

# Mark Twain Lake



# Site 1

## 2010 DATA

Monroe and Ralls County  
 Latitude: 39.524 Longitude: -91.6478

Date	4/24	5/16	6/5	6/26	7/17	8/8	X	9/18	Mean
Secchi (inches)	21	18	22	42	44	46		48	32
TP (µg/L)	117	113	48	52	25	34		36	47
TN (µg/L)	1320	1000	1600	1470	1360	940		620	1137
CHL (µg/L)	27.6	8.1	51.3	22.9	9.9	19.9		22.9	19.8
ISS (mg/L)	6.9	4.4	6.7	3.4	2.0	2.0		1.9	3.4

Mark Twain Lake sampling sites

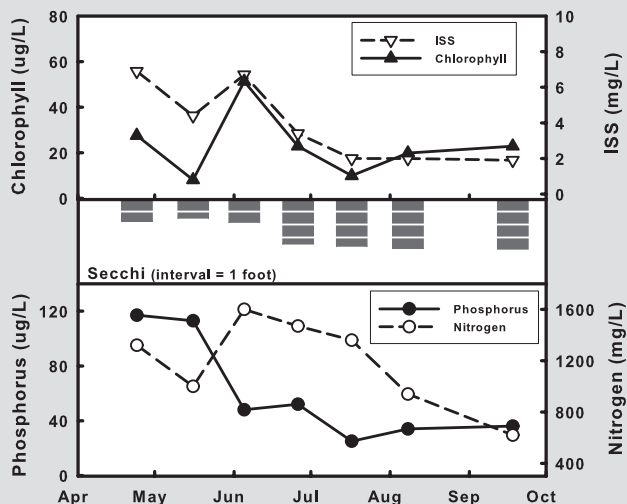


The sample season can be divided into two portions based on water quality at Site 1. The April to early June sample dates had water clarity averaging 20 inches, with the remainder of the season averaging 45 inches of clarity. The shift in Secchi transparency can be attributed to a decrease in inorganic suspended sediment concentrations. The first three sample dates average 6.0mg/L of suspended sediment compared to an average of 2.3mg/L for the second half of the season. Algal chlorophyll was highly variable in the early season and fairly stable during the second half of the season. The nutrients showed a general trend of decreasing values over the season

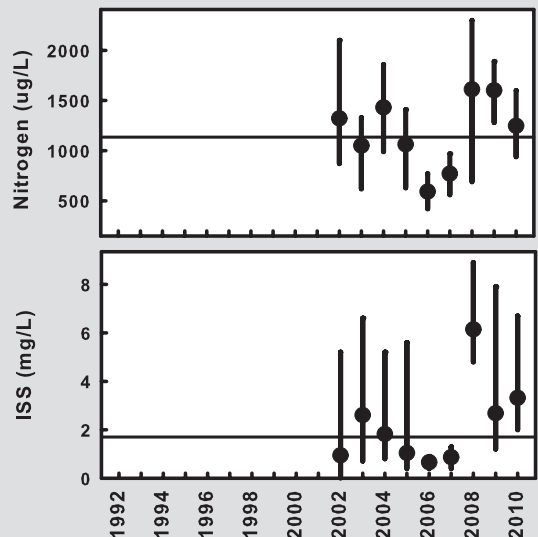
three years having substantially more rainfall than normal. Average annual rainfall in the watershed is around 39 inches. Annual rainfall for the years 2008-2010 ranged from 47 to 67 inches, depending on the weather station. More rainfall equates to increased runoff from the watershed that can carry more inorganic suspended sediment into the lake. Increased rainfall also transports nitrogen from the watershed, usually through the movement of groundwater. Interestingly, only one of the last three years had an average phosphorus value that was substantially higher than the long-term mean (graph not shown).

Average summertime inorganic suspended sediment and nitrogen levels have been higher than the long-term average during the last three years. These elevated values relate to the last

## 2010 GRAPHS



## TREND GRAPHS



See pages 10-11 for help interpreting graphs

# Mark Twain Lake

## 2010 DATA Site 2

Latitude: 39.5395

Longitude: -91.6972

Date	4/24	5/16	6/5	6/26	7/17	8/8	X	9/18	Mean
Secchi (inches)	22	17	19	38	34	54		59	31
TP (µg/L)	113	115	75	35	30	26		42	53
TN (µg/L)	1340	1600	1410	1760	1170	900		730	1223
CHL (µg/L)	57.4	19.2	48.8	15.3	6.3	10.4		27.6	20.4
ISS (mg/L)	10.2	4.3	6.0	3.0	4.5	1.8		2.1	3.9

Site 2, located in the Indian Creek Arm of Mark Twain, had water quality in 2010 that was very similar to that observed at Site 1. The same general trend of higher inorganic suspended sediment values during the early season, followed by lower levels during the second half of the season were observed. In response to shifts in suspended sediment, water clarity improved throughout the season with the September Secchi reading being roughly three times deeper than values measured earlier in the season. Algal chlorophyll was quite variable, with a nine-fold difference between the minimum and maximum measured value.

Water quality at Site 5 was very comparable to that

found at Site 2 in Indian Creek Arm and Site 1 at the dam. Along with similar mean values, the seasonal trends of clearer water, lower nutrient concentrations and lower suspended sediment values during the second half of the season was also identified at Site 5. The biggest differences among sites were slightly higher suspended sediment values at Site 5, which led to shallower Secchi readings.

Mark Twain Lake sampling sites

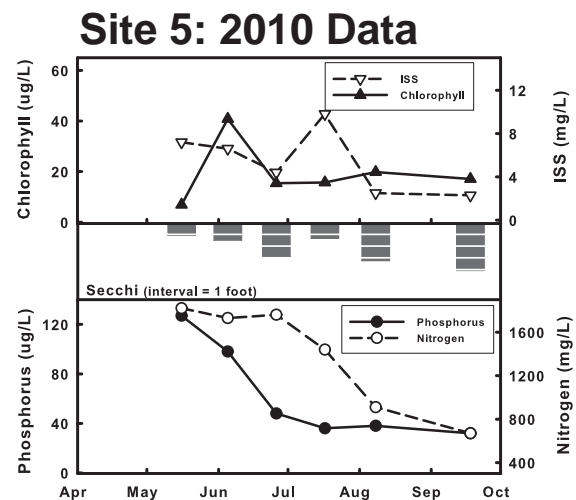
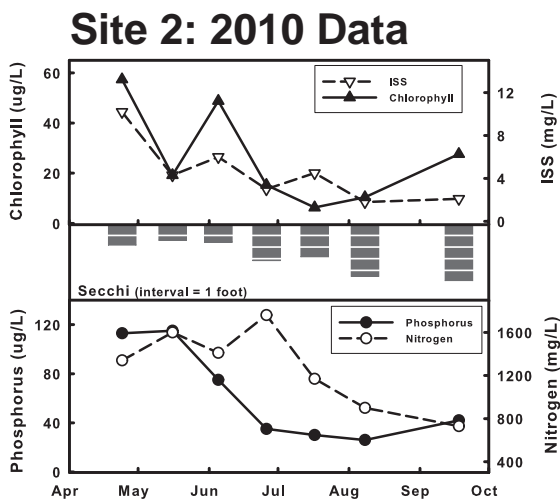


## 2010 DATA Site 5

Latitude: 39.5066

Longitude: -91.7679

Date	X	5/16	6/5	6/26	7/17	8/8	X	9/18	Mean
Secchi (inches)		13	18	35	16	39		49	25
TP (µg/L)		127	98	48	36	38		32	54
TN (µg/L)		1820	1730	1760	1440	910		670	1302
CHL (µg/L)		6.9	40.8	15.4	15.7	19.8		17.1	16.9
ISS (mg/L)		7.2	6.6	4.4	9.8	2.5		2.3	4.8



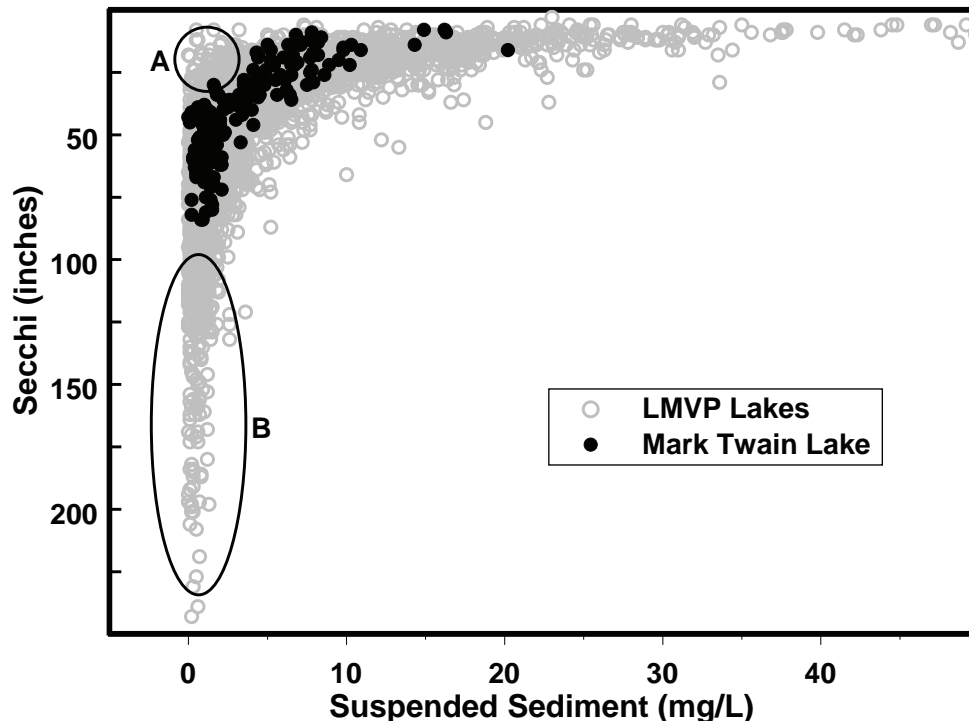
# Mark Twain Lake

# Trends

In Missouri lakes the two factors that dictate water clarity readings are inorganic suspended sediment (soil particles) and algae (estimated via the photosynthetic pigment chlorophyll). While clarity in some Missouri lakes is a function of only one of these factors, in most lakes both suspended sediment and algae combine to dictate water clarity. The following graphs compare these parameters to Secchi transparency, showing data from all LMVP lakes (grey symbols) and Mark Twain sites 1, 2 and 5 (solid, black symbols). Where Mark Twain data points fall within the relationship is informative, as is the areas of the relation where data don't fall.

watershed is located in an area known as the claypan till plains. Simply put, there is a notable layer of clay in the soil profile, and where erosion is occurring the clay is transported via streams and rivers into Mark Twain Lake. Some of these clay particles are very small in size, and are able to pass through the suspended sediment filter. This means the LMVP inorganic suspended sediment readings actually under-estimate the total amount of suspended sediment in the water column. Also, the small size of the clay particle allows them to remain suspended in the water longer than large particles that would easily settle out.

Note a large portion of Mark Twain Lake's



There is a predictable relation between inorganic suspended sediment values and water clarity in Missouri lakes, with Mark Twain Lake fitting within the relationship. The lack of Mark Twain data in region A of the graph

indicates that extremely low Secchi transparency readings associated only with high algal biomass do not occur in Mark Twain Lake. Put in another way, if we are getting very low Secchi readings (<25 inches) the

# Mark Twain Lake

# Trends

suspended sediment levels are at least 4mg/L (plus any small particles too small to be captured on our filters). The lack of data points in region B of the graph indicates that Mark Twain Lake does not achieve water clarity that exceeds 85 inches, even when measured suspended sediment values are low. The failure of water clarity to exceed 85 inches reflects a combination of algal biomass and the smaller clay particles that are not being measured.

The algal chlorophyll-Secchi transparency data from Mark Twain Lake also fits within the statewide relation. As previously noted, water clarity does not exceed 85 inches (region A in graph), even on the few days

when chlorophyll levels are quite low (<4µg/L). This indicates that on these days suspended sediment was the major determinant of water clarity (low clarity due to suspended sediment may have led to low chlorophyll levels by limiting light availability). Another indication that suspended sediments limit algal growth in Mark Twain Lake is the fact that only 8% of the individual chlorophyll values were >40µg/L, a level that indicates extreme algal biomass in Missouri lakes (also referred to as hypereutrophic, and identified on graph by line B). In contrast, 20% of individual phosphorus values and 47% of nitrogen measurements were in the hypereutrophic zone.

