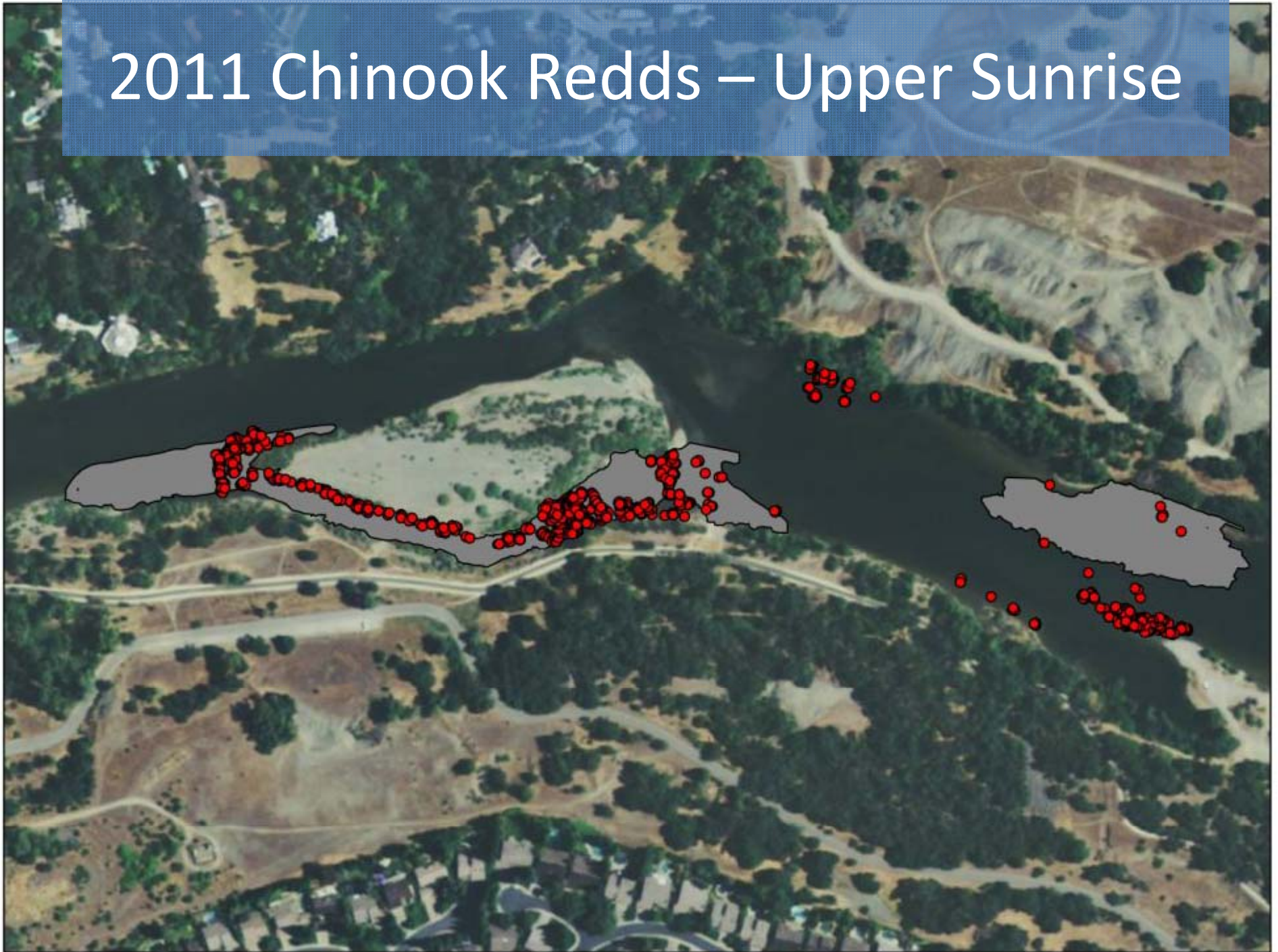
Upper Sunrise Gravel Placement Completed



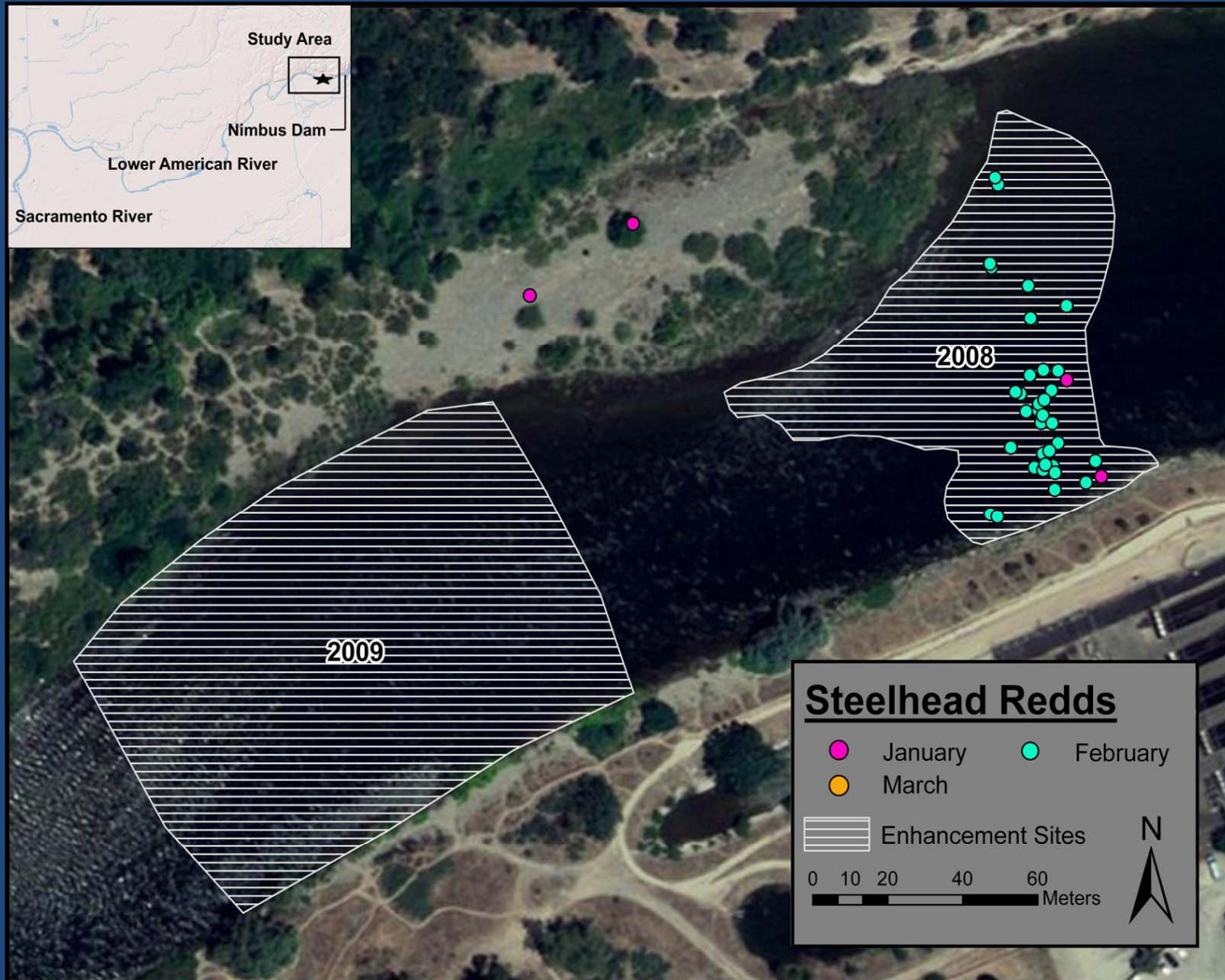
2011 Chinook Salmon Redds – Sailor Bar



2011 Chinook Redds – Upper Sunrise



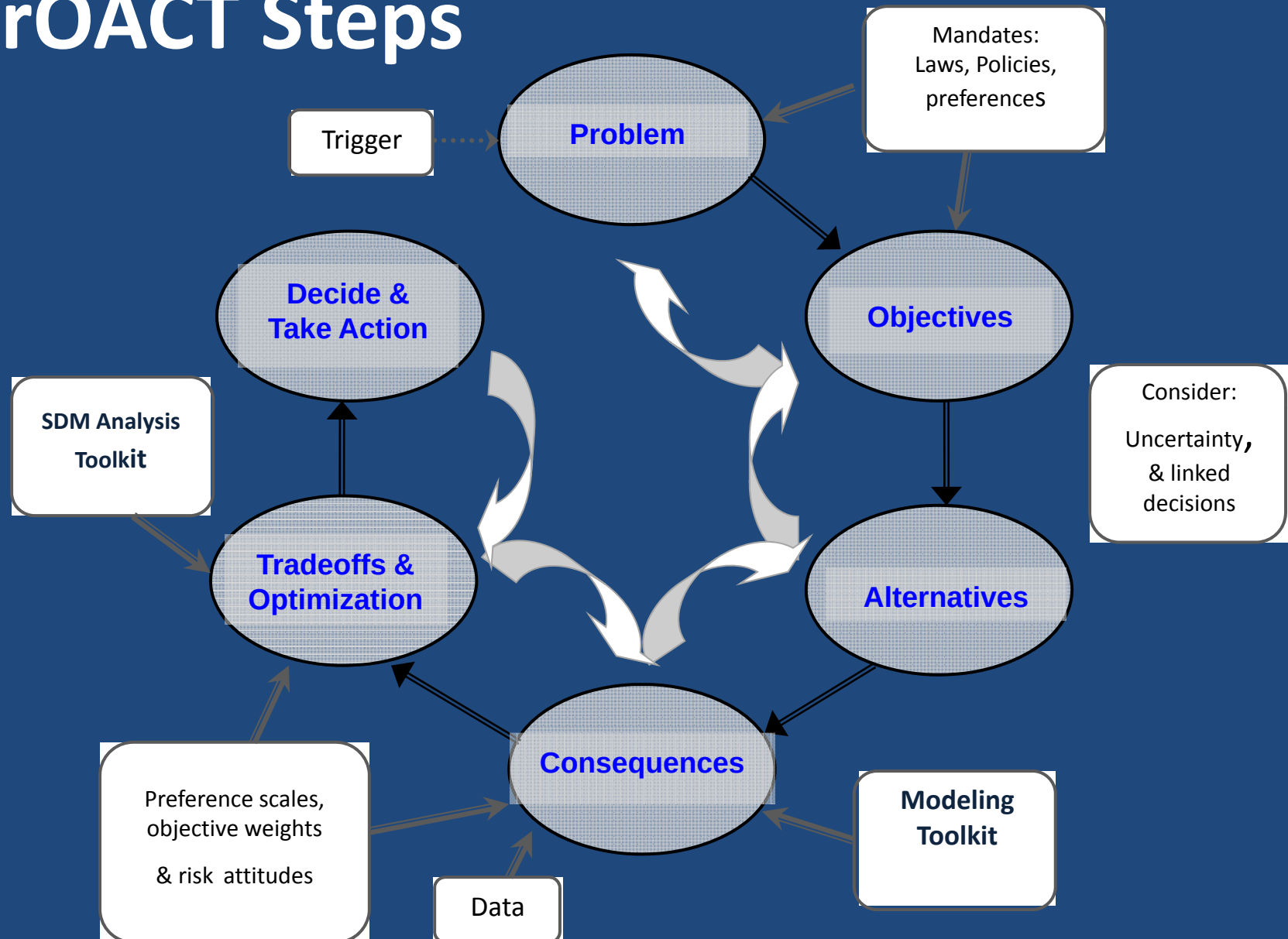
Steelhead 2011 Redds



American River monitoring - 2011

- 4% egg retention, exceeding goal of <10%
- Riverwide 51% of steelhead and 47% of Chinook spawned on gravel projects
- Floodplain inundation increased by 4.6 acres
- Hyporheic water quality
- Gravel movement and bed changes
- Juvenile salmonid habitat use
- Macroinvertebrate production

PrOACT Steps



Decision problem

- Instream habitats degraded due to CVP
 - gravel recruitment and availability
 - stream incision and loss of spawning and rearing habitat.
- Efficiently use management resources to maximize quality and amount of channel and floodplain habitat for spawning and rearing by anadromous salmonids
- Objective: Maximize natural production of anadromous fishes while minimizing management costs

Decision model

- Estimate marginal gain (Chinook outmigrants/cost)
- Tradeoffs among alternative actions and monitoring
- Model components:
 - Future habitat availability
 - Spawning
 - in-channel rearing
 - seasonally-inundated rearing
 - Streamflow during spawning and rearing
 - Fry emergence (future habitat, plus...)
 - spawning potential
 - Escapement
 - Potential juveniles (future habitat, fry, plus...)
 - Rearing potential
 - Chinook outmigrants (fry, juveniles, plus...)
 - System dynamics –spawning vs. rearing habitat

Where do we need more information?

- Parameterize model with actual data
- Create individual model components and recombine
- Sensitivity analysis – create response profiles to determine factors that have the greatest effect on utility
- Focus monitoring where additional information could cause a change in a decision

Adaptive Management – American River

- Early gravel placements focused on margin habitats (along the banks)
- Monitoring showed higher flows required for fish to utilize the placed gravel and to mobilize gravel
- Now use channel spanning placements in upriver areas where fish densities result in competition for spawning sites
- Egg retention is high when competition for spawning sites is high so trying to ease competition by providing additional spawning and rearing areas
- Overall increased emphasis on rearing habitat

Partners Make the Projects Possible

- Water Forum
- City of Sacramento
- Sacramento County Parks
- California State Parks
- California Department of Fish and Game
- California Department of Water Resources
- Army Corps of Engineers
- National Park Service
- Sacramento State
- Oakdale Irrigation District
- South San Joaquin Irrigation District
- Water Board
- Cramer Fish Sciences
- CBEC Eco Engineering
- Fishery Foundation
- National Marine Fisheries Service
- Fish and Wildlife Service
- Bureau of Reclamation

Questions?