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Scenarios

The utility of using mechanistic models is to allow the development of different scenarios (conditions or assumptions). A scenario is where the current condition (calibrated model) model can be manipulated and compared to another condition.

The following is a list of scenarios that were developed using the Current condition (calibrated models).

- Natural Condition
- Facilities Assumed at Advance Waste Water Treatment
- Low Flow Sensitivity Analysis

Natural Condition

A natural condition scenario was developed that converted all anthropogenic landuses (developed, agriculture, etc.) to upland forest and wetlands. All point source loads and flows were removed. The watershed natural condition scenario was executed and fed forward into the calibrated Ochlockonee and Little River WASP models. The river models and the directly connected watershed model results were fed forward into the calibrated Lake Talquin WASP model.

Files Altered

For the development of this scenario the following model input files were modified:

- LSPC Input File **Revision_3.inp** to **Natural.inp**
    - Anthropogenic Landuses converted to Upland Forests and Wetlands
- Little River WASP Input File **Little_River.wif** to **Little_River_Natural.wif**
    - NPDES Facility Discharges set to Zero
    - Non-point source loadings were changed to the LSPC Natural.inp results
- Ochlockonee River WASP input file **Ochlockonee_River.wif** to **Ochlockonee_River_Natural.wif**
    - NPDES Facility Discharges set to Zero
    - Non-point source loadings were changed to the LSPC Natural.inp results
- Lake Talquin WASP input file **Lake_Talquin-v3.wif** to **Lake_Natural.wif**
    - NPDES Facility Discharges set to Zero
    - Non-point source loadings were changed to the LSPC Natural.inp results
    - Ochlockonee and Little River boundaries to Lake Talquin updated to **Ochlockonee_River_Natural.wif** and **Little_River_Natural.wif** model results from natural condition scenario

Ochlockonee River

Figure 1 - Figure 2 current conditions and the natural condition scenarios for total nitrogen and total phosphorus for the Ochlockonee River.

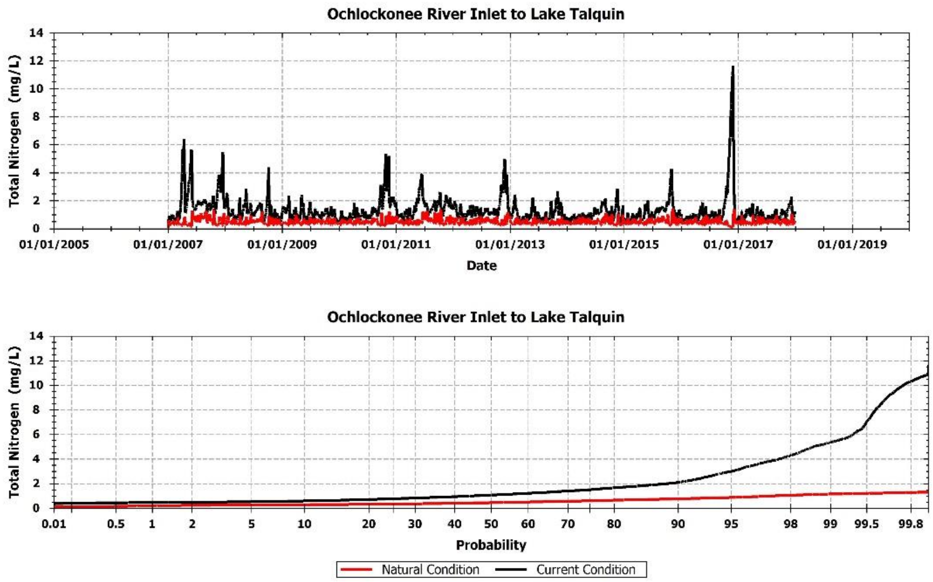


Figure 1 Ochlockonee River Predicted Total Nitrogen: Current vs. Natural Conditions

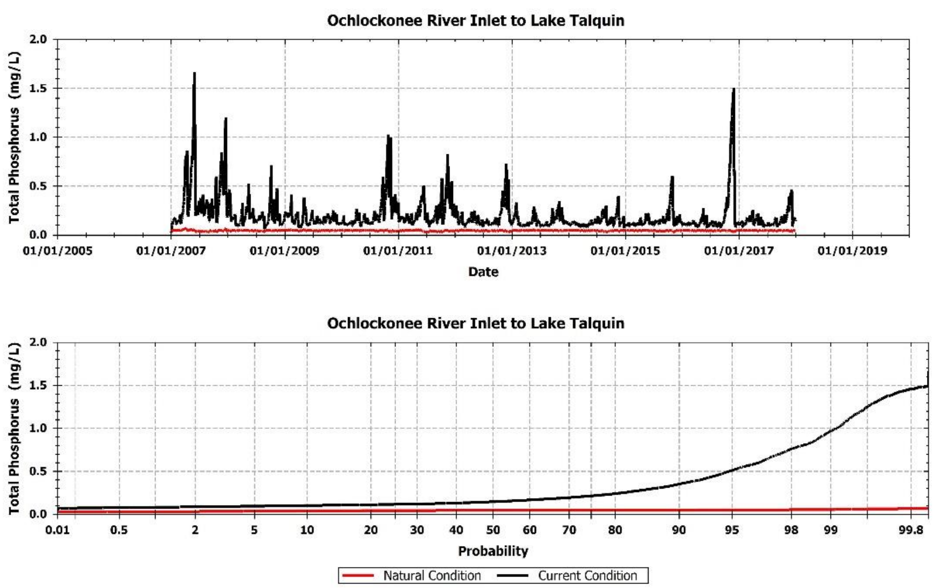


Figure 2 Ochlockonee River Predicted Total Phosphorus: Current vs. Natural Conditions

Little River

Figure 3 - Figure 4 illustrate the difference between the current conditions and the natural condition scenarios for total nitrogen and total phosphorus for the Little River.

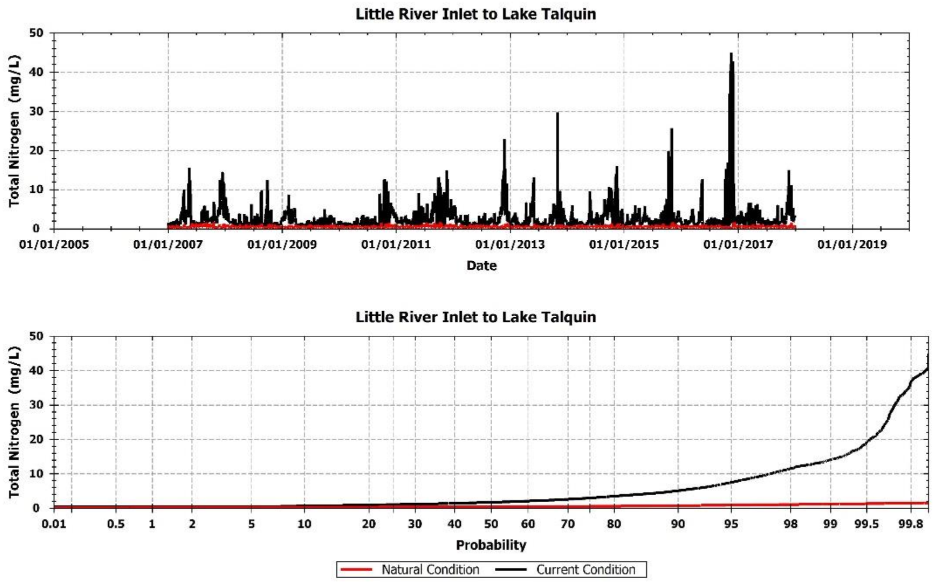


Figure 3 Little River Predicted Total Nitrogen: Current vs. Natural Conditions

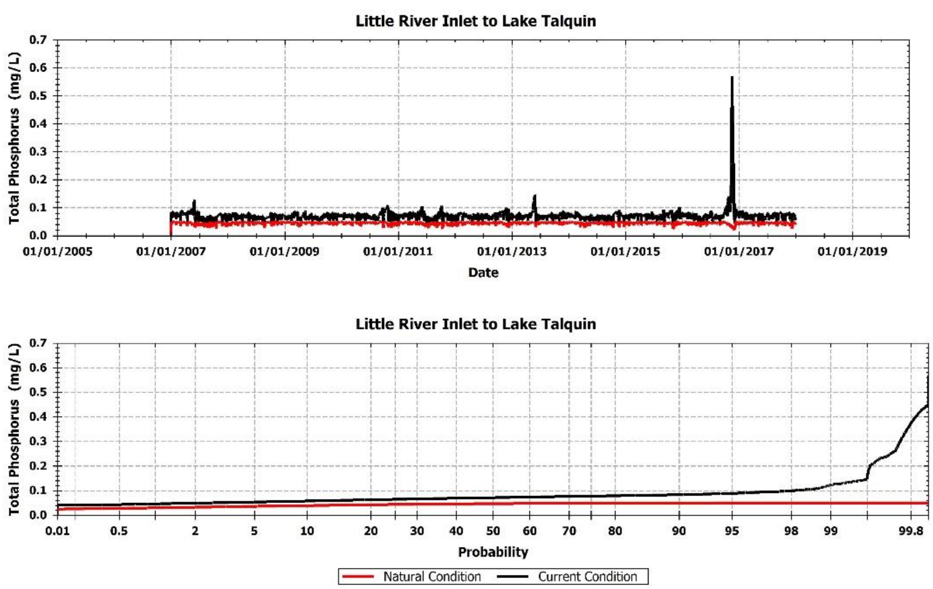


Figure 4 Little River Predicted Total Phosphorus: Current vs. Natural Conditions

Lake Talquin

Table 1 provides the calculated annual geometric means for total nitrogen, total phosphorus and chlorophyll a under the natural condition scenario for the three zones of Lake Talquin.

Table 1 Annual Geometric Means for Lake Talquin under Natural Conditions

	Lower			Middle			Upper		
Year	Total Nitrogen	Total Phosphorus	Chlorophyll a	Total Nitrogen	Total Phosphorus	Chlorophyll a	Total Nitrogen	Total Phosphorus	Chlorophyll a
2008	0.44	0.035	10.81	0.42	0.039	10.26	0.44	0.043	8.59
2009	0.42	0.038	11.13	0.43	0.041	11.01	0.45	0.045	10.03
2010	0.42	0.035	9.71	0.43	0.037	8.33	0.47	0.040	7.29
2011	0.37	0.025	7.71	0.42	0.027	8.20	0.48	0.031	7.91
2012	0.41	0.026	7.95	0.42	0.030	9.06	0.47	0.034	10.29
2013	0.42	0.037	11.22	0.42	0.040	10.99	0.44	0.044	9.55
2014	0.45	0.035	10.49	0.46	0.038	9.17	0.48	0.042	7.14
2015	0.42	0.033	10.30	0.45	0.036	9.59	0.50	0.039	8.26
2016	0.46	0.036	10.98	0.45	0.039	11.23	0.45	0.043	8.99
2017	0.43	0.034	10.53	0.44	0.037	11.04	0.45	0.042	10.63

Table 2 illustrates the difference in the calculated annual geometric means for total nitrogen, total phosphorus and chlorophyll a between the current condition and the natural condition simulation. Note that red highlighted cells indicate a decrease in the geometric means.

Table 2 Difference between Current Condition and Natural Condition

	Lower			Middle			Upper		
Year	Total Nitrogen	Total Phosphorus	Chlorophyll a	Total Nitrogen	Total Phosphorus	Chlorophyll a	Total Nitrogen	Total Phosphorus	Chlorophyll a
2008	-0.40	-0.06	-14.42	-0.55	-0.07	-15.81	-0.56	-0.12	-12.01
2009	-0.40	-0.05	-12.91	-0.55	-0.06	-16.36	-0.52	-0.10	-14.45
2010	-0.33	-0.05	-10.53	-0.46	-0.06	-11.79	-0.52	-0.11	-11.03
2011	-0.41	-0.05	-12.75	-0.56	-0.05	-14.79	-0.49	-0.09	-17.91
2012	-0.39	-0.03	-9.24	-0.54	-0.04	-13.40	-0.47	-0.08	-20.01
2013	-0.42	-0.04	-10.45	-0.62	-0.06	-14.80	-0.46	-0.09	-11.62
2014	-0.48	-0.05	-11.62	-0.60	-0.05	-10.77	-0.36	-0.08	-7.29
2015	-0.46	-0.04	-11.62	-0.63	-0.05	-12.67	-0.47	-0.08	-11.64
2016	-0.39	-0.04	-10.27	-0.54	-0.05	-12.49	-0.44	-0.08	-9.71
2017	-0.46	-0.04	-11.71	-0.53	-0.05	-15.09	-0.38	-0.08	-12.53

Advanced Waste Water

This scenario sets all NPDES dischargers to the Ochlockonee and Little River to advanced waste water treatment (AWT) standards. Table 3 provides the assumed AWT concentrations for nitrogen and phosphorus species. These concentration values replaced the monitoring data that was provided for all the facilities. The facilities flow rates were assumed to remain the same.

Table 3 Advanced Waste Water Treatment Assumptions

Nutrient Species	Concentration (mg/L)
Ammonia (NH3/4)	0.21
Nitrate (NO3O2)	1.92
Dissolved Organic Nitrogen (DON)	0.87
Dissolved Inorganic Phosphorus (DIP)	0.5
Dissolved Organic Phosphorus (DOP)	0.5

Files Altered

For the development of this scenario the following model input files were modified:

- Little River WASP Input File **Little_River.wif** to **LR_AWT.wif**
  - NPDES Facility concentrations set to AWT condition
- Ochlockonee River WASP input file **Ochlockonee_River.wif** to **OR_AWT.wif**
  - NPDES Facility concentrations set to AWT condition
- Lake Talquin WASP input file **Lake_Talquin-v3.wif** to **Lake_AWT.wif**
  - Ochlockonee and Little River boundaries to Lake Talquin updated to **OR_AWT.wif** and **LR_AWT.wif** model results from AWT condition scenario

Ochlockonee River

Figure 5 - Figure 6 illustrate the difference between the current conditions and the advanced waste water treatment scenarios for total nitrogen and total phosphorus for the Ochlockonee River.

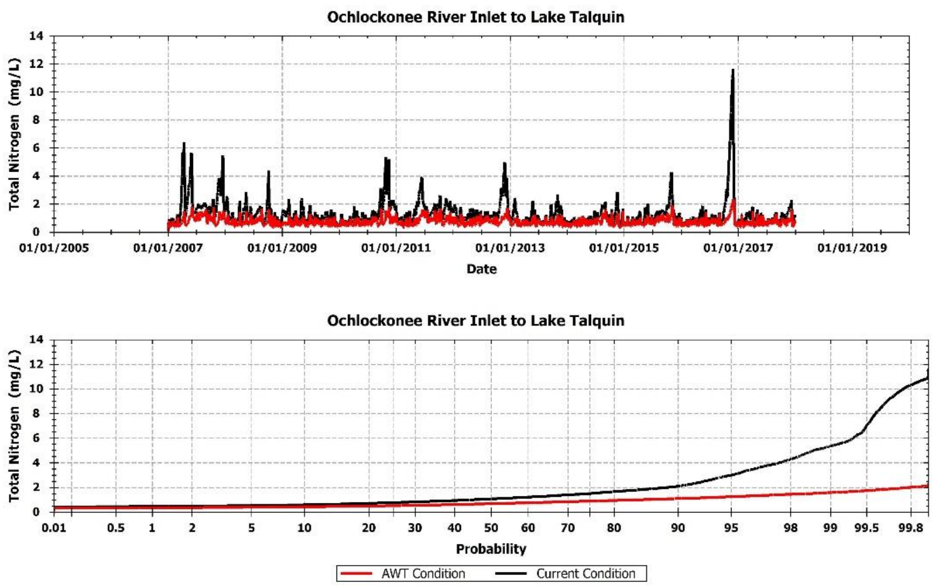


Figure 5 Comparison Total Nitrogen of the Ochlockonee River Inlet to Lake Talquin with Facilities at AWT

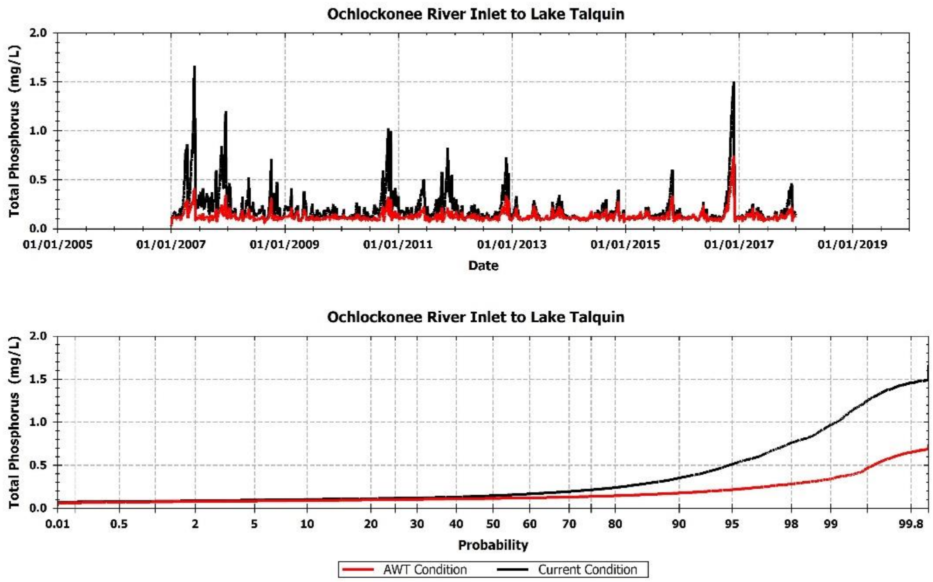


Figure 6 Comparison Total Phosphorus of the Ochlockonee River Inlet to Lake Talquin with Facilities at AWT

Little River

Figure 7 - Figure 8 illustrate the difference between the current conditions and the advanced waste water treatment scenarios for total nitrogen and total phosphorus for the Little River.

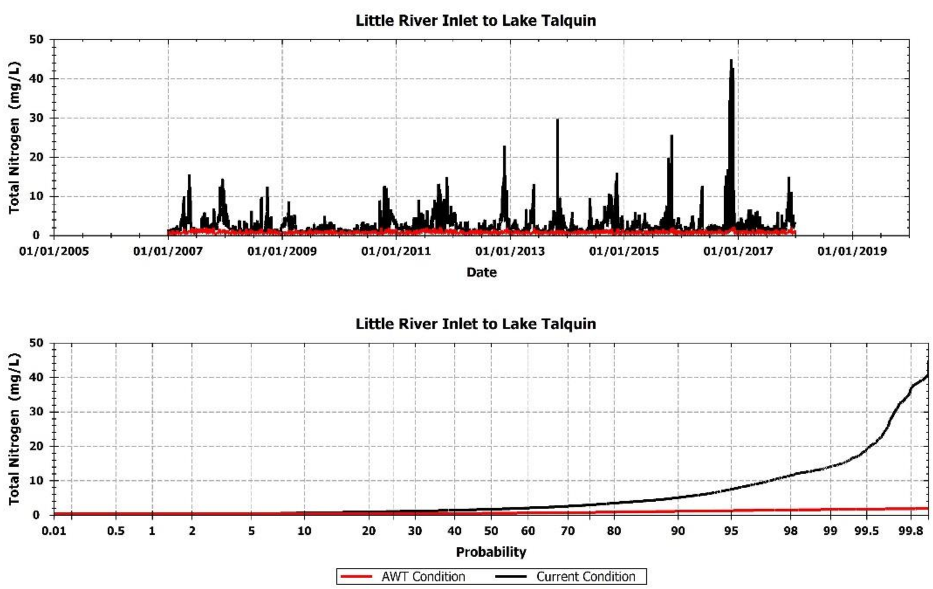


Figure 7 Comparison Total Nitrogen of the Little River Inlet to Lake Talquin with Facilities at AWT

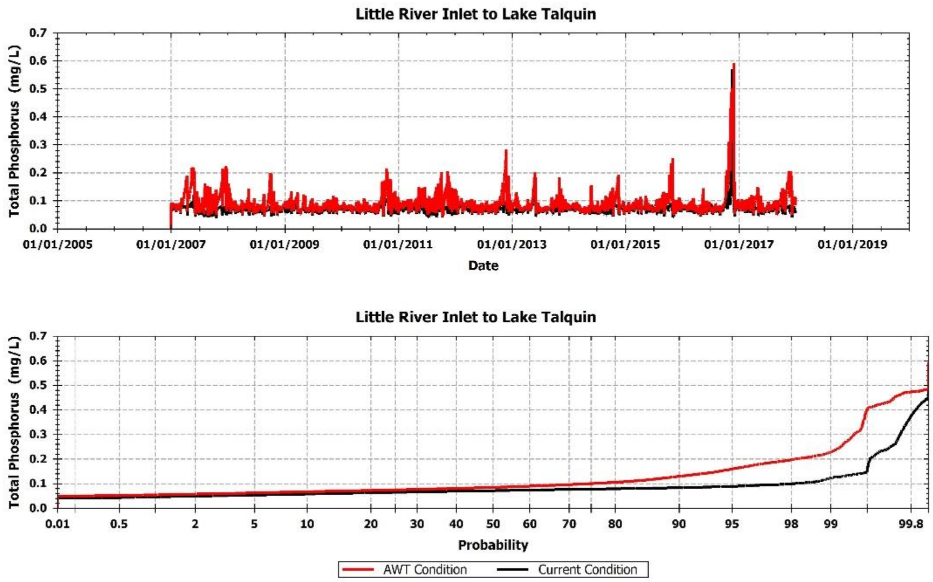


Figure 8 Comparison Total Phosphorus of the Little River Inlet to Lake Talquin with Facilities at AWT

Lake Talquin

Table 4 provides the calculated annual geometric means for total nitrogen, total phosphorus and chlorophyll a under the AWT condition scenario for the three zones of Lake Talquin.

Table 4 Annual Geometric Mean with Facilities at AWT

	Lower			Middle			Upper		
Year	Total Nitrogen	Total Phosphorus	Chlorophyll a	Total Nitrogen	Total Phosphorus	Chlorophyll a	Total Nitrogen	Total Phosphorus	Chlorophyll a
2008	0.56	0.076	17.14	0.56	0.087	15.28	0.60	0.106	11.58
2009	0.54	0.076	16.38	0.56	0.085	16.44	0.60	0.105	14.32
2010	0.53	0.069	14.83	0.55	0.075	12.82	0.62	0.097	10.09
2011	0.44	0.068	13.80	0.50	0.072	15.78	0.59	0.087	15.65
2012	0.49	0.057	14.77	0.52	0.066	16.43	0.60	0.089	19.21
2013	0.53	0.077	16.27	0.56	0.091	16.14	0.61	0.112	12.24
2014	0.57	0.083	15.68	0.60	0.089	13.44	0.63	0.106	9.00
2015	0.53	0.075	16.70	0.58	0.08	16.13	0.66	0.1	12.98
2016	0.59	0.072	17.58	0.60	0.085	17.71	0.61	0.109	12.58
2017	0.55	0.076	16.99	0.57	0.086	17.75	0.60	0.105	15.98

Table 5 illustrates the difference in the calculated annual geometric means for total nitrogen, total phosphorus and chlorophyll a between the current condition and the AWT scenario. Note that red highlighted cells indicate a decrease in the geometric means.

Table 5 Difference between Current Condition and AWT Scenario

	Lower			Middle			Upper		
Year	Total Nitrogen	Total Phosphorus	Chlorophyll a	Total Nitrogen	Total Phosphorus	Chlorophyll a	Total Nitrogen	Total Phosphorus	Chlorophyll a
2008	-0.28	-0.02	-8.08	-0.41	-0.02	-10.80	-0.40	-0.06	-9.03
2009	-0.29	-0.02	-7.66	-0.42	-0.02	-10.93	-0.36	-0.04	-10.16
2010	-0.22	-0.01	-5.41	-0.34	-0.02	-7.30	-0.38	-0.06	-8.23
2011	-0.34	0.00	-6.65	-0.48	-0.01	-7.22	-0.38	-0.04	-10.17
2012	-0.30	0.00	-2.42	-0.44	0.00	-6.03	-0.34	-0.02	-11.09
2013	-0.31	0.00	-5.41	-0.48	0.00	-9.65	-0.30	-0.02	-8.93
2014	-0.36	0.00	-6.43	-0.46	0.00	-6.50	-0.21	-0.01	-5.43
2015	-0.35	0.00	-5.22	-0.49	0.00	-6.13	-0.30	-0.02	-6.93
2016	-0.26	0.00	-3.67	-0.40	0.00	-6.01	-0.27	-0.01	-6.12
2017	-0.34	0.00	-5.25	-0.40	0.00	-8.38	-0.23	-0.02	-7.17

Low Flow Sensitivity

A stakeholder asked that a sensitivity analysis be performed to investigate the potential impact on water quality predictions in Lake Talquin from over prediction of low flow in the Ochlockonee River. It was suggested by a commenter the sensitivity analysis be conducted by testing low flow conditions below 4.2 cubic meters per second (cms) which is equivalent to 150 cubic feet per second (cfs). Calendar year 2011 was selected because it has one of the longest continuous periods of time where flow was below the 4.2 cms threshold. This sensitivity analysis was conducted on the balanced inflows from the Ochlockonee River that are used in the Lake Talquin hydrodynamic model.

An attempt was made to use the actual gaged flows for when the flows were below 4.2 cms. Because of the sensitivity of the model to balanced inflows, the hydrodynamic model crashed due to model cells drying up. Two methods were developed to test the model sensitivity for over predicting low flow conditions in the Ochlockonee River.

Low Flow Sensitivity Analysis – 1

The first method did not attempt to alter the flows from the Ochlockonee River to Lake Talquin in the EFDC QSER file. The Ochlockonee River boundary concentration time series for nitrogen and phosphorus in the Lake Talquin water quality model were scaled to replicate the nutrient loadings that would exist if the modeled inflows matched the gaged flows. Figure 9 illustrates the difference between model predicted inflow to Lake Talquin and the measured flow below 4.2 cms (150 cfs). It is during this period when the measured flows are below the blue line in the figure that the nutrient conditions will be scaled.

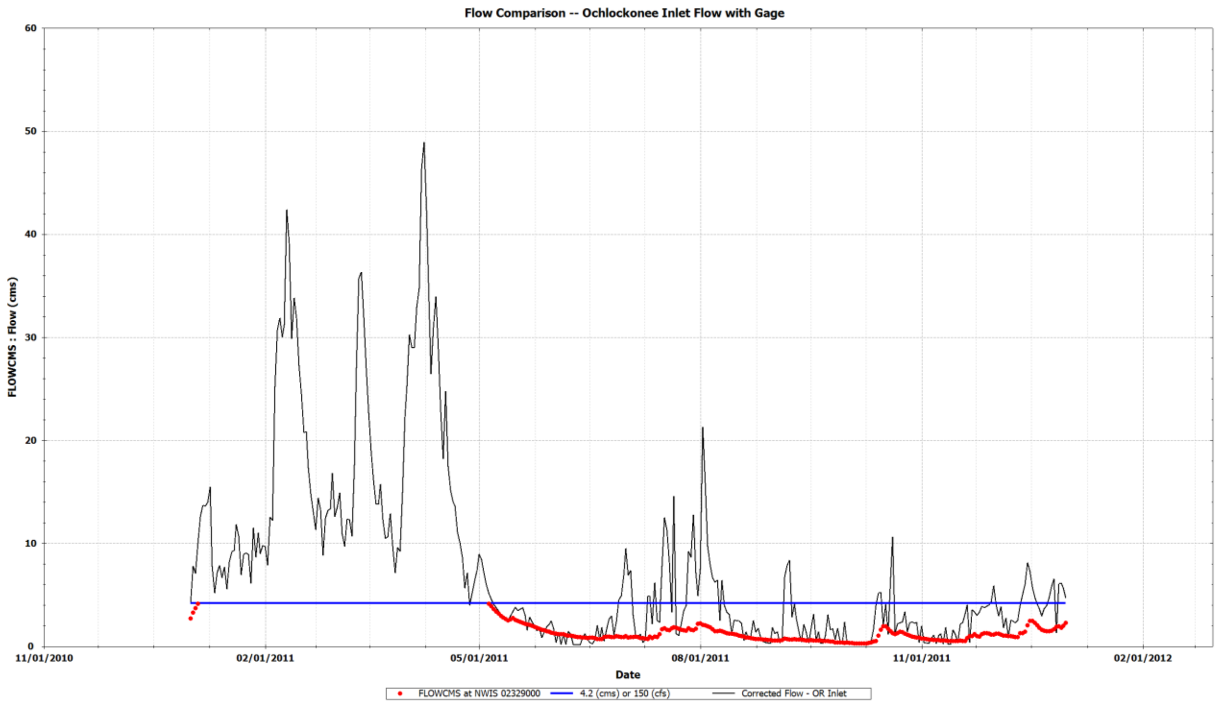


Figure 9 Flow Comparison between Ochlockonee River Inflow (corrected) and USGS Gage at Havana, FL

The load correction multiplier is calculated daily by comparing the balanced flow from the Ochlockonee River inflow to the gage and is calculated using equation below.

$$Load\ Correction\ Multiplier = \frac{USGS\ Gaged\ Flow}{OR\ Corrected\ Flow}$$

Figure 10 shows the concentration multiplier used to attenuate the nutrient loads from the Ochlockonee River to Lake Talquin. The original concentrations for the boundary conditions for nitrogen and phosphorus in the Lake Talquin model are replaced with concentrations that would represent nutrient loadings under the gaged flow condition.

$$Lake\ Talquin\ Boundary\ Concentration = OR\ Simulated\ Concentration * Multiplier$$

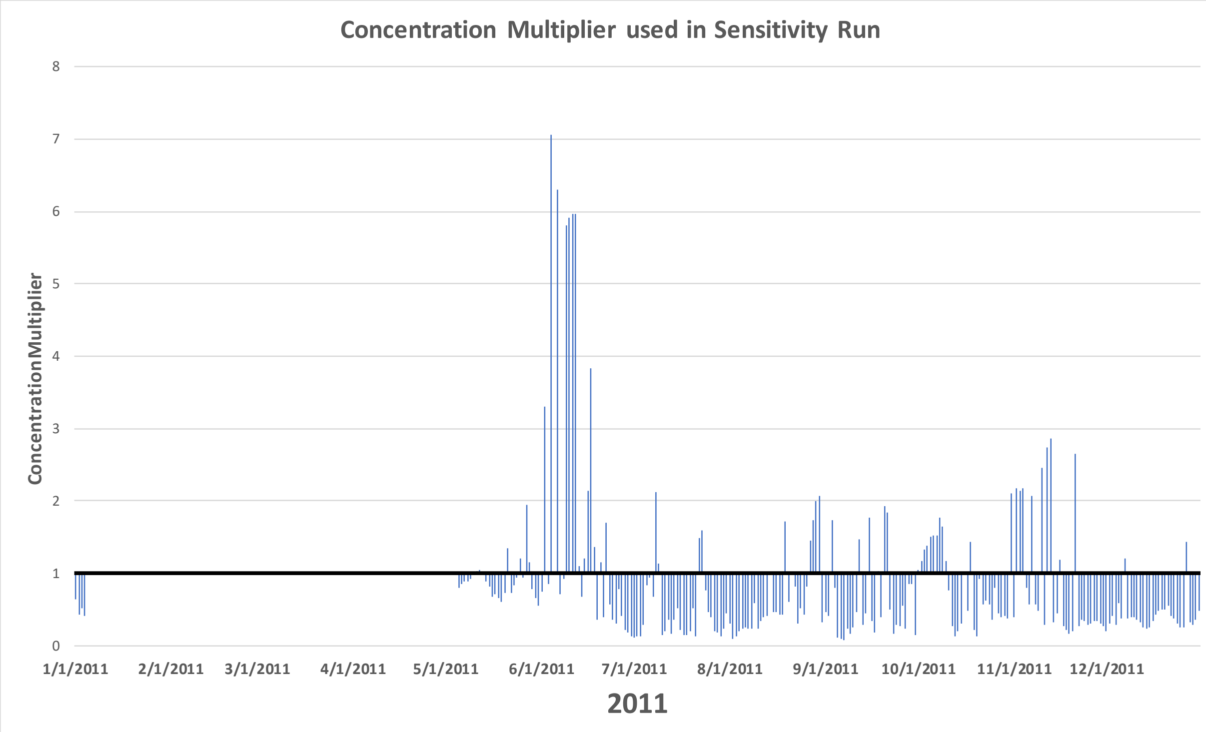


Figure 10 Concentration Multiplier used to adjust Ochlockonee River Loads to Lake Talquin equivalent to Gaged Flow

Results

Table 6 provides the calculated annual geometric means for total nitrogen, total phosphorus and chlorophyll a for the low flow sensitivity analysis 1.

Table 6 Sensitivity Analysis 1 Annual Geometric Means for the three zones of Lake Talquin

	Lower			Middle			Upper		
Year	Total Nitrogen	Total Phosphorus	Chlorophyll a	Total Nitrogen	Total Phosphorus	Chlorophyll a	Total Nitrogen	Total Phosphorus	Chlorophyll a
2008	0.84	0.09	25.22	0.97	0.11	26.07	1.00	0.16	20.61
2009	0.82	0.09	24.04	0.97	0.10	27.37	0.96	0.15	24.48
2010	0.75	0.08	20.24	0.89	0.09	20.12	0.99	0.15	18.32
2011	0.76	0.07	20.21	0.91	0.07	21.22	0.73	0.10	19.67
2012	0.77	0.06	16.44	0.93	0.07	20.88	0.88	0.11	28.52
2013	0.83	0.08	21.67	1.04	0.10	25.79	0.90	0.13	21.17
2014	0.93	0.08	22.11	1.05	0.09	19.94	0.84	0.12	14.43
2015	0.88	0.07	21.92	1.08	0.08	22.26	0.96	0.12	19.91
2016	0.85	0.08	21.26	1.00	0.09	23.72	0.88	0.12	18.70
2017	0.89	0.08	22.24	0.96	0.09	26.13	0.83	0.12	23.15

Table 7 illustrates the difference in the calculated annual geometric means for total nitrogen, total phosphorus and chlorophyll a between the current condition and the flow sensitivity analysis 1 simulation. Note that green highlighted cells indicate an increase in the geometric means.

Table 7 Sensitivity Run 1 Difference between Current Condition and Sensitivity Analysis Condition

	Lower			Middle			Upper		
Year	Total Nitrogen	Total Phosphorus	Chlorophyll a	Total Nitrogen	Total Phosphorus	Chlorophyll a	Total Nitrogen	Total Phosphorus	Chlorophyll a
2008	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2009	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2010	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2011	0.02	0.00	0.24	0.07	0.01	1.78	0.24	0.03	6.16
2012	0.03	0.00	0.76	0.03	0.00	1.58	0.06	0.01	1.78
2013	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2017	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Files Altered

For the development of this scenario the following model input files were modified:

- Lake Talquin WASP input file **Lake_Talquin-v3.wif** to **LT-2011-Low-Flow.wif**
  - Updated 2011 Ochlockonee River boundary concentrations for nutrient species (NH3, NO3O2, DON, PON, DIP, DOP, POP) to methodology described above.

Low Flow Sensitivity Analysis – 2

The second low flow sensitivity run manipulates the outflows at the dam and sets the Ochlockonee River inflows when below 4.2 cms to the measured gaged data for 2011. Figure 11 illustrates the flows from the Ochlockonee River that are used in the EFDC QSER file. The first panel is the time series of flows used by the hydrodynamic model compared to the USGS gaged flow at Havana. The bottom panel is a 1 to 1 plot showing the fit of the flows being used in the hydrodynamic model and the gage. The boundary concentration time series is in the Lake Talquin model was not altered.

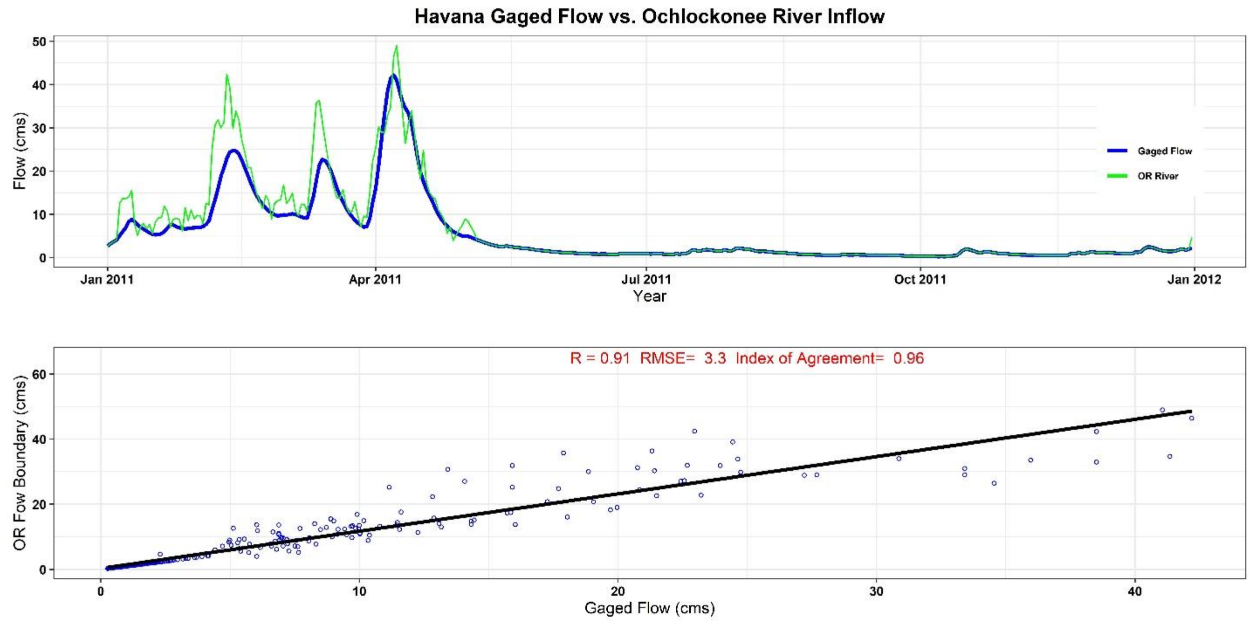


Figure 11 Ochlockonee River Flows used in Sensitivity Run 2

Figure 12 illustrates the time series of flows used in the EFDC QSER file for the dam discharge. To maintain the same water surface elevation (lake volume) when the flow rate from the Ochlockonee River was decreased to match the gaged flows released at the dam were decreased the same amount. Conversely, when the flows from the Ochlockonee River were increased to match the gaged data, the outflow at the dam was increased the same amount. There are periods of time in 2011 in this sensitivity run that water flows from downstream back over the dam into Lake Talquin. For this sensitivity run that water is assumed to have zero concentrations for all state variables in the water quality mode.

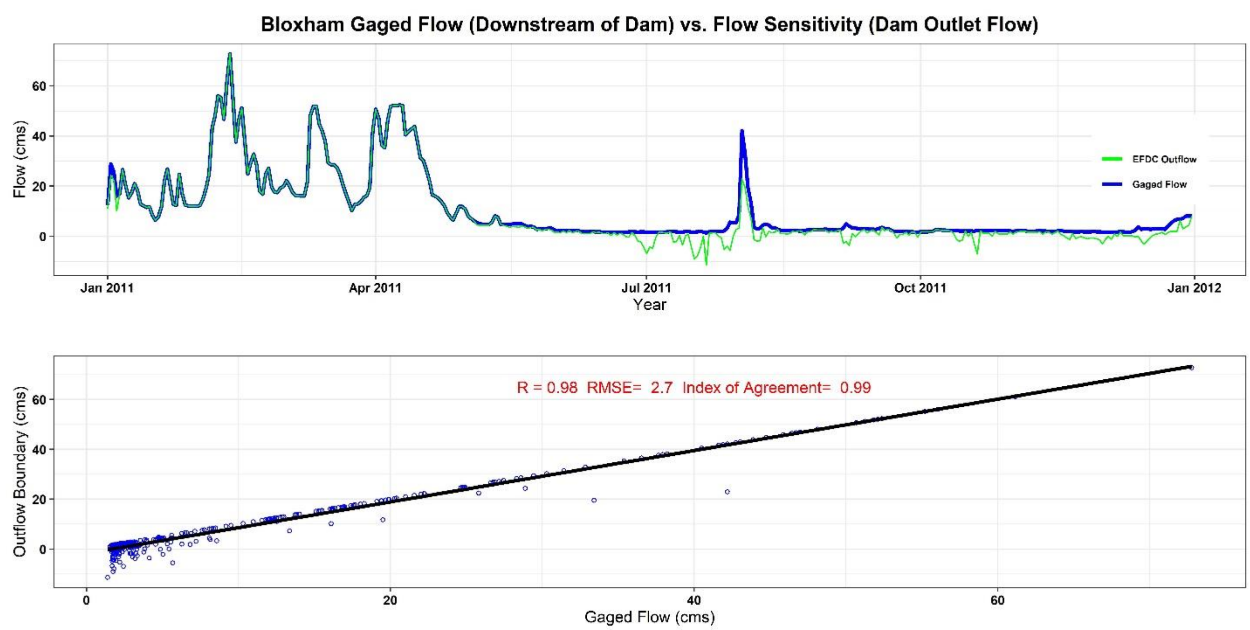


Figure 12 Lake Talquin Dam Outflows used in Sensitivity Run 2

Results

Table 8 provides the calculated annual geometric means for total nitrogen, total phosphorus and chlorophyll a for the low flow sensitivity analysis run.

Table 8 Sensitivity Analysis 2 Annual Geometric Means for the three zones of Lake Talquin

	Lower			Middle			Upper		
Year	Total Nitrogen	Total Phosphorus	Chlorophyll a	Total Nitrogen	Total Phosphorus	Chlorophyll a	Total Nitrogen	Total Phosphorus	Chlorophyll a
2008	0.84	0.091	25.22	0.97	0.111	26.07	1.00	0.161	20.61
2009	0.82	0.091	24.04	0.97	0.104	27.37	0.96	0.148	24.48
2010	0.75	0.080	20.24	0.89	0.094	20.12	0.99	0.152	18.32
2011	0.73	0.070	19.48	0.92	0.074	21.24	0.87	0.104	22.06
2012	0.77	0.054	16.19	0.94	0.065	20.41	0.89	0.104	28.42
2013	0.83	0.077	21.54	1.04	0.095	25.86	0.90	0.129	21.58
2014	0.92	0.080	22.13	1.05	0.089	20.25	0.84	0.117	14.73
2015	0.88	0.073	22.00	1.07	0.084	22.47	0.96	0.117	20.19
2016	0.85	0.075	21.13	1.00	0.088	23.75	0.88	0.122	18.95
2017	0.89	0.078	22.13	0.97	0.089	26.12	0.83	0.122	23.42

Table 9 illustrates the difference in the calculated annual geometric means for total nitrogen, total phosphorus and chlorophyll a between the current condition and the flow sensitivity analysis simulation. Note that green highlighted cells indicate an increase in the geometric means.

Table 9 Sensitivity Run 2 Difference between Current Condition and Sensitivity Analysis Condition

	Lower			Middle			Upper		
Year	Total Nitrogen	Total Phosphorus	Chlorophyll a	Total Nitrogen	Total Phosphorus	Chlorophyll a	Total Nitrogen	Total Phosphorus	Chlorophyll a
2008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2011	0.054	0.003	0.974	0.059	0.006	1.753	0.104	0.021	3.759
2012	0.027	0.003	1.007	0.020	0.006	2.047	0.048	0.009	1.878
2013	0.003	0.000	0.135	0.002	0.000	-0.073	0.000	0.000	-0.411
2014	0.002	0.000	-0.016	0.002	0.000	-0.306	-0.001	0.000	-0.305
2015	0.001	0.000	-0.080	0.003	0.000	-0.218	0.000	0.000	-0.285
2016	0.000	0.000	0.131	0.001	0.000	-0.024	0.003	0.001	-0.242
2017	0.000	0.000	0.104	-0.001	0.000	0.014	0.000	0.000	-0.268

Files Altered

For the development of this scenario the following model input files were modified:

- Lake Talquin EFDC input files **QSER.INP** (Changes timeseries for Ochlockonee River and Dam outflows)
  - Copy **QSER-Sen-2.inp** to **QSER.INP** prior to running EFDC
- Lake Talquin EFDC input file **EFDC.WSP** (Changes the name of the WASP hydrodynamic linkage file)
  - Copy **EFDC-Sen-2.WSP** to **EFDC.WSP** prior to running EFDC
  - Lake Talquin WASP Model **Lake_Talquin_V4.wif** change hydrodynamic linkage file to point to hydrodynamic linkage (**LT-Sen-2.hyd**)

EMC Sensitivity Analysis

Stakeholders requested a sensitivity analysis be conducted on the event mean concentrations (EMC) parameterized for total phosphorus used in the Ochlockonee River watershed model. The comment was made that the total phosphorus EMC was in the lower range of published values. It was suggested that median values be used in a sensitivity analysis. The calibrated EMC values were scaled up to approximately the median published values. Table 10 shows a comparison between the watershed model calibrated EMCs and the ones used in the sensitivity analysis.

A comparison of the loadings from the current and previous EMC assumptions was made using the USGS statistical package LOADEST. This tool uses measured flow and concentration data to calculate a representative loading using measured data. The calculated concentrations from both the current and previous EMC assumptions are compared to the LOADEST calculation (https://water.usgs.gov/software/loadest/).

Table 10 Event Mean Concentrations for Total Phosphorus (mg/L) per Landuse

	Current		Sensitivity	
Landuse	**Surface**	**Interflow**	**Surface**	**Interflow**
Beach	0.06105	0.0306	0.2035	0.102
Water	0.015	0.0075	0.05	0.025
LowIntDevPerv	0.06105	0.0306	0.2035	0.102
LowIntDevImperv	0.0282	0.0141	0.094	0.047
MedIntDevPerv	0.06105	0.0306	0.2035	0.102
MedIntDevImperv	0.06105	0.0306	0.2035	0.102
HighIntDevPerv	0.078	0.039	0.26	0.13
HighIntDevImperv	0.05175	0.02595	0.1725	0.0865
Barren	0.06105	0.0306	0.2035	0.102
Forest	0.0165	0.00825	0.055	0.0275
Golf	0.0924	0.0462	0.308	0.154
Pasture	0.0924	0.0462	0.308	0.154
Crop	0.1275	0.06375	0.425	0.2125
Wetland	0.1026	0.0513	0.342	0.171
AllOtherImperv	0.06105	0.0306	0.2035	0.102

Figure 13 shows the location of the two LSPC subbasins used for the comparison between the current EMCs and the sensitivity analysis EMCs. These loads represent the total loading from the individual subbasin to the river network. These subbasins were chosen because of location and similar size.

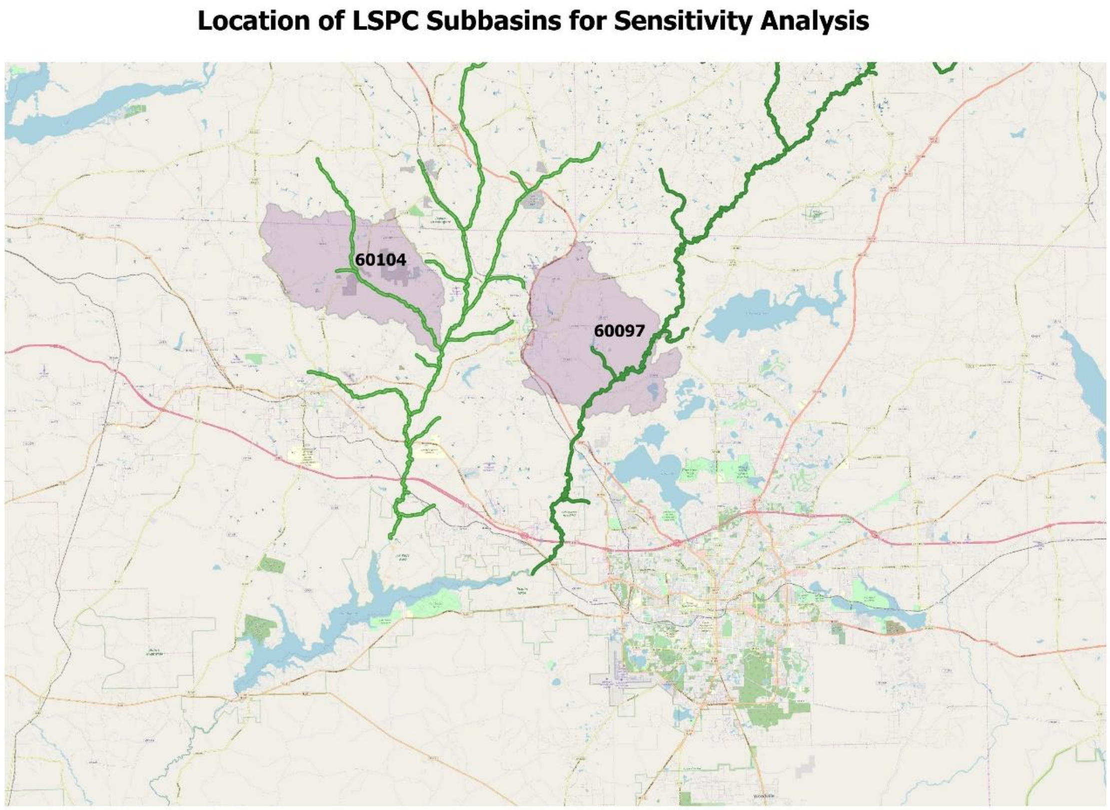
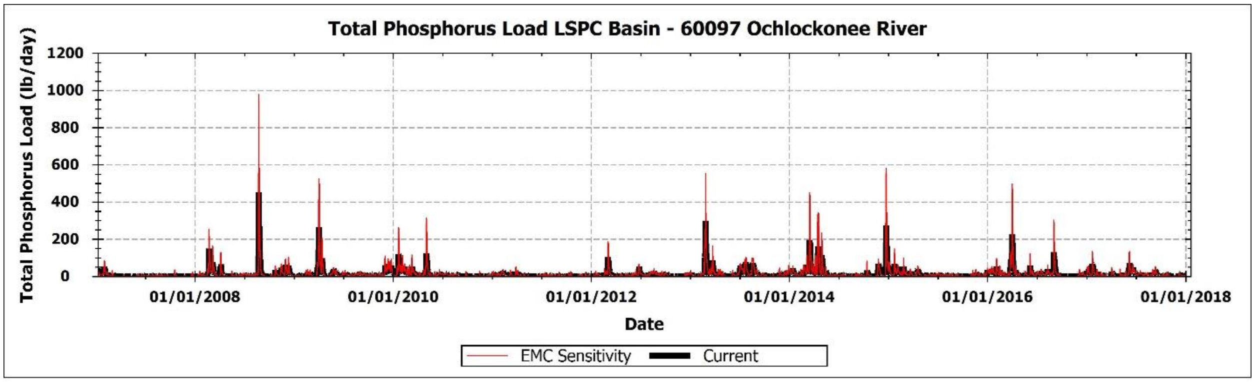


Figure 13 Location of Two LSPC Basins for Comparison

Figure 14 and Figure 15 illustrates the difference in loadings between the two EMC assumptions used in the LSPC watershed model. The top panel is a timeseries over the simulation period and the bottom panel is a probability distribution function for each assumption.



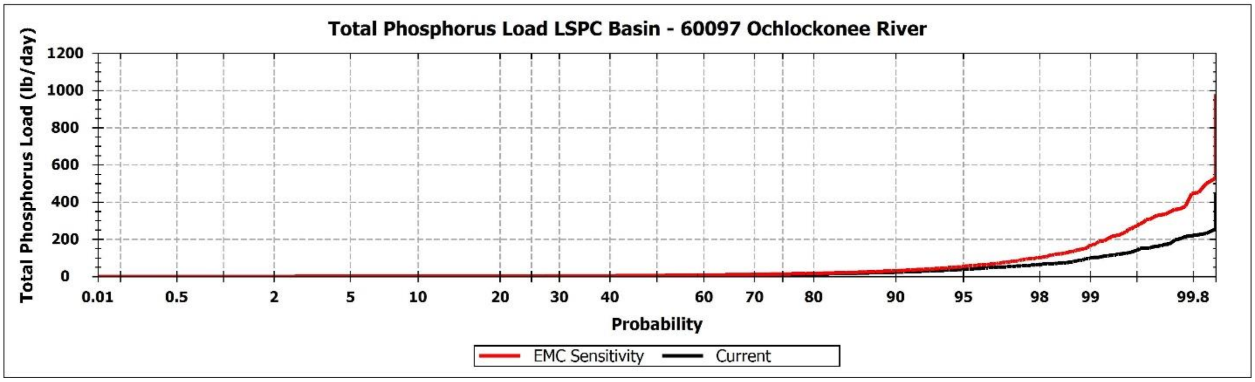
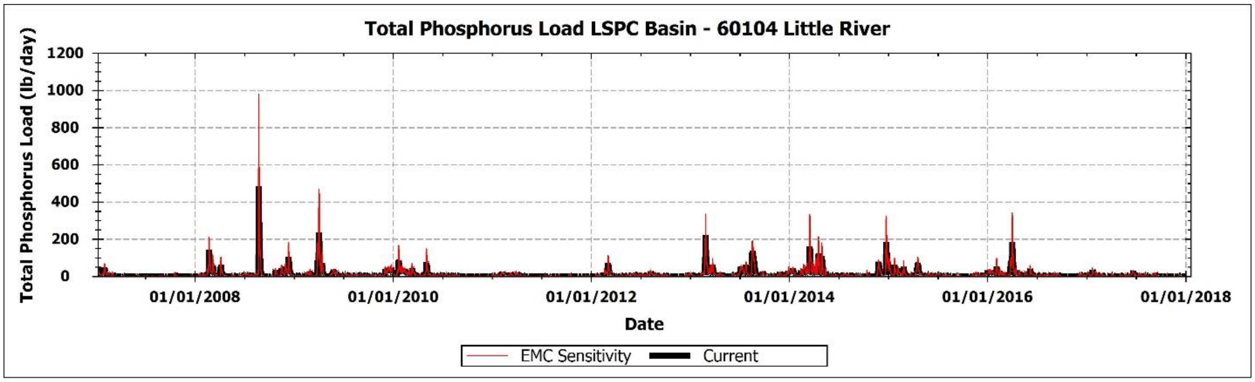


Figure 14 Total Phosphorus Load from LSPC Basin 60097 to Ochlockoee River (Timeseries and Probability Plot)



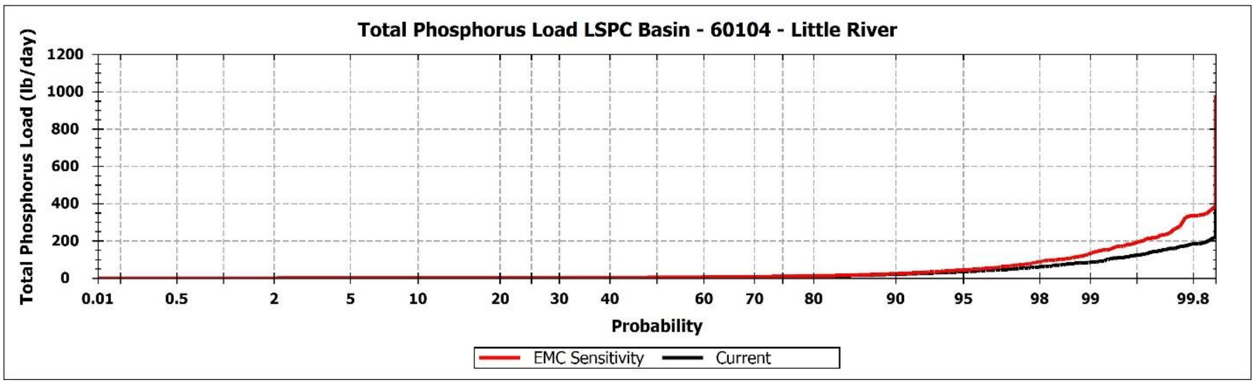


Figure 15 Total Phosphorus Load from LSPC Basin 60104 to Little River (Timeseries and Probability Plot)

Figure 16 through Figure 17 provides a comparison of the EMC sensitivity simulation versus the current calibrated model with the observed data.

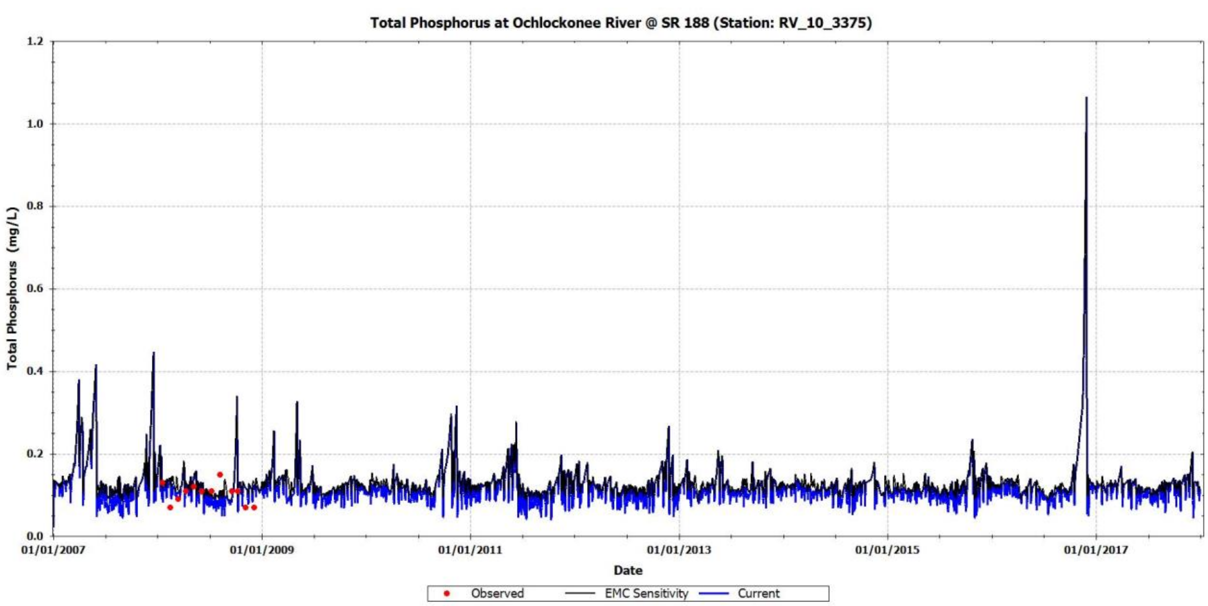


Figure 16 Total Phosphorus Comparison Ochlockonee River at SR 188 (EMC Sensitivity vs. Current Model)

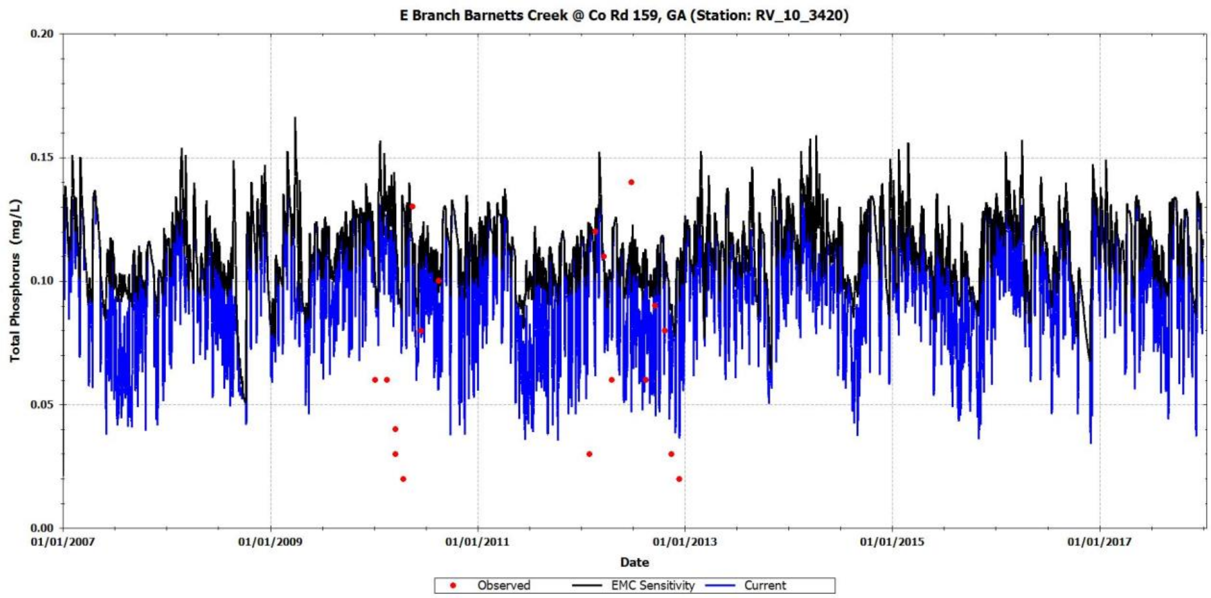


Figure 17 Total Phosphorus Comparison East Branch Barnetts Creek (EMC Sensitivity vs. Current Model)

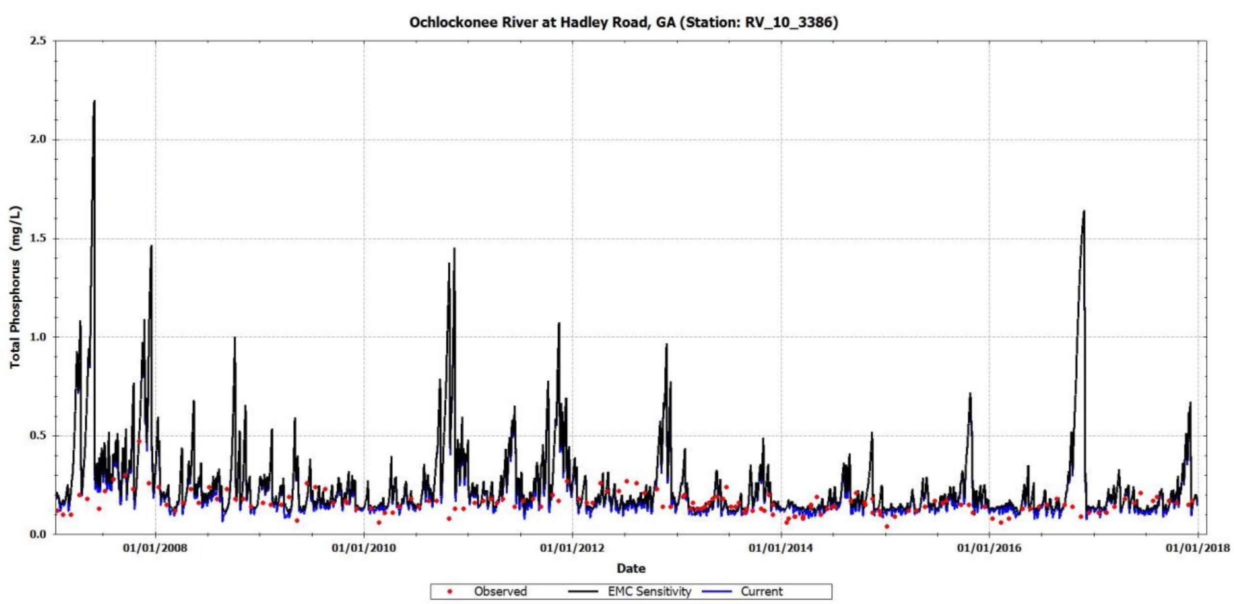


Figure 18 Total Phosphorus Comparison Ochlockonee River at Hadley Road, GA (EMC Sensitivity vs. Current Model)

Figure 19 shows a comparison of the predicted total phosphorus concentrations at the inlet to Lake Talquin between the current calibrated model and the EMC sensitivity analysis model. There is virtually no difference between the current calibrated model and the median EMC values.

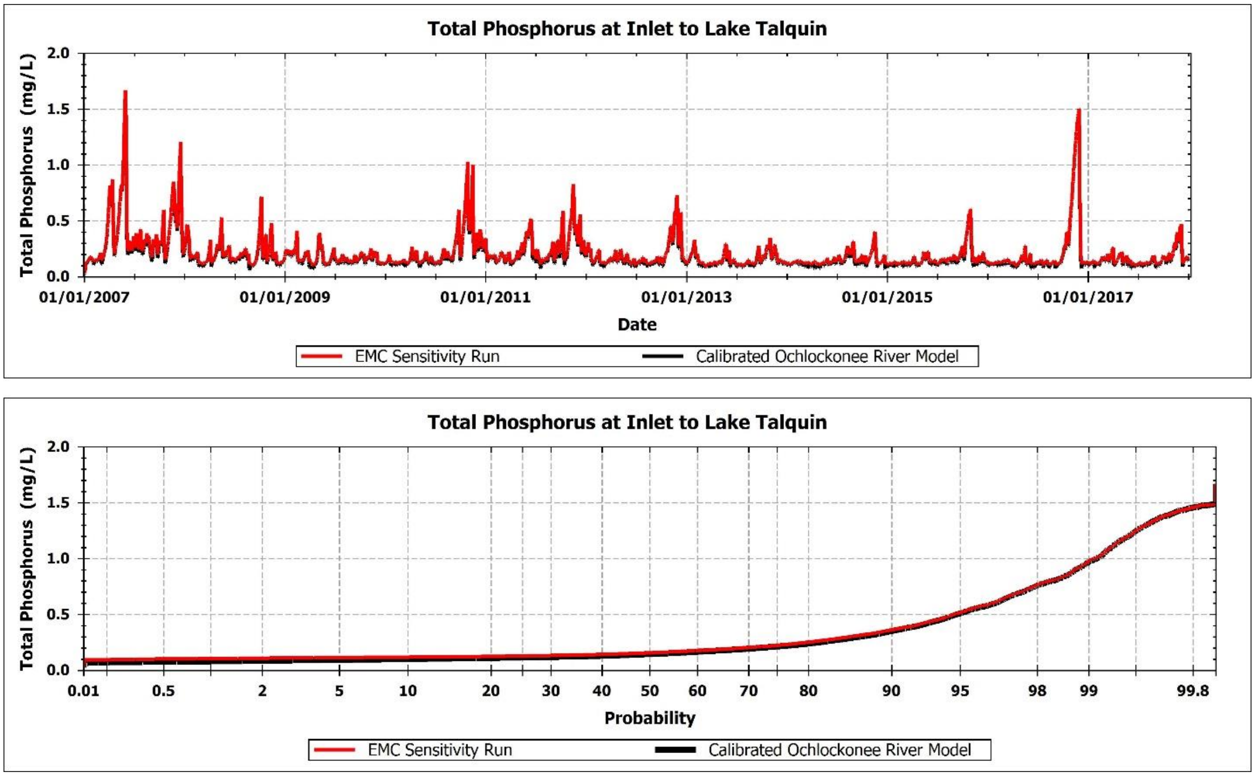


Figure 19 Comparison of EMC Sensitivity Run to Calibrated Model for Total Phosphorus

USGS LOADEST Comparison

Two water quality monitoring stations (RV_10_3386 – Hadley Road, GA and 21FLGW 3540 – Ochlocknee River at SR 12, FL) were selected for the LOADEST comparison. These stations were selected because they had the most available total phosphorus measurements. The location of the monitoring stations are shown in Figure 20 and the data is summarized in Table 11. The measured flows from the USGS flow gage (02328522) were used in the LOADEST calculations for both monitoring stations. The gage is located at SR 12, Concord, FL. The gage flow was adjusted down by 6% (using drainage area ratio) for the Hadley Road calculation.

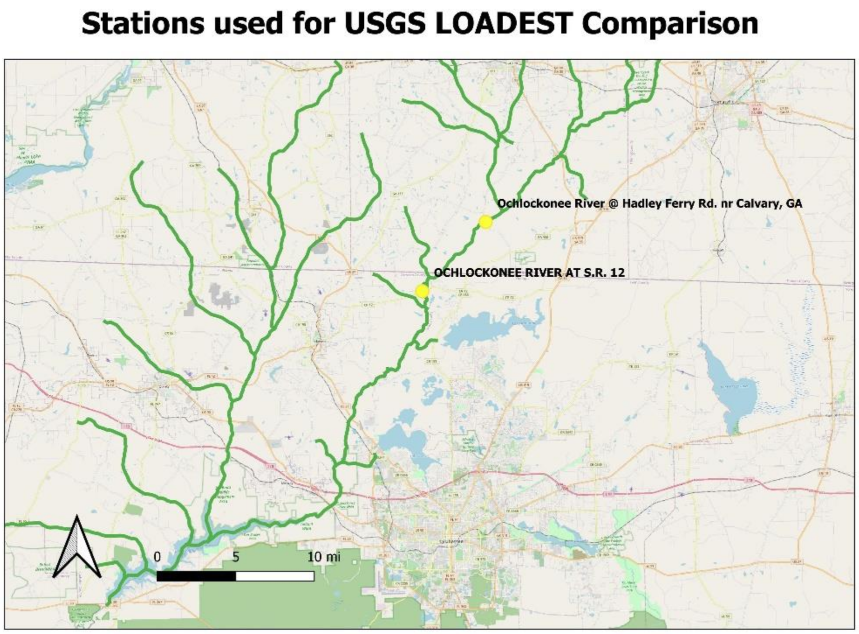


Figure 20 Location of USGS Concord, FL and Hadley Road, GA Monitoring Station used in LOADEST Analysis

Table 11 Monitoring Stations used for LOADEST Analysis

Station	Station Name	Parameter Name	Units	No. Obs.	Mean	Min	Max	First Date	Last Date
21FLGW 3540	OCHLOCKONEE RIVER AT S.R. 12	Total Phosphorus	mg/L	126	0.16	0.07	1.9	1/9/2007 10:15	7/17/2017 11:20
RV_10_3386	Ochlockonee River @ Hadley Ferry Rd. nr Calvary, GA	Total Phosphorus	mg/L	157	0.16	0.04	0.47	1/22/2007 13:30	12/12/2017 11:07

The USGS LOADEST program was applied to Ochlockonee River at the two station locations using the measured USGS flow, the monitored total phosphorus concentrations and the two water quality model scenarios (current EMC and EMCs from previous model). The LOADEST results are presented graphically in Figure 21 - Figure 24 and statistically Table 12 - Table 13. For both monitoring locations the current EMC values used in the Ochlockonee watershed compare more favorably with the LOADEST calculation.

The figures presented below are the results of the LOADEST multi-regression on the observed paired flow and concentration data. The red dots indicate the correlation of the LOADEST estimated loads (LOADEST estimate using modeled flow and concentration) with the model (WASP) predicted loads. The blue line represents a 1:1 comparison.

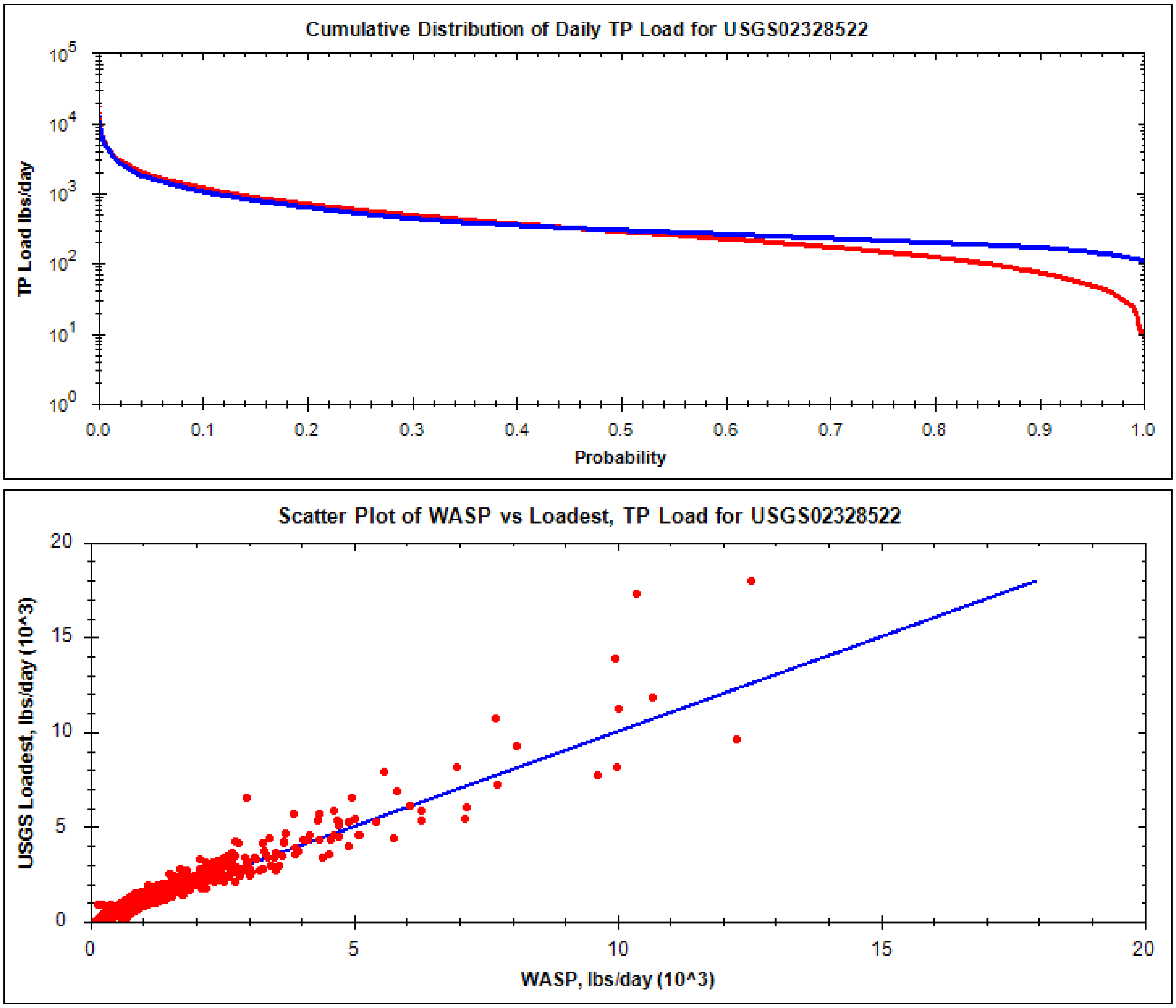


Figure 21 Current EMC LOADEST Comparison at Hadley Road, GA

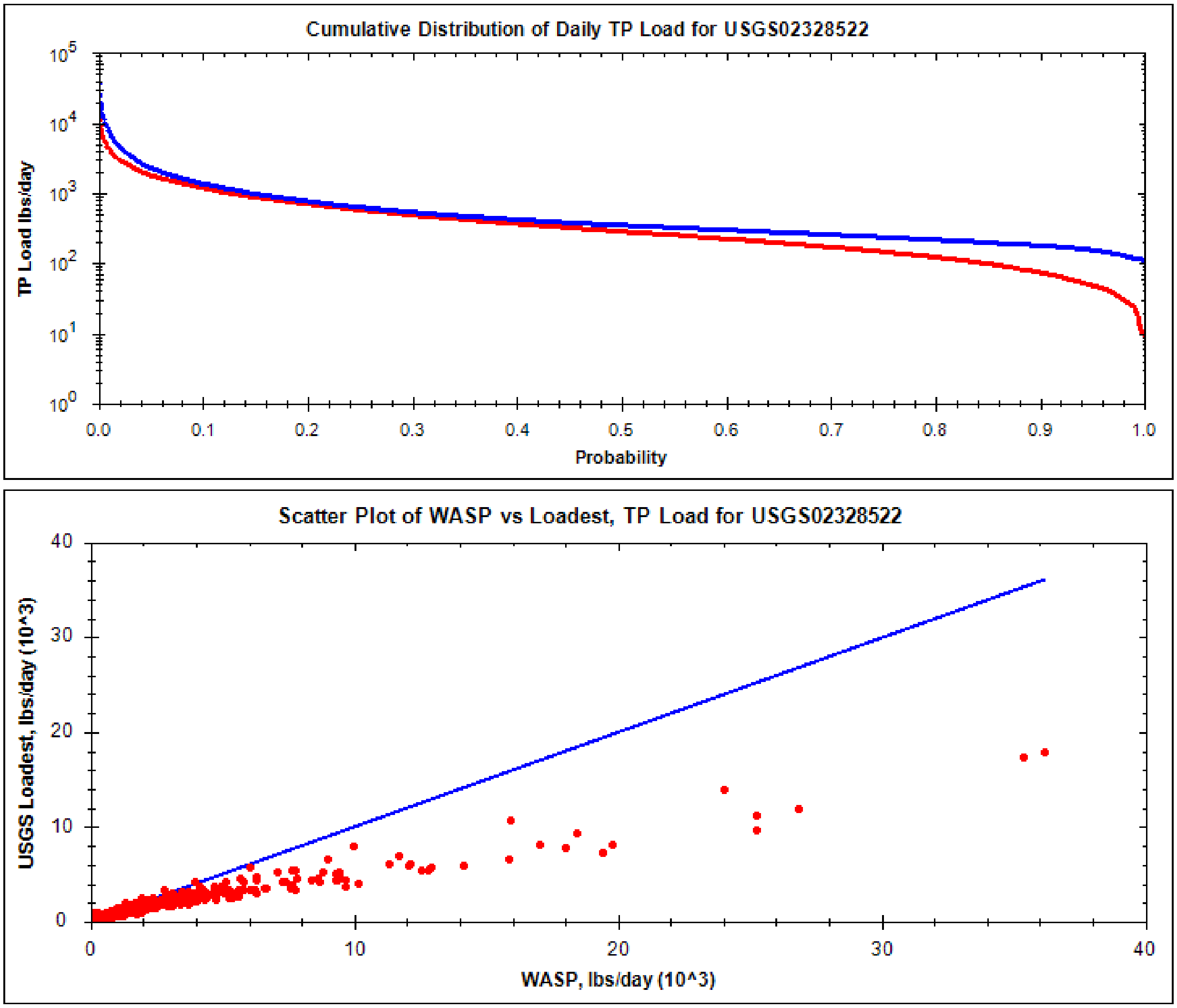


Figure 22 Previous EMC LOADEST Comparison at Hadley Road, GA

Table 12 Statistical Comparison of LOADEST Analysis for Hadley Road, GA Station

Statistic	Current	Previous
Bias	-9.28	205.141
Standard Error	253.583	898.708
Relative Bias	-0.017	0.378
Relative Standard Error	0.272	0.966
Nash-Sutcliffe Coefficient	0.926	0.067
Coefficient of Efficiency	0.751	0.521
Index of Agreement	0.867	0.782
Kolmogorow-Smirnov Statistic	0.201	0.224

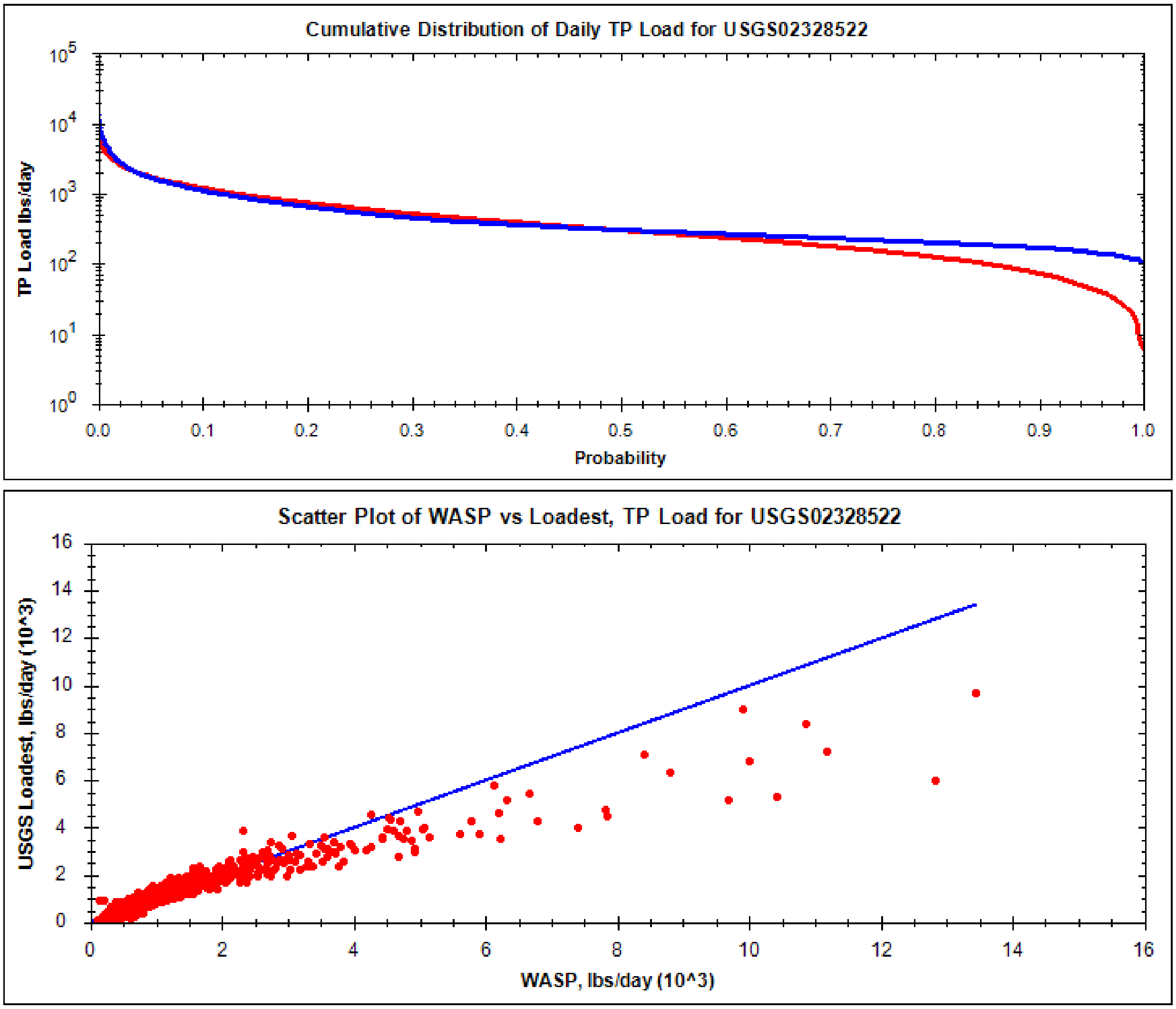


Figure 23 Current EMC LOADEST Comparison at Concord, FL

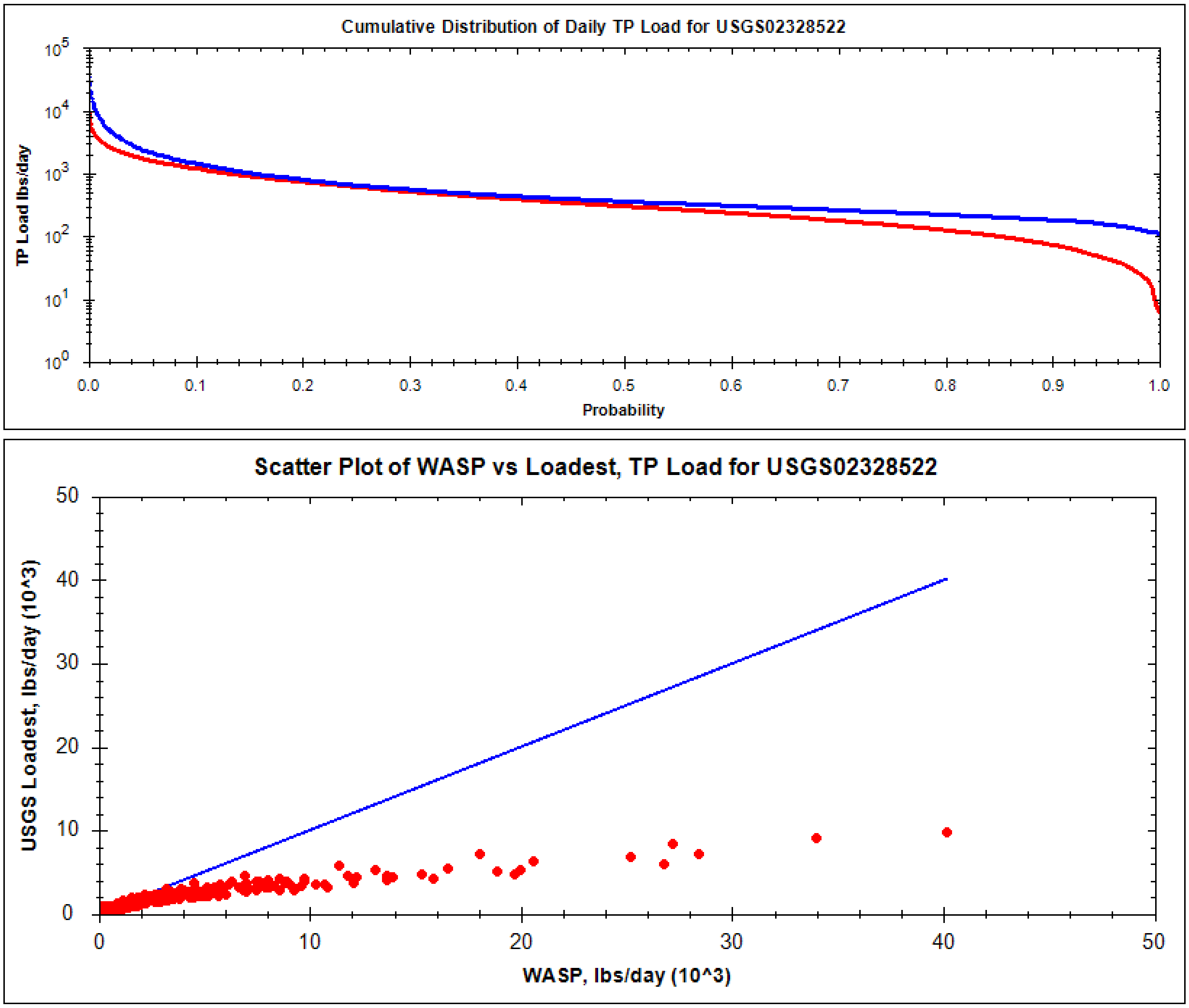


Figure 24 Previous EMC LOADEST Comparison at Concord, FL

Table 13 Statistical Comparison of LOADEST Analysis for Concord, FL Station

Statistic	Current	Previous
Bias	29.29	255.089
Standard Error	284.316	1250.64
Relative Bias	0.056	0.491
Relative Standard Error	0.408	1.797
Nash-Sutcliffe Coefficient	0.833	-2.28
Coefficient of Efficiency	0.718	0.354
Index of Agreement	0.856	0.726
Kolmogorow-Smirnov Statistic	0.194	0.217

Files Altered

For the development of the EMC scenario the following model input files have been modified:

- Ochlockonee River watershed model input (**Revision3.inp**) EMCs were scaled as described in Table 10, to create new file **EMC_Sensitivity.inp** for the LSPC model
- Ochlockonee River water quality model input (**Ochlockonee_River_V4.wif**), watershed boundary concentration timeseries were updated to EMC sensitivity scenario which created new file **EMC_Sensitivity.wif**
- LOADEST input files **Ochlockonee_Loadest.zip**