



# **Falls Lake Data Evaluation of Existing Conditions**

## **Considerations for a Site-Specific Chlorophyll a Standard**

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# Overview and Results

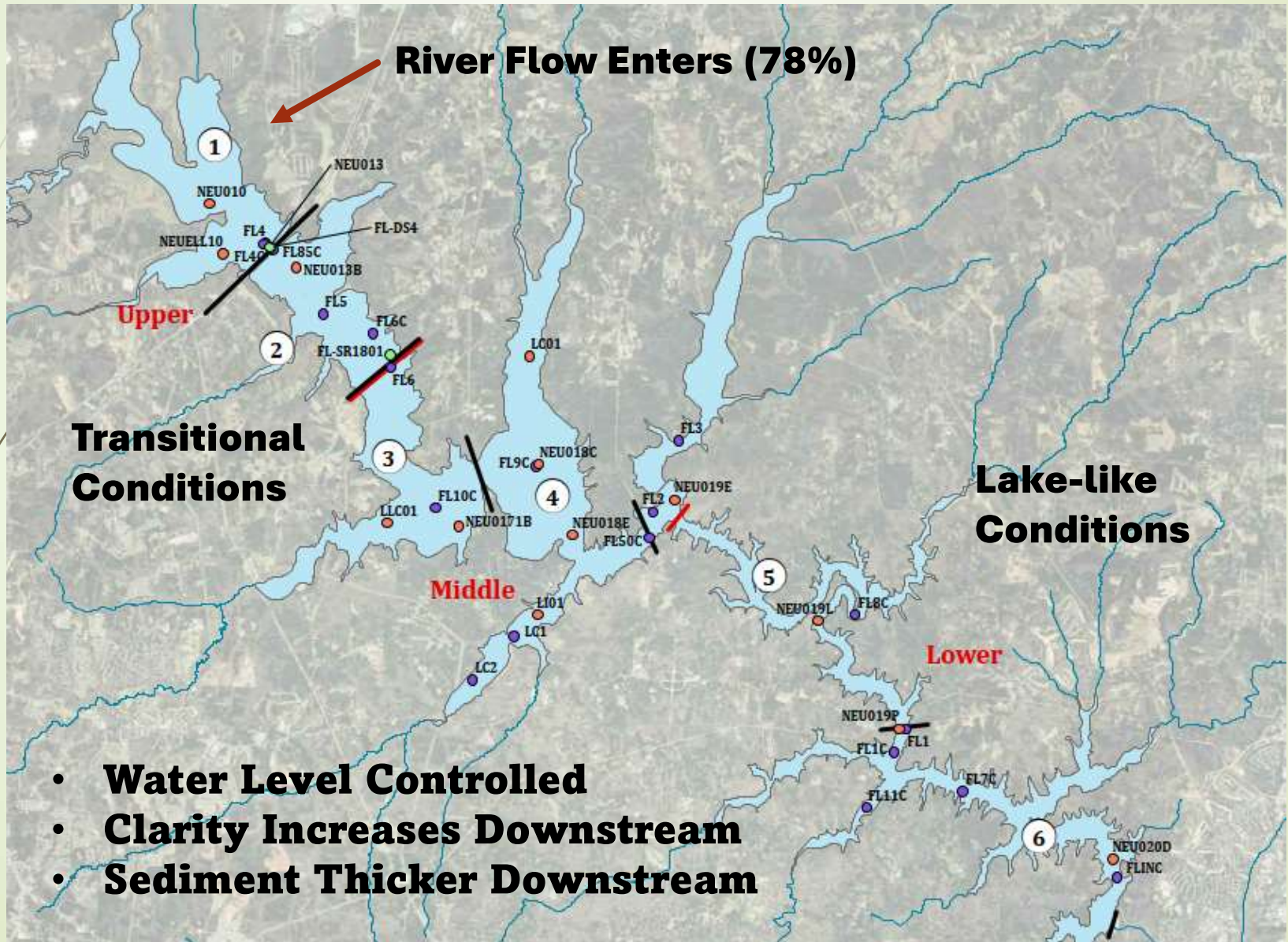
- Concept for Evaluation
- Physical Features of Falls Lake
- Chlorophyll Data Patterns
- Water Quality Evaluation
- Biological Evaluation
- Key Results from Evaluation



# Concept for Evaluation

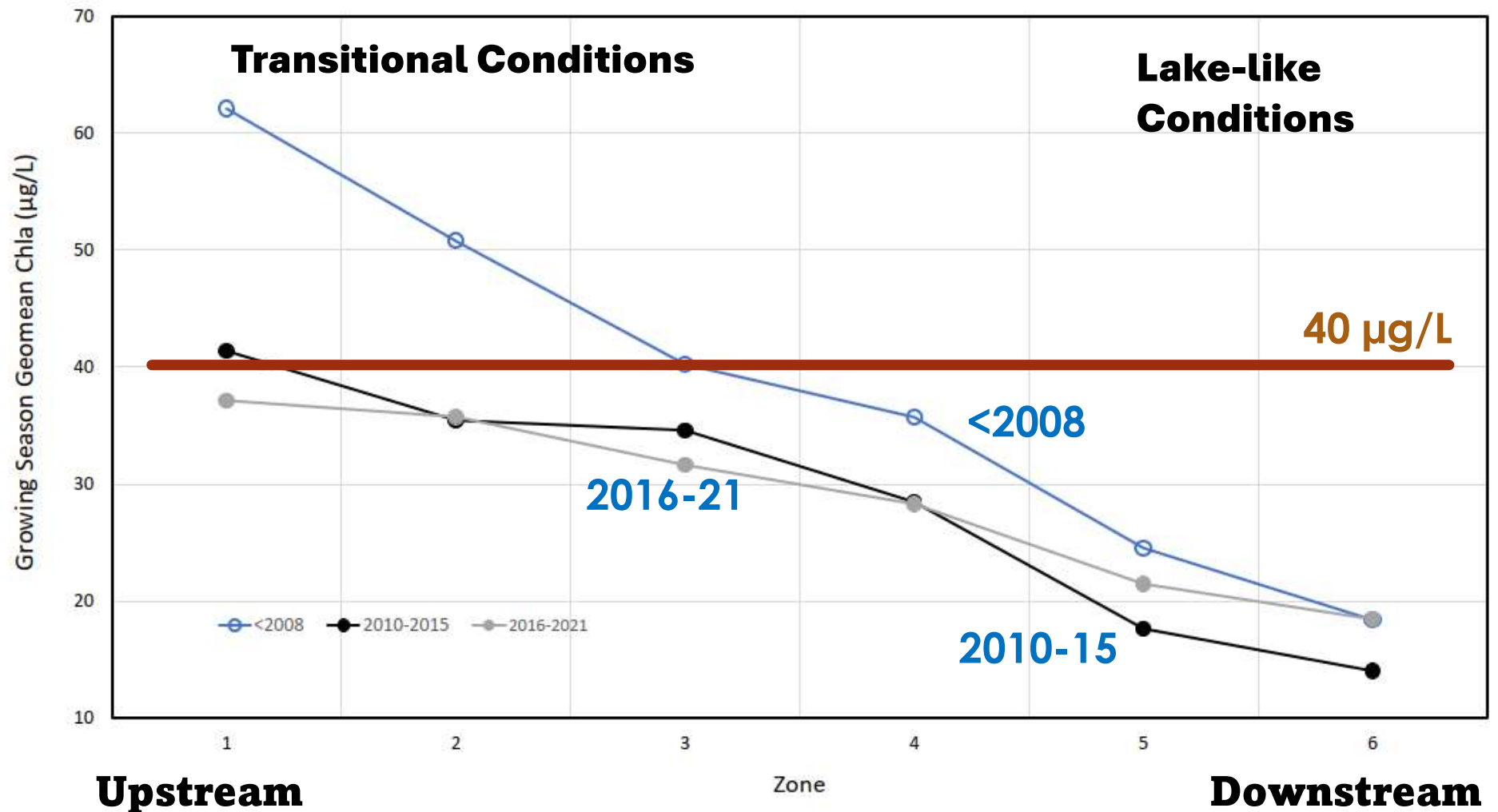
1. Evaluate Data from Falls Lake to Determine Existing Conditions
2. Compare Data to Conditions Potentially Harmful to Aquatic Life
  - a. Dissolved Oxygen and pH
  - b. Release of Algal Toxins
3. Algal Species Present
4. Conditions Support Uses?

# Key Physical Features



# Chlorophyll Spatial Pattern

← River Flow Enters (78%)



# Chlorophyll Variability

Table 1. Variability in annual growing season geomean Chla values by reservoir segment for data collected in 2010 to 2021. The Chla value listed is the average of the 11 growing season geomean values for the segment. Standard deviation of annual geomean values by segment is expressed as a concentration ( $\mu\text{g/L}$ ) and a percent of the average for annual geomean values for the 11-year period.

Segment	Years	Chla ( $\mu\text{g/L}$ )	Standard Deviation $\mu\text{g/L}$ (%)	Range ( $\mu\text{g/L}$ )
Upper	11	35.2	9.28 (26%)	19.7 to 55.2
Middle	11	29.6	6.01 (20%)	17.0 to 38.9
Lower	11	18.1	4.08 (23%)	11.6 to 26.9

Average for 11 years

Range for 11 Individual Years



# Chlorophyll a Evaluation

- Data from 2001 to 2021 included
- Spatial pattern follows general reservoir model – higher upstream and decrease in lower reservoir
- Averages consistent 2010-2021
- Variability in annual values – standard deviation ~25%

# Water Quality Evaluation

- Data from 2001 to 2021 included
- Potential water quality stress due to high Chla
  - pH in surface waters > 9
  - DO in surface waters > 147%
  - DO < 2 mg/L in subsurface waters
- Compare water quality to Chla



# Frequency of pH > 9 – 0.2 meters

Zone	0-40 µg/L	20-60 µg/L	40-80 µg/L	60-100 µg/L
0.2 meter readings - frequency pH > 9.0				
1	0%	0%	0%	4%
2	1%	1%	1%	0%
3	0%	0%	1%	6%
4	0%	0%	0%	0%
5	0%	0%	0%	0%
6	1%	1%	1%	1%

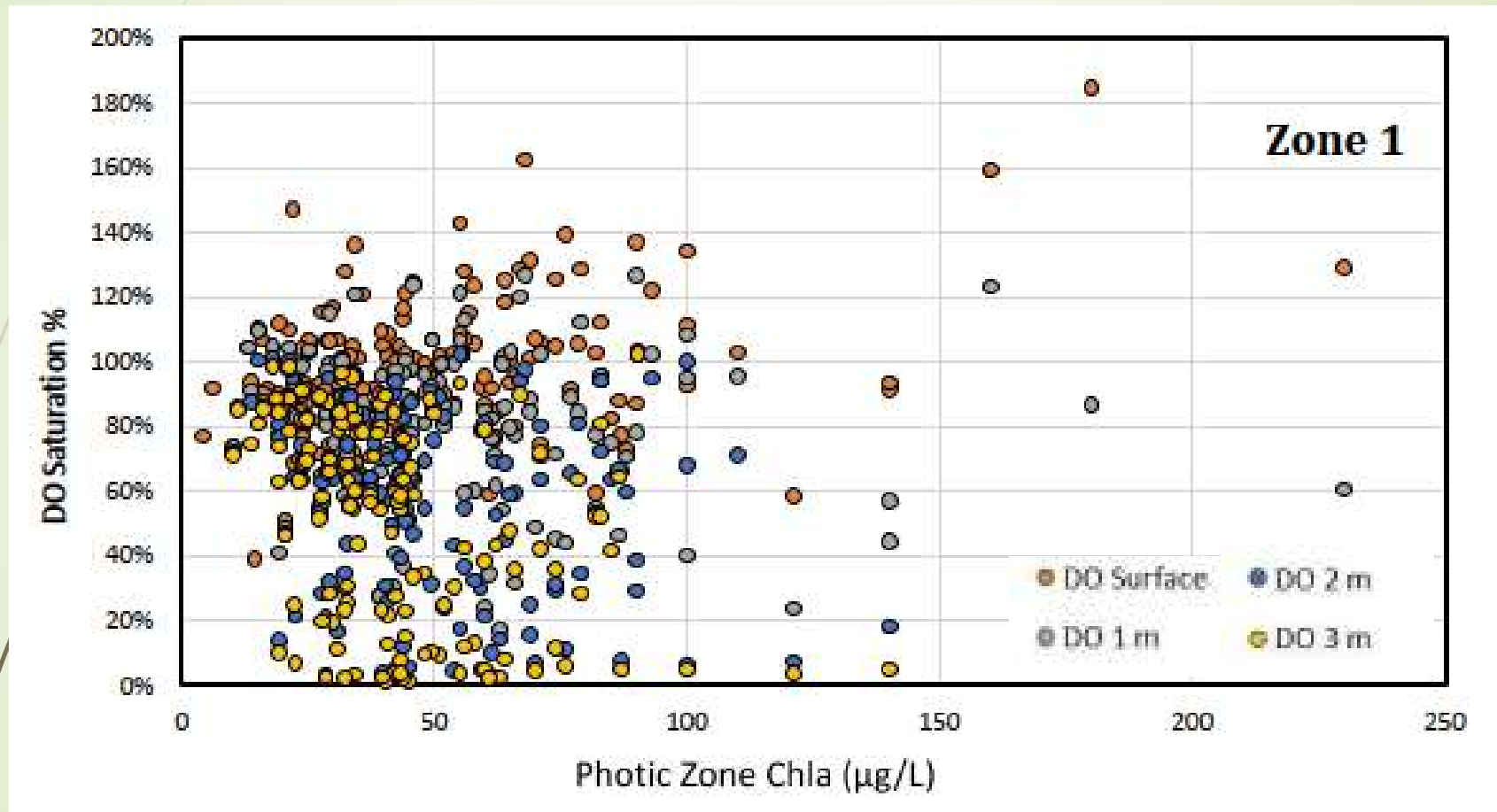
**Low occurrence of high pH in all zones in reservoir**

# Frequency of pH < 6 – 3.0 meters

Zone	0-40 µg/L	20-60 µg/L	40-80 µg/L	60-100 µg/L
3.0 meter readings – frequency pH < 6.0				
1	29%	30%	39%	55%
2	43%	46%	52%	53%
3	37%	33%	34%	25%
4	41%	39%	39%	19%
5	33%	31%	32%	36%
6	28%	36%	45%	67%

**Subsurface waters had lower pH but not a clear relationship with Chla concentrations – may be affected by tributaries**

# DO saturation versus Chla



**High dissolved oxygen in surface waters (>120 percent saturation) were infrequent – even in Zone 1**

# Depletion of Subsurface DO

Table 4. Average temperature gradient ( $^{\circ}\text{C}$ ) for 0.2 meter depth compared to the value at 3.0 meters. Values are the mean (standard deviation) for data from the growing season.

Zone	Dates $\text{DO}_{\text{sat}} < 50\%$	Dates $\text{DO}_{\text{sat}} > 70\%$
1	2.55 (1.70)	0.63 (0.70)
2	2.75 (4.00)	0.71 (0.70)
3	2.60 (4.12)	0.69 (0.76)
4	1.93 (1.07)	0.61 (0.79)
5	1.25 (0.94)	0.93 (1.14)
6	0.86 (1.11)	0.91 (1.57)

# Water Quality Evaluation

- Low frequency pH > 9 in photic zone
- Subsurface pH < 6 occurs but not clearly linked to Chla
- Photic Zone DO > 120% occurs at times but not correlated to Chla
- Subsurface DO linked to thermal stratification
- Infrequent conditions of concern



# Biological Evaluation

- Low levels of algal toxins present at times but below risk thresholds
- Blue-green algae can dominate algal community at times
- Biomass peaks occur for other algal groups
- Linkage of algae to zooplankton and fish seems consistent with healthy system



# Key Results from Evaluation

- Designated Uses Not Impaired by Existing Conditions in Reservoir
- Reservoir Physical Conditions Support Evaluation By Lake Regions
- Evaluation By Central Tendency Metric to Represent Productivity
- Chla Variable by Year – Inclusion of a Frequency Component Important