

Sampling design changes from inception (1988) to present for the water quality component of UMRR-EMP Long Term Resource Monitoring Program (LTRMP) on the Upper Mississippi River System (UMRS). LTRMP uses two separate designs: 1) a judgment sample from sites in tributaries and different aquatic area types of local interest using Fixed Site Sampling (FSS) and 2) a probability sampling using Stratified Random Sampling (SRS) of strata defined by aquatic area types (i.e., main channel, side channels, backwaters, impounded area).

		Time Period																
		1988-1992		1993-1999		Jan 2000-Sept 2002		Oct 2002-Mar 2003	Apr-Dec 2003		Jan-Mar 2004		Apr-Sept 2004		Oct 2004-Feb 2007		Mar 2007-Present	
General changes		FSS started in Field Stations 2, 3, and 4 in July 1988, Field Station 6 in September 1989, Field Station 1 in January 1990, and Field Station 5 in March 1991.		SRS design initiated. Only a subset of FSS sites continued to be sampled.		Reduced FSS sampling frequency, and reduced SRS chemistry <sup>1</sup> sites from ~1/2 to ~1/3 of total sites.		no sampling	FSS resumed at reduced levels of parameters, sites, and frequency. No SRS sampling.		SRS resumed.		FSS returned to 2000-02 level of sample size, sampling frequency increased, added back NOx, NHx, SRP, and Phyto <sup>2</sup> sampling.		FSS sites reduced to include only major tributaries and selected UMRS sites; reduced FSS sampling frequency.		For Field Station 2, FSS resumed at 4 sites discontinued in Oct 2004, and 2 new sites were added.	
Sampling frequency	FSS (UMRS)	weekly		2 weeks		2 weeks, except 4 weeks for lateral transect sampling			4 weeks		NC <sup>3</sup>		2 weeks		2 weeks March-May, monthly June-Nov and Jan. (no Dec. or Feb. sampling)		NC	
	FSS (tributary)					4 weeks			NC				NC					
	SRS	no sampling		Quarterly		NC			no sampling		Quarterly		NC		NC		NC	
Sampled parameters	FSS	Starting in 1988, <i>in situ</i> <sup>5</sup> (except no pH, vegetation and substrate) and turbidity; pH starting in 1990; chemistry <sup>1</sup> (except no SO <sub>4</sub> ), TSS/VSS, Metals <sup>6</sup> , and Chl <sup>4</sup> starting in June 1991		FSS full set [ <i>in situ</i> , turbidity, chemistry, TSS/VSS, Metals (except no Fe and Mn), Chl, Phyto]		NC			FSS full set, except no NOx, NHx, SRP, Phyto, Metals, Cl, or SO <sub>4</sub> .		NC		FSS full set, except no Metals, Cl, or SO <sub>4</sub>		NC		NC	
	SRS	no sampling		SRS full set ( <i>in situ</i> , turbidity, chemistry, TSS/VSS, Chl, Phyto)		SRS full set, except Cl ending in 2001			no sampling		SRS full set, except no SO <sub>4</sub> and Cl		NC		NC		NC	
		<i>Field station</i>		<i>Field station</i>		<i>Field station</i>			<i>Field station</i>		<i>Field station</i>		<i>Field station</i>		<i>Field station</i>		<i>Field station</i>	
		1 2 3 4 5 6		1 2 3 4 5 6		1 2 3 4 5 6			1 2 3 4 5 6		1-6		1 2 3 4 5 6		1 2 3 4 5 6		1 2 3-6	
Sample Size	FSS sites (UMRS)	24 23 25 24 28 24		19 6 13 15 6 7		18 11 13 14 7 7			16 6 3 7 0 5		NC		18 11 11 14 7 7		11 9 7 7 7 6		11 NC NC	
	FSS sites (tributary)	3 3 0 0 2 2		5 7 13 7 2 6		6 7 13 7 2 6			6 7 7 7 0 6				6 7 13 7 2 6		3 4 5 4 2 5		8	
	SRS sites ( <i>in situ</i> <sup>5</sup> , TSS/VSS, turbidity, Chl)	no sampling		135 150 150 121 150 135		NC		no sampling		Same as 1993		NC		NC		NC		
	SRS sites (subset for chemistry <sup>1</sup> )			72 79 80 65 80 73		46 50 51 41 52 47				Same as Jan. 2000								

<sup>1</sup> chemistry samples to be analyzed in the laboratory are only collected at a subset of all SRS sample sites. Chemistry parameters include: Total N, NOx, NHx, Total P, Soluble Reactive Phosphorus (SRP), SO<sub>4</sub>, Cl, and SiO<sub>2</sub>.

<sup>2</sup> Phytoplankton (Phyto) samples are collected, preserved, and stored for possible future analysis.

<sup>3</sup> NC = No Change from previous design.

<sup>4</sup> Chl = Chlorophyll. Chlorophyll using spectrophotometric methods began in 1991, and is measured at a subset of all sites. Fluorometric chlorophyll is measured at all SRS sites beginning in 1993 and all FSS sites in 1998.

<sup>5</sup> *in situ* parameters include water temperature, DO, pH, conductivity, velocity, secchi, measures of water depth and waves, measures of snow and ice, measures of vegetation and substrate

<sup>6</sup> metals analyzed by LTRMP were Ca, Fe, Mg, Mn, K, Na.