White River Algae

2016 Results

COLORADO
Parks and Wildlife
Department of Natural Resources

Mindi May

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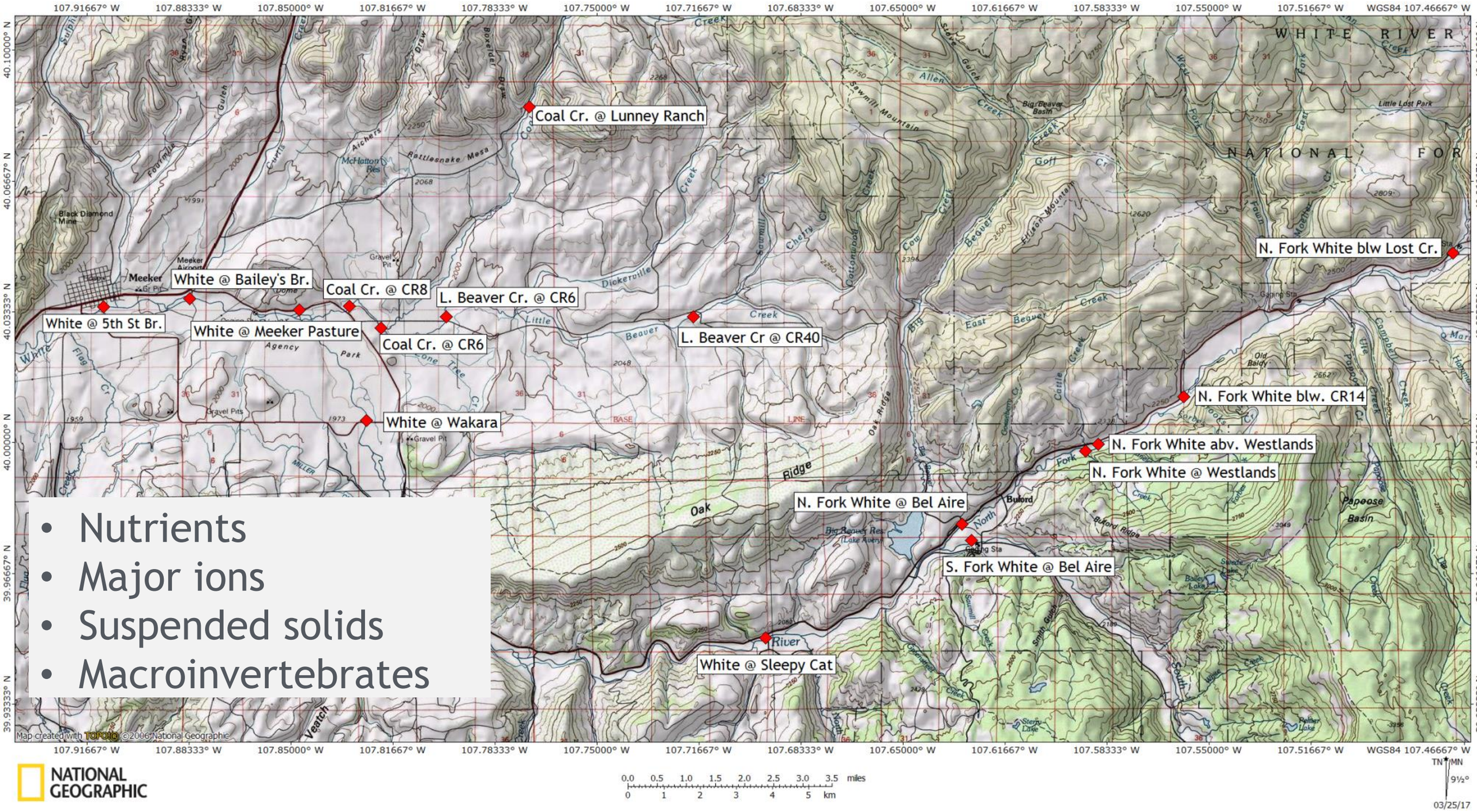
1/11/2018

Sample Locations - 2016



- Nutrients
- Major ions
- Suspended solids
- Macroinvertebrates

Site List and Samples Collected

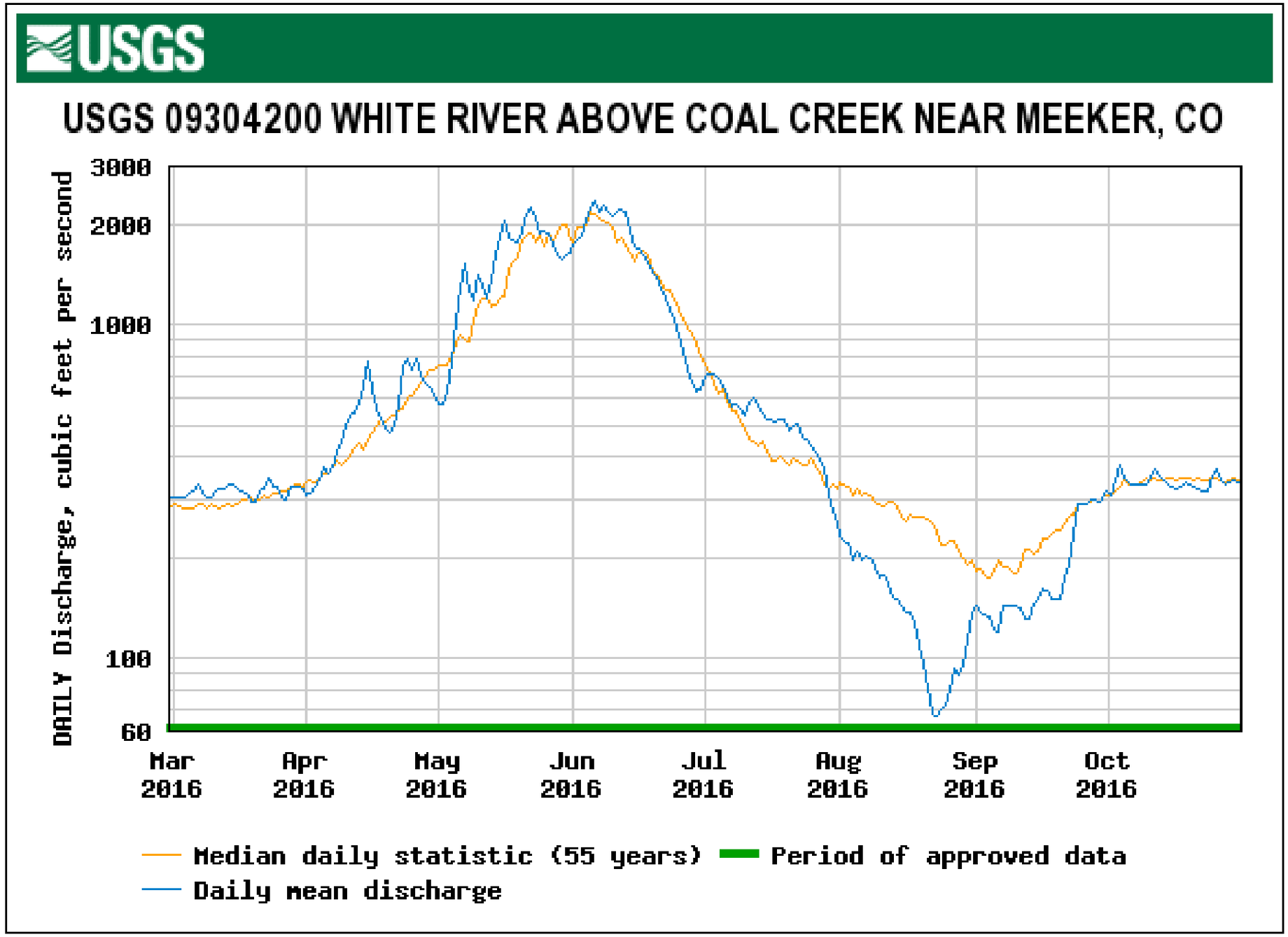
Site Description	Lat	Long	Water Quality	Macro-inverts	Nutrient Addition Experiment	Chl a	Algae ID
N. Fk. White R. blw. Lost C.	40.048284	-107.46994	X	X	X	X	
N. Fk. White R. @ CR 14	40.01147	-107.55807	X	X			
N. Fk. White R. Abv. Westlands	39.999358	-107.58608	X				
N. Fk. White R. @ Westlands	39.997722	-107.59053	X	X	X	X	
N. Fk. White R. @ Bel Aire	39.979058	-107.63047	X	X			
S. Fk. White R. @ Bel Aire	39.97484	-107.62739	X	X	X	X	
White R. @ Sleepy Cat	39.950112	-107.69475	X	X			
White R. @ Wakara	40.006063	-107.82519	X	X	X	X	X
White R. @ Meeker Pasture	40.033632	-107.84710	X	X		X	
White R. @ Bailey's Bridge	40.036522	-107.8832			X		
White R. 5th St. Bridge	40.034631	-107.91162	X	X			
Coal Cr. @ CR 8	40.033656	-107.83288	X				
Coal Cr. @ CR 6	40.030919	-107.82209	X				
Coal Cr. @ Lunney Ranch	40.085553	-107.7728	X				
Little Beaver Cr. @ CR 6	40.030933	-107.7996	X				
Little Beaver Cr. @ CR 40	40.03315	-107.71635	X				

Time Series at Wakara

Lab analyte list and method information

Lab	Analyte	Method	Reporting Limit
River Watch	Chloride	EPA 325.1	1.0 mg/L
	Sulfate	EPA 375.4	0.5 mg/L
	TSS	EPA 160.2	4.0 mg/L
	Nitrate + Nitrite	EPA 353.2	0.02 mg/L
	Total Phosphorus	EPA 365.1	0.005 mg/L
Metro	Nitrate + Nitrite	EPA 353.2 rev2	0.02 mg/L
	Total Kjeldahl nitrogen	ASTM D3590-02B06	~~0.2~~ 0.1 mg/L
	Total Nitrogen	calculated	~~0.3~~ 0.1mg/L
	Total Phosphorous	4500-P-H 99,21st	0.01 mg/L
CU Center for Limnology	Chlorophyll a	Marker et al. 1980; Nusch 1980	0.06 ug
	Periphyton ID and cell count	NA	NA
Timberline Aquatics	Macroinvertebrate ID and count	WQCC 2017	NA

Hydrograph

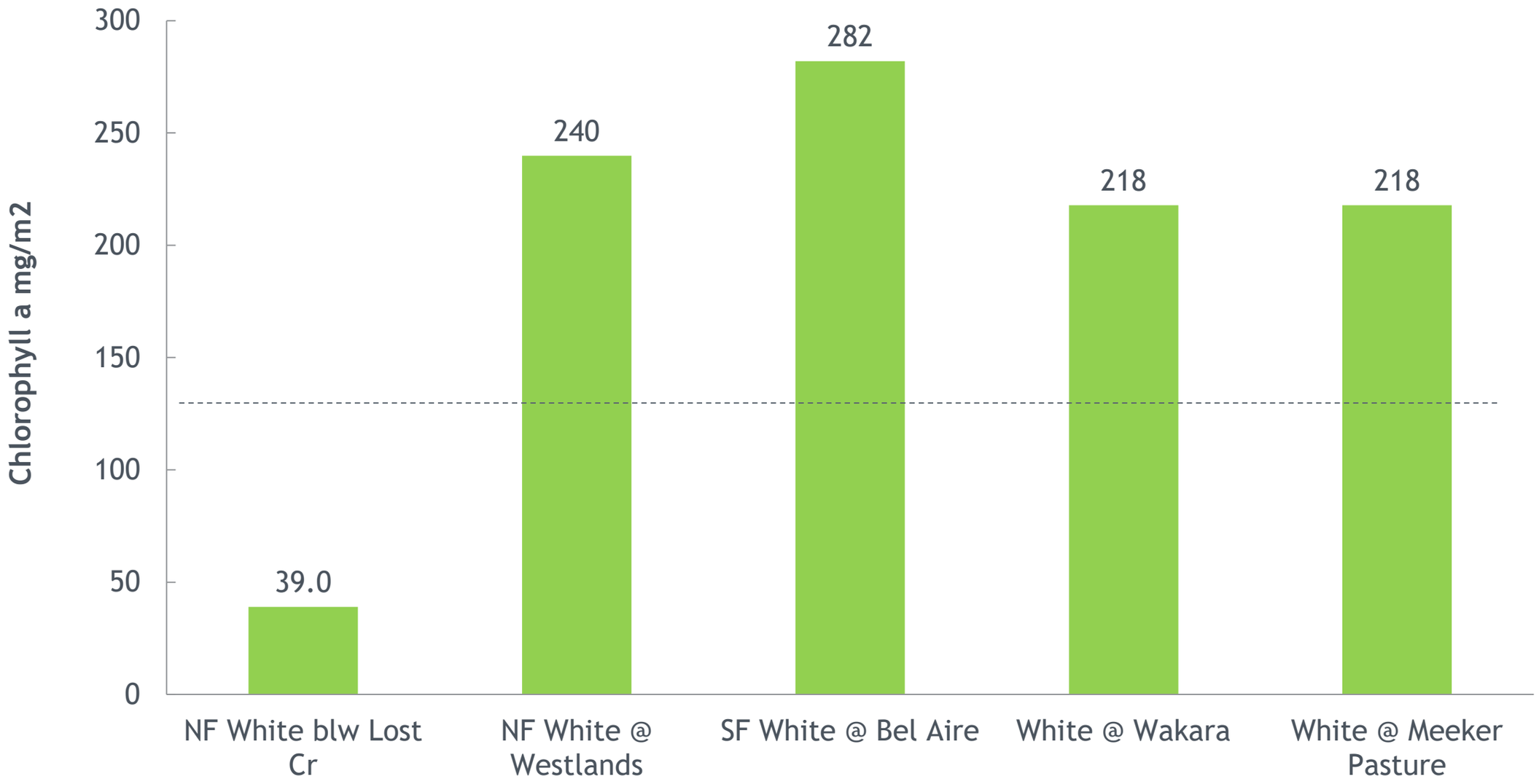

USGS
USGS 09304200 WHITE RIVER ABOVE COAL CREEK NEAR MEEKER, CO
DAILY Discharge, cubic feet per second
3000
2000
1000
100
60
Mar 2016
Apr 2016
May 2016
Jun 2016
Jul 2016
Aug 2016
Sep 2016
Oct 2016
Median daily statistic (55 years)
Period of approved data
Daily mean discharge

July Periphyton on Rock Photos

N.Fk blw Lost Cr	N.Fk CR 14	N. Fk Abv. Westlands	N. Fk. @ Westlands	N. Fk Bel Aire

S. Fk. Bel Aire	White @ Sleepy Cat	White @ Wakara	White @ Meeker Pasture	White @ 5th St Bridge

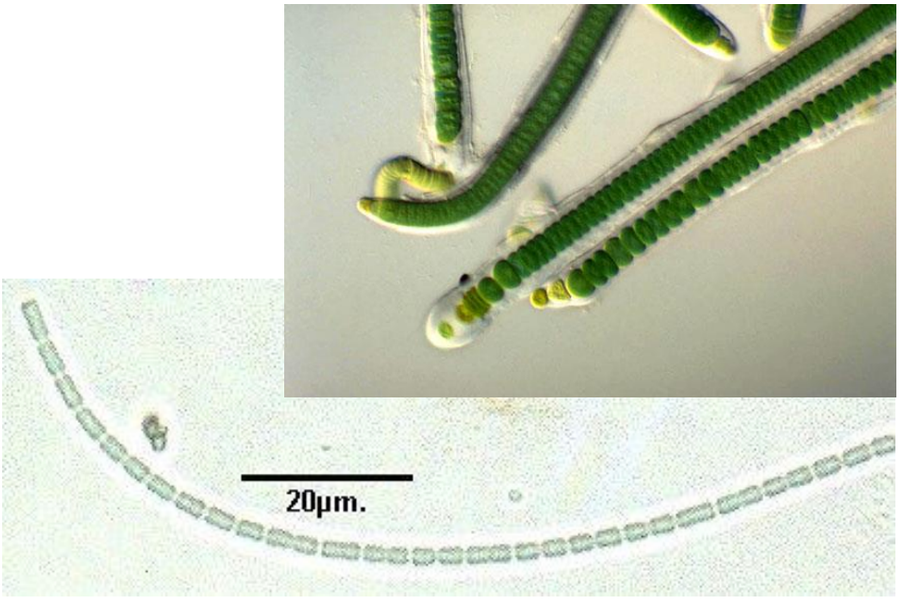
Periphyton Primary Producer Biomass



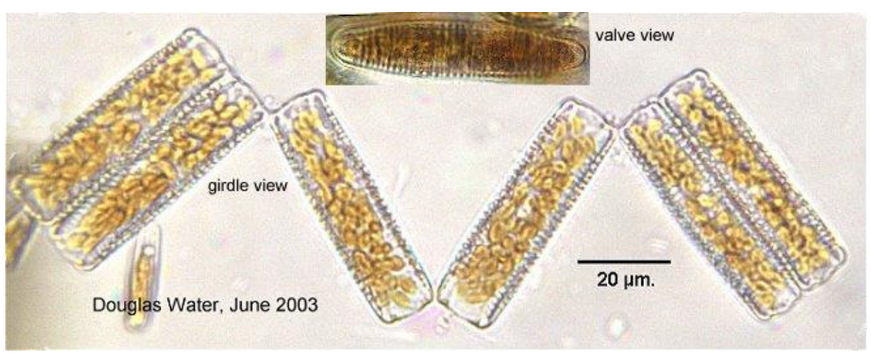
Comparison of periphyton biomass measured July 19, 2016. The dashed line is Colorado's standard of 150 mg/m^2.

Types of algae in the White River

Blue-Green algae (Cyanobacteria)

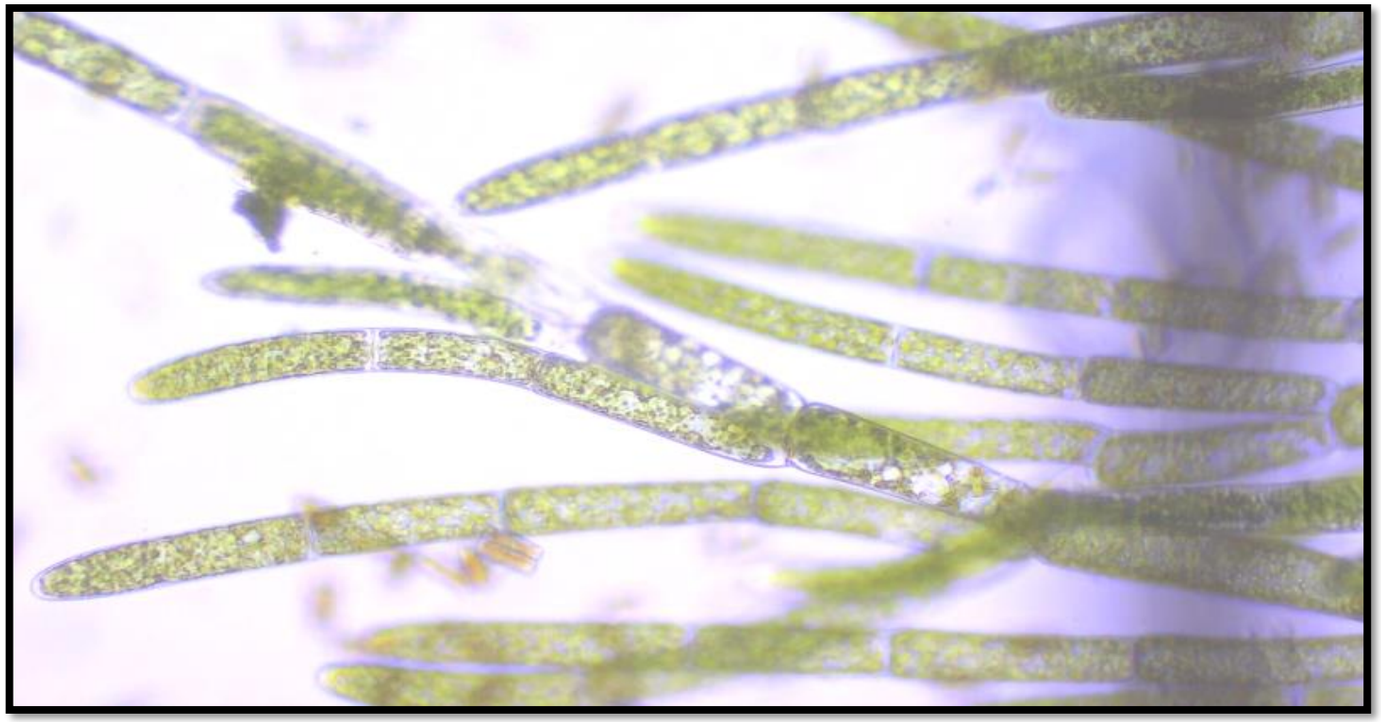


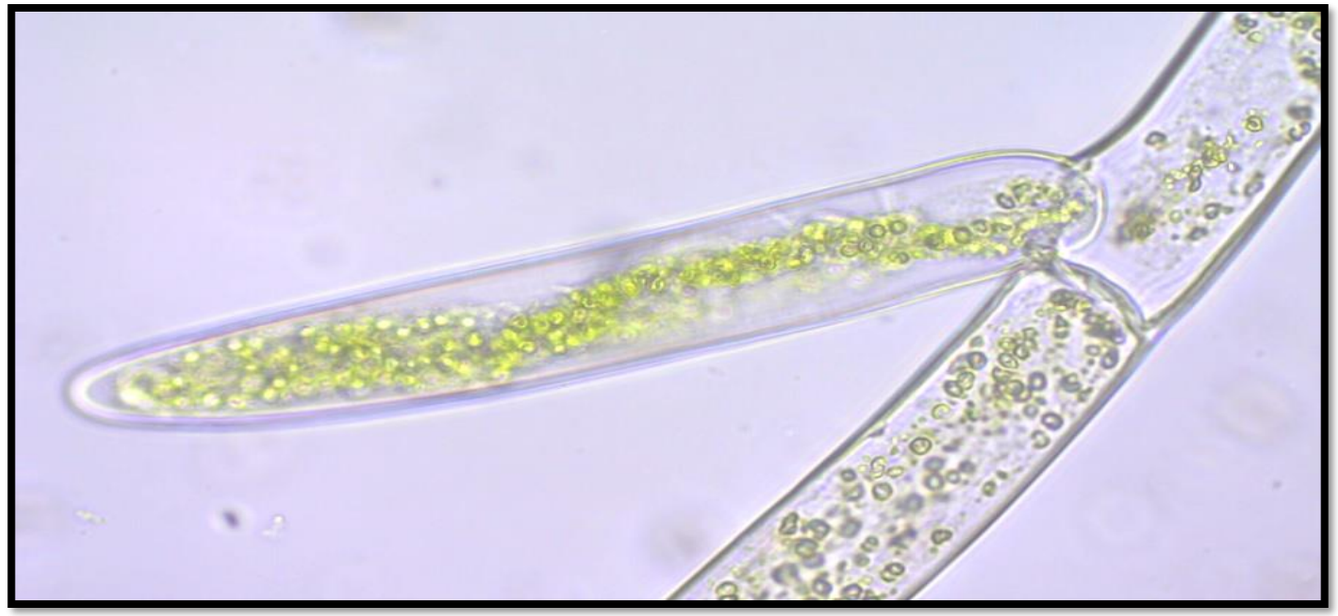
Diatoms (Bacillariophyta)



Green Algae (Chlorophyta)

Cladophora glomerata





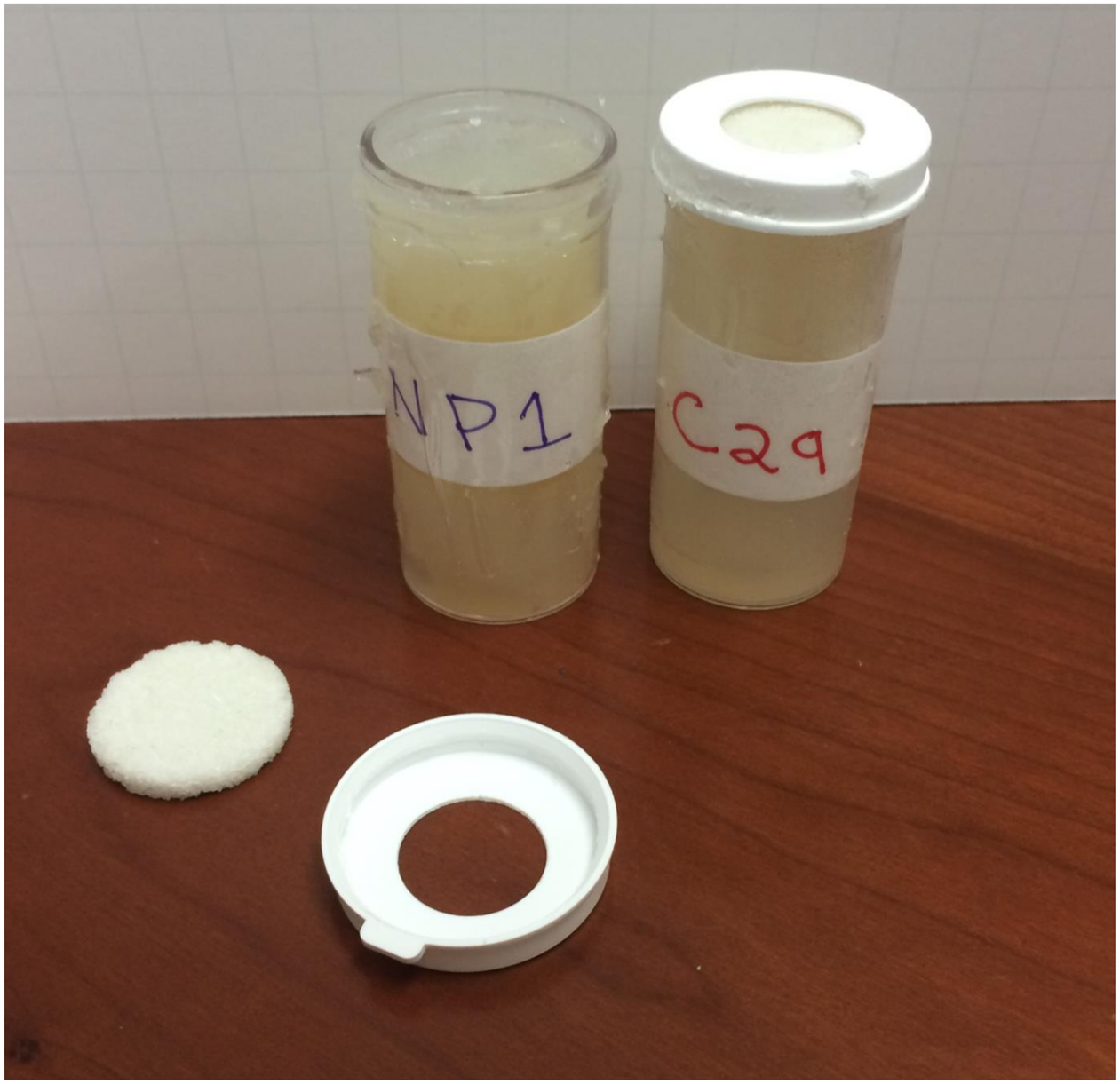
Nutrient Addition Experiment

Nutrient Addition Experiment

C	C	C	C	C
P	P	N	N	N
P	P	P	N	N
N+P	N+P	N+P	N+P	N+P

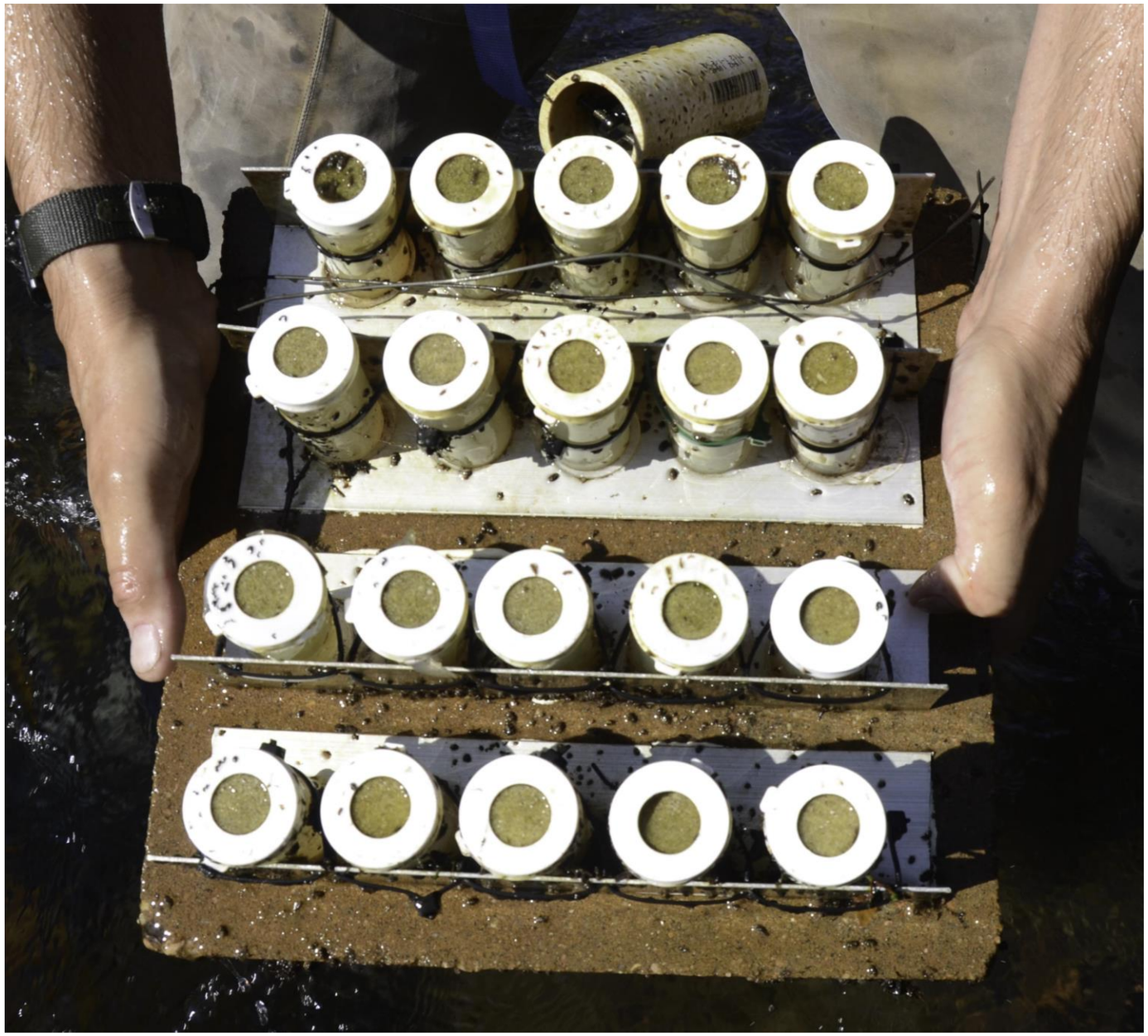
Flow

Nutrient Addition Experiment

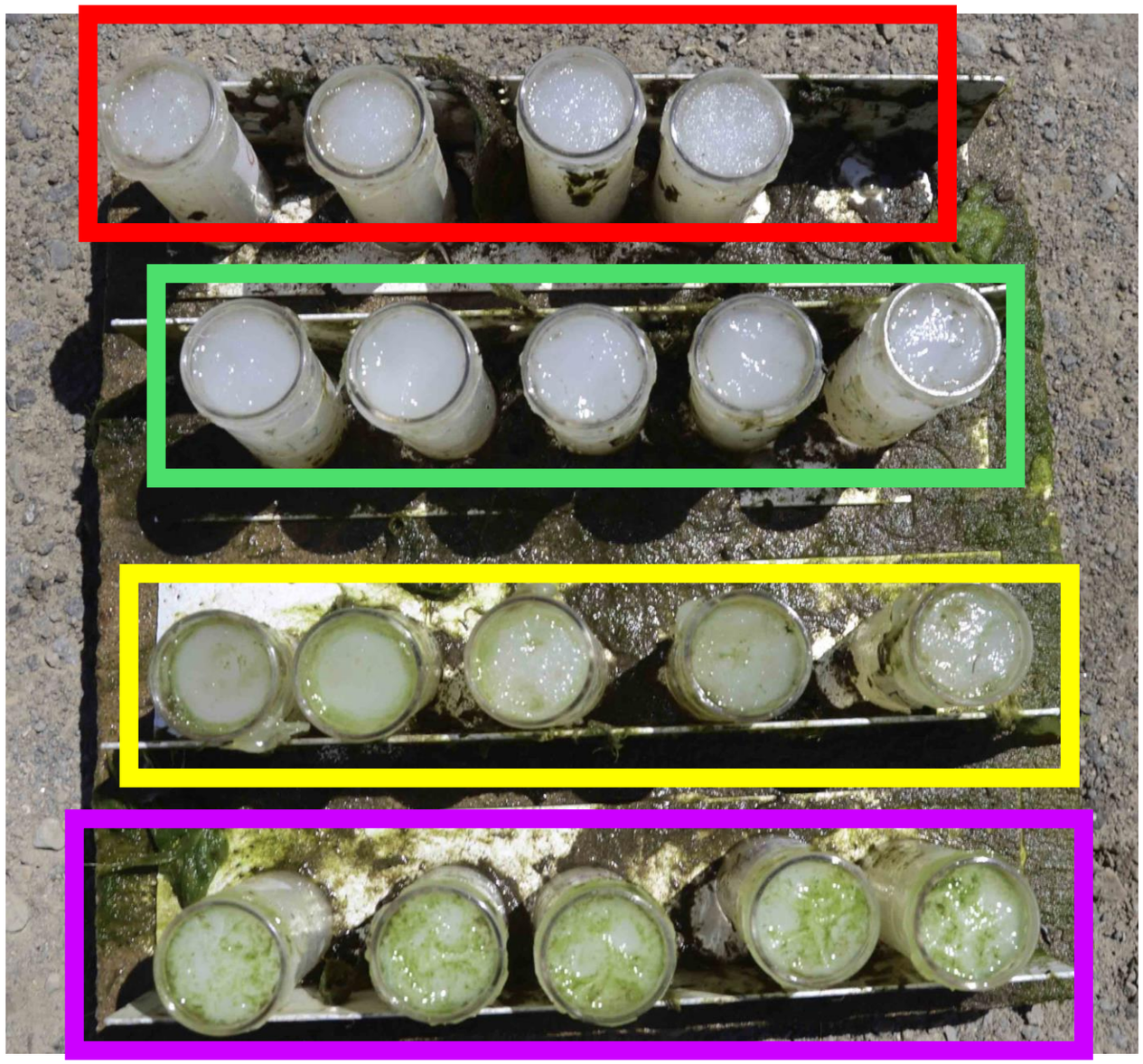


- Tubes filled with agar
  - Control
  - Phosphorus
  - Nitrogen
  - Phosphorus+Nitrogen
- Porous glass disk
- Lid with opening

Nutrient Addition Experiment



Nutrient Addition Experiment



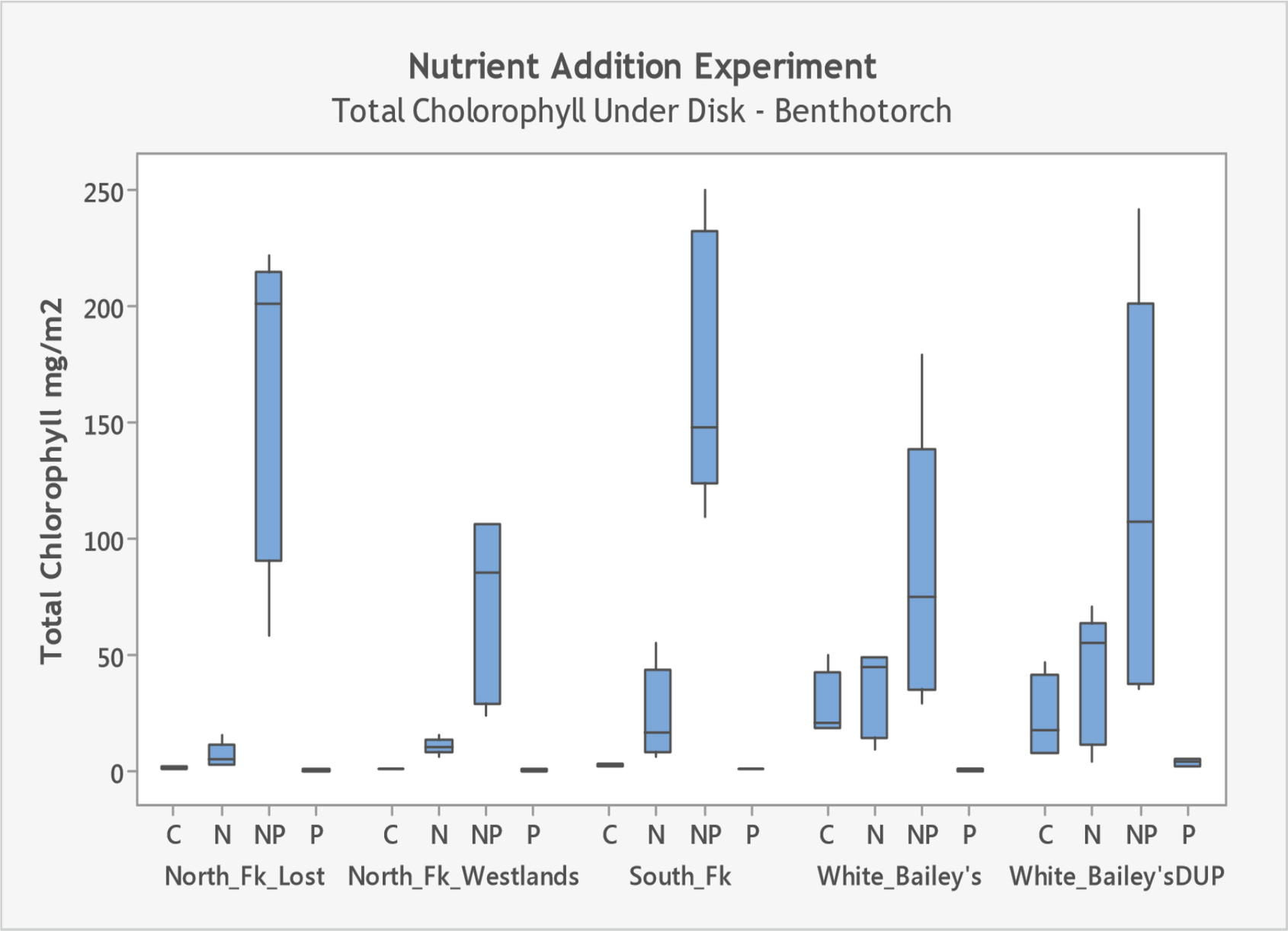
Control

Phosphorus

Nitrogen

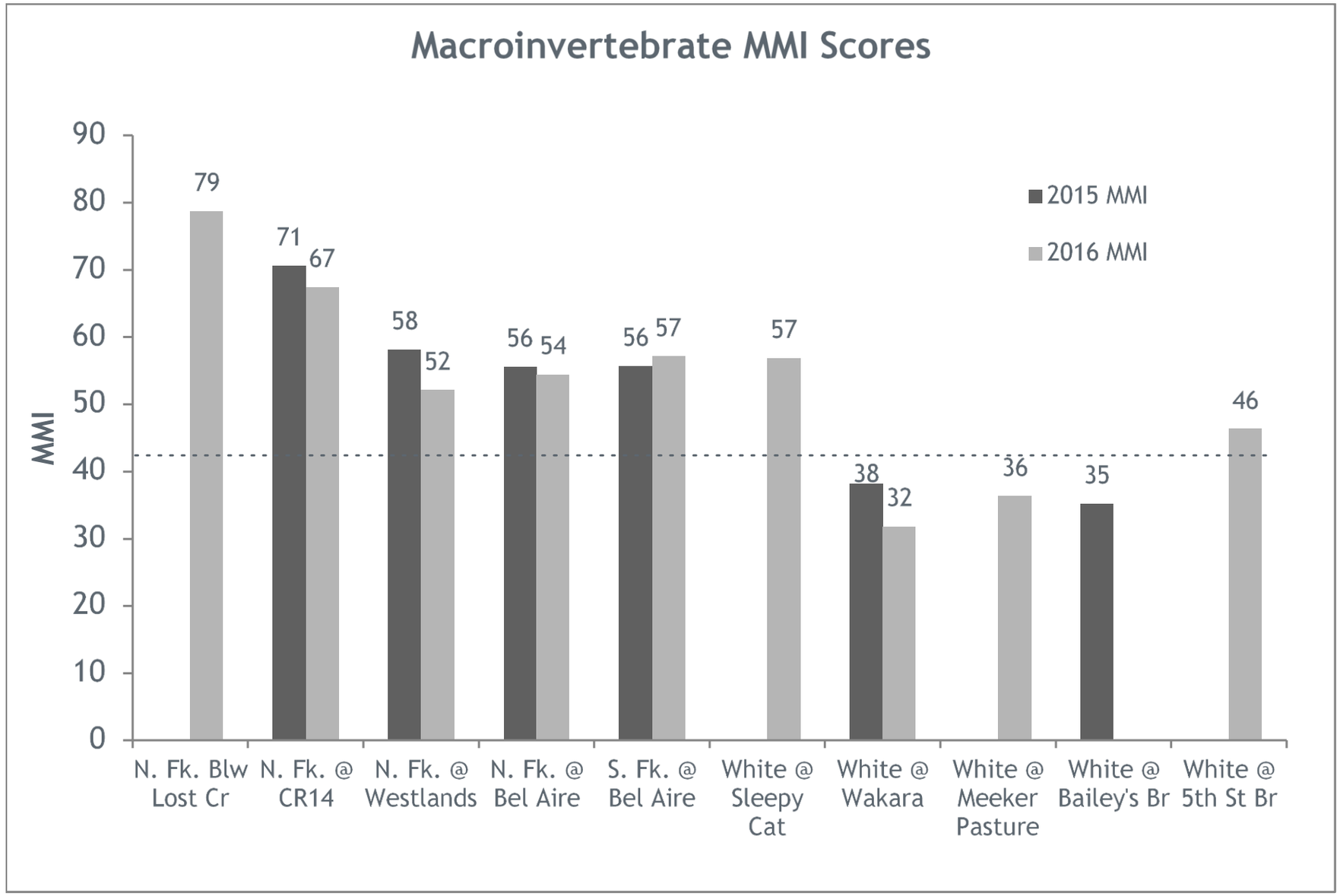
Nitrogen+Phosporus

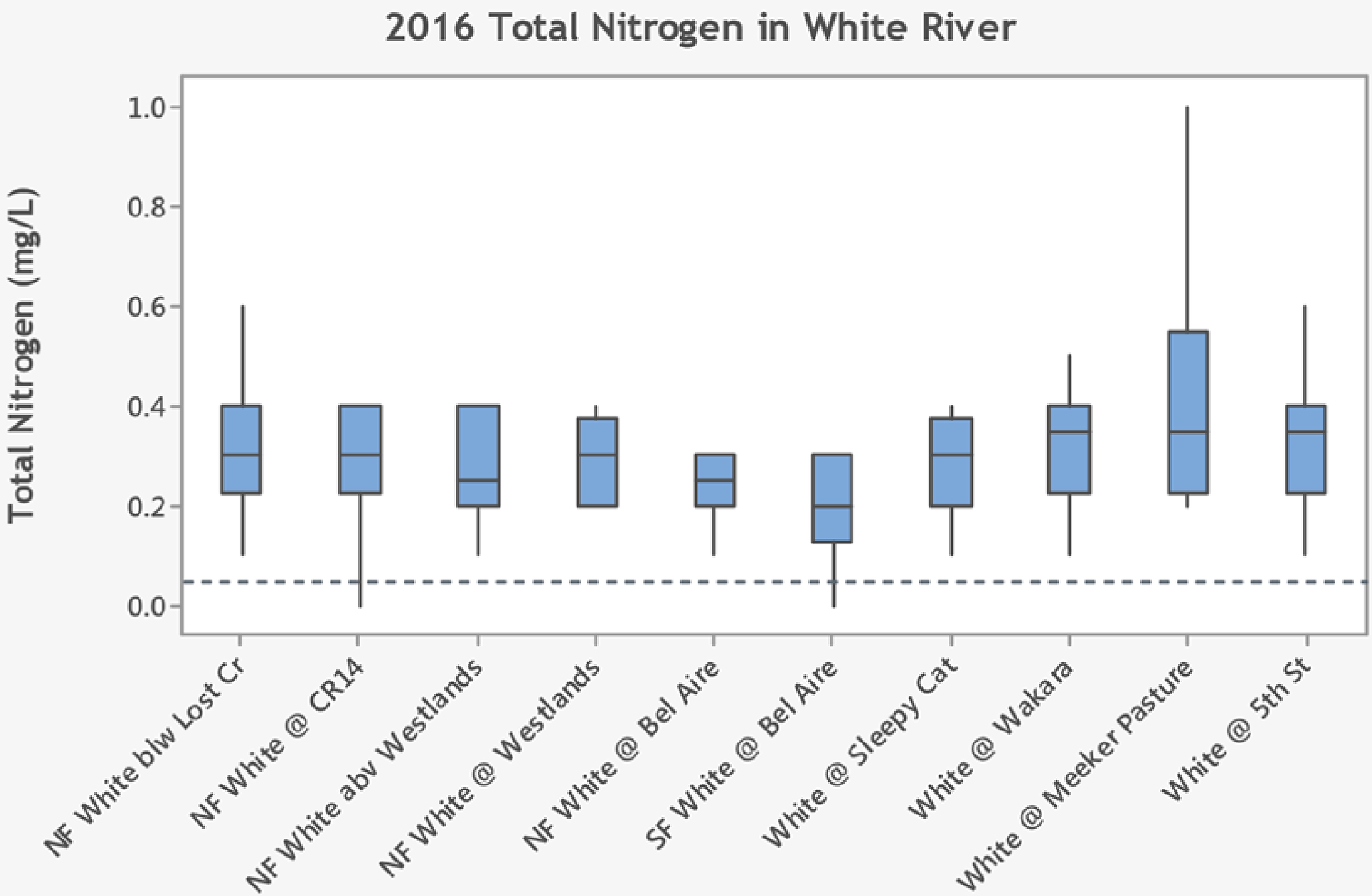
Nutrient Addition Experiment

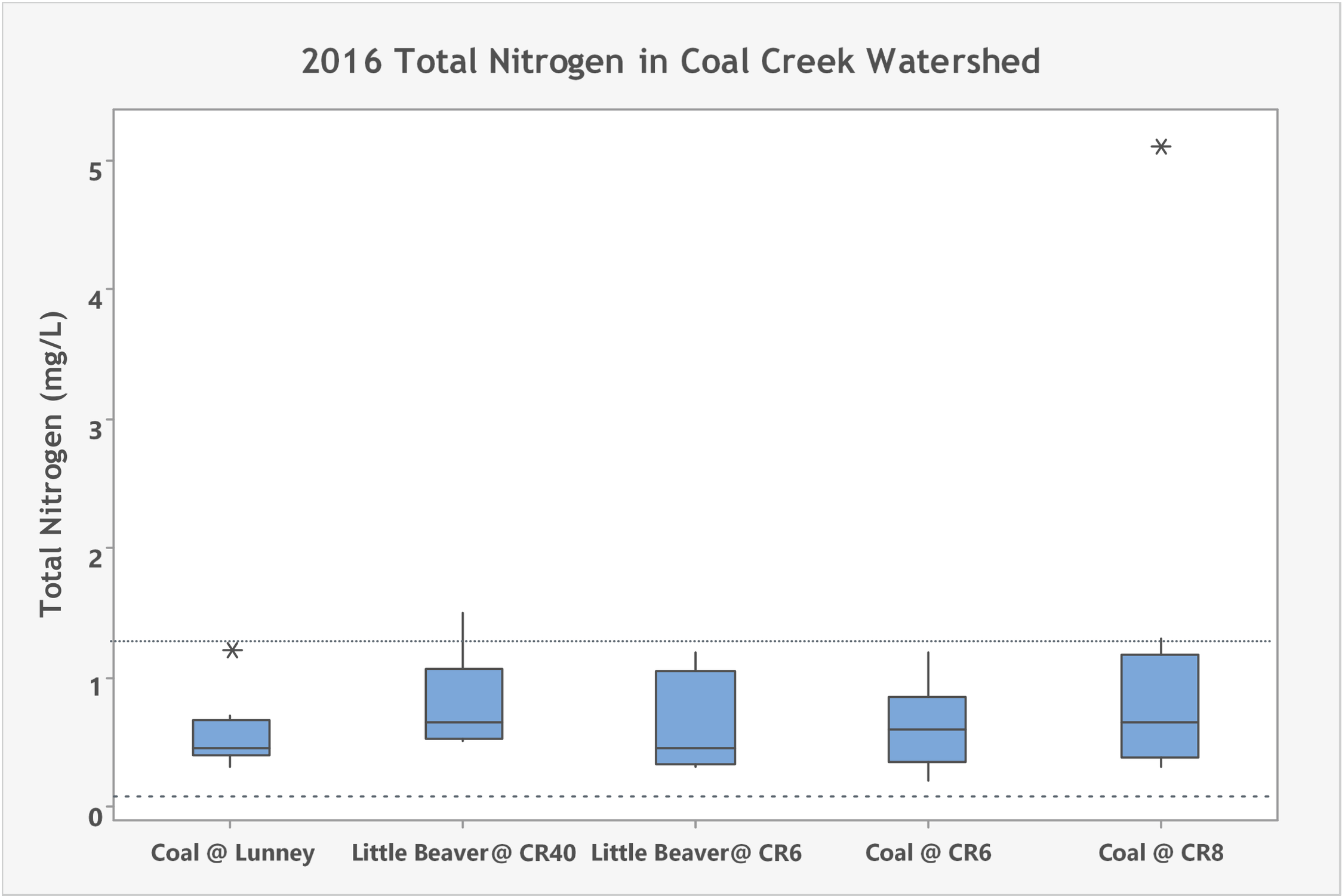


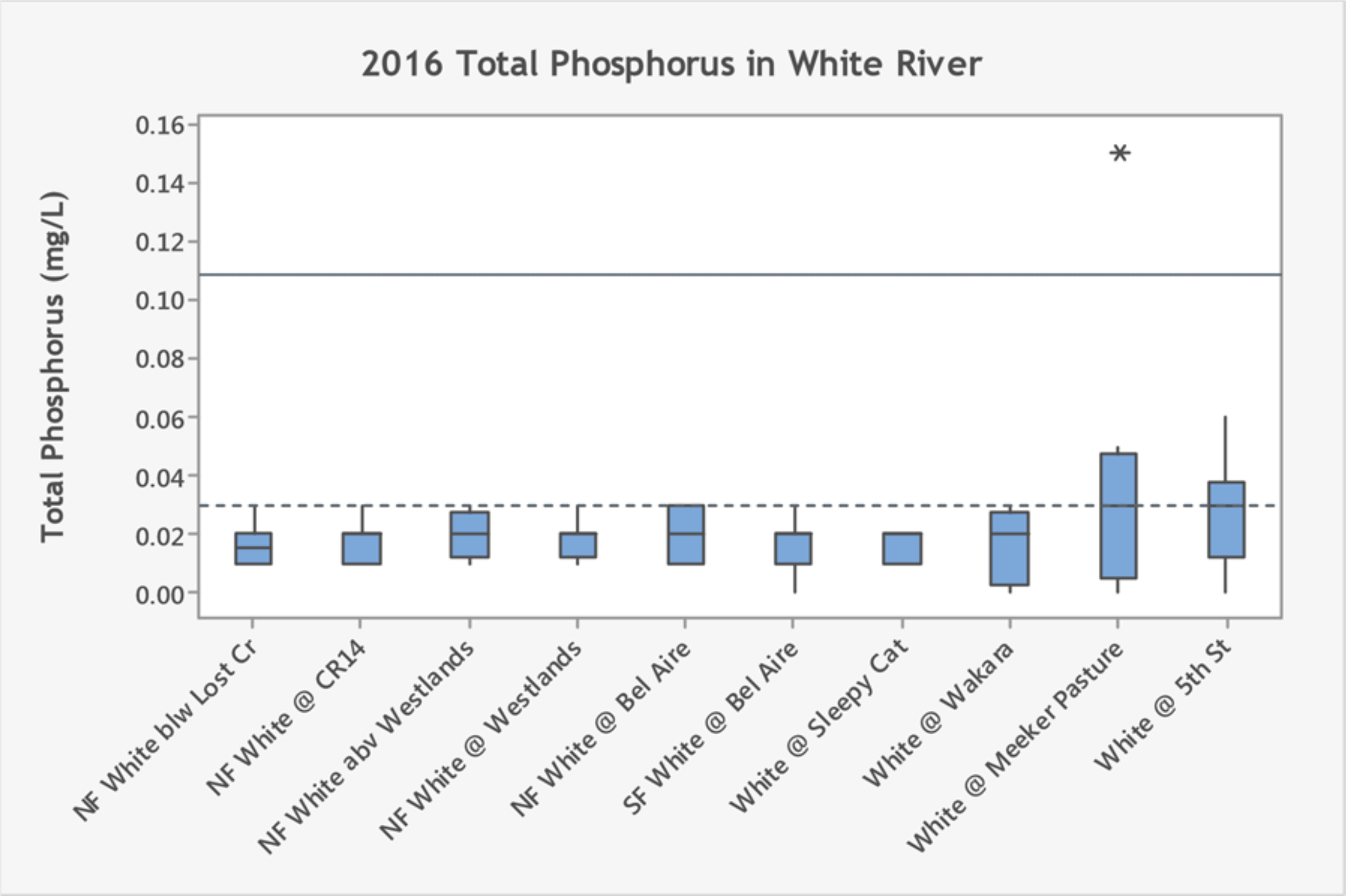
Comparison of total periphyton (cyanobacteria + green + diatom) growth on agar in response to nutrient conditions

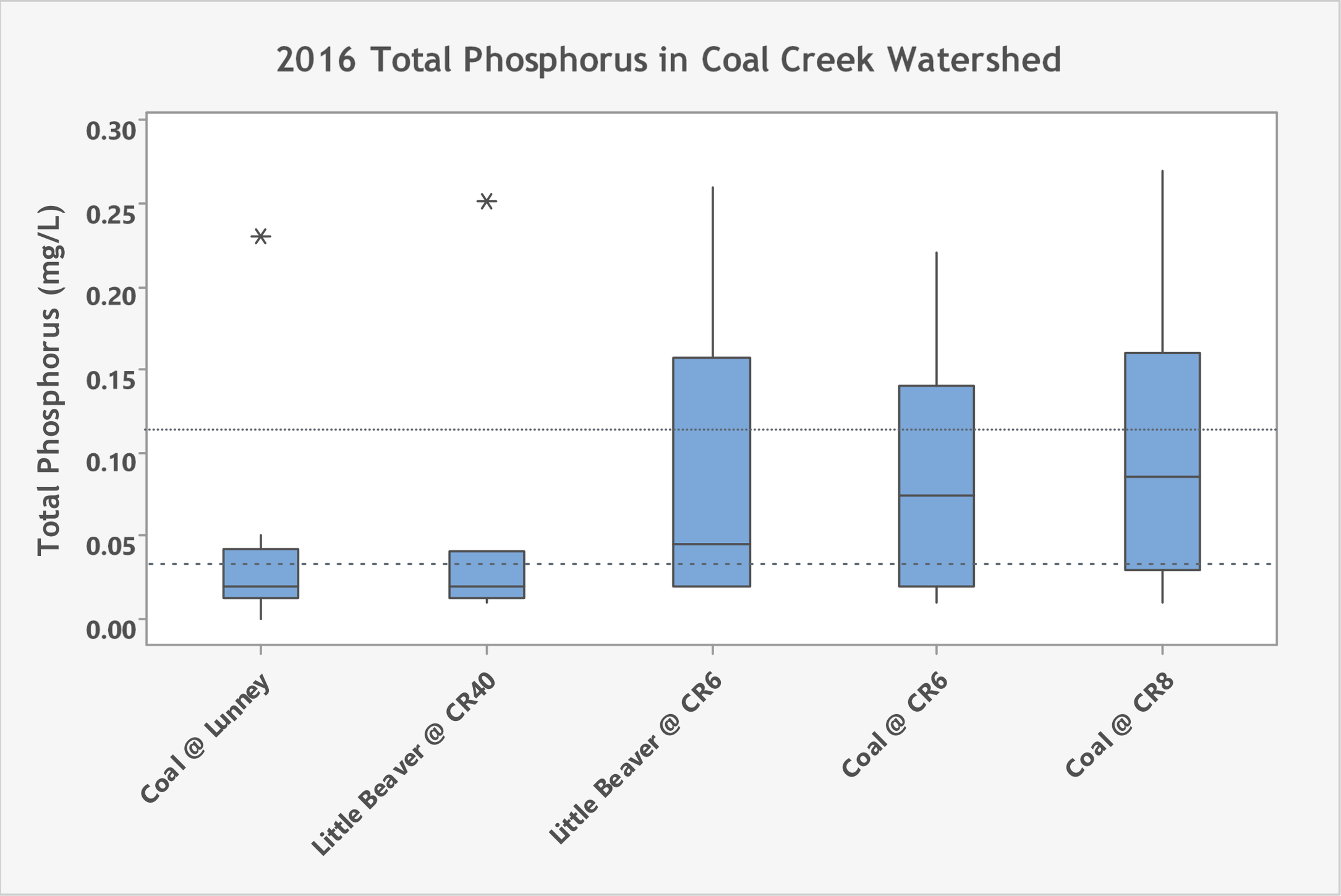
Macroinvertebrate Scores




2016 Total Nitrogen in White River
Total Nitrogen (mg/L)
1.0
0.8
0.6
0.4
0.2
0.0
NF White blw Lost Cr
NF White @ CR14
NF White abv Westlands
NF White @ Westlands
NF White @ Bel Aire
SF White @ Bel Aire
White @ Sleepy Cat
White @ Wakara
White @ Meeker Pasture
White @ 5th St


2016 Total Nitrogen in Coal Creek Watershed
Total Nitrogen (mg/L)
0
1
2
3
4
5
Coal @ Lunney
Little Beaver@ CR40
Little Beaver@ CR6
Coal @ CR6
Coal @ CR8


2016 Total Phosphorus in White River
Total Phosphorus (mg/L)
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
*
NF White blw Lost Cr
NF White @ CR14
NF White abv Westlands
NF White @ Westlands
NF White @ Bel Aire
SF White @ Bel Aire
White @ Sleepy Cat
White @ Wakara
White @ Meeker Pasture
White @ 5th St


2016 Total Phosphorus in Coal Creek Watershed
Total Phosphorus (mg/L)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Coal @ Lunney
Little Beaver @ CR40
Little Beaver @ CR6
Coal @ CR6
Coal @ CR8

Summary

- The filamentous alga impacting angling in the White River is *Cladophora glomerata*.

- Fast-moving current during high flows may temporarily reduce algae by scouring growths from rocks.
  - Re-growth will begin when flows subside
  - Scouring flows occur naturally during spring runoff, not during the peak algal growth in the summer (June-August)
  - There is no practical way to increase flows during peak algal growth in the summer
  - Relying on flows does not address the underlying cause of the excessive algal growth, which is nutrients

Summary

- Algal growth is limited by nitrogen.
  - Reduction of phosphorus alone is unlikely to reduce algal growth, unless the reductions are significant.
  - *Cladophora* can store excess phosphorus, concentrations must be kept low at all times to effectively control growth. Phosphorus concentrations in the White River watershed are highest during high flows.
  - Any additional nitrogen inputs will likely stimulate additional algal growth
  - Reducing nitrogen inputs, particularly in summer, will likely reduce algal growth

Summary

- Nutrient availability is sufficient to support nuisance blooms of algae in the North Fork from County Road 14 (aka Herrell Rd) to the confluence of the South Fork of the White River, and in the mainstem of the White River down to Meeker.

Recommendations for Ongoing Study

- Measure peak algal biomass so we can track changes (hopefully reduction) over time.
- What makes algae grow? Nutrients
    - Measure nutrients in algae and water
    - Use isotopes or other measure to identify nutrient sources
- What removes algae?
    - Flows - Identify flows that would scour algae
    - Macroinvertebrate grazers – study macroinvertebrates and pesticides