The Impact of the Grand Canyon High flow Experiment on Lake Mead

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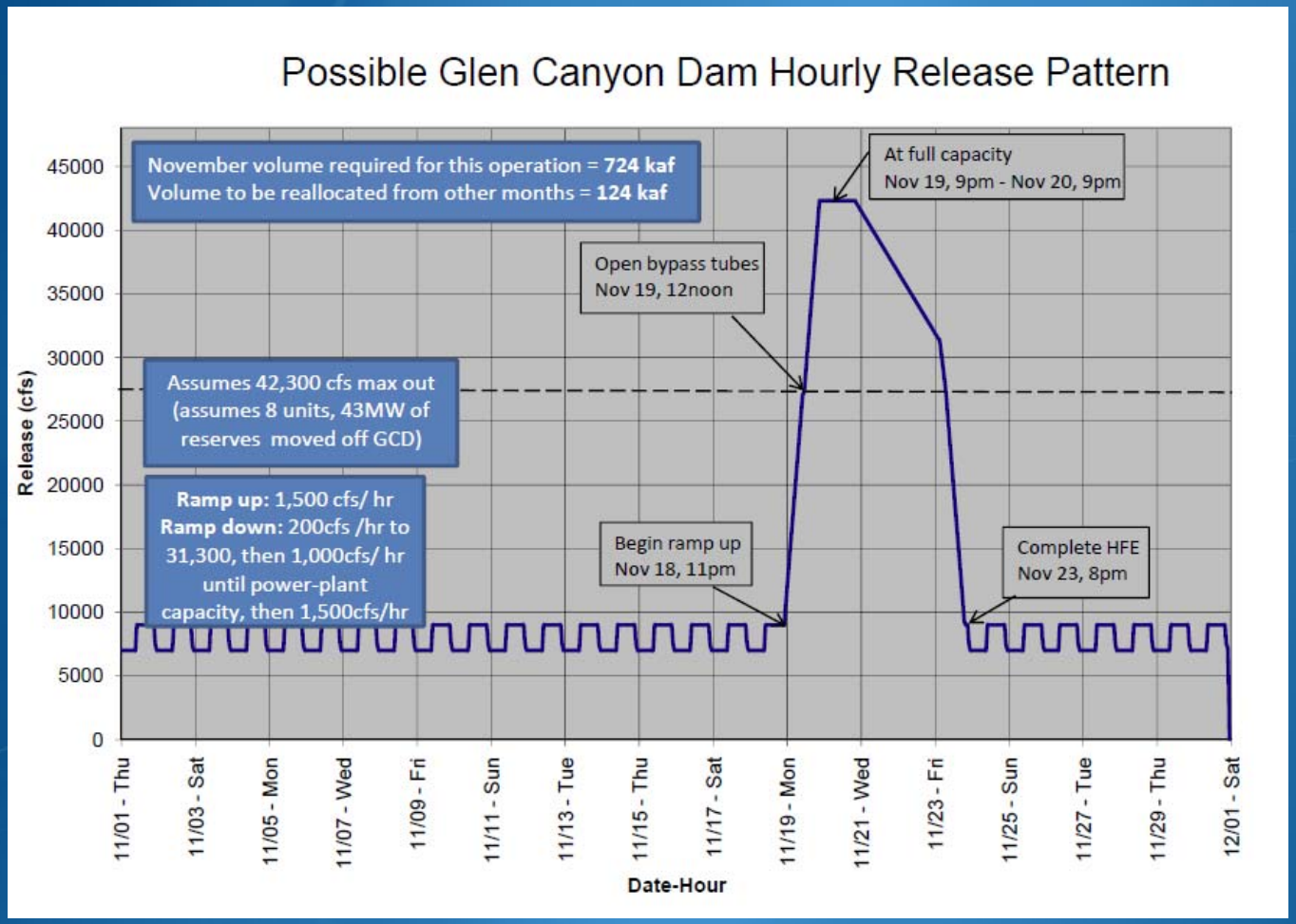
The High Flow Experiment

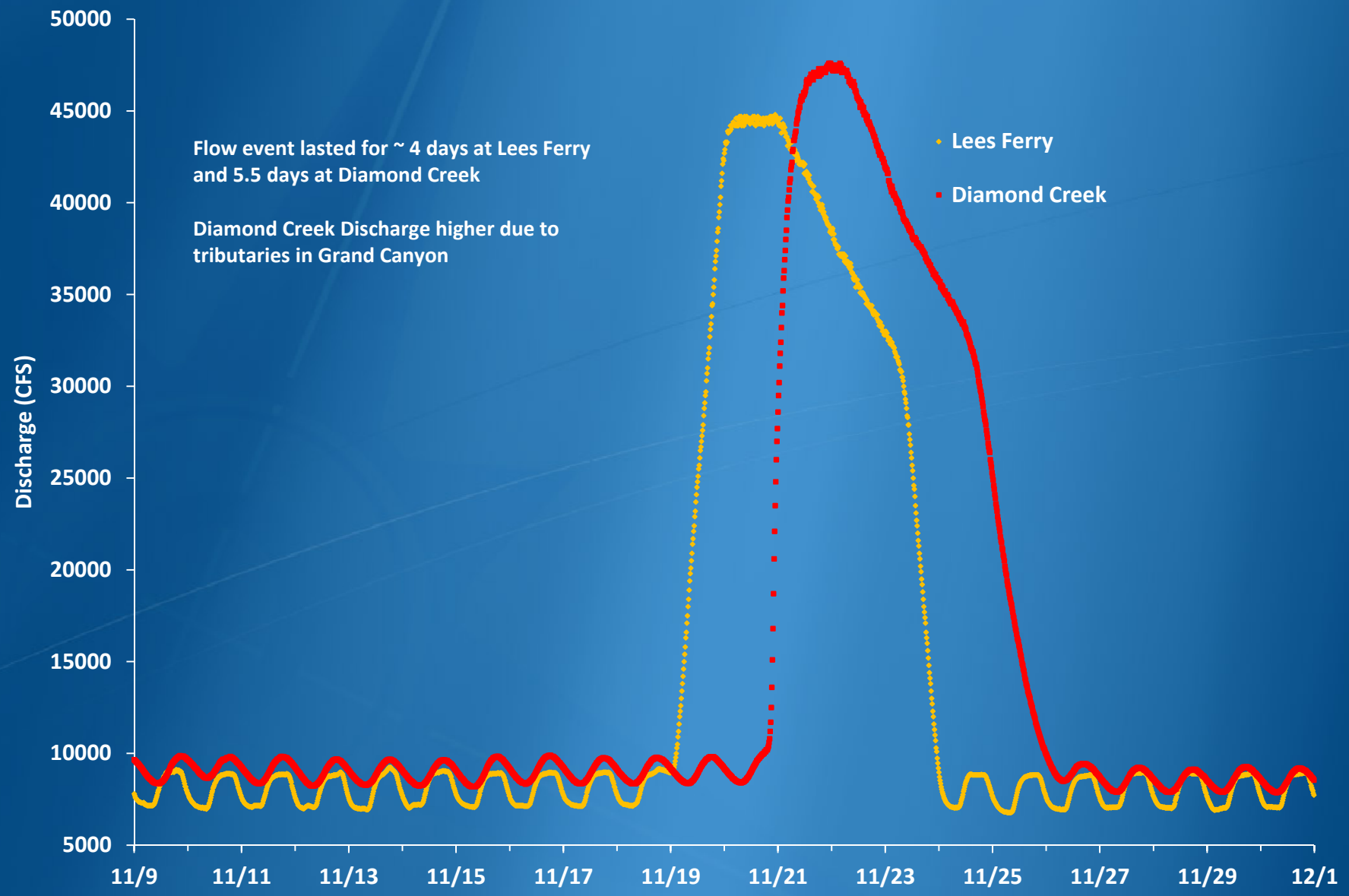
- The goal of the High Flow Experiment is to try to rebuild sandbars in Grand Canyon
  - Recreation Areas/Camping Beaches
  - Critical habitat for the endangered Humpback Chub
- High Flow Experiments have been conducted twice in the past and have demonstrated some success
- High Flow Experiments are now authorized to occur in the future when resources permit
  - Water
  - Sediment

High flow Experiment Protocol

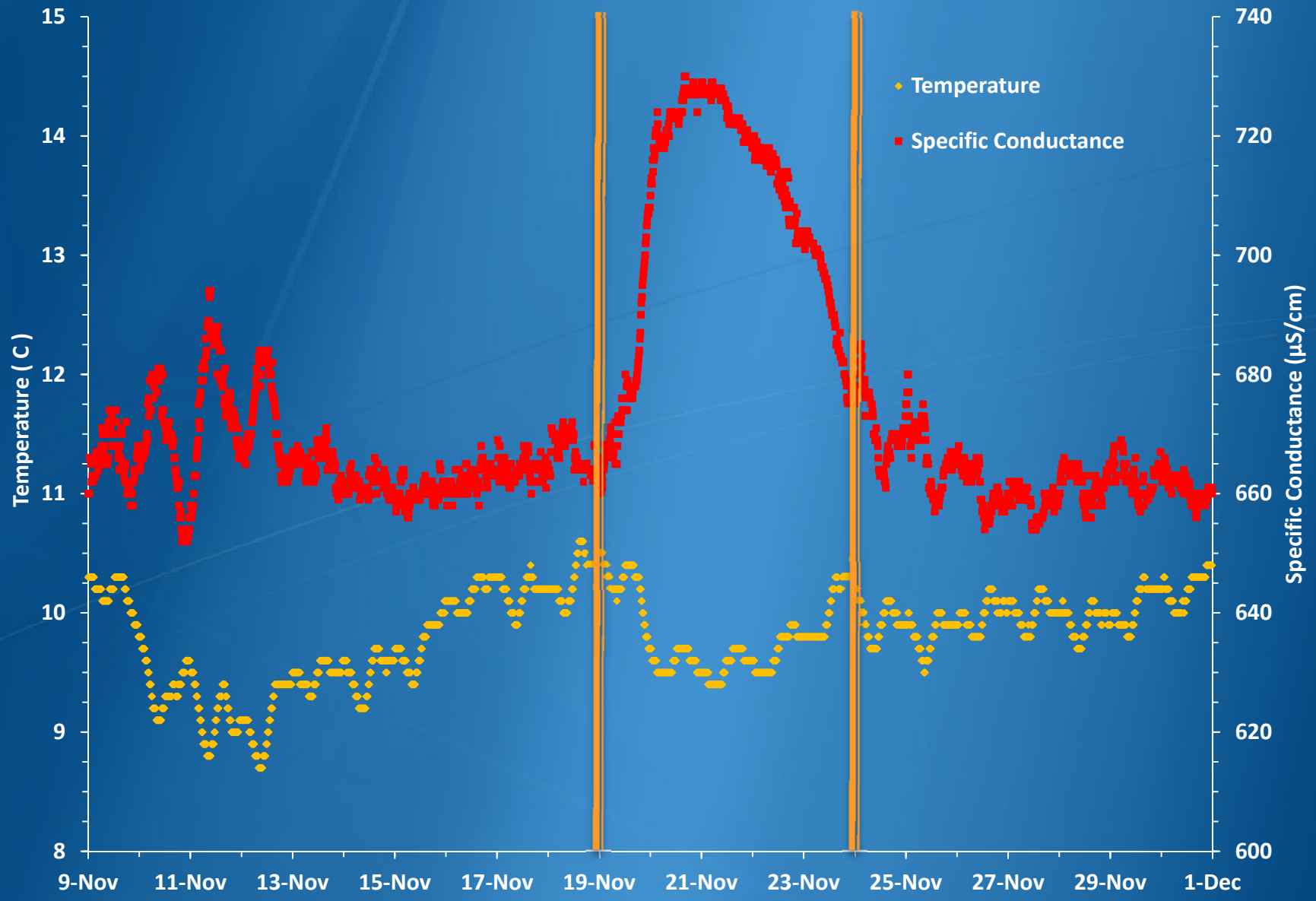


Releases from Glen Canyon were expected to reach Lake Mead ~2.5 days later

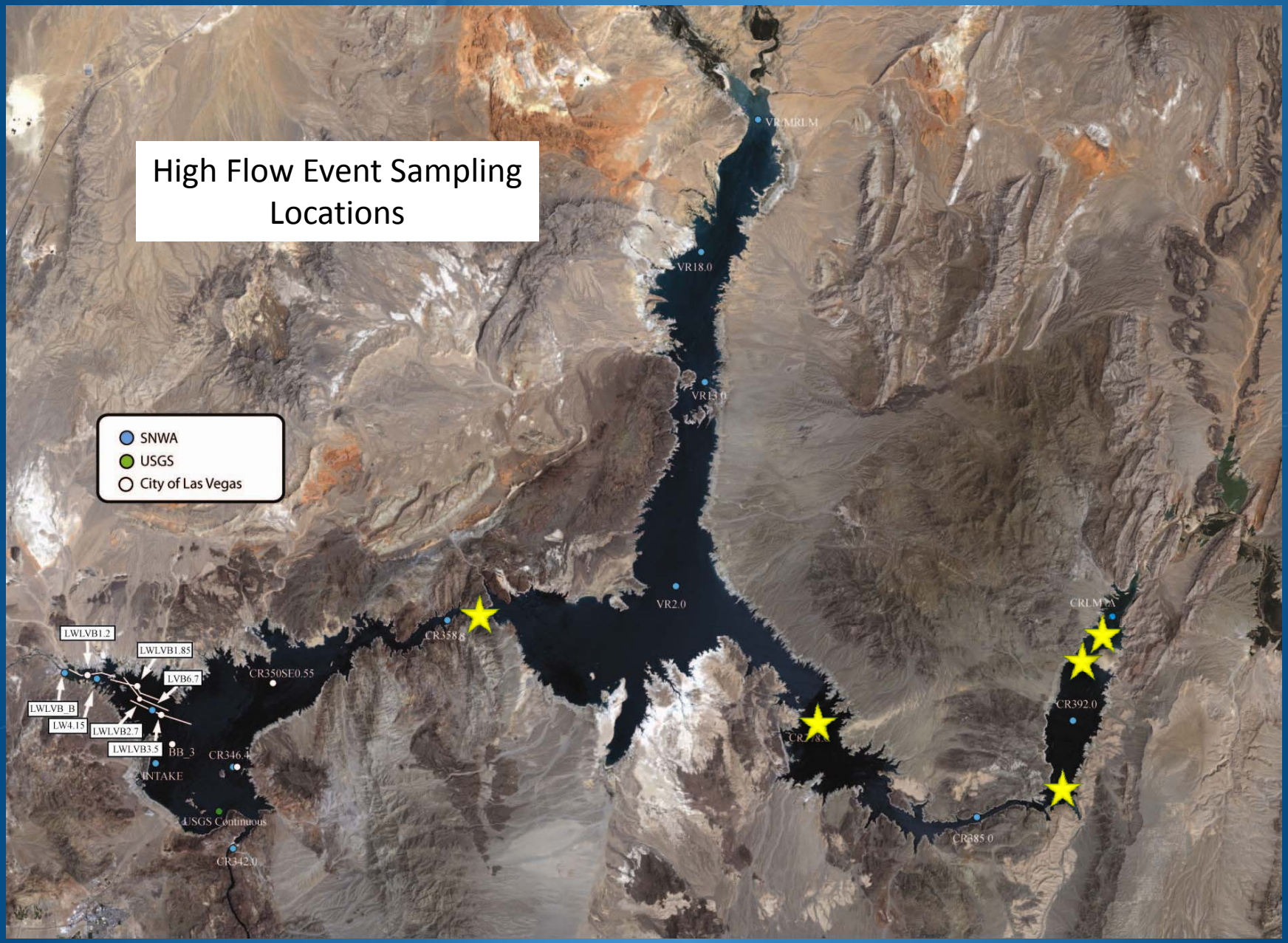
Flood Hydrograph



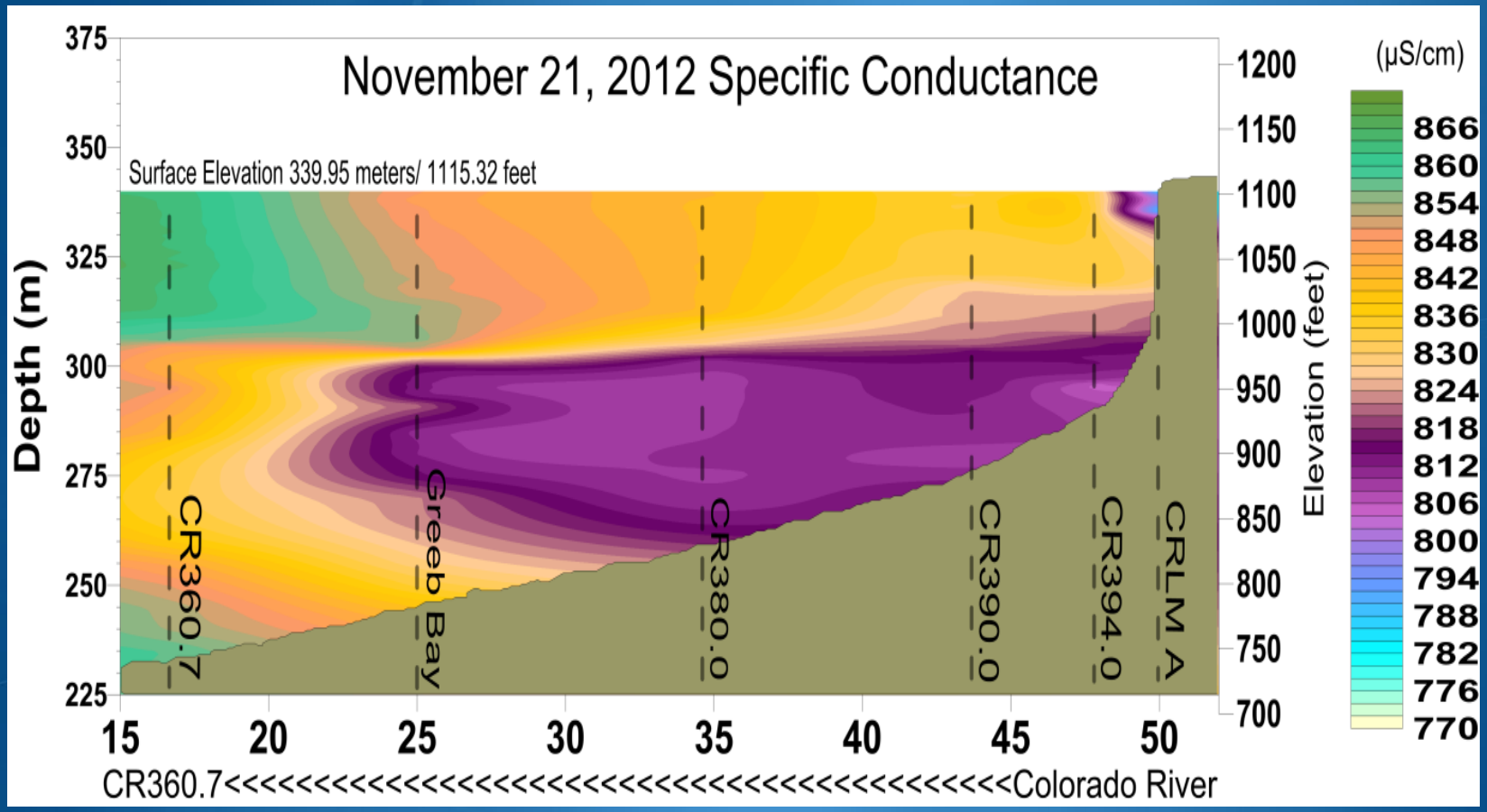
Lee's Ferry Water Quality



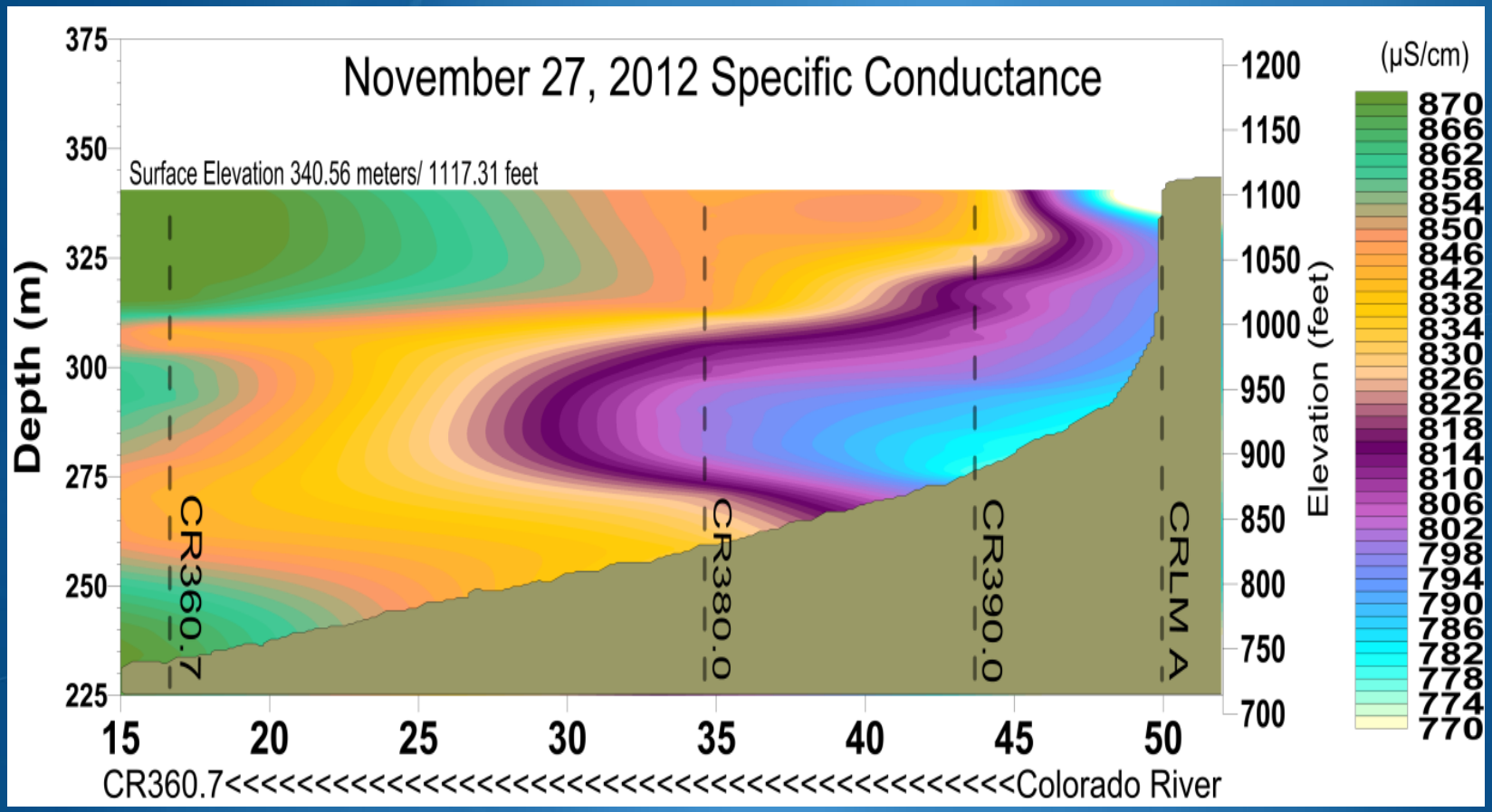
High Flow Event Sampling Locations



Lake Mead Water Quality Pre Flood


November 21, 2012 Specific Conductance
Surface Elevation 339.95 meters/ 1115.32 feet
Depth (m)
375
350
325
300
275
250
225
15
20
25
30
35
40
45
50
CR360.7
Greeb Bay
CR380.0
CR390.0
CR394.0
CRLM A
CR360.7<<

Lake Mead Water Quality Post Flood


November 27, 2012 Specific Conductance
Surface Elevation 340.56 meters/ 1117.31 feet
Depth (m)
375
350
325
300
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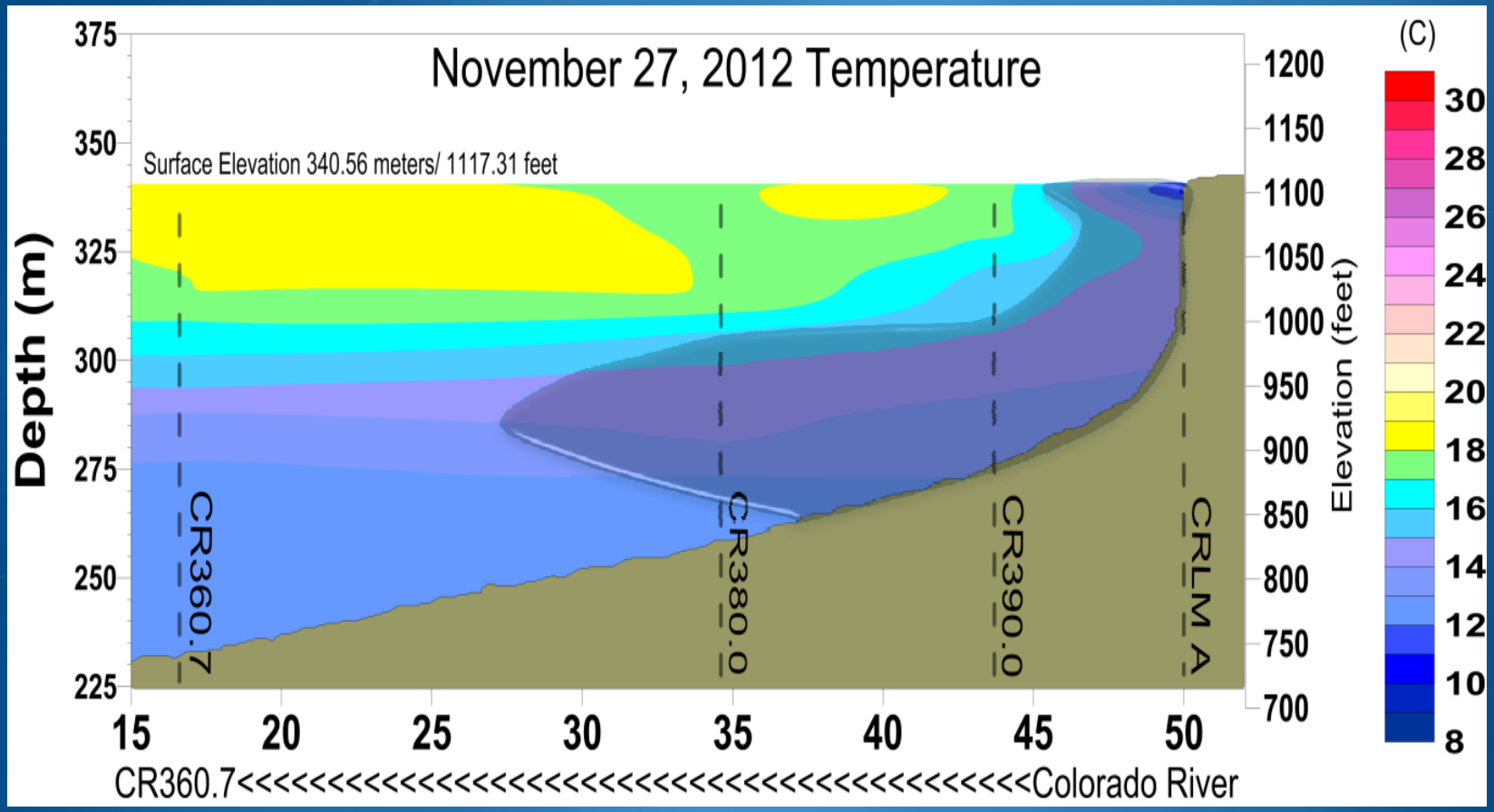
Lake Mead Water Quality Post Flood


November 27, 2012 Temperature
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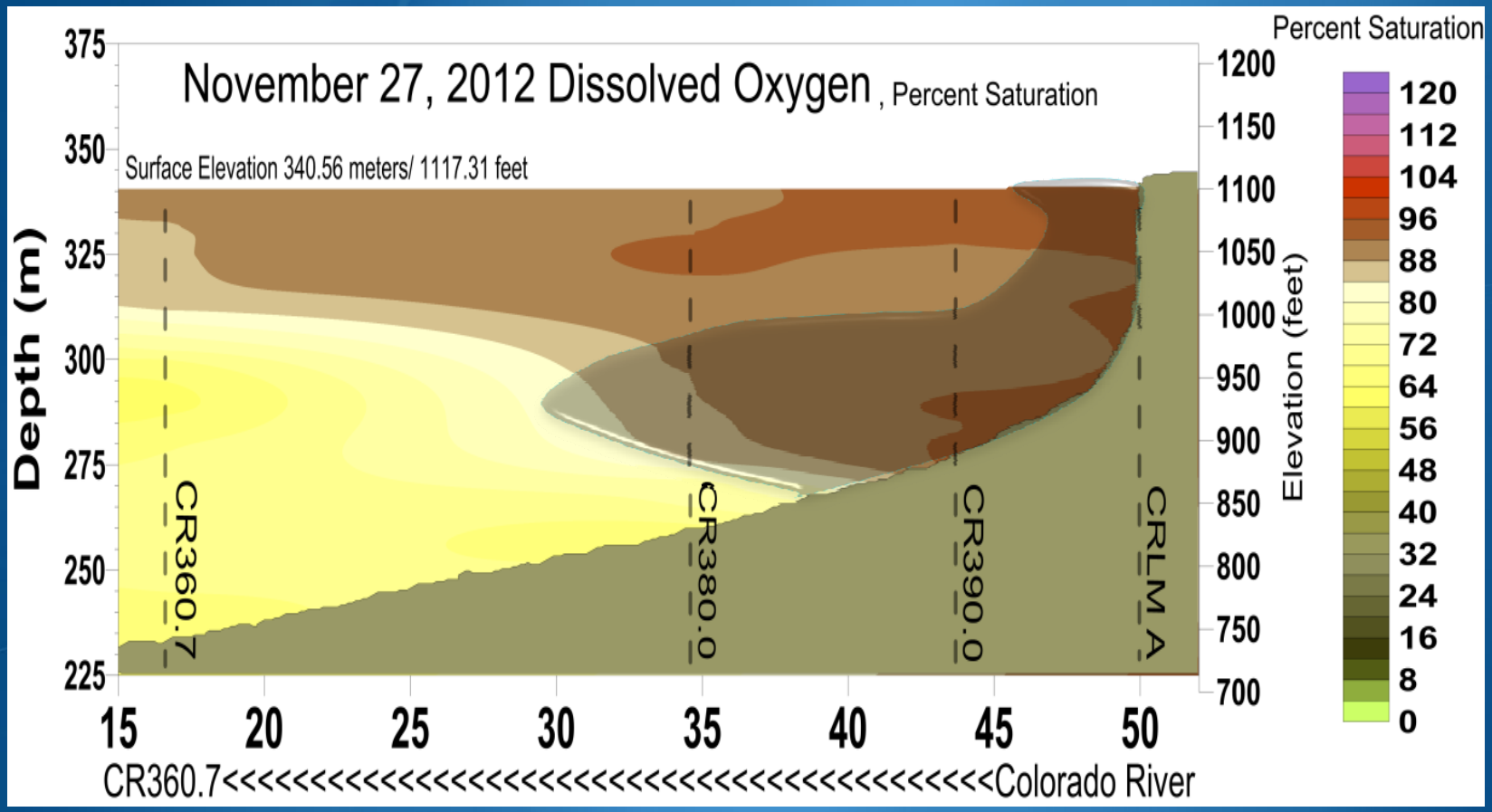
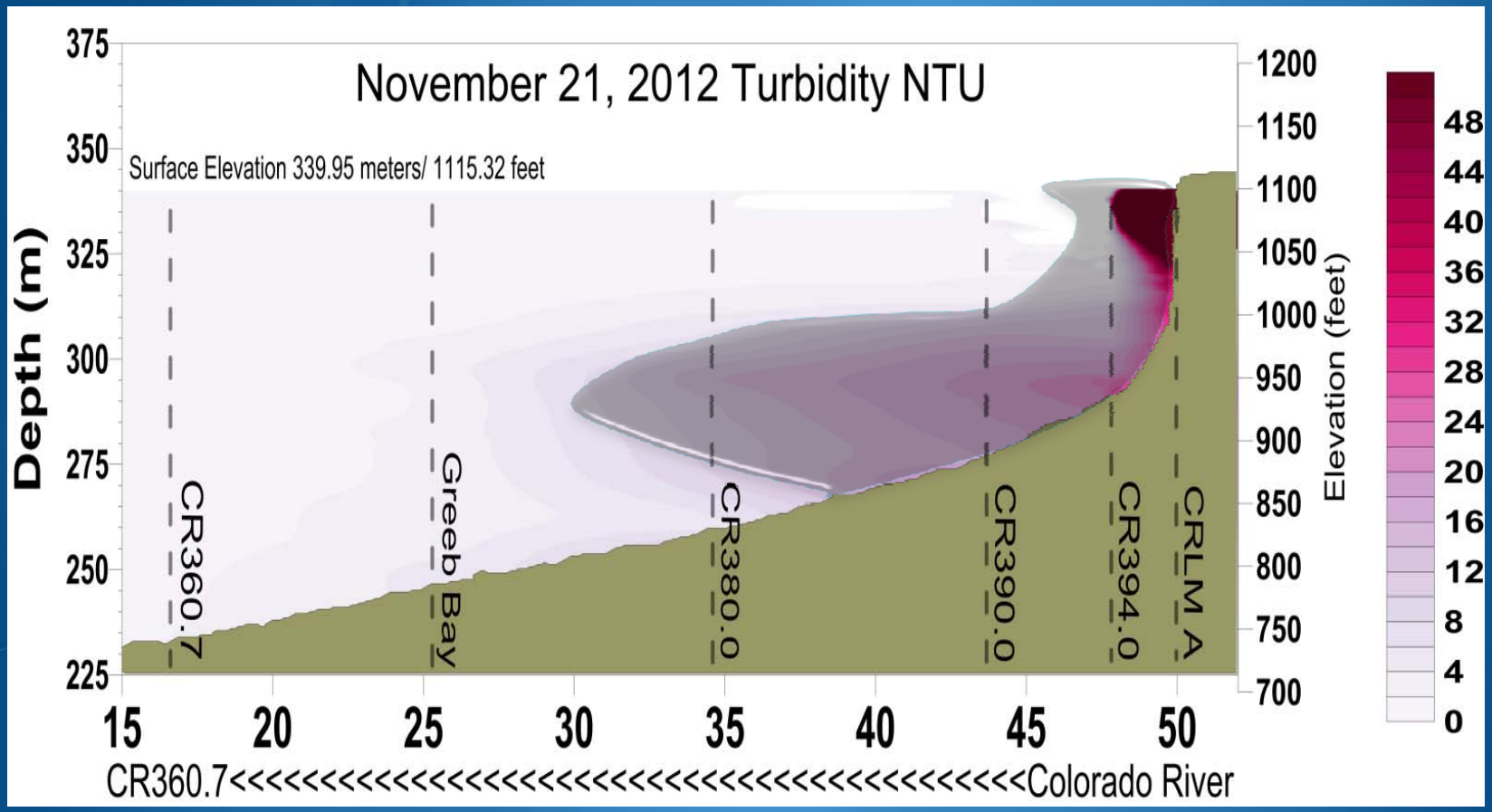
Lake Mead Water Quality Post Flood


November 27, 2012 Dissolved Oxygen, Percent Saturation
Surface Elevation 340.56 meters/ 1117.31 feet
Depth (m)
375
350
325
300
275
250
225
15
20
25
30
35
40
45
50
CR360.7<<

Lake Mead Water Quality Post Flood


November 21, 2012 Turbidity NTU
Surface Elevation 339.95 meters/ 1115.32 feet
Depth (m)
375
350
325
300
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225
15
20
25
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35
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50
CR360.7<<

Risks associated with the HFE

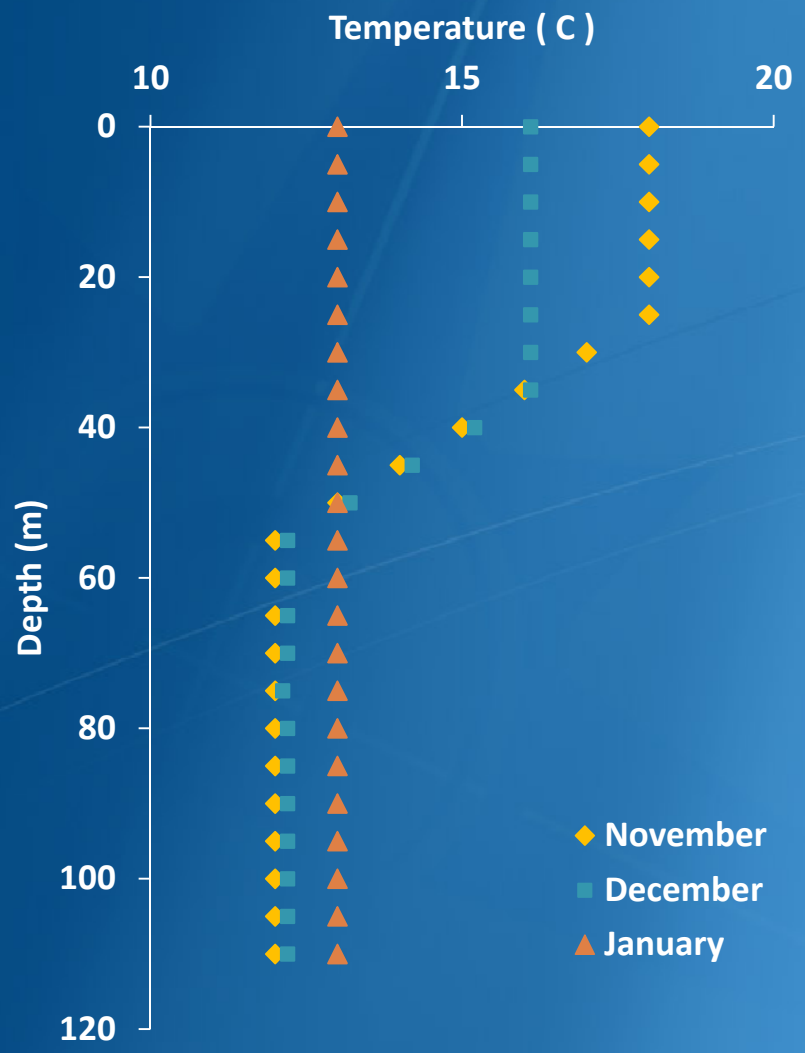
- Increased turbidity carried far into Lake Mead
  - Drinking water treatment
  - Recreation
- There is a reasonably high probability that this could happen but the magnitude of the change will likely be small at current lake levels
  - This year's event entered the lake near the level of the SNWA intakes and coincided with storm water entering from the Las Vegas Wash
  - If Colorado River water entered as a warm surface flow it could carry sediments further into the lake as settling time increases

Risks associated with the HFE

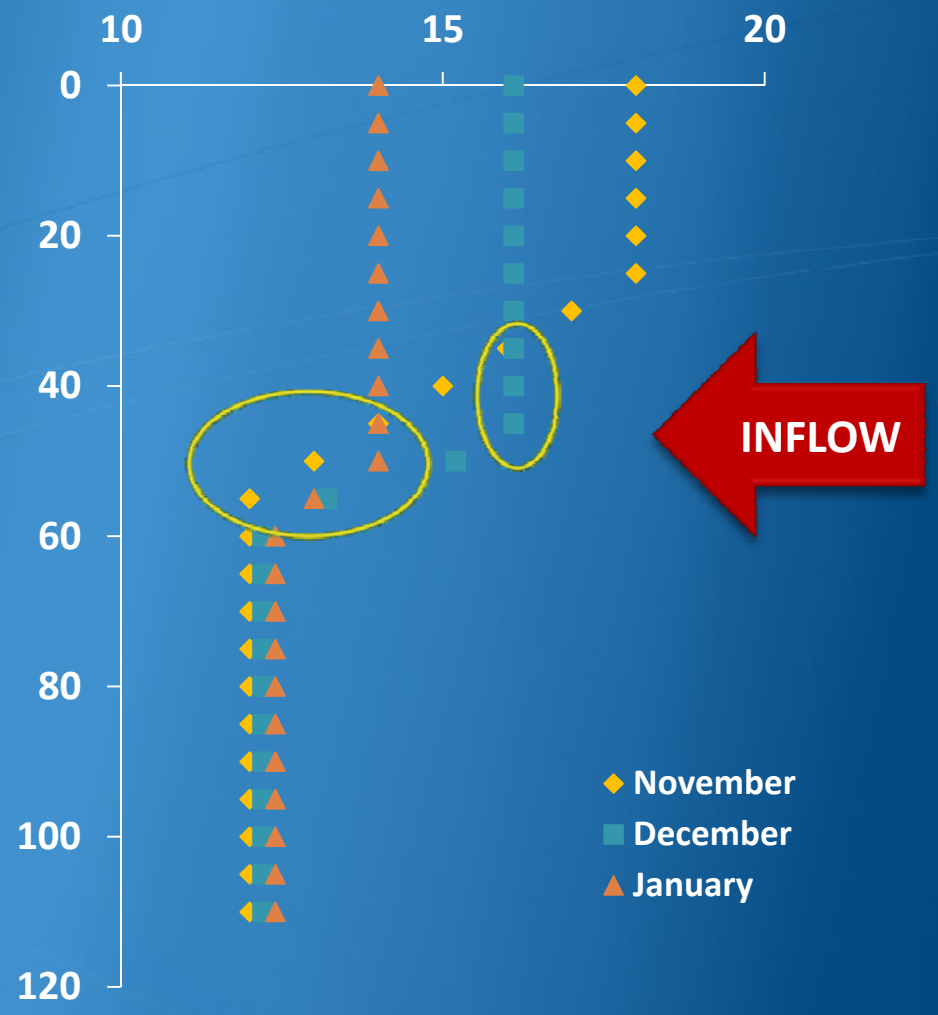
- The inflowing Glen Canyon/Grand Canyon water could reinforce stratification in Lake Mead near the time of destratification
  - This year the experimental water entered the lake at the lower extent of the metalimnion
  - Weather soon after the experimental event turned cold and windy
    - This accelerated destratification of the lake and complete mixing of the flood water with Lake Mead water
  - If the weather were to stabilize (a warm, calm winter) it is possible that the flood waters would prevent or limit the complete mixing of the water column
- It is difficult to assess the likelihood of this occurring
    - Depends on weather

Metalimnetic Inflow

"Typical" Year

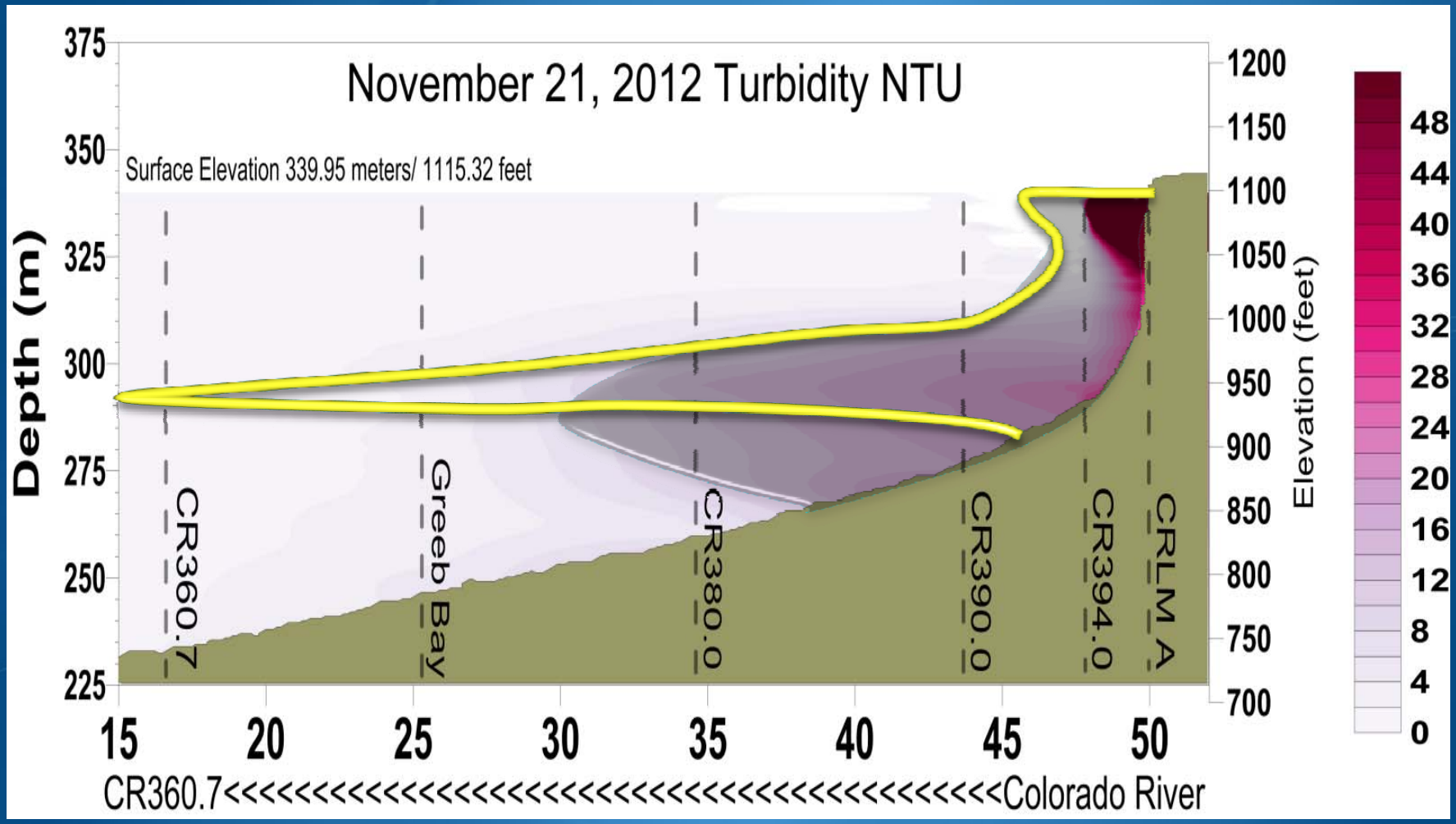


High Flow Year



Risks associated with the HFE

- This year the experimental water entered Lake Mead as a fairly broad interflow in the middle of the water column
- If the experimental water were to enter as a narrow band it likely would extend further into the lake as a recognizable parcel of water
  - Carry turbidity more effectively
  - Route experimental water to the SNWA intakes
    - Good or Bad
- It is difficult to assess the likelihood of this occurring
  - Depends on stratification and temperature of the released water


November 21, 2012 Turbidity NTU
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Depth (m)
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Elevation (feet)
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1100
1050
1000
950
900
850
800
750
700
48
44
40
36
32
28
24
20
16
12
8
4
0
CR360.7
Greeb Bay
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Future High Flow Experiments

- These events are likely to occur again
  - Grand Canyon Protection Act
  - Ongoing alternatives being discussed among interested parties
- Can we attempt to influence the timing of the events?
  - Later in the stratified/destratified period could be better as the flood waters could sink to the bottom of the lake
    - Could remain at the surface if warmer

Future High Flow Experiments

- Sampling of future events
  - Hopefully not on a holiday weekend
  - SNWA is working with partners to develop a sampling plan
    - Sampling of the 2012 event was a coordinated effort by SNWA, the City of Las Vegas, and LMNRA with support from the USGS monitoring platform
      - 4 special sampling trips in addition to routine efforts
  - Better turbidity data
    - Lake Mead and Colorado River
    - Particle size classification as well as “turbidity”
    - Total Phosphorus load?
  - Considering using other tracers of experimental water to better track the inflow
    - Stable isotope analysis: $^{18}O/^{16}O$ and $^{2}H/H$
    - Trace organic compounds
      - Sucralose, Caffeine, etc