

NDEP Bureau of Water Quality Planning

DRAFT Proposed Lahontan Reservoir Water Quality Standards Revisions - NAC 445A.1792, 445A.1822, 445A.1824

February 18, 2014 – Carson City
February 20, 2014 – Silver Springs

What are Standards and How Are They Used?

- Required by State Law and Federal Clean Water Act
- Define the water quality goals for a surface water
 - ◆ Beneficial uses are defined
 - ◆ Water quality criteria as needed to protect the beneficial uses
- Used to assess health status of a surface water
- Used to establish limitations for surface water discharge permits
- Used to guide voluntary nonpoint source improvement projects

Key Elements of Water Quality Standards

- Defined by waterbody reach
 - ◆ Designated beneficial uses
 - ◆ Criteria to protect beneficial use
 - ◆ Antidegradation provision (RMHQs)



Current Reaches

NAC 445A.1822

Carson River from
Dayton to US Hiway
95

NAC 445A.1824

Carson River from
US Hiway 95 to
Lahontan Dam



New Reaches

NAC 445A.1822

Carson River from
Dayton to ~~US Hiway 95~~
Lahontan Reservoir

NAC 445A.1824

~~Carson River from US
Hiway 95 to Lahontan
Dam~~ Lahontan
Reservoir

Beneficial Uses Assigned to Lahontan Reservoir

- Municipal or domestic supply
- Irrigation
- Watering livestock
- Propagation of aquatic life (warm water fish)
 - ◆ Species of concern – walleye, channel catfish and white bass
- Propagation of wildlife

Beneficial Uses Assigned to Lahontan Reservoir

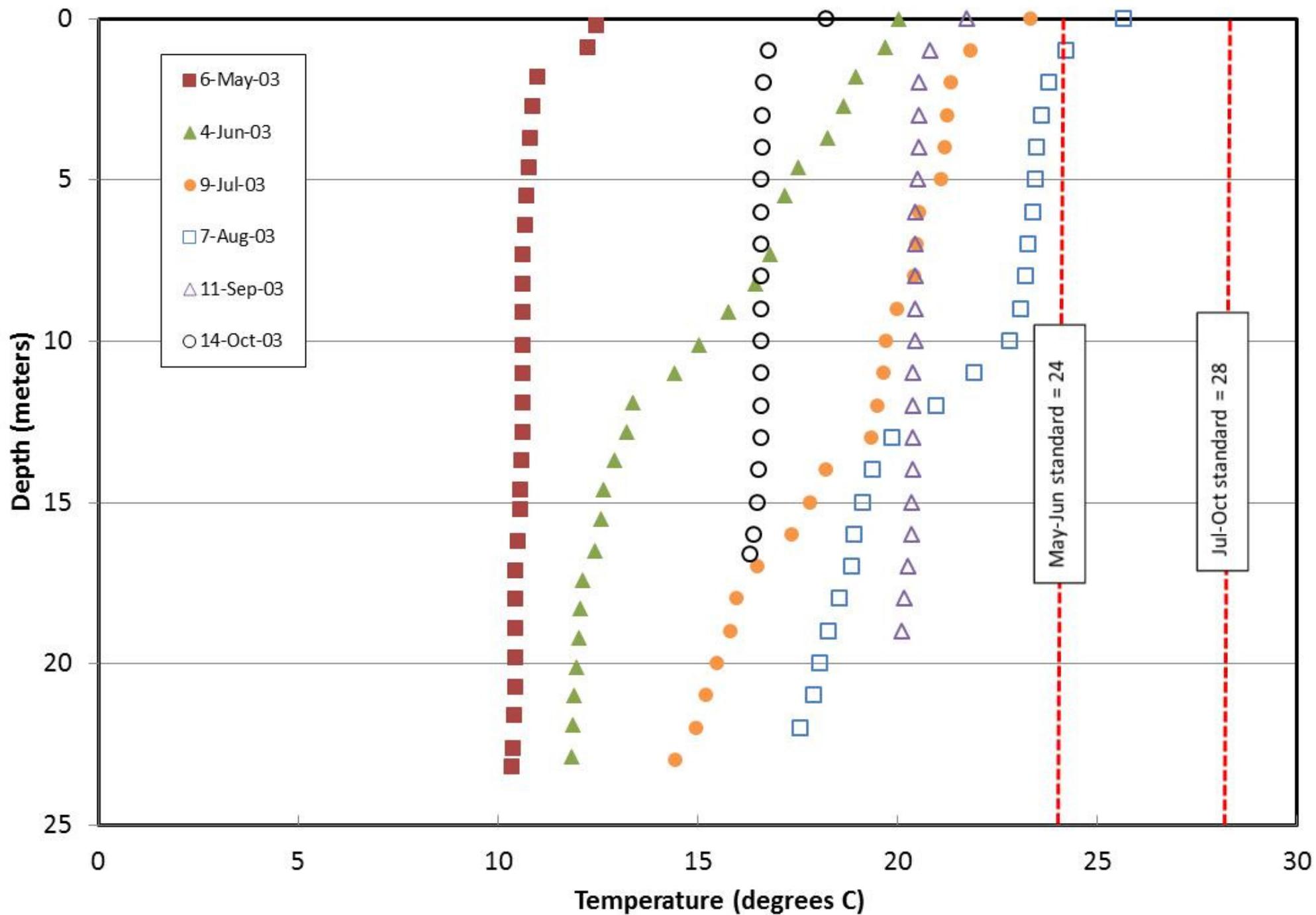
- Industrial Supply
- Recreation involving contact with the water (swimming)
- Recreation not involving contact with the water (boating)

No changes are proposed for the beneficial uses

Temperature

- Nov-Mar < 11 °C
 - Apr-Jun < 24 °C
 - Jul-Oct < 28 °C
 - $\Delta T \leq 2$ °C - Maximum allowable increase at boundary of mixing zone
-
- Set in 1984 based upon NDOW and EPA recommendations for warmwater fish.
 - >99% of temperature readings (2003-05, 2012-13) met standards
 - No new recommendations available. No NAC changes recommended at this time

Temperature Profiles at LR5 - 2003



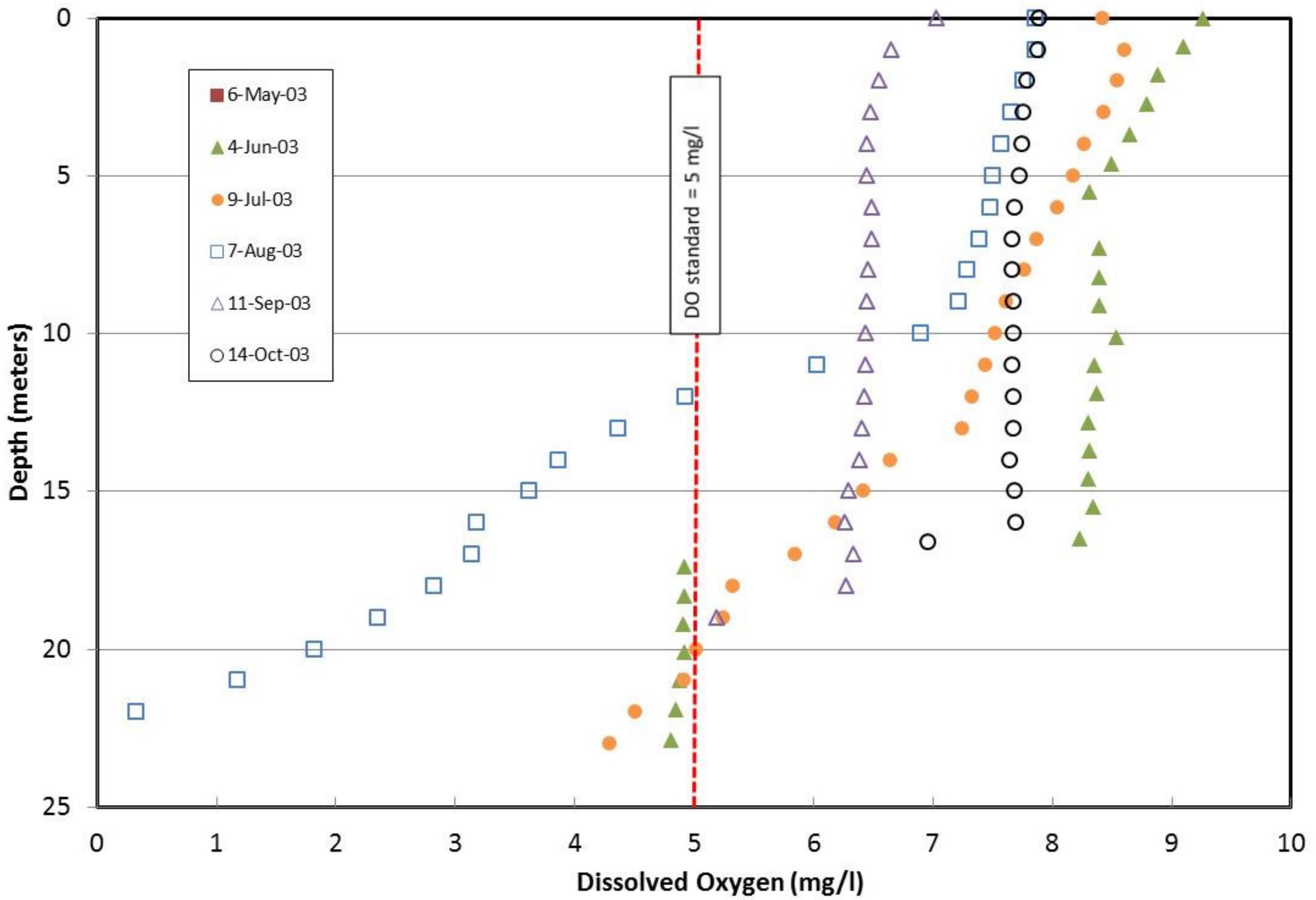
pH

- 6.5 – 9.0
- Set in 2002 based upon EPA recommendations (1984 - Gold Book) for aquatic life
- 98% of pH readings (2003-05, 2012-13) met standards
- No new EPA recommendations. No changes recommended by NDEP

Dissolved Oxygen

- 5.0 mg/l
- Set in 1984 based upon EPA recommendations (1976 Red Book) for aquatic life
- Current EPA recommendation (1984 Gold Book) is 5 mg/l for warmwater fisheries
- Low DO in hypolimnion is common in many lakes/reservoirs. Organic matter settles, decomposes, and DO is consumed.

Dissolved Oxygen Profiles at LR5 - 2003



Dissolved Oxygen

- Proposed change:
 - ◆ Retain 5.0 mg/l
 - ◆ Add footnote – “When lake is stratified, the dissolved oxygen standard applies only to the epilimnion”
- 95% of samples (2003-05, 2012-13) meet this criterion

Total Suspended Solids

- 25 mg/l
- Set in 1984 based upon EPA's Blue Book (1972)
- ~30% of TSS readings (2003-05, 2012-13) exceed standards. On 303(d) List as impaired. Worst conditions are in the upper basins.
- EPA guidance documents subsequent to 1972 Blue Book have not provided any recommendations for TSS. EPA recognizes the need for updated criteria. No NAC changes are recommended until EPA revises guidance.

Turbidity

- 50 NTUs (nephelometric turbidity units)
- Set in 1984 based upon EPA's Green Book (1968) for protection of warmwater fish
- ~25% of TSS readings (2003-05, 2012-13) exceed standards. On 303(d) List as impaired. Worst conditions are in the upper basins.
- EPA guidance documents subsequent to 1968 Green Book have not provided any recommendations for Turbidity. EPA recognizes the need for updated criteria. No NAC changes are recommended until EPA revises guidance.

Color

- 75 PCUs (platinum-cobalt units)
- Set in 1984 based upon EPA's Red Book (1968) for protection of municipal or domestic supplies
- ~99% of color readings (2003-05, 2012-13) meet standards.
- No new EPA recommendations. No NAC changes recommended at this time

Total Dissolved Solids

- 500 mg/l (Annual Average)
- Set in 1984, for protection of municipal or domestic supplies, based upon 1977 Water Supply Regulations established by Nevada Division of Health
- Consistent with current EPA guidance
- 100% of TDS readings (2003-05, 2012-13) meet standards.
- No NAC changes are proposed at this time.

Chloride

- 250 mg/l (single value)
- Set in 1984, for the protection of municipal or domestic supplies, based upon 1977 Water Supply Regulations established by Nevada Division of Health
- Update using current EPA guidance – Aquatic life protection
 - ◆ Chronic – 230 mg/l (96-hour)
 - ◆ Acute – 860 mg/l (1-hour)
 - ◆ Not to be exceeded more than once in 3 years
- 100% of chloride readings (2003-05, 2012-13) meet proposed standards

Sulfate

- 250 mg/l (single value)
- Set in 1984 , for the protection of municipal or domestic supplies, based upon 1977 Water Supply Regulations established by Nevada Division of Health
- 100% of sulfate readings (2003-05, 2012-13) meet standards.
- No NAC changes proposed at this time.

Sodium Adsorption Ratio

- 8 (unitless)
- Calculated based upon sodium, calcium, magnesium
- Set in 1984 for the protection of irrigation based upon 1976 EPA guidance
- 100% of SAR (2003-05, 2012-13) meet standards.
- No new EPA guidance. No changes are recommended at this time

Alkalinity

- <25% change from natural conditions
 - ◆ Standard is difficult to assess
- Set in 1984 for the protection of aquatic life based upon 1972 EPA guidance.
- Alkalinity buffers pH change; can complex with some toxic heavy metals and reduce their toxicity
- Update with current EPA recommendations
 - ◆ ≥ 20 mg/l or more as Calcium Carbonate
- 100% of alkalinity samples (2003-05, 2012-13) currently meet this recommendation

E coli

- SV – 235 No./100 ml; AGM – 126 No./100 ml
- Set in 2002 for the protection of contact recreation based upon 1986 EPA guidance.
 - ◆ Guidance included range of Single Value criteria depending upon the level of recreation use
- 100% of E coli samples (2003-05, 2012-13) currently meet the existing standard
- EPA has recently issued new E coli recommendations. NDEP in process of working with EPA to resolve issues. No changes are recommended at this time.

Fecal Coliform

- SV – 1,000 No./100 ml
- Set in 2012 for the protection of irrigation and wildlife based upon 1972 EPA guidance. No more recent recommendations exist.
- 100% of fecal coliform samples (2003-05, 2012-13) currently meet this standard
- No changes are recommended

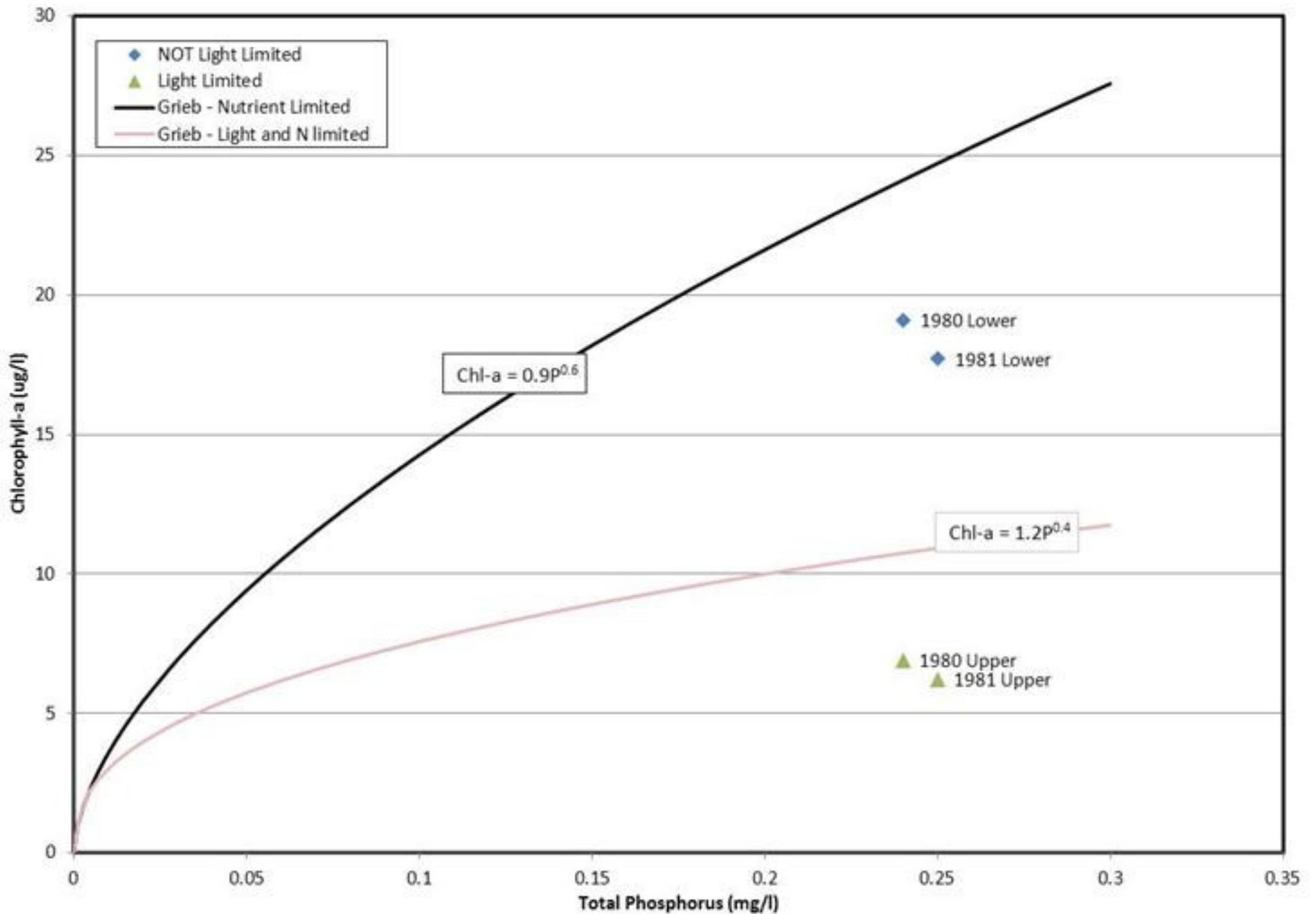
Current Nutrient WQS

Parameter	RMHQs	Beneficial Use Criteria	Most Restrictive Beneficial Use
Total Phosphates (aka total phosphorus)	None	SV: ≤ 0.06 mg/l	Aquatic life; contact recreation
Total Nitrogen	AA: 1.3 mg/l SV: 1.7 mg/l	None	Not applicable
Nitrate	None	SV: ≤ 10.0 mg/l	Municipal or domestic supply
Nitrite	None	SV: ≤ 1.0 mg/l	Municipal or domestic supply

History of Nutrient WQS

- Total Phosphorus: $SV \leq 0.06$ mg/
 - ◆ Established in 1984 based upon DRI study
 - ◆ Concluded phosphorus loading was major contributor to eutrophic conditions
 - ◆ Set to limit algae levels (chlorophyll-a) to 10 $\mu\text{g/l}$
 - Need to question the appropriateness of this threshold for Lahontan Reservoir
 - ◆ Based upon relationship between P and chl-a derived from data for manmade lakes in SE U.S.
 - “Care should be taken in applying the model in dissimilar regions other than as a first approximation of the expected conditions in a warm water fishery.”

Figure 2. 1980-81 Data Compared to Grieb Predictions



History of Nutrient WQS (cont'd)

■ Total Nitrogen

◆ No beneficial use WQS set

◆ DRI concluded phosphorus loading was major contributor to eutrophic conditions. No nitrogen standard recommended

- The control of nitrogen levels beyond existing levels was not thought to impact algae levels
 - Relied on RMHQs for control

■ Nitrate: $SV \leq 10$ mg/l; Nitrite: $SV \leq 1$ mg/l

- ◆ Set in 1984 based upon EPA recommendation for drinking water

Proposed Approach for Nutrients

- EPA encourages adoption of standards for both causal (nutrients) and response (variables)
 - ◆ Evaluate appropriate chlorophyll-a target/criteria
 - ◆ Opted to include as criteria due to uncertainty in the nutrient:algae relationships
 - ◆ Evaluate P and N levels needed to meet chlorophyll-a criteria

Select Appropriate Chlorophyll-a Target

- Current WQS based upon desired trophic conditions between mesotrophic and eutrophic conditions – 10 µg/l
 - ◆ Trophic state is a general concept
 - ◆ No precise definition
 - ◆ No single set of agreed upon algae thresholds for classification
 - ◆ Not necessarily tied to beneficial use protection
- Protection of beneficial uses is foundation of WQS
 - ◆ Contact and non-contact recreation; aquatic life; drinking water
 - ◆ No EPA recommendations
 - ◆ Review of literature and other states' regulations
 - ◆ Wide range of values

Summary of Chlorophyll-a Thresholds

Beneficial Use	Chlorophyll-a ($\mu\text{g/l}$)
Contact and noncontact Recreation	15 – 20
Aquatic Life (warmwater fishery)	20 – 25
Municipal or domestic supply	None
Recommended Criteria	15

Scale for Chlorophyll-a and Nutrient WQS

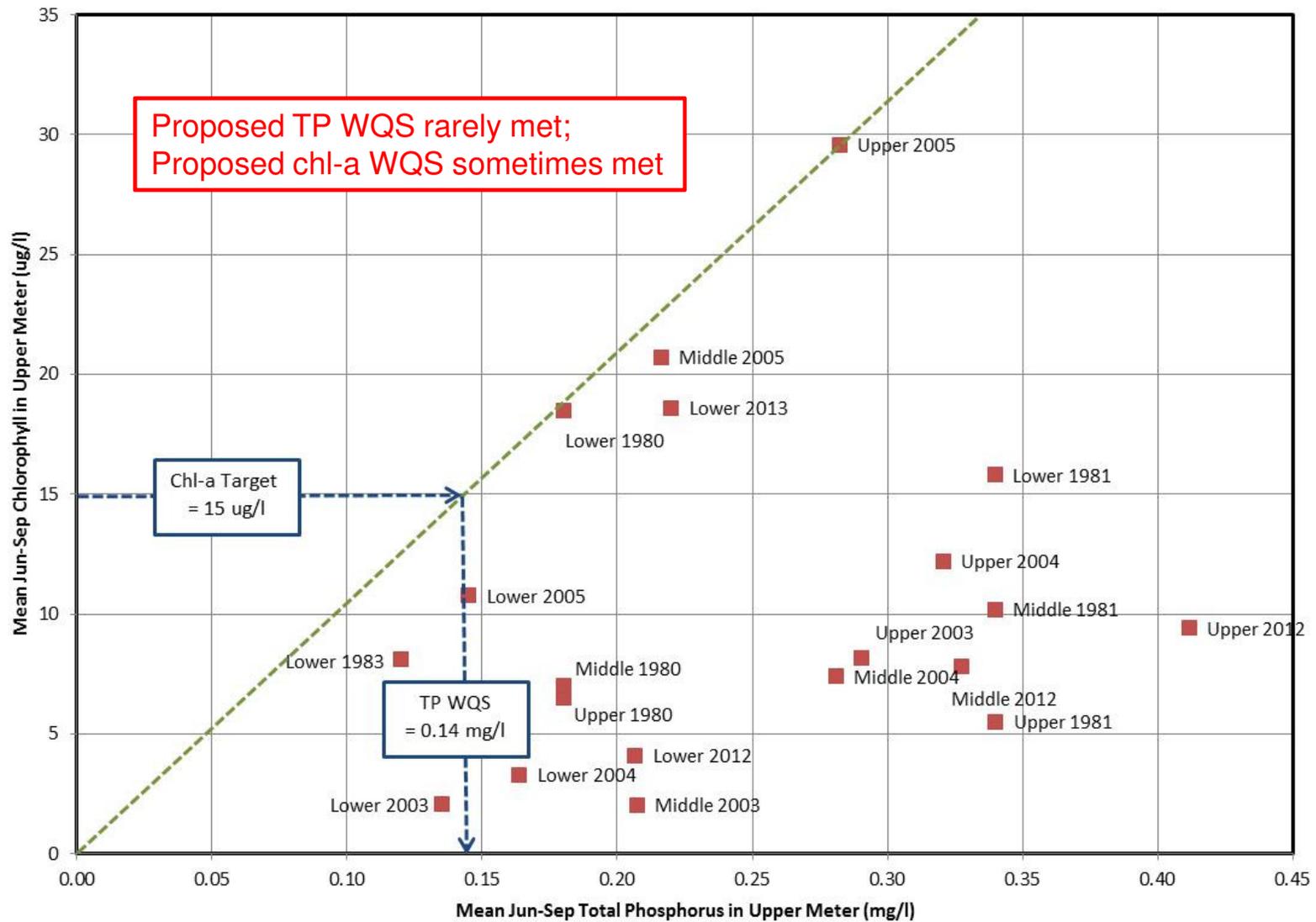
■ Temporal Scale Options

- ◆ Annual mean
- ◆ Summer mean
- ◆ June – Sept mean ← Recommended
- ◆ May – October mean

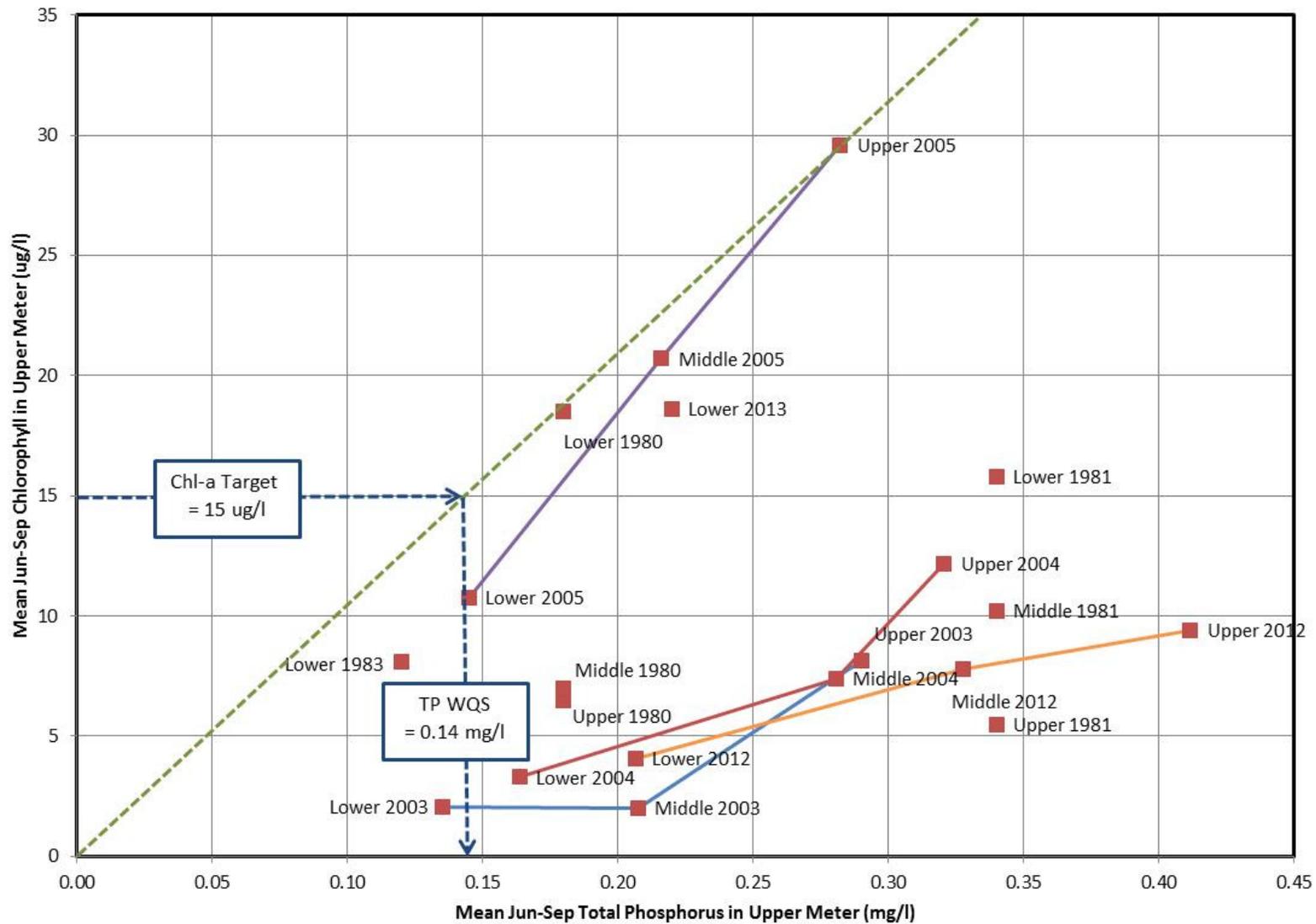
■ Spatial Scale Options

- ◆ Areal
 - ◆ Mean of all sites in reservoir
 - ◆ Mean of all sites in a segment (basin) ← Recommended
 - ◆ Each monitoring sites separately
- ◆ Water column
 - ◆ Mean in entire water column
 - ◆ Mean in epilimnion
 - ◆ Mean in upper meter ← Recommended
 - ◆ Mean in euphotic zone

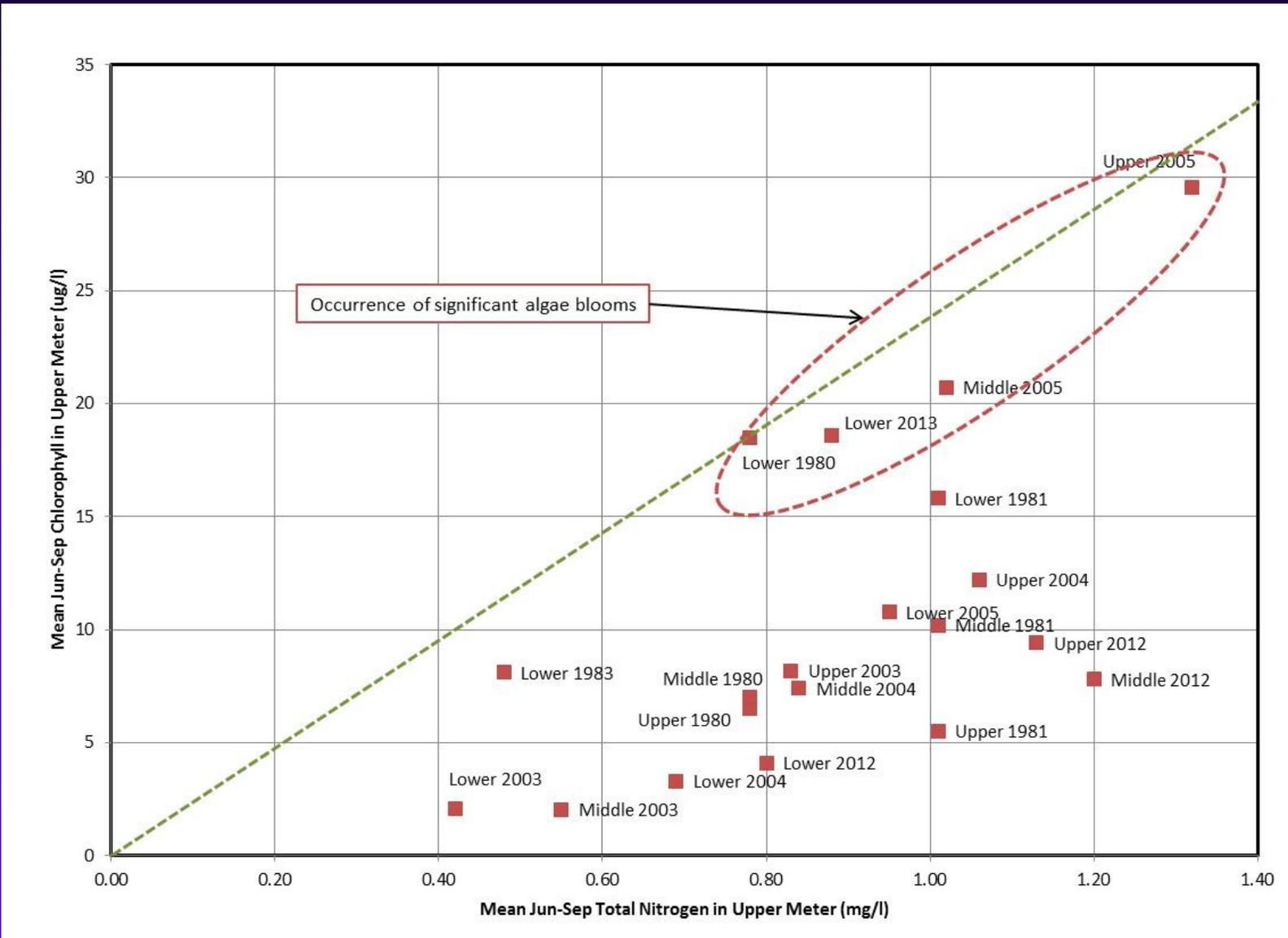
Total P vs. Chlorophyll-a



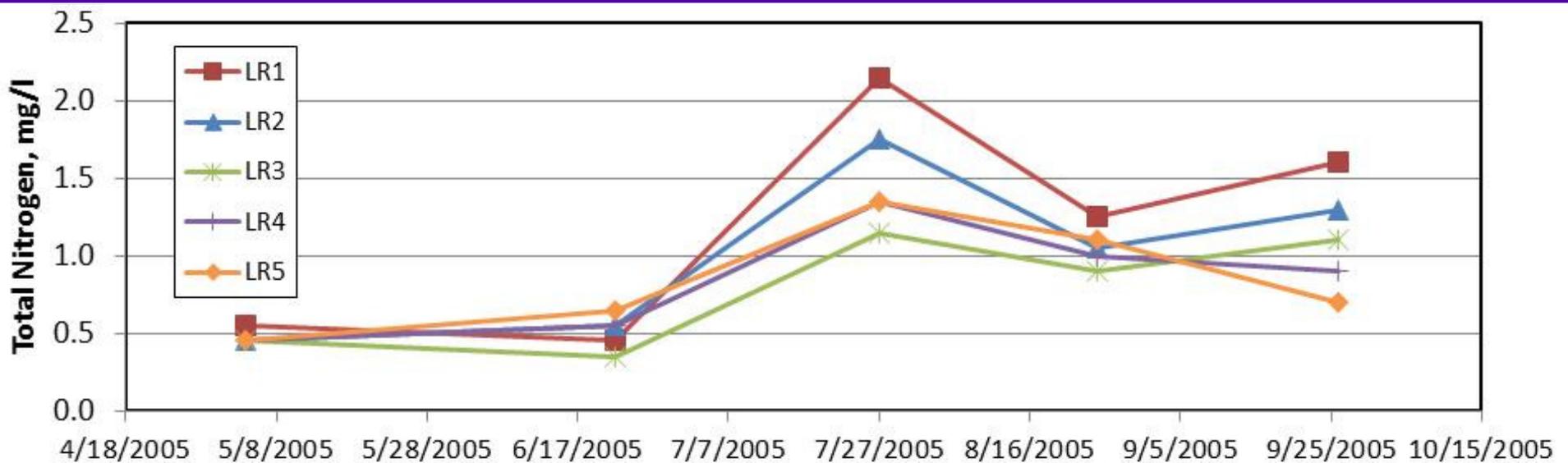
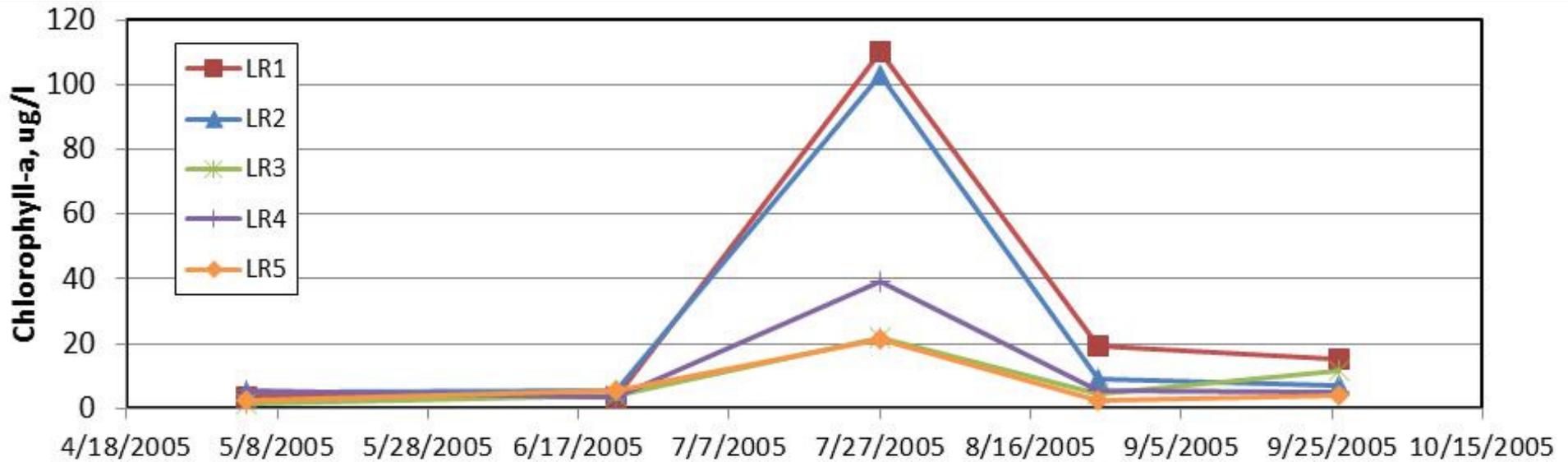
Total P vs. Chlorophyll-a



Total N vs. Chlorophyll-a



TN - Chlorophyll-a: Cause or Response?



TN WQS?

- Some researchers have concluded that lake eutrophication cannot be controlled by TN controls, and that only TP WQS are necessary
 - ◆ Significant disagreement
 - ◆ EPA recommends setting both N and P criteria
- NDEP recognizes the need to control both N and P
 - ◆ Causal-response analysis confounded due to N fixation. Unable to set N WQS for the control of algae.
 - ◆ Rely on RMHQs
 - SV = 1.7 mg/l
 - AA = 1.3 mg/l
 - Insufficient data exists to re-evaluate existing RMHQs

Decision Framework for TP and Algae

- Considerable uncertainty in TP:chlorophyll-a relationship
- Chlorophyll-a – more direct measure of beneficial use impact
 - ◆ Best to rely on to determine beneficial use support /impairment

	Jun-Sep Mean TP \leq 0.14 mg/l	Jun-Sep Mean TP $>$ 0.14 mg/l
Jun-Sep Mean Chl-a \leq 15 μg/l	Criteria met	Criteria met
Jun-Sep Mean Chl-a $>$ 15 μg/l	Criteria NOT met	Criteria NOT met
Chl-a level is unknown	Criteria met	Criteria NOT met

Nitrate and Nitrite Recommendations

- Nitrate: $SV \leq 10 \text{ mg/l}$
 - ◆ Set in 1984 based upon EPA recommendation for drinking water
 - ◆ EPA recommendation is unchanged
 - ◆ No change is proposed
- Nitrite: $SV \leq 1 \text{ mg/l}$
 - ◆ Set in 1984 based upon EPA recommendation for drinking water
 - ◆ EPA recommendation is unchanged
 - ◆ No change is proposed

Summary of Beneficial Use Criteria Changes

- Break lake out into separate reach
- Nutrients - Modify TP criteria, add chlorophyll-a criteria
 - ◆ Incorporate decision framework to rely on chlorophyll-a for beneficial use support determinations
- DO – modify to account for stratification
- Chloride – modify for protection of aquatic life
- Alkalinity – modify in accordance with EPA guidance

RMHQs

- Requirements to Maintain Existing Higher Quality
 - ◆ Set for routine parameters where the existing quality is better than beneficial use standards
 - ◆ Primarily set to protect higher quality degradation from permitted discharges
 - ◆ Degradation (up to Beneficial Use standard) allowed if justified due to social/economic factors

- Current Lahontan RMHQs set in 1984 - Appear to be based upon quality near the dam
 - ◆ Temperature
 - ◆ Total Nitrogen
 - ◆ Turbidity
 - ◆ Color
 - ◆ TDS
 - ◆ Chloride
 - ◆ Sulfate
 - ◆ SAR
 - ◆ Fecal Coliform

- Insufficient data to revise RMHQ – No changes proposed

Next Steps

- Comments on Draft Proposal due by 5:00 PM, March 14, 2014
 - ◆ Draft Rationale soon available at http://ndep.nv.gov/bwqp/lahontan_rvw.html
- Revise Proposal and Petition as appropriate
- Submit to LCB
- Tentative State Environmental Commission Meeting – June 11, 2014, Carson City
- Submit to AG and EPA

Thank You

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