

**2009 Lake Maxinkuckee *E. coli* Sampling Report**  
**Lake Maxinkuckee Environmental Council**  
**Marshall County, Indiana**

**1.0 Introduction**

JFNew was contracted by the Lake Maxinkuckee Environmental Council (LMEC) to collect *E. coli* samples during one storm flow and one base flow event at six sampling sites within the Lake Maxinkuckee watershed. Storm flow conditions were defined as the flow resulting from a rain event that was equal to or greater than 0.75" of precipitation. Flow velocity data was also taken at each site so instantaneous loading of *E. coli* could be calculated.

**2.0 Sampling**

Sampling during one storm flow and one base flow event occurred at six sites chosen by the LMEC within the Lake Maxinkuckee watershed: 1) downstream end of 18B ditch just before it enters into the lake at the public boat launch located on the west side of the lake; 2) the north stream feeding into 18B ditch; 3) the south stream feeding into 18B ditch; 4) the Culver Academy outfall; 5) the park beach located on the northwest corner of the lake in the Town of Culver; 6) the spillway from wetland on the south side of the lake (Figure 1). Storm flow sampling occurred after a 1-inch rainfall event on 6/11/2009. Base flow sampling occurred on 7/30/2009.

*E. coli* samples were collected at each site first using a glass beaker to extract a water sample from the sampling area. The water sample was then poured into a laboratory-prepared 100 ml sampling bottle. After each sampling site, the glass beaker was triple rinsed with distilled water to clean the beaker before the next sample was taken. All sampling bottles were placed into a cooler with ice to preserve the sample until the samples reached the lab. Water samples were taken immediately after sampling to Sherry Laboratories in Warsaw IN, for analysis.

Flow velocity data was taken at five of the six sites during storm flow and base flow. Flow data was not taken at Site 5 because water sampling occurred within the lake. Storm and base flows were calculated for each site so an instantaneous *E. coli* loading rate for each site could be calculated. From the instantaneous loading rates it can be determined which sites are contributing the greatest amount of *E. coli* into Lake Maxinkuckee. Identifying those sites contributing the greatest amount of *E. coli* can help prioritize areas within the watershed where projects aimed at reducing *E. coli* should take place.

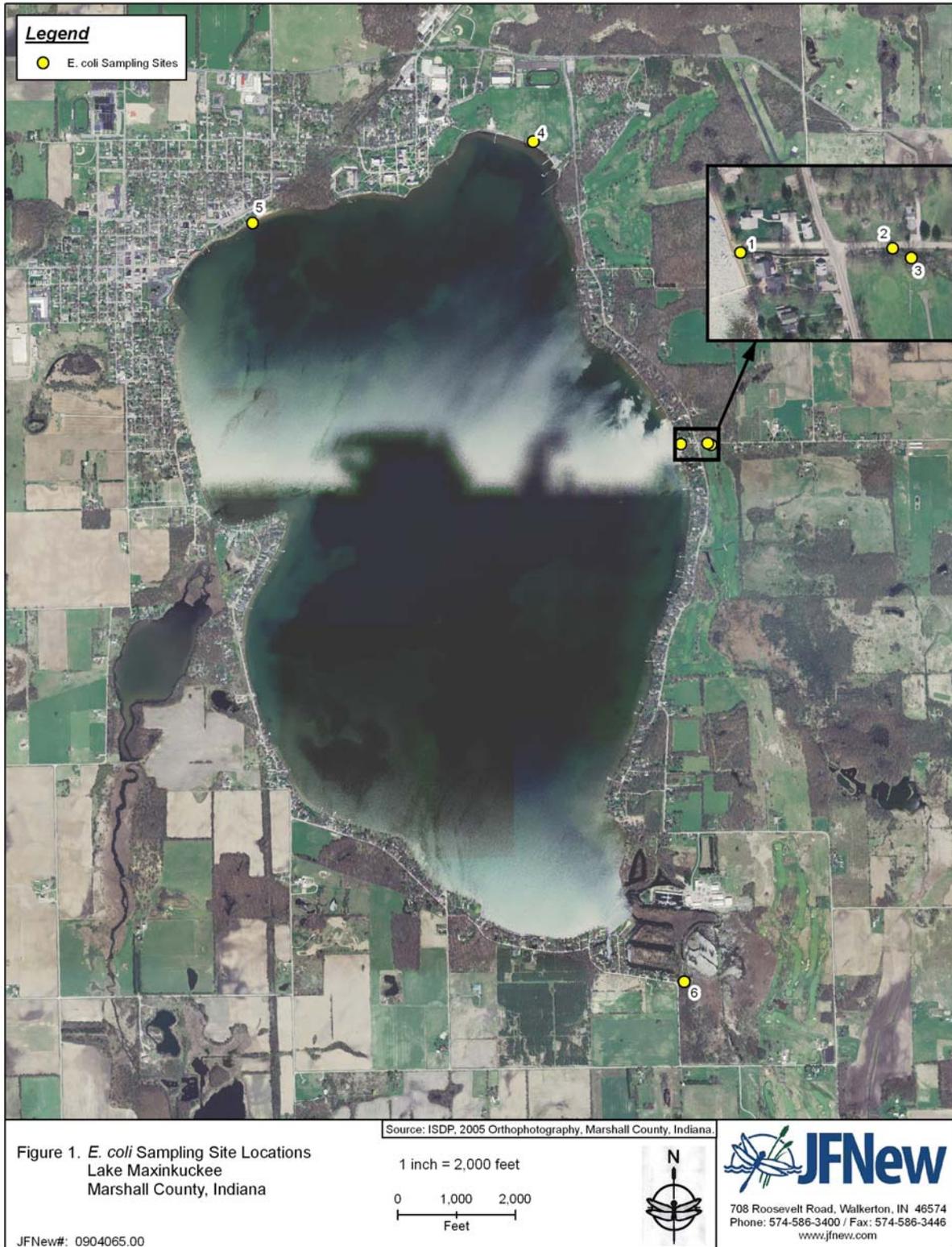


Figure 1. 2009 *E. coli* sampling locations.

### 3.0 Results

#### Storm flow

*E. coli* concentrations at all six sites sampled during storm flow exceeded Indiana's Administrative Code (IAC) state standard for recreational waterbodies (235 col/100 ml; Table 1; Figure 2). Sites 1 and 3 had the highest concentration of *E. coli* at >24,190 col/100 ml followed by Site 6 (8,160 col/100 ml), Site 2 (3,280 col/100 ml), Site 5 (530 col/100 ml), and Site 4 (470 col/100 ml; Table 1). Sites 1 and 3 are reported as >24,190 col/100 ml because Sherry Laboratories methods for determining *E. coli* concentrations only allows accurate results to this maximum.

As with *E. coli* concentrations, flow rates varied between the sites. Site 6 had the highest flow rate at 10.97 ft<sup>3</sup>/sec, followed by Site 1 (2.94 ft<sup>3</sup>/ sec), Site 2 (1.81 ft<sup>3</sup>/sec), Site 3 (0.88 ft<sup>3</sup>/sec), and Site 4 (0.03 ft<sup>3</sup>/sec; Table 1). The instantaneous loading rate was greatest at Site 6 (2.53x10<sup>7</sup> col/ft<sup>3</sup>/sec), followed by Site 1 (2.01x10<sup>7</sup> col/ft<sup>3</sup>/sec), Site 3 (6.03x10 col/ft<sup>3</sup>/sec), Site 2 (1.68x10<sup>6</sup> col/ft<sup>3</sup>/sec), and Site 4 (3,995 col/ft<sup>3</sup>/sec; Table 1). It is possible that sites 1 and 3 could have higher instantaneous loading rates than Site 6 as Sites 1 and 3's exact *E. coli* concentrations were not determined.

**Table 1. Results of storm flow and base flow *E. coli* sampling.**

Site	Location	Sampling Event	Sampling Date	<i>E. coli</i> concentration (col/100mL)	Rate (ft <sup>3</sup> /sec)	Instantaneous Loading (col/ft <sup>3</sup> /sec)
1	18 B Public Access	Storm	6/11/2009	>24,190	2.94	2.01x10 <sup>7</sup>
		Base	7/30/2009	3,260	0.08	73,839
2	N stream feeding into 18 B access ditch	Storm	6/11/2009	3,280	1.81	1.68x10 <sup>6</sup>
		Base	7/30/2009	3,450	0.33	322,368
3	S stream feeding into 18B access ditch	Storm	6/11/2009	>24,190	0.88	6.03x10 <sup>6</sup>
		Base	7/30/2009	1,300	0.01	3,679
4	Academy outfall	Storm	6/11/2009	470	0.03	3,995
		Base	7/30/2009	10	0.05	146
5	Culver Park Beach	Storm	6/11/2009	530	-	-
		Base	7/30/2009	150	-	-
6	Wetland spillway	Storm	6/11/2009	8,160	10.97	2.53x10 <sup>7</sup>
		Base	7/30/2009	220	5.37	334,536

#### Base flow

All sites sampled during base flow conditions showed a decrease in *E. coli* concentrations except for Site 2, which increased from 3,280 col/100 ml to 3,450 col/100 ml (Table 1). Site 2 had the highest *E. coli* concentration during base flow sampling. Three of the six sites sampled during base flow were within the Indiana state *E. coli* standard for recreational waterbodies, Site 4 (10 col/100 ml), Site 5 (150 col/100 ml), and Site 6 (220 col/100 ml; Table 1; Figure 2). Sites 1 and 3 showed a significant reduction in *E. coli* concentrations during base flow sampling, >24,190 col/100 ml to 3,260 col/100 ml and >24,190 col/100 ml to 1,300 col/100 ml, respectively; however, both sites still exceeded the state standard.

All sites had flowing water during base flow conditions; however, only Site 6 had any significant flow (Table 1). Site 6 despite having reduced *E. coli* levels still had the highest instantaneous loading rate at 334,536 col/ft<sup>3</sup>/sec, followed by Site 2 (322,368 col/ft<sup>3</sup>/sec), Site 1 (73,839 col/ft<sup>3</sup>/sec), Site 3 (3,679 col/ft<sup>3</sup>/sec), and Site 4 (146 col/ft<sup>3</sup>/sec; Table 1).

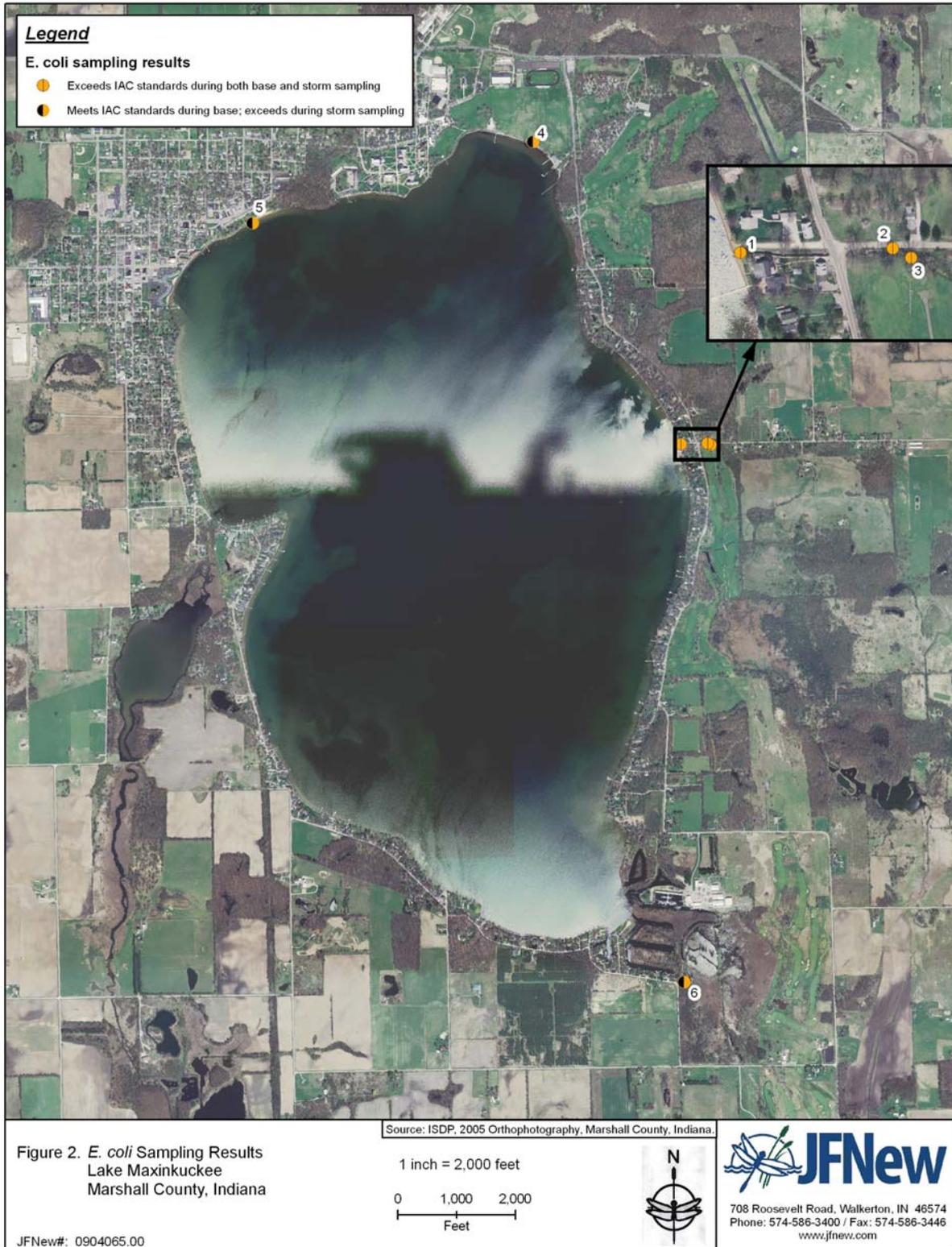


Figure 2. Storm flow and base flow results for *E. coli* concentrations compared to IAC standards.

#### **4.0 Discussion**

Results of the *E. coli* sampling indicate all sites sampled during storm flow exceeded the Indiana state standard for *E. coli*. Special attention should be given to Sites 1 and 3 where concentrations were >24,190 col/100 ml. Reducing the source of *E. coli* to Sites 2 and 3, with an emphasis on Site 3, should be a priority as these two streams combine and flow down to sampling Site 1 which discharges in Lake Maxinkuckee at the west side public boat launch. The high concentrations of *E. coli* observed after a storm event could pose a human health risk to people who use this area. Follow-up sampling of the immediate area out in the lake from the inlet at Site 1 should be considered during a storm flow event and during base flow. The wetland on the south end of Lake Maxinkuckee could also be an area of concern as a source of *E. coli*. While the wetland outfall during base flow sampling was within the Indiana state standard, storm flow sampling was elevated. Instantaneous loading at Site 6 was highest among all sites during both storm flow and base flow. *E. coli* levels at Sites 4 and 5 should be of minimal concern as both were within state standards during base flow and just a little high during storm flow.