



# Building a GIS Toolbar for TMDL development

September 2021





# Challenges to TMDL development

Announcements

Meeting Notifications  
and Updates

Final TMDL Reports

Draft TMDL Reports

Groundwater Management  
Section

Site-Specific TMDL  
Prioritization

Priority Framework  
Document

TMDL Tracker

All Water Quality  
Evaluation and TMDL  
Program Content

Waterbody Name(s)	Waterbody Identification Number (WBID)	Nutrient TMDL	Other TMDL	F.A.C. Rule No.
34th Street Basin, Clam Bayou Drain, Clam Bayou, (East Drainage), and Clam Bayou Drain (Tidal)	1716A, 1716B, 1716C, and 1716D		<a href="#">Fecal Coliform TMDL</a>	62-304.645
Alachua Sink	2720A	<a href="#">Nutrient TMDL</a>		62-304.500
Alafia River Above Hillsborough Bay - Tidal Segment	1621G	<a href="#">Nutrient TMDL</a>		62-304.605
Allen Creek Tidal	1604		<a href="#">Fecal Coliform TMDL</a>	62-304.600
Alligator Creek	123		<a href="#">Fecal Coliform TMDL</a>	62-304.325



# Tools of the trade



python<sup>TM</sup>





# Things that code can build

## Tools for coders

One-off analysis

Script

Function

Library

## Tools for all users

ArcPro tool

Web application

Desktop graphical user Interface



# Bridging the spatial divide

WBID History Database - updated through 10/1/2010

WBID History Database - Updated through 10/1/2010

**ENTER WBID:**   *Double-click any record below for details*

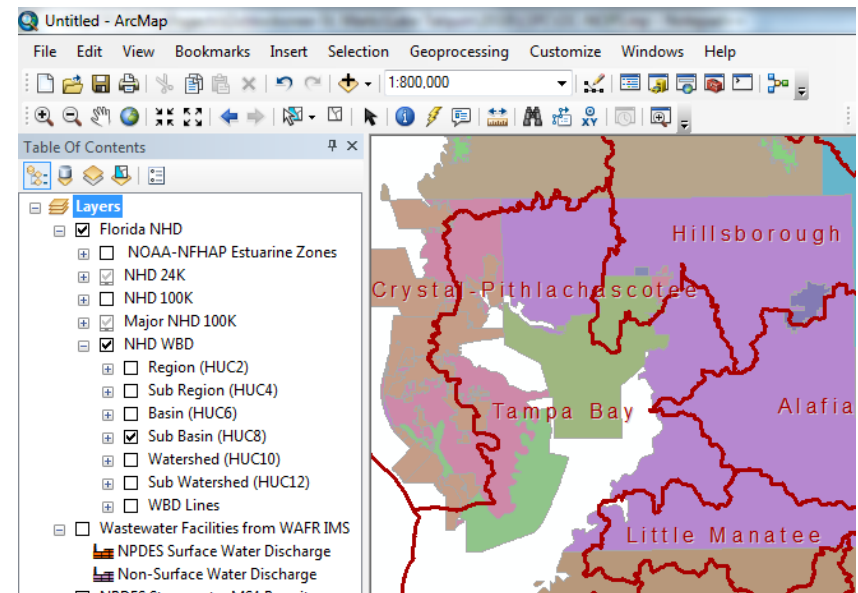
Run#	WBID	Basin	Type	Class	Group#	Dist.	Group Name
1	2606B	CRESCENT LK	LAKE	3		NED	Lower St. Johns
2	2606B	CRESCENT LK	LAKE	3F	Group 2	NED	Lower St. Johns
3_2	2606B	CRESCENT LK	LAKE	3F	Group 2	NED	Lower St. Johns
4	2606B	CRESCENT LK	LAKE	3F	Group 2	NED	Lower St. Johns
5_1	2606B	CRESCENT LK	LAKE	3F	Group 2	NED	Lower St. Johns
6_1	2606B	CRESCENT LK	LAKE	3F	Group 2	NED	Lower St. Johns
6_3	2606B	CRESCENT LK	LAKE	3F	Group 2	NED	Lower St. Johns

R	A	Cyc	Grp	OGC#	WBID	98 303(d) Parameter	Parameter Assessed	TMDL Priority	TMDL Yr
*	1	2		03-2543	2606B		Iron	Medium	2008
	1	2		03-2544	2606B		Nutrients (TSI)	Medium	2008
	2	2		09-2560	2606B		Mercury (in fish tissue)	High	
	2	2		09-2606	2606B		Nutrients (TSI)	Medium	
	3	2		15-0762	2606B		Nutrients (Chlorophyll-a)	Medium	
	3	2		15-0763	2606B		Nutrients (Total Phosphorus)	Medium	

R	A	Cyc	Grp	OGC#	WBID	98 303(d) Parameter	Parameter Assessed	Assessment Cat.	Status	Verify
*	1	2		10-0654	2606B		Iron	4c		92/2
	3	2		15-1204	2606B		Mercury (in fish tissue)	4a	Delis	Asse
	3	2		15-1205	2606B		Nutrients (TSI)	NA	Delis	NA





## Solution: Develop a GIS Toolbar

- Data extraction
- Plotting
- Data analysis
- Model setup tasks



# Development Team

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- Eric Tano
- Oluchukwu Obinegbo
- Alireza Merikhi



# GIS toolbar

## Data Extraction Tools

IWR Data Extraction

USGS Data extraction

Weather Data Extraction

## Data visualization Tools

Timeseries Plot

XY Plot

Nutrient data viewer

## Statistical Tools

Baseflow  
separation

Kendall trends

## TMDL Modeling Tools

NNC TMDL  
Approach

Single Regression  
TMDL

Curve Number  
Model

OSTDS Loading  
Model

BATHTUB pre/  
post processing

Combined  
Regression TMDL

PLSM

SERC Tool





# Toolbar Phases

- **Phase 0 - 2018**

- SERC Tool

- **Phase 1 - 2019**

- Data extraction
- XY Plotting
- Timeseries plotting
- PLSM

- **Phase 2 - 2020**

- Curve Number
- OSTDS
- USGS Data Extraction

- Single regression TMDL

- **Phase 3 – 2020/2021**

- Trend tool
- USGS Tool II
- Combined regression TMDL
- Bathtub pre-processor
- Bathtub post-processor
- Bathtub file split

- **Phase 4 – 2021**

- Nutrient data viewer
- NNC TMDL
- Precipitation Data Extraction

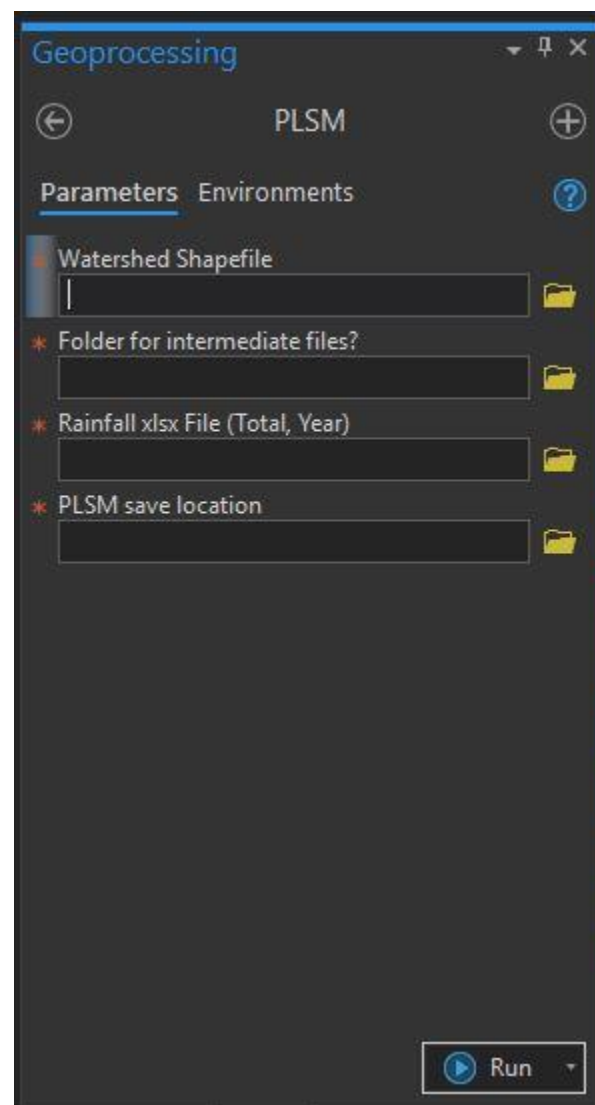
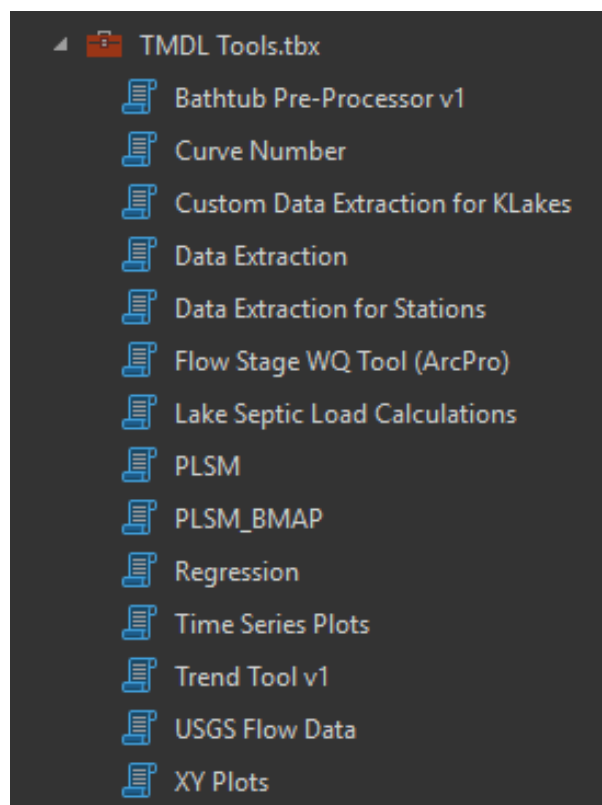


# Benefits

- Toolbar Phase 0: \$17k
- Toolbar Phase 1: \$34k
- Toolbar Phase 2: \$60k
- Toolbar phase 3: ~\$50K
- Toolbar phase 4: ~\$50K



# Tool Interface

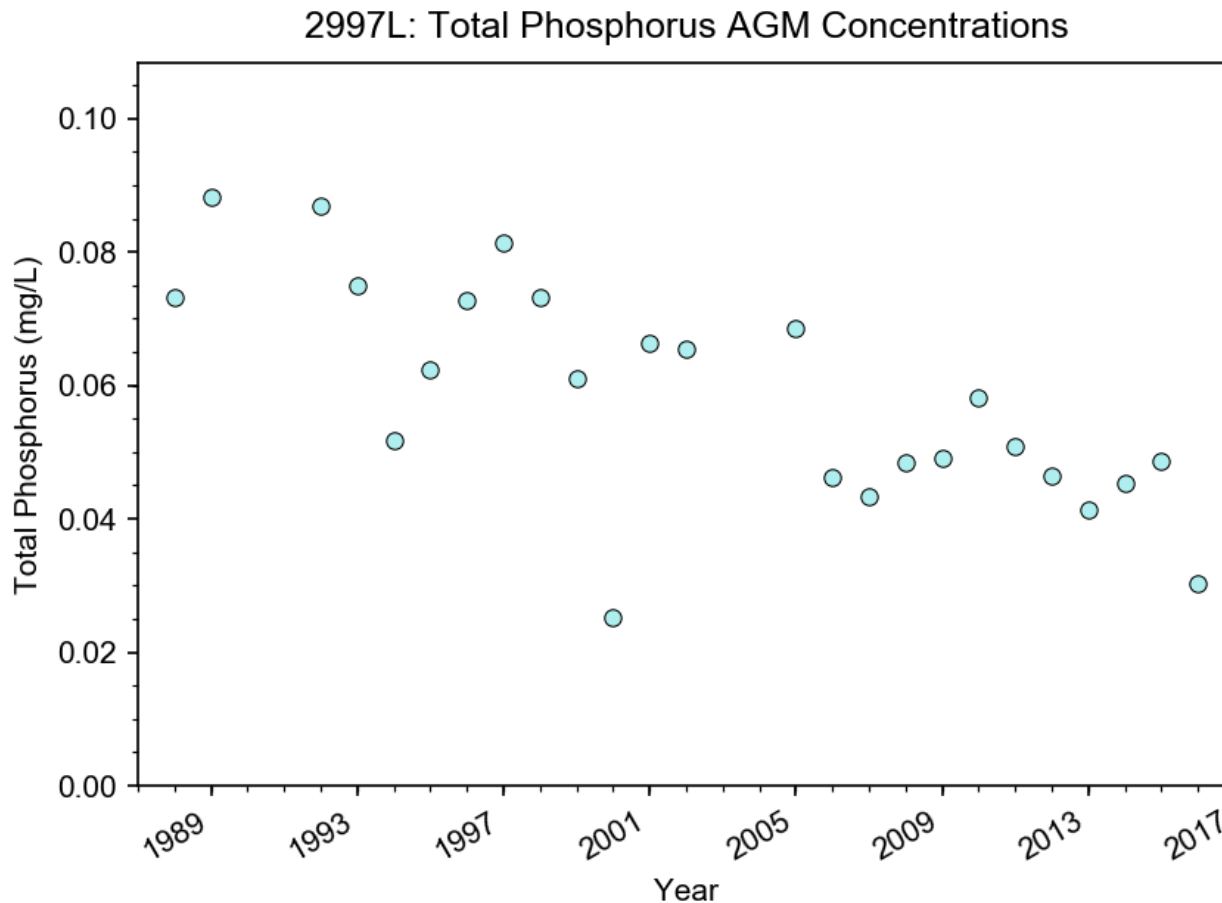




# Examples of Selected Tools



# Plotting tools

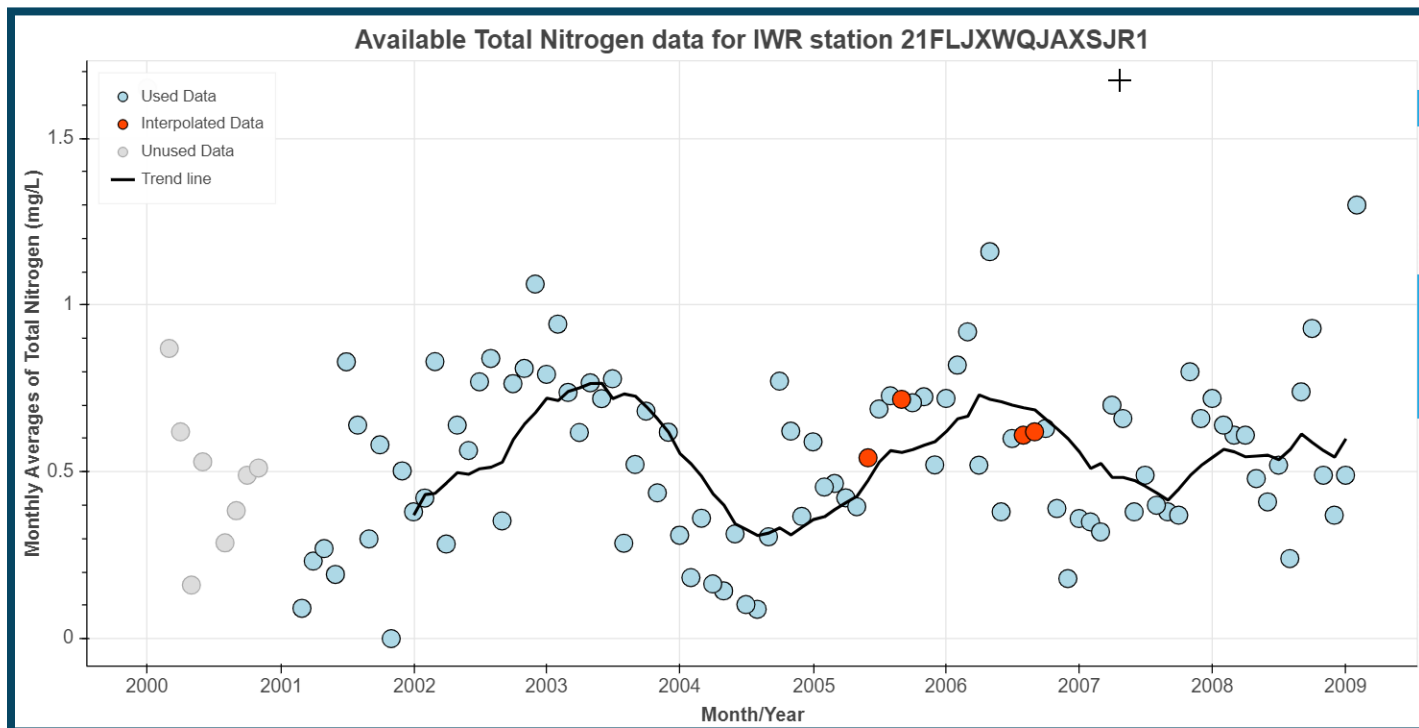






# Trend tool

	A	B	C	D	E	F	G
1	Station	Slope	Tau	Pvalue	Timescale	Trend test	Slope unit
2	21FLJXWQJAXSJR1	0.006964	0.054	0.772	Quarterly	Seasonal Mann-Kendall	mg/l/quarter

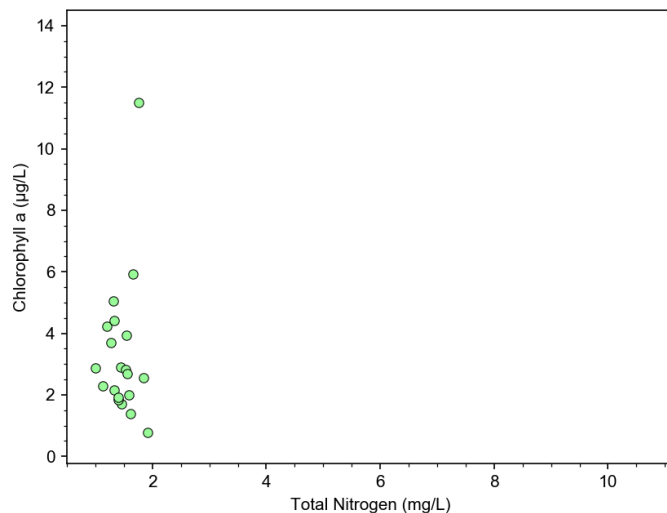




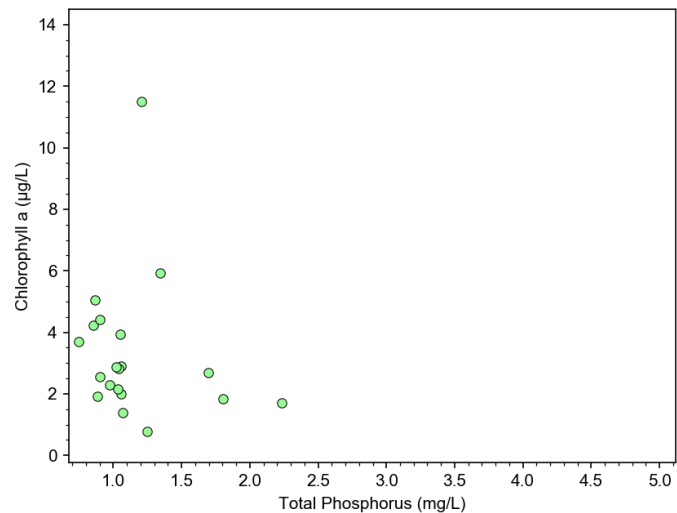
# Regression Tool

	A	B	C	D	E	F	G	H	I	J	K
		Coefficient	Standard Error	t-value	p-value	Confidence Interval (Lower Limit)	Confidence Interval (Upper Limit)	Observations used in Regression	R-Squared	Overall p-value (F-Statistic)	VIF Factor
1											
2	const	-18.5	6.53	-2.83	0.00719	-31.7	-5.3	45	0.76	9.30359E-12	4.09
3	COLOR	-0.04	0.06	-0.69	0.49181	-0.17	0.08				
4	TEMP	0.16	0.16	1.05	0.30041	-0.15	0.48				
5	TN	24.07	2.44	9.85	3E-12	19.13	29.01				
6	TP	97.68	68.14	1.43	0.1595	-40.04	235.4				
7											

1623F: Chlorophyll a AGMs vs. Total Nitrogen AGMs (1964 to 2018)



1623F: Chlorophyll a AGMs vs. Total Phosphorus AGMs (1964 to 2018)

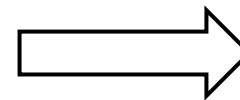
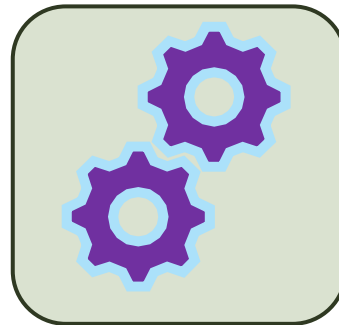
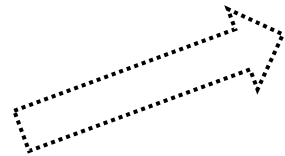
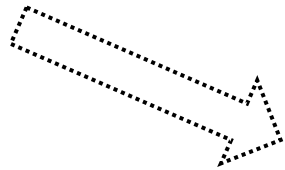




# BATHTUB Input File Utility

CN/PLSM  
output

Septic  
output



Bathtub  
setup file(s)



# Questions?

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9/22/2021