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Cyanobacteria, cyanotoxins, and nutrients: Cypress River Basin

Presented at

Cypress River Basin
Clean Rivers Program Meeting

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Milford Reservoir, Kansas 7/14/16

Photo: Christopher Churchill, USGS

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Acknowledgements

- Funding cooperator for Caddo Lake
  - Caddo Lake Institute (LA!)/USACE
- Other studies
  - Texas Commission on Environmental Quality/USEPA
    - Statewide study
    - Phase 1: 2016-2017
    - Phase 2: 2018-2019
    - Phase 3: 2020-2021
  - USGS WMA CMF: NTX Cyanos/Satellite data study

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Purpose

- Presence/absence and concentrations
  - Nutrients
  - Cyanobacteria
  - Cyanotoxins
  - T&O compounds
- Comparison of field and lab methods

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Target compounds

- Field measures
  - Big 5, PAR, photopigments–2, Secchi, atmospheric–4
- Water chemistry
  - Ions, DOC, TOC, TDS, nutrients, photopigments–2
- Cyanotoxins
  - Dipstick kits-3, ELISA-5
- Taste and odor compounds
  - Geosmin, MIB
- Taxonomy (to species)

Sample design

- CY 18
  - Two surveys (8/23/2018, 10/4/2018)
  - One sample per survey
- CY 19 (if funded)
  - One survey in spring or early summer
  - Two samples
- TCEQ study
  - Lake O' the Pines (9/28/2016, 8/22/2018)
  - QC samples

Site selection

- YSI EXO total algae sensor (TAS)
  - Chlorophyll, phycocyanin
  - Readings at many sites (up to 30) and depths
  - Target high concentrations of photopigments

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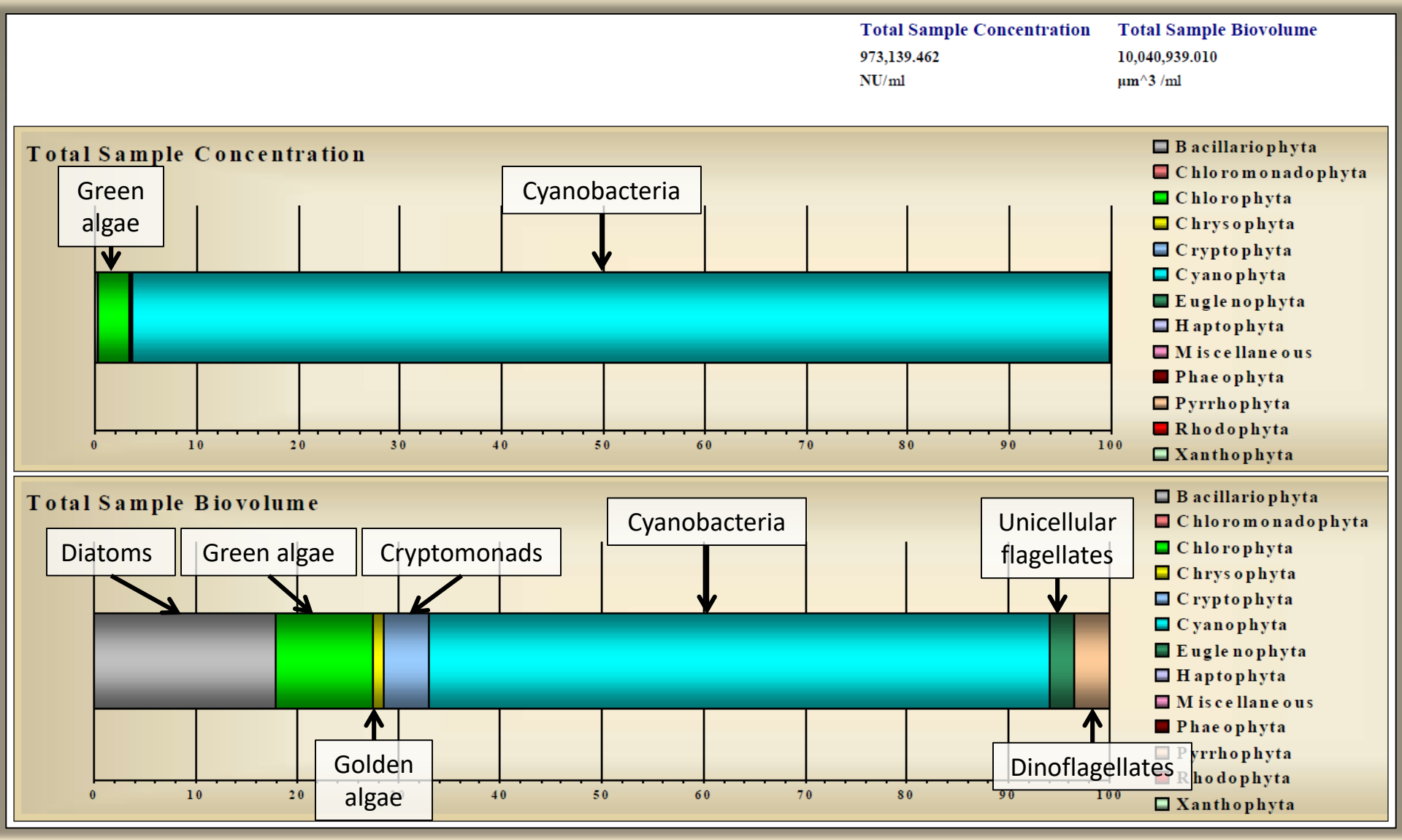
Preliminary results – Caddo

- Photopigments
  - Chlorophyll-*a* (lab) 42–59 µg/L
  - Chlorophyll-*a* (field) 16–51 µg/L
  - Pheophytin-*a* 4–6 µg/L
  - Phycocyanin 2.3–5.0 µg/L
- Nutrients
  - TN 1.1–1.3 mg/L
  - TP 0.09–0.10 mg/L
- T&O compounds
  - Geosmin 8–18 ng/L
  - MIB 3–4 ng/L

Preliminary results – Caddo

- Cyanotoxins
  - Dipstick kits
    - All cyanotoxins <LRL
  - ELISA
    - CYN <0.08 µg/L
    - SXN <0.02 µg/L
    - MCN/NDN pending
    - ATN pending

Caddo Lake 8/23/18

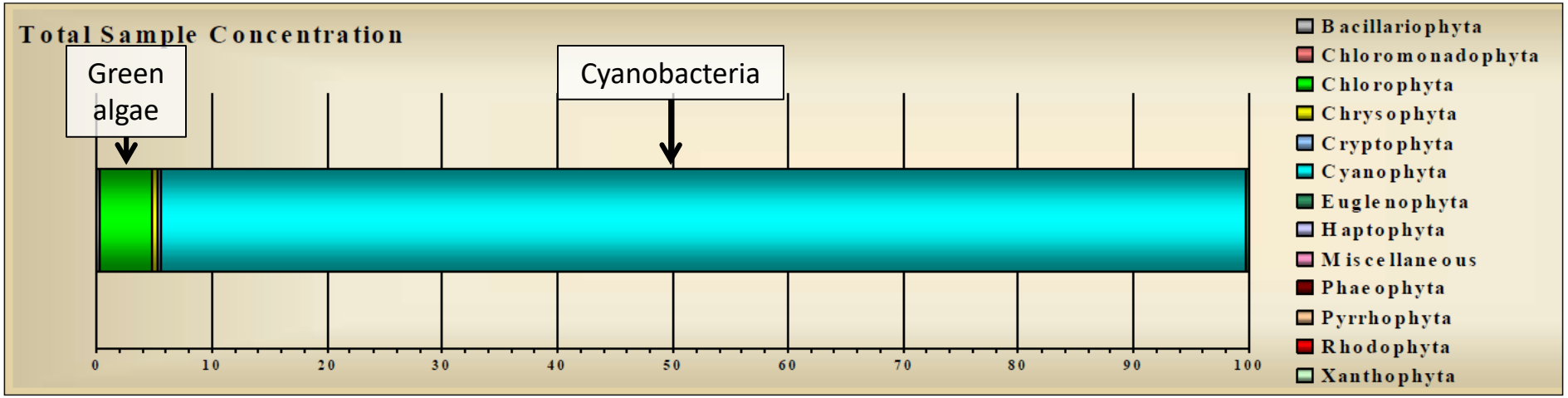


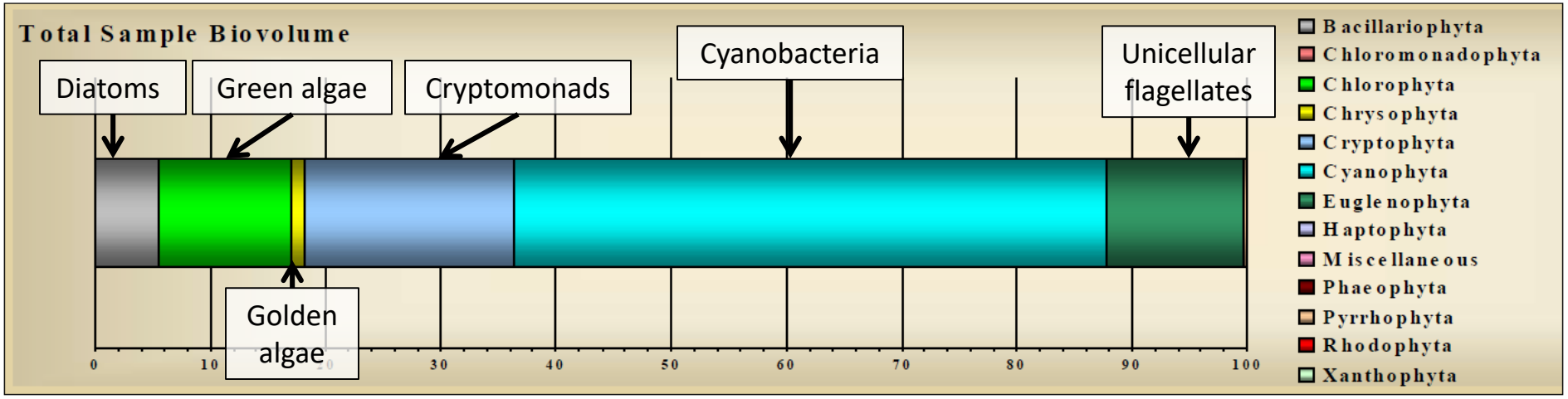
Percent of sample

Preliminary results, subject to revision

Caddo Lake 10/4/18

Total Sample Concentration	Total Sample Biovolume
537,547.542	7,729,755.638
NU/ml	µm^3 /ml

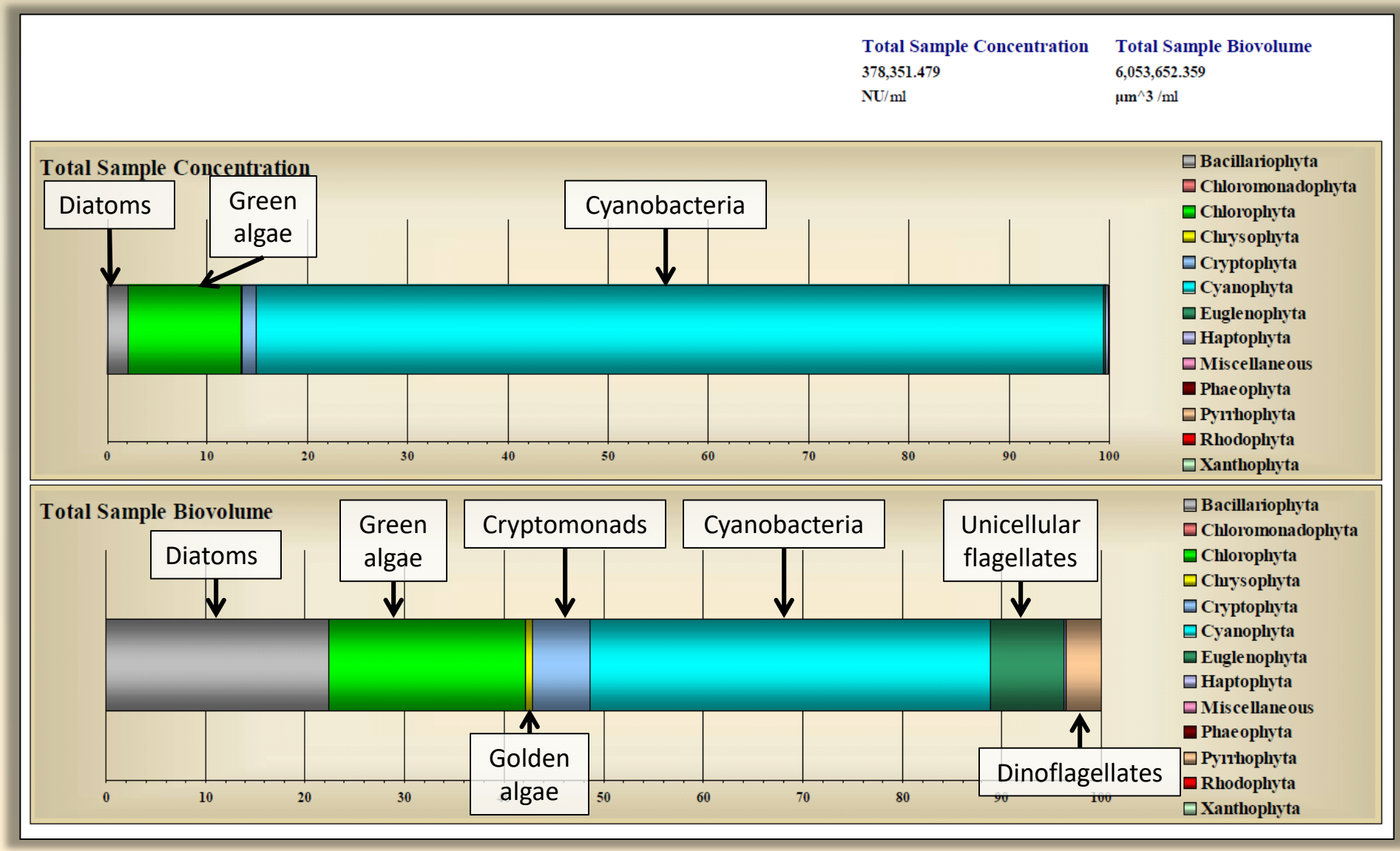




Percent of sample

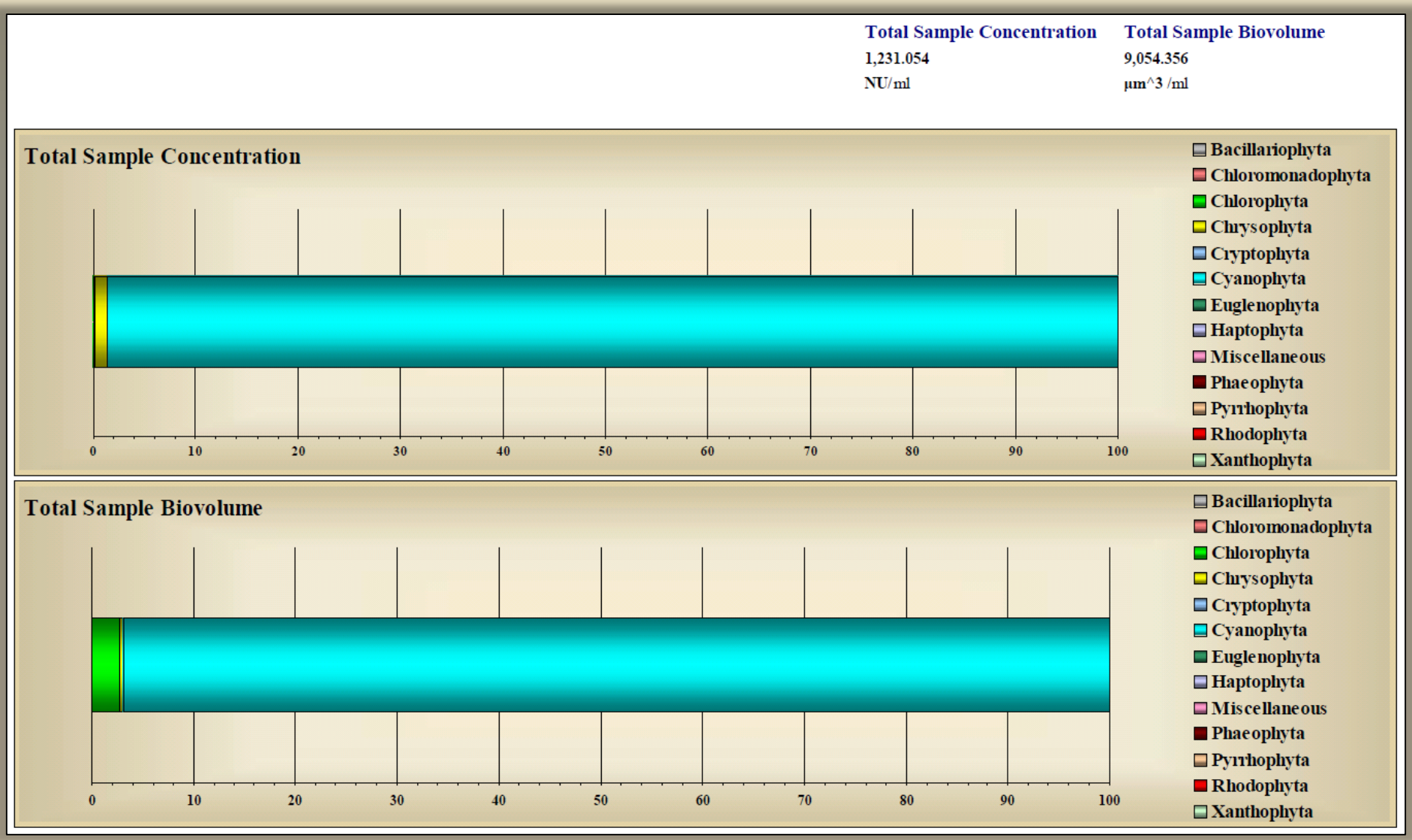
Preliminary results, subject to revision

Lake O' the Pines TCEQ 2016



Preliminary results, subject to revision

NRCS Upper Bosque River Res. 9/7/16



Percent of sample

Preliminary results, subject to revision

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Salient results – TCEQ study

- Green algae and cyanobacteria detected in all sampled reservoirs
- Cyanobacteria prevalent in all reservoirs and dominant in many
- Total algae sensor
  - Correlations with phytoplankton/cyanobacteria
  - No correlations with toxins

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Salient results – TCEQ study

Variable 1	Variable 2	Spearman's rank correlation coefficient (r_s)	*p* value
Sensor-measured chlorophyll	Laboratory chlorophyll-*a*	0.61	0.008
Sensor-measured chlorophyll	Laboratory pheophytin-*a*	0.60	0.008
Sensor-measured chlorophyll	Total phytoplankton biovolume	0.77	< 0.001
Sensor-measured chlorophyll	Total phytoplankton abundance	0.92	< 0.001
Sensor-measured chlorophyll	Total Cyanophyta biovolume	0.69	0.001
Sensor-measured chlorophyll	Total Cyanophyta abundance	0.90	< 0.001
Sensor-measured phycocyanin	Laboratory chlorophyll-*a*	0.84	< 0.001
Sensor-measured phycocyanin	Total phytoplankton abundance	0.57	0.014
Sensor-measured phycocyanin	Total Cyanophyta biovolume	0.52	0.028
Sensor-measured phycocyanin	Total Cyanophyta abundance	0.56	0.015
Turbidity	*Pseudanabaena* biovolume	- 0.64	0.004
Turbidity	*Pseudanabaena* abundance	- 0.73	< 0.001

n = 18

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Questions?

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