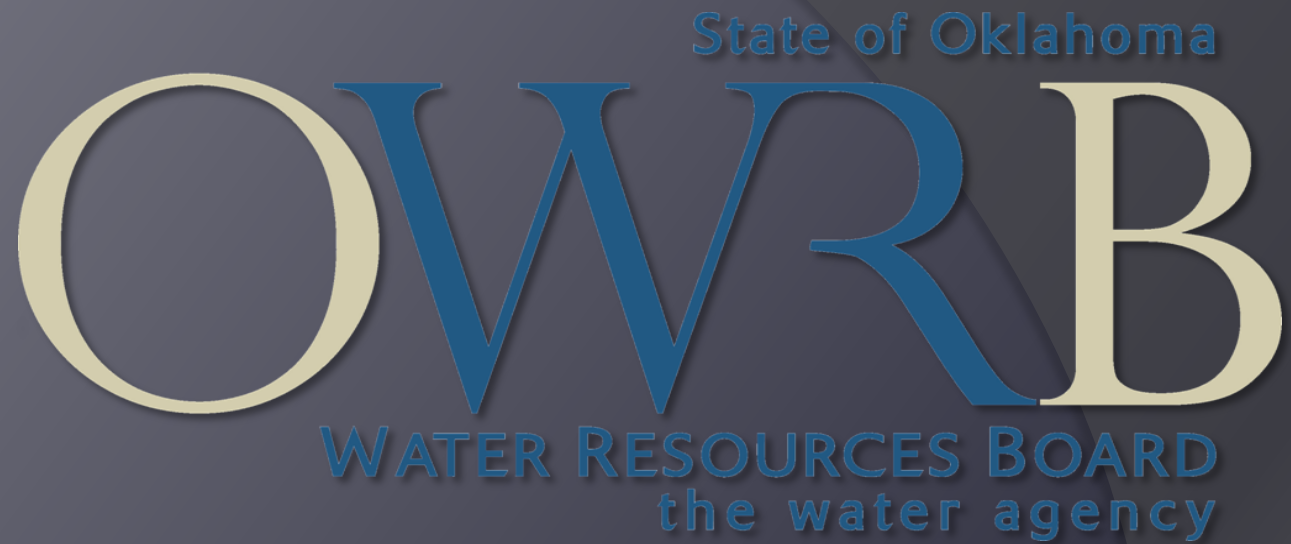




DISSOLVED OXYGEN MONITORING FOR THE GRAND RIVER DAM AUTHORITY (GRDA)

Lance Phillips Environmental Programs Specialist
Oklahoma Water Resources Board (OWRB)

Project Overview

- ◉ Started monitoring in Summer 2006
- ◉ Monitoring is conducted to fulfill GRDA's Federal Energy Regulatory Commission (FERC) license
- ◉ Monitoring is performed below Pensacola Dam (Grand Lake) and Kerr Dam (Lake Hudson)
- ◉ Started with 3 water quality sondes at Pensacola Dam and 1 water quality sonde at Kerr dam
- ◉ Currently have 6 water quality sondes below Pensacola Dam year round
- ◉ And 5 water quality sondes below Kerr dam year round
- ◉ More sondes are deployed during the summer months for mitigation testing

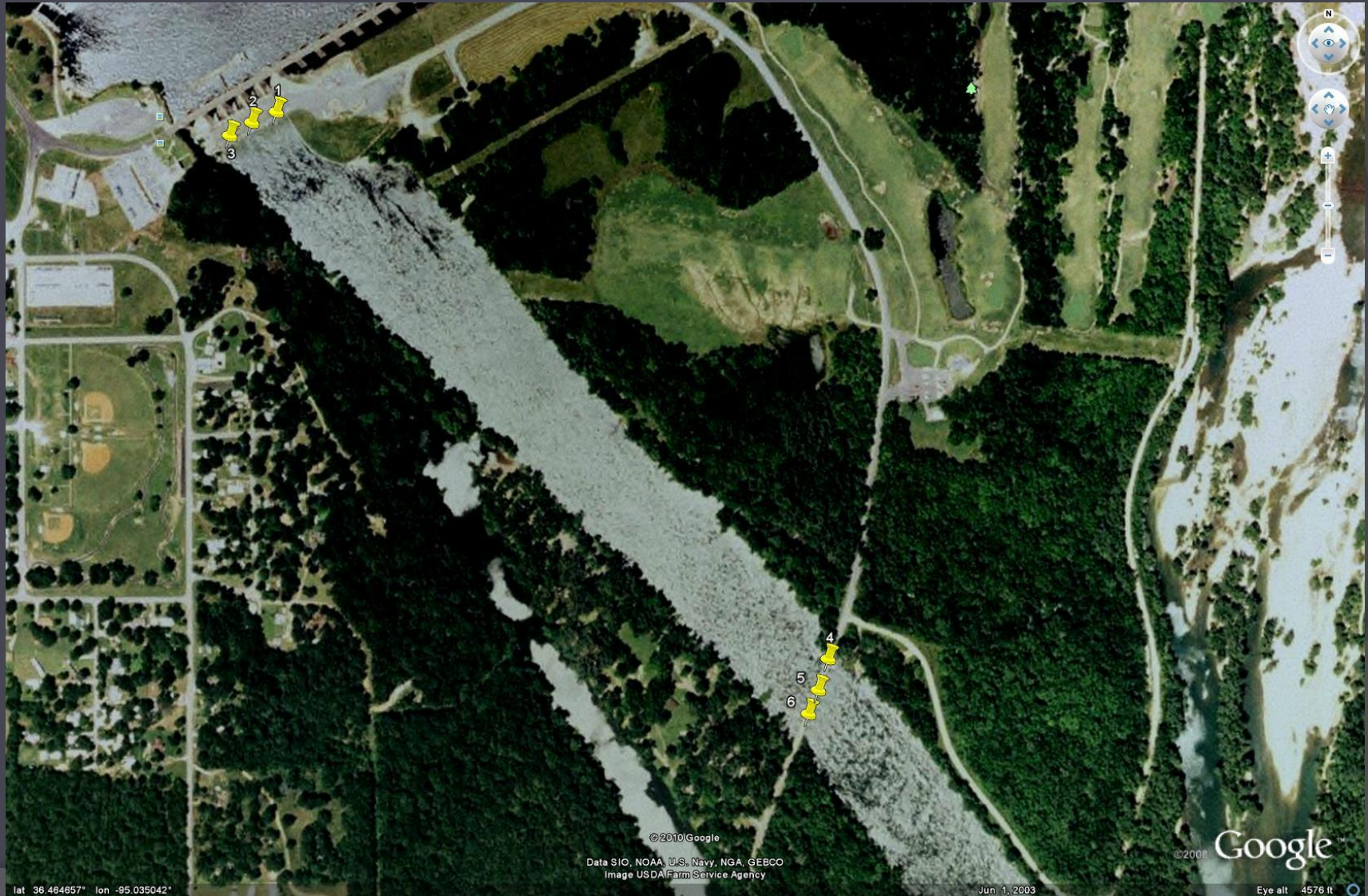
Project Overview Cont.

- ◉ Monitor for Temperature (Celsius), Dissolved Oxygen Concentration (DO mg/L), and Dissolved Oxygen Percent Saturation (DO %).
- ◉ Use YSI 6-series water quality sondes with ROX DO probes.
- ◉ We use a combination of cellular, satellite, and radio to transmit data to our office.
- ◉ All data are stored in the water quality sonde, a data logger, and at our office on a remote server.
- ◉ Produce a yearly Water Quality Standards (WQS) and Use Support Assessment Protocol (USAP) compliance report.

Project Overview Cont.

- ◉ Water quality sondes are typically calibrated on a two-week interval.
- ◉ All water quality sondes are covered with copper tape and an anti-fouling paint to prevent biological buildup.
- ◉ Data are logged on 15 min. intervals, except during summer testing when data are logged on 5 min. intervals.
- ◉ All data are corrected for calibration and fouling drift.
- ◉ Three separate projects
 - Compliance monitoring (year round) at both sites.
 - Pensacola Dam mitigation testing (summer only).
 - Kerr Dam mitigation testing (summer only).

Pensacola Dam



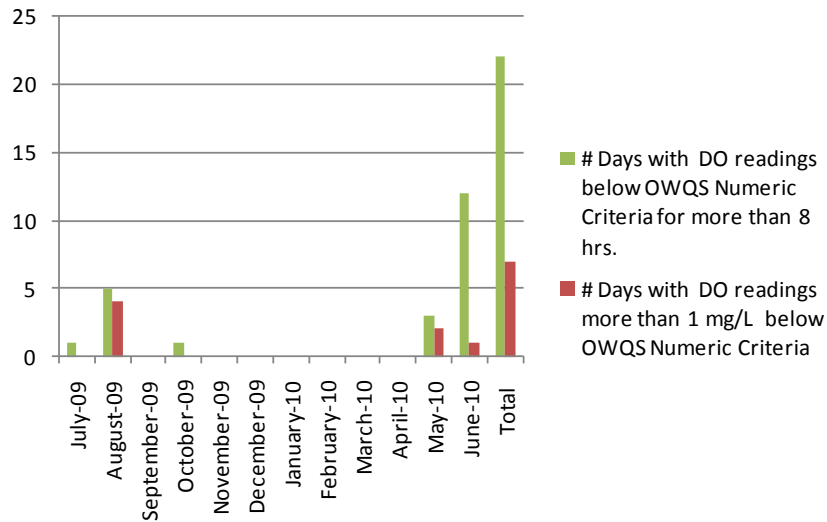
Kerr Dam



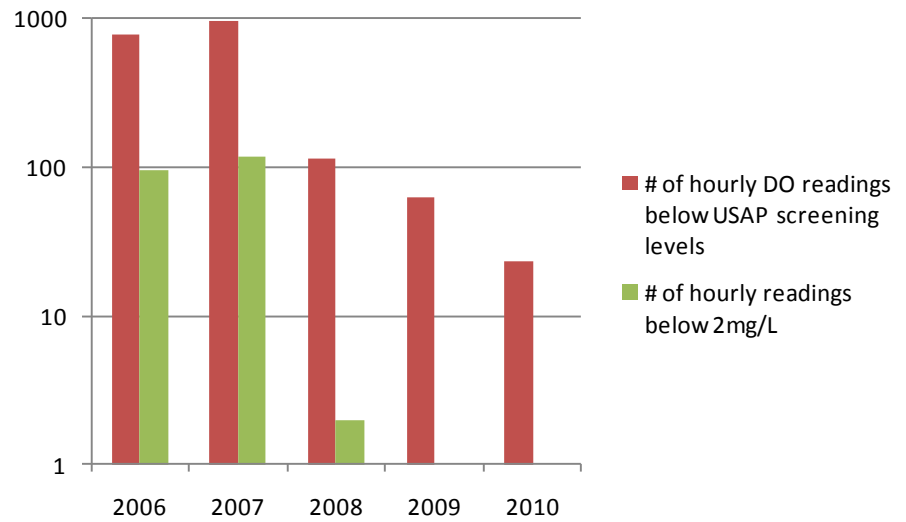
Compliance Report

Pensacola Dam

OWQS Compliance

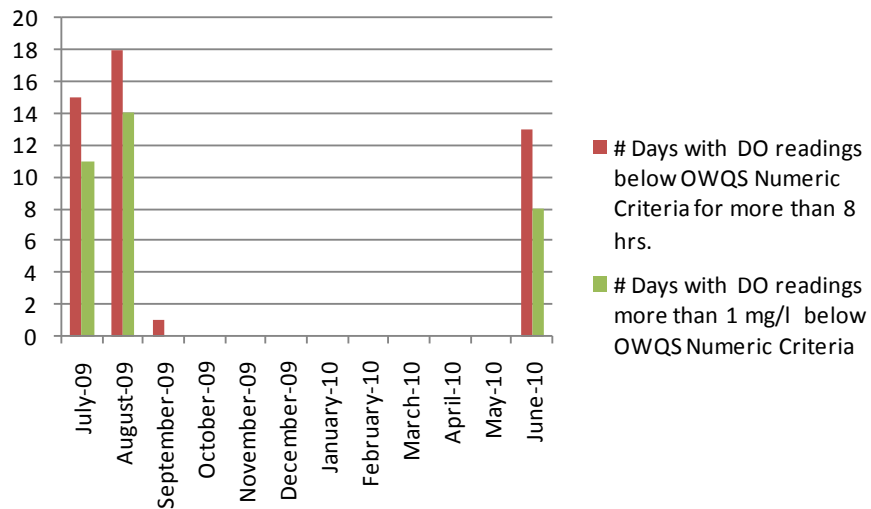


USAP Compliance

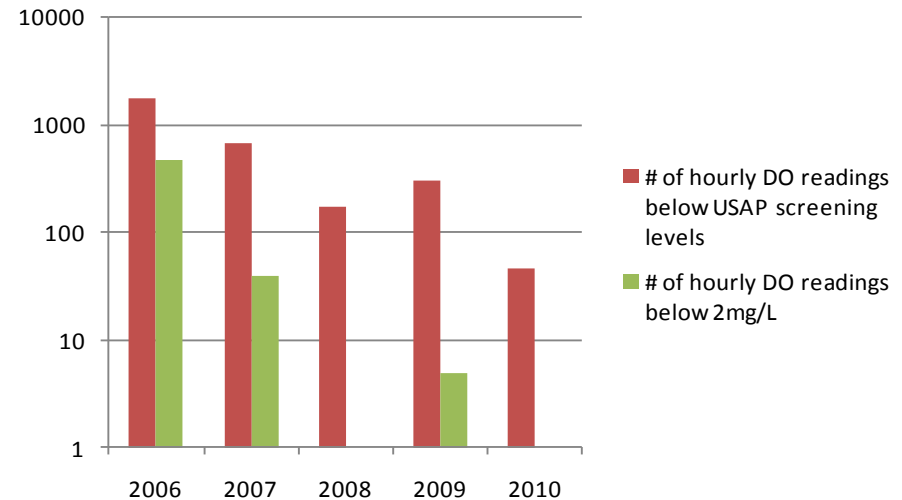


Compliance Report Kerr Dam

OWQS Compliance



USAP Compliance



Summer Testing 2010

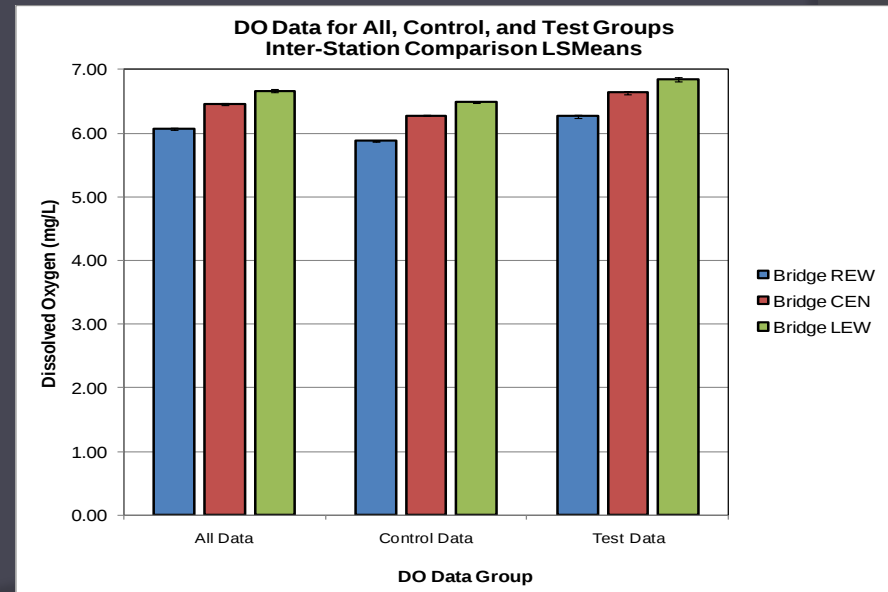
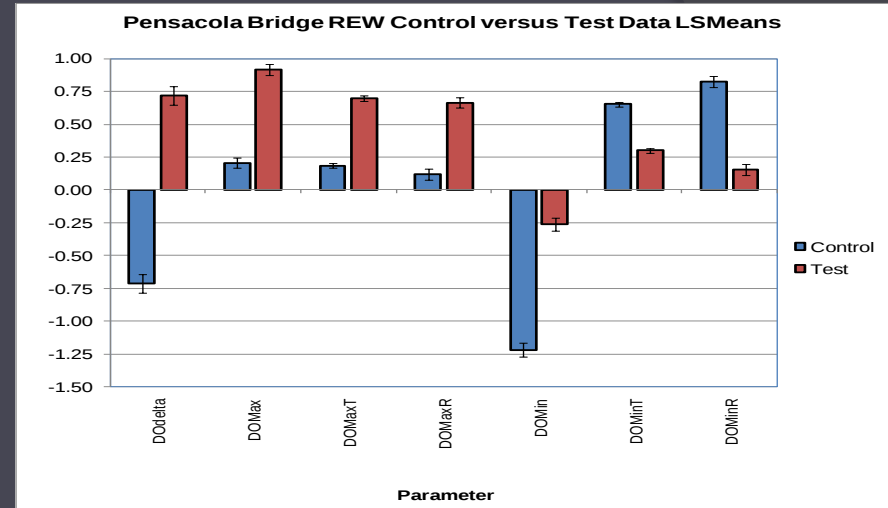
Pensacola Dam

- ⦿ Tested pulse releases from Pensacola Dam
- ⦿ 2200 cfs releases from 2-4 units
 - 2 units 45% wicket gate
 - 4 units 25% wicket gate
- ⦿ 30 min.-1 hr. duration pulses
- ⦿ Pulse intervals were every 3-6 hrs.

Pensacola Dam

General Conclusions

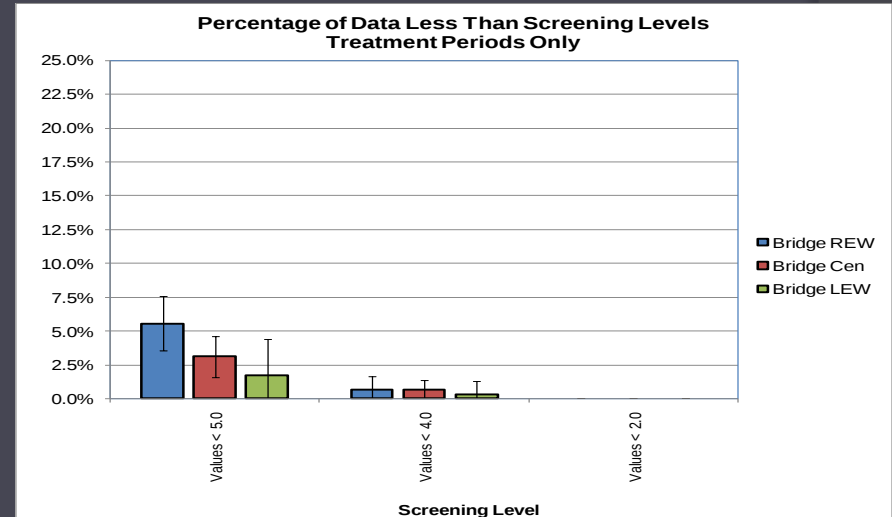
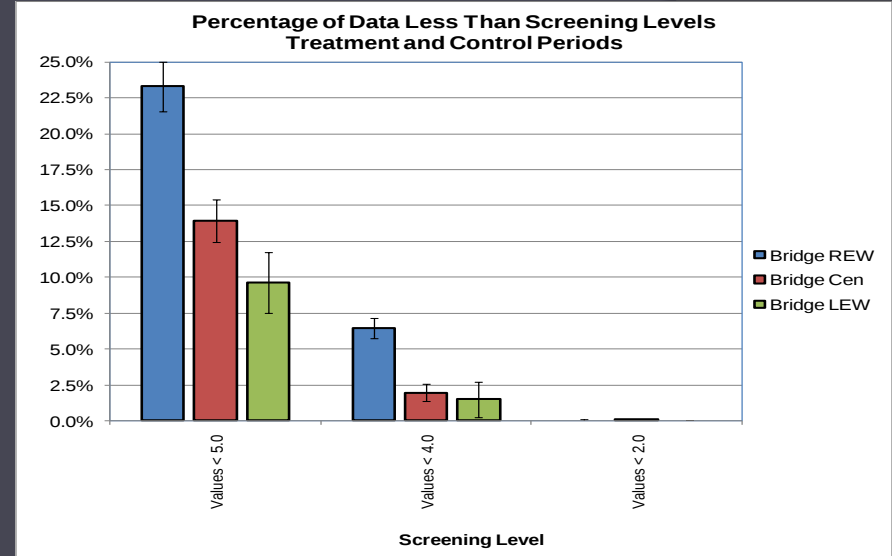
- Treatment effect is an immediate and sustained rise in DO
 - Concentrations are 3-5 times higher than the control data and maintained throughout a significant portion of the treatment period
 - concentrations continue to rise through approximately 69% of the treatment period compared to less than 25% during control periods
- negative gain in DO concentrations are minimal
 - less than 3.5-4.5 times smaller than the control period loss in concentration
 - occurs within the first 33% of the treatment period compared to approximately 61% of the control period
- concentrations appear to be sustained through at least a portion of the subsequent control period



Pensacola Dam

General Conclusions

- Test data sets are above the 5ppm DO criterion in the state Water Quality standards
- Whole data sets are below criterion



Results

- ⦿ Immediate effects downstream during pulses
- ⦿ Very little retention time
- ⦿ Need further testing

Summer Testing 2010

Kerr Dam

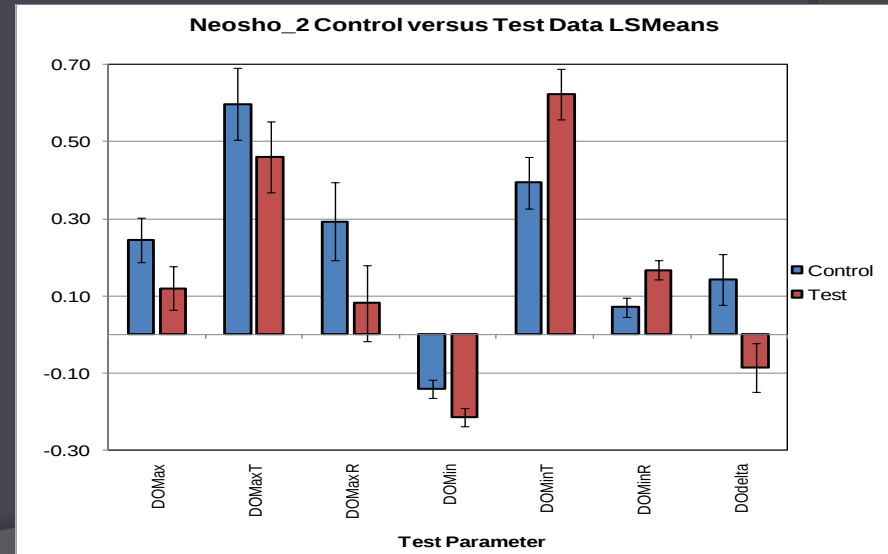
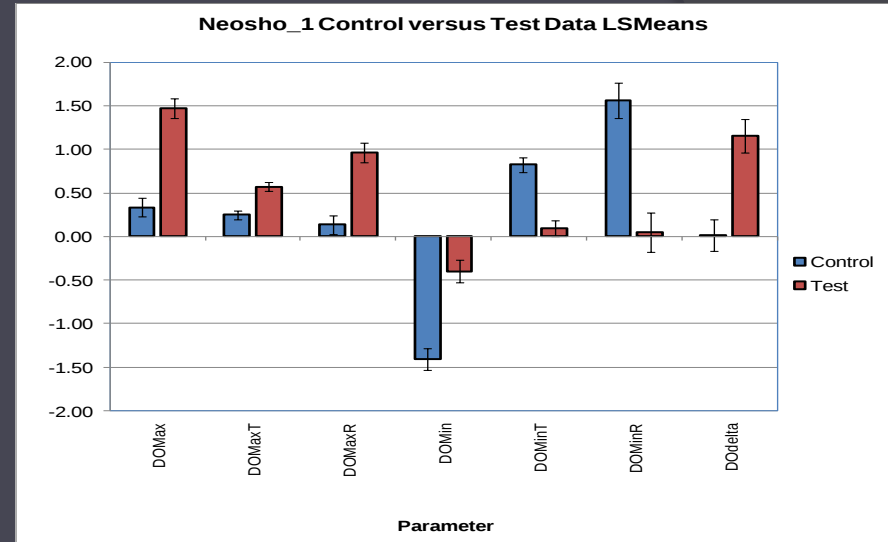
- Spillage testing from one Tainter gate
- ~350 cfs (one chain link)
- Release duration was 2, 4, and 8 hrs.
- Release intervals were 2, 4, and 8 hrs.

Kerr Dam

General Conclusions

- Treatment effect is an immediate and sustained rise in DO at Station 1
 - Concentrations are 4.5 times higher than the control data and maintained throughout a significant portion of the treatment period
 - concentrations continue to rise through approximately 57% of the treatment period
- negative gain in DO concentrations are minimal at Station 1
 - less than 3.5 times smaller than the control period loss in concentration
 - occurs within the first 10% of the treatment period compared to approximately 85% of the control period

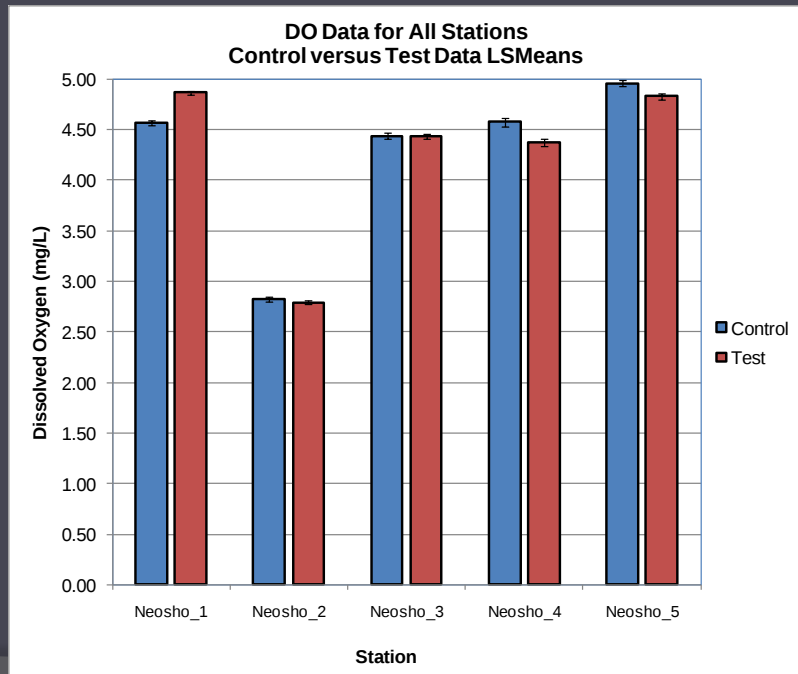
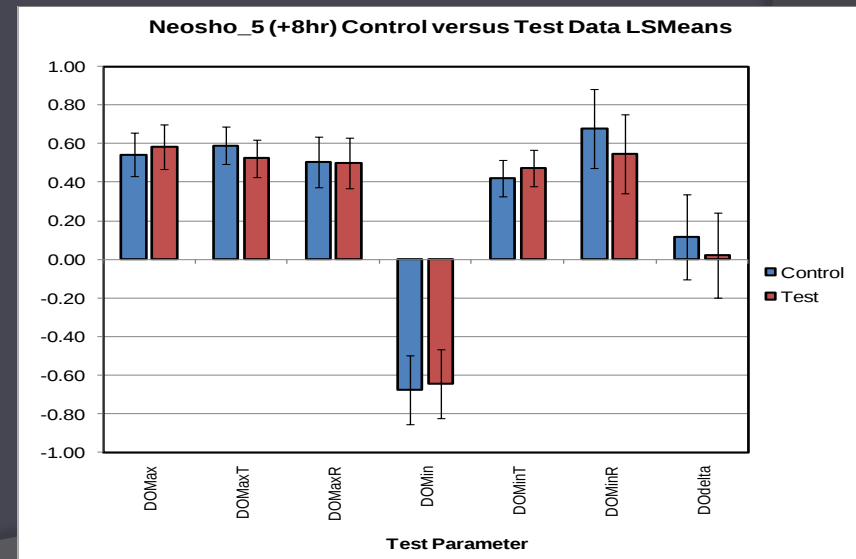
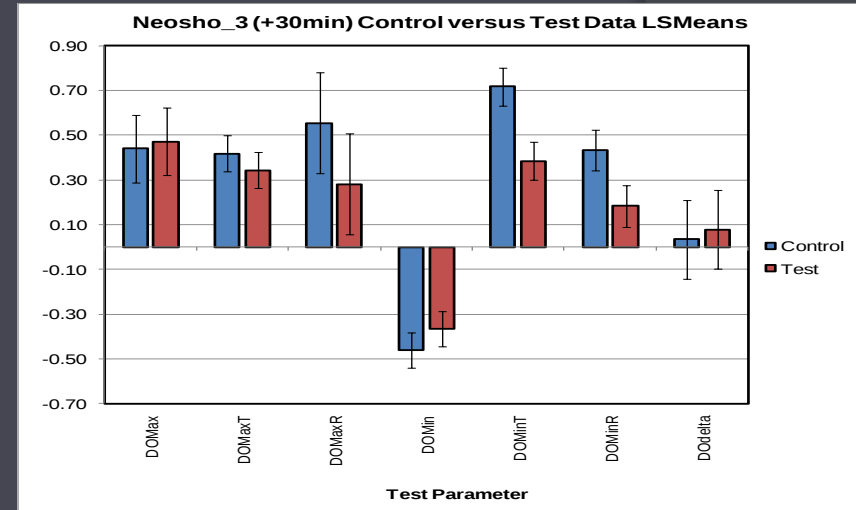
Results opposite for the negative control



Kerr Dam

General Conclusions

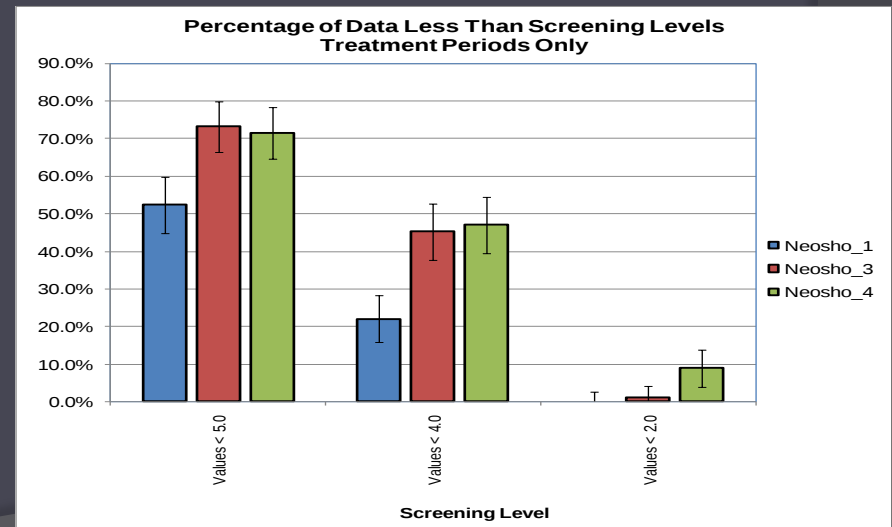
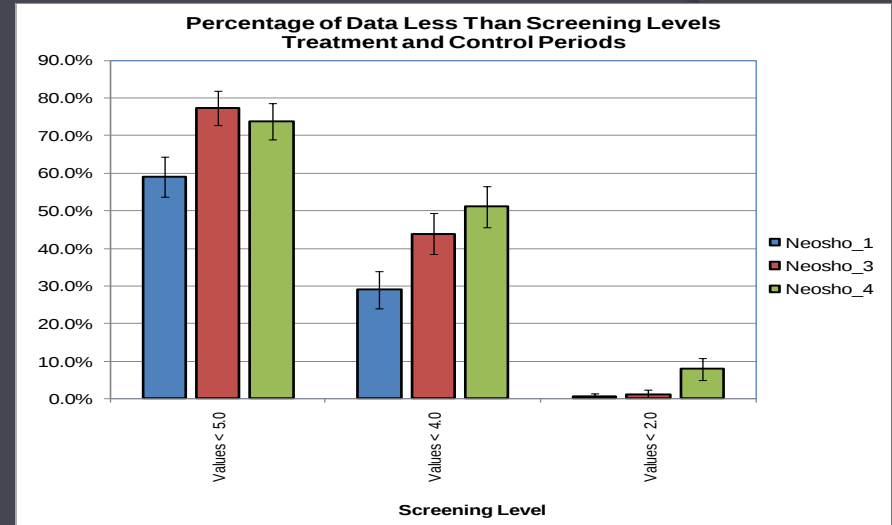
- Below Station 2, results appear to be affected by natural variation as much as treatment
- Evidenced by
 - Diurnal patterns
 - Very little experimental effect
 - Values are not significantly different than control data or the control data are higher



Kerr Dam

General Conclusions

- Whole data and treatment data sets are below the 4 and 5ppm DO criterion and screening limit in the state Water Quality standards and Use Support Assessment Protocols
- Treatment does not accomplish goals



Results

- ⦿ Small area affected.
- ⦿ Little to no effect downstream past 2nd buoy.
- ⦿ Downstream was influenced more by natural diurnal cycle.
- ⦿ Very little retention time.
- ⦿ Need further testing.

Summer 2011 Testing

- ⦿ In-lake water quality vertical profilers
 - Profiles every 4-6 hrs.
 - Temperature, DO mg/L, DO % sat, ORP, pH, Conductivity.
 - Transmitted via cellular telemetry to OWRB and GRDA.
- ⦿ Move two Pensacola Dam tail deck water quality sondes to mid channel buoys.
- ⦿ Add two more water quality buoys below Kerr Dam.
- ⦿ DO mapping below Kerr Dam before and after spillway releases to determine extent of treatment area.

Summer 2011 Testing

- Continue generator pulse testing at Pensacola Dam using different release amounts and release duration.
- Begin testing generator pulsing at Kerr Dam for background data.
- Begin mitigation testing during early life stages (May 15-June 15) at both locations.

Pensacola Dam Summer 2011



Kerr Dam Summer 2011



Questions ?

A photograph of a river scene. On the right side, there is a bridge structure with concrete pillars and metal beams. Two black pipes or conduits run diagonally from the bridge down into the water. The water is slightly turbulent. On the left side, there are green trees and bushes, with some branches hanging over the water.

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