Lower Withlacoochee River
Environmental Study

Phase 2 – Interim Data Summary

Prepared for

Withlacoochee Aquatic Restoration

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Prepared by

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Table of Acronyms

FDEP	Florida Department of Environmental Protection
FWC	Florida Fish and Wildlife Commission
HUC	Hydrologic Unit Code
LWR	Lower Withlacoochee River
PAR	Photosynthetically Active Radiation
pH	Hydrogen Ion Concentration
SWFWMD	Southwest Florida Water Management District
WAR	Withlacoochee Aquatic Restoration
WSI	Wetland Solutions, Inc.

Executive Summary

Through the ongoing efforts of the advocacy group Withlacoochee Aquatic Restoration (WAR) the environmental health of the Lower Withlacoochee River has been the site of intensive investigation since 2013 (Wetland Solutions, Inc. 2013). The second phase of this three-phase evaluation is currently underway and expected to be completed near the end of 2018. Phase 3 will include final reporting of baseline conditions and a plan for comprehensive restoration of the Lower Withlacoochee River. Completion of the Phase 3 report is planned for late 2019.

This Phase 2 Interim Report is provided as a preliminary data summary with conclusions that will be re-evaluated once all data collection efforts are complete. Based on information gathered and reviewed to-date, preliminary conclusions include the following:

- The Withlacoochee River (South) is highly altered where it borders Citrus, Marion, and Levy counties, including the creation of an artificial impoundment (Lake Rousseau) by the Inglis Dam in 1905 and creation of the incomplete Cross-Florida Barge Canal in 1968;
- Flows in the Withlacoochee River have been experiencing a downward trend in recent decades due to a combination of anthropogenic (agricultural and urban development) and natural causes;
- Peak flows have been truncated in the Lower Withlacoochee River due to the impoundment of the river, design of the by-pass spillway to the river, and spillway to the Cross-Florida Barge Canal;
- The concentration of total nitrogen in the Lower Withlacoochee River has risen consistently due to groundwater inflows, mostly from the Rainbow River;
- Chemical control of aquatic plants in Lake Rousseau and the Rainbow River, have contributed to the loss of submerged aquatic vegetation in the lower river;
- Reduced flows and upstream reservoir management activities have impaired the Lower Withlacoochee River through habitat smothering and decreased visible light penetration.

The combined effect of these issues is an impaired aquatic ecosystem in the Lower Withlacoochee River caused by human activities. While these impairments are unintentional, they can all be reduced to some extent through implementation of intentional restoration measures. The proposed Phase 3 report will describe recommendations and responsible parties for those restoration efforts.

Introduction

The Withlacoochee River (south) in west-central Florida drains surface water runoff from the Green Swamp near the City of Lakeland in Polk County and then flows west and north to the Gulf of Mexico near Yankeetown (Figure 1). In addition to surface water the Withlacoochee River intercepts and conveys significant quantities of groundwater from a large area of karst terrain that extends west through Pasco, Sumter, Citrus, Marion, and Levy Counties. The Withlacoochee River is approximately 157 miles long with a surface watershed of about 2,060 square miles. The largest tributary to the Withlacoochee River and primary source of groundwater inflow is the

Rainbow River/Springs System near Dunnellon. The Rainbow River is fed by a springshed with an estimated area of about 737 mi^2.

In its lower reaches (below Dunnellon and the Rainbow River) human activities have highly altered the Withlacoochee River. The most significant structural changes to the river were the construction of the Inglis Dam on the river in 1909 that impounded Lake Rousseau; the construction of the Cross-Florida Barge Canal and lock system just east of US 19 and south of Inglis in the 1960s; the construction of a by-pass spillway to return baseflow to the lower river; and the dredging of the lower river to accommodate boat traffic for mining and power generation. These alterations, as well as other environmental stresses resulting from conversion from natural to developed land uses in the river's watershed, have changed the physical, chemical, and biological conditions in the Withlacoochee River.

Despite local and state protections for this natural aquatic ecosystem, detrimental changes continue to be evident to local residents. In response to these observed changes, a local citizens' advocacy group, the Withlacoochee Aquatic Restoration (WAR) contracted with Wetland Solutions, Inc. (WSI) in 2013 to conduct a multi-phase evaluation of the health of the Lower Withlacoochee River and to develop recommendations for restoration. During the first phase (Phase 1) of this evaluation, WSI prepared a summary of relevant existing information for the portion of the river referred to as the Lower Withlacoochee River Study Area (Figure 2). This river segment extends from the Lake Rousseau Inglis Bypass Canal to the Gulf of Mexico and includes approximately 10 miles of the historic lower river channel. During the second study phase (Phase 2) WSI, with analytical support from the Florida Department of Environmental Protection (FDEP) and staff support from the Southwest Florida Water Management District (SWFWMD), conducted a two-year "baseline" assessment of the Study Area that included flow and water quality sampling as well as limited collection of biological and human-use data. The proposed Phase 3 of this Lower Withlacoochee River project will use the historic and recent data to develop a detailed strategy for restoration.

This Phase 2 data collection was completed in October 2017. In January 2018, WAR agreed to extend the Phase 2 baseline sampling to fill some key data gaps concerning existing conditions in the Study Area. Budget for this Phase 2 extension was not immediately available, and it was decided to incorporate all Phase 2 results into the final Phase 3 report. This brief interim report is intended to serve as an update on the Phase 2 work already completed and all conclusions are tentative until completion of additional study and completion of the Phase 3 restoration plan.

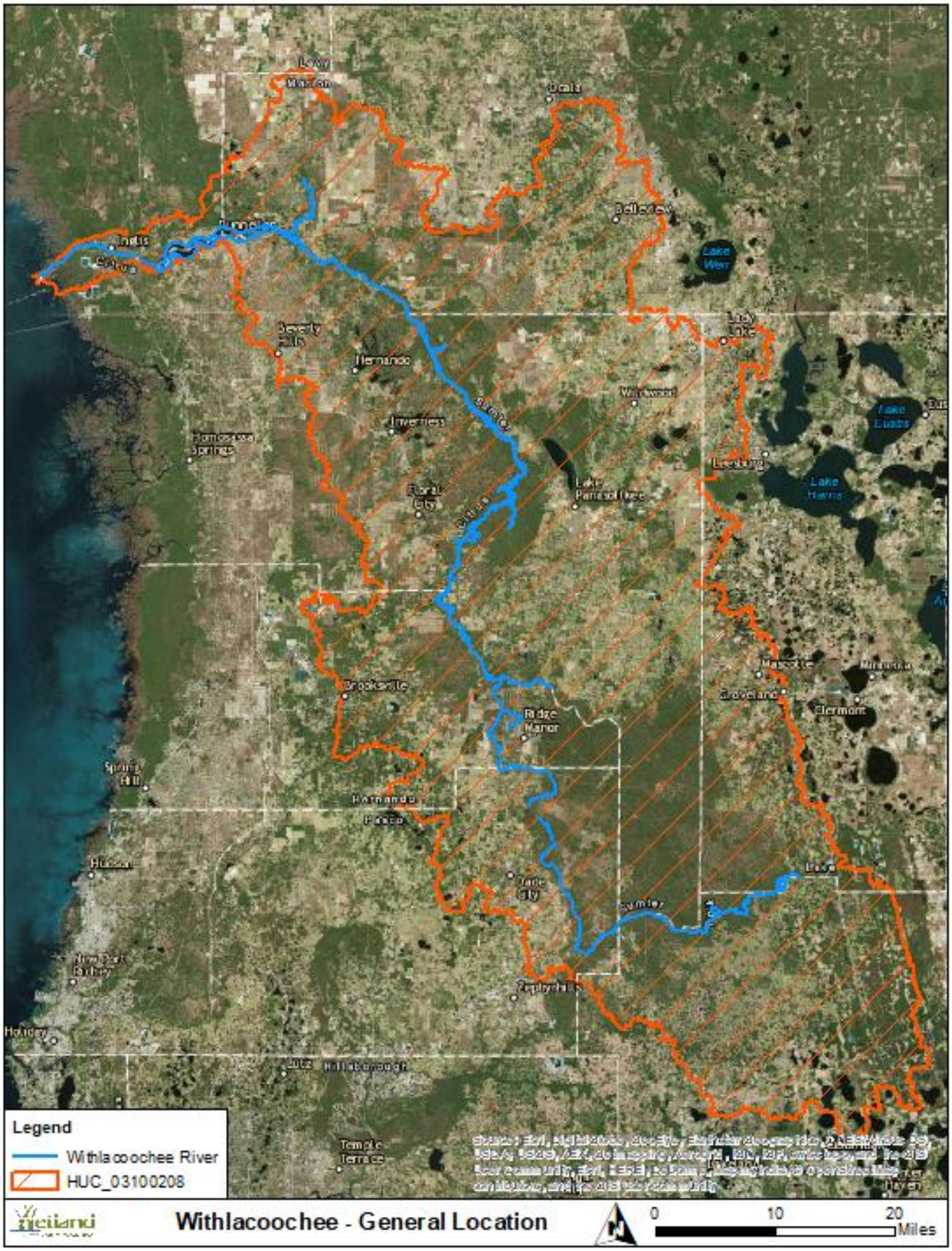


Figure 1. Withlacoochee River (South) location map and surface watershed.

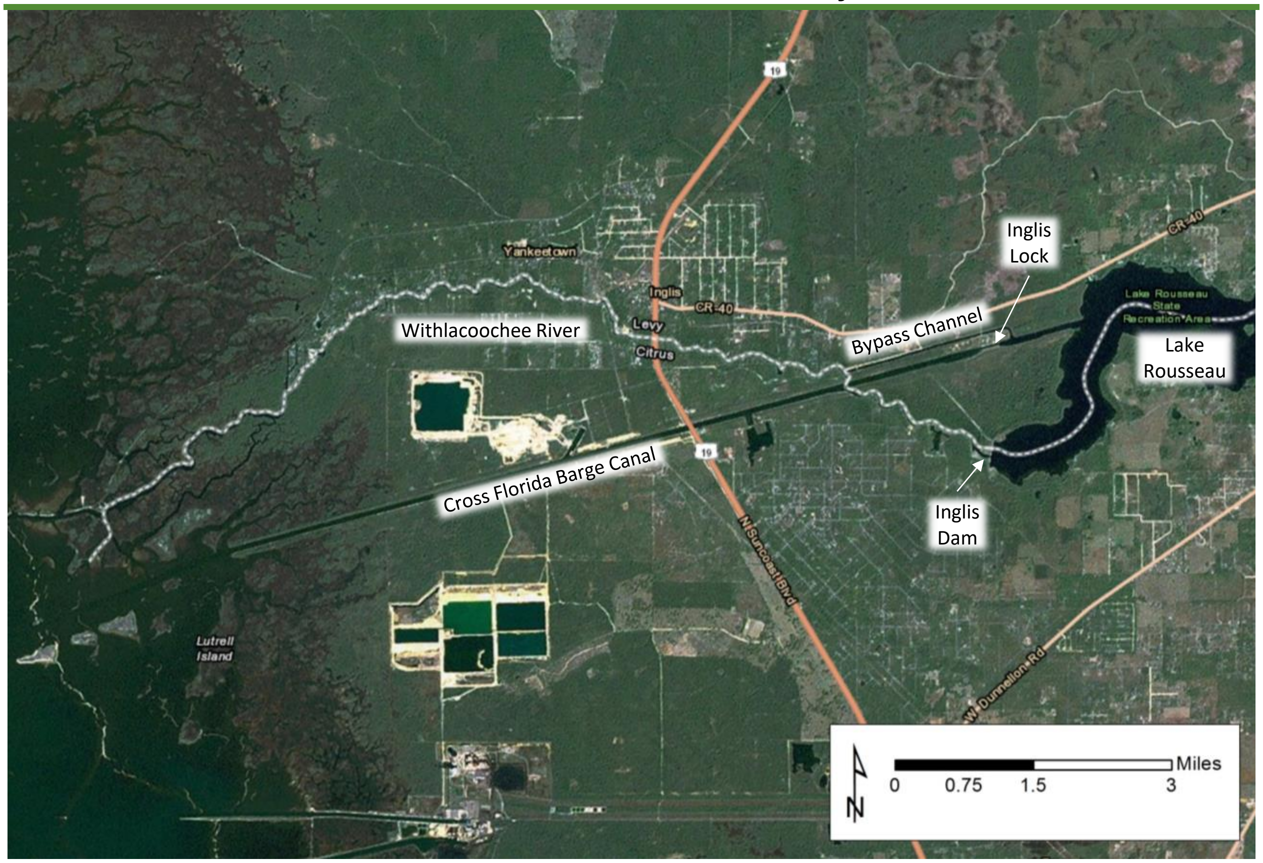


Figure 2. Lower Withlacoochee River physical setting and surrounding features.

Phase 1 Summary

WSI's Phase 1 summary of existing environmental data from the Lower Withlacoochee River provided the following preliminary conclusions:

- The Lower Withlacoochee River has been significantly altered by human activities over the past 100+ years and very likely since the first colonization of the Gulf Coastal Plain by Europeans. Major impacts include historic timber extraction, dredging, ditching, current and historic phosphate mining, construction of dams and spillways, construction of the Cross-Florida Barge Canal, aquatic weed management, and agricultural and urban development in the surface and groundwater basin that supplies water to the river.
- Specific impacts affecting the existing environment in the Lower Withlacoochee River noted during this study include the following:
  - Creation and maintenance of a dredged channel connecting the mouth of the lower river to the Gulf of Mexico;
  - Construction of the Inglis Dam and lock in 1904;
  - Alterations in water quality and the physical aquatic environment with the conversion of 5.7 miles of the historic river and floodplain wetlands to Lake Rousseau;

- Diversion of historic high flows from the lower river to the Cross-Florida Barge Canal in December 1969;
- Significant long-term (1960s to present) flow reduction in all portions of the system on the order of 40 to 60%;
- Increasing concentrations of nitrate nitrogen, a plant-growth nutrient, entering the Rainbow River from groundwater sources and traveling downstream to the lower river;
- Proliferation of native and non-native aquatic plants in the Lower Withlacoochee River, the Rainbow River, and Lake Rousseau, leading to state-funded chemical eradication efforts;
- Releases of dead plant matter, herbicides, and high densities of microscopic planktonic algae to Lake Rousseau and the lower river, with creation of eutrophic conditions, and wide swings in concentrations of dissolved oxygen and pH; and
- Apparent eradication of submerged aquatic vegetation with associated declines in fish, manatees, and other wildlife.

Studies by Frazer *et al.* (2001) from the University of Florida indicate that there was little to no submerged aquatic vegetation in the Lower Withlacoochee River for at least the past 15 years, if not longer. However, there is a paucity of biological data from the lower river. No algal, macroinvertebrate, fish, reptile/amphibian, bird, or mammal population data were located for this Phase 1 analysis. This data gap, both past and present, makes development of conclusions concerning causation of current conditions somewhat speculative.

Two additional Phases of study/synthesis were recommended to guide future restoration efforts of the Lower Withlacoochee River. These included Phase 2 to conduct a comprehensive baseline evaluation of existing conditions and Phase 3 to develop a plan for specific restoration needs, costs, and responsible entities. These proposed activities were recommended for a limited area, namely the 10 miles (16 km) of the lower river from the Inglis Spillway to the outlet of the river. The Phase 2 study ultimately included upstream water quality stations above and below the confluence of the Withlacoochee River and its principal tributary the Rainbow River (Figure 3).

Phase 2 included collection of environmental data monthly for a two-year period from November 2015 until October 2017. Partners during the Phase 2 study included the SWFWMD (shared staff resources), FDEP (analytical and biological sampling resources), and the Florida Fish and Wildlife Conservation Commission (FWC) with support of fish population studies and information on aquatic weed control activities.

Phase 2 study components included the following:

- Physical Setting
    - Land use of the surface watershed (including waterfront houses and septic systems)
    - Water balance (inflows and outflows)
    - River bathymetry
    - Flow regime (velocity profiles)

  - Sediment sampling (5 stations) for grain size, organic content, and occurrence of trace metals and organics

- Water Quality (5 stations)
  - Light transmittance (secchi depth and underwater photometer)
  - Field parameters vertical profiles and continuous (temperature, pH, dissolved oxygen, specific conductance)
  - General analytical monthly with all samples analyzed by the FDEP laboratory (chloride, salinity, sulfate, iron, chlorophyll a, nitrate-nitrite, total ammonia, and organic nitrogen, ortho-phosphorus, total phosphorus, fecal coliforms, total coliforms)
- Biological (5 transects)
  - Algal taxonomy and biovolume (FDEP sampling)
  - Benthic macroinvertebrates (FDEP sampling)
  - Fish species and biomass (FWC)
  - Other fauna (herptiles, birds, mammals)
- Human Use
  - Boating survey

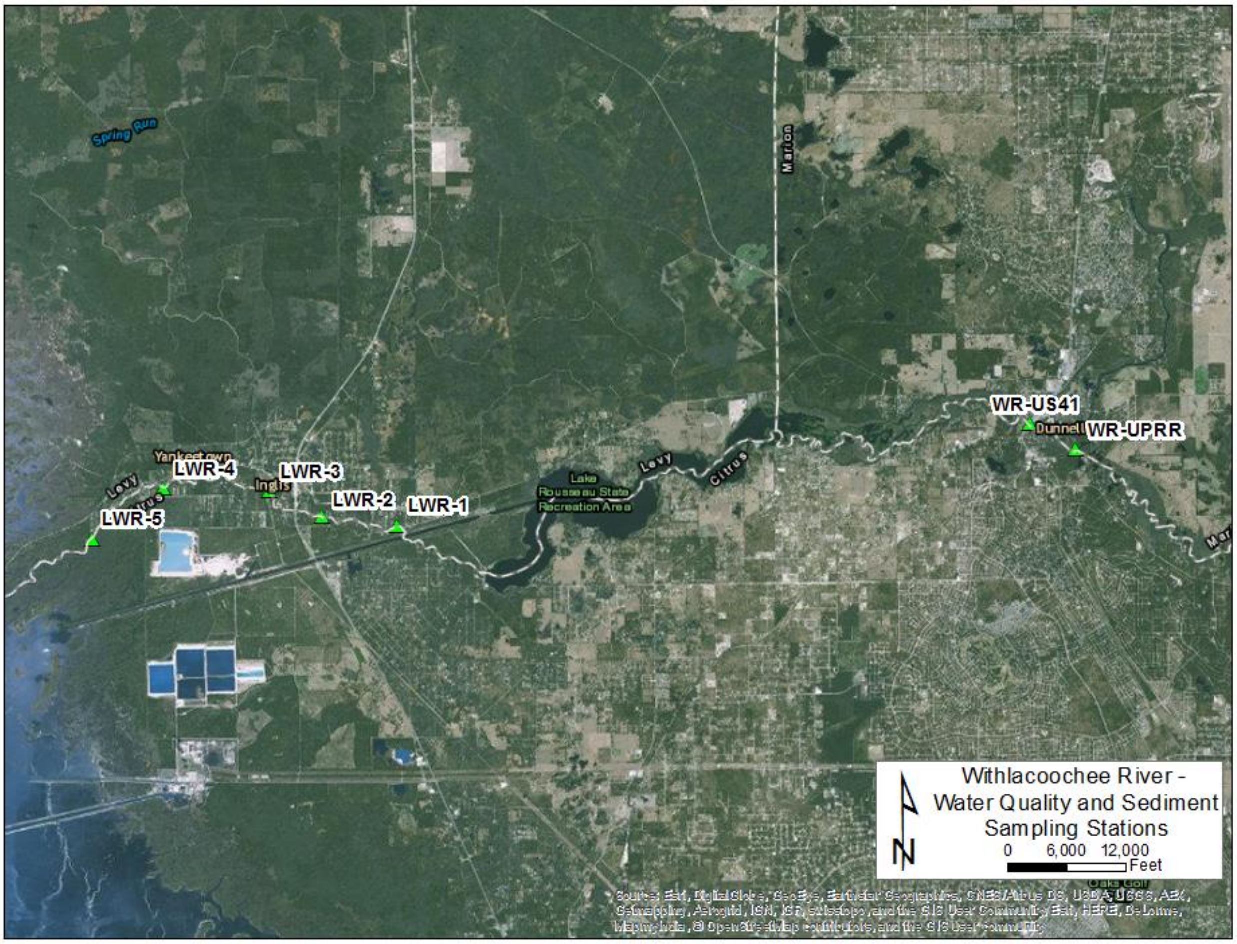


Figure 3. Sediment and water quality sampling stations on the Withlacoochee River and Lower Withlacoochee River (LWR).

Preliminary Findings

Physical Setting

The Lower Withlacoochee River is located along the border of Citrus and Levy Counties in west central Florida. The lower portion of the river begins at the spillway on the Inglis Bypass Canal that was designed to provide flow to the lower river after it was severed by construction of the Cross-Florida Barge Canal. The Cross-Florida Barge Canal was constructed beginning in 1964 and was terminated in 1971. In the vicinity of the Lower Withlacoochee River the Cross-Florida Barge Canal created an artificial connection between the Gulf of Mexico and Lake Rousseau, north of the Lower Withlacoochee River. This connection to Lake Rousseau split the Lower Withlacoochee River about two miles downstream of the historic connection to Lake Rousseau at the southwest terminus of the lake, Figure 2.

The Lower Withlacoochee River in the context of this environmental evaluation includes the section of the Withlacoochee River below the Inglis Dam and Lake Rousseau. This section of river receives all its upstream flow through the Inglis Bypass Canal with flow controlled by spillway operations. The river then flows through a meandering channel for about ten miles before emptying into the Gulf of Mexico. Additional sources of water to the river include seeps from surficial aquifers and possible Floridan Aquifer contributions from fissures in the limestone channel. In the entire lower river, tidal cycles cause significant changes in water levels and river flows slowed or even reversed under strong incoming tides, or low river inflows.

River Flows

Average flow rates in the Withlacoochee River at SE 200 have been declining throughout the period-of-record (1928 to present). Average flows in the Rainbow River have been declining since the 1960s. Combined flows to the Lower Withlacoochee River through the Inglis Lock Bypass Channel have also been declining since measurements started in 1970, with an average reduction greater than 40%. While recorded river flows during the period of this Phase 2 study have been above recent averages (Figure 4), the effect of long-term average flow reductions is a likely contributor to the observed decline of ecological function in the lower river.

The flow regime within the Lower Withlacoochee River is dominated in the upstream portions by inflows from Lake Rousseau, and within the lower sections by tidal fluctuations. At the upstream end of the Lower Withlacoochee River a flow station is maintained from the Bypass Canal to the Lower Withlacoochee River. The structure is limited to a maximum flow of approximately 1,450 cfs. Figure 4 illustrates how flows in the Lower Withlacoochee River are truncated compared to flows in the river as a whole. The dark blue (diamond) data points in Figure 4 illustrate how major peak flows are much lower, in some cases less than one half of the combined river flows entering Lake Rousseau. Peak flow events are a very important driver for healthy riverine ecology and their elimination is likely impairing the health of the Lower Withlacoochee River ecosystem.

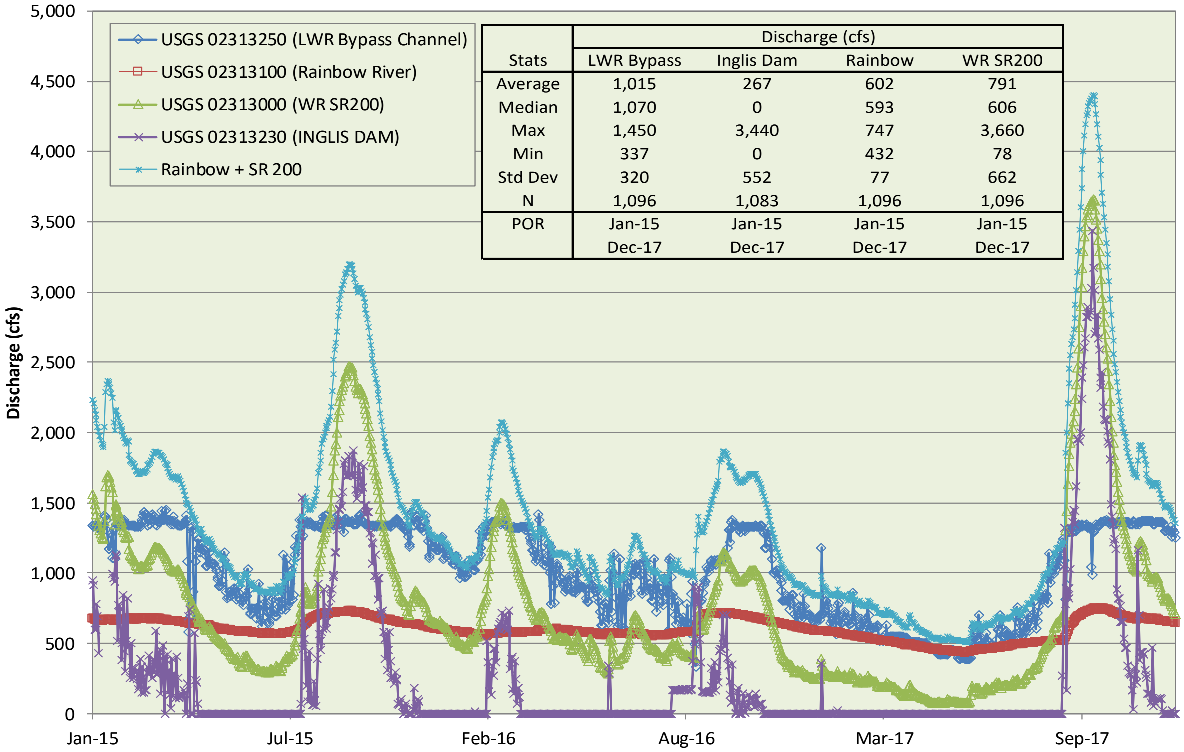


Figure 4. Flows on the Lower Withlacoochee River during the Phase 2 Study.

Water Quality

Water quality includes a wide array of parameters that include both chemical constituents and physical constituents. Water quality can have positive or negative impacts on all portions of the ecosystem from the biota to the physical setting. For the purposes of this project three different types of data were collected to assess the potential impacts of the systems water quality: light transmittance, field parameters, and lab-analyzed samples. Each of these is briefly described in additional detail in the following sections with a discussion of the data collected.

Light Transmittance

Light transmittance is a measure of the portion of incoming light that is transmitted through the water column (water transparency). Of particular interest to this study is photosynthetically active radiation (PAR), which is the portion of the light spectrum available to plants to allow photosynthesis. Figure 5 provides a comparison of underwater light transmittance at the seven Lower Withlacoochee River stations. The station above the Rainbow River has the lowest light transmittance due to the natural influence of tannic waters in the upstream watershed, the station immediately downstream of Rainbow River has higher water clarity due to the spring inflows, but transparency is reduced in the outflow from Lake Rousseau measured at LWR-1 and LWR-2, and then increases downstream, indicating greater light penetration in the marine waters.

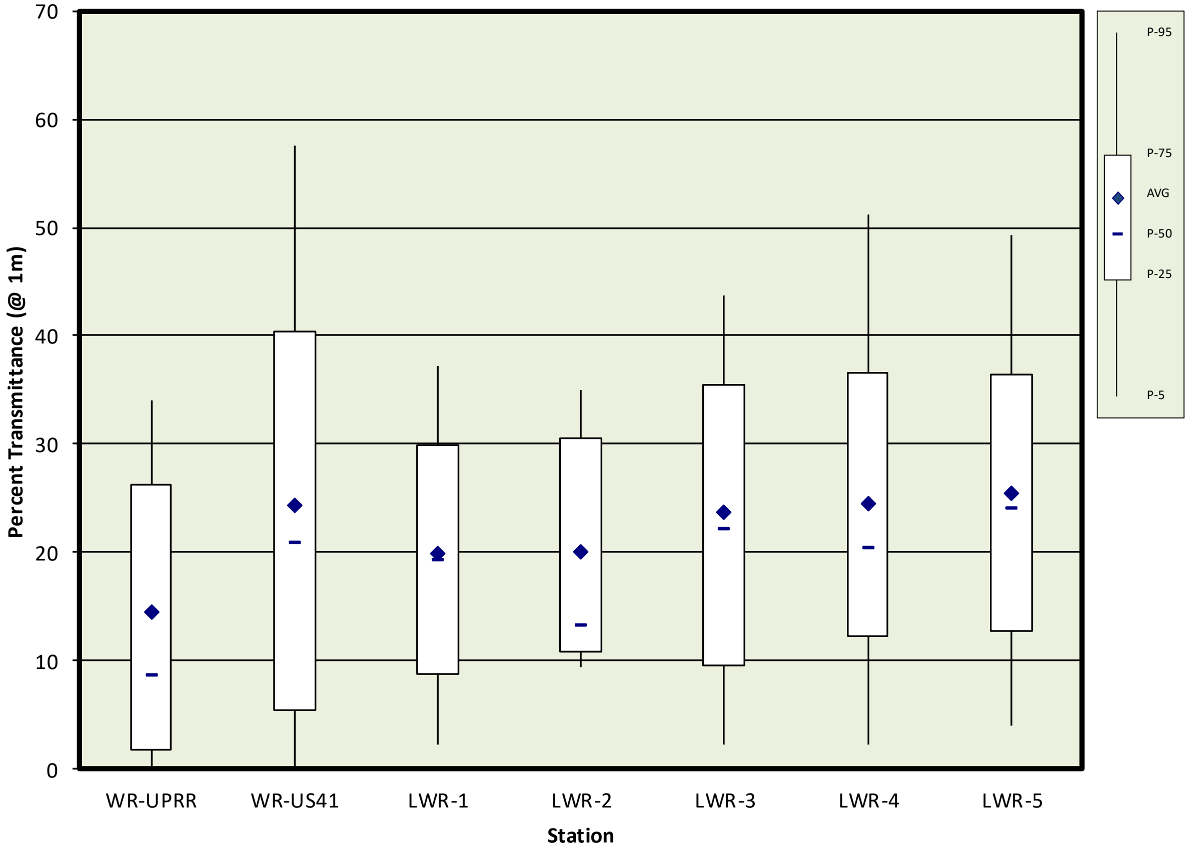


Figure 5. Summary of Phase 2 light transmittance in the Lower Withlacoochee stations during the Phase 2 study period.

Figure 6 provides the time-series data for light transmittance. The two years of study were measurably different in terms of upstream contributions and resulting water clarity. The 2017 data indicate lower flows and greater water clarity up until late summer and the arrival of Hurricane Irma in September.

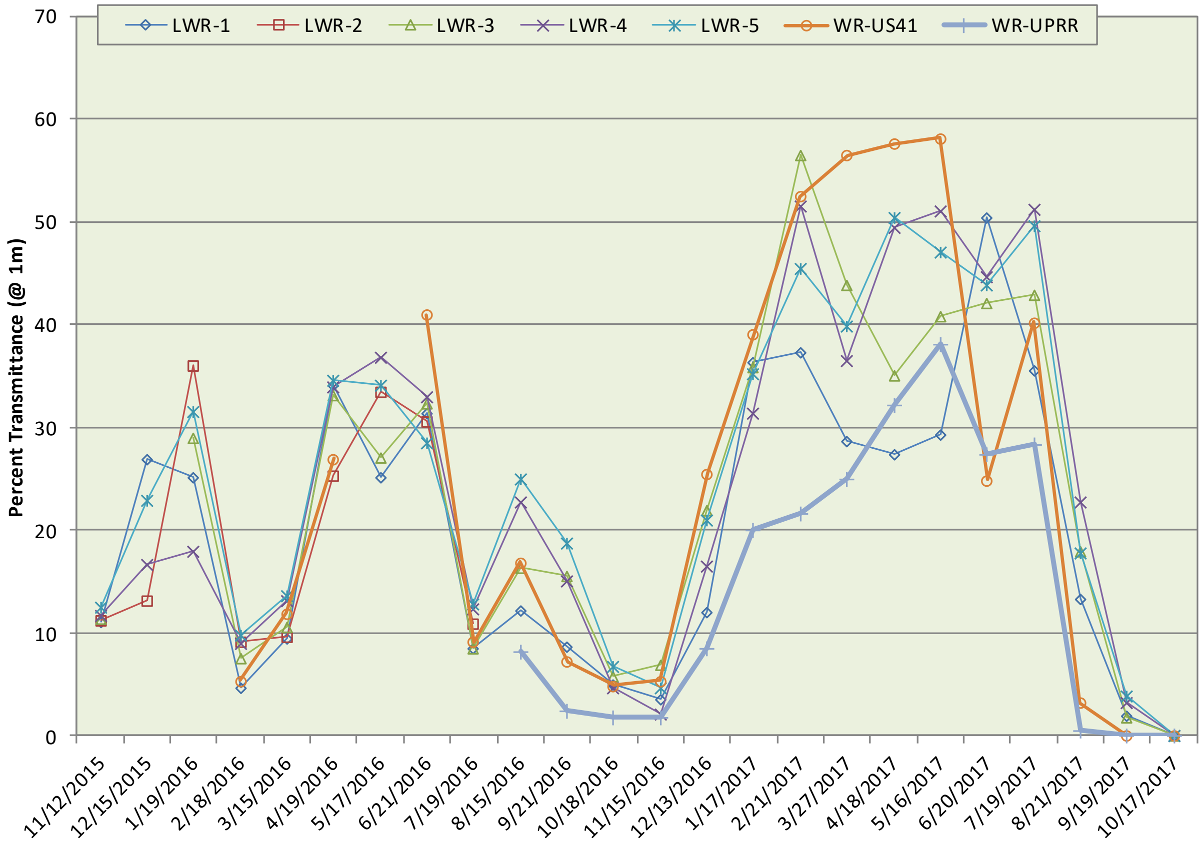


Figure 6. Time-series of light transmittance in the Lower Withlacoochee river during the Phase 2 study period.

Field Parameters

Field parameters are water quality constituents that can be conveniently measured in the field using hand-held meters. These include water temperature, pH, specific conductance, and dissolved oxygen. Field parameter data are provided in Appendix A and briefly summarized as follows.

- Water temperature was seasonal with highest temperatures (about 30°C) recorded during July/August of each year and lowest temperatures (15 to 18°C) recorded in December/January of each year.
- Hydrogen ion (pH) showed a slight seasonal variation with higher values (basic) recorded in summer months (8 to 8.5 s.u.) and lower values (neutral) recorded in the fall and winter (7 to 7.5 s.u.).
- Specific conductance readings showed the influence of upstream groundwater inputs (raising conductance) and at the downstream Lower Withlacoochee River station from tidal estuarine influence during periods of lower flow.
- Dissolved oxygen was generally high (above 6 mg/L) at most stations and did not significantly vary in the lower river segment. Lowest dissolved oxygen concentrations were observed in response to Hurricane Irma.

Water Quality Analytical Results

Detailed data for 36 analytical parameters that were sampled by WSI during Phase 2 and analyzed by the Florida Department of Environmental Protection's Laboratory in Tallahassee are provided in Appendix A. A brief summary of the results for selected parameters follows.

- Chlorophyll a, a measure of phytoplanktonic algal populations peaked in the Lower Withlacoochee River each year during summer at about 20 µg/L (Figure 7). This is a problem level considered to be indicative of water quality pollution.
- There was a spike in total arsenic concentrations in the Withlacoochee River upstream of US 41 and Rainbow River following the passage of Hurricane Irma in September 2017. This spike was also visible in the Lower Withlacoochee River study area. The highest value of 2.5 µg/L did not exceed the water quality criterion of 50 µg/L. Total iron also peaked in the river during that same time period at about 2.5 mg/L, about two and one-half times higher than the state standard of 1 mg/L.
- Nitrate nitrogen is elevated in all stations below the Rainbow River due to inputs from the springs feeding that river. While upstream nitrate concentrations were generally less than 0.2 mg/L, the US 41 station averaged about 1 mg/L over the two-year study and downstream stations in the Lower Withlacoochee River study area averaged between 0.4 and 0.5 mg/L.
- A number of herbicides were detected in the Lower Withlacoochee River study area. The most significant concentrations of an aquatic herbicide (fluridone is the active ingredient in SONAR® a broad spectrum and very persistent herbicide typically used for hydrilla control) was detected at all downstream stations with peaks during each summer growing season (Figure 8). Also, a clear slug of 2,4-D systemic, organic herbicide appeared in the Lower Withlacoochee River stations from June through August 2017 (see graph in Appendix A). This herbicide was not detected at the US 41 station downstream of the Rainbow River, indicating that it was probably applied in Lake Rousseau. The algicide Diuron was detected at the Lower Withlacoochee River stations in July 2016 and 2017.

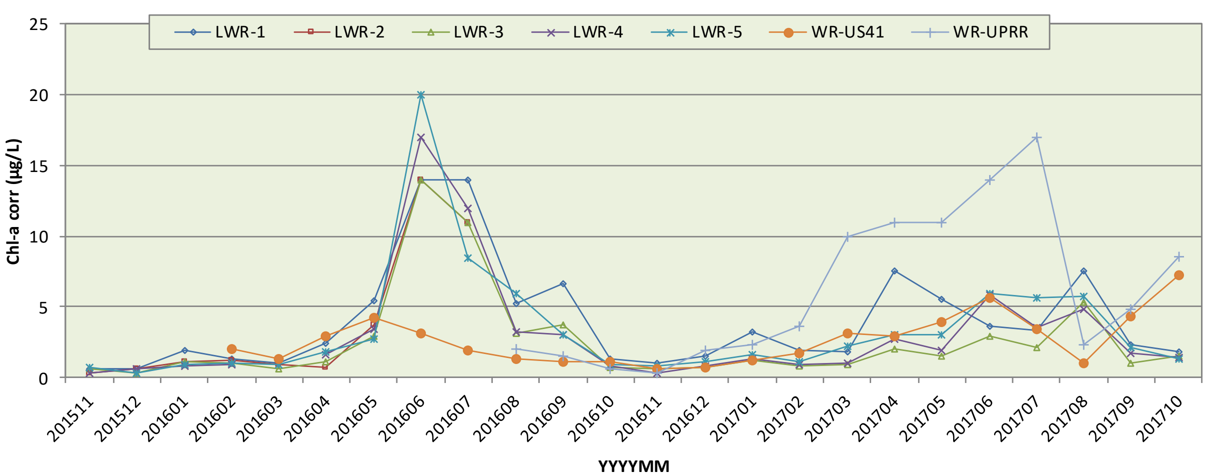


Figure 7. Time-series of chlorophyll a in the Lower Withlacoochee River Phase 2 study.

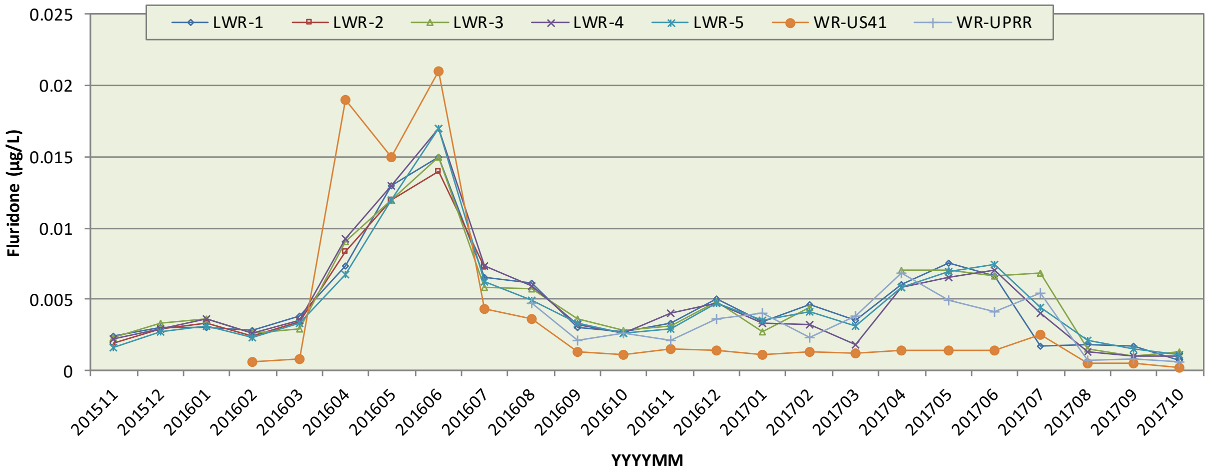


Figure 8. Time-series of fluridone concentrations recorded in the Phase 2 Lower Withlacoochee River study.

A recording multi-parameter data sonde deployed in the Lower Withlacoochee River recorded periods of high turbidity in the river in early February 2016, the first half of March 2016, and a couple of days in June 2016. Turbidity data from Lake Rousseau were not available to determine the origin of these elevated turbidity numbers.

The presence of impounded Lake Rousseau did not greatly influence the water quality in the Lower Withlacoochee River, during the period of this study. Based on the results of the monthly sampling frequency, there was limited evidence of plant management activities in Lake Rousseau affecting water quality in the Lower Withlacoochee River, although capturing a complete treatment event might be challenging due to the frequency of sampling required.

The elevated nitrate levels, primarily due to the inflow from the Rainbow River, were likely responsible for an algal bloom evident in the Lower Withlacoochee River chlorophyll data during the summer of 2016. This bloom did not otherwise impair water quality in the Lower Withlacoochee River. During the period of this Phase 2 study, there was no evidence of other significant water quality impacts in the Lower Withlacoochee River due to residential or commercial activities.

Sediments

Sediment samples were collected and analyzed semi-annually at the same stations where water quality samples were collected. Laboratory results are summarized in Appendix B. Sediment samples often provide a record of conditions on and within the river over a longer period. Parameters analyzed included: nutrients (nitrogen and phosphorus), sediment characteristics (particle size distribution, organic content), and limited metals (arsenic, copper, and iron). Arsenic, copper, and iron concentrations in the river sediments were significantly elevated at station LWR-3 near the former powerplant.

Biological and Human Use Sampling

Biological and human use sampling for this project was used to look more broadly at the ecosystem. Biological sampling evaluated the flora and fauna observed during the field trips as well as data collected by other agencies or entities. Human uses such as land development for private homes, docks, and commercial sites, as well as boating observations, were recorded. Collection and analysis of biological and human use data in the Lower Withlacoochee River study area is not yet complete and no preliminary results are included in this interim report.

Phase 2 Supplemental Studies

Phase 2 monitoring of the Lower Withlacoochee River Study Area was completed in October 2017; however, supplemental sampling will be conducted to help fill in some gaps in the existing information collected during Phase 2. The following supplemental monitoring tasks were agreed upon (subject to available funding) by WAR and WSI.

Macroinvertebrate Sampling (@ 2 stations, semi-annual events)

Macroinvertebrates are the small organisms at the bottom of the aquatic food chain. They have long been used by the FDEP as a sensitive indicator of ecosystem health. The original Phase 2 scope included macroinvertebrate sampling by FDEP. During Phase 2 sampling, FDEP scientists made the decision to not collect macroinvertebrate samples because their habitat assessment found unsuitable conditions. WSI recommends further documenting this ecosystem impairment by sampling the macroinvertebrate community.

WSI will conduct semi-quantitative sampling of macroinvertebrate populations along the lower river and compare to a similar stretch of the Withlacoochee River upstream of Lake Rousseau. Sampling techniques will include sweep net sampling and taxonomic analyses to estimate macroinvertebrate diversity and populations. These are useful indicators in assessing the overall health or condition of water bodies, as they will respond to many kinds of pollutants, physical disturbance, and hydrologic changes. Comparisons will be made between the macroinvertebrate populations collected upstream and downstream of Lake Rousseau.

Suspended and Floating Solids Monitoring (@ 2 stations, 2 events)

Aquatic plant management activities in the Rainbow River and Lake Rousseau kill aquatic vegetation, resulting in decaying plant material settling in the lake and discharging down the spillway into the Lower Withlacoochee River. This dead and decaying vegetation results in impacts to river water quality and aesthetics. The original Phase 2 monitoring program did not address contributions of floating and suspended plant and detrital material into the lower river that contributes to habitat smothering and consumption of dissolved oxygen. The magnitude of this impact to the lower river can be quantified by specialized sampling techniques.

Suspended and floating solids entering the lower river via the Bypass Canal will be quantified using submerged plankton nets and floating plant traps. Downstream export of suspended living and dead material will be estimated on the lower river by sampling at two stations (LWR-1 and LWR-4). These data will also be used for evaluating the ecosystem metabolism (see below). This task assumes that a WAR member can provide boat transportation.

Ecosystem Metabolism Analysis

Aquatic ecosystem health is closely tied to primary productivity and community respiration. These processes generate the plant food that fuels the entire food chain leading to fish and other large consumers. Specialized analysis of dissolved oxygen data allows quantification of ecosystem metabolism.

WSI will analyze existing Lower Withlacoochee River upstream and downstream continuous dissolved oxygen data sets to assess gross primary productivity and community respiration in the lower river. This task relies on continuous dissolved oxygen measurements collected during Phase 2 and will not require additional water quality sonde deployments. These data analyses may confirm suspicions about excessive decomposition stress on the lower river due to high organic inputs from Lake Rousseau.

Reporting

WSI will fully document the results of the above monitoring activities and additional data collection efforts in the final Phase 3 report (Lower Withlacoochee River Restoration Plan).

References

Frazer, T. K., Hoyer, M. V., Notestein, S. K., Hale, J. A., & Canfield, Jr., D. E. 2001. *Physical, Chemical and Vegetative Characteristics of Five Gulf Coast Rivers.* University of Florida, Department of Fisheries and Aquatic Sciences. Gainesville, FL.

Wetland Solutions, Inc. 2013. Phase 1 – Summary of Existing Environmental Data. Lower Withlacoochee River Environmental Study. Gainesville, FL.

Appendix A

Water Quality

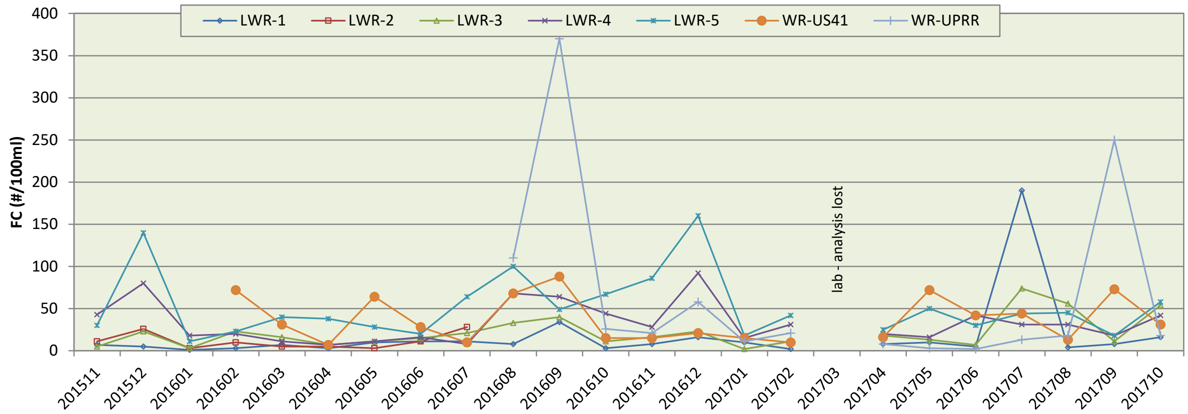
Parameter Group	Parameter	Units	Station	Average	Maximum	Minimum	StdDev	Count	Count BDL	POR	
BACTERIOLOGICAL	FC	#/100ml	LWR-1	16.5	190	1.00	38.4	23	1	11/12/15	10/17/17
			LWR-2	11.3	28.0	3.00	9.45	9	0	11/12/15	7/19/16
			LWR-3	21.4	74.0	2.00	18.5	23	0	11/12/15	10/17/17
			LWR-4	32.9	92.0	7.00	23.6	23	0	11/12/15	10/17/17
			LWR-5	51.6	160	11.0	38.1	23	0	11/12/15	10/17/17
			WR-UPRR	66.4	370	2.00	109	14	0	8/15/16	10/17/17
			WR-US41	36.8	88.0	7.00	26.5	20	0	2/18/16	10/17/17
BIOLOGICAL	Chl-a corr	µg/L	LWR-1	3.96	14.0	0.560	3.76	24	0	11/12/15	10/17/17
			LWR-2	3.73	14.0	0.275	5.13	9	1	11/12/15	7/19/16
			LWR-3	2.53	14.0	0.275	3.33	24	1	11/12/15	10/17/17
			LWR-4	3.03	17.0	0.275	3.97	23	2	11/12/15	10/17/17
			LWR-5	3.33	20.0	0.275	4.15	24	1	11/12/15	10/17/17
			WR-UPRR	6.05	17.0	0.275	5.39	15	1	8/15/16	10/17/17
			WR-US41	2.60	7.20	0.630	1.73	21	0	2/18/16	10/17/17
	Chl-a uncorr	µg/L	LWR-1	5.90	18.0	1.20	4.84	24	0	11/12/15	10/17/17
			LWR-2	6.03	18.0	0.980	6.96	9	0	11/12/15	7/19/16
			LWR-3	4.11	17.0	1.10	4.13	24	0	11/12/15	10/17/17
			LWR-4	4.14	19.0	1.00	4.71	23	0	11/12/15	10/17/17
			LWR-5	4.27	22.0	1.10	4.55	24	0	11/12/15	10/17/17
			WR-UPRR	7.02	18.4	0.610	6.37	15	0	8/15/16	10/17/17
			WR-US41	3.19	8.10	0.950	1.90	21	0	2/18/16	10/17/17
	Chl-a/Pheo Ratio	---	LWR-1	1.36	1.50	1.10	0.100	20	0	11/12/15	6/20/17
			LWR-2	1.29	1.50	1.20	0.105	9	0	11/12/15	7/19/16
			LWR-3	1.29	1.50	1.10	0.099	20	0	11/12/15	6/20/17
			LWR-4	1.39	1.60	1.20	0.151	19	0	11/12/15	6/20/17
			LWR-5	1.44	1.60	1.20	0.118	20	0	11/12/15	6/20/17
			WR-UPRR	1.55	1.70	1.40	0.093	11	0	8/15/16	6/20/17
			WR-US41	1.48	1.60	1.40	0.066	17	0	2/18/16	6/20/17
	Pheo-a	µg/L	LWR-1	2.93	6.40	0.830	1.87	24	0	11/12/15	10/17/17
			LWR-2	3.41	10.0	0.880	2.89	9	0	11/12/15	7/19/16
			LWR-3	2.46	6.60	0.750	1.61	24	0	11/12/15	10/17/17
			LWR-4	1.57	6.30	0.200	1.44	23	3	11/12/15	10/17/17
			LWR-5	1.33	4.00	0.200	0.995	24	2	11/12/15	10/17/17
			WR-UPRR	1.24	7.60	0.200	1.92	15	8	8/15/16	10/17/17
			WR-US41	0.861	1.90	0.200	0.434	21	3	2/18/16	10/17/17
DISSOLVED OXYGEN	DO	%	LWR-1	103	114	76.7	9.85	31	0	11/12/15	10/17/17
			LWR-2	102	109	88.2	6.39	13	0	11/12/15	7/19/16
			LWR-3	96.1	109	70.9	9.82	35	0	11/12/15	10/17/17
			LWR-4	93.4	110	68.7	11.7	36	0	11/12/15	10/17/17
			LWR-5	89.8	114	53.0	15.0	37	0	11/12/15	10/17/17
			WR-UPRR	67.2	106	6.80	29.8	16	0	8/15/16	10/17/17
			WR-US41	70.8	87.0	7.50	19.5	21	0	2/18/16	10/17/17
	DO	mg/L	LWR-1	8.79	10.7	6.11	1.26	31	0	11/12/15	10/17/17
			LWR-2	9.05	10.7	6.92	1.19	13	0	11/12/15	7/19/16
			LWR-3	8.15	10.7	5.73	1.39	35	0	11/12/15	10/17/17
			LWR-4	7.96	10.5	5.09	1.45	36	0	11/12/15	10/17/17
			LWR-5	7.55	10.4	3.91	1.77	37	0	11/12/15	10/17/17
			WR-UPRR	5.56	8.95	0.560	2.49	16	0	8/15/16	10/17/17
			WR-US41	5.97	7.42	0.500	1.71	21	0	2/18/16	10/17/17
GENERAL INORGANIC	Cl-T	mg/L	LWR-1	8.75	11.0	6.80	1.06	24	0	11/12/15	10/17/17
			LWR-2	9.69	11.0	8.80	0.805	9	0	11/12/15	7/19/16
			LWR-3	8.72	11.0	6.80	1.06	24	0	11/12/15	10/17/17
			LWR-4	9.63	21.0	6.90	2.58	24	0	11/12/15	10/17/17
			LWR-5	128	570	10.0	179	24	0	11/12/15	10/17/17
			WR-UPRR	10.7	12.0	7.50	1.42	15	0	8/15/16	10/17/17
			WR-US41	8.69	11.0	7.20	1.01	21	0	2/18/16	10/17/17

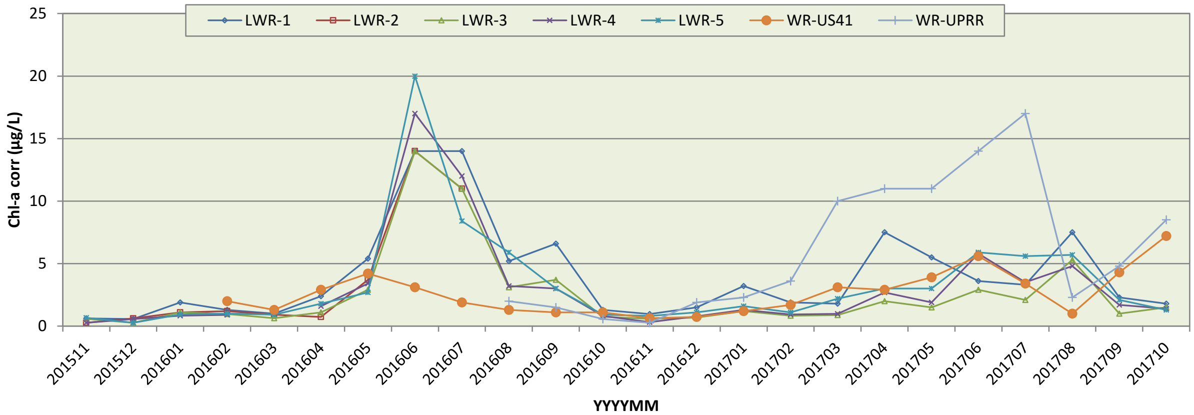
Parameter Group	Parameter	Units	Station	Average	Maximum	Minimum	StdDev	Count	Count BDL	POR	
GENERAL INORGANIC	Hardness	mg/L as CaCO3	LWR-1	133	163	103	14.6	24	0	11/12/15	10/17/17
			LWR-2	143	164	125	11.0	9	0	11/12/15	7/19/16
			LWR-3	134	160	106	13.5	24	0	11/12/15	10/17/17
			LWR-4	135	163	106	14.0	24	0	11/12/15	10/17/17
			LWR-5	175	311	108	59.2	24	0	11/12/15	10/17/17
			WR-UPRR	144	188	94.1	35.1	15	0	8/15/16	10/17/17
			WR-US41	140	156	102	16.1	21	0	2/18/16	10/17/17
	SO4	mg/L	LWR-1	17.2	28.0	9.50	4.40	24	0	11/12/15	10/17/17
			LWR-2	15.7	21.0	11.0	2.65	9	0	11/12/15	7/19/16
			LWR-3	17.1	27.0	9.50	4.24	24	0	11/12/15	10/17/17
			LWR-4	17.4	28.0	9.70	4.54	24	0	11/12/15	10/17/17
			LWR-5	33.5	95.0	10.0	26.4	24	0	11/12/15	10/17/17
			WR-UPRR	25.1	52.0	8.10	13.9	15	0	8/15/16	10/17/17
			WR-US41	17.2	27.0	9.50	4.50	21	0	2/18/16	10/17/17
METAL	As-T	µg/L	LWR-1	0.639	1.84	0.400	0.348	24	0	11/12/15	10/17/17
			LWR-2	0.567	0.770	0.410	0.113	9	0	11/12/15	7/19/16
			LWR-3	0.645	1.70	0.410	0.334	24	0	11/12/15	10/17/17
			LWR-4	0.656	1.71	0.400	0.326	24	0	11/12/15	10/17/17
			LWR-5	0.695	1.69	0.420	0.312	24	0	11/12/15	10/17/17
			WR-UPRR	1.05	2.71	0.580	0.600	15	0	8/15/16	10/17/17
			WR-US41	0.682	2.24	0.330	0.469	21	0	2/18/16	10/17/17
	Ca-T	mg/L	LWR-1	44.7	55.4	34.2	5.55	24	0	11/12/15	10/17/17
			LWR-2	48.5	55.6	43.1	3.75	9	0	11/12/15	7/19/16
			LWR-3	44.8	54.4	33.3	5.16	24	0	11/12/15	10/17/17
			LWR-4	45.1	55.4	34.8	5.25	24	0	11/12/15	10/17/17
			LWR-5	47.4	55.7	37.1	4.60	24	0	11/12/15	10/17/17
			WR-UPRR	49.7	65.4	32.7	11.8	15	0	8/15/16	10/17/17
			WR-US41	47.6	52.7	35.1	5.20	21	0	2/18/16	10/17/17
	Cu-T	µg/L	LWR-1	0.147	0.390	0.050	0.091	24	16	11/12/15	10/17/17
			LWR-2	0.127	0.250	0.050	0.086	9	6	11/12/15	7/19/16
			LWR-3	0.156	0.320	0.050	0.084	24	13	11/12/15	10/17/17
			LWR-4	0.312	3.24	0.050	0.628	24	9	11/12/15	10/17/17
			LWR-5	0.228	0.550	0.050	0.126	24	9	11/12/15	10/17/17
			WR-UPRR	0.207	0.400	0.100	0.109	15	7	8/15/16	10/17/17
			WR-US41	0.171	0.400	0.050	0.098	21	10	2/18/16	10/17/17
	Fe-T	µg/L	LWR-1	221	1,050	35.0	236	24	0	11/12/15	10/17/17
			LWR-2	200	390	72.0	118	9	0	11/12/15	7/19/16
			LWR-3	218	1,080	15.0	243	24	1	11/12/15	10/17/17
			LWR-4	203	1,040	15.0	231	24	1	11/12/15	10/17/17
			LWR-5	204	1,030	32.0	221	24	0	11/12/15	10/17/17
			WR-UPRR	647	2,780	63.0	747	15	0	8/15/16	10/17/17
			WR-US41	369	2,200	15.0	509	21	4	2/18/16	10/17/17
	Mg-T	mg/L	LWR-1	5.27	6.18	3.42	0.738	24	0	11/12/15	10/17/17
			LWR-2	5.35	6.00	4.33	0.561	9	0	11/12/15	7/19/16
			LWR-3	5.30	6.22	3.58	0.714	24	0	11/12/15	10/17/17
			LWR-4	5.33	6.57	3.49	0.769	24	0	11/12/15	10/17/17
			LWR-5	13.7	45.2	3.83	13.1	24	0	11/12/15	10/17/17
			WR-UPRR	4.77	6.47	3.01	1.35	15	0	8/15/16	10/17/17
			WR-US41	5.24	6.20	3.50	0.787	21	0	2/18/16	10/17/17
NITROGEN	NH4-N	mg/L	LWR-1	0.059	0.320	0.016	0.060	24	0	11/12/15	10/17/17
			LWR-2	0.036	0.063	0.016	0.015	9	0	11/12/15	7/19/16
			LWR-3	0.053	0.250	0.017	0.046	24	0	11/12/15	10/17/17
			LWR-4	0.046	0.240	0.007	0.044	24	0	11/12/15	10/17/17
			LWR-5	0.040	0.220	0.003	0.041	24	0	11/12/15	10/17/17
			WR-UPRR	0.041	0.400	0.005	0.100	15	0	8/15/16	10/17/17
			WR-US41	0.035	0.340	0.012	0.070	21	0	2/18/16	10/17/17

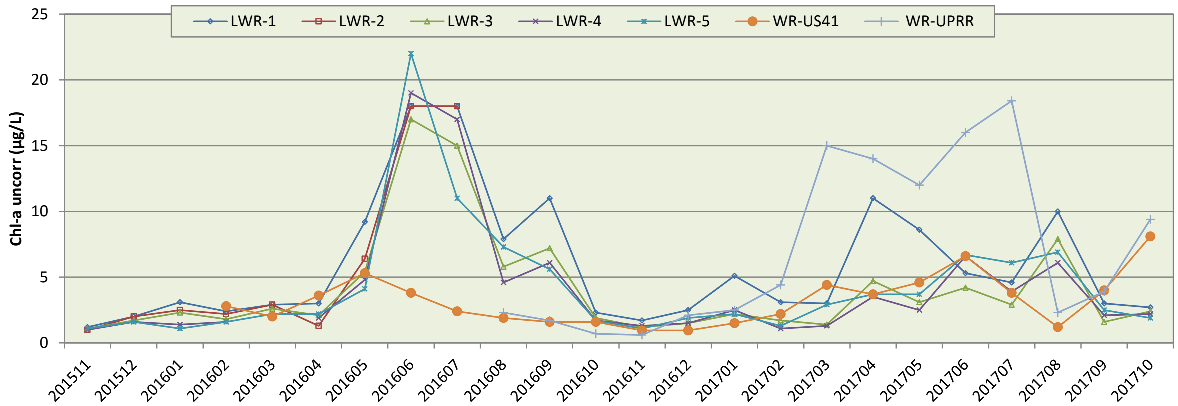
Parameter Group	Parameter	Units	Station	Average	Maximum	Minimum	StdDev	Count	Count BDL	POR	
NITROGEN	NOx-N	mg/L	LWR-1	0.475	0.890	0.120	0.231	24	0	11/12/15	10/17/17
			LWR-2	0.508	0.830	0.180	0.187	9	0	11/12/15	7/19/16
			LWR-3	0.497	0.900	0.170	0.213	24	0	11/12/15	10/17/17
			LWR-4	0.495	0.890	0.180	0.213	24	0	11/12/15	10/17/17
			LWR-5	0.483	0.830	0.140	0.205	24	0	11/12/15	10/17/17
			WR-UPRR	0.128	0.320	0.002	0.107	15	1	8/15/16	10/17/17
			WR-US41	0.951	1.40	0.260	0.324	21	0	2/18/16	10/17/17
	OrgN	mg/L	LWR-1	0.575	1.28	0.373	0.239	24	0	11/12/15	10/17/17
			LWR-2	0.539	0.690	0.374	0.107	9	0	11/12/15	7/19/16
			LWR-3	0.583	1.29	0.302	0.257	24	0	11/12/15	10/17/17
			LWR-4	0.539	1.16	0.316	0.206	24	0	11/12/15	10/17/17
			LWR-5	0.550	1.18	0.322	0.195	24	0	11/12/15	10/17/17
			WR-UPRR	0.902	1.98	0.525	0.437	15	0	8/15/16	10/17/17
			WR-US41	0.647	1.49	0.259	0.373	21	0	2/18/16	10/17/17
	TKN	mg/L	LWR-1	0.633	1.60	0.400	0.283	24	0	11/12/15	10/17/17
			LWR-2	0.576	0.730	0.390	0.115	9	0	11/12/15	7/19/16
			LWR-3	0.608	1.30	0.350	0.236	24	0	11/12/15	10/17/17
			LWR-4	0.585	1.40	0.340	0.238	24	0	11/12/15	10/17/17
			LWR-5	0.591	1.40	0.340	0.225	24	0	11/12/15	10/17/17
			WR-UPRR	0.943	2.00	0.530	0.480	15	0	8/15/16	10/17/17
			WR-US41	0.598	1.60	0.280	0.368	21	0	2/18/16	10/17/17
	TN	mg/L	LWR-1	1.11	1.85	0.620	0.304	24	0	11/12/15	10/17/17
			LWR-2	1.08	1.31	0.690	0.196	9	0	11/12/15	7/19/16
			LWR-3	1.11	1.62	0.630	0.262	24	0	11/12/15	10/17/17
			LWR-4	1.08	1.73	0.620	0.270	24	0	11/12/15	10/17/17
			LWR-5	1.07	1.74	0.650	0.273	24	0	11/12/15	10/17/17
			WR-UPRR	1.07	2.00	0.551	0.451	15	0	8/15/16	10/17/17
			WR-US41	1.55	1.93	1.18	0.184	21	0	2/18/16	10/17/17
OTHER	Acetaminophen	µg/L	LWR-1	0.003	0.010	0.002	0.002	24	23	11/12/15	10/17/17
			LWR-2	0.002	0.002	0.002	0.0000	9	9	11/12/15	7/19/16
			LWR-3	0.003	0.010	0.002	0.002	23	23	11/12/15	10/17/17
			LWR-4	0.003	0.010	0.002	0.002	24	24	11/12/15	10/17/17
			LWR-5	0.003	0.012	0.002	0.003	24	23	11/12/15	10/17/17
			WR-UPRR	0.004	0.013	0.002	0.003	15	14	8/15/16	10/17/17
			WR-US41	0.003	0.012	0.002	0.003	21	20	2/18/16	10/17/17
	Carbamazepine	µg/L	LWR-1	0.0002	0.0003	0.0002	0.0000	24	24	11/12/15	10/17/17
			LWR-2	0.0002	0.0005	0.0002	0.0001	9	8	11/12/15	7/19/16
			LWR-3	0.0002	0.0003	0.0002	0.0000	23	23	11/12/15	10/17/17
			LWR-4	0.0002	0.0003	0.0002	0.0000	24	24	11/12/15	10/17/17
			LWR-5	0.0002	0.0003	0.0002	0.0000	24	24	11/12/15	10/17/17
			WR-UPRR	0.0002	0.0003	0.0002	0.0000	15	15	8/15/16	10/17/17
			WR-US41	0.0002	0.0003	0.0002	0.0000	21	21	2/18/16	10/17/17
	Primidone	µg/L	LWR-1	0.004	0.010	0.002	0.002	24	24	11/12/15	10/17/17
			LWR-2	0.004	0.004	0.004	0.0000	9	9	11/12/15	7/19/16
			LWR-3	0.004	0.010	0.002	0.002	23	23	11/12/15	10/17/17
			LWR-4	0.004	0.010	0.002	0.002	24	24	11/12/15	10/17/17
			LWR-5	0.004	0.010	0.002	0.002	24	24	11/12/15	10/17/17
			WR-UPRR	0.004	0.010	0.002	0.002	15	15	8/15/16	10/17/17
			WR-US41	0.004	0.010	0.002	0.002	21	21	2/18/16	10/17/17
	Sucralose	µg/L	LWR-1	0.031	0.078	0.005	0.023	24	5	11/12/15	10/17/17
			LWR-2	0.043	0.080	0.005	0.023	9	1	11/12/15	7/19/16
			LWR-3	0.032	0.080	0.005	0.023	23	5	11/12/15	10/17/17
			LWR-4	0.034	0.098	0.005	0.026	24	4	11/12/15	10/17/17
			LWR-5	0.034	0.078	0.005	0.022	24	3	11/12/15	10/17/17
			WR-UPRR	0.031	0.110	0.005	0.029	15	3	8/15/16	10/17/17
			WR-US41	0.028	0.066	0.005	0.019	21	4	2/18/16	10/17/17

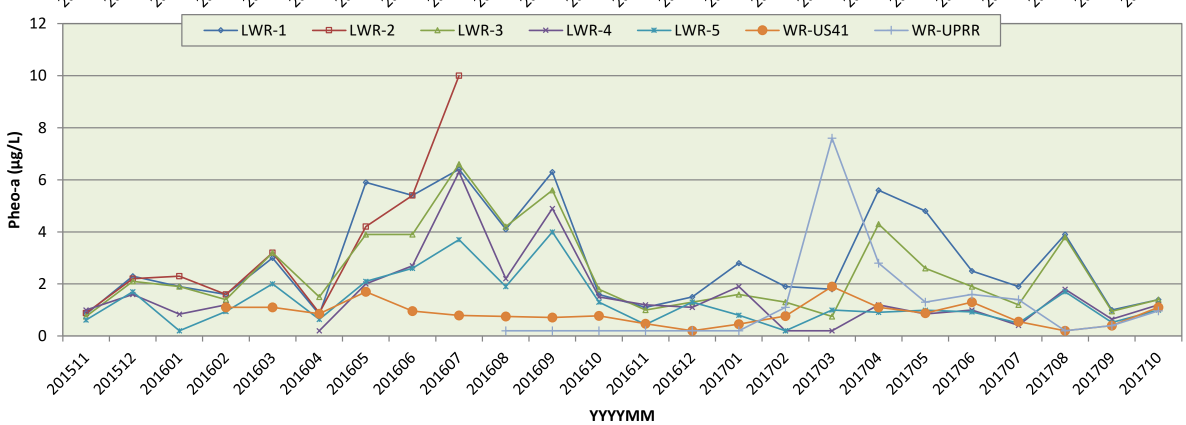
Parameter Group	Parameter	Units	Station	Average	Maximum	Minimum	StdDev	Count	Count BDL	POR	
PESTICIDE	2,4-D	µg/L	LWR-1	0.009	0.039	0.0004	0.014	8	4	3/27/17	10/17/17
			LWR-3	0.010	0.042	0.0004	0.015	7	3	4/18/17	10/17/17
			LWR-4	0.014	0.087	0.0004	0.030	8	5	3/27/17	10/17/17
			LWR-5	0.011	0.068	0.0004	0.023	8	4	3/27/17	10/17/17
			WR-UPRR	0.001	0.003	0.0004	0.0009	8	7	3/27/17	10/17/17
			WR-US41	0.001	0.002	0.0004	0.0005	8	7	3/27/17	10/17/17
	Bentazon	µg/L	LWR-1	0.006	0.049	0.0004	0.017	8	7	3/27/17	10/17/17
			LWR-3	0.0004	0.0005	0.0004	0.0000	7	7	4/18/17	10/17/17
			LWR-4	0.006	0.049	0.0004	0.017	8	7	3/27/17	10/17/17
			LWR-5	0.006	0.048	0.0004	0.017	8	7	3/27/17	10/17/17
			WR-UPRR	0.006	0.048	0.0004	0.017	8	7	3/27/17	10/17/17
			WR-US41	0.006	0.049	0.0004	0.017	8	7	3/27/17	10/17/17
	Diquat	µg/L	LWR-1	0.500	0.500	0.500		1	1	8/15/16	8/15/16
			WR-US41	0.500	0.500	0.500		1	1	8/15/16	8/15/16
	Diuron	µg/L	LWR-1	0.002	0.010	0.0004	0.002	24	22	11/12/15	10/17/17
			LWR-2	0.002	0.012	0.001	0.004	9	8	11/12/15	7/19/16
			LWR-3	0.002	0.010	0.0004	0.002	23	21	11/12/15	10/17/17
			LWR-4	0.002	0.015	0.0004	0.003	24	22	11/12/15	10/17/17
			LWR-5	0.002	0.010	0.0004	0.002	24	21	11/12/15	10/17/17
			WR-UPRR	0.002	0.004	0.0004	0.001	15	14	8/15/16	10/17/17
			WR-US41	0.001	0.002	0.0004	0.0007	21	21	2/18/16	10/17/17
	Endothall	µg/L	LWR-1	2.50	2.50	2.50		1	1	8/15/16	8/15/16
			WR-US41	2.50	2.50	2.50		1	1	8/15/16	8/15/16
	Fenuron	µg/L	LWR-1	0.010	0.027	0.004	0.012	4	3	7/19/17	10/17/17
			LWR-3	0.007	0.014	0.004	0.005	4	3	7/19/17	10/17/17
			LWR-4	0.004	0.004	0.004	0.00	4	4	7/19/17	10/17/17
			LWR-5	0.004	0.004	0.004	0.00	4	4	7/19/17	10/17/17
			WR-UPRR	0.004	0.004	0.004	0.00	4	4	7/19/17	10/17/17
			WR-US41	0.004	0.004	0.004	0.00	4	4	7/19/17	10/17/17
	Fluridone	µg/L	LWR-1	0.005	0.015	0.0007	0.003	24	0	11/12/15	10/17/17
			LWR-2	0.006	0.014	0.002	0.004	9	0	11/12/15	7/19/16
			LWR-3	0.005	0.015	0.001	0.003	23	0	11/12/15	10/17/17
			LWR-4	0.005	0.017	0.0010	0.004	24	0	11/12/15	10/17/17
			LWR-5	0.005	0.017	0.001	0.004	24	0	11/12/15	10/17/17
			WR-UPRR	0.003	0.007	0.0006	0.002	15	0	8/15/16	10/17/17
			WR-US41	0.004	0.021	0.0002	0.006	21	1	2/18/16	10/17/17
	Imidacloprid	µg/L	LWR-1	0.002	0.003	0.0004	0.0007	24	22	11/12/15	10/17/17
			LWR-2	0.002	0.002	0.002	0.0000	9	9	11/12/15	7/19/16
			LWR-3	0.002	0.003	0.0004	0.0007	23	21	11/12/15	10/17/17
			LWR-4	0.002	0.003	0.0004	0.0007	24	22	11/12/15	10/17/17
			LWR-5	0.002	0.003	0.0004	0.0007	24	23	11/12/15	10/17/17
			WR-UPRR	0.001	0.002	0.0004	0.0007	15	13	8/15/16	10/17/17
			WR-US41	0.002	0.002	0.0004	0.0007	21	19	2/18/16	10/17/17
	Linuron	µg/L	LWR-1	0.002	0.005	0.002	0.0006	24	24	11/12/15	10/17/17
			LWR-2	0.002	0.002	0.002	0.0000	9	9	11/12/15	7/19/16
			LWR-3	0.002	0.005	0.002	0.0006	23	23	11/12/15	10/17/17
			LWR-4	0.002	0.005	0.002	0.0006	24	24	11/12/15	10/17/17
			LWR-5	0.002	0.005	0.002	0.0006	24	24	11/12/15	10/17/17
			WR-UPRR	0.002	0.005	0.002	0.0008	15	15	8/15/16	10/17/17
			WR-US41	0.002	0.005	0.002	0.0007	21	21	2/18/16	10/17/17
	MCPP	µg/L	LWR-1	0.001	0.002	0.001	0.0005	8	8	3/27/17	10/17/17
			LWR-3	0.001	0.002	0.001	0.0004	7	7	4/18/17	10/17/17
			LWR-4	0.001	0.002	0.001	0.0005	8	8	3/27/17	10/17/17
			LWR-5	0.001	0.002	0.001	0.0005	8	8	3/27/17	10/17/17
			WR-UPRR	0.001	0.002	0.001	0.0005	8	8	3/27/17	10/17/17
			WR-US41	0.001	0.002	0.001	0.0005	8	8	3/27/17	10/17/17
	Triclopyr	µg/L	LWR-1	0.003	0.005	0.002	0.001	8	8	3/27/17	10/17/17
			LWR-3	0.002	0.005	0.002	0.001	7	7	4/18/17	10/17/17
			LWR-4	0.003	0.005	0.002	0.001	8	8	3/27/17	10/17/17
			LWR-5	0.003	0.005	0.002	0.001	8	8	3/27/17	10/17/17
			WR-UPRR	0.003	0.005	0.002	0.001	8	8	3/27/17	10/17/17
			WR-US41	0.003	0.005	0.002	0.001	8	8	3/27/17	10/17/17

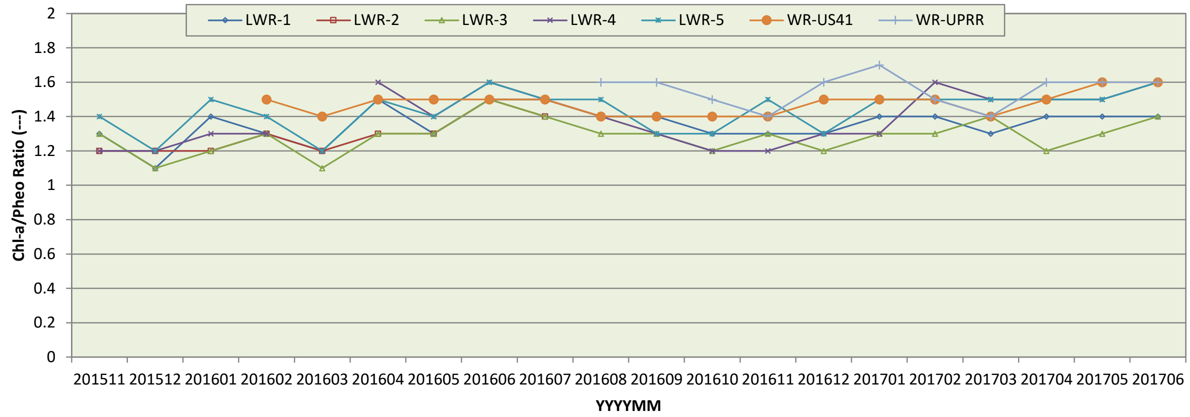
Parameter Group	Parameter	Units	Station	Average	Maximum	Minimum	StdDev	Count	Count BDL	POR	
PHOSPHORUS	OrthoP	mg/L	LWR-1	0.028	0.170	0.002	0.035	24	1	11/12/15	10/17/17
			LWR-2	0.025	0.058	0.002	0.016	9	1	11/12/15	7/19/16
			LWR-3	0.030	0.180	0.004	0.036	24	0	11/12/15	10/17/17
			LWR-4	0.030	0.170	0.002	0.034	24	1	11/12/15	10/17/17
			LWR-5	0.030	0.170	0.002	0.034	24	1	11/12/15	10/17/17
			WR-UPRR	0.056	0.280	0.002	0.077	15	3	8/15/16	10/17/17
			WR-US41	0.043	0.180	0.017	0.044	21	0	2/18/16	10/17/17
	TP	mg/L	LWR-1	0.061	0.230	0.028	0.041	24	0	11/12/15	10/17/17
			LWR-2	0.061	0.084	0.039	0.017	9	0	11/12/15	7/19/16
			LWR-3	0.060	0.240	0.025	0.044	24	0	11/12/15	10/17/17
			LWR-4	0.057	0.230	0.026	0.041	24	0	11/12/15	10/17/17
			LWR-5	0.058	0.220	0.029	0.038	24	0	11/12/15	10/17/17
			WR-UPRR	0.097	0.410	0.028	0.103	15	0	8/15/16	10/17/17
			WR-US41	0.076	0.320	0.033	0.072	21	0	2/18/16	10/17/17
PHYSICAL	Color	CPU	LWR-1	82.4	440	11.0	96.3	24	0	11/12/15	10/17/17
			LWR-2	69.9	130	23.0	39.6	9	0	11/12/15	7/19/16
			LWR-3	81.7	440	10.0	96.0	24	0	11/12/15	10/17/17
			LWR-4	83.3	450	10.0	100	24	0	11/12/15	10/17/17
			LWR-5	81.2	430	9.70	94.9	24	0	11/12/15	10/17/17
			WR-UPRR	185	530	22.0	183	15	0	8/15/16	10/17/17
			WR-US41	101	440	5.20	117	21	0	2/18/16	10/17/17
	Depth	m	LWR-1	1.53	3.40	0.550	0.553	23	0	11/12/15	10/17/17
			LWR-2	2.89	3.70	2.40	0.453	9	0	11/12/15	7/19/16
			LWR-3	3.52	4.10	2.60	0.372	22	0	11/12/15	10/17/17
			LWR-4	5.57	6.70	3.60	0.797	24	0	11/12/15	10/17/17
			LWR-5	5.02	6.40	3.60	0.799	25	0	11/12/15	10/17/17
			WR-UPRR	2.98	3.40	2.80	0.201	15	0	8/15/16	10/17/17
			WR-US41	2.15	2.60	1.80	0.255	21	0	2/18/16	10/17/17
	pH	SU	LWR-1	7.87	8.61	6.90	0.427	31	0	11/12/15	10/17/17
			LWR-2	7.90	8.27	7.32	0.293	13	0	11/12/15	7/19/16
			LWR-3	7.83	8.30	6.86	0.339	35	0	11/12/15	10/17/17
			LWR-4	7.77	8.29	6.94	0.367	36	0	11/12/15	10/17/17
			LWR-5	7.74	8.29	6.64	0.400	37	0	11/12/15	10/17/17
			WR-UPRR	7.33	8.01	6.12	0.571	16	0	8/15/16	10/17/17
			WR-US41	7.41	7.87	6.31	0.451	21	0	2/18/16	10/17/17
	Secchi	m	LWR-1	1.19	1.80	0.250	0.419	24	0	11/12/15	10/17/17
			LWR-2	1.91	2.70	1.30	0.523	9	0	11/12/15	7/19/16
			LWR-3	2.15	3.60	0.350	1.06	24	0	11/12/15	10/17/17
			LWR-4	2.37	5.70	0.300	1.37	24	0	11/12/15	10/17/17
			LWR-5	1.93	3.70	0.400	0.849	25	0	11/12/15	10/17/17
			WR-UPRR	1.30	2.20	0.150	0.697	15	0	8/15/16	10/17/17
			WR-US41	1.60	2.60	0.300	0.634	21	0	2/18/16	10/17/17
	SpCond	umhos/cm	LWR-1	267	314	209	31.1	31	0	11/12/15	10/17/17
			LWR-2	294	314	264	17.5	13	0	11/12/15	7/19/16
			LWR-3	267	315	211	29.0	35	0	11/12/15	10/17/17
			LWR-4	1,143	17,930	214	3,673	36	0	11/12/15	10/17/17
			LWR-5	3,967	36,353	231	8,573	37	0	11/12/15	10/17/17
			WR-UPRR	290	370	190	69.8	16	0	8/15/16	10/17/17
			WR-US41	278	313	209	31.0	21	0	2/18/16	10/17/17
	Turb	NTU	LWR-1	0.238	1.10	0.150	0.238	25	21	11/12/15	10/17/17
			LWR-2	0.213	0.400	0.150	0.116	8	6	11/12/15	7/19/16
			LWR-3	0.267	1.10	0.150	0.266	29	23	11/12/15	10/17/17
			LWR-4	0.268	2.20	0.150	0.385	30	23	11/12/15	10/17/17
			LWR-5	1.31	11.0	0.150	2.37	31	20	11/12/15	10/17/17
			WR-UPRR	1.41	7.20	0.150	2.23	15	8	8/15/16	10/17/17
			WR-US41	0.583	5.90	0.150	1.41	18	16	2/18/16	10/17/17
TEMPERATURE	Wtr Temp	C	LWR-1	23.8	30.4	15.4	4.54	31	0	11/12/15	10/17/17
			LWR-2	21.8	29.7	15.4	4.86	13	0	11/12/15	7/19/16
			LWR-3	24.2	30.6	15.4	4.57	35	0	11/12/15	10/17/17
			LWR-4	24.5	31.1	15.4	4.72	36	0	11/12/15	10/17/17
			LWR-5	24.3	31.0	15.5	4.68	37	0	11/12/15	10/17/17
			WR-UPRR	25.3	31.0	19.0	4.13	16	0	8/15/16	10/17/17
			WR-US41	24.1	27.2	18.2	2.47	21	0	2/18/16	10/17/17

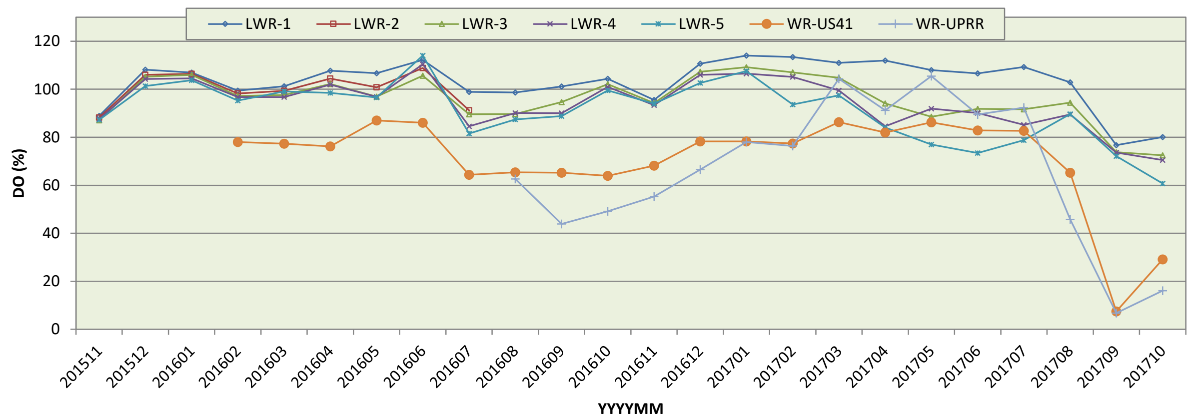

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
FC (#/100ml)
lab - analysis lost

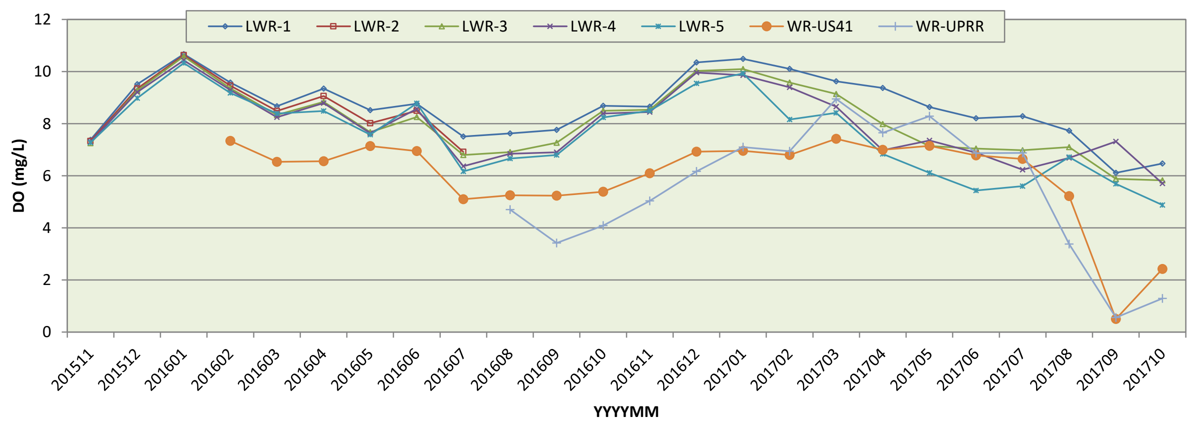

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Chl-a corr (µg/L)
YYYYMM

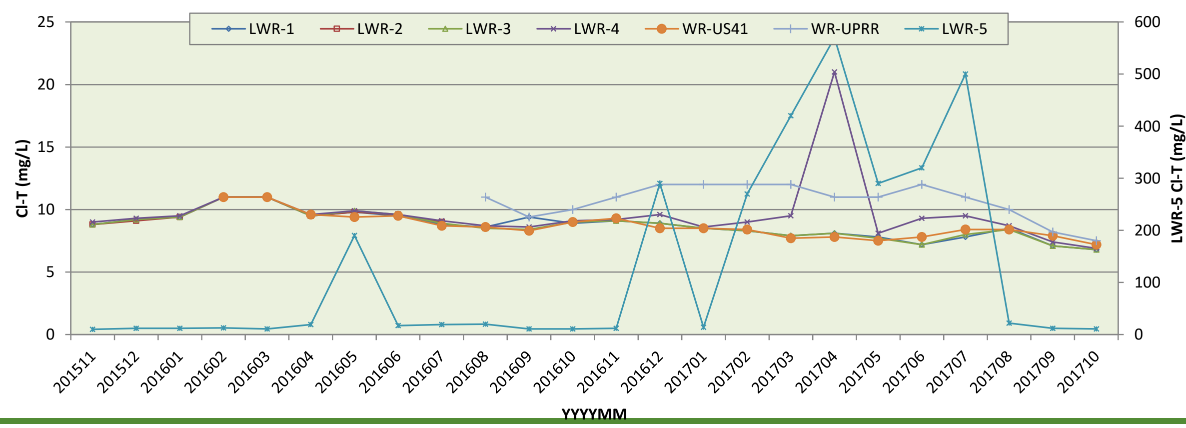

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Chl-a uncorr (µg/L)

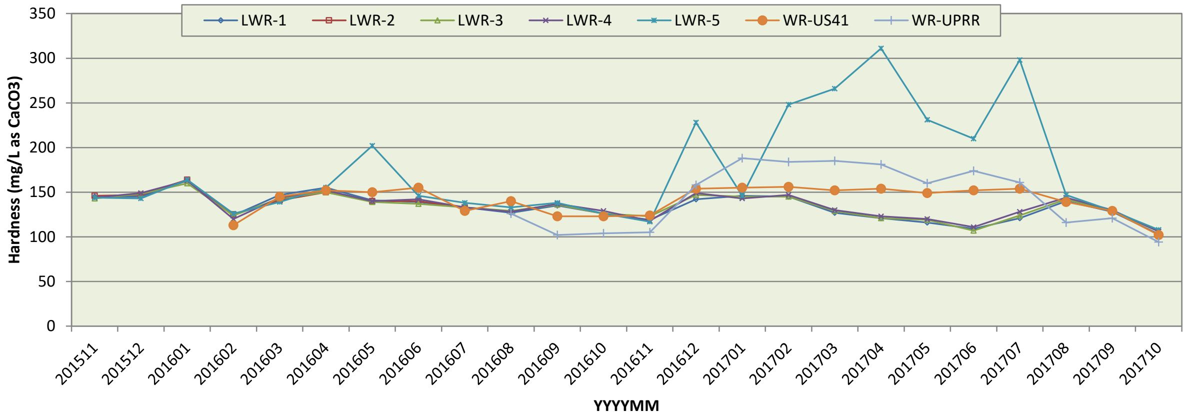

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Pheo-a (µg/L)
YYYYMM

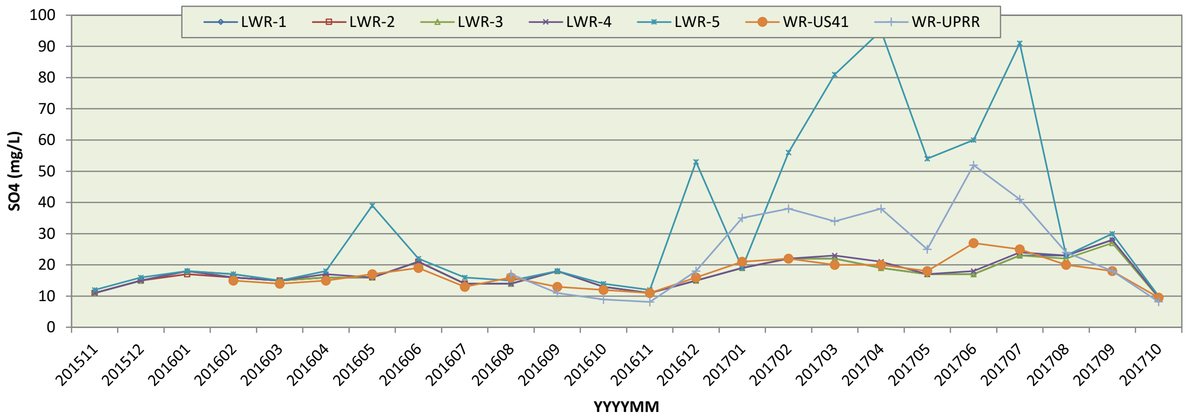

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Chl-a/Pheo Ratio (---)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
201511 201512 201601 201602 201603 201604 201605 201606 201607 201608 201609 201610 201611 201612 201701 201702 201703 201704 201705 201706
YYYYMM

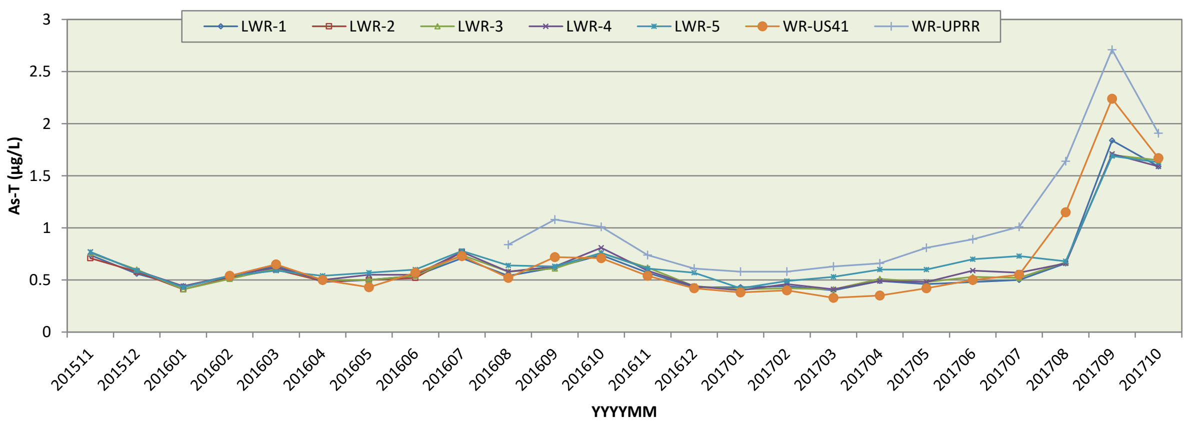

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
DO (%)
120
100
80
60
40
20
0
201511 201512 201601 201602 201603 201604 201605 201606 201607 201608 201609 201610 201611 201612 201701 201702 201703 201704 201705 201706 201707 201708 201709 201710
YYYYMM

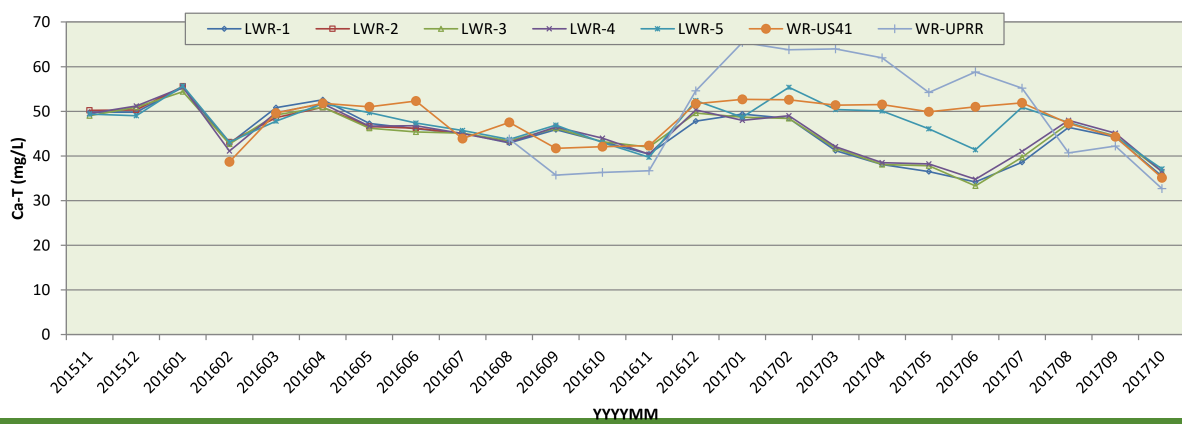

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
DO (mg/L)
12
10
8
6
4
2
0
201511 201512 201601 201602 201603 201604 201605 201606 201607 201608 201609 201610 201611 201612 201701 201702 201703 201704 201705 201706 201707 201708 201709 201710
YYYYMM

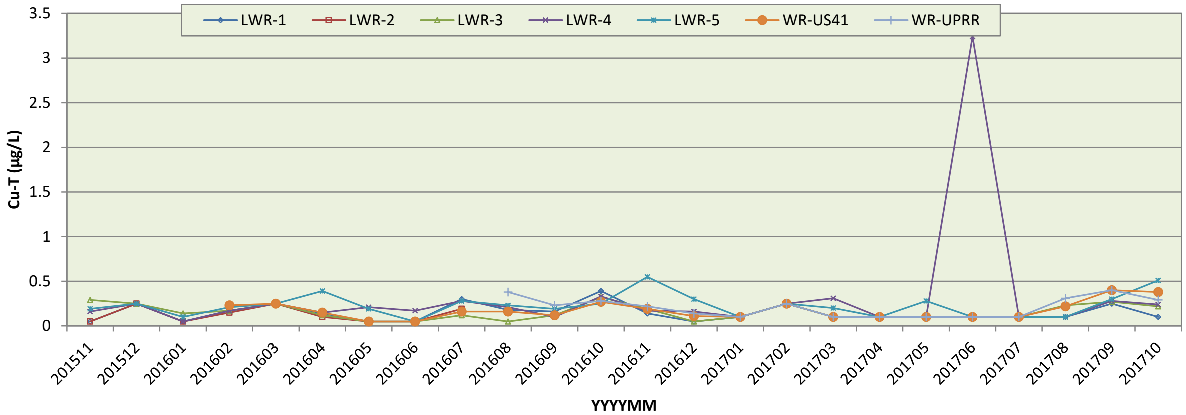

LWR-1
LWR-2
LWR-3
LWR-4
WR-US41
WR-UPRR
LWR-5
Cl-T (mg/L)
25
20
15
10
5
0
LWR-5 Cl-T (mg/L)
600
500
400
300
200
100
0
201511 201512 201601 201602 201603 201604 201605 201606 201607 201608 201609 201610 201611 201612 201701 201702 201703 201704 201705 201706 201707 201708 201709 201710
YYYYMM

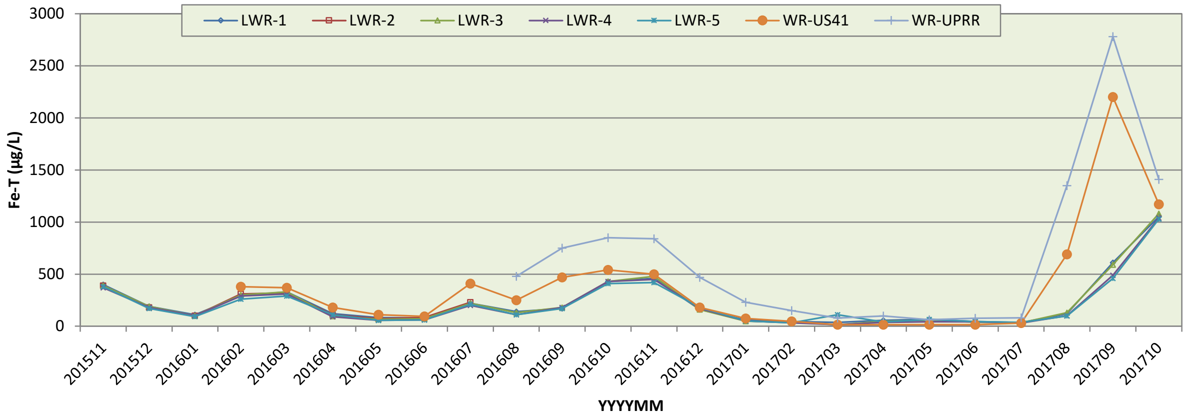

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Hardness (mg/L as CaCO3)
0
50
100
150
200
250
300
350
201511
201512
201601
201602
201603
201604
201605
201606
201607
201608
201609
201610
201611
201612
201701
201702
201703
201704
201705
201706
201707
201708
201709
201710
YYYYMM

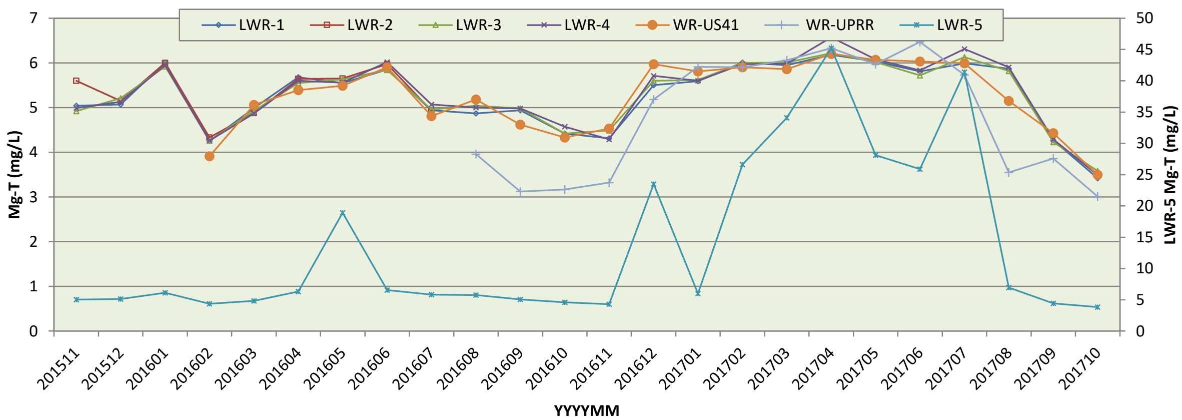

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
SO4 (mg/L)
0
10
20
30
40
50
60
70
80
90
100
201511
201512
201601
201602
201603
201604
201605
201606
201607
201608
201609
201610
201611
201612
201701
201702
201703
201704
201705
201706
201707
201708
201709
201710
YYYYMM

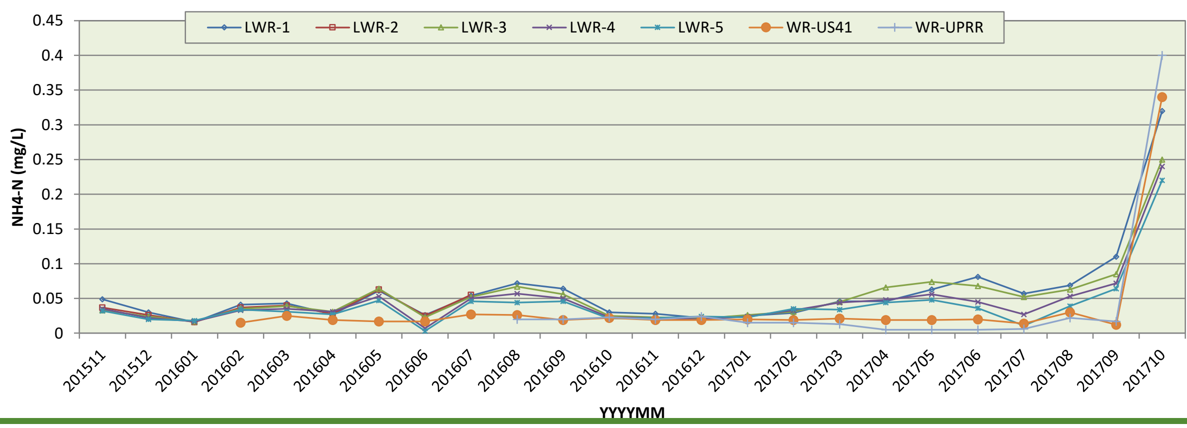

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
As-T (µg/L)
0
0.5
1
1.5
2
2.5
3
201511
201512
201601
201602
201603
201604
201605
201606
201607
201608
201609
201610
201611
201612
201701
201702
201703
201704
201705
201706
201707
201708
201709
201710
YYYYMM

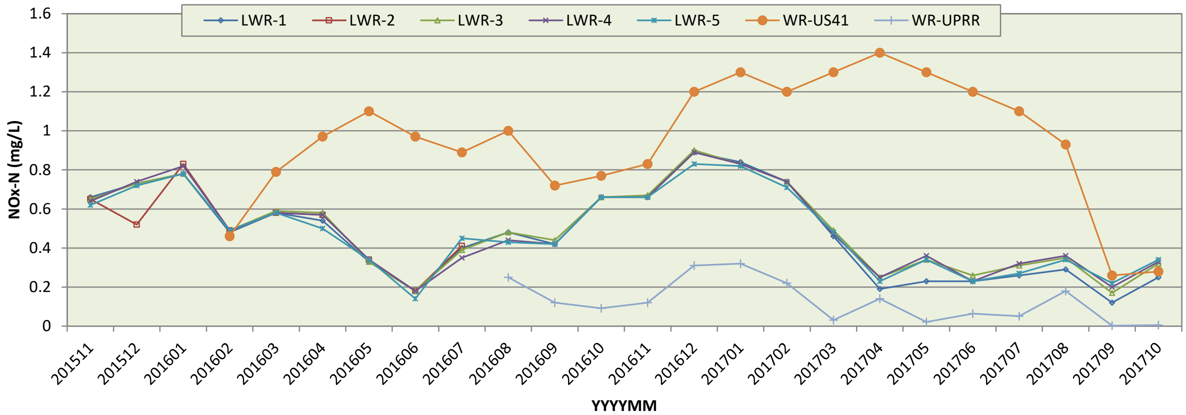

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Ca-T (mg/L)
0
10
20
30
40
50
60
70
201511
201512
201601
201602
201603
201604
201605
201606
201607
201608
201609
201610
201611
201612
201701
201702
201703
201704
201705
201706
201707
201708
201709
201710
YYYYMM

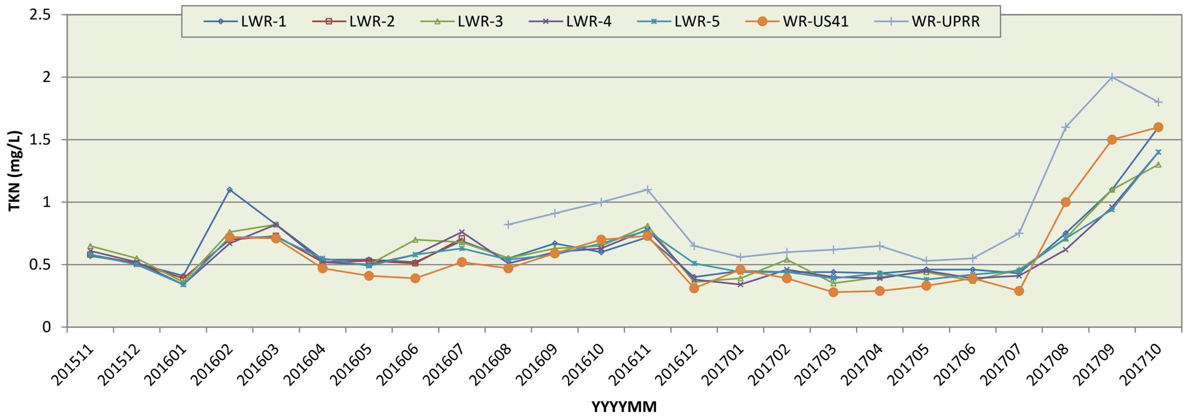

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Cu-T (µg/L)
YYYYMM

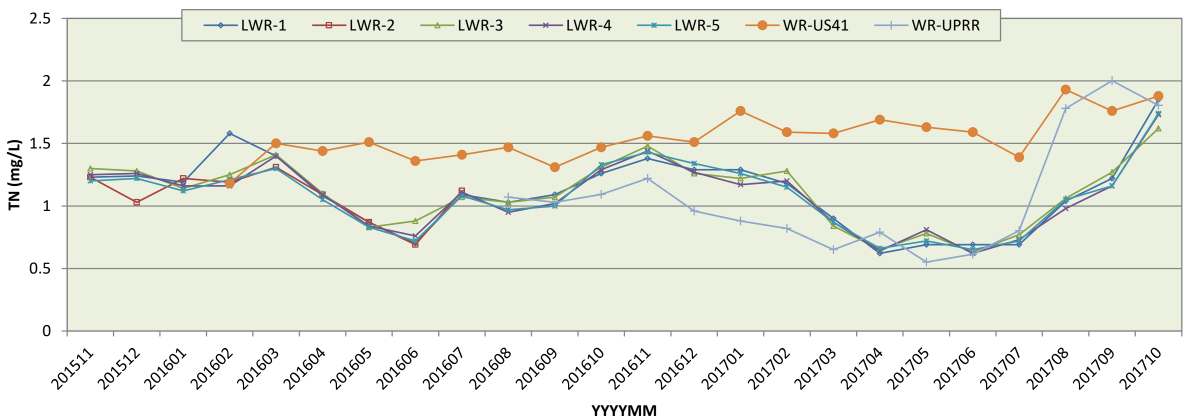

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Fe-T (µg/L)
YYYYMM

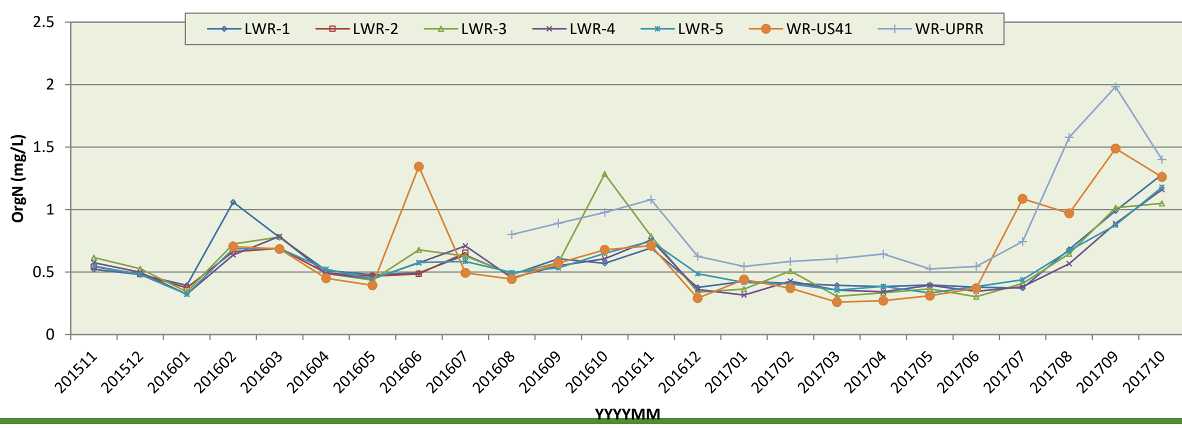

LWR-1
LWR-2
LWR-3
LWR-4
WR-US41
WR-UPRR
LWR-5
Mg-T (mg/L)
LWR-5 Mg-T (mg/L)
YYYYMM

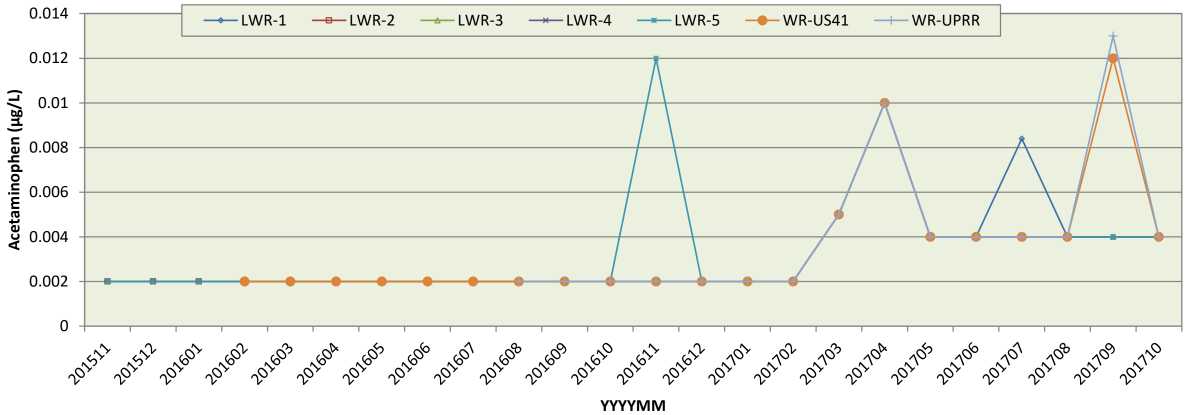

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
NH4-N (mg/L)
YYYYMM

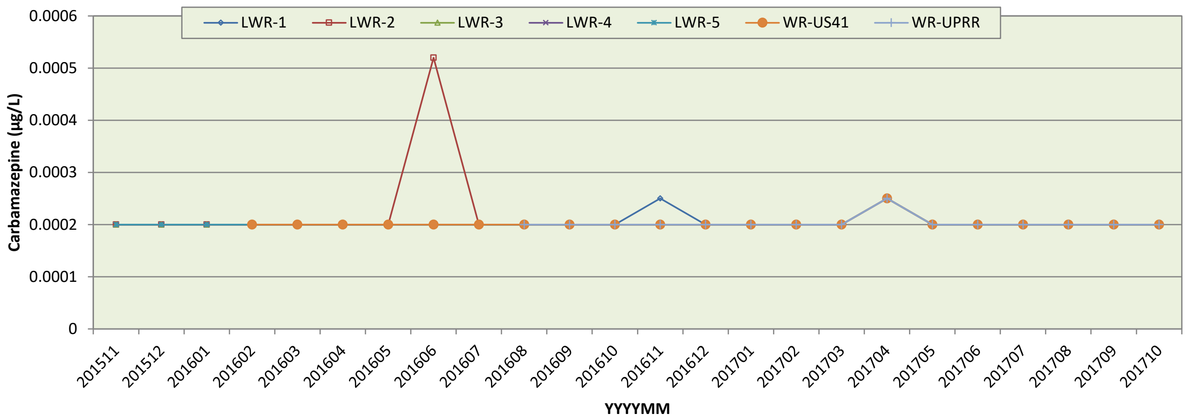

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
NOx-N (mg/L)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
201511 201512 201601 201602 201603 201604 201605 201606 201607 201608 201609 201610 201611 201612 201701 201702 201703 201704 201705 201706 201707 201708 201709 201710
YYYYMM

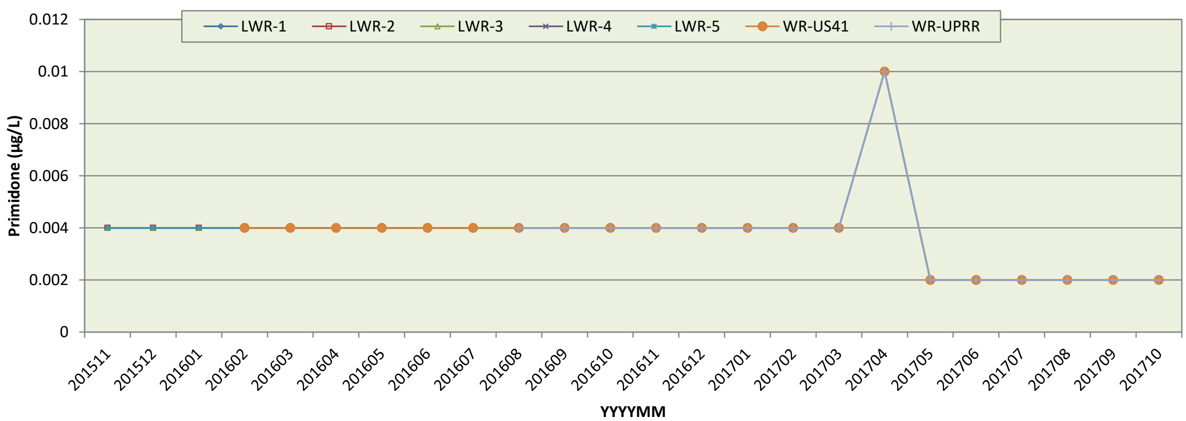

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
TKN (mg/L)
2.5
2
1.5
1
0.5
0
201511 201512 201601 201602 201603 201604 201605 201606 201607 201608 201609 201610 201611 201612 201701 201702 201703 201704 201705 201706 201707 201708 201709 201710
YYYYMM

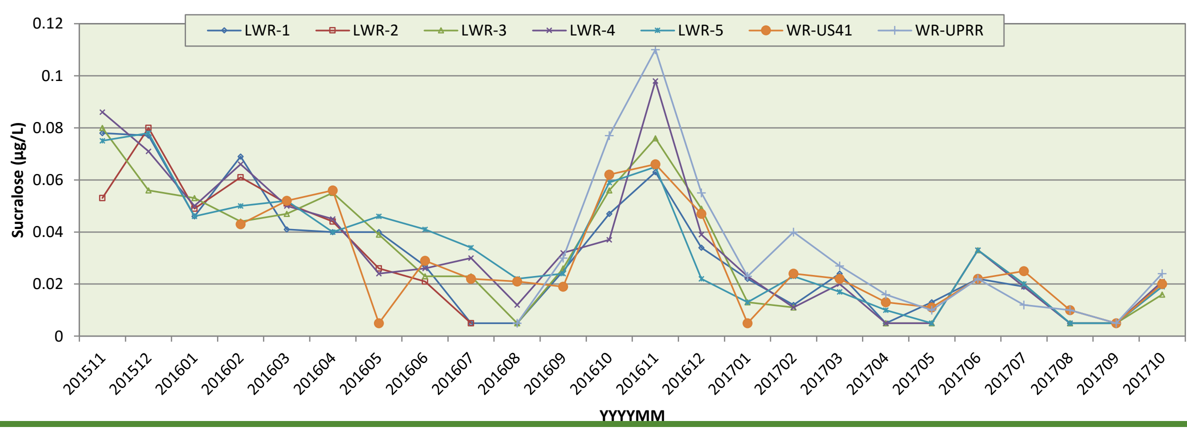

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
TN (mg/L)
2.5
2
1.5
1
0.5
0
201511 201512 201601 201602 201603 201604 201605 201606 201607 201608 201609 201610 201611 201612 201701 201702 201703 201704 201705 201706 201707 201708 201709 201710
YYYYMM

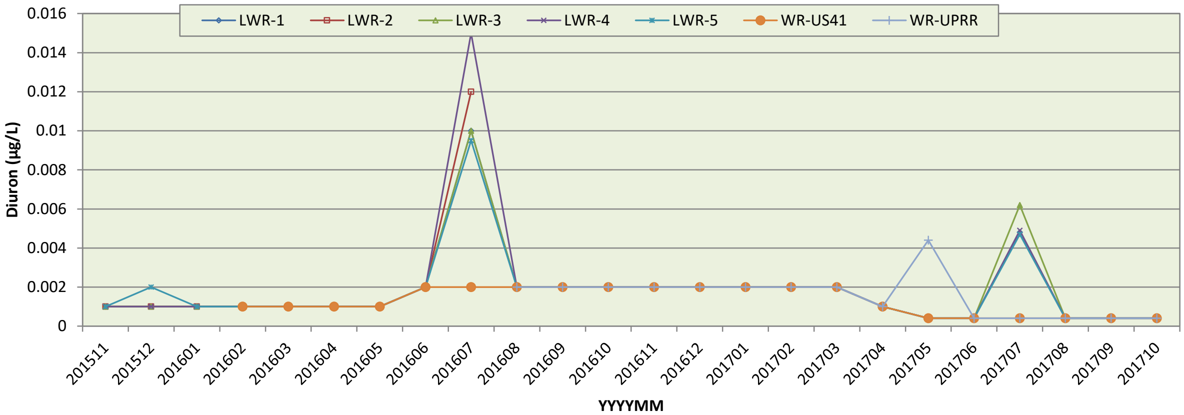

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
OrgN (mg/L)
2.5
2
1.5
1
0.5
0
201511 201512 201601 201602 201603 201604 201605 201606 201607 201608 201609 201610 201611 201612 201701 201702 201703 201704 201705 201706 201707 201708 201709 201710
YYYYMM

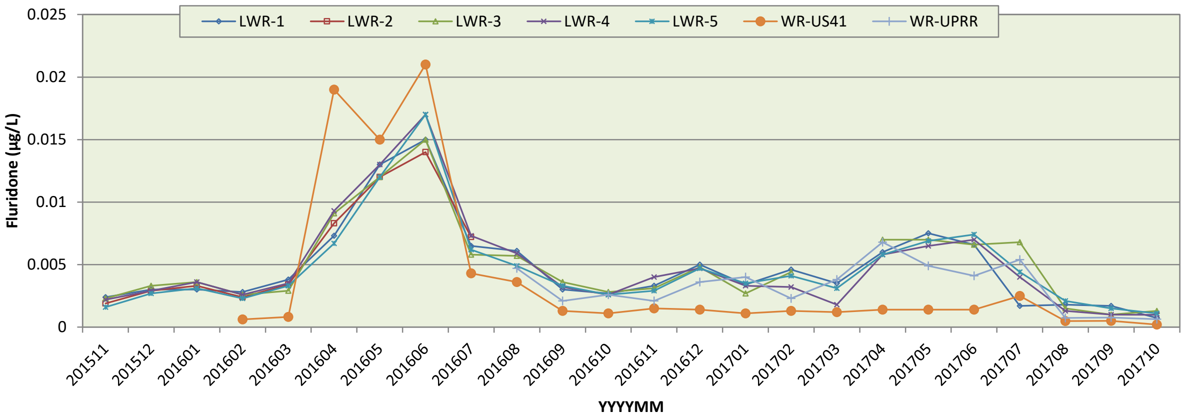

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Acetaminophen (µg/L)
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
201511 201512 201601 201602 201603 201604 201605 201606 201607 201608 201609 201610 201611 201612 201701 201702 201703 201704 201705 201706 201707 201708 201709 201710
YYYYMM

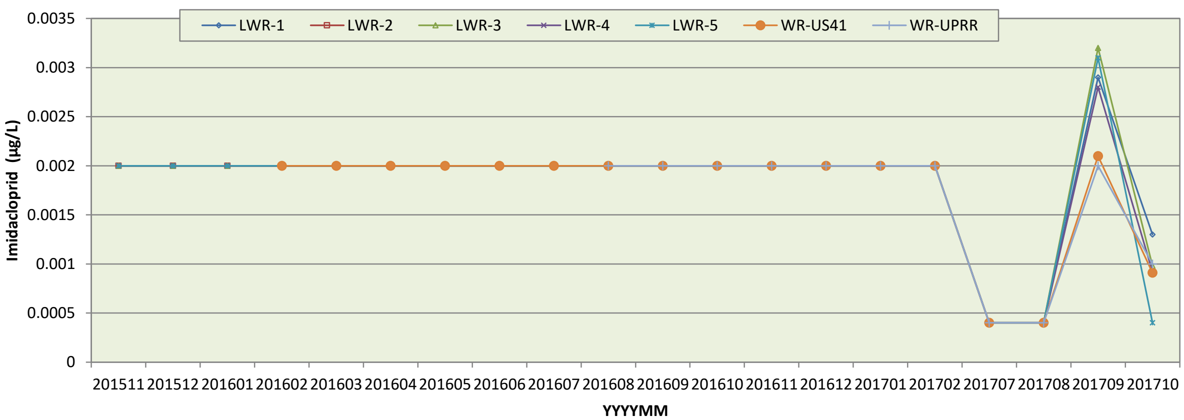

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Carbamazepine (µg/L)
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0
201511 201512 201601 201602 201603 201604 201605 201606 201607 201608 201609 201610 201611 201612 201701 201702 201703 201704 201705 201706 201707 201708 201709 201710
YYYYMM

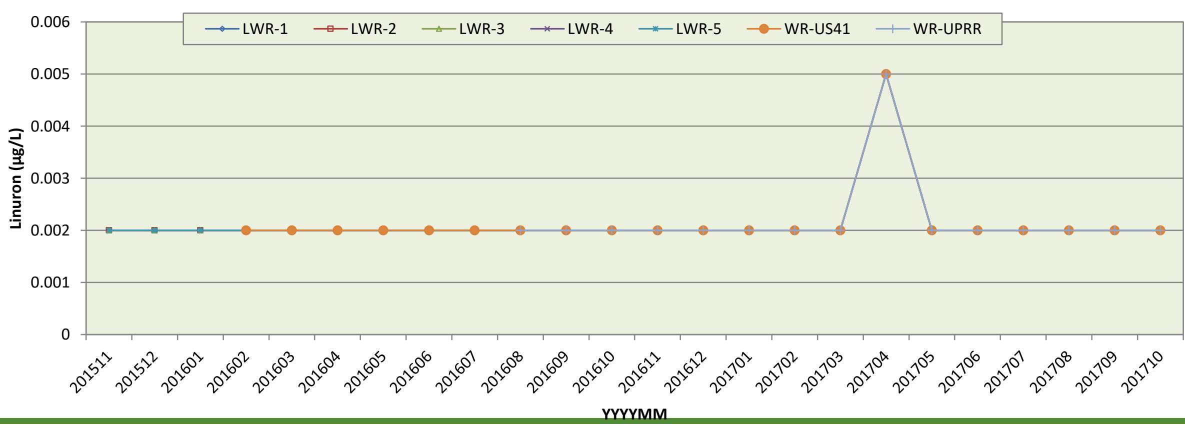

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Primidone (µg/L)
0.012
0.01
0.008
0.006
0.004
0.002
0
201511 201512 201601 201602 201603 201604 201605 201606 201607 201608 201609 201610 201611 201612 201701 201702 201703 201704 201705 201706 201707 201708 201709 201710
YYYYMM

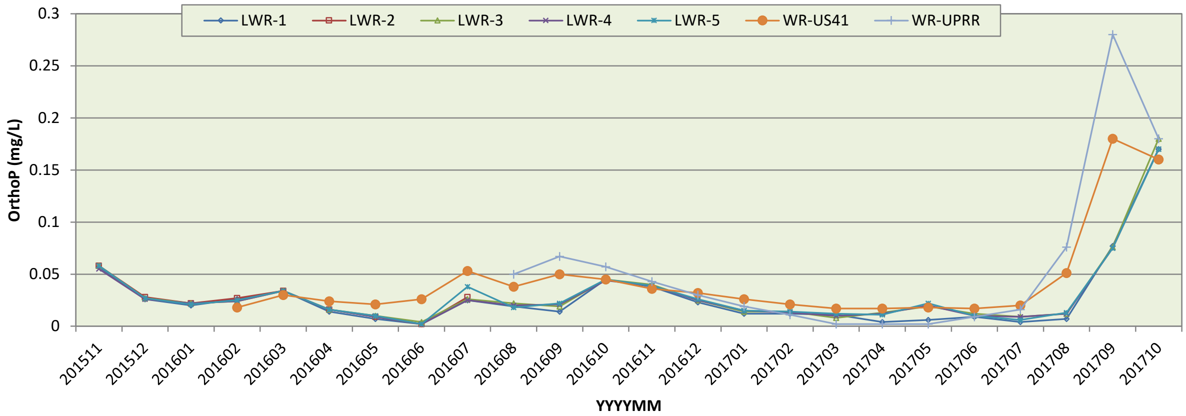

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Sucralose (µg/L)
0.12
0.1
0.08
0.06
0.04
0.02
0
201511 201512 201601 201602 201603 201604 201605 201606 201607 201608 201609 201610 201611 201612 201701 201702 201703 201704 201705 201706 201707 201708 201709 201710
YYYYMM

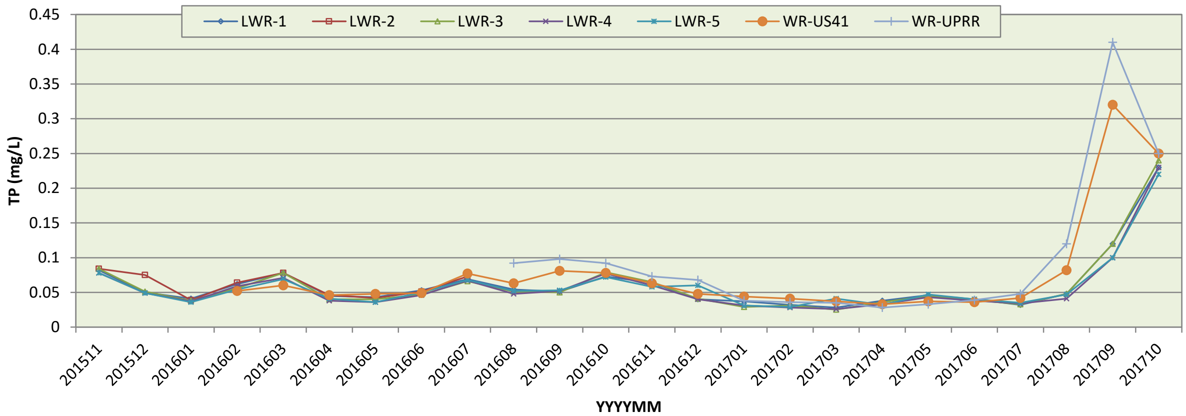

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Diuron (µg/L)
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
201511
201512
201601
201602
201603
201604
201605
201606
201607
201608
201609
201610
201611
201612
201701
201702
201703
201704
201705
201706
201707
201708
201709
201710
YYYYMM

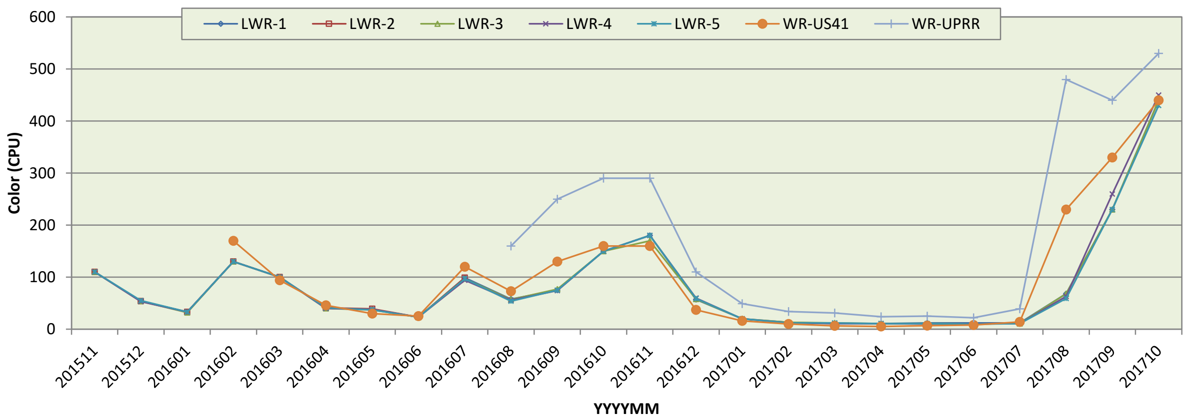

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Fluridone (µg/L)
0.025
0.02
0.015
0.01
0.005
0
201511
201512
201601
201602
201603
201604
201605
201606
201607
201608
201609
201610
201611
201612
201701
201702
201703
201704
201705
201706
201707
201708
201709
201710
YYYYMM

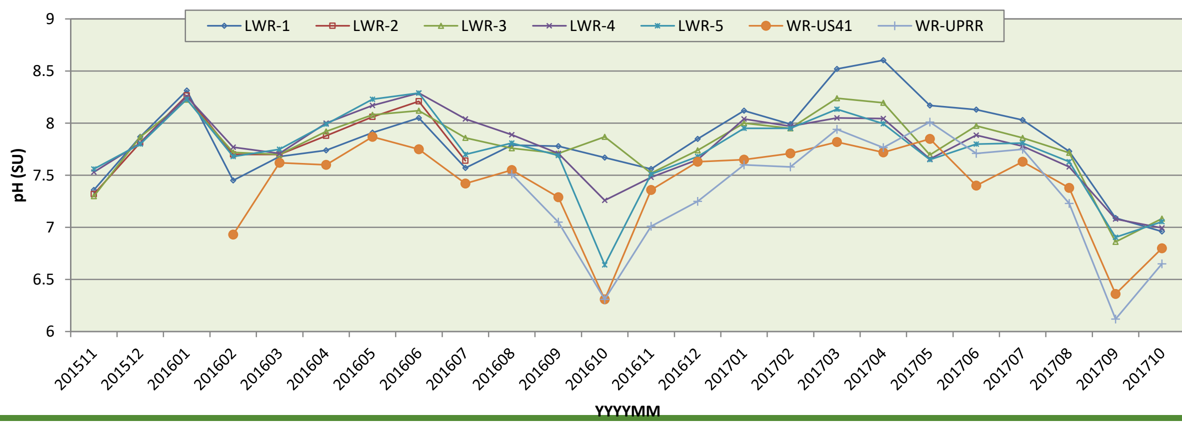

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Imidacloprid (µg/L)
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
201511
201512
201601
201602
201603
201604
201605
201606
201607
201608
201609
201610
201611
201612
201701
201702
201707
201708
201709
201710
YYYYMM

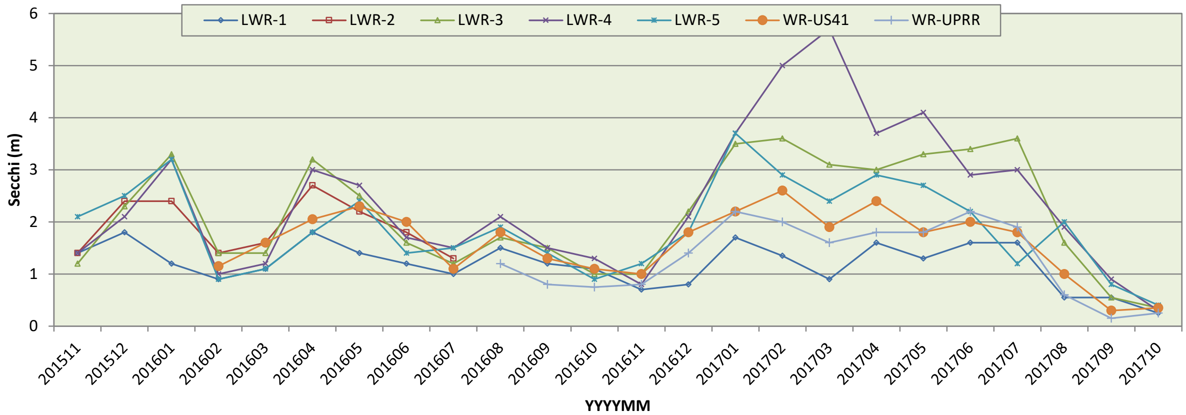

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Linuron (µg/L)
0.006
0.005
0.004
0.003
0.002
0.001
0
201511
201512
201601
201602
201603
201604
201605
201606
201607
201608
201609
201610
201611
201612
201701
201702
201703
201704
201705
201706
201707
201708
201709
201710
YYYYMM

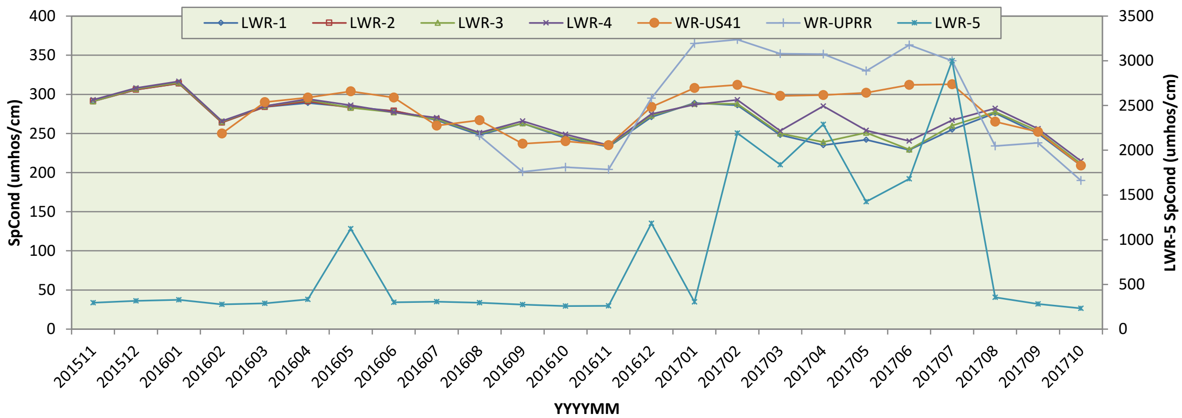

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
OrthoP (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
201511 201512 201601 201602 201603 201604 201605 201606 201607 201608 201609 201610 201611 201612 201701 201702 201703 201704 201705 201706 201707 201708 201709 201710
YYYYMM

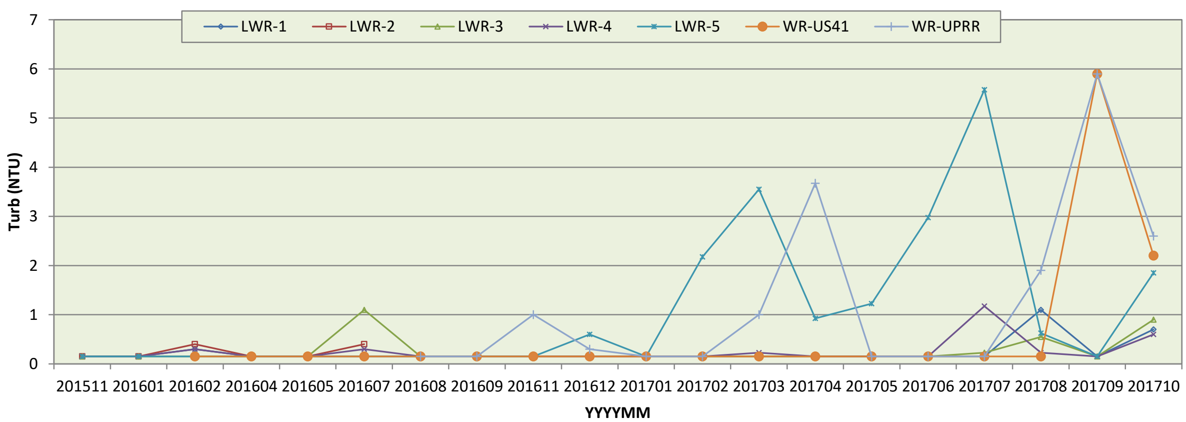

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
TP (mg/L)
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
201511 201512 201601 201602 201603 201604 201605 201606 201607 201608 201609 201610 201611 201612 201701 201702 201703 201704 201705 201706 201707 201708 201709 201710
YYYYMM

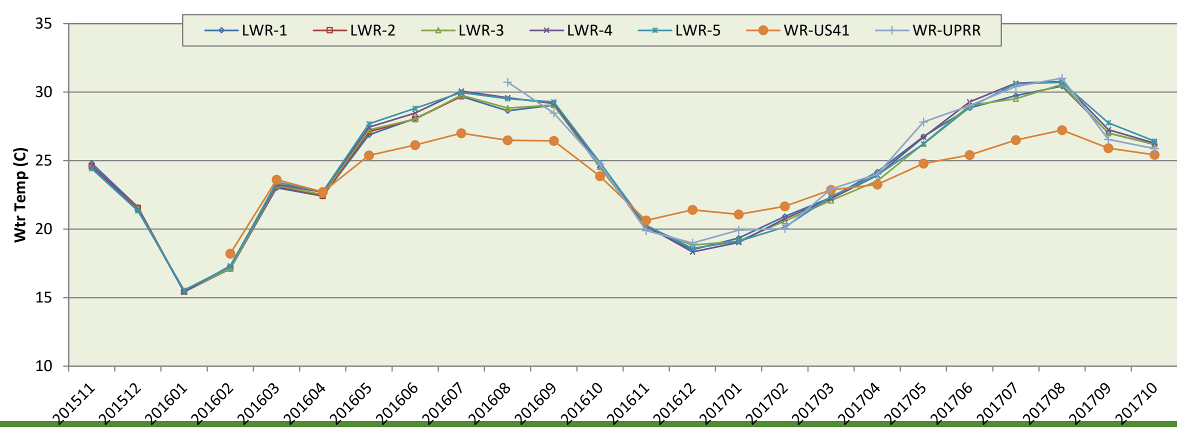

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Color (CPU)
600
500
400
300
200
100
0
201511 201512 201601 201602 201603 201604 201605 201606 201607 201608 201609 201610 201611 201612 201701 201702 201703 201704 201705 201706 201707 201708 201709 201710
YYYYMM

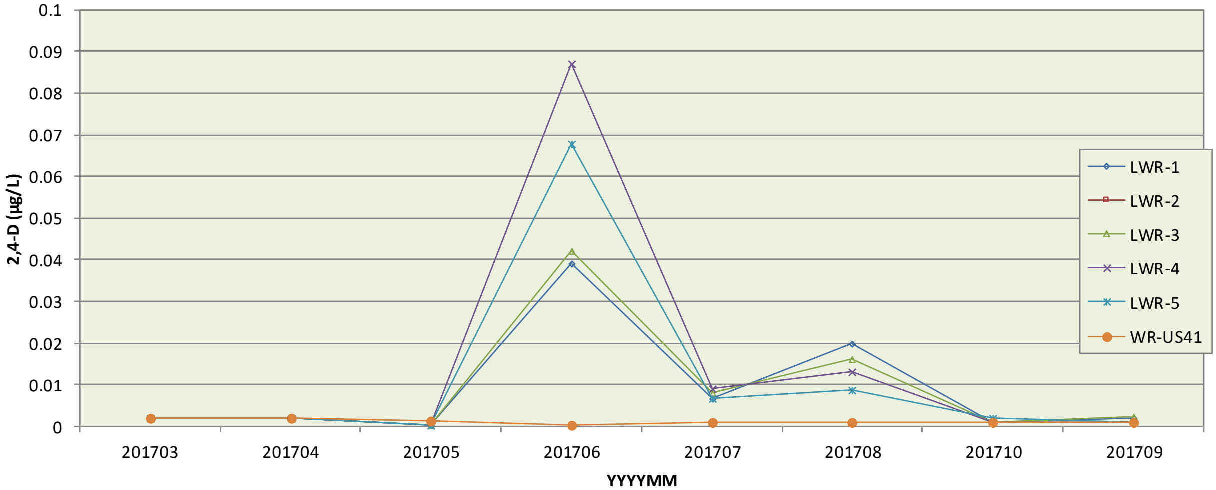

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
pH (SU)
9
8.5
8
7.5
7
6.5
6
201511 201512 201601 201602 201603 201604 201605 201606 201607 201608 201609 201610 201611 201612 201701 201702 201703 201704 201705 201706 201707 201708 201709 201710
YYYYMM

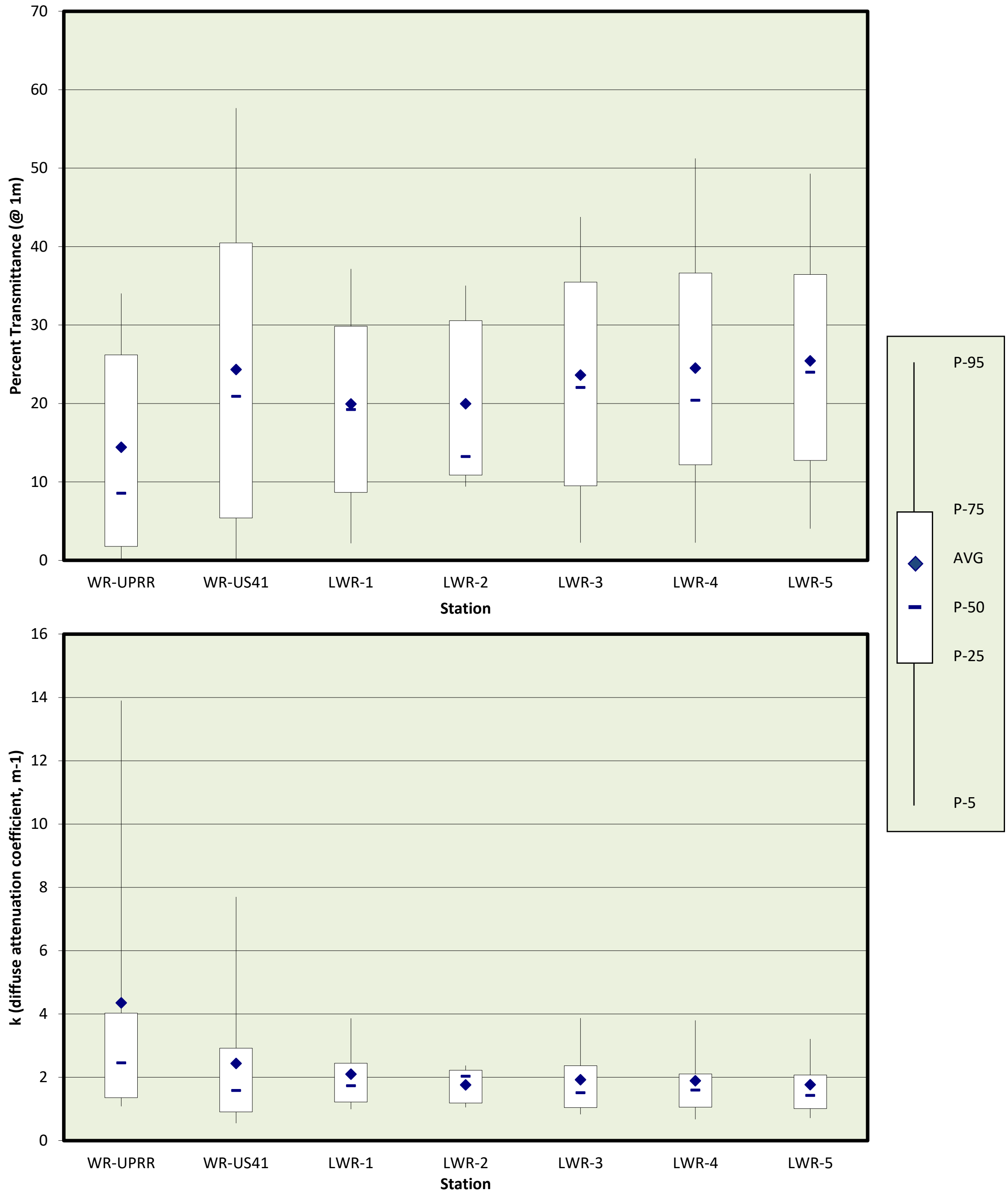

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Secchi (m)
YYYYMM


LWR-1
LWR-2
LWR-3
LWR-4
WR-US41
WR-UPRR
LWR-5
SpCond (umhos/cm)
LWR-5 SpCond (umhos/cm)
YYYYMM

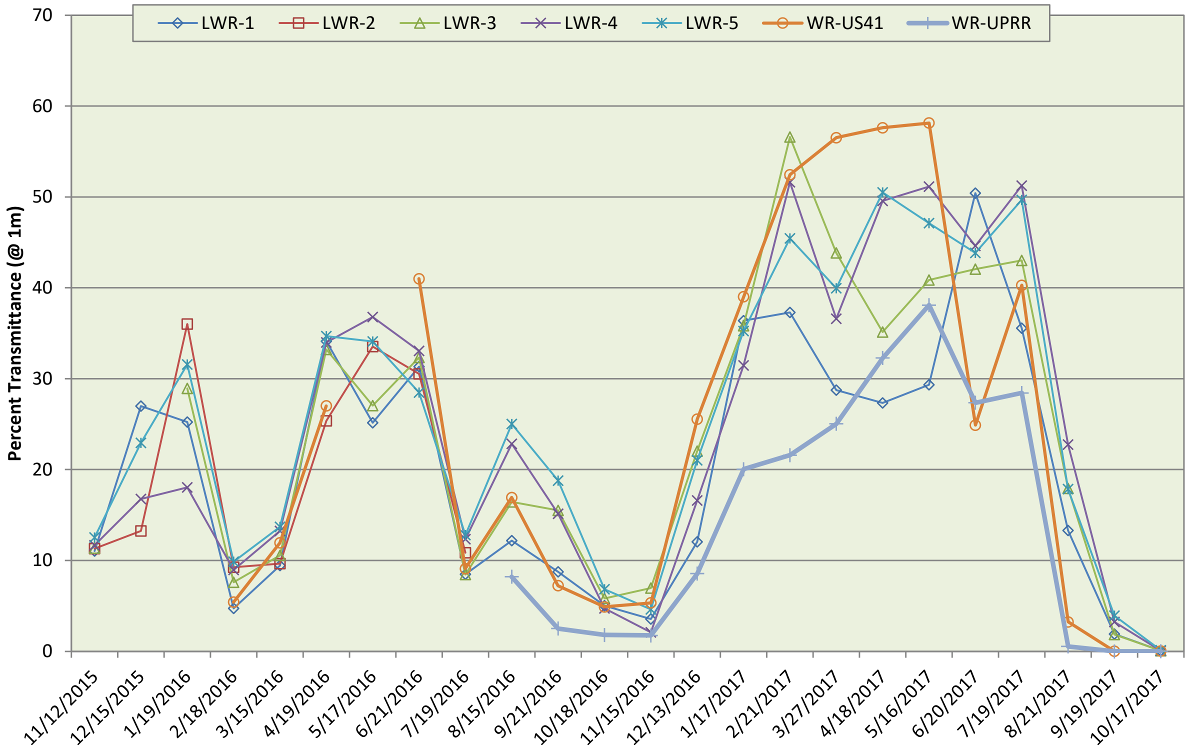

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Turb (NTU)
YYYYMM

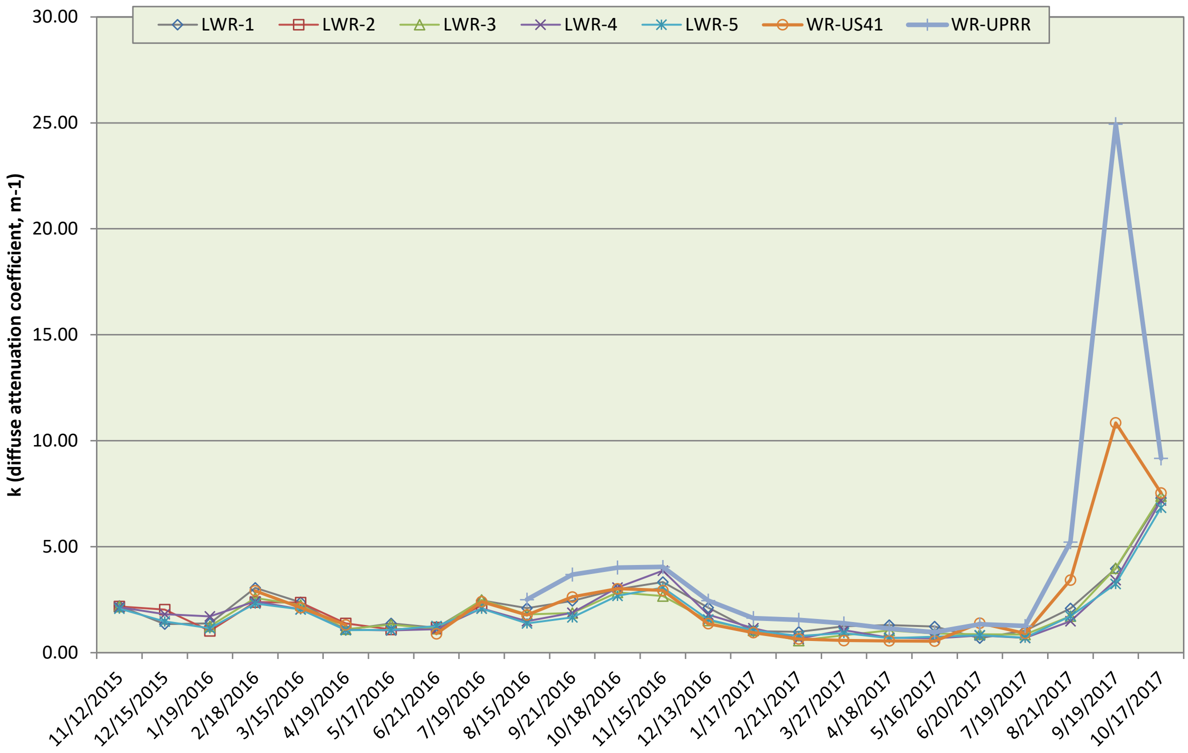

LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Wtr Temp (C)
YYYYMM


2,4-D (µg/L)
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
201703
201704
201705
201706
201707
201708
201710
201709
YYYYMM
LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41



Period of Record: 11/12/2015 10/17/2017


LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
Percent Transmittance (@ 1m)
70
60
50
40
30
20
10
0
11/12/2015
12/15/2015
1/19/2016
2/18/2016
3/15/2016
4/19/2016
5/17/2016
6/21/2016
7/19/2016
8/15/2016
9/21/2016
10/18/2016
11/15/2016
12/13/2016
1/17/2017
2/21/2017
3/27/2017
4/18/2017
5/16/2017
6/20/2017
7/19/2017
8/21/2017
9/19/2017
10/17/2017


LWR-1
LWR-2
LWR-3
LWR-4
LWR-5
WR-US41
WR-UPRR
k (diffuse attenuation coefficient, m-1)
30.00
25.00
20.00
15.00
10.00
5.00
0.00
11/12/2015
12/15/2015
1/19/2016
2/18/2016
3/15/2016
4/19/2016
5/17/2016
6/21/2016
7/19/2016
8/15/2016
9/21/2016
10/18/2016
11/15/2016
12/13/2016
1/17/2017
2/21/2017
3/27/2017
4/18/2017
5/16/2017
6/20/2017
7/19/2017
8/21/2017
9/19/2017
10/17/2017

Appendix B

Sediment Chemistry

LOWER WITHLACOOCHEE RIVER - SEDIMENT RESULTS

PARAMETER GROUP	PARAMETER	UNITS	YYYYMM	WR-UPRR	WR-US41	LWR-1	LWR-2	LWR-3	LWR-4	LWR-5
METAL	As-T	mg/kg	201603	---	1.50	0.219	0.912	51.7	1.23	0.316
			201609	2.89	58.7	0.705	---	0.860	3.43	3.99
			201703	1.46	1.24	0.253	---	55.0	1.54	2.80
			201709	2.57	1.48	0.342	---	27.5	3.25	5.67
	Cu-T	mg/kg	201603	---	7.89	0.290	2.14	165	1.72	0.420
			201609	3.31	12.5	0.590	---	1.10	7.49	8.71
			201703	59.5	6.32	0.490	---	126	3.23	2.93
			201709	2.51	12.7	0.810	---	74.6	10.6	12.1
	Fe-T	mg/kg	201603	---	3,540	592	2,140	90,600	2,040	1,210
			201609	6,570	4,900	939	---	757	5,160	3,490
			201703	4,740	2,840	596	---	144,000	1,110	5,490
			201709	9,870	4,460	699	---	68,500	4,480	3,510
NITROGEN	NOx-N	mg/kg	201603	---	1.00	0.700	0.800	0.750	0.950	4.90
			201609	lab missed - not analyzed						
			201703	2.00	1.80	1.40	---	1.45	1.35	2.15
			201709	4.10	1.90	1.25	---	1.35	2.20	1.50
	TKN	mg/kg	201603	---	2,500	460	1,100	340	1,500	310
			201609	2,100	1,400	540	---	340	4,500	930
			201703	2,700	1,700	510	---	700	250	3,300
			201709	1,600	2,000	340	---	410	4,000	1,100
PHOSPHORUS	TP	mg/kg	201603	---	4,500	160	830	2,500	400	970
			201609	2,200	1,100	230	---	240	1,900	960
			201703	1,600	7,710	150	---	1,620	340	4,150
			201709	17,000	3,700	190	---	2,200	1,500	1,100
SOLID	Total Dry Weight	g	201603	---	33.4	49.8	45.1	49.7	36.3	48.2
			201609	35.3	32.6	44.6	---	50.9	26.8	34.8
			201703	28.5	28.5	42.6	---	46.4	42.9	26.3
			201709	34.7	30.0	43.4	---	47.7	26.7	38.0
	% Organic	% dry wt	201603	---	10.0	1.20	3.20	1.50	8.00	1.60
			201609	5.60	4.60	1.30	---	1.10	9.00	4.50
			201703	8.40	6.60	1.20	---	1.50	1.00	9.70
			201709	5.40	10.0	1.20	---	2.50	7.20	4.10
	Solids, Dry Wt	%	201603	---	47.4	73.8	66.3	74.4	56.6	73.6
			201609	46.9	60.0	75.0	---	73.0	38.4	65.1
			201703	46.7	60.4	74.5	---	70.3	73.3	44.8
	Silt Clay (<0.063 mm)	% Vol	201603	---	34.9	9.15	37.4	8.16	26.0	8.05
			201609	40.8	23.1	10.8	---	10.7	38.3	29.2
			201703	30.8	25.5	12.7	---	9.10	8.62	28.4
			201709	62.7	29.7	13.2	---	15.7	49.6	30.5
	Very Fine Sand (0.063-0.125 mm)	% Vol	201603	---	10.8	22.8	10.5	4.91	10.5	6.10
			201609	13.3	8.26	7.03	---	5.51	11.2	14.4
			201703	13.6	8.48	11.8	---	5.16	6.89	10.2
			201709	14.4	9.39	22.9	---	8.21	14.6	12.7
	Fine Sand (0.125-0.25 mm)	% Vol	201603	---	22.5	57.5	36.8	35.4	29.2	40.6
			201609	29.5	28.6	42.2	---	47.2	24.9	34.5
			201703	31.0	23.3	60.9	---	31.6	45.3	25.1
			201709	21.8	26.4	52.8	---	33.6	20.7	39.0
	Medium Sand (0.25-0.5 mm)	% Vol	201603	---	15.6	7.14	11.2	28.5	20.9	35.1
			201609	13.9	22.9	29.9	---	29.3	16.2	12.0
			201703	9.74	21.3	11.3	---	28.3	34.9	15.6
			201709	1.08	20.4	10.8	---	29.7	8.50	11.9
	Coarse Sand (0.5-2.0 mm)	% Vol	201603	---	16.2	3.44	4.14	23.1	13.5	10.2
			201609	2.42	17.2	10.1	---	7.32	9.44	9.88
			201703	14.8	21.4	3.27	---	25.9	4.27	20.7
			201709	0.100	14.1	0.290	---	12.7	6.57	5.93
	Gravel (>2.0 mm)	% Dry Wt	201603	---	12.9	9.53	10.9	14.0	12.5	1.34
			201609	22.0	4.00	19.0	---	15.0	2.10	2.30
			201703	3.60	8.20	16.0	---	25.0	1.00	5.00
			201709	10.9	7.61	7.17	---	11.9	1.00	8.81
	Sample Location (N or S Bank)		201603	---	N	S	N	N	S	S
			201609	N	N	N	---	S	N	N
			201703	N	N	S	---	N	S	S
			201709	N	N	S	---	N	N	S