

# Updates on 2014 HFE, 2015 Paria River inputs, and 2015 mass balance for Marble Canyon

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# Introduction

## Overview of 2014 HFE

- Initial conditions
- Downstream tour – where did the sand end up?
- How did the beaches respond?

## 2015 Paria River sand inputs

- How much sand have we received to date?
- Improvements in processing samples and updating the website
- How does this year compare with previous years?

## 2015 Marble Canyon mass balance

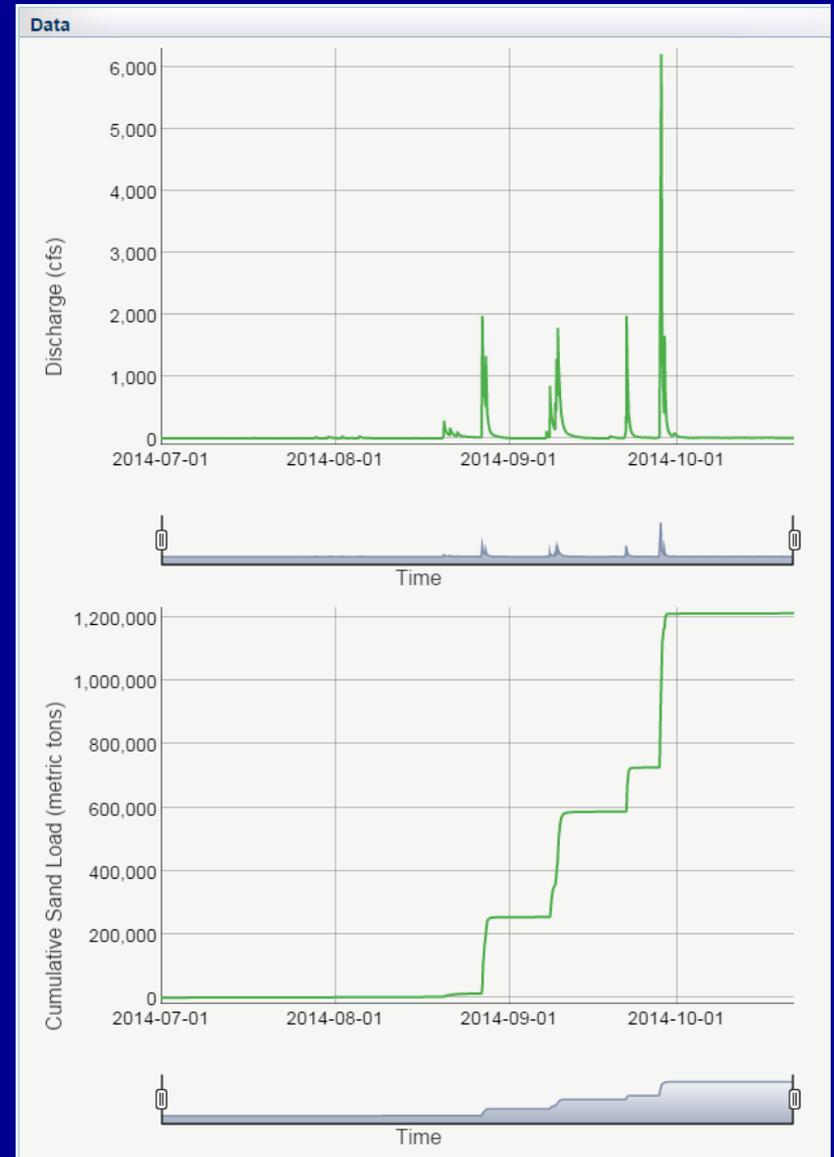
- How much sand has been retained from the Paria
- Comparisons with previous years

# 2014 HFE overview

3 Paria River floods of approximately 2000 cfs, 1 flood of approximately 6000 cfs

1.2 million metric tons of sand input from July 1, 2014 through October 20, 2014

2014 Paria River sand inputs



*Preliminary results, subject to review and revision – do not cite*

# 2014 HFE overview

## Upper Marble Canyon RM 0 – RM 30

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**Grand Canyon Monitoring and Research Center**

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### Grand Canyon Reaches

Home > Discharge, Sediment and Water Quality > Grand Canyon Reaches

**Reaches**

- Upper Marble Canyon**  
(Colorado River at Lees Ferry, AZ to Colorado River near river mile 30)
- Lower Marble Canyon**  
(Colorado River near river mile 30 to Colorado River above Little Colorado River near Desert View, AZ)
- Eastern Grand Canyon**  
(Colorado River above Little Colorado River near Desert View, AZ to Colorado River near Grand Canyon, AZ)
- East Central Grand Canyon**  
(Colorado River near Grand Canyon, AZ to Colorado River above National Canyon near Supai, AZ)
- West Central Grand Canyon**  
(Colorado River above National Canyon near Supai, AZ to Colorado River above Diamond Creek near Peach Springs, AZ)
- Western Grand Canyon and the Lake Mead Delta**  
(Colorado River above Diamond Creek near Peach Springs, AZ to Pearce Ferry near river mile 280)

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## 2014 HFE upper Marble Canyon



# 2014 HFE overview

## Lower Marble Canyon RM 30 – RM 61

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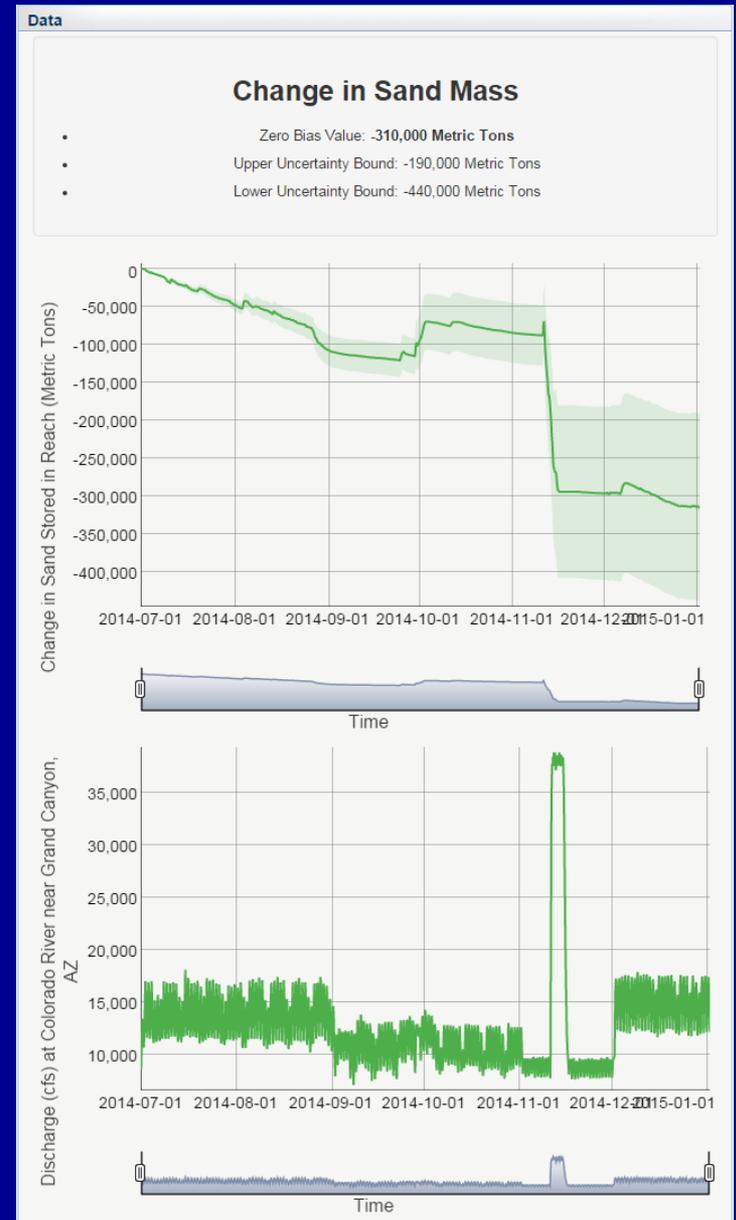
## 2014 HFE lower Marble Canyon



# 2014 HFE overview

## Western Grand Canyon RM 61 – RM 87

### 2014 HFE western Grand Canyon

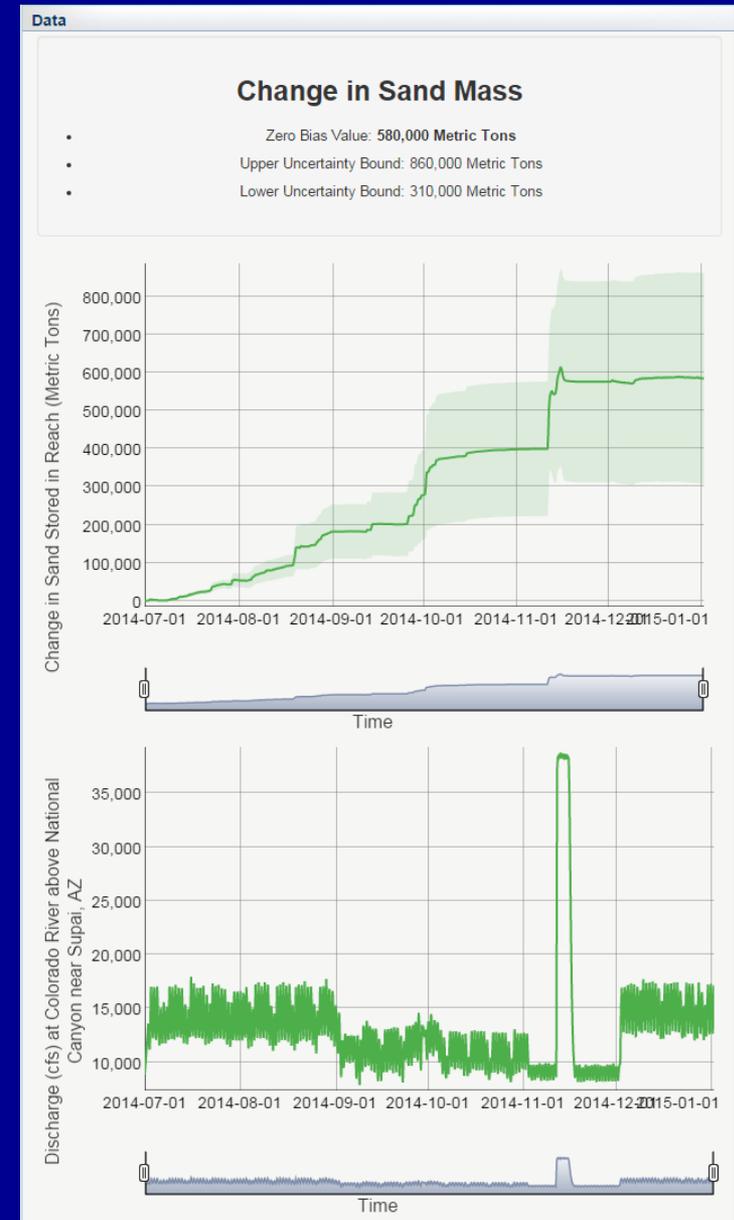


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# 2014 HFE overview

## East Central Grand Canyon RM 87 – RM 166

### 2014 HFE east central Grand Canyon

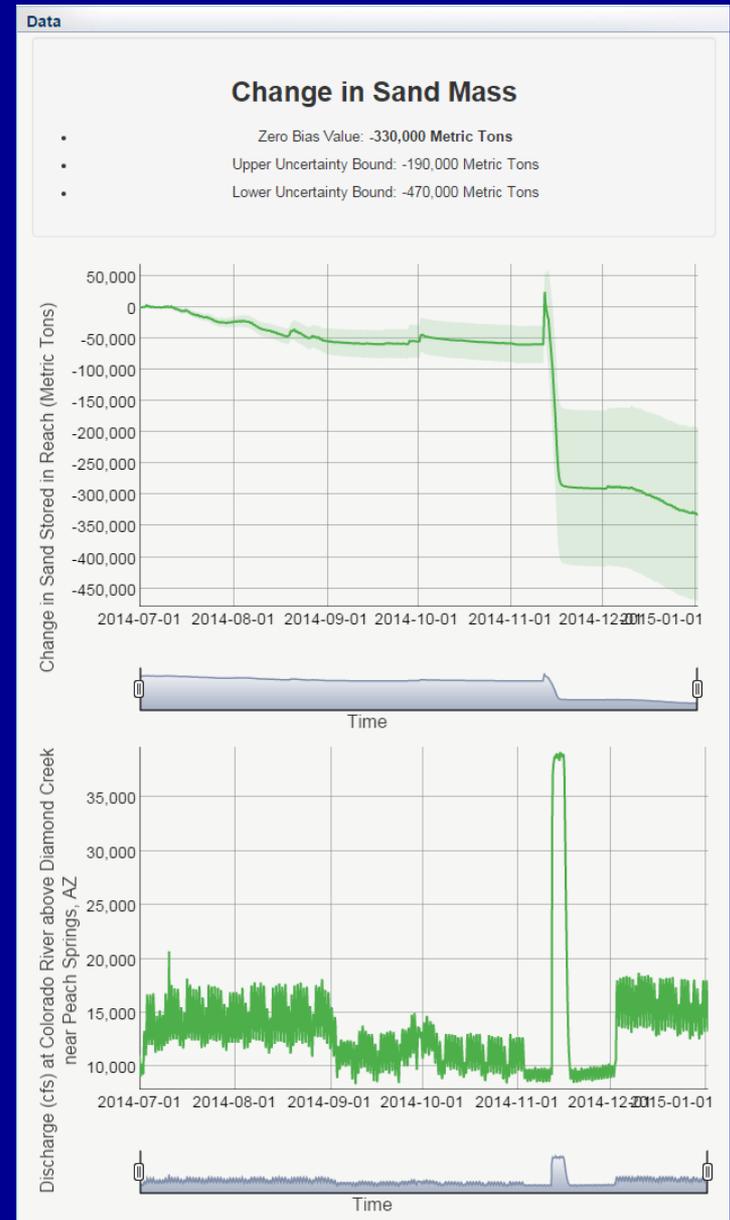


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# 2014 HFE overview

## West Central Grand Canyon RM 166 – RM 225

### 2014 HFE west central Grand Canyon



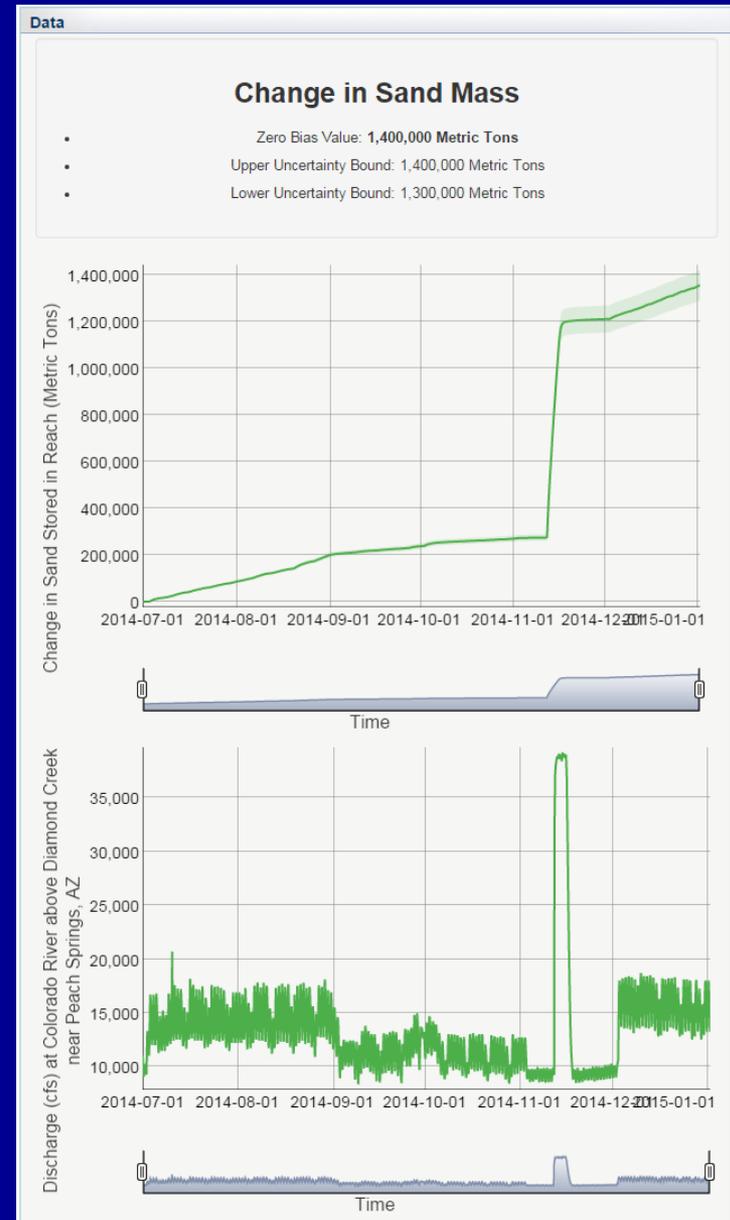
*Preliminary results, subject to review  
and revision – do not cite*

# 2014 HFE overview

## Western Grand Canyon and the Lake Mead Delta > RM 225

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### 2014 HFE western Grand Canyon



# 2014 HFE overview

Overall change in sand mass in the Colorado River between RM0 and RM225 (Lees Ferry to Diamond Creek) during July 1, 2014 – January 1, 2015 was:

+0.59 $\pm$ 0.92 million metric tons; sand deposited in lower Marble Canyon and east central Grand Canyon, sand evacuated from western Grand Canyon and west central Grand Canyon

Overall change in sand mass in the Colorado River below RM225 (below Diamond Creek) during July 1, 2014 – January 1, 2015 was:

+1.4 $\pm$ 0.1 million metric tons

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# 2014 HFE overview



Sandbar size immediately after HFE, in relation to pre-flood size:

- 24 sites (58%) larger
- 13 sites (29%) no change
- 5 sites (14%) smaller

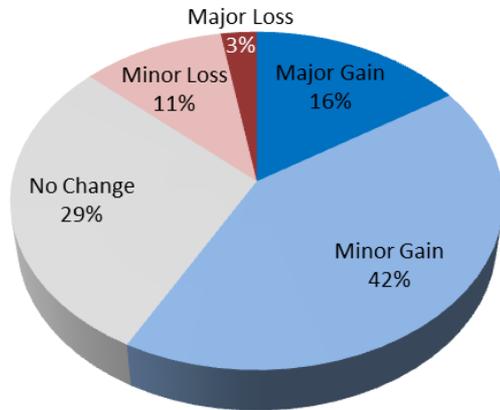


Photos at [www.gcmrc.gov/sandbar/](http://www.gcmrc.gov/sandbar/)

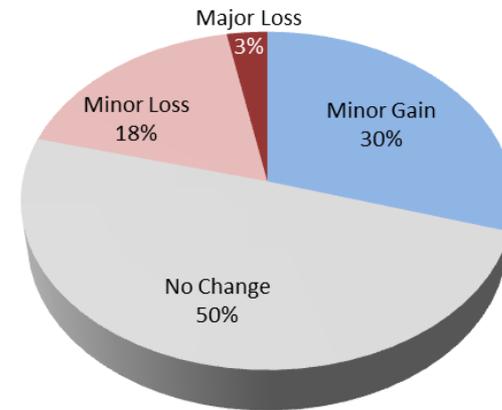
# 2014 HFE overview

compared to sandbar size pre-HFE

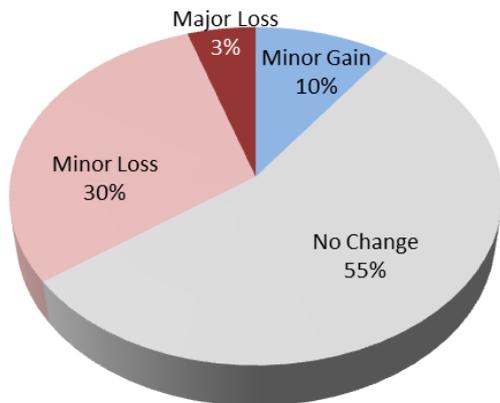
### Immediately After 2014 HFE



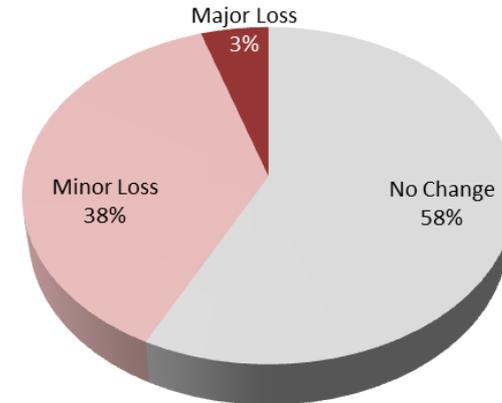
### 3 Months After 2014 HFE



### 10 Months After 2014 HFE

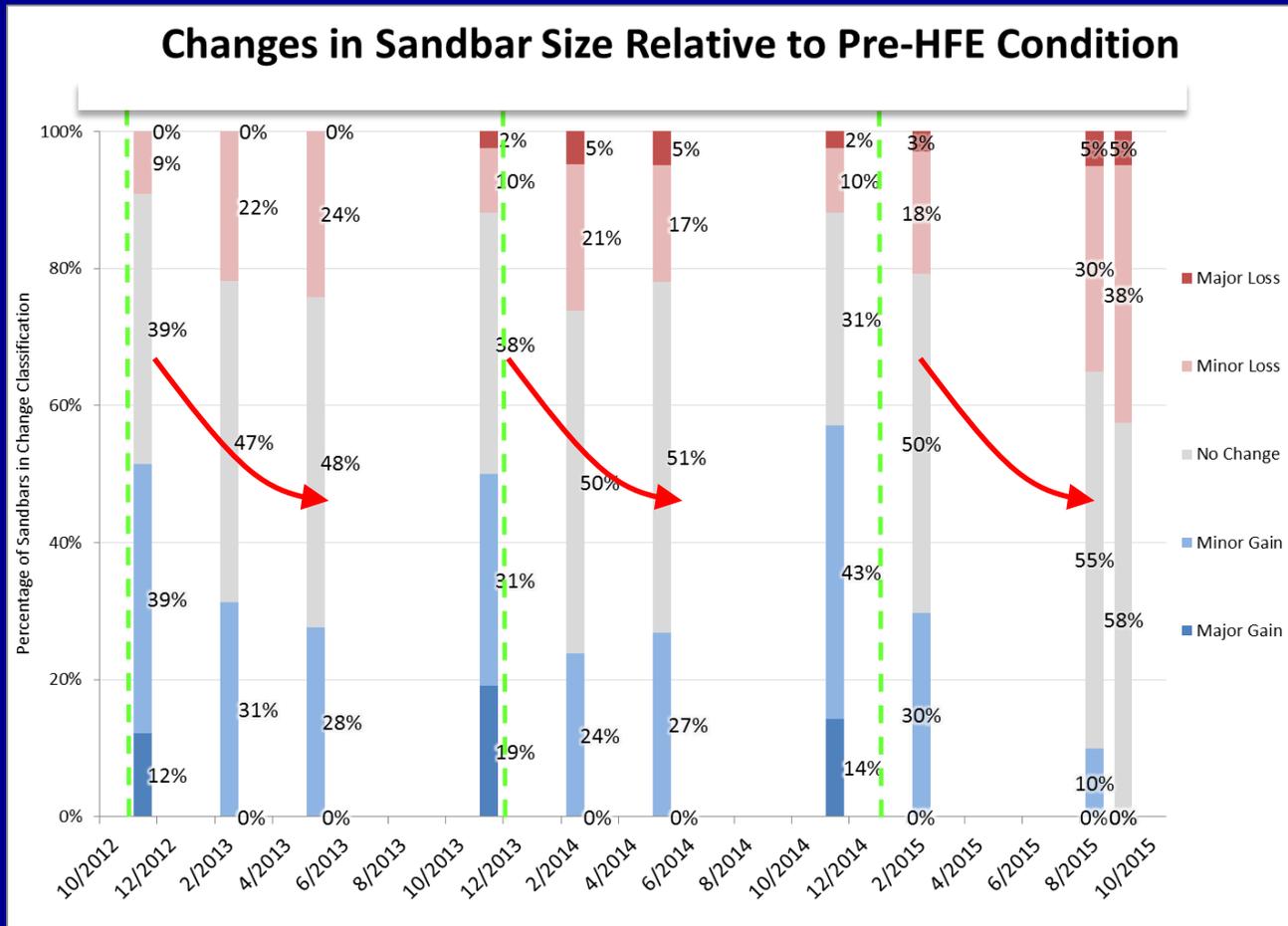


### 11 Months After 2014 HFE



# 2014 HFE overview

## Response to HFE Protocol Since 2012



Each of the HFEs in the past 3 years has resulted in sandbar deposition

– They continue to erode in following 6 to 12 months

2012 HFE    2013 HFE    2014 HFE

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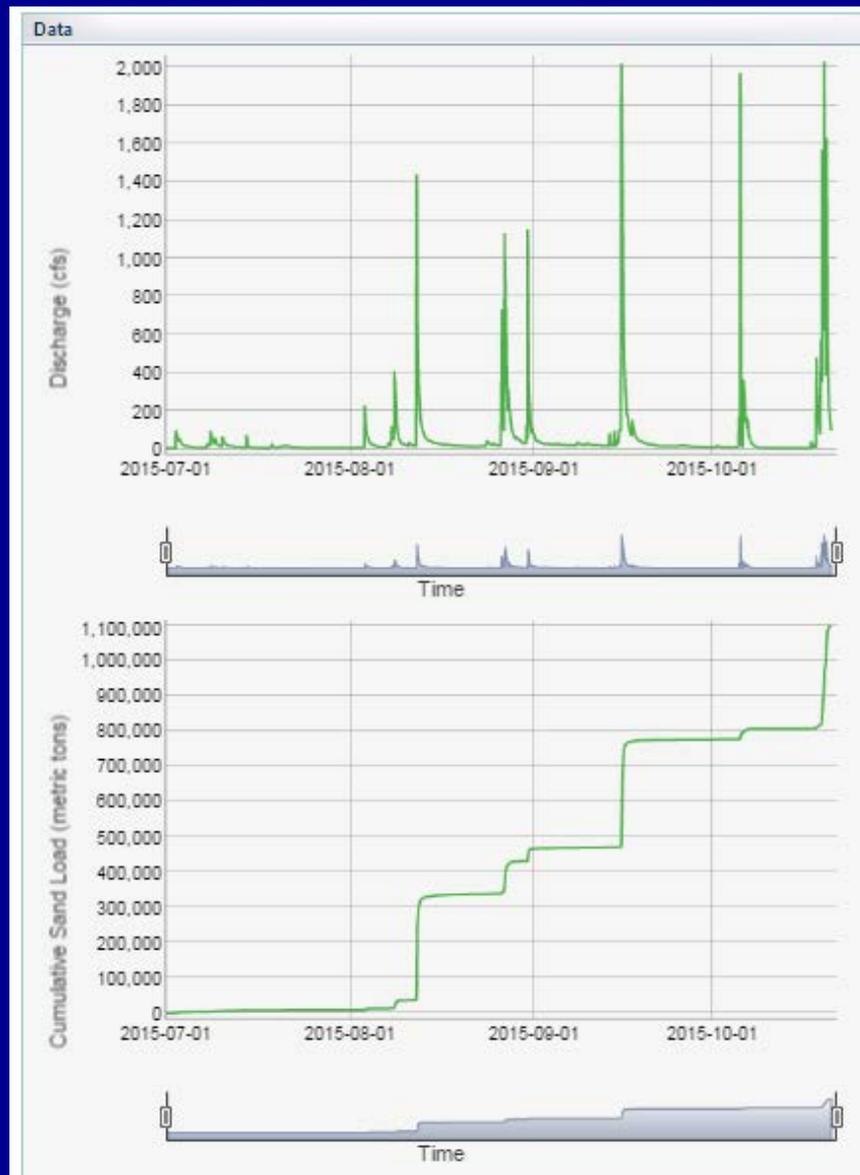
Photos at [www.gcmrc.gov/sandbar/](http://www.gcmrc.gov/sandbar/)

# 2015 Paria River sand inputs

Zero bias value for 2015 Paria sand inputs is approximately 1.1 million metric tons, almost an additional 400,000 metric tons in June



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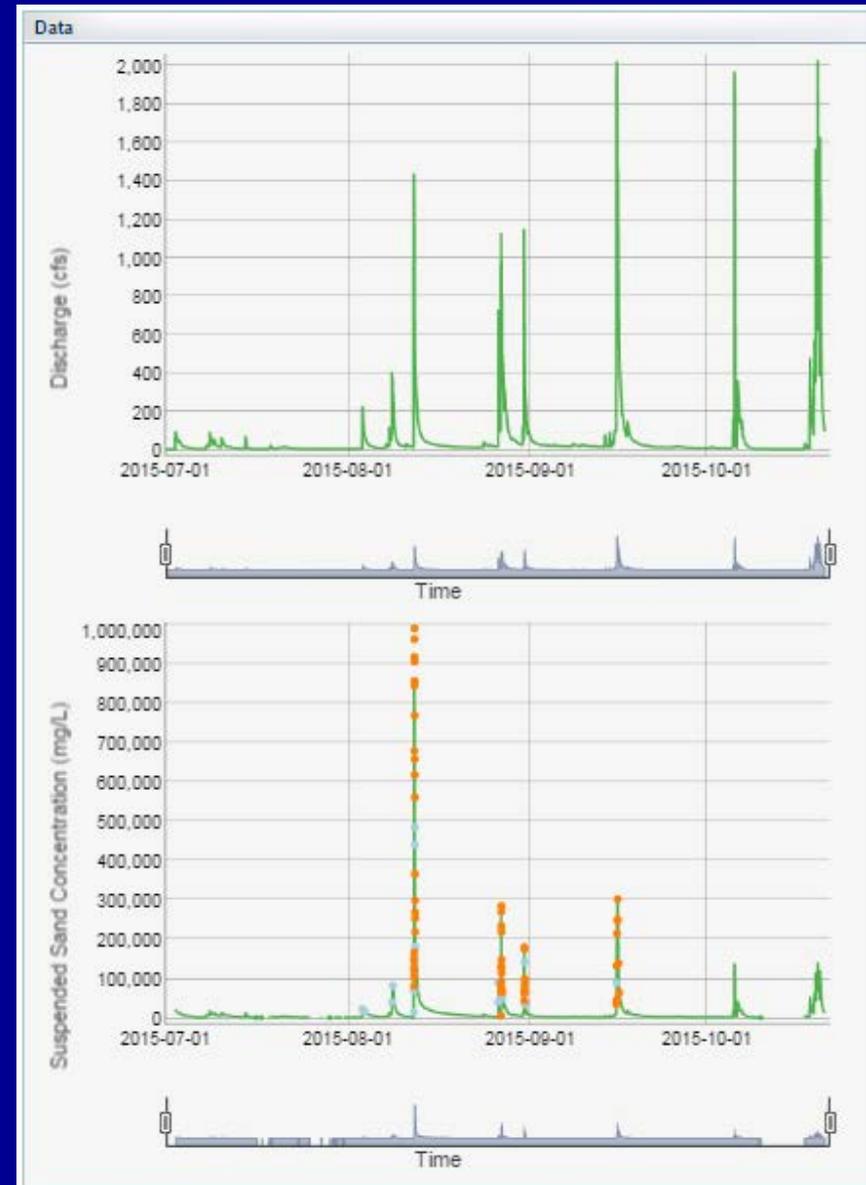
# 2015 Paria River sand inputs

Flood event on 8/12/2015 is an example of “hyperconcentrated flow”, this flood input over 1/4 of the total 2015 Paria sand input

All samples through 8/27/2015 have been processed by the laboratory, most recent processed sample is from 9/17/2015

The processed samples represent 80% of the total number of Paria samples collected this year compared with 52% of the samples at this time last year

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# 2015 Paria River sand inputs

Laboratory procedures have been changed over the last year to increase efficiency and expedite Paria samples

- Backlog of other samples have been reduced
- Dynamic staffing of the laboratory increases the number of samples processed during key periods
- Representative samples are selected to process within days of a flood to rapidly increase the accuracy of the Paria sand loads
- During the HFE accounting period, Paria samples are given precedent over other samples

# 2015 Paria River sand inputs

Comparison of 2015 zero bias value Paria sand inputs with previous years; accounting period 7/1 through 10/20

- 2015 Paria sand input: 1.1 million metric tons
- 2014 Paria sand input: 1.2 million metric tons – HFE
- 2013 Paria sand input: 1.8 million metric tons – HFE
- 2012 Paria sand input: 0.7 million metric tons – HFE
- 2011 Paria sand input: 0.1 million metric tons

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and revision – do not cite*

# 2015 Marble Canyon mass balance

Upper Marble Canyon from 7/1/2015 through 9/28/2015 (most recent download date)

- Uncertainty bound straddles zero
- Approximately 450,000 metric tons of sand was exported during the equalization flows of July
- Some of the sand exported was the result of June Paria floods increasing the sand supply

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# 2015 Marble Canyon mass balance

Lower Marble Canyon from 7/1/2015 through 9/28/2015

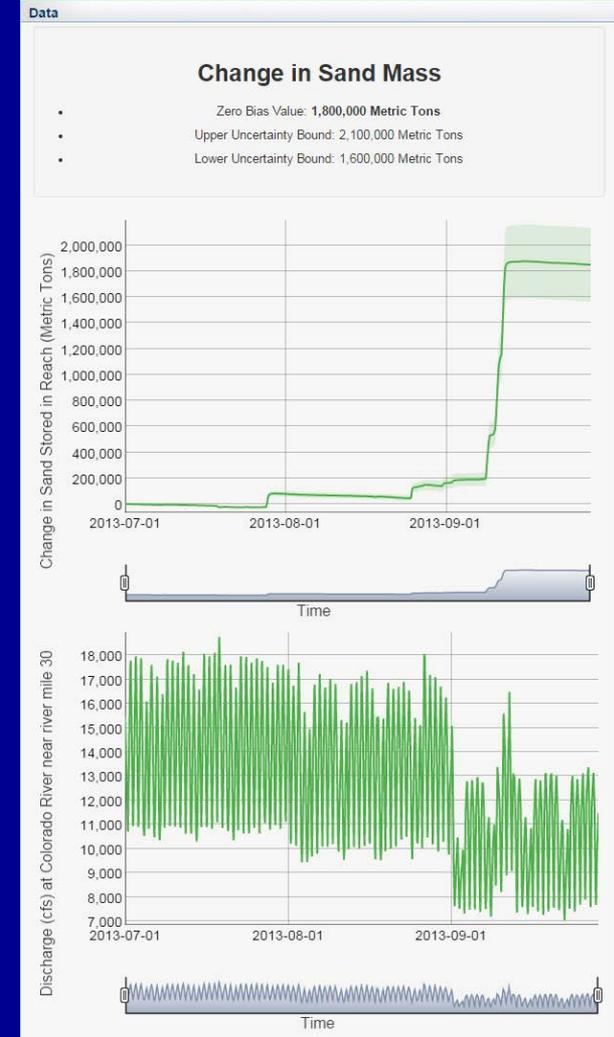
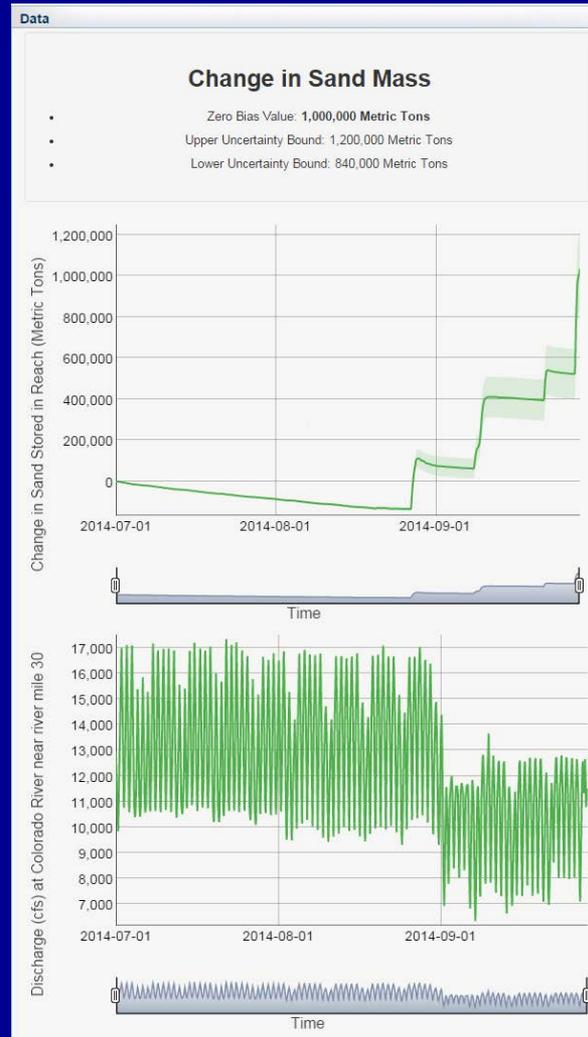
- Zero bias value is +590,000 metric tons
- Much of the sand exported from upper Marble Canyon was deposited in lower Marble Canyon
- During this period, the sand mass balance of Marble Canyon was +650,000  $\pm$  290,000 metric tons



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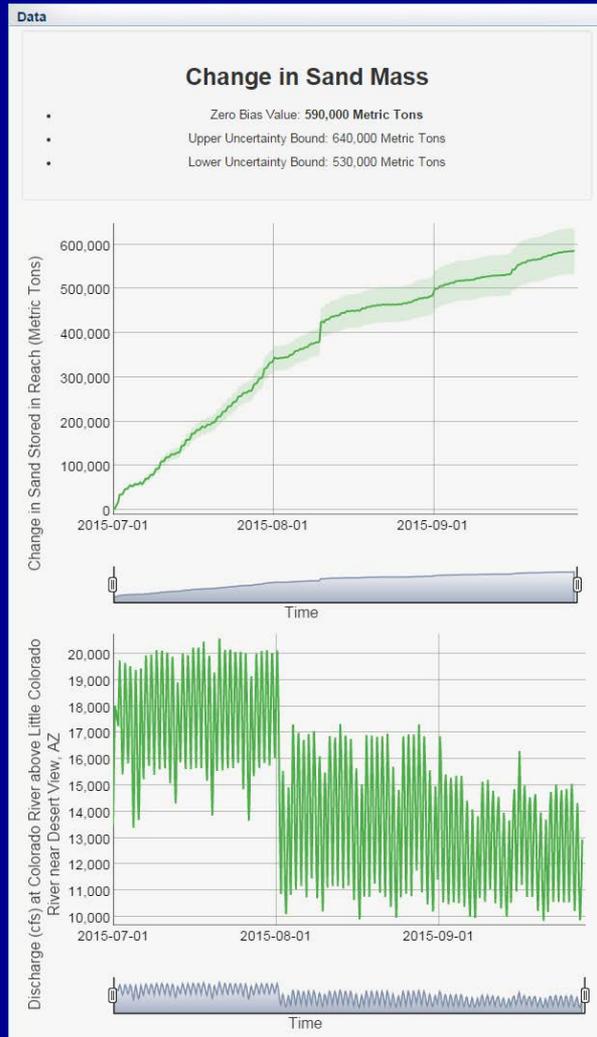
# 2015 Marble Canyon mass balance

## Comparison of upper Marble Canyon with previous years



# 2015 Marble Canyon mass balance

## Comparison of lower Marble Canyon with previous years



# 2015 Marble Canyon mass balance

Comparison of Marble Canyon zero bias sand mass balance with previous years 7/1 through 9/28

- 2015: +650,000 metric tons
- 2014: +1,200,000 metric tons
- 2013: +1,900,000 metric tons
- 2012: +720,000 metric tons
- 2011: -580,000 metric tons – equalization flows

# 2015 Marble Canyon mass balance

Sand was evacuated from upper Marble Canyon during July and early August flows— likely from retreating sandbars and June Paria inputs

Sand deposited in lower Marble Canyon – in storage underwater or below the 20k CFS flow level

The total change in sand mass for Marble Canyon from 7/1/2015 to 9/28/2015 is +650,000 metric tons plus a likely additional +300,000 metric tons input from the Paria River since 9/28 (next update will occur on 11/9)

Questions?