



Mississippi Lake Tributary Water Sampling 2017-2018

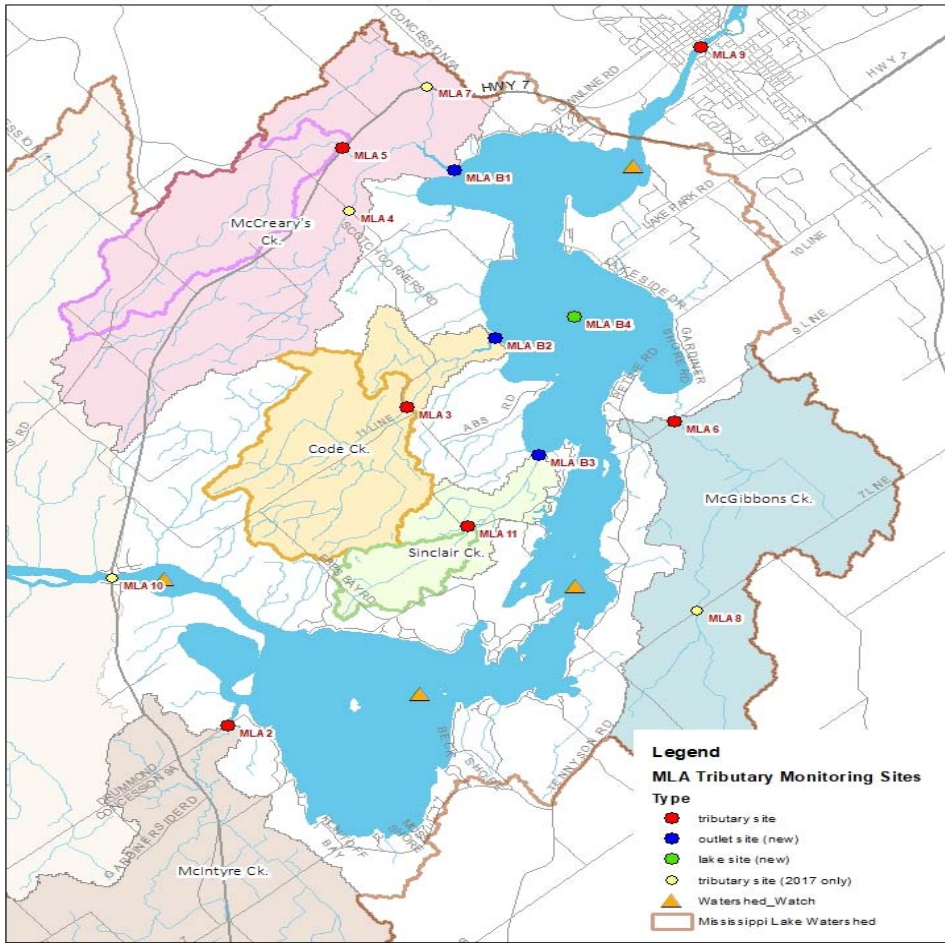
Hmmmm, it certainly looks like a tributary but what do we do now?



Purpose of Sampling

- Provide water quality and flow information for input to lake ecological modeling
 - Provide some basic water quality information for streams flowing into Mississippi Lake
 - Look for indications of water quality impairment that may be related to anthropogenic sources
- 

Mississippi Lake Tributary Catchments and Monitoring Sites



Sampling by Year

2017

Sites	Field Analyses	Lab Analyses
MLA7	Conductivity	TP
MLA5	pH	TKN
MLA4	DO	NO ₃
MLA3	Temperature	NO ₂
MLA2	Fluorometer	PO ₄
MLA8		Cl
MLA6		
MLA9		
MLA10		

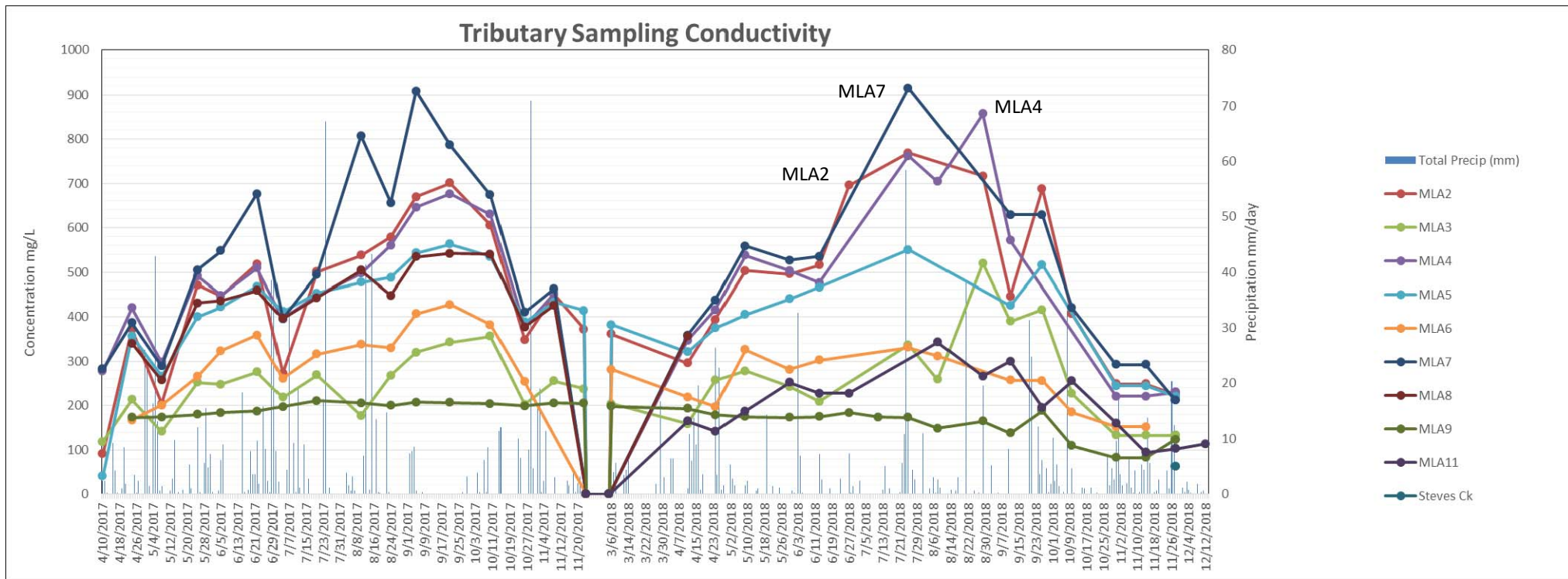
2018

Sites	Field Analyses	Lab Analyses
MLA7	Conductivity	TP
MLA5	pH	TKN
MLA4	DO	NO ₃
MLA3	Temperature	NO ₂
MLA2		PO ₄
MLA6		NH ₃ +NH ₄
MLA9		Cl
MLA11		
B1 (McCreary's)		
B2 (Code)		
B4 (lake)		

Land Use Upstream of Sampling Locations

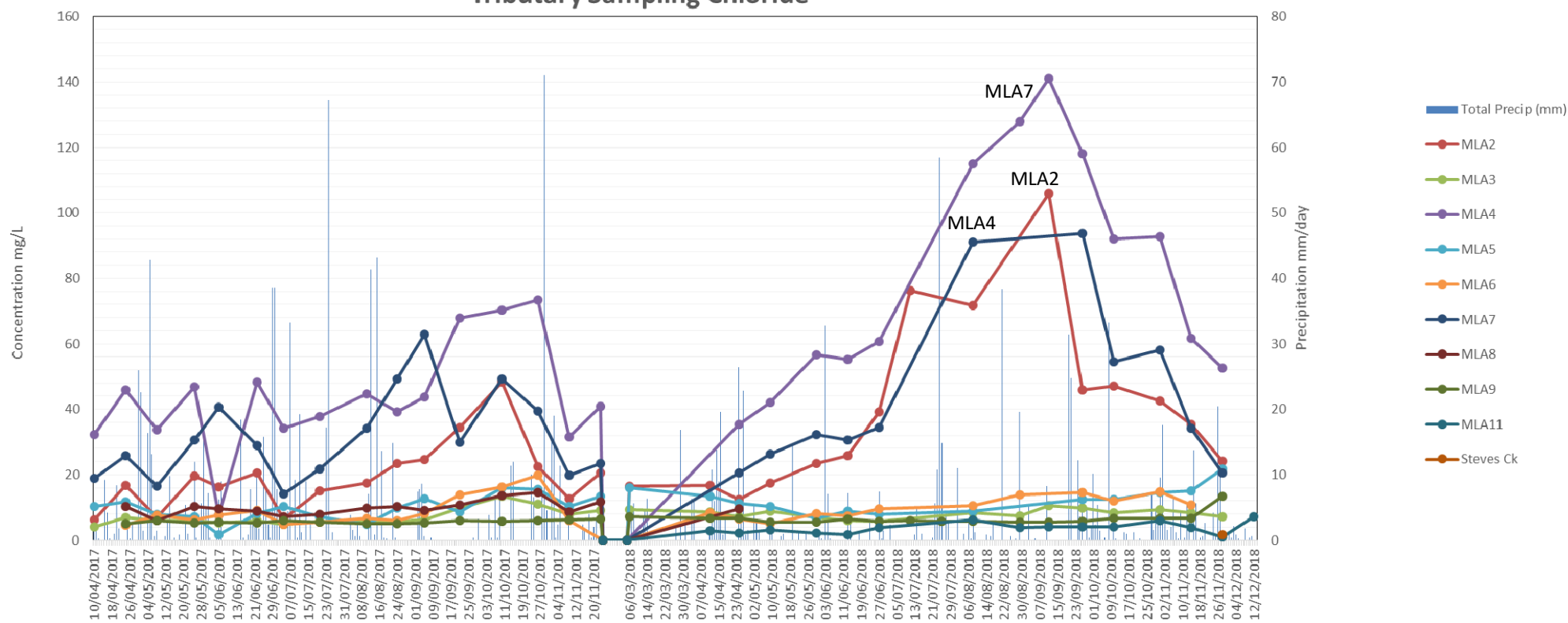
	Tributary	Drainage Area	Mean Annual Flow	Includes Highway 7	Urban/ Infrastructure	Agriculture	Marsh, fen, bog, Swamp	Trees	Open Water	Total Undeveloped
MLA7	McCreary's	2.6	.03	Yes	3	35	23	39	0	62
MLA5	McCreary's	5.8	.07	No	0	29	3	69	0	72
MLA4	McCreary's	7.9	.09	Yes	0	32	3	65	0	68
MLA3	Code	7.4	.09	No	0	19	6	75	0	81
MLA11	Sinclair	1.9	.02	No	0	2	5	91	2	100
MLA2	McIntyre	61.1	.71	Yes	3	59	23	14	0	37
MLA8	McGibbons	5.8	.07	No	1	28	46	23	0	69
MLA6	McGibbons	16.3	.19	No	1	38	42	17	0	59
MLA9	Mississippi R at CP	2866	33.7	Yes						

Fluid Conductivity



Chloride

Tributary Sampling Chloride



Nitrogen

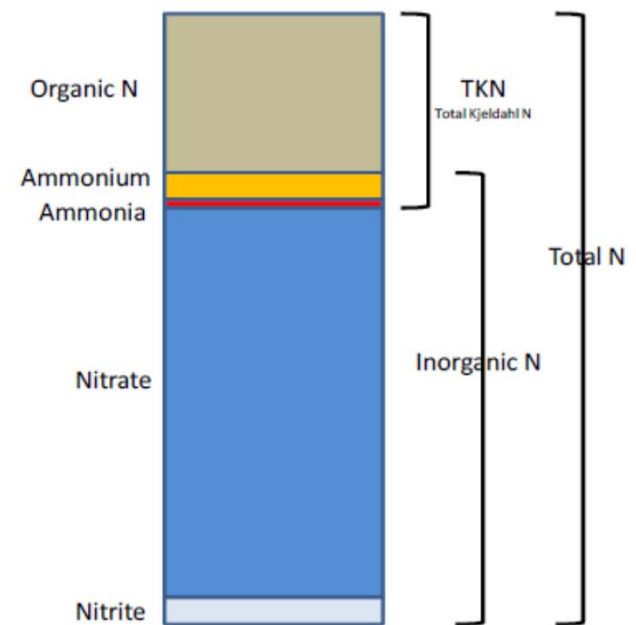
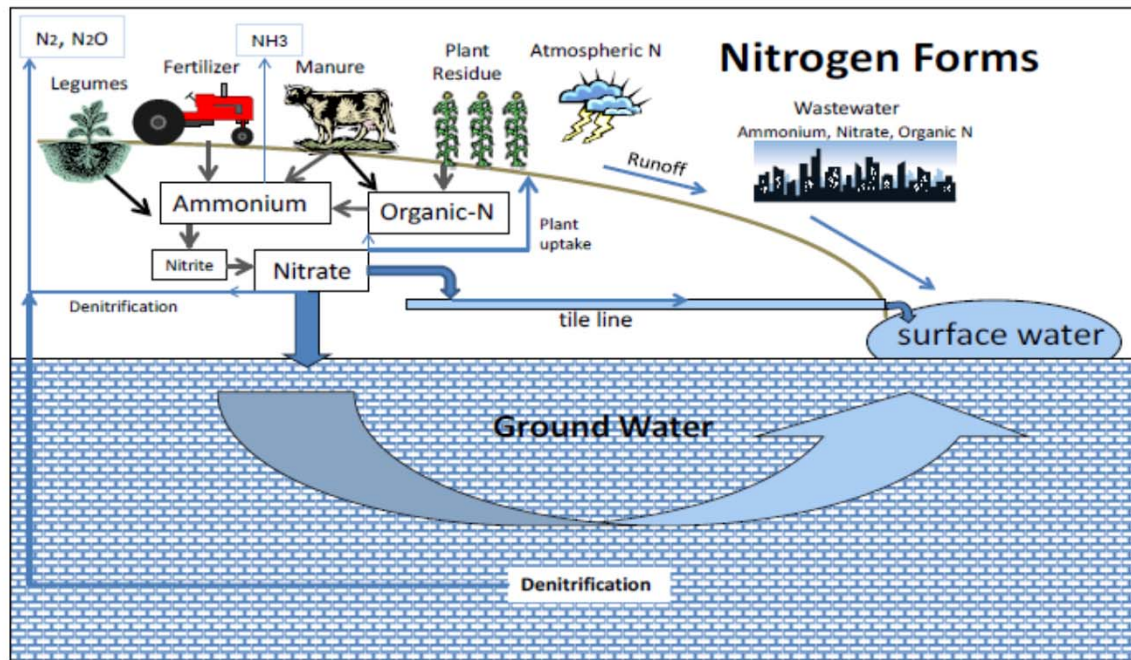


Figure 1. Nitrogen cycle, showing primary N sources, forms and routes to surface waters.

Nitrogen

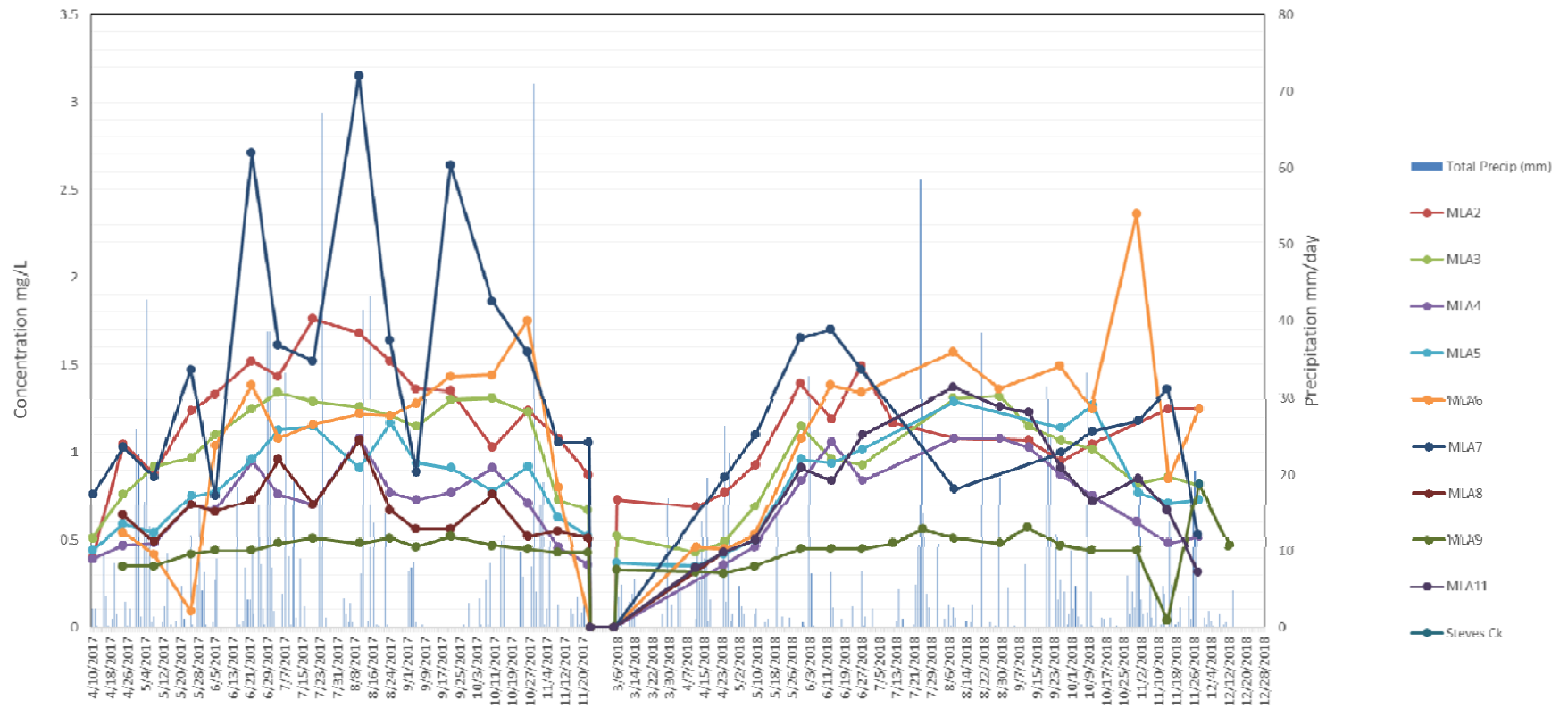
TKN measurement includes both organic nitrogen and ammonia+ammonium-N but does not include nitrate or nitrite.

Organic-N includes all substances in which N is bonded to carbon. It occurs in both soluble and particulate forms. Organic-N is found in proteins, amino acids, urea, living or dead organisms (i.e., dead algae and bacteria), and decaying plant material. Soluble organic-N is from wastes excreted by organisms, including livestock manure and human wastes, or from the degradation of particulate organic-N from plants and plant residues. Some organic-N is attached to soil particles and is associated with sediment losses to water. Different soils have varying amounts of organic-N. For example, soils developed under prairies and prairie wetlands have more organic-N than soils developed in forested areas. Climate, soil particle sizes, age of the land surface, agricultural practices and soil chemistry also affect the amount of organic-N in soils. Typically, the organic-N fraction of TKN in surface waters is much higher than the ammonia+ammonium-N fraction.

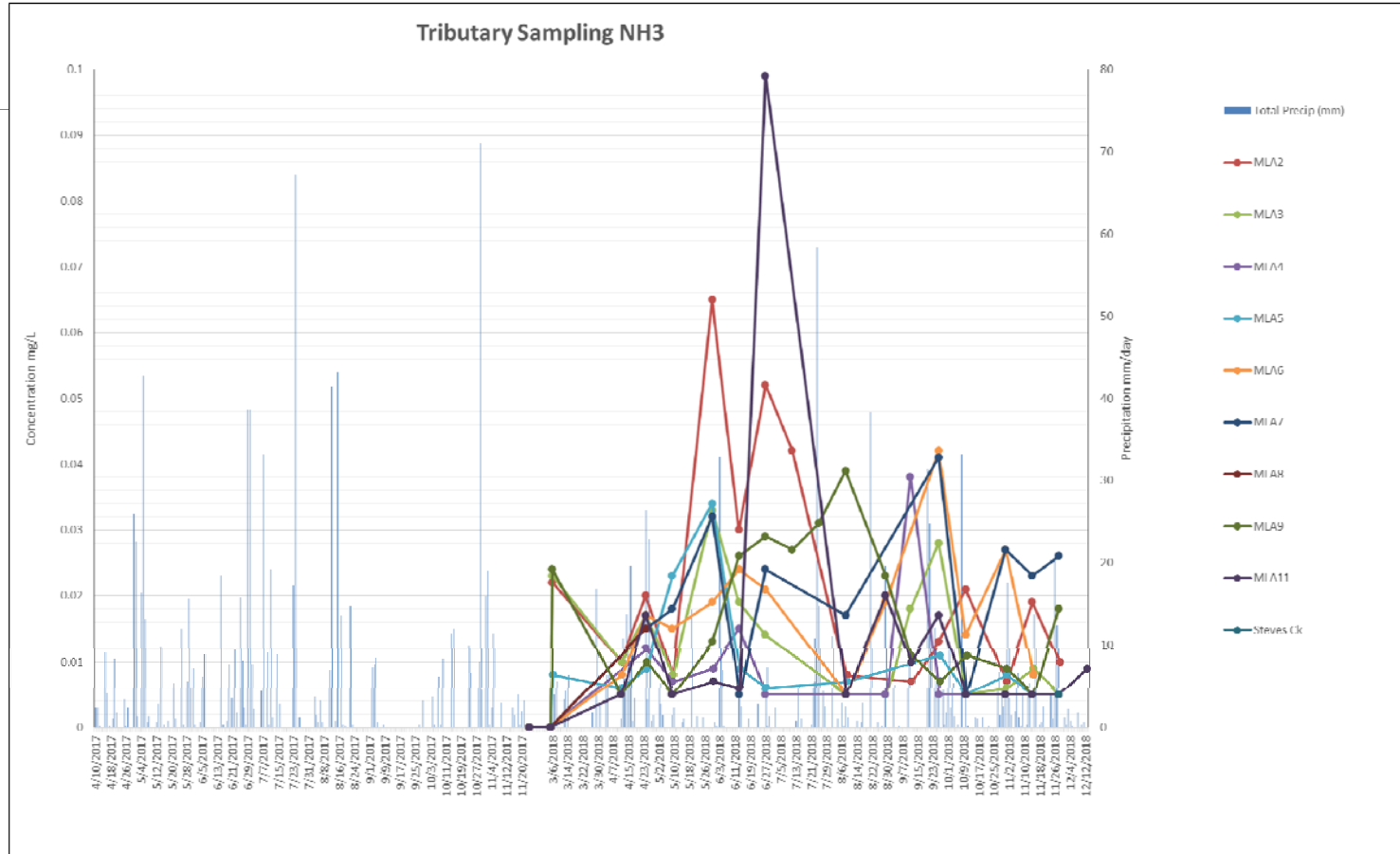
In nature, organic-N can be biologically transformed to the ammonium form and then to the nitrite and nitrate form. Once in the nitrate or ammonium forms, these nutrients can be used by algae and aquatic organisms and thereby convert back to organic forms of N. Heiskary et al. (2010) and Heiskary and Lindon (2010) found that in high P surface waters, where algae growth is high, TKN is also elevated. Where P and algae are low, TKN is also low. The high algae levels were not believed to be caused by the high TKN, but rather the algae were believed to comprise much of the organic-N in the TKN measurements. Organic-N sometimes makes up a significant fraction of soluble and particulate N in natural waters, especially in forest and rangeland areas where natural sources of organic matter are found and nitrate concentrations are typically low.

TKN

Tributary Sampling TKN

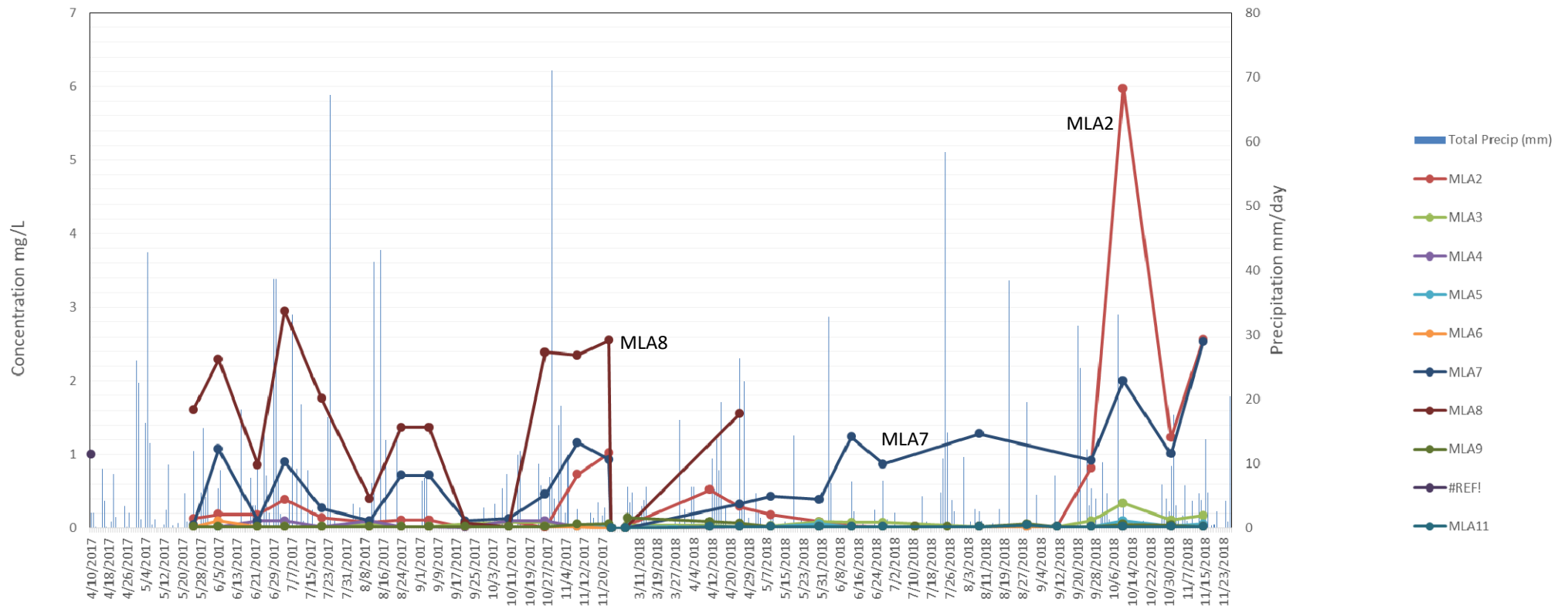


Ammonia+Ammonium



Nitrate

Tributary Sampling Nitrate

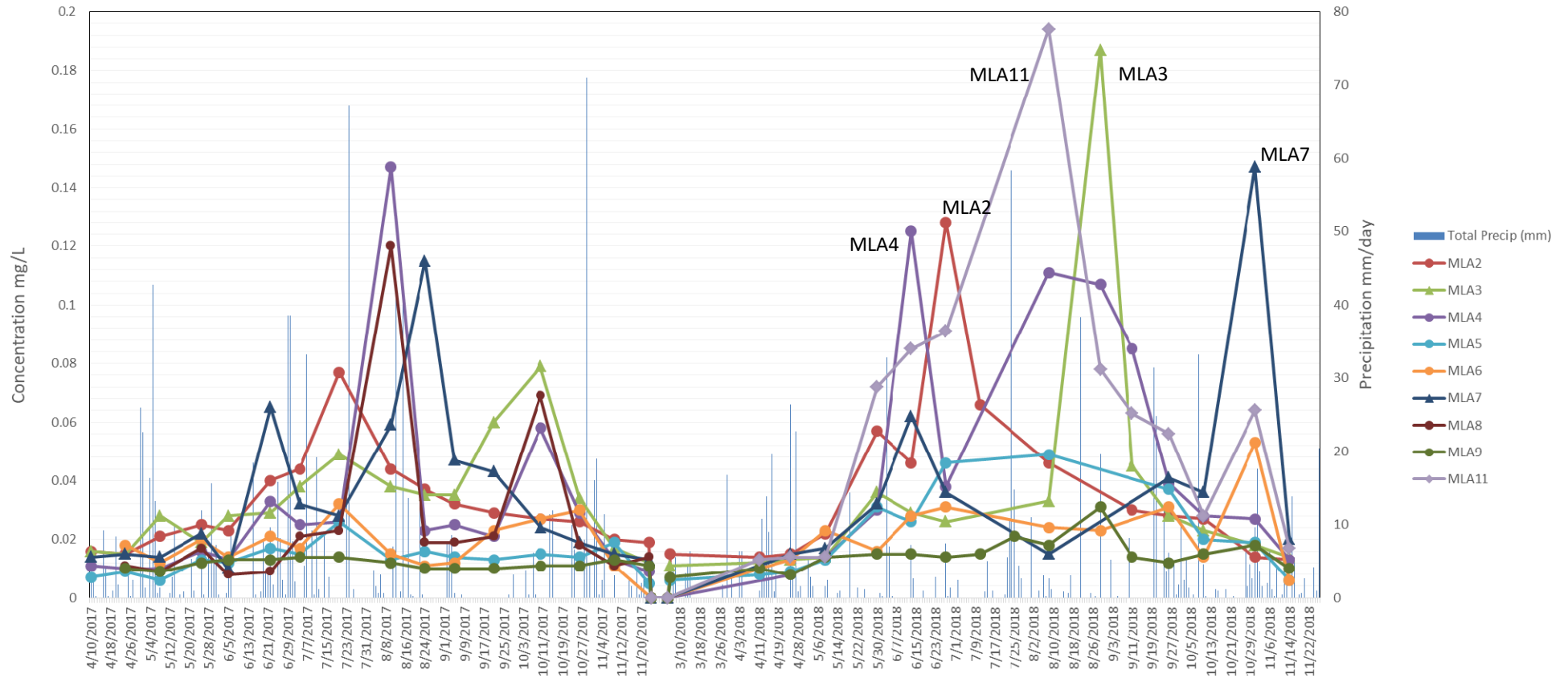


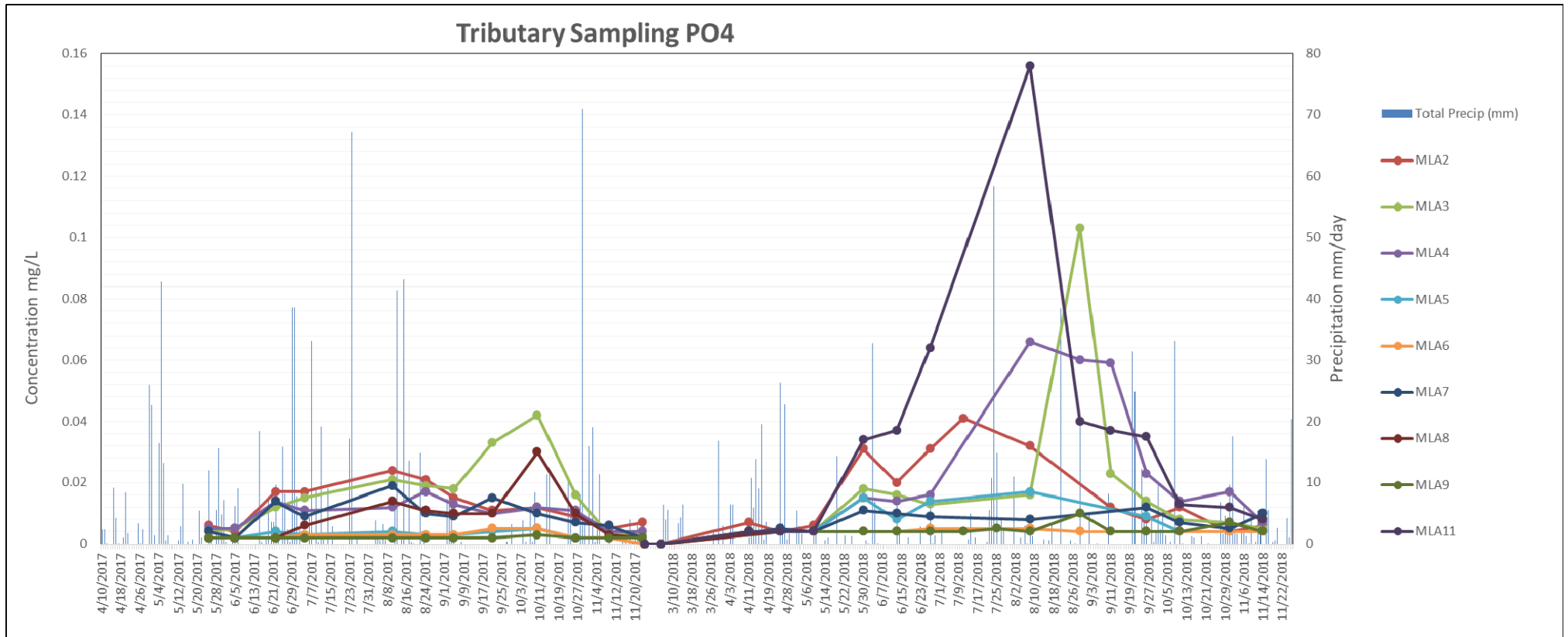
Phosphorus

- Multiple sources including erosion of rocks and soils, fertilizers, human and animal waste, precipitation, runoff from roads, detergents, septic systems, sediments at the bottom of a lake, erosion of stream banks, groundwater
- Total Phosphorus is a measure of all sources of P in a water sample including dissolved P, weakly sorbed P onto sediment or organic load, and P contained in tissues of plants floating in water
- Dissolved P is directly usable by plants and typically formed 10-50% of the TP measured in the tributary samples.

Total Phosphorus

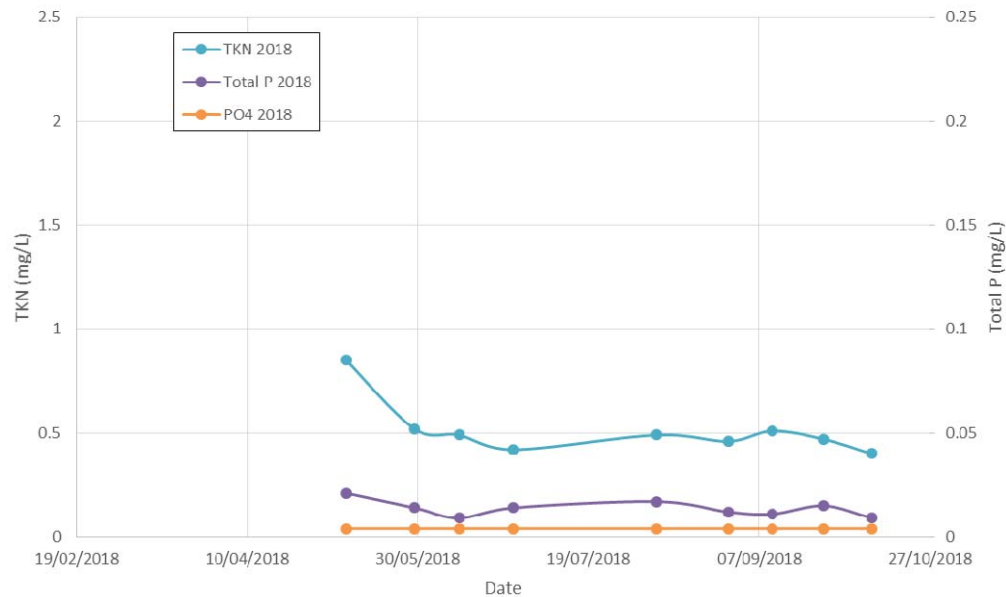
Tributary Sampling Total Phosphorus



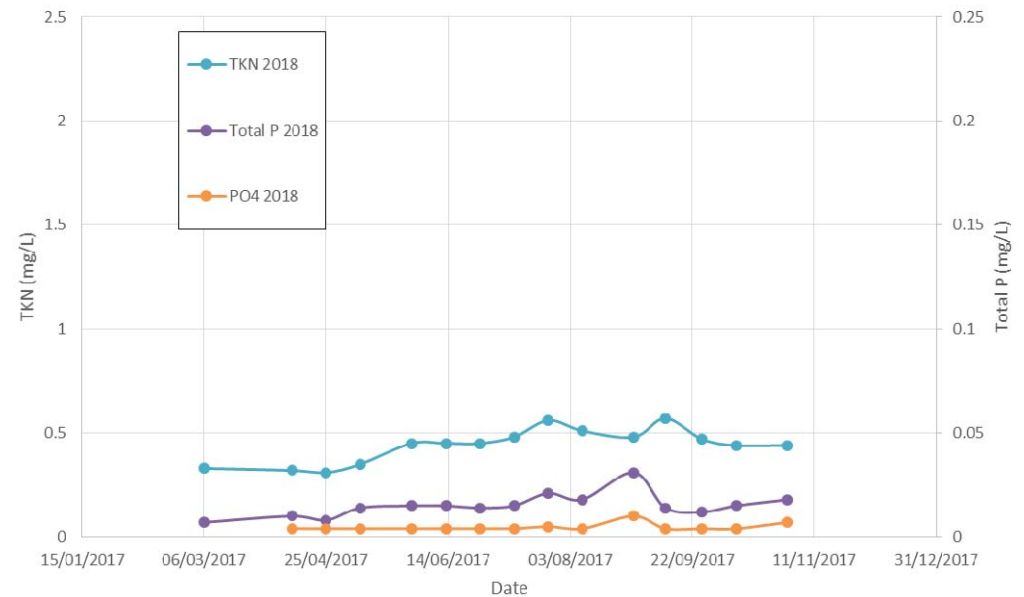


Comparison of TP, PO4, TKN 2018

Tributary Sampling B4 (Mid-lake) TP, PO4 and TKN

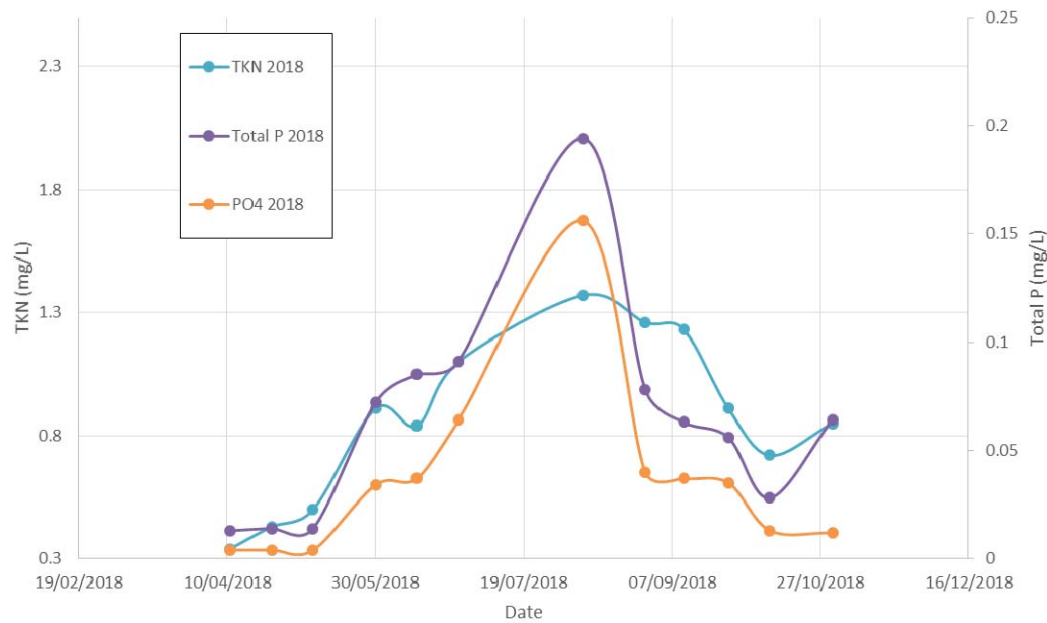


Tributary Sampling MLA9 TP, PO4 and TKN

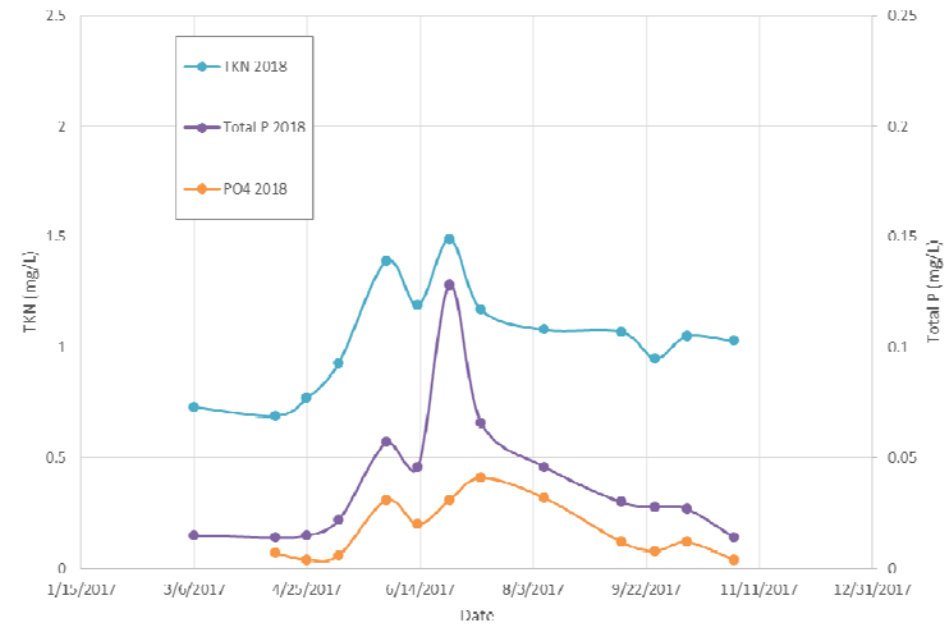


Comparison of TP, PO4, TKN 2018

Tributary Sampling MLA11 TP, PO4 and TKN

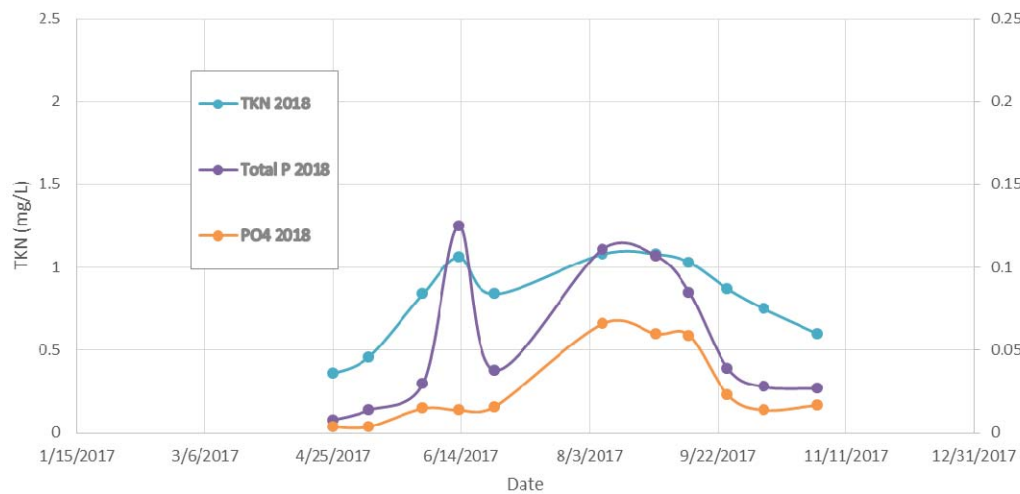


Tributary Sampling MLA2 TP, PO4 and TKN

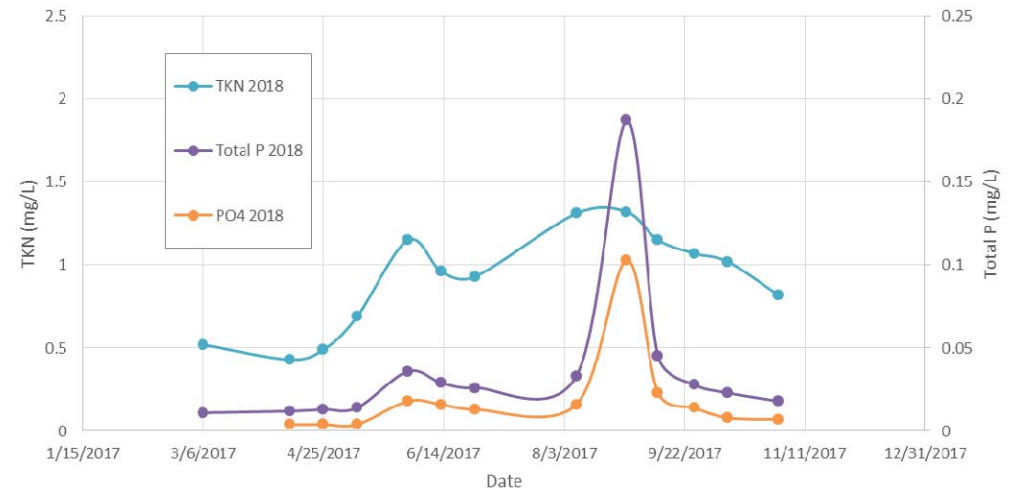


Comparison of TP, PO₄, TKN 2018

Tributary Sampling MLA4 TP, PO₄ and TKN



Tributary Sampling MLA3 TP, PO₄ and TKN



Issues With Roadside Sampling

- Representativeness of results for some sites where the sampling point is distant from the lake?
- Worries that TP results, especially the peaks, may not be representative of actual TP of water but perhaps sampling issues?
- Could not consistently sample streams from lake side
- MLA6 has flow up or down stream depending on lake elevation
- Flow measurement – flows are assigned based on (area/area upstream of river)*flow in river + assign flow when some creeks were dry (but flow was small so likely no influence)

