RECLAMATION

Managing Water in the West

Fall 2013 HFE Protocol Decision Process

Glen Knowles
Katrina Grantz
Nick Williams
Bureau of Reclamation

Glen Canyon Dam
Adaptive Management Program
TWG Webinar
November 6, 2013

U.S. Department of the Interior
Bureau of Reclamation

HFE Decision Making Process

1. Planning and Budgeting Component
   - Annual resource status assessment
   - GCDAMP Annual Reporting (Jan 28-29, 2013)
   - GCDAMP Budget and Work Plan Process
2. Modeling Component
3. Decision and Implementation Component
   - Review Modeling Component
   - Review Status of Resources
   - GCDAMP- Consultation with agencies and tribes, AMWG and TWG presentations
   - Basin States Consultation
   - DOI/DOE Technical Team Recommendation/DOI GCD Leadership Team Decision (Oct 25, 2013)

RECLAMATION

HFE Protocol Parameters

Possible Timing

- **March-April and October-November through 2020**
- **Spring HFEs will not be considered until 2015**

Duration range

- **1 hr – 96 hrs (at full magnitude)**
- **1 ½ days – 6 ½ days (including ramping)**

Magnitude range

- **31,500 cfs – 45,000 cfs (depends on maintenance and reservoir conditions)**

Ramping rates

- **Ramping rates are defined by 1996 ROD and 1997 Glen Canyon Dam Operating Criteria (62 FR 9447, 4,000 cfs up and 1,500 cfs down)**

Model Constraints

- **"the Leadership Team's view is that it would be inappropriate to adjust the model output in a way that would increase the amount of water to be released or increase power costs associated with an HFE release." November 7, 2012 memo from Anne Castle**

RECLAMATION

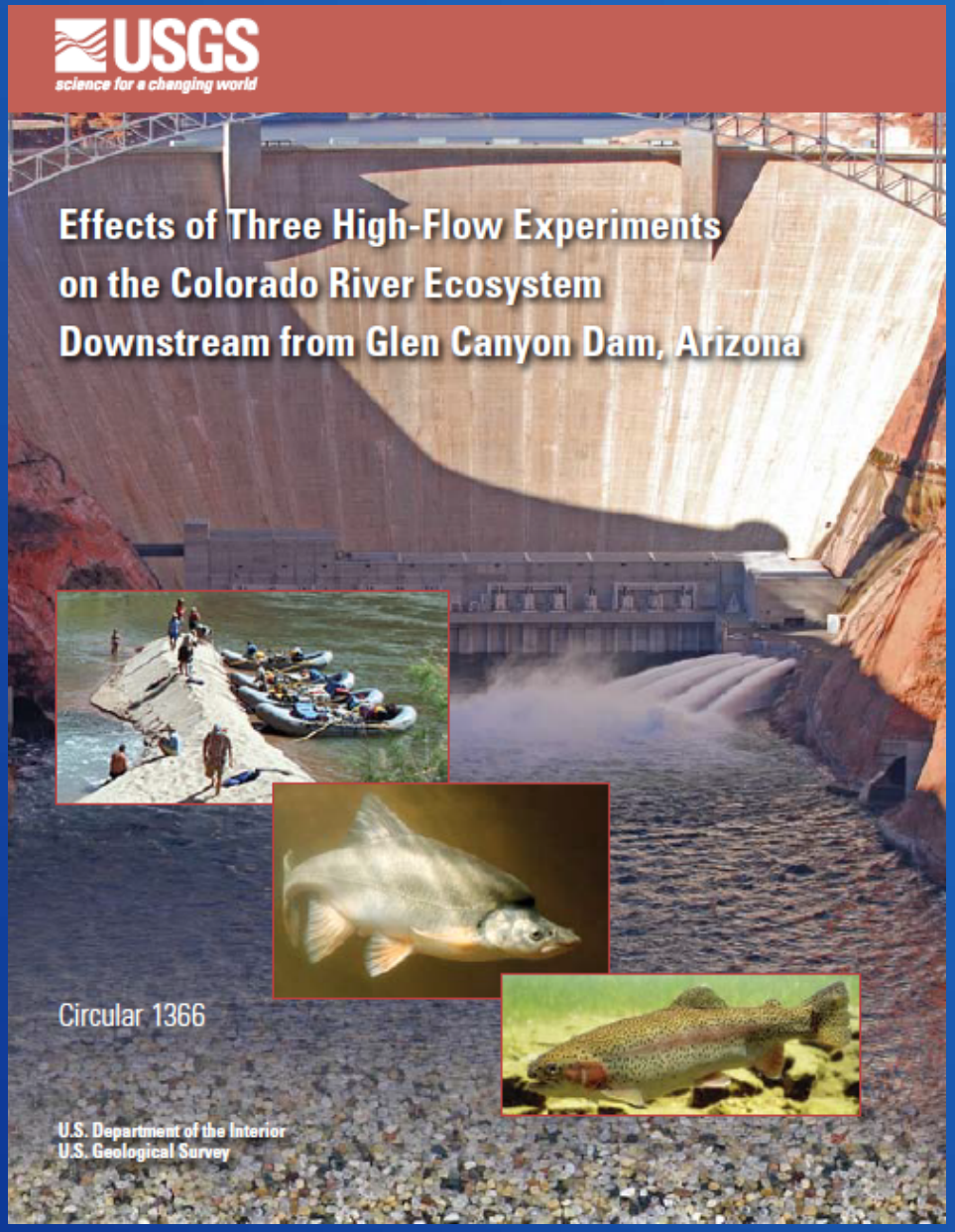
HFE Protocol Reporting

1. GCDAMP Annual Reporting meeting every January.
2. Updates at TWG and AMWG GCDAMP meetings.
3. Meet with the HFE MOA consulting parties and consult with tribes as needed.
4. The HFE Technical Team report to the Secretary's Glen Canyon Leadership Team for their consideration in HFE decisions.
5. US Fish and Wildlife Service report early each year on the effects of prior HFEs and conservation measures of the FWS biological opinion (first report Feb 2014).

RECLAMATION

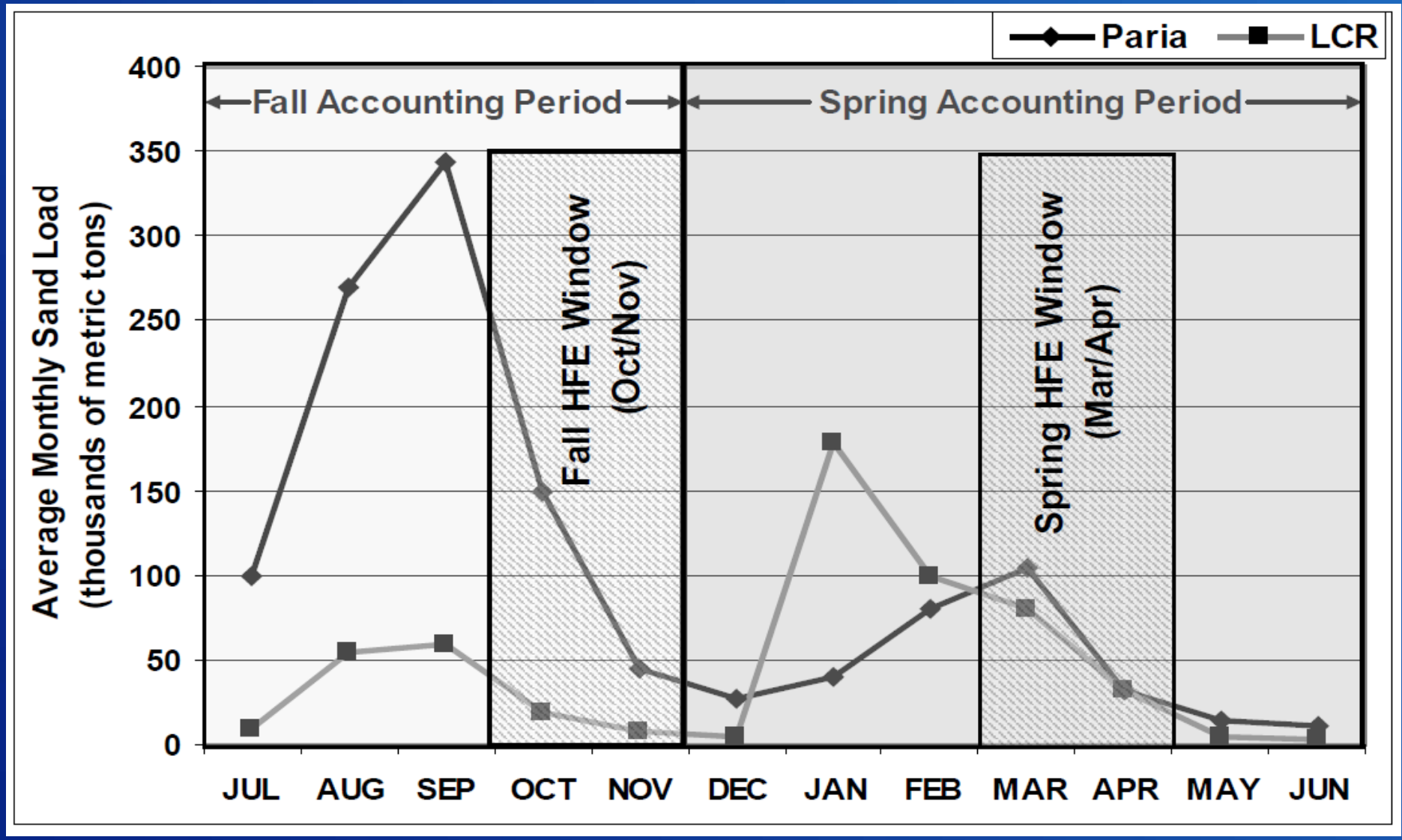
USGS Circular 1366

- Synthesis report of results of 1996, 2004, 2008 HFEs.
- Extensive summary of effects to physical and biological resources.
- Forms basis for Tech Team Report
- Available online at *pubs.**usgs**.gov/circ/**1366**/c**1366**.pdf*



RECLAMATION

Modeling Component



RECLAMATION

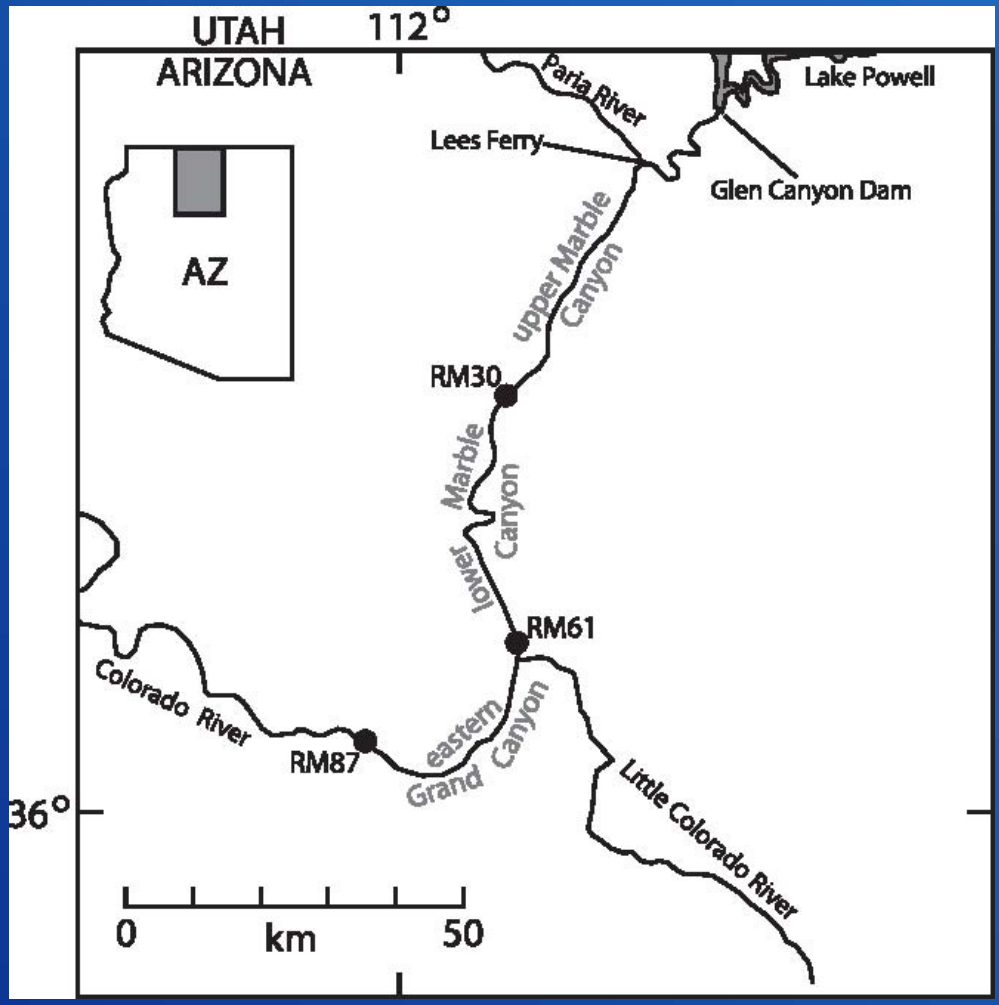
Sand Budget Model

- Developed from USGS model (Wright et al. 2010)
  - Empirically based rating curves
  - Computes sand budget in 3 reaches
- Inputs:
  - Hourly Paria sand load
  - Antecedent conditions (bed thickness, median grain size)
- Determines HFE peak and duration
  - Potential HFE range:
    - 45,000 to 31,000 cfs, 96 hours to 1 hour
- Output
  - Sand mass balance between RM 0 and RM 61

RECLAMATION

Model Reaches

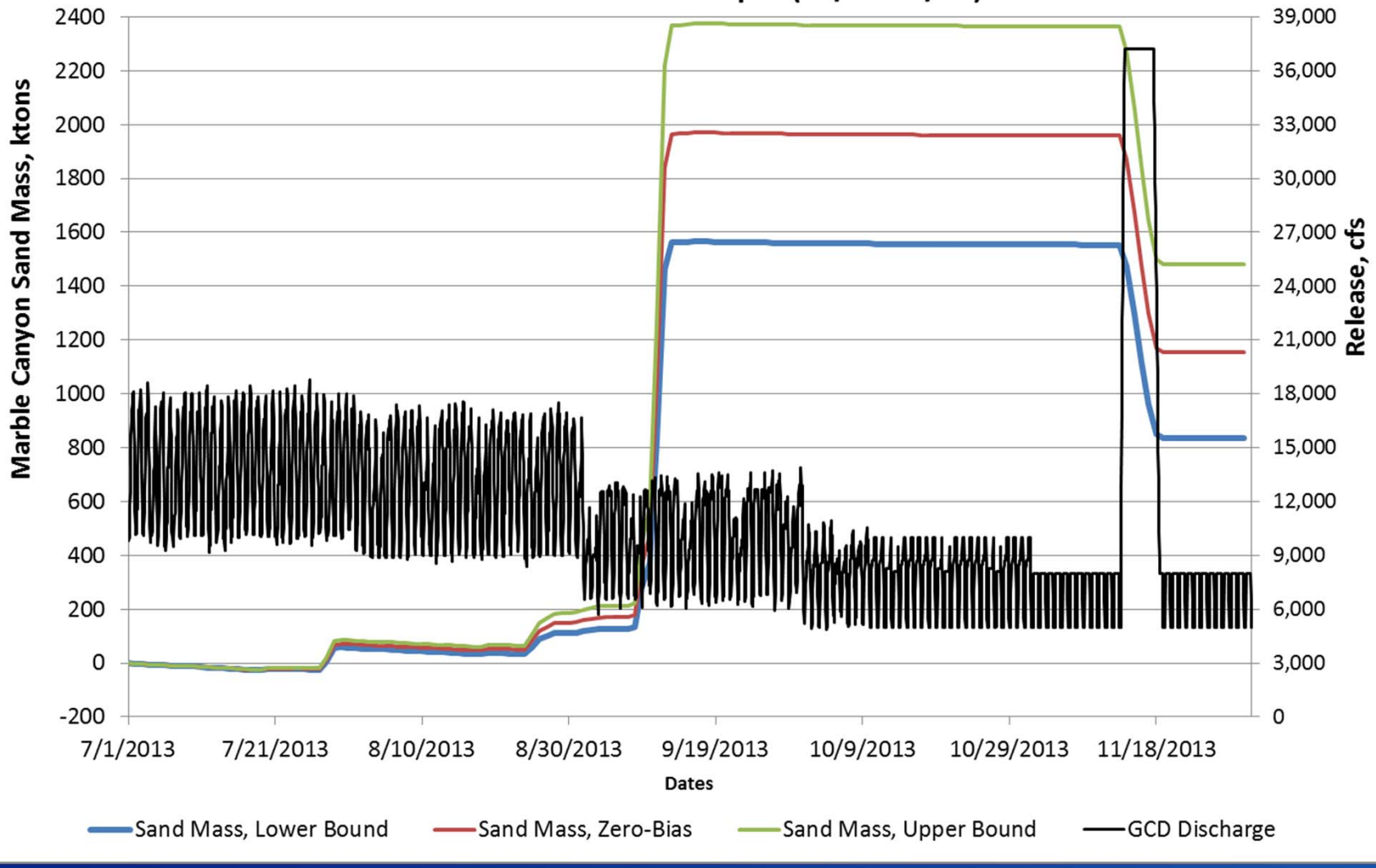
- **Sand Budget Model Reaches**
  - **RM30 (upper Marble Canyon)**
  - **RM61 (lower Marble Canyon)**
  - **RM87 (eastern Grand Canyon)**



RECLAMATION

****PROVISIONAL****

Sand Budget Model Results, 2013 Jul - Nov
Paria Sand Input through 9/30/2013
Zero Future Paria Sand Input (10/1 - 11/30)



RECLAMATION

2013 HFE Recomendation

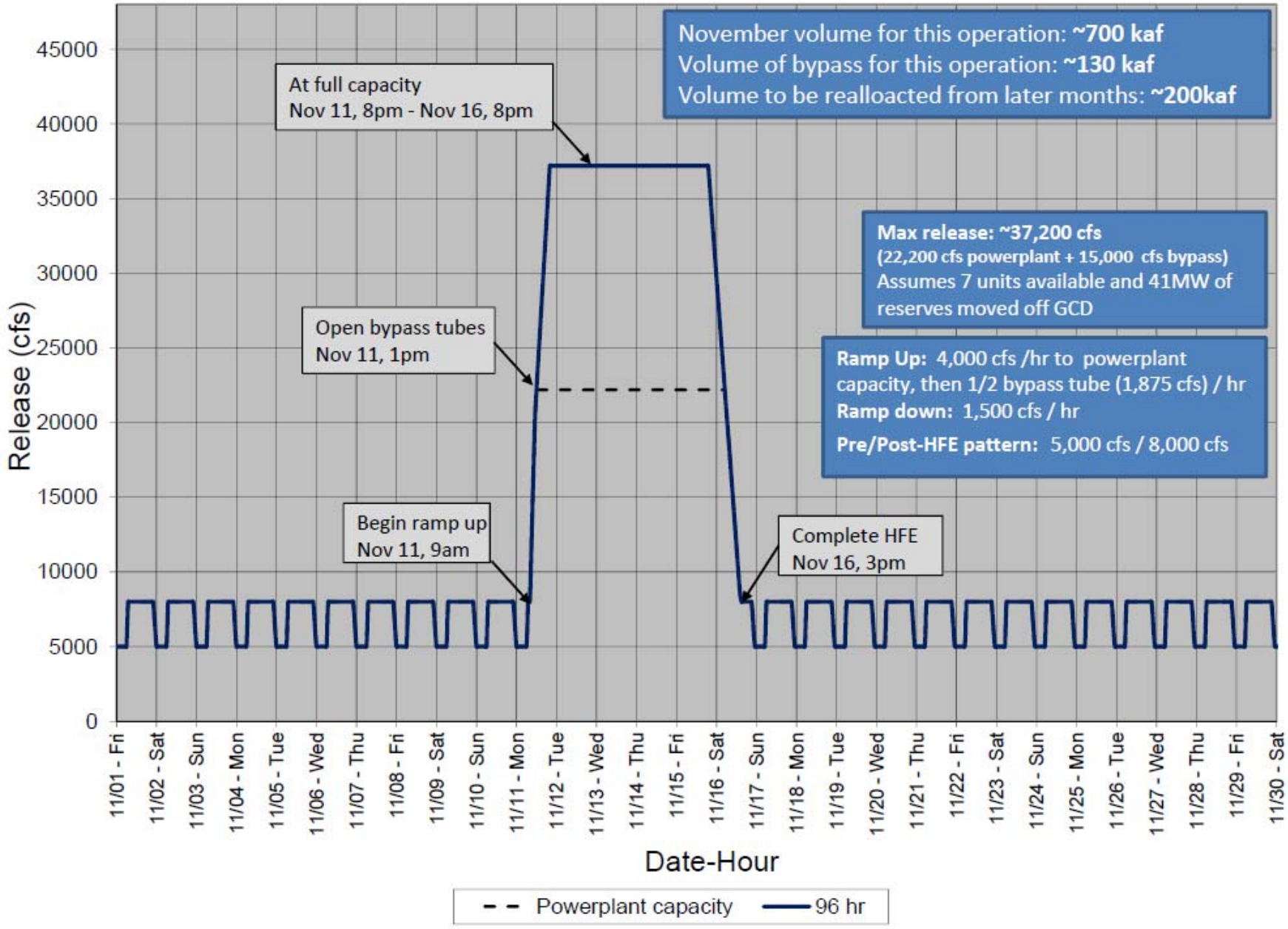
DOI/DOE Technical Team recommends that the HFE:

- Ramp up from base releases at 4,000 cfs/hr at until reaching powerplant capacity (~22,200 cfs)
- Ramp up from powerplant capacity to full bypass (~37,200 cfs) at half a bypass tube (~1,875 cfs, consistent with prior HFEs) per hour in 8 hrs
- Stay at peak release (37,200 cfs) for 96 hrs
- Ramp down from peak release to base releases at 1,500 cfs/hr

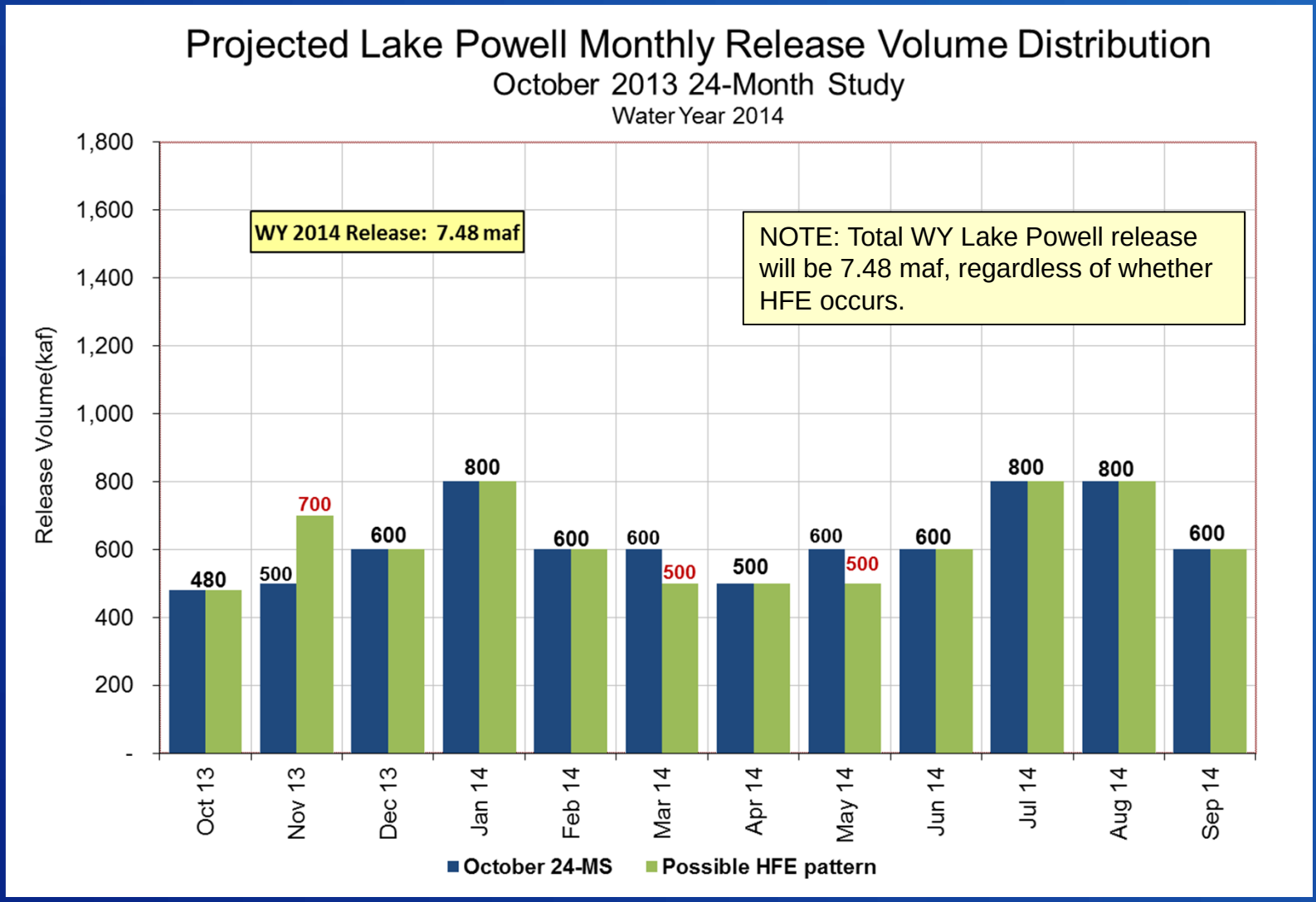
- Begin ramp up from 5,000 cfs at 9:00 am on November 11
- Reach powerplant capacity at 1:00 pm November 11
- Open bypass tubes at 1:00 pm November 11
- Reach full bypass at 8:00 pm on November 11
- Begin ramp-down from bypass at 8:00 pm on November 15
- Complete HFE (back to 8,000 cfs) at 3:00 pm on November 16

RECLAMATION

Possible Glen Canyon Dam HFE Release Pattern



Possible Monthly Release redistribution



RECLAMATION

Possible Monthly Release redistribution

7.48 maf Annual Release Pattern (values in kaf)		
	No HFE	**Proposed HFE**
Oct	480	480
Nov	500	**700**
Dec	600	600
Jan	800	800
Feb	600	600
Mar	600	**500**
Apr	500	500
May	600	**500**
Jun	600	600
Jul	800	800
Aug	800	800
Sep	600	600
WY total	7480	7480

RECLAMATION

Resource Status Assessment

Sediment Resources
In-channel sediment storage
Sandbar campable area
High-elevation sand deposits

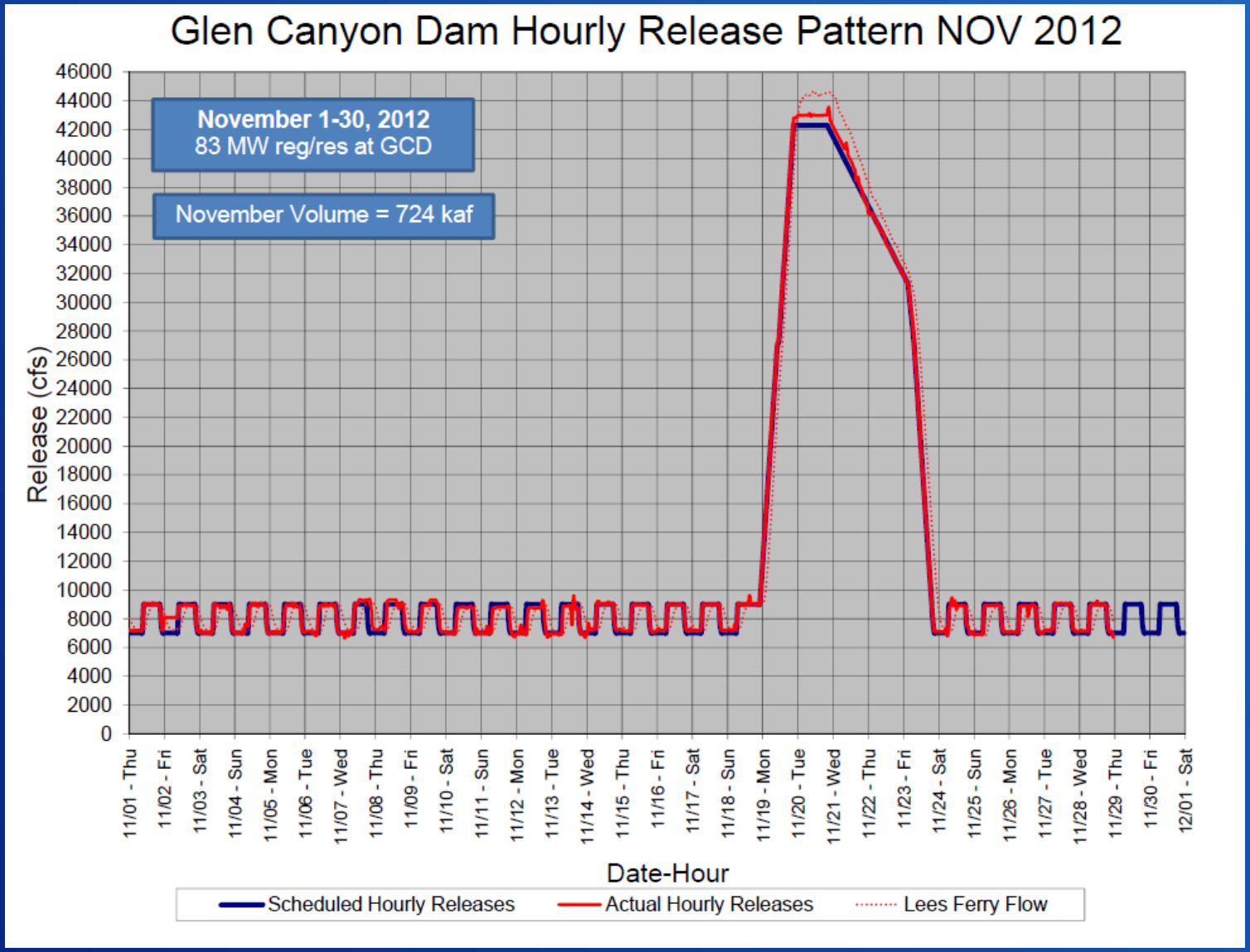
Cultural Resources
Archaeological site condition and stability
Access to archaeological sites by tribes

Biological Resources
Aquatic food base
Lees Ferry trout population
Lees Ferry fishery recreation experience quality
Endangered humpback chub and other fish abundance
Riparian vegetation

Hydropower and water delivery
Water quality
Water delivery
Dam maintenance
Hydropower production and marketable capacity

RECLAMATION

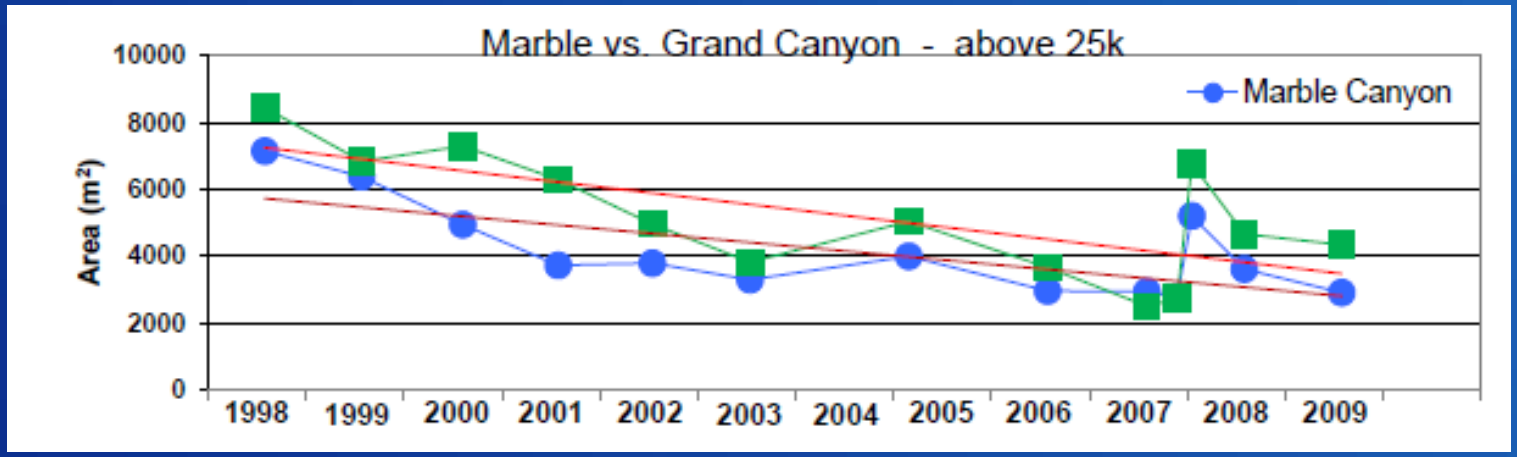
2012 High Flow Experiment

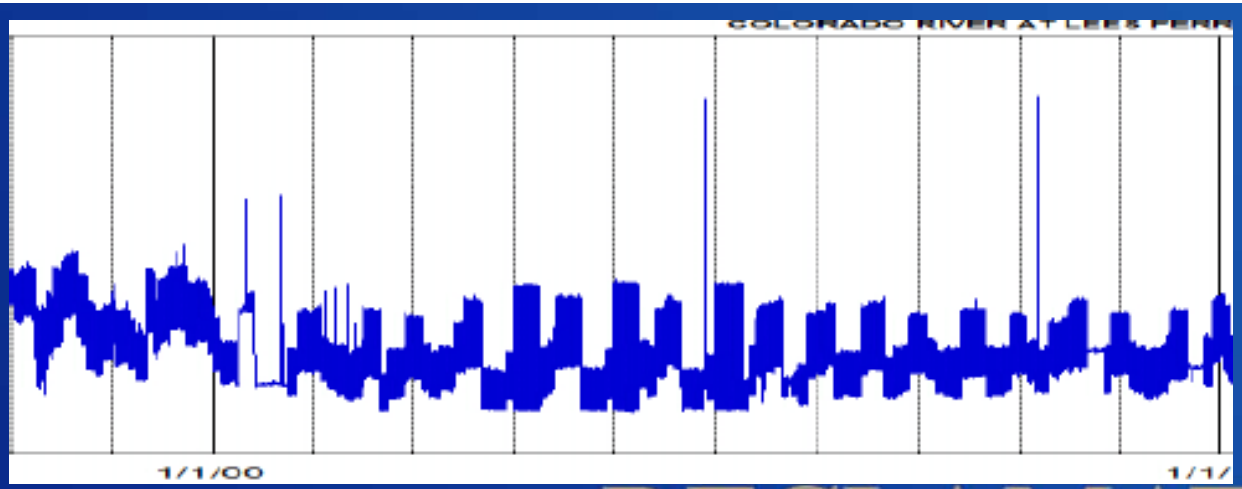


RECLAMATION

Sediment – Campsite Area

Sand bar size and campsite area have been decreasing, but have increased with each HFE, including 2012; the protocol will increase frequency of HFEs which should improve this resource.





RECLAMATION

Cultural Resources

- HFE-caused erosion is a consideration, most sites already mitigated.
- The HFE MOA requires reporting and consultation after HFEs.
- Reclamation met with MOA signatories Feb. 12-13, 2013.
- No impacts to sites were identified from the 2012 HFE, no reports of issues with access to sites.
- The MOA for the HFE Protocol requires notification to all the consulting parties at least 30 days in advance of a HFE and will consult with tribes to resolve any issues.

A 30-day letter was sent notifying MOA signatories of a possible HFE in November 2013 on September 30, 2013.

RECLAMATION

Hydropower/Socioeconomic Impacts

- HFEs effect hydropower production negatively:
  - Water released during an HFE counts against the annual release and is not available to be programmed in peaking releases during high demand months (HFE windows of Mar/Apr and Oct/Nov are low-demand shoulder months).
  - 30-40% of HFE releases bypass the power plant.
  - Lake Powell is lowered, reducing hydrologic head.
- Other impacts – Hualapai Enterprise, regional.

Western Area Power Administration estimate hydropower impact of $1.74M from Fall 2013 HFE

(2012 HFE was $1.318).

RECLAMATION

Lees Ferry Rainbow Trout

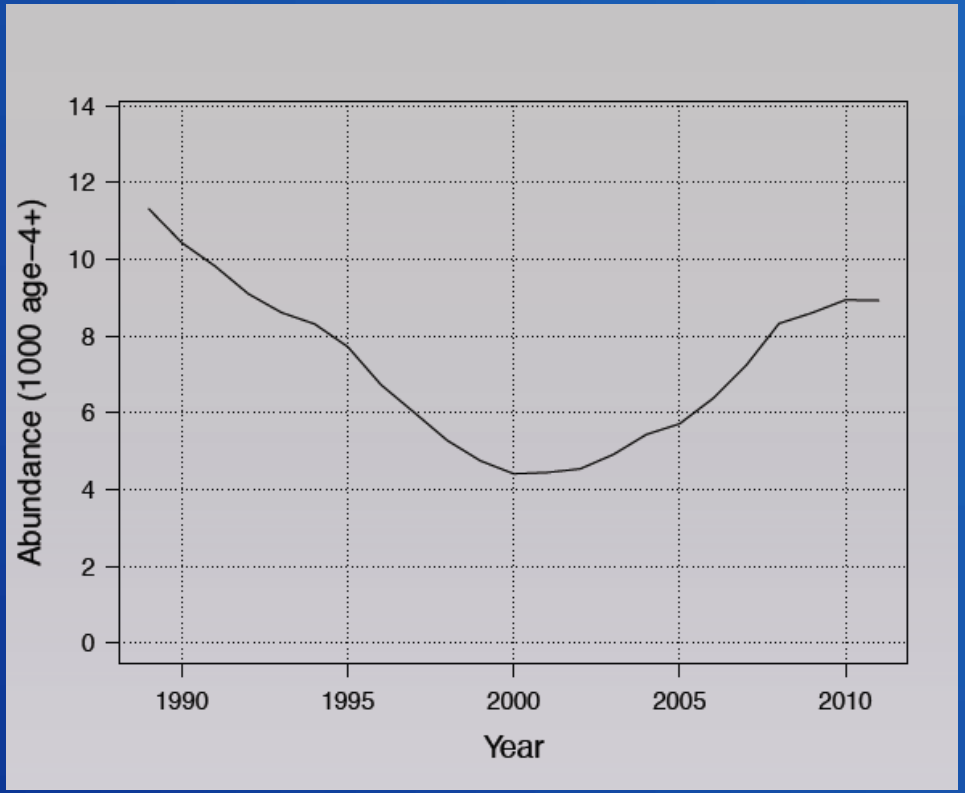
- 1996 and 2008 Spring HFEs led to increases in rainbow trout in Lees Ferry, 2011 high steady releases led to very large recruitment event in Lees Ferry.
- Rainbow trout moving into Marble Canyon, no increase yet at Little Colorado River.
- Effects of Fall HFEs on Lees Ferry Trout is poorly understood.
- 2004 Fall HFE appears to have resulted in displacement or mortality of very young trout.
- Condition overall declined slightly following 2004 November HFE.
- Appears that rainbow trout declined system-wide over period of 2012 HFE, although near removal trigger number at LCR.

RECLAMATION

Humpback Chub and other native fish

Humpback chub adult population size in the Little Colorado River Using Age-Structured Mark Recapture Estimate (ASMR) 2012

- **9,000 adults in 2012**
- **Increases over period with HFEs in 2004, 2008, 2012**
- **Other native fish populations have responded similarly**



RECLAMATION

Humpback Chub and other native fish

Humpback chub sub-adult and juveniles, recruitment

- **Some evidence that HFEs can cause displacement.**
- **Improved monitoring is helping evaluate effects to survivorship; survivorship in mainstem appeared to remain stable over the period of the 2012 HFE.**

RECLAMATION

Aquatic Food Base

- Primary effect of HFEs on Food Base is scouring in Lees Ferry of algae and aquatic plants and animals.
- The degree of this effect is proportional to discharge, little effect at 31,500.
- Little effect at LCR.
- Food base recovered from the 2008 HFE in 4 months.
- New Zealand mud snails were significantly reduced, a beneficial effect.
- Multiple HFEs could shift to flood-tolerant species, a potential benefit to higher trophic levels (trout).
- Food base little affected by 2012 fall HFE, more blackflies in drift Jan. than Sept.

RECLAMATION

Biological Resources

- 2012 HFE appears to have had little effect on food base or trout and native fishery.
- Trout populations in Lees Ferry and downstream may have decreased, but not significantly so.
- None of the triggers for nonnative fish control have been met, although rainbow trout numbers at the LCR are near the trigger.
- Humpback chub status appears to be stable or increasing.

RECLAMATION