

# Clear Creek Technical Team Combined Long-Term Operations Annual Review

Matt Brown

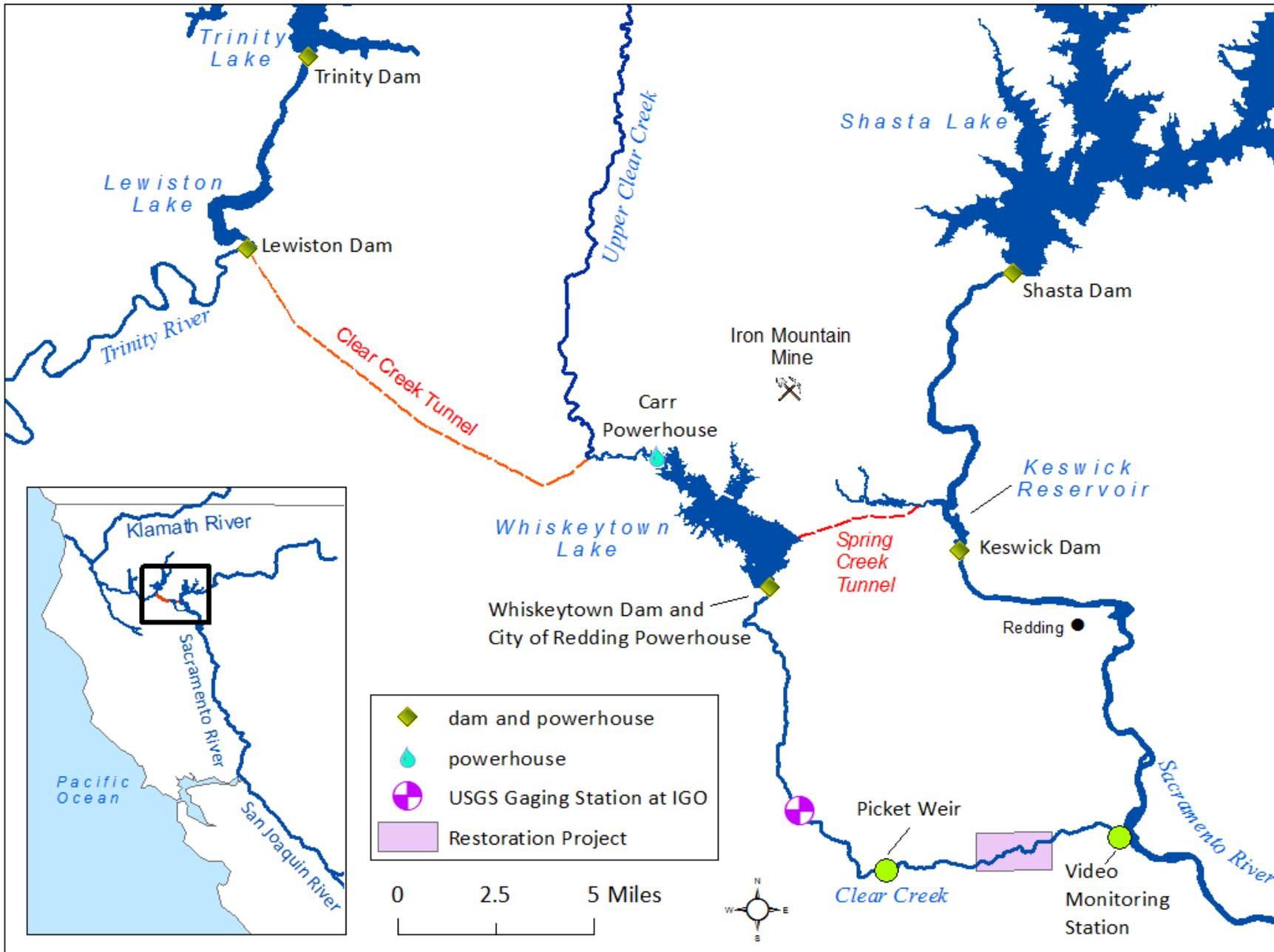
U.S. Fish and Wildlife Service

October 31, 2012

# Presentation Overview

- RPA Actions I.1.1, I,1,3 and I.1.5:
- Attraction Pulse Flows
- Connecting Spawning Gravel to Biological Results
- Temperature Control Proposals





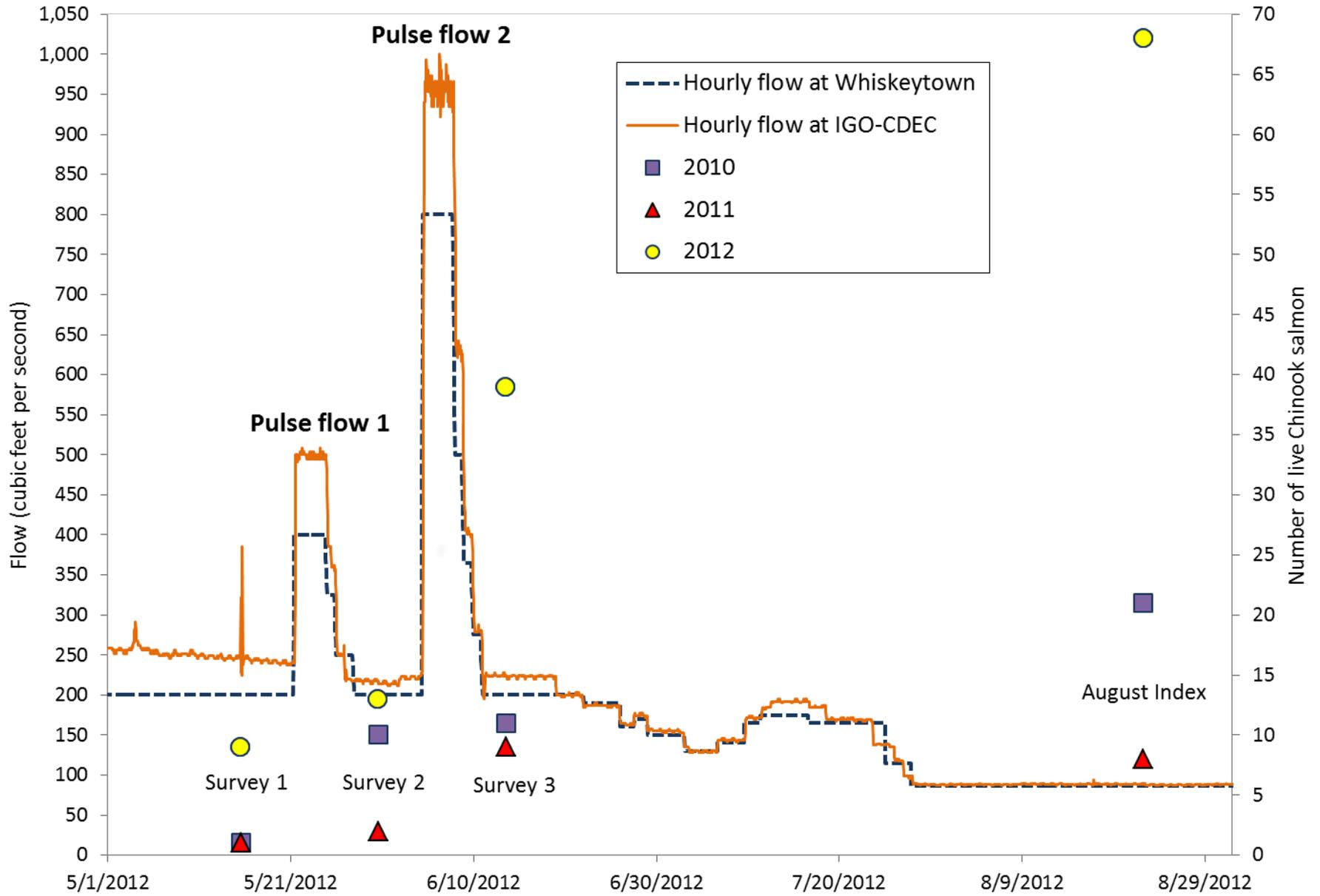
# Action I.1.1

## Spring Attraction Flows

- **Objective:** Encourage spring-run movement upstream for spawning.
- **Action:** Annually conduct two pulse flows in May and June of at least 600 cfs for at least three days for each pulse.
- **Results:** Two pulse flows were provided between May 23 and June 13, 2012 of 400 and 800 cfs.
- **Results:** Verified that higher flows could be obtained
- **Results:** **XXX**

# 2011 IRP Recommendation: Clarify Pulse Flows

- Proposal for changing the pulse flows
  - Timing, duration, magnitude
- Replication required before changing experimental conditions
- Spring Chinook migrating earlier
- Ecological positives and negatives
  - Longer term geomorphic benefits
  - Ground nesting birds and mammals



# Action I.1.3 Spawning Gravel

- Actions: Continue spawning gravel augmentation and provide report to NMFS on Implementation and Effectiveness.
- Results:
  - 5 Projects totaling 10,000 tons
  - Long-term permits
  - Long-term gravel supply
  - Report on geomorphic monitoring related to effectiveness.

# 2011 IRP Recommendation

## Gravel Augmentation

- Action I.1.3. “The discussion of meeting the intended purpose of this action was again focused on the amount of gravel injected (potential spawning habitat) into the system and not on its intended realized purpose of improving spawning conditions. **Data relating the gravel augmentation efforts to improvements in salmonid spawning success was not provided.**”

# Connecting Actions to Biological Results: Gravel Action

- Previous presentations emphasized water operations
- Project types:
  - talus cone injection,
  - lateral berm placement,
  - riffle construction,
  - stream channel / floodplain restoration
- Many scales of evaluation
- Physical to biological
- Examples of how each has informed restoration

# Watershed Scale

- Longitudinal topographic surveys, LiDAR,
- Bedload transport and Sediment budget
- Annual adult salmonid population estimates
- Annual juvenile production estimates
- Annual juvenile productivity estimates (juvenile production / adult escapement)
- Temperature monitoring system of loggers

# Spawning Reach Scale

- Topographical change, especially estimating volumes of gravel moving in and out of project sites
- Salmonid spawning habitat suitability mapping
- Salmonid spawning habitat use
- Redd distribution surveys
- Salmonid using supplemental gravel?

# Smaller Scale

- Spawning gravel evaluation: sediment size
- Juvenile habitat use studies compare salmonid densities between:
  - restored and control reaches,
  - physical habitat treatments,
  - habitat types,
  - types or presence of riparian vegetation,
- Macro-invertebrate studies comparing gravel restoration types in treated and control areas

# In 2007 to 2010, Central Valley Fall Chinook Collapsed to 24% of 1992-2006 Average

**However!**

Clear Creek **74%**

Battle Creek **9%**

Mill Creek **20%**

Deer Creek **32%**

Butte Creek **23%**

Feather River **27%**

Yuba River **34%**

American River **11%**

Mokelumne River **29%**

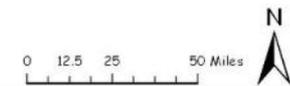
Stanislaus River **25%**

Tuolumne River **7%**

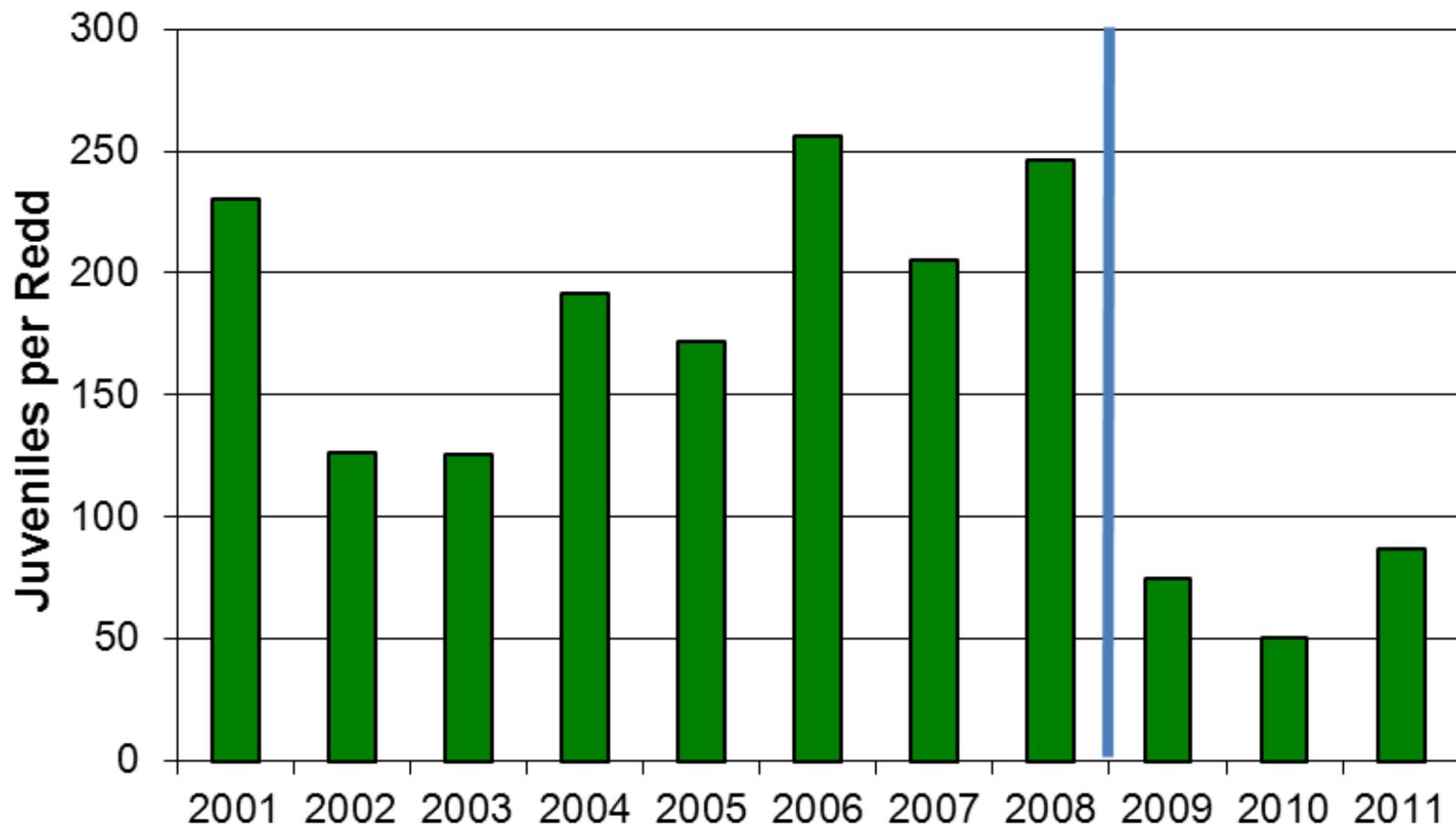
Merced River **12%**

Sacramento River **23%**

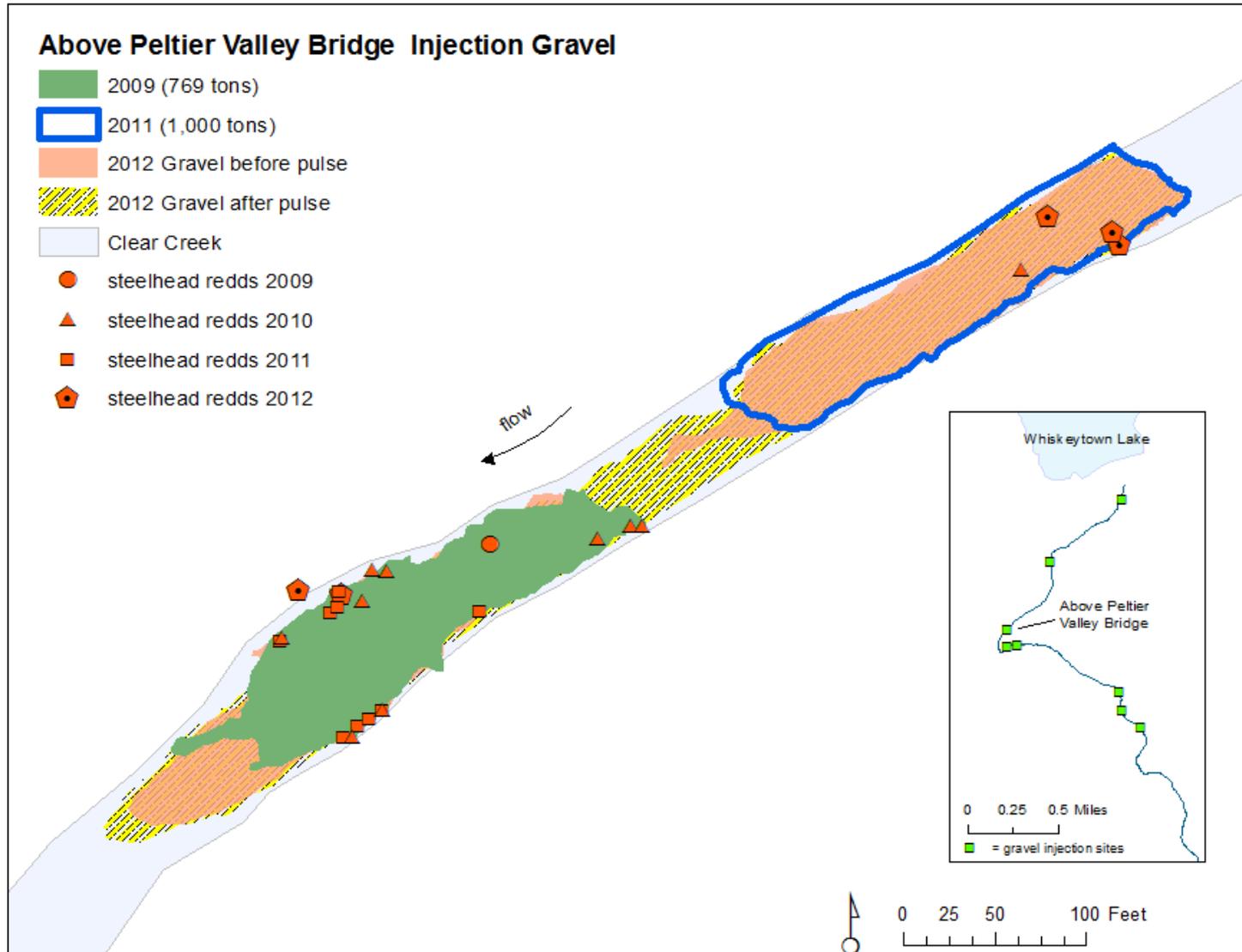
San Joaquin River



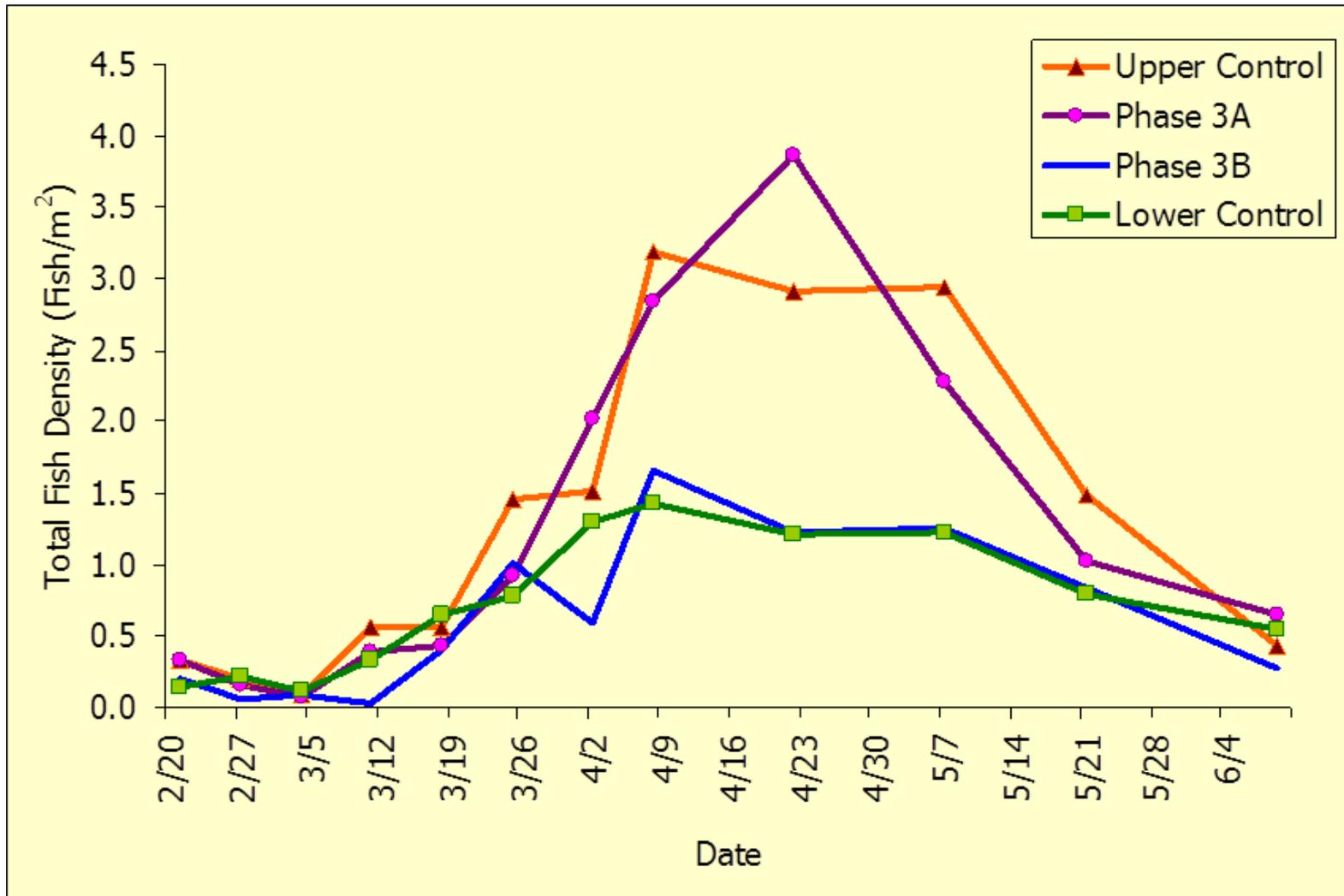
# Steelhead Juvenile Productivity Decreased 86% After 2008 Fires



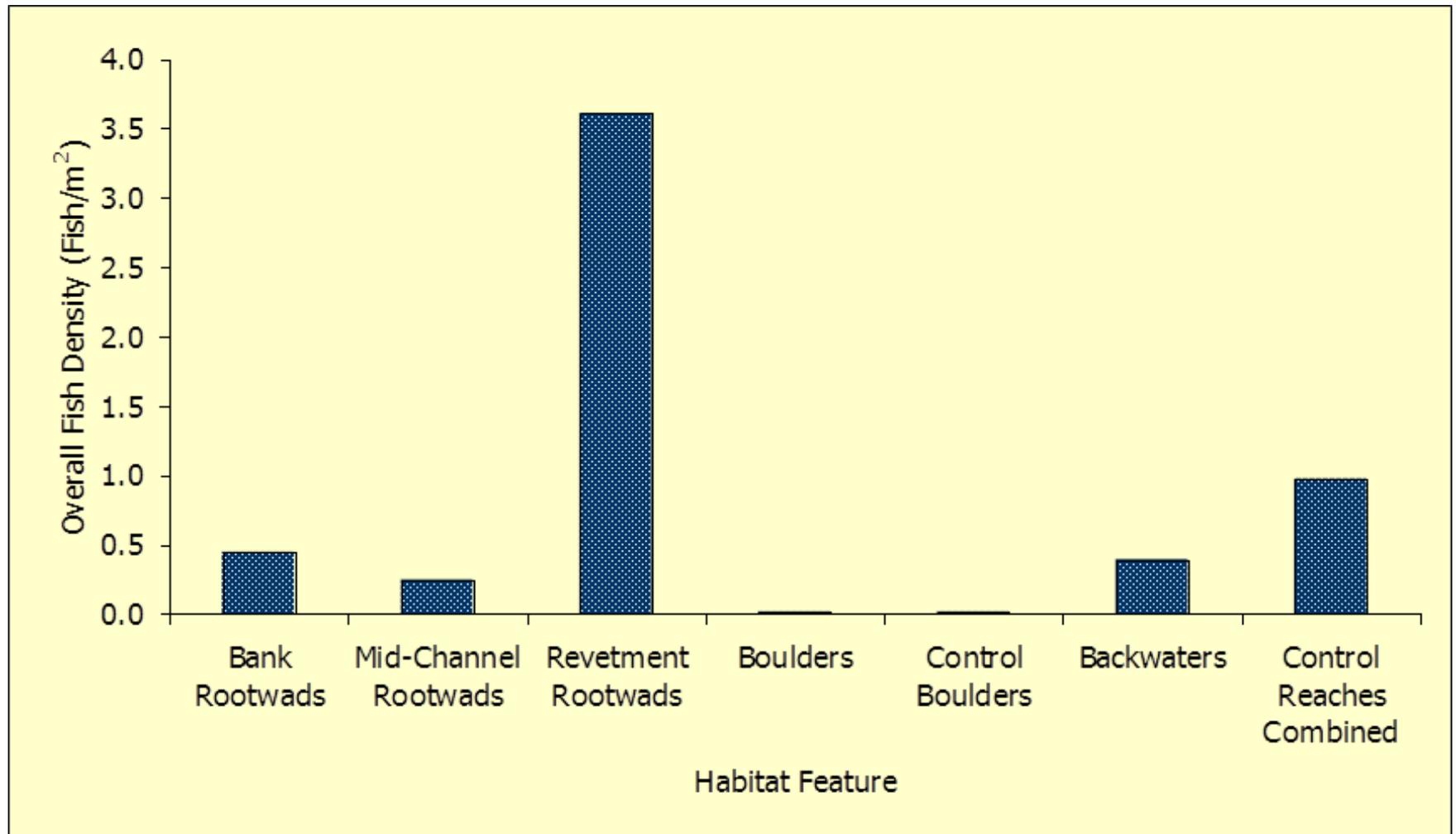
# Peltier Valley Spawning Gravel Moved Relatively Little in Pulse Flows



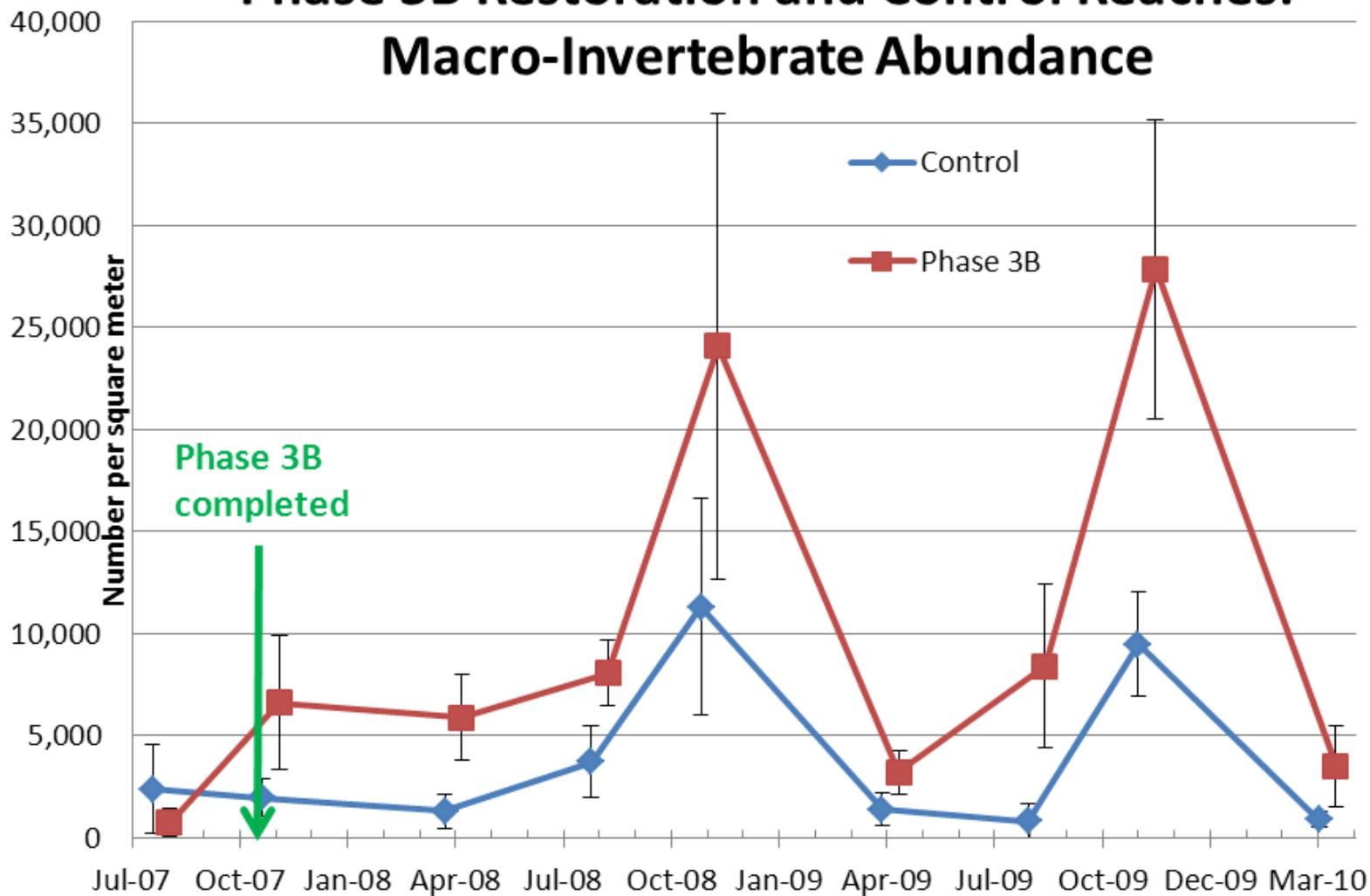
# Juvenile CHN Density Varies Between Restoration Projects- Why?



# Juvenile CHN Density Varies Between Habitats Created in Restoration Projects



## Phase 3B Restoration and Control Reaches: Macro-Invertebrate Abundance



# Action I.1.5

## Thermal Stress Reduction

- **Objective:** Reduce thermal stress to over-summering steelhead and spring-run
- **Action:** manage releases to meet mean daily water temperatures at Igo gage
- **Action:** Assess improvements to modeling water temperatures and identify a schedule for making improvements.

# Temperature Targets Are Not Being Met in Recent Years:

From	To	Target	Average 2001 to 08	2009	2010	2011	2012
Sept 15	Oct 31	56	93%	28%	26%	62%	62%?

Why?

# NMFS Concerned With Temperature Compliance

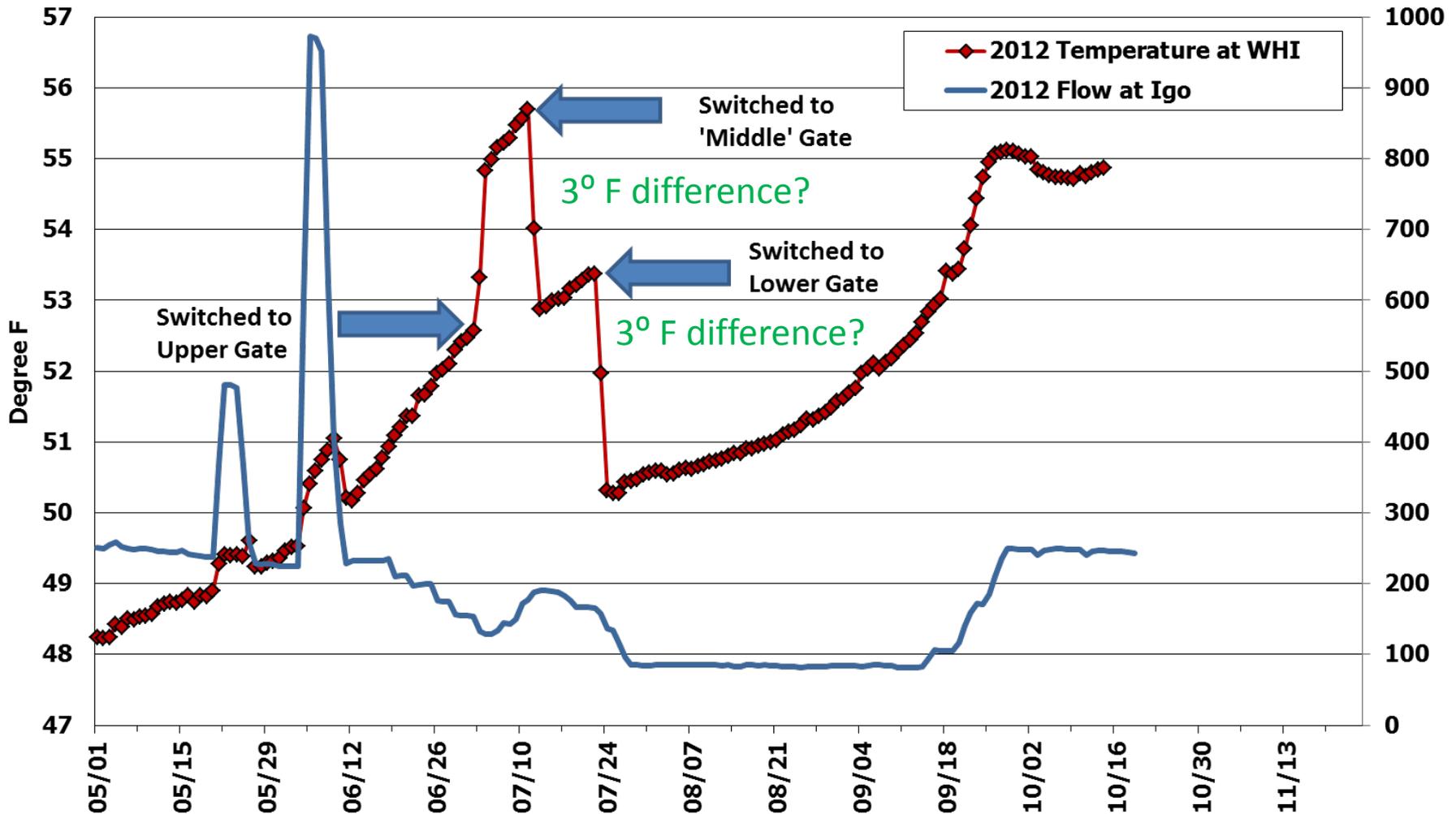
- In April 2011, NMFS wrote to BOR amending the 2009 BO. One of the purposes of the letter was to:
- “(4) highlight the need ...to explore options to avoid non-compliance with the RPA.”
- “NMFS strongly encourages Reclamation to fully explore actions that could be taken earlier in the year to avoid potential exceedences in the future, and to proactively manage and coordinate operations within the Shasta Division to ensure timely temperature compliance on Clear Creek”.

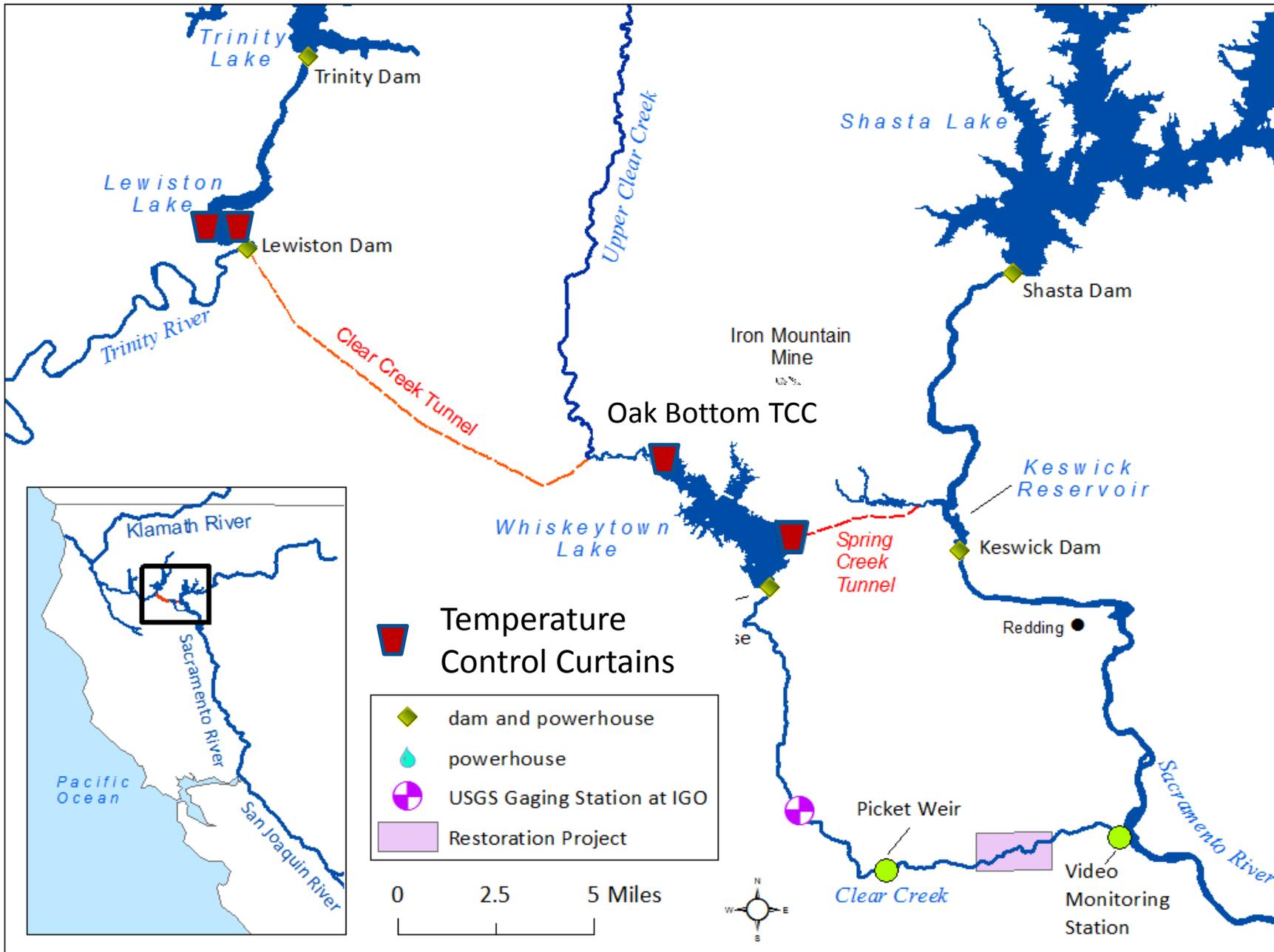
# 2012 Water Temperature Proposals

- a) Use upper Whiskeytown outlets when temperatures are not warm
- b) Replace Oak Bottom TCC
- c) Avoid full power peaking;
- d) Don't ramp down from October flows (allows higher flows during temperature control);
- e) Move Igo temperature compliance point;
- f) Improve water temperature modeling (RPA I.1.5); and
- g) Evaluate temperature control curtains (RPA I.1.4).

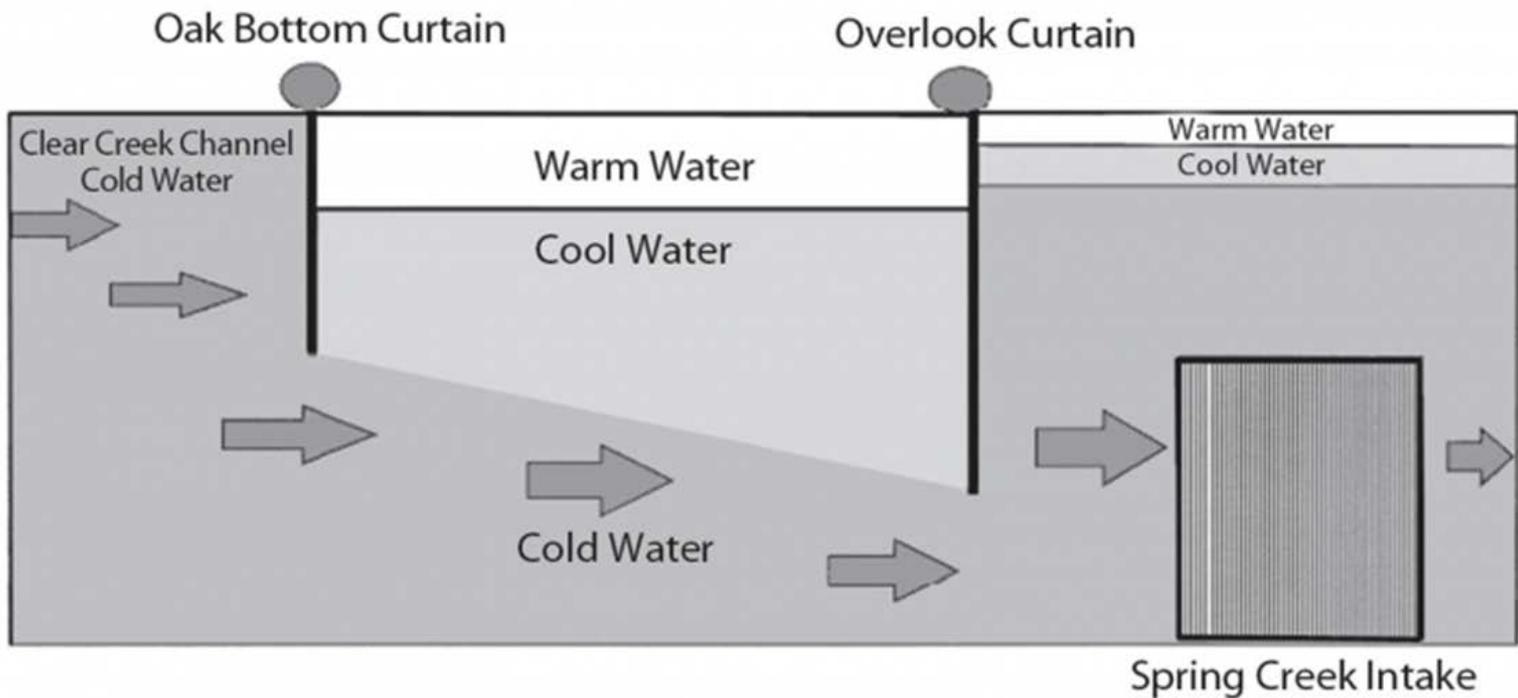
# Temperatures Changed by Outlet Gate Changes

## Whiskeytown Dam Outflow Temperature and Igo Discharge 2012

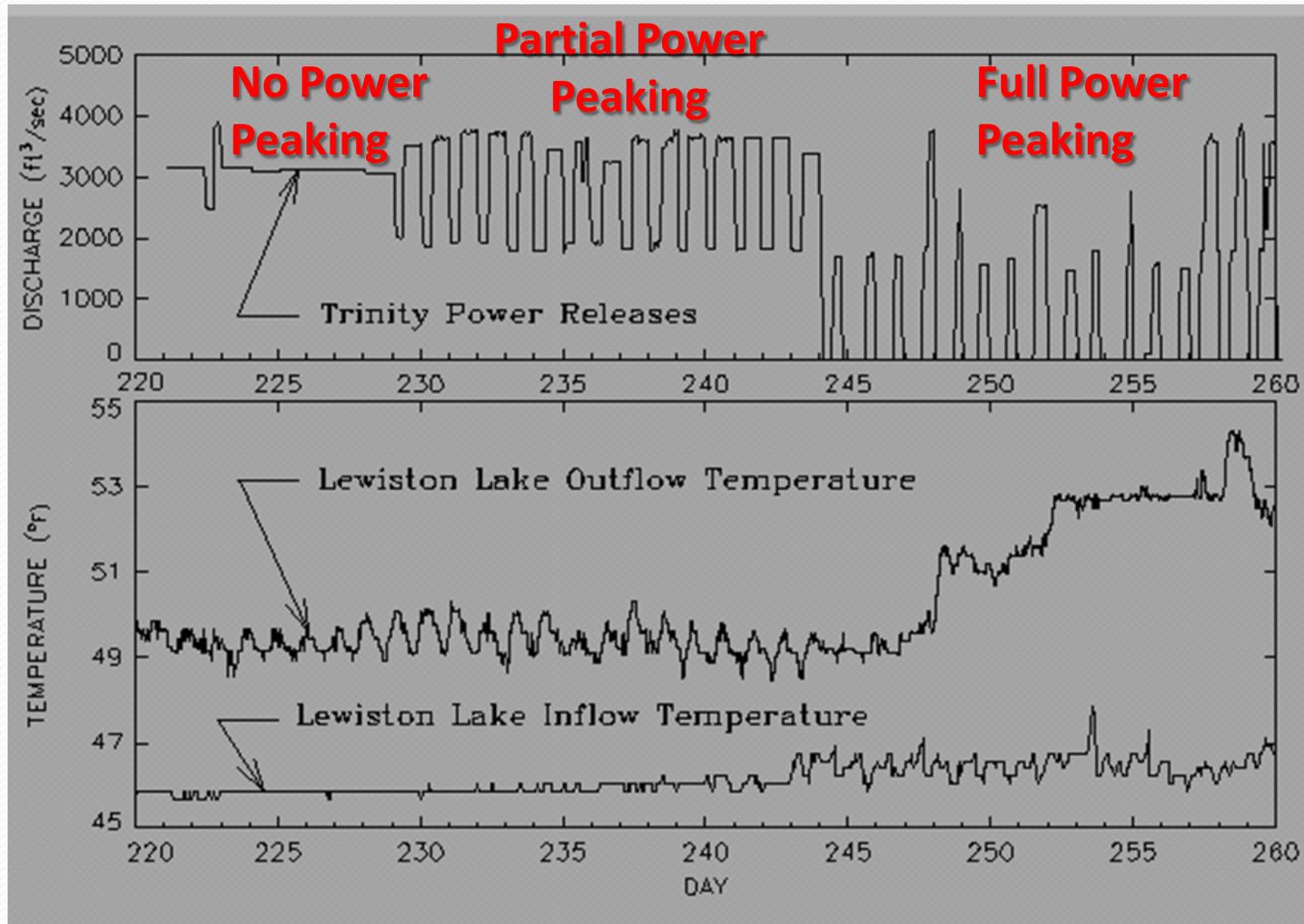




# Whiskeytown Curtains



# Trinity Powerhouse Evaluation 1994



**Figure 1** - Lewiston Reservoir operations along with inflow and outflow temperatures for August 8 - September 17, 1994. These data illustrate the temperature gain of Trinity River water diverted through the reservoir.

# Full Power-Peaking

- Warms summer water temperatures in Trinity River, Sacramento River and Clear Creek
- Reclamation studies recommend not doing it during temperature-sensitive periods
- Past Reclamation operations followed these recommendations and avoided full peaking
- Request to avoid full power peaking
- Experiment with lowest level of partial peaking

# Differences Between 1994 and 2012

- No ROD then vs. ROD now
- All TCC working then vs. 3 TCC working now
- Additional release in 2012 for lower Klamath increased flows in Lewiston during full peaking at Carr PH
- No full power peaking from Trinity PH in 2012
  - Don't expect to see large change in Carr temperatures
- To evaluate full power peaking at Carr PH need to evaluate temperatures downstream of mixing in Whiskeytown, and at outlets
- Temp logger arrays deployed and ADCP used to measure flows

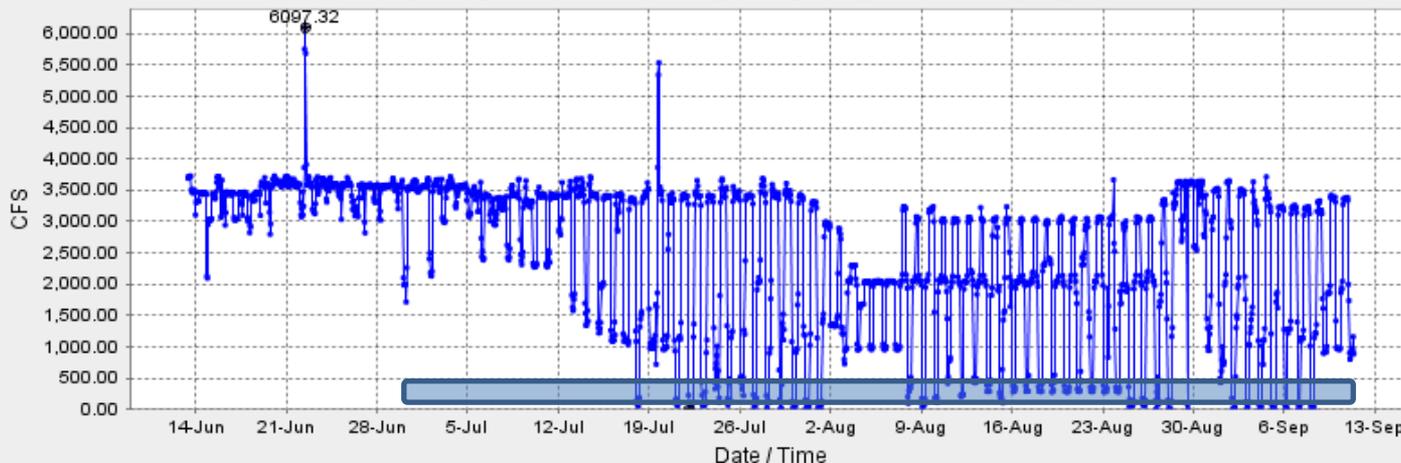
# Full Power Peaking Avoided at Trinity PH

## 2011 Discharge

### TRINITY LAKE ( CLE )

Date from 06/13/2011 09:33 through 09/11/2011 09:33 Duration : 90 days

Max of period : (06/22/2011 11:00, 6097.32) Min of period : (07/22/2011 02:00, 0.0)



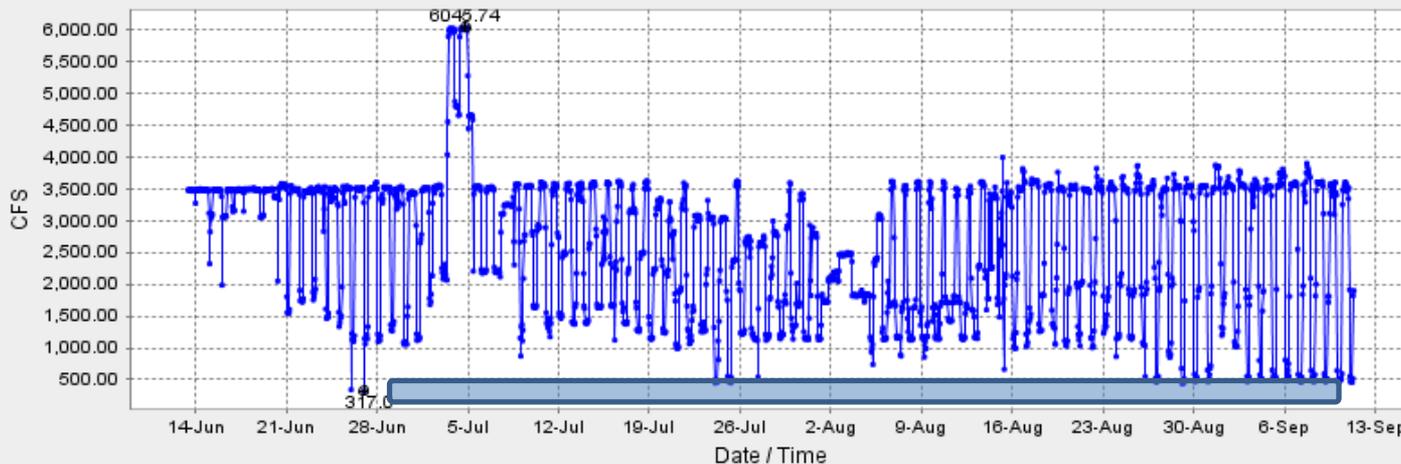
— RESERVOIR OUTFLOW - CFS (403)

### TRINITY LAKE ( CLE )

## 2012 Discharge

Date from 06/13/2012 09:33 through 09/11/2012 09:33 Duration : 90 days

Max of period : (07/04/2012 20:00, 6045.74) Min of period : (06/27/2012 00:00, 317.0)



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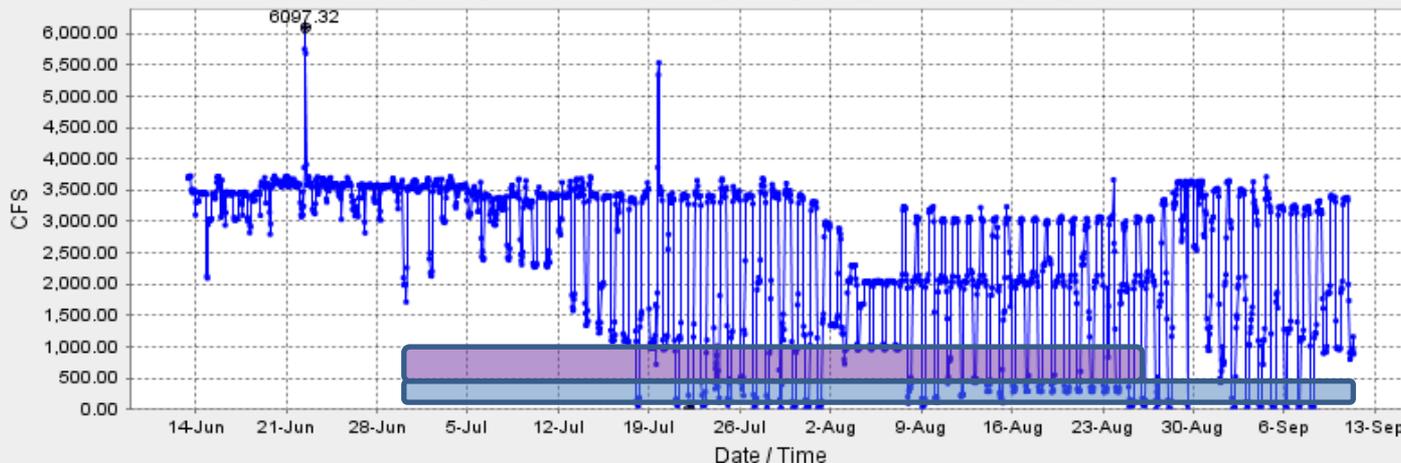
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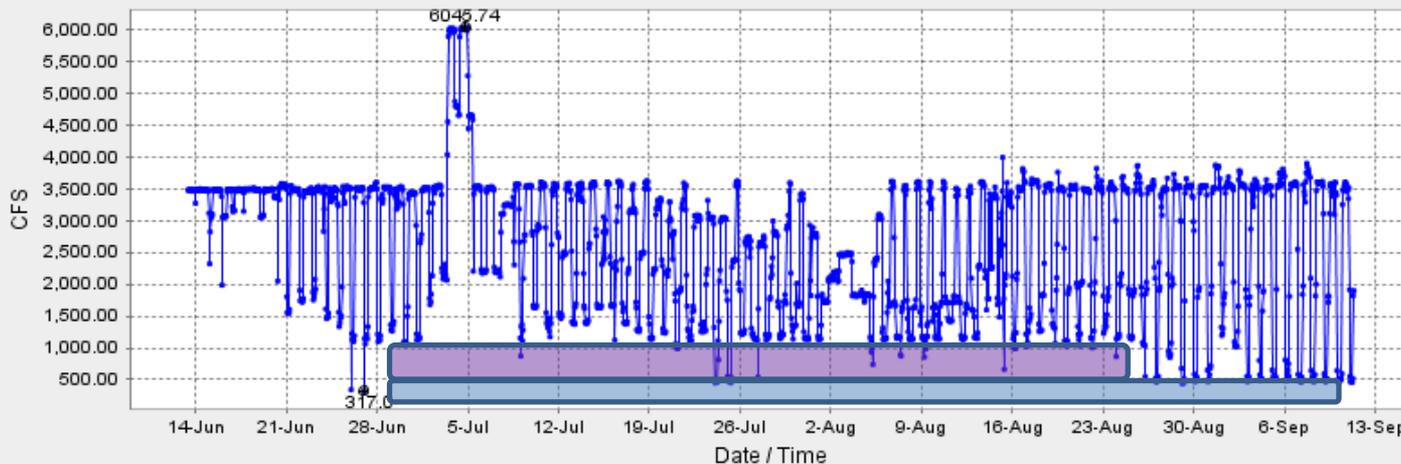
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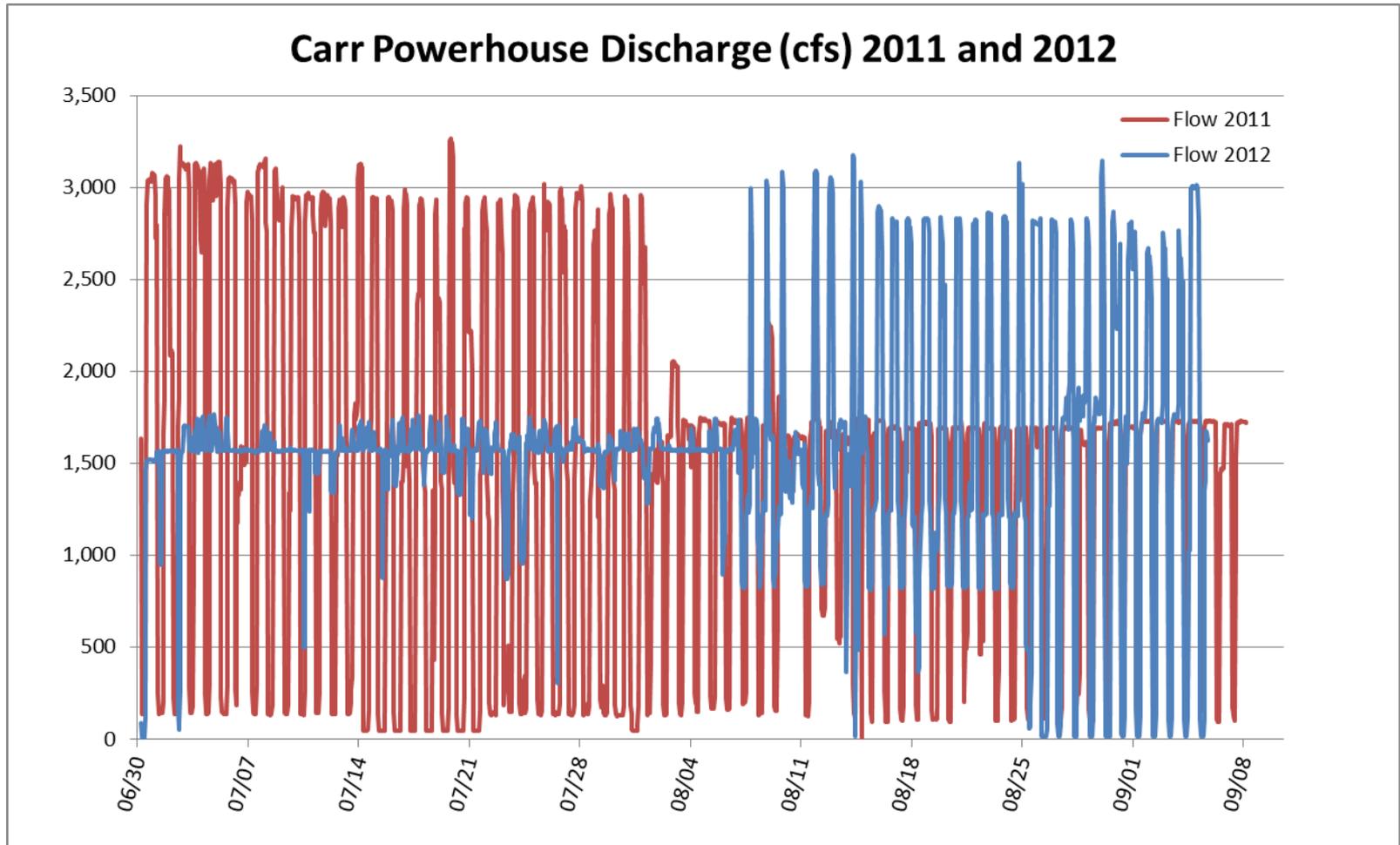
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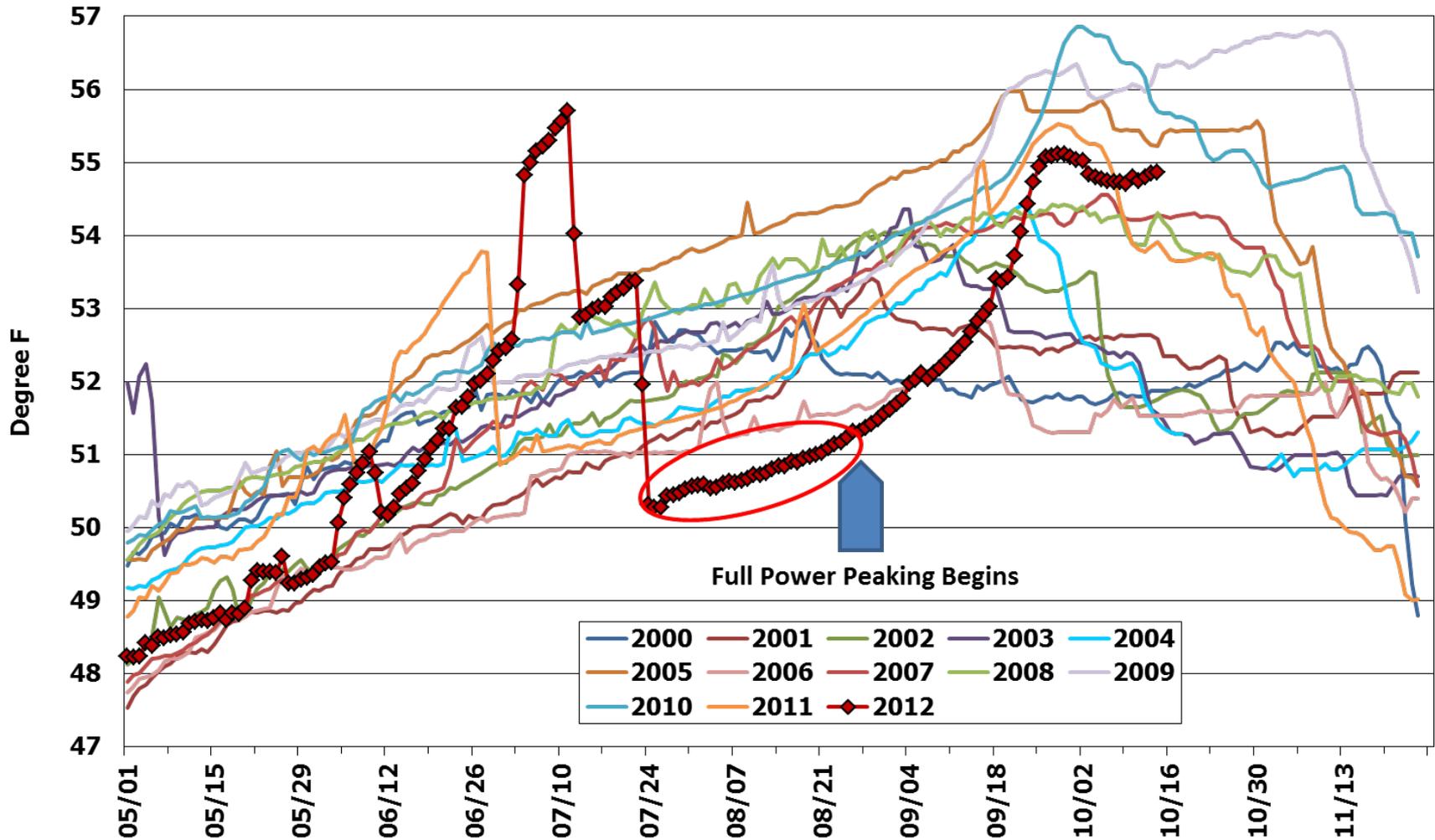
— RESERVOIR OUTFLOW - CFS (403)

# Full Power Peaking at Carr PH Avoided Through August 26, 2012

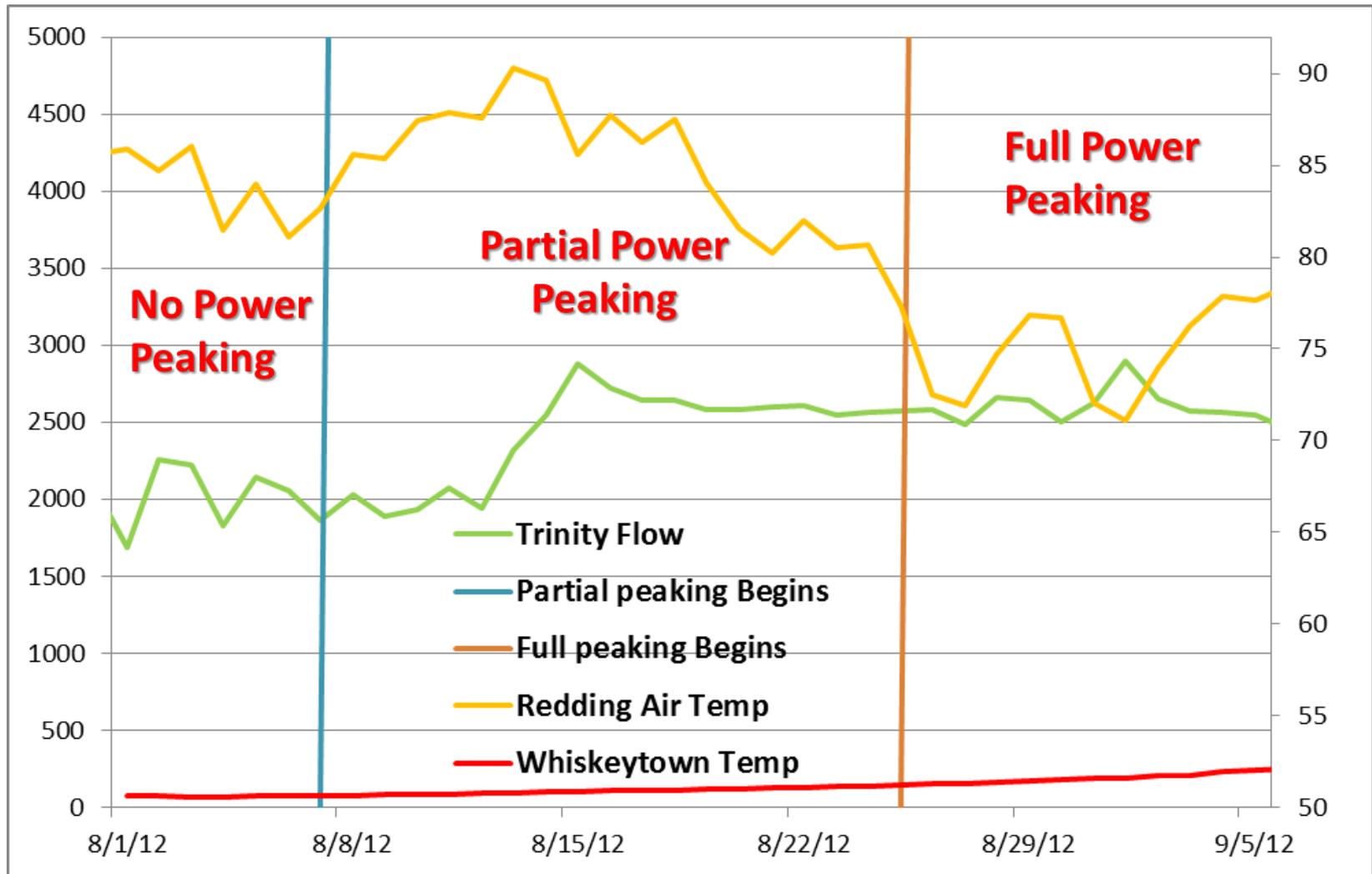


# Avoiding Full Power Peaking Associated with Temperature Improvement In Whiskeytown?

## Whiskeytown Dam Outflow Water Temperatures 2000-2012



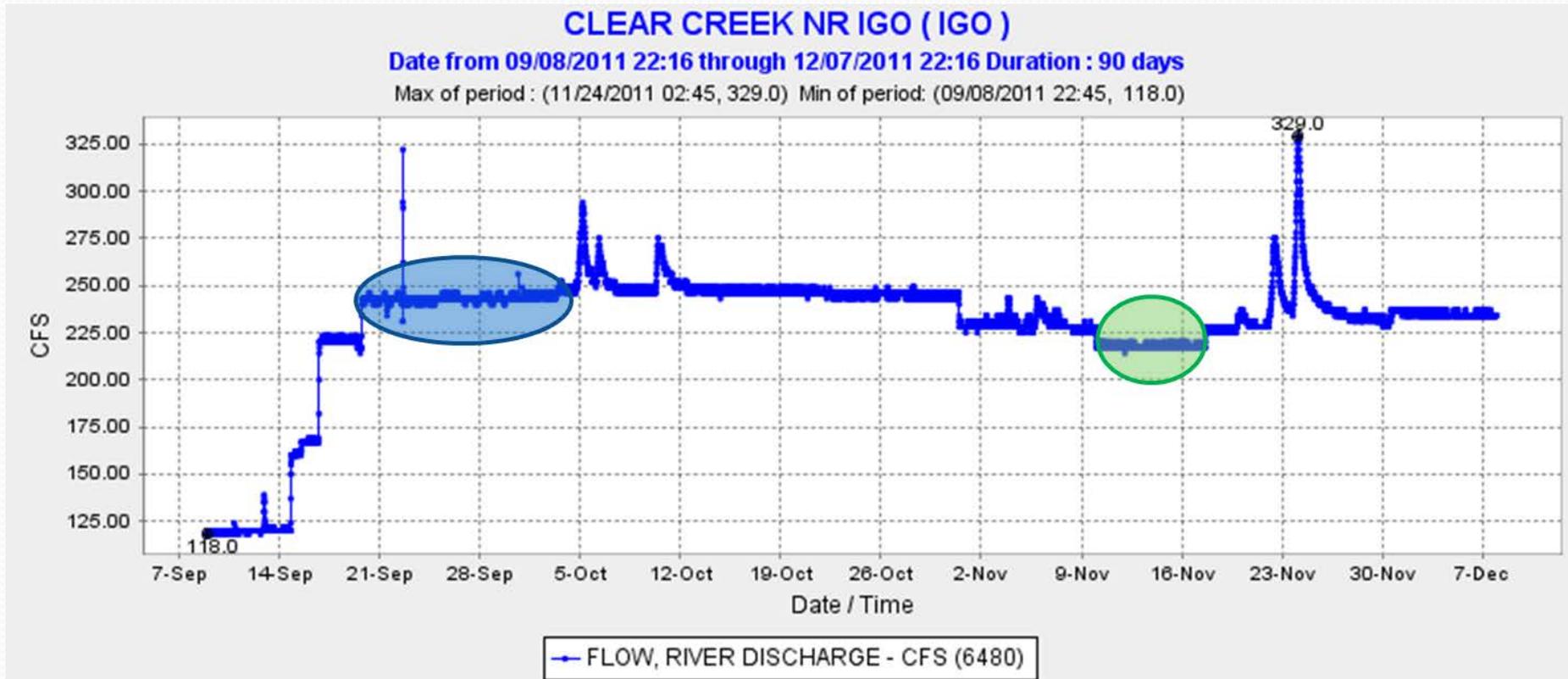
# Air Temperatures Drop 20 degrees F and Trinity Releases Increase When Full Peaking Begins



# Reasons Considered Why 2012 Whiskeytown Outflow Was Cooler

- Use of upper and lower WHI outlets. **Yes!**
- Full Power Peaking avoided at Trinity and Carr powerhouses. **Yes?**
- Increased Trinity or Carr water volume. **No**
  - Klamath releases came later: Aug. 13 to Sep. 19
- Lower water temperature of Trinity Release. **No**
- Lower Redding air temperature. **No**

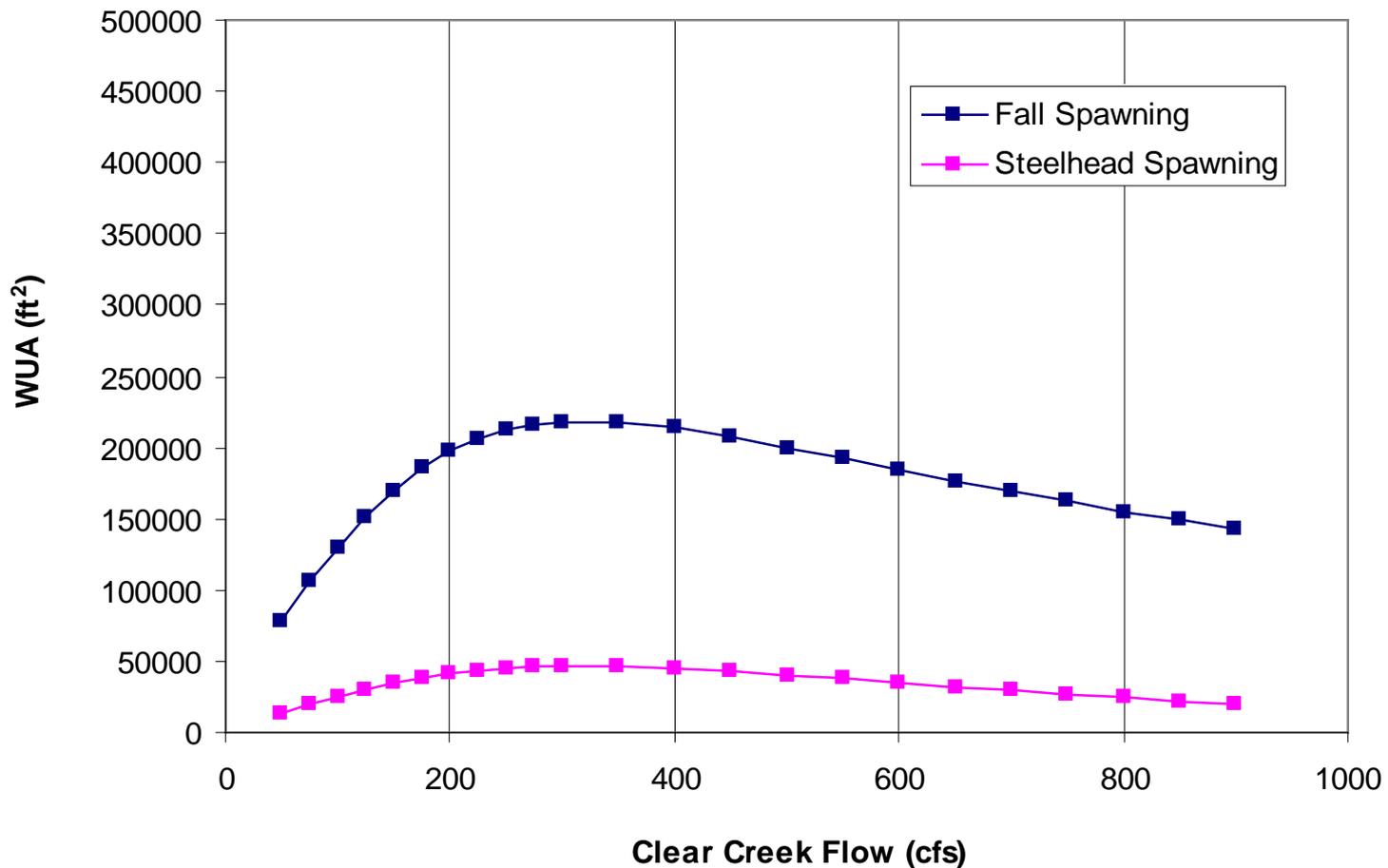
# Don't Ramp Down After October Flows: Allows Higher Flows During Temperature Control



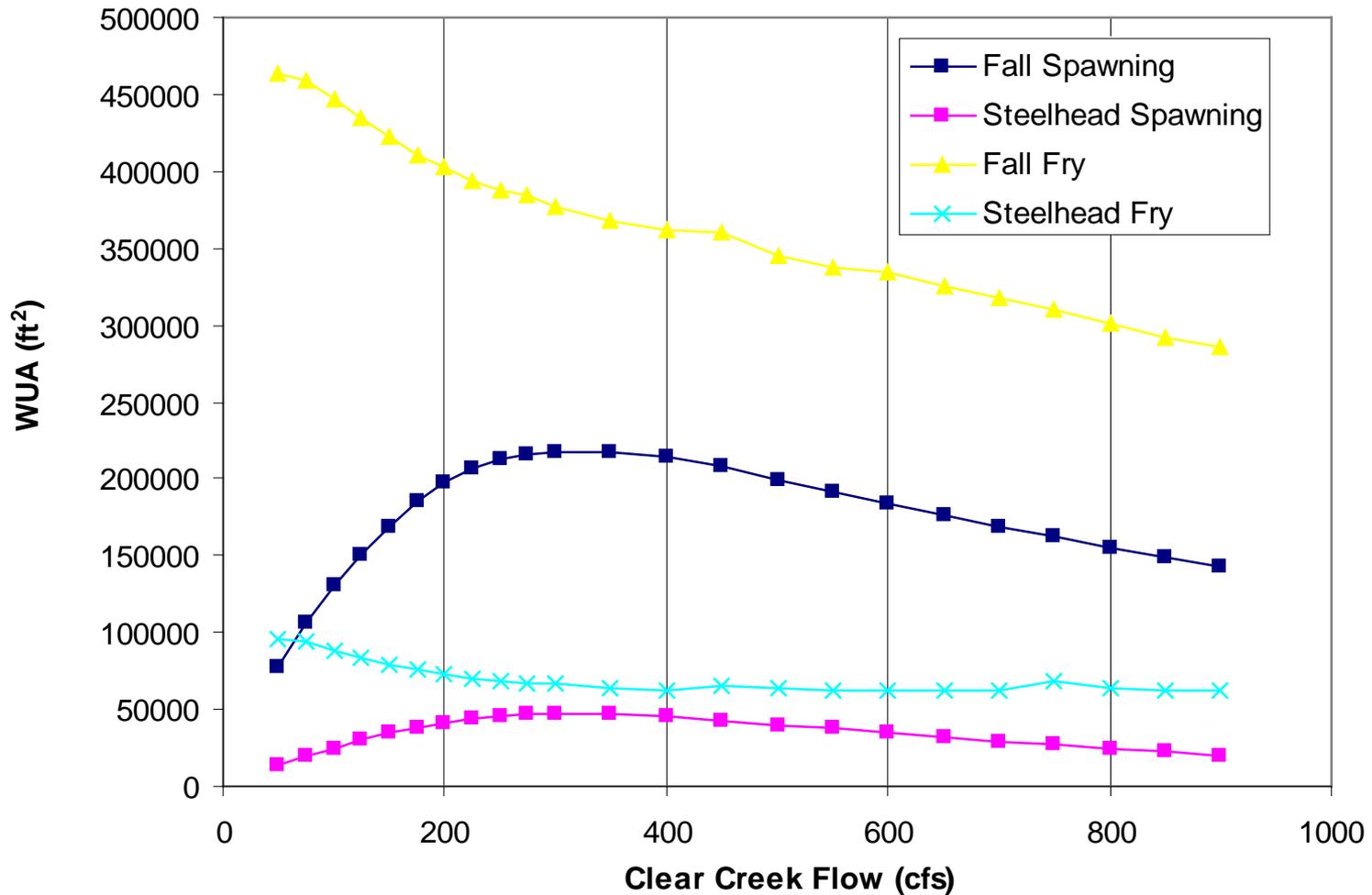
# Alternatives Team Considered:

- Maintain October 31<sup>st</sup> flows through May 31st
- Options that could still de-water redds:
  - Ramp down flows as temperatures decrease- almost daily operations
  - Ramp down flows from November 1 to 30
  - Ramp down flows as accretions increase- but there are no accretions in Reach 1 where spring Chinook spawn
- Always require higher flows through May 31st

# Spawning Habitat in Lower Reaches Peaks at 300 cfs

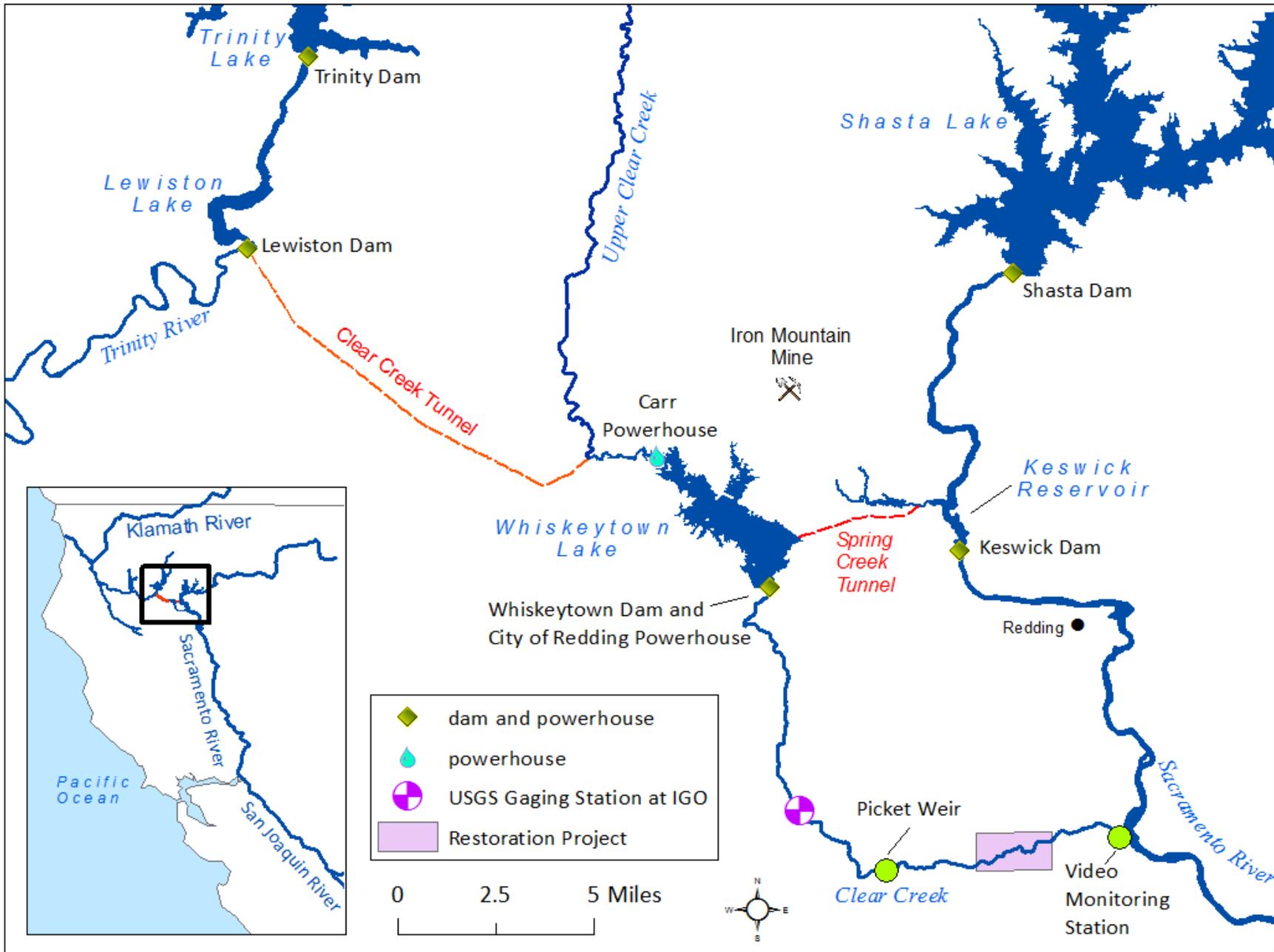


# Rearing Habitat in Lower Reaches Peaks at 50 cfs



# Considerations:

- Higher flows provide more spawning habitat- IFIM
- Would increase flow variability between years
- Additional water required:
  - Nov. thru May @ 25 cfs = 10,500 a.f.
  - Nov. thru Dec. @ 25 cfs = 3,022 a.f.
- Other temperature, operational or power impacts?
- Warmer years require more water which may not be available
- Base flows on water year type or water availability?  
Ramp-down in some year types?



# Change the Temperature Compliance Point

- From Igo gage at rivermile 10.9 to the spring Chinook segregation weir at river mile 7.4
- Includes all of the “spring Chinook spawning area”
- 50% further downstream (1/3 of spawning area)
- Provides greater protection for steelhead and spring Chinook juveniles further downstream (think rm 1.7)
- Easily achieved June to Sept 15.
- How limited is the Whiskeytown cold water pool?
- Model downstream water temperatures

# What Could Modeling Include?

- Compare affects of different operations on cold water pool in Whiskeytown and the other two reservoirs.
- Tradeoffs with Trinity and Sacramento River
- Change pattern and volume of delivery
- Investigate ways the Whiskeytown cold water pool could be increased and/or prolonged into the summer.
- How would using less water during the summer effect the duration of the coldwater pool?
- What causes accelerated warming in September?

## “The IRP Believes that a Model for Management of Whiskeytown Reservoir Would Be Valuable.”

- “The panel suggests that a more quantitative model-based program is needed to efficiently utilize the limited cold water resources in the Central Valley reservoirs...”
- “...take real definitive actions to better coordinate the temperature control programs and commit real resources...”
- “...includes alternative operations like seasonal shifts in Trinity River diversions to maintain cold water moving through the reservoir to the Sacramento River.”
- “...measuring and reporting real-time water column temperatures in the reservoirs and possibly additional stations in the Sacramento River and tributaries that impact water temperature .”

# Wrap Up

- Attraction Pulse Flows
- Connecting Spawning Gravel to Biological Results
- Temperature Control Proposals

# Thanks!

