Aquatic Ecosystem Sciences LLC

TECHNICAL MEMORANDUM

Upper Klamath Lake Tributary Sampling: 2017 Data Summary Report

Prepared By:

Jacob Kann, Ph.D.
Aquatic Ecosystem Sciences LLC
295 East Main St., Suite 7
Ashland, OR 97520

Prepared For:

Klamath Tribes Natural Resources Department
PO Box 436
Chiloquin, OR 97624

May 2018

Table of Contents

List of Figures

List of Tables

INTRODUCTION

The Klamath Tribes have been monitoring nutrient concentration and loading in Upper Klamath Lake (UKL) tributaries since 1991. Data from 1991-1998 were summarized and incorporated into water and nutrient balances for UKL (Kann and Walker 1999). More recently the longer term 1991-2010 database was evaluated for seasonal and inter-annual dynamics, long term trends, and both water and nutrient balances were computed for UKL (Walker et al. 2012). This report serves as an annual update to the UKL tributary water quality database, including a summary of 2017 data (basic summary statistics and graphical analysis), and limited comparison of graphical time-series trends of tributary data collected for the 1991-2017 period. Included in this summary is an update of previous UKL tributary water quality databases with data collected during 2016, including appropriate quality assurance analyses (*see Excel spreadsheets: Klamath Tribes Inflow Nutrient Data 1991-2000.xls* and *Klamath Tribes Inflow Nutrient-Q Data 2001-2017.xls*).

METHODS

Methods followed the Klamath Tribes established procedures for field collection and laboratory analysis of water quality parameters (see Klamath Tribes QAPP and SOP; 2013 for a complete description of these methods). Beginning in 2008 for nutrient parameters, laboratory analyses transitioned from Aquatic Research, INC. in Seattle WA to the Sprague River Water Quality Laboratory (SRWQL) in Chiloquin OR. During the transition period duplicate samples were analyzed by both laboratories to confirm parameter reproducibility. Specific nutrient methodology and field collection protocol are contained in the SRWQL QAPP (Klamath Tribes 2013) and SOP (2013). Nutrient parameters (Table 1) were collected at seven tributary stations during the 2016 sampling season at an approximately biweekly frequency (Figure 1; Figure 2). Specific computation of nutrient loading is outlined in Kann and Walker (1999) and Walker et al. (2012), but is briefly summarized here.

Table 1. Nutrient parameters collected in Upper Klamath Lake tributaries, 2017.

Parameter	Abbreviation/Unit	Grab [a]
Total Phosphorus	TP (µg/L)	X
Soluble Reactive Phosphorus	SRP or PO_4 (µg/L)	X
Total Nitrogen	TN (µg/L)	X
Ammonia Nitrogen	NH_4-N (µg/L)	X
Nitrate-Nitrite Nitrogen	NO_3+ NO_2-N (µg/L)	X
Nitrite Nitrogen	NO_2-N (µg/L)	X
Silica	SiO_2 (µg/L)[1]	X
Total Suspended Sediments	TSS (mg/L)	X
Turbidity	NTU	X

[a]Grab = integrated water column sample and x-sectional sample collected with a Van-Dorn sampler.

[1] Silica measurements were initiated in 2008, NO_2 in 2013, and TSS and Turbidity in 2016 and are now included as a regularly measured parameter.

Table 3. Station location and Site ID Code for data collected in Upper Klamath Lake tributaries, 2017.

Location	Site ID Code	Latitude/Longitude
Sprague R. @ Kirchers Bridge	WR1000	N42.567806° W121.864472°
Annie Ck @ Snow Park	WR2000	N42.763685° W122.058362°
Wood R @ Weed Rd	WR3000	N42.646461° W121.994959°
Wood R @ Dike Rd	WR4000	N42.581460° W121.941536°
7-mile canal @ Dike Rd	WR5000	N42.581970° W121.970898°
Williamson R @ Bridge on Modoc Pt. Road	WR6000	N42.514355° W121.916714°
Upper Klamath Lake @ Pelican Marina/Fremont Bridge (UKL Outflow)	KL0001/KL0002	N42.238472° W121.805557°

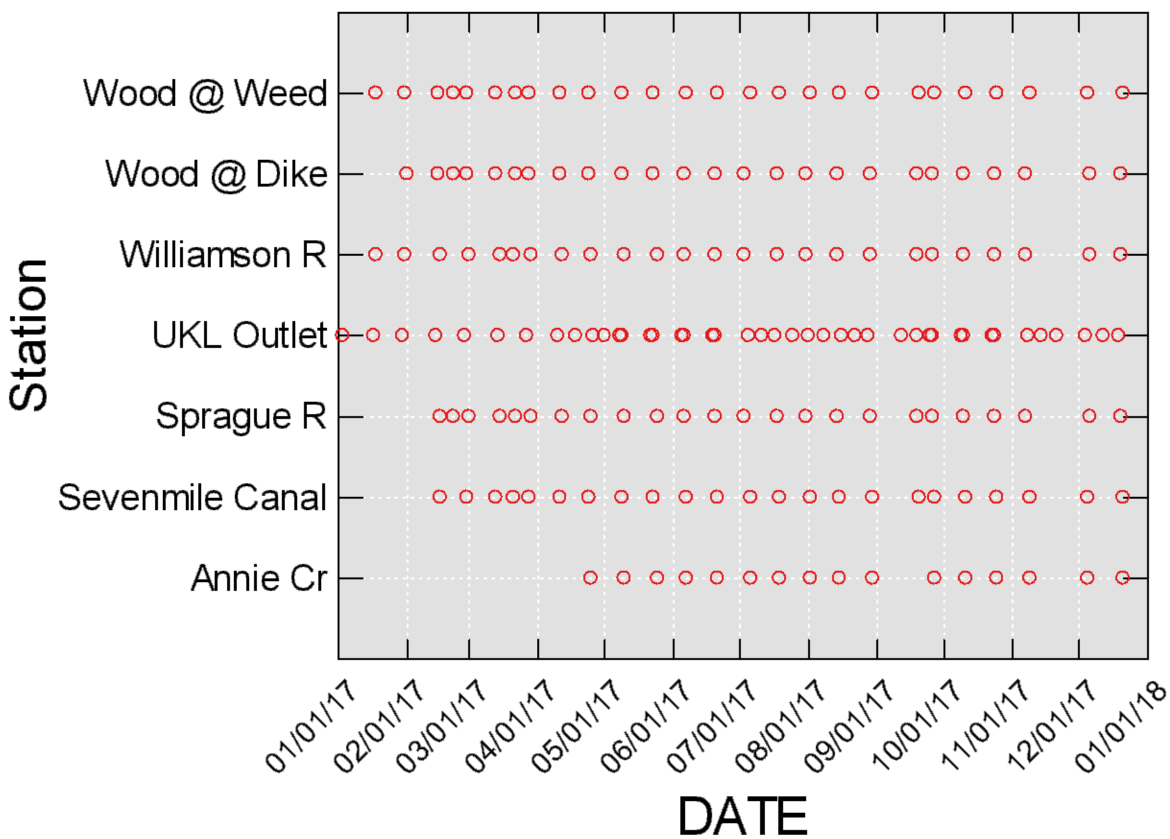


Figure 1. Spatial-temporal sampling matrix for Upper Klamath Lake tributaries, 2017.

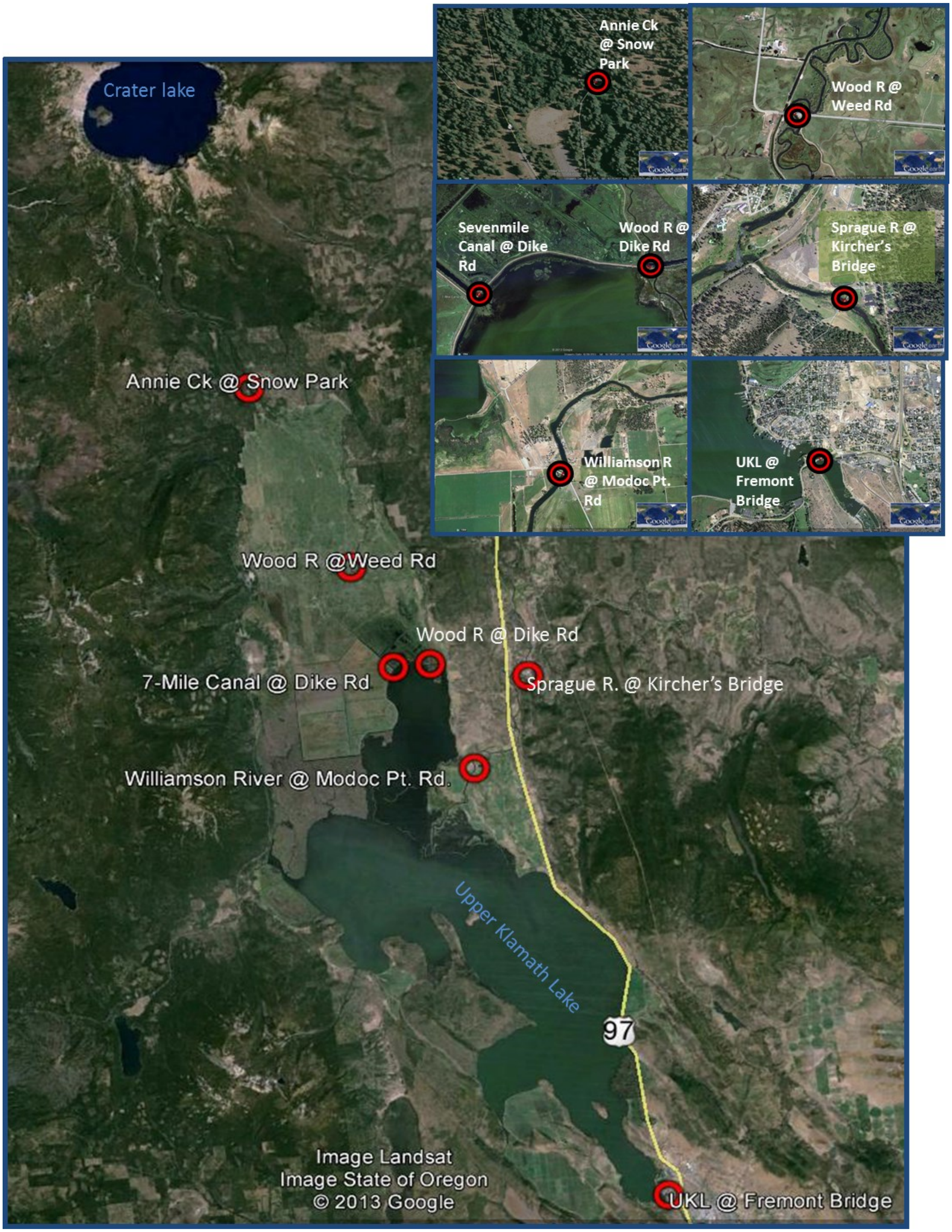


Figure 2. Location of Klamath Tribes Upper Klamath Lake tributary sampling stations.

Daily inflow volume for the Williamson and Sprague Rivers on a given sample date was extracted from continuous daily discharge data obtained from U.S. Geological Survey (USGS) stream-flow discharge stations. These data were obtained online for the Williamson River Gage 11502500[2] and Sprague River Gage 11501000[3]. Daily outflow volume for Upper Klamath Lake (UKL outflow) was computed from the sum of USGS discharge station at Link River 11507500[4] and USBR A-Canal[5] daily discharge measurements:.

For the Wood R. @ Weed and Wood R. @ Dike stations, continuous daily discharge measurements were generated by Graham Matthews and Associates (e.g., see GMA 2004) for 1992-2006, but these data were not available after 2006 for Dike Road. However, instantaneous discharge continued to be measured at Wood R. @ Weed, Wood R. @ Dike, 7-mile canal @ Dike Rd and Annie Cr. @ Snow Park stations by both the Klamath Tribes[6] and GMA (2004a; 2011a). Beginning in 2013, USGS implemented a continuous flow monitoring station at Wood R. @ Dike (USGS 11504115 Wood River Near Klamath Agency, OR[7]), which aside from several outliers, generally showed good agreement with the Klamath Tribes instantaneous biweekly measurements (Figure 3; the regression line was not significantly different from the 1:1 line). Flow measurements coinciding with nutrient sample collection dates are shown in Figure 4. Although additional nutrient concentration data were collected by GMA (e.g., 2004b; 2011b) and these data were incorporated into tributary loading calculations for the overall 1991-2010 analysis (Walker et al. 2012), only data collected by the Klamath Tribes are presented in this annual data update report.

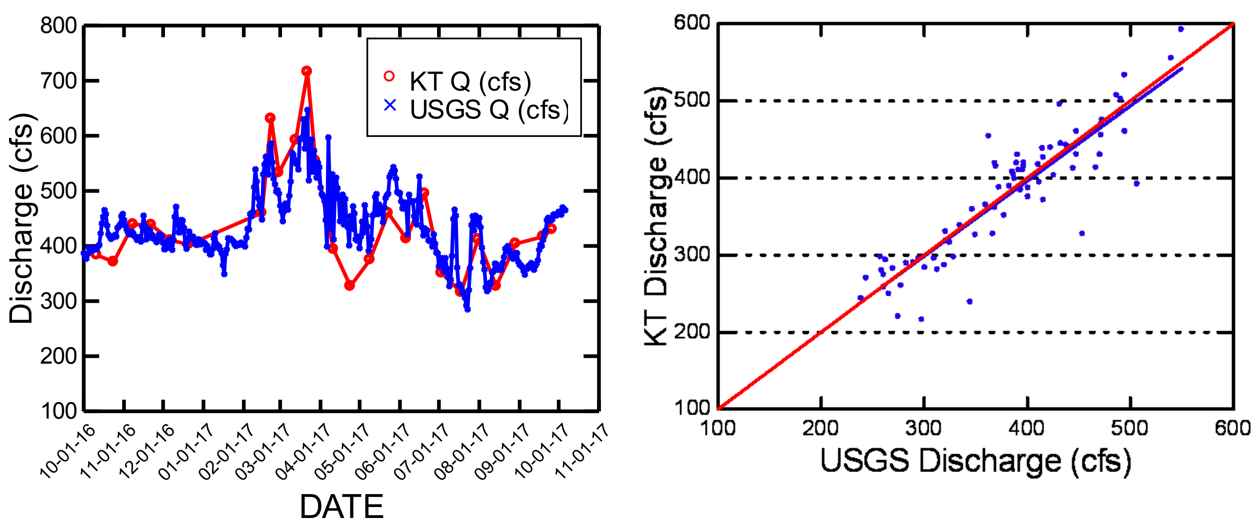


Figure 3. Comparison of USGS and Klamath Tribes discharge measurements at Wood River @ Dike Road. Red line on the scatter plot is the 1:1 line; blue line is the linear regression line.

2 http://waterdata.usgs.gov/nwis/dv/?site_no=11502500&agency_cd=USGS&referred_module=sw
3 http://waterdata.usgs.gov/or/nwis/dv/?site_no=11501000&agency_cd=USGS&referred_module=sw).
4 http://waterdata.usgs.gov/or/nwis/dv/?site_no=11507500&agency_cd=USGS&referred_module=sw
5 http://www.usbr.gov/mp/kbao/operations/water/korep1.cfm?lakeid=ukldata3
6 Note that in 2017 logistical issues precluded flow measurements at Annie Creek on several dates, and difficulty obtaining velocity measurements at Sevenmile Canal precluded discharge calculation for most dates (see Figure 4).
7 http://waterdata.usgs.gov/usa/nwis/uv?11504115

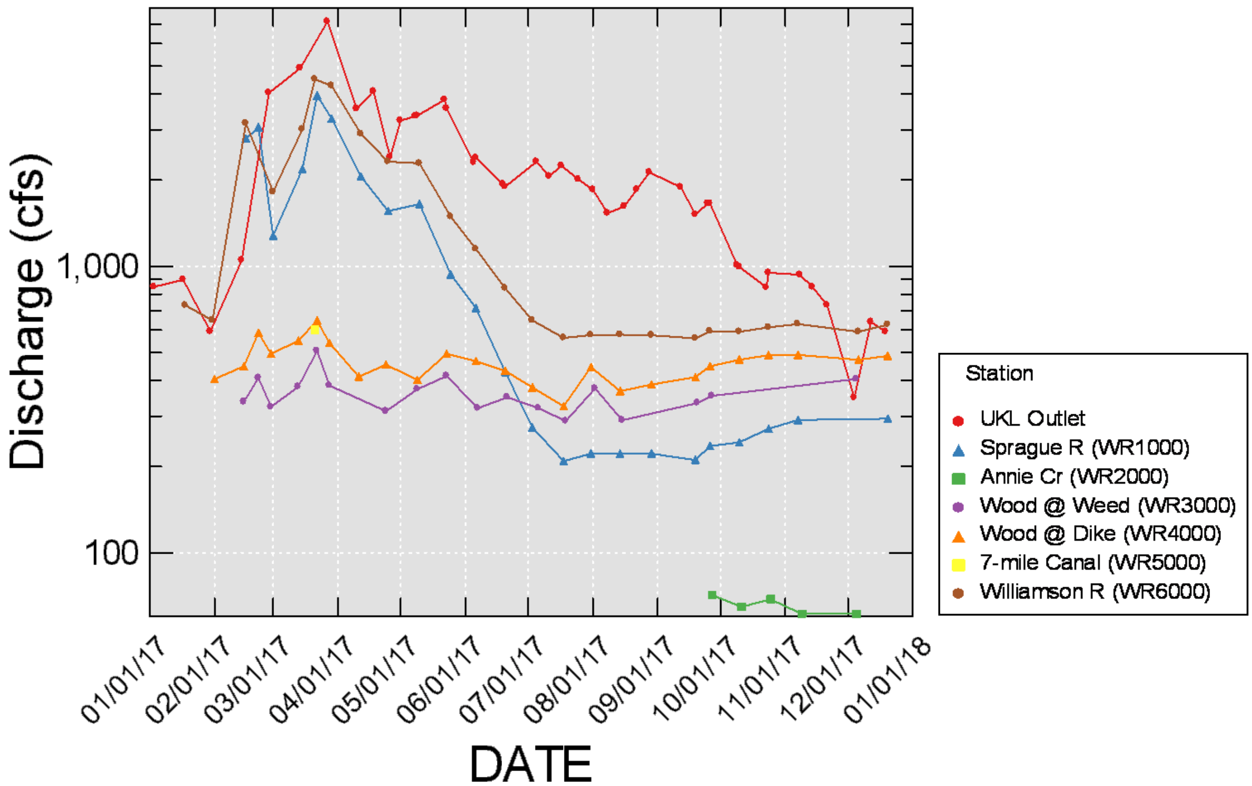


Figure 4. Flow (cfs) measurements coinciding with nutrient sample collection dates, 2017. Flow shown only for dates that nutrient data exist.

The total phosphorus (TP) and total nitrogen (TN) mass (kg/day) for each 2017 sample station and date were computed as the product of daily water volume and measured TP or TN concentration. Nutrient data collection at the UKL outflow station (Upper Klamath Lake @ Fremont Bridge) was discontinued by the Klamath Tribes during 2006-2011 due to funding reductions. Although the UKL sampling station PM is used as a surrogate for the UKL outflow for intervals when data for Upper Klamath Lake @ Fremont Bridge are not available, this caused data gaps for the October-March period during 2006 and 2007.

Beginning in 2008, the U.S. Bureau of Reclamation (USBOR) began monitoring nutrients during the winter months at Link River Dam and near the mouth of the Link River. These data were provided by USBOR along with limited data collected by PacifiCorp during the winter of 2009 and 2010 (Excel spreadsheets: *KRWQ2007-2010KLLD.xls* and *Pacificorpdata2009-2010.xlsx*). Outflow data provided by USBOR for 2011 and 2012 also included additional data for 2009 and 2010 that had not been previously provided (Excel spreadsheets: *KRWQ2007-2012KLLD.xls*[8]) In addition, the Klamath Tribes again began sampling Upper Klamath Lake @ Fremont Bridge in 2012. Additional nutrient data were incorporated from data provided by both USGS and USBR in 2013- 2017 leading to greater sampling frequency at this station. Only Klamath Tribes

[8] sources: http://www.kbmp.net/collaboration/klamath-hydroelectric-settlement-agreement-monitoring, and spreadsheet "UKL-FreemontBridge-WQ-2012-13-BOR.xlsx" provided by Rick Carlson, Physical Scientist, Bureau of Reclamation Klamath Basin Area Office, racarlson@usbr.gov. The latter file includes additional data collected at Fremont Bridge as part of a 3-year nutrient budget study of the Klamath Project.

data for 2017 are included in this data summary report. Station names for the various outflow stations were standardized by renaming them UKL-Outlet. When stations were sampled on the same date a mean was taken. Loading graphs and summaries are computed based on the October-September hydrologic water year (denoted HY in below plots).

Additional tributary sampling on the Sevenmile system also took place in 2017, with the intent of the additional sampling to determine longitudinal nutrient concentrations and loads between Sevenmile Creek at Sevenmile Rd. and Sevenmile Creek just below the confluence of West Canal. A total of 5 stations were sampled to determine the influence of West Canal, one of the Wood River Valley's main irrigation return flows, on nutrient concentrations and loads entering Agency Lake (see Kann 2017 for the 2016 West Canal Analysis).

RESULTS/DISCUSSION

Nutrient Concentration

The 2017 nutrient concentration pattern compared among inflow stations was similar to that of the 1991-2016 sampling period (Figure 5); total P and PO4-P tended to be higher at the Wood River and Seven Mile stations (WR3000, WR4000, and WR5000); total N tended to be lower for the Wood River stations (WR3000 and WR4000) but higher for Seven Mile (WR5000); values for the Williamson River (WR6000) tended to be intermediate relative to other stations for most parameters, but values for the Sprague River (WR1000) tended to be lower for TP and PO4-P, and second highest for TN after Seven Mile. In addition, Annie Creek at Snow Park (previously sampled from 2003-2016) showed consistently lower concentrations for all nutrient parameters except nitrate/nitrite among the inflow stations (Figure 5; Table 2).

With the exception of Seven Mile Canal, the UKL outlet (KL0001) tended to be higher than inflow stations for TP, lower for PO4, and substantially higher for TN and ammonia (NH4-N). Long-term upper quartile values for NO3-NO2-N were also higher at the UKL Outlet station than for inflow stations, and were substantially higher in 2017. Outflow NO3-NO2-N was also notably higher than inflow stations during 2012-2017. Similar to some previous years (e.g., 2010 and 2013), when NH4-N at the UKL Outlet was notably higher than Seven Mile Canal, the pattern in 2017 also showed higher upper quartile (and median) values at UKL Outlet (Figure 5; Table 2). Whereas in 2009, 2011, and 2014, the UKL Outlet showed values more similar to Sevenmile Canal.

Unlike 2016 when the was noticeably lower for the Sprague River and Williamson River stations compared to the long-term 1991-2015 distribution (Figure 5), the 2017 distribution was similar to the 1991-2016 distribution. 2017 was similar to 2014 when UKL-Outflow TP was comparable to the long-term distribution (the 2015 and 2016 distributions were lower- see Kann 2017). Annie Creek TP concentration was somewhat higher in 2017 than it was in previous years, although this pattern was also observed in 2016.
Similar to 2011-2015, the 2016 distribution of Sprague River PO4-P concentration was noticeably lower (evident in the lower quartile) when compared to the long-term distribution, whereas other inflow stations were similar to their respective long-term PO4-P distributions (Sevenmile showed an elevated upper quartile, however). 2017 was similar to 2014 when the

UKL-Outflow PO4-P distribution was noticeably higher than the long-term distribution. Other notable departures from the long-term distributions include lower TN concentration at all inflow stations except the Sprague River, somewhat higher NH4-N at the Outflow station (upper quartile), and higher NO3-NO2-N at all stations except Annie Cr. and Sprague River (Figure 5).

Comparisons of inflow ammonia and nitrate-nitrite between 2017 and the long-term distribution are confounded by levels near method detection limits and by a change in detection limits when the SRWQL began processing samples in 2008[9]. However, Outflow, Williamson River, and Sevenmile values for these parameters are affected to a lesser degree because values tend to be above method detection limits. Although beyond the scope of the annual data report, long-term comparisons can be facilitated by constraining values to be no less than the higher detection limits used prior to 2008. Higher Outflow nitrate values in 2013-2017 may be due to the increased sampling frequency during winter months when NO3-NO2-N is usually higher overall than other seasons. With the exception of the Outflow, a comparison of seasonal June-October distributions compared to the long-term distribution shows that all stations were generally lower for TN (Appendix III).

Similar to previous years, time series plots of the 2017 concentration data show Seven Mile Canal (WR5000) to have among the highest inflow values for TP, PO_4, PP (particulate P which equals TP minus PO_4), and TN (Figure 6). Although in previous years values at Sevenmile Canal tended to be higher during the summer irrigation season (Kann 2017), values in 2017 peaked during the spring runoff period (Figure 6)[10]. TP, PP, and TN at the UKL Outflow station were generally low in the spring and then increased substantially relative to the inflow stations during the summer algal growing season (primarily June-August; Appendix IV).

Ammonia (NH_4-N) and nitrate-nitrite (NO_3-NO_2-N) at the Outflow station also increased seasonally (during the fall and winter months), and remained elevated until the spring (Figure 7; Appendix IV). Outflow NH4-N and NO3-NO2-N patterns are tied to algal uptake and nitrogen fixation dynamics in UKL, as well as ammonification/nitrification (see Kann 2016). In general, ammonia in Sevenmile Cr. tends to be among the highest relative to other inflow stations, especially during the irrigation season.

Dissolved silica concentration at the Wood River and Annie Cr. Stations tended to be higher than the Sevenmile, Sprague, and Williamson stations during the spring; the Sprague River tended to show the lowest silica concentrations, followed by 7-Mile and the Williamson River (Figure 7; Appendix IV). The UKL Outflow station showed a clear seasonal pattern where silica values were depressed during the spring and early summer before increasing sharply in June to higher levels that remain high through the winter (Figure 7; Appendix IV). The spring silica depression at the Outflow station coincides with diatom blooms occurring in Upper Klamath Lake, summer increases are likely due to decline of diatoms as well as release of sediment P-bound silica due to high summer pH levels.

[9] Aquatic Research Inc. indicated a reporting limit of 10 µg/L for NH4 and NO23; the SRWQL utilizes a reporting limit of 6 µg/L for NH4 and 8 µg/L for NO23.

[10] This trend may be due to reduced irrigation return flows into Sevenmile Canal due to Klamath Tribal water calls in 2017

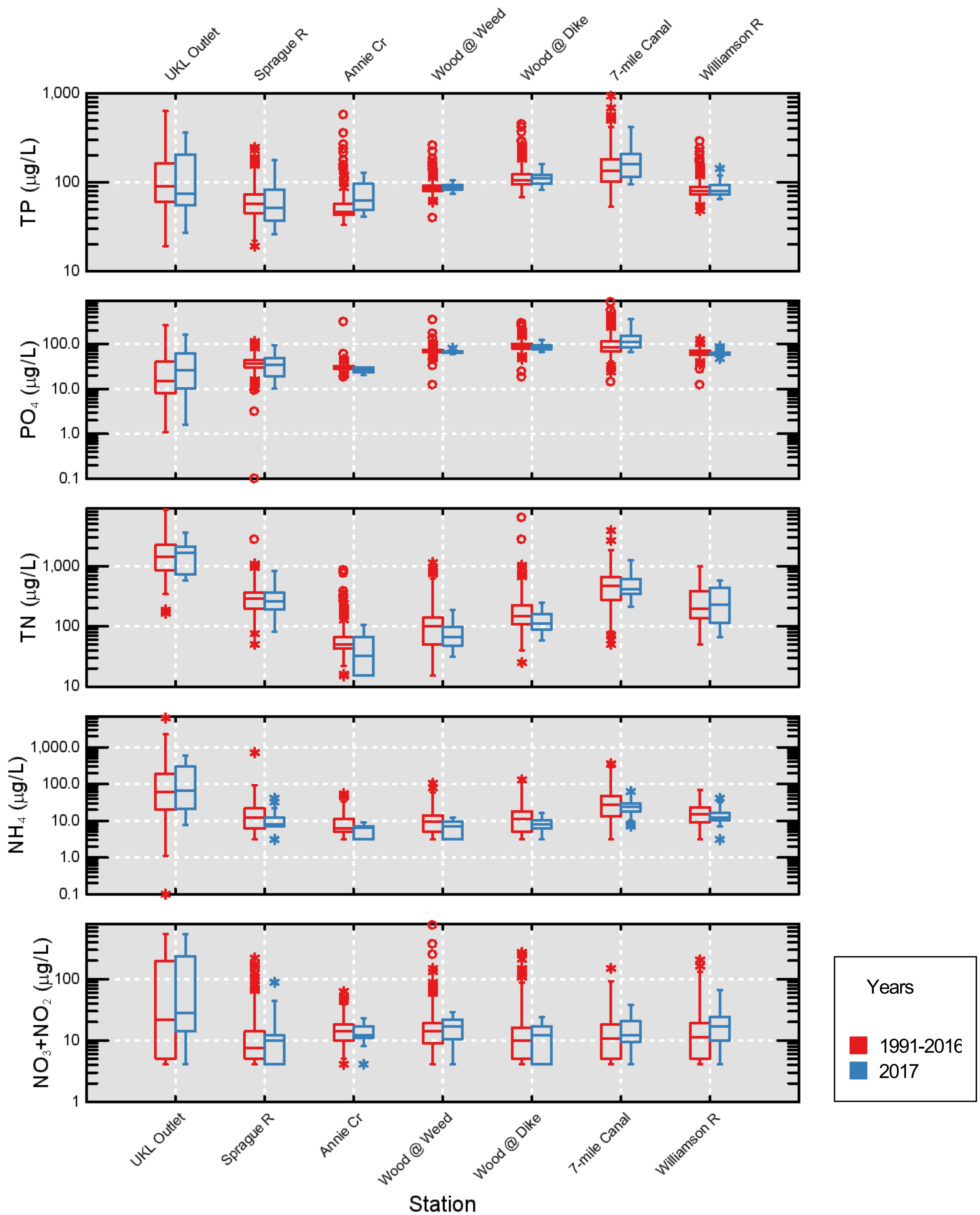


Figure 5. Station distributions of TP, SRP, TN, NH4-N, and NO3+ NO2-N concentration (µg/L) compared between 1991-2016 (red) and 2017 (blue).

Table 2. Basic statistics by station for TP, SRP, TN, NH_4-N, NO_3+ NO_2-N and SiO_2 concentration, and TP and TN load, Water Year 2017.

Station Code	Station Name	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
UKL Out	UKL Outlet	N of Cases	39.00	38.00	39.00	39.00	39.00	27.00	39.00	39.00
UKL Out	UKL Outlet	Median	74.00	25.50	1670.00	65.00	28.00	37400.00	564.77	5707.69
UKL Out	UKL Outlet	Arithmetic Mean	131.68	44.38	1632.79	165.24	140.81	33285.19	653.73	7414.53
UKL Out	UKL Outlet	Coefficient of Variation	0.80	1.06	0.54	1.23	1.30	0.22	0.75	0.57
UKL Out	UKL Outlet	Pct25	55.00	10.00	707.50	21.00	14.00	26275.00	225.80	4075.96
UKL Out	UKL Outlet	Pct75	207.50	61.00	2147.50	321.50	265.63	39075.00	953.70	10798.39
WR1000	Sprague R	N of Cases	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
WR1000	Sprague R	Median	51.00	34.00	259.00	8.00	10.00	28600.00	52.36	228.31
WR1000	Sprague R	Arithmetic Mean	66.64	39.24	295.84	11.40	15.08	28488.00	245.22	1085.53
WR1000	Sprague R	Coefficient of Variation	0.57	0.52	0.58	0.78	1.25	0.12	1.33	1.32
WR1000	Sprague R	Pct25	36.50	19.00	186.75	7.00	4.00	25550.00	20.17	102.40
WR1000	Sprague R	Pct75	84.00	48.75	367.00	12.75	12.75	30925.00	361.49	1486.53
WR2000	Annie Cr	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	5.00	5.00
WR2000	Annie Cr	Median	62.50	27.00	32.50	6.50	12.00	39400.00	7.12	2.61
WR2000	Annie Cr	Arithmetic Mean	71.00	26.44	41.81	5.88	13.25	37318.75	7.14	4.53
WR2000	Annie Cr	Coefficient of Variation	0.39	0.14	0.77	0.37	0.41	0.14	0.29	1.04
WR2000	Annie Cr	Pct25	48.50	23.00	15.00	3.00	11.00	32300.00	5.55	1.82
WR2000	Annie Cr	Pct75	96.00	30.00	66.50	7.00	17.00	41600.00	8.43	5.87
WR3000	Wood @ Weed	N of Cases	27.00	27.00	27.00	27.00	27.00	27.00	22.00	22.00
WR3000	Wood @ Weed	Median	87.00	66.00	66.00	7.00	17.00	38900.00	74.73	62.02
WR3000	Wood @ Weed	Arithmetic Mean	88.78	66.52	80.00	6.74	16.56	38603.70	76.72	77.92
WR3000	Wood @ Weed	Coefficient of Variation	0.09	0.08	0.56	0.48	0.41	0.05	0.17	0.69
WR3000	Wood @ Weed	Pct25	82.50	63.25	47.50	3.00	10.25	36925.00	66.50	43.10
WR3000	Wood @ Weed	Pct75	93.75	69.00	104.75	9.75	22.00	40000.00	83.98	94.85
WR4000	Wood @ Dike	N of Cases	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
WR4000	Wood @ Dike	Median	111.00	81.00	110.50	8.00	12.00	37550.00	116.78	122.87
WR4000	Wood @ Dike	Arithmetic Mean	112.50	85.54	127.38	8.15	11.88	37219.23	123.31	145.47
WR4000	Wood @ Dike	Coefficient of Variation	0.17	0.17	0.42	0.39	0.53	0.05	0.27	0.59
WR4000	Wood @ Dike	Pct25	96.00	76.00	89.00	6.00	4.00	35900.00	94.20	81.95
WR4000	Wood @ Dike	Pct75	122.00	93.00	159.00	10.00	17.00	38700.00	138.74	176.63
WR5000	7-mile Canal	N of Cases	23.00	23.00	23.00	23.00	23.00	23.00	3.00	3.00
WR5000	7-mile Canal	Median	159.00	110.00	418.00	24.00	12.00	29700.00	23.05	59.13
WR5000	7-mile Canal	Arithmetic Mean	188.48	142.17	517.74	27.17	15.52	29286.96	60.09	227.01
WR5000	7-mile Canal	Coefficient of Variation	0.53	0.63	0.53	0.55	0.64	0.16	1.24	1.42
WR5000	7-mile Canal	Pct25	114.75	82.50	336.50	17.50	9.25	26200.00	14.35	31.71
WR5000	7-mile Canal	Pct75	211.00	153.00	609.75	29.00	20.75	33275.00	115.10	464.28
WR6000	Williamson R	N of Cases	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
WR6000	Williamson R	Median	79.00	59.00	227.00	12.00	17.00	32700.00	162.18	406.03
WR6000	Williamson R	Arithmetic Mean	86.04	60.68	272.80	13.36	21.68	31412.00	327.83	1364.62
WR6000	Williamson R	Coefficient of Variation	0.22	0.14	0.64	0.60	0.83	0.13	0.93	1.18
WR6000	Williamson R	Pct25	72.75	57.00	113.75	9.75	10.00	30075.00	102.84	157.51
WR6000	Williamson R	Pct75	93.50	64.00	444.50	16.00	24.50	33900.00	506.66	2422.56

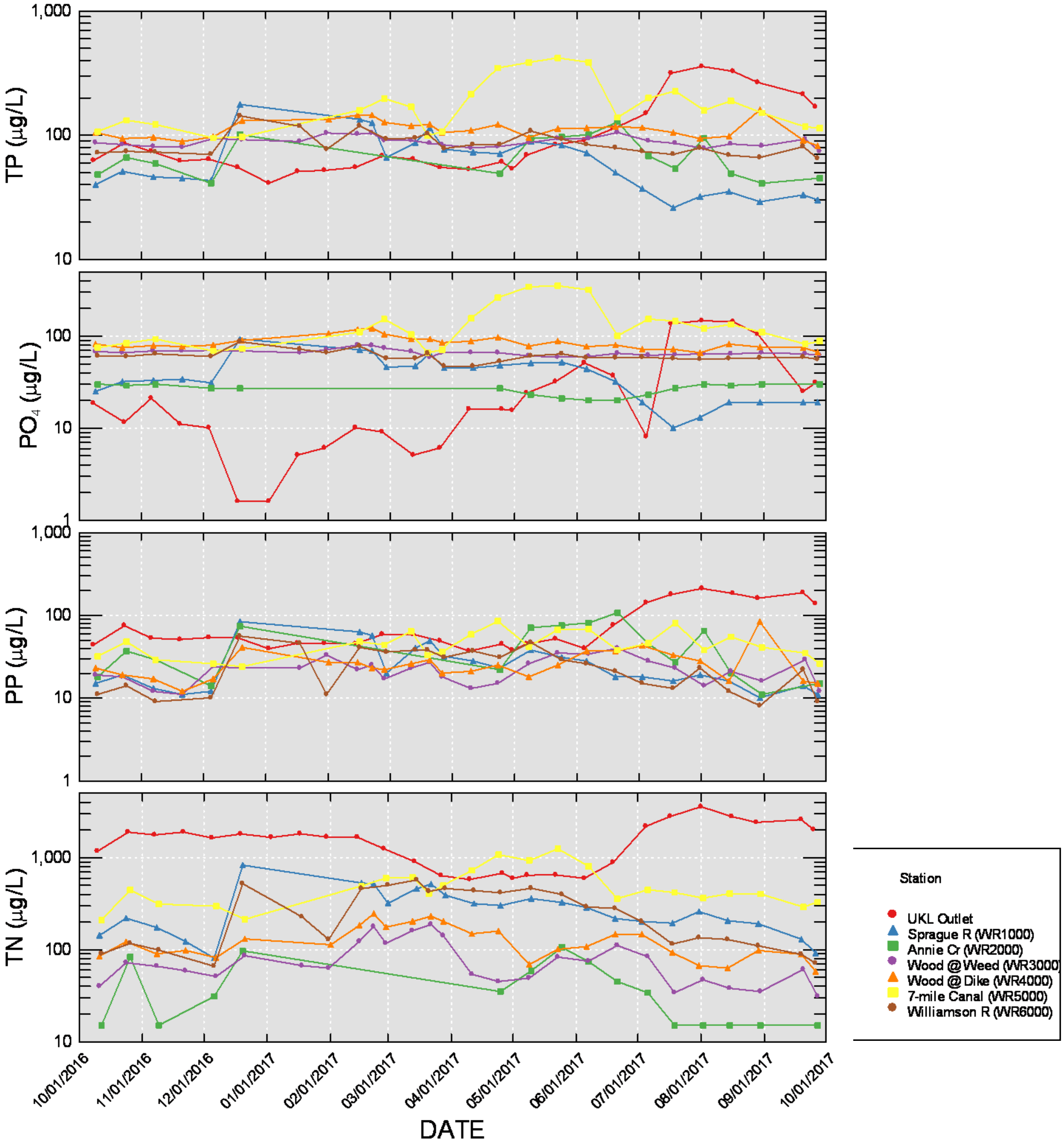


Figure 6. Time-series plot of TP, SRP, PP and TN concentrations for Upper Klamath Lake tributaries and outflow, HY 2017.

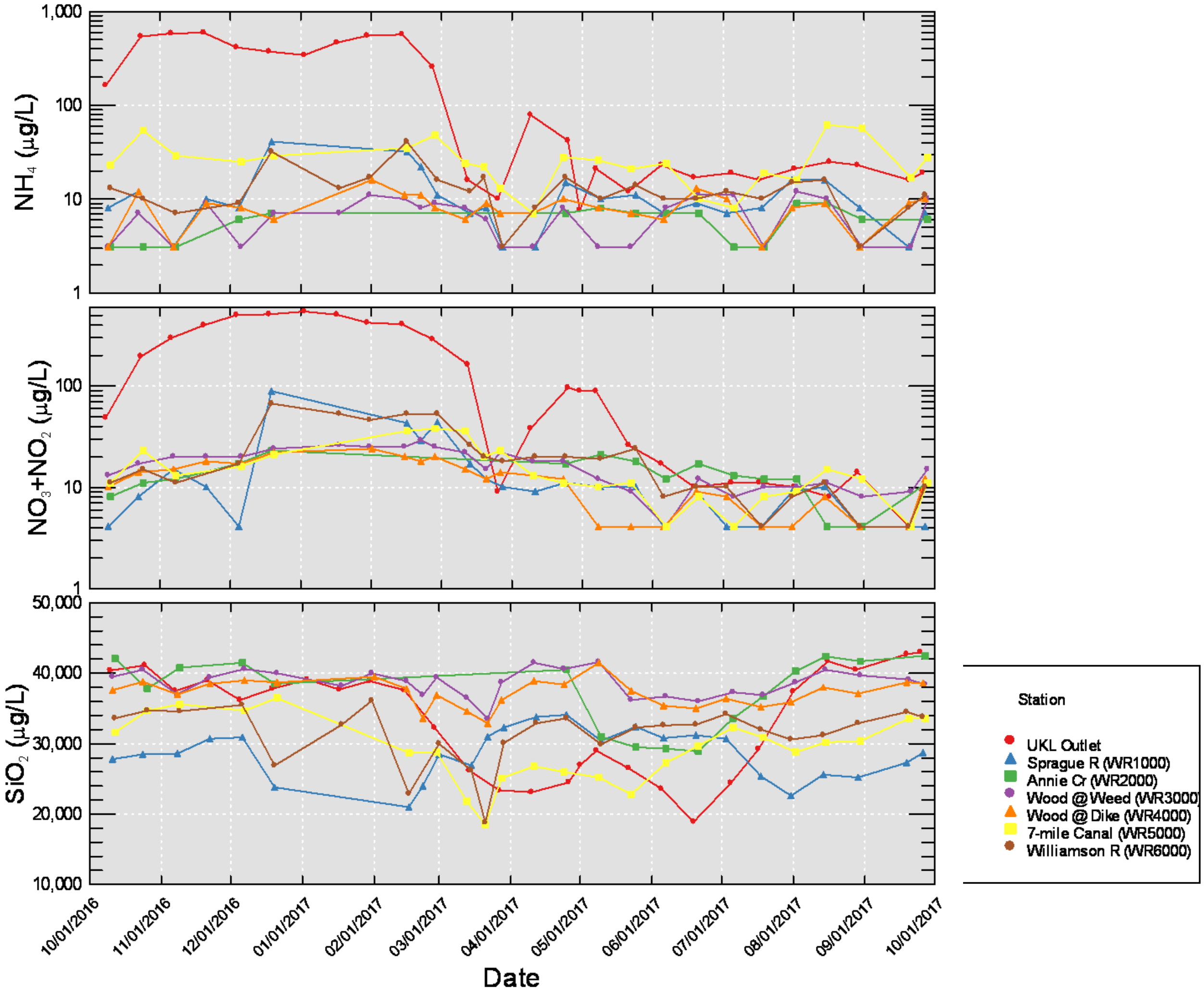


Figure 7. Time-series plot of NH_4-N, NO_3+ NO_2-N and SiO_2 concentrations for Upper Klamath Lake tributaries and outflow, HY 2017.

The TN:TP ratio at the UKL Outflow station was relatively high (TN:TP > ~15) during the late fall and early winter (2014-2017), and similar to earlier years (see Kann 2016), ratios then remained higher than tributary stations through the season (Figure 8). The lowest values of the year (~7) occurred during late-May and June. The overall pattern appears similar to earlier years when the TN:TP ratio at UKL Outflow was higher (TN:TP ≅ 10) than tributary stations in April, declined during May and June, increased during early summer UKL bloom development, and declined through the bloom decline period before increasing again in August (Figure 8). In 2017 the TIN:SRP ratio in the Outflow decreased from peak values of ~600 during winter-spring, to ~10 in mid-spring, and then to seasonal low values in July-August (~0.2), before increasing again in September (~10) (Figure 8). Both TN:TP and the majority of TIN:SRP values in the inflow tributary stations indicate nitrogen limiting conditions (<10 for TN:TP and <1 for TIN:SRP) that would tend to promote nitrogen-fixing algae such as the *Aphanizomenon* prevalent in UKL. The Wood River and Sevenmile in particular showed very low TIN:SRP ratios (<0.3).

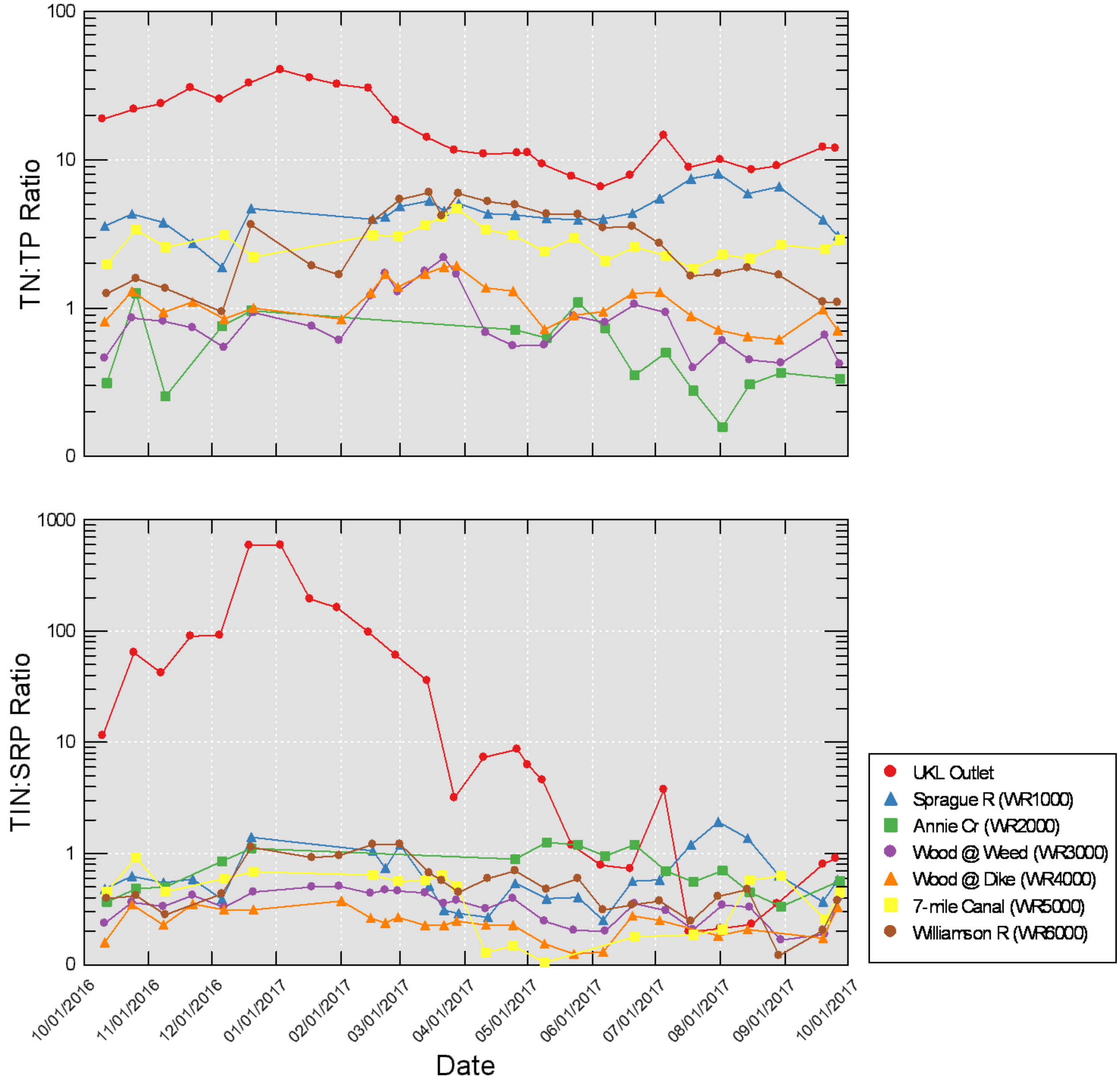


Figure 8. Total nitrogen to total phosphorus (TN:TP) and total inorganic nitrogen (NOx-N+NH_4-N) to PO_4 (TIN:SRP) ratios in Upper Klamath Lake tributaries and outflow stations, HY 2017.

Time-series plots of these ratio data comparing the Williamson River and UKL Outflow (summarized for the April-October period when data for both stations were consistently available) show that both ratios (TP:TN and TIN:SRP) were always higher leaving UKL than they were in the Williamson River inflow (Figure 9). Much of this increase is likely due to increases in UKL nitrogen due to both nitrogen-fixation by blue-green algae (particularly the dominant *Aphanizomenon flos-aquae*) and sediment regeneration of ammonia to the water column (although the ultimate source of the sediment nitrogen is also derived from settled algal biomass). Ratios rose in the outflow relative to inflow despite additional internal loading or sediment recycling of phosphorus (Walker et al. 2012), which would tend to drive ratios downward. There is also indication of cyclical sub-decadal trends, particularly for the TIN:SRP ratio, over the 1991-2017 period. Further analysis is required to explore these apparent trends.

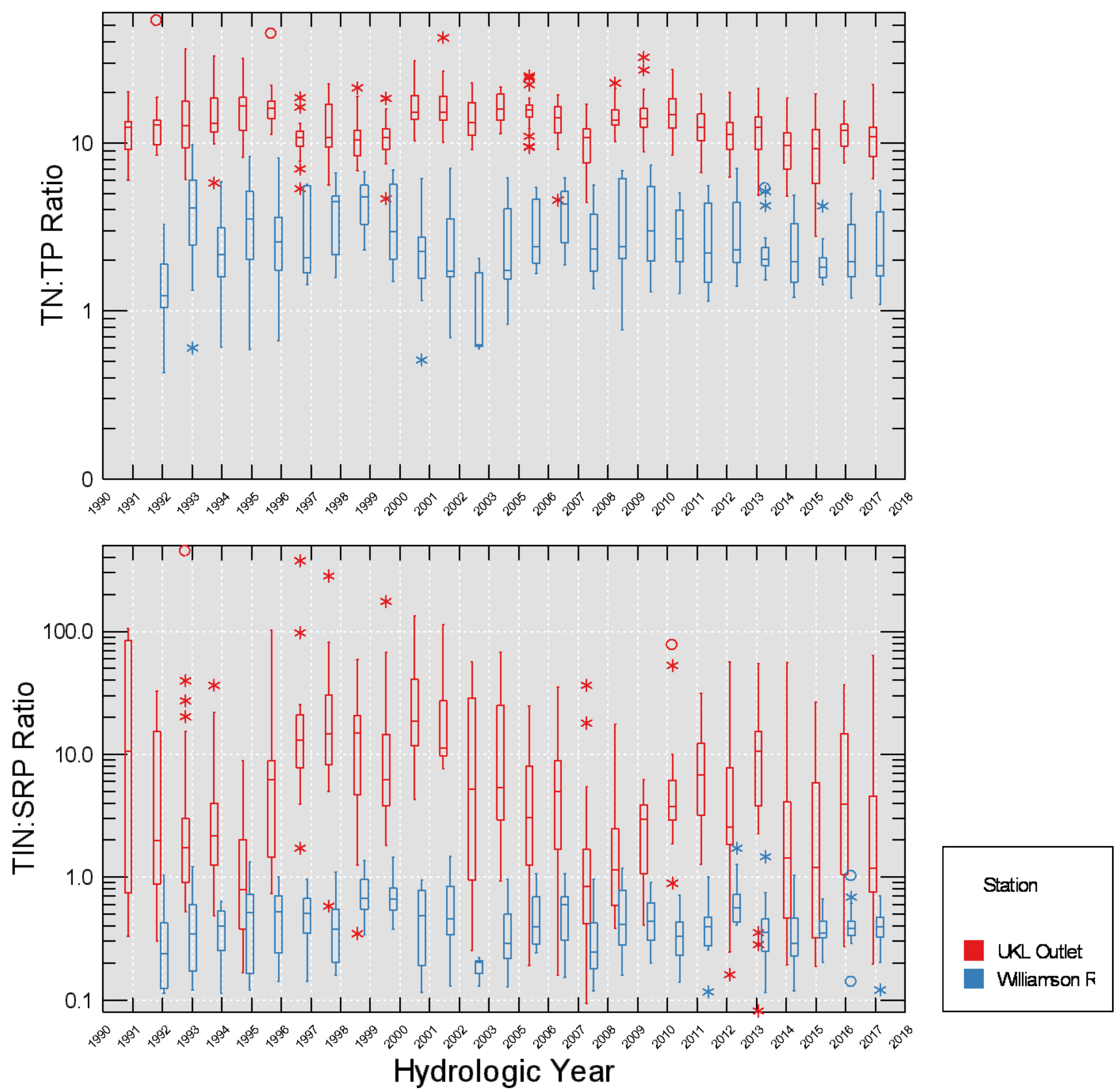


Figure 9. Total nitrogen to total phosphorus (TN:TP) and total inorganic nitrogen (NOx-N+NH_4-N) to PO_4 (TIN:SRP) ratios in the Williamson River and UKL outflow stations, April-October: 1991-2017.

TP and TN Loading

2017 Seasonal Pattern

Similar to previous years the 2017 seasonal TP and TN tributary loading pattern showed several peaks in the winter and spring, with loading generally increasing during the March-May period coinciding with peak discharge (Figure 4; Figure 10). This was in contrast to 2014 and 2015 when loading was relatively constant during that period[11]. The winter-spring increase in TP load was more evident for the Sprague and Williamson Rivers than for the Wood River system. Missing flows for Sevenmile precluded delineating 2017 seasonal loading trends, although there was an increase in both TP and TN loads in March. Williamson and Sprague loading then declined through mid-July before leveling off through the late-summer period. UKL outflow loads of TN and TP declined in late-fall before increasing again late-spring, with a secondary and larger increase in mid-June that is tied to internal nutrient recycling from sediments and nitrogen fixation in UKL (e.g., see Kann 1998; Kann and Walker 1999; Walker et al. 2012). Outflow TP loads were similar to or lower than Williamson, Sprague, and Wood River loading during the late-winter to early-spring spring period, but were then higher through the remainder of the year, while outflow TN loads generally remained higher than those for the Williamson River over this same period (Figure 10).

2017 Station Patterns

The 2017 nutrient loading pattern among stations was similar to that of the 1991-2015 sampling period (Figure 11). Also, as indicated above, TP and TN outflow loads tended to be higher than any individual inflow tributary loads during both 2017 and for the overall time period (1991-2016). In contrast to the previous four years (2013-2016), when outflow TP and TN loads were lower overall than they were for the previous long-term period, 2017 outflow loads were higher than the long term 1991-2016 distribution (a similar trend occurred in 2010). Although comparisons are somewhat confounded by the lack of consistent winter data for the outflow during earlier years, a comparison of the core irrigation and summer algal growing season when measurements are consistent also shows that 2017 outflow loads were higher than the long term distribution (Appendix III). As noted above, high UKL outlet loads reflect sediment regeneration and nitrogen fixation processes taking place in UKL. The TP and TN loads were lower for all inflow stations relative to the outflow station.

Of the inflow tributaries, the Williamson River (WR6000) showed highest overall loading, followed by the Sprague River, with the 2017 TP and TN loading distributions higher than previous years (Figure 11; for the core irrigation season they were intermediate or lower; see Appendix III). Sprague River TN load was more similar to the Williamson River TN load than it was for TP load (which was noticeably lower in the Sprague when compared to the Williamson), indicating that the Sprague River is contributing proportionally more nitrogen to the overall load. Wood River 2017 TP load was somewhat higher when compared to the long-term distribution, but Wood River TN was similar (Figure 11). TP and TN loading patterns in both the Williamson and Sprague Rivers tended to follow the general pattern in discharge (although loading appears to be more closely linked to discharge in the Sprague River than in the Williamson River), and as noted above for Outflow concentration, there is indication of cyclical trending over the period of

[11] 2014 was among the driest years on record with low precipitation and snowpack, and 2015 was also a dry year.

record (Figure 12). Flows and loads in 2017 were noticeably higher than the previous 5 years for both the Sprague and Williamson Rivers (Figure 12). A lack of discharge measurements at Annie Creek at Snow Park and Sevenmile Canal in 2017 precluded long-term comparisons.

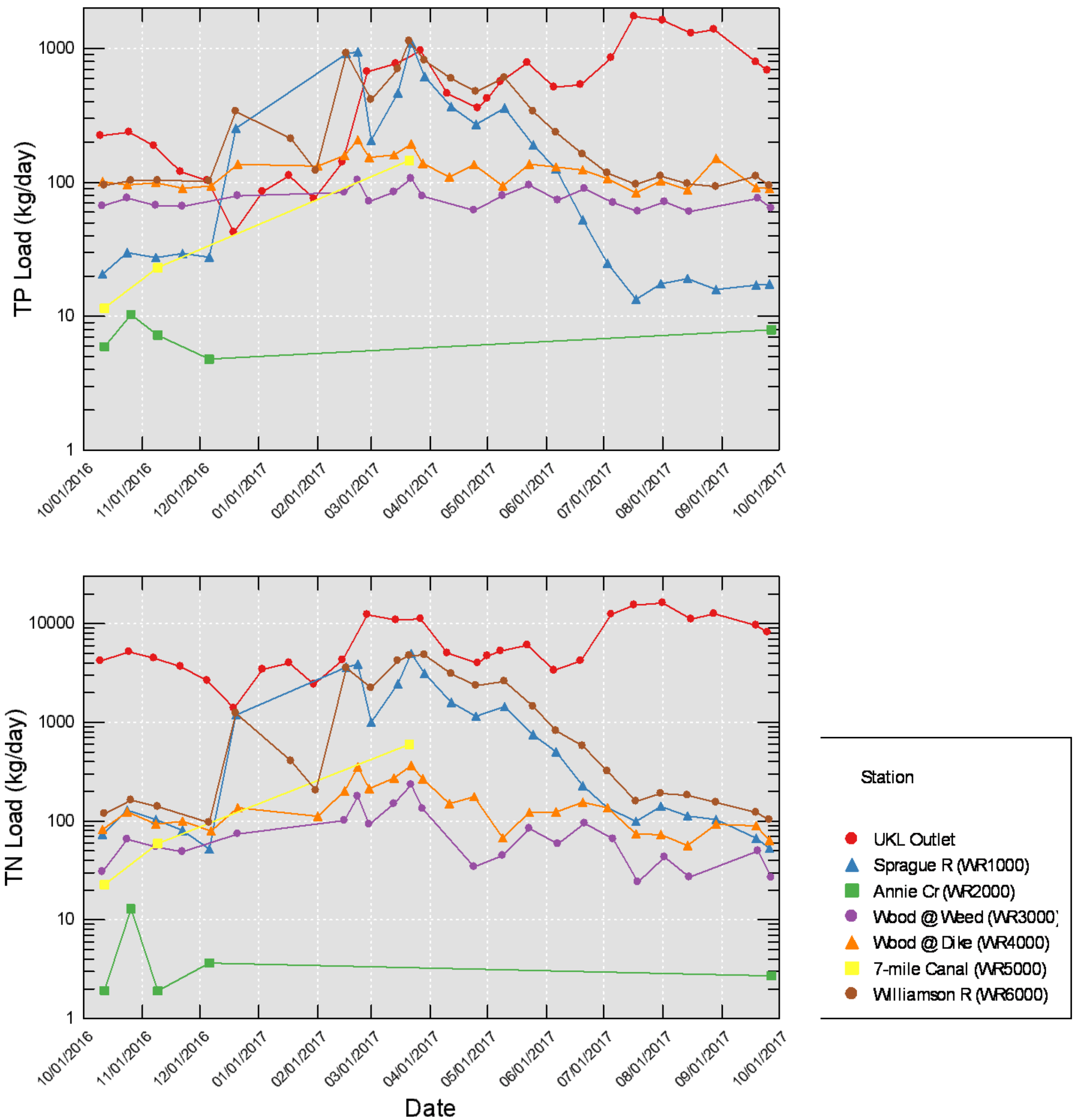


Figure 10. Seasonal TP and TN loading trends by station, HY 2017.

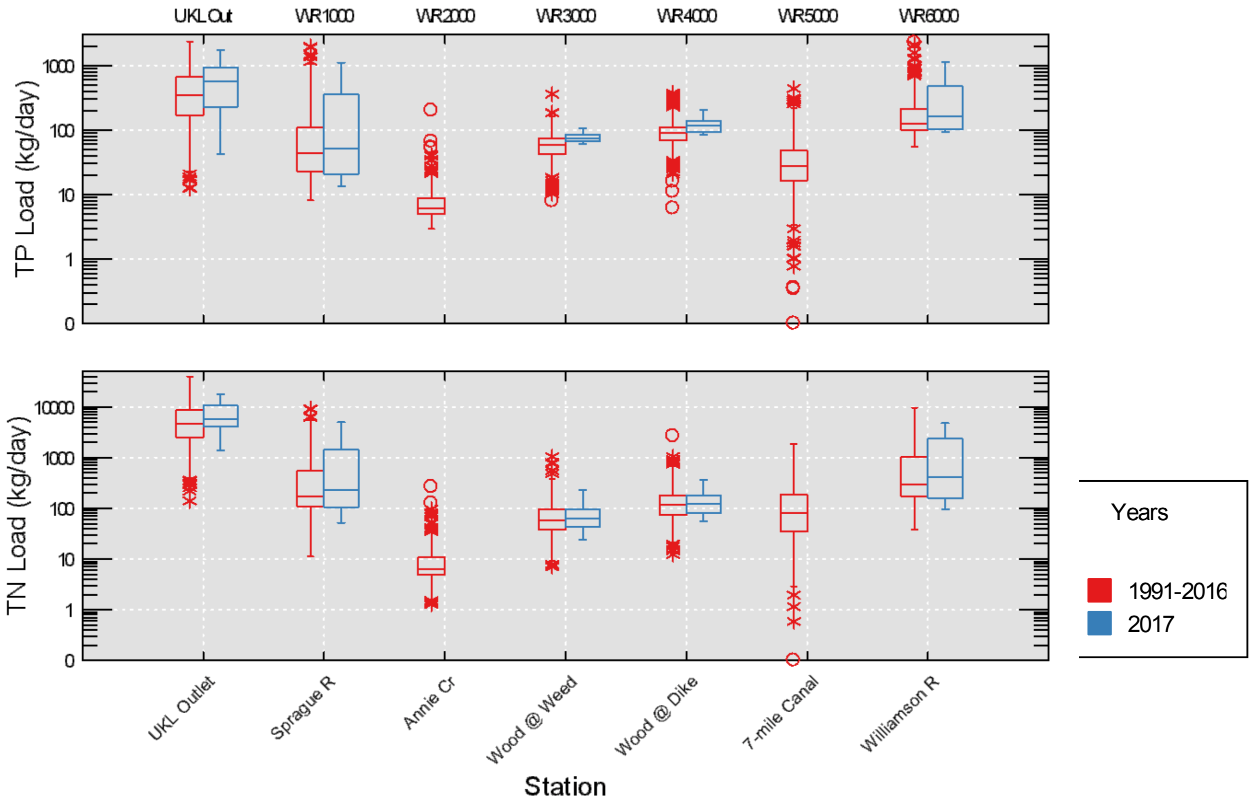


Figure 11. **Station distributions of TP and TN loading compared between 1991-2016 (red) and 2017 (blue). Note: for the outflow station KL0001 there are no samples from January to mid-April in HY2006, and for HY2007-2009 and HY2011 samples are missing between November and mid-April.**

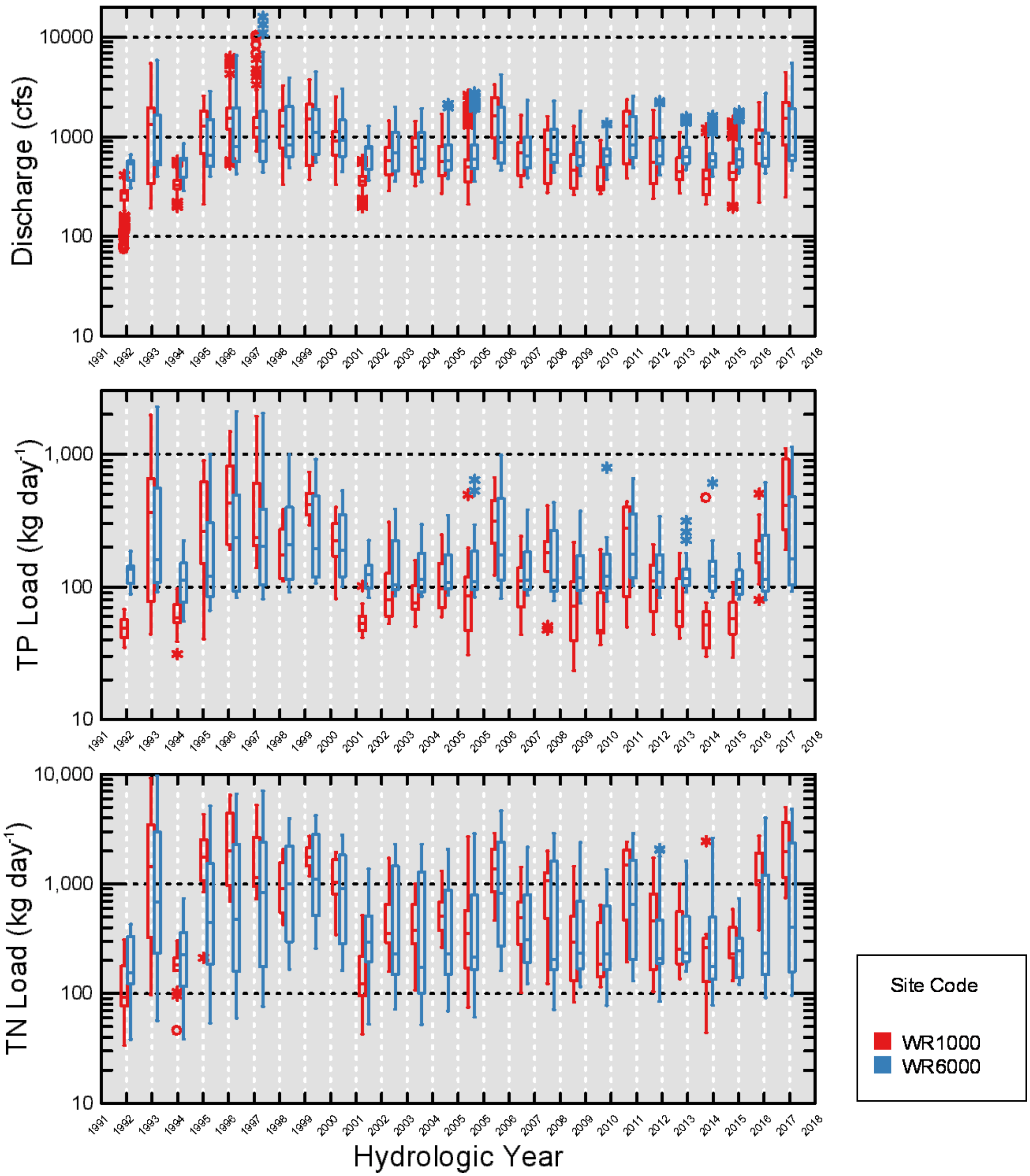


Figure 12. Distribution of Williamson River (WR6000) and Sprague River (WR1000) daily discharge (top panel), TP load (middle panel), and TN load (bottom panel) for the January-May inflow period, 1992-2017.

Sonde, TSS and Turbidity

Seasonal and spatial patterns in temperature, specific conductance, dissolved oxygen, and pH are shown in Figure 13. Peak temperatures generally occurred in June for the Wood and Williamson River stations, and July for Annie Creek, Sprague, and Sevenmile stations. The Annie Cr. and Wood River stations showed cooler overall temperatures than the Sevenmile, Sprague and Williamson stations. Among the inflows, dissolved oxygen decreased seasonally at several stations, but was most apparent at the Sevenmile Canal, Wood Dike, and Williamson/Sprague River stations. Aside from UKL Outlet, which is controlled by productivity dynamics in Upper Klamath Lake, pH was showed moderate fluctuations over the season (ranging between 7 and 8.5). The exception to this was Wood at Weed which increased to a pH of 9 in June (Figure 13). Specific Conductance increased during spring runoff for Sevenmile and was noticeably lower for Annie Creek.

TSS concentrations and loads in the winter and spring were highest for the Sprague and Williamson stations in 2017; however, Annie Creek was not sampled during that period in 2017 (Figure 14). Annie Creek TSS concentrations tended to be higher than other stations from June-August. A pronounced peak in TSS concentration and load occurred at the Wood R. Dike Rd. station in late-March. Turbidity also tended to be higher in Annie Creek during late-May and early-summer, and again the Sprague and Williamson stations showed highest seasonal turbidity concentrations in the winter and spring months (Figure 14). Peak snowmelt in May and June are likely driving the Annie Creek increases in TSS and Turbidity, especially given the loose pumice material that much of the Annie Creek streambed is composed of.

Sevenmile Creek Longitudinal Study

The study that was instituted in 2016 to determine longitudinal nutrient concentrations and loads between Sevenmile Creek at Sevenmile Rd. (7M7R) and Sevenmile Creek just below the confluence of West Canal (7MBW) was continued in 2017. A total of 4 stations were sampled with the intent to determine the influence West Canal (WC), one of the Wood River Valley's main irrigation return flows, on nutrient concentrations and loads entering Agency Lake (Figure 15). Although stations were sampled approximately biweekly between March and November in 2016, only 3 samples were obtained in 2017 due to low velocity measurements that precluded measuring discharge (Figure 16).

Although seasonal trends could not be determined in 2017 (see Kann 2017 for seasonal patterns), similar to 2016, concentrations of TP, PP, PO4, TN, PN, NH4, SiO2, and turbidity were substantially higher in WC than they were at 7MAW (Figure 17; Figure 18). Concentrations below the WC confluence at 7MBW and 4C were also elevated in comparison to 7MAW, reflecting the mixing of water from both WC and 7MAW. Fourmile Canal (4C) tended to show higher concentrations than 7MBW for most parameters.

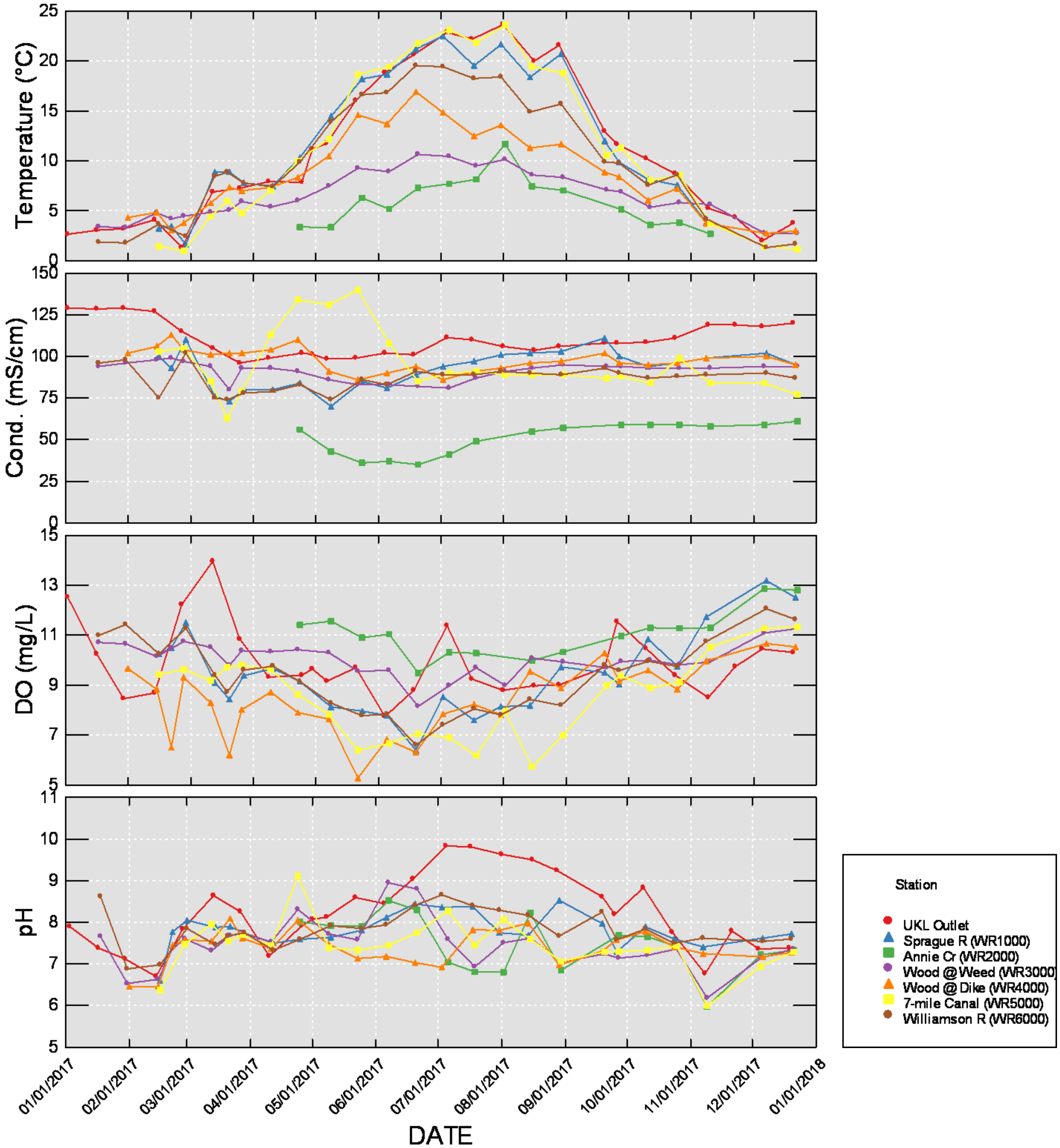


Figure 13. Time series plot of YSI multi-parameter probe water quality measurements for Upper Klamath Lake tributaries and outflow, 2017.

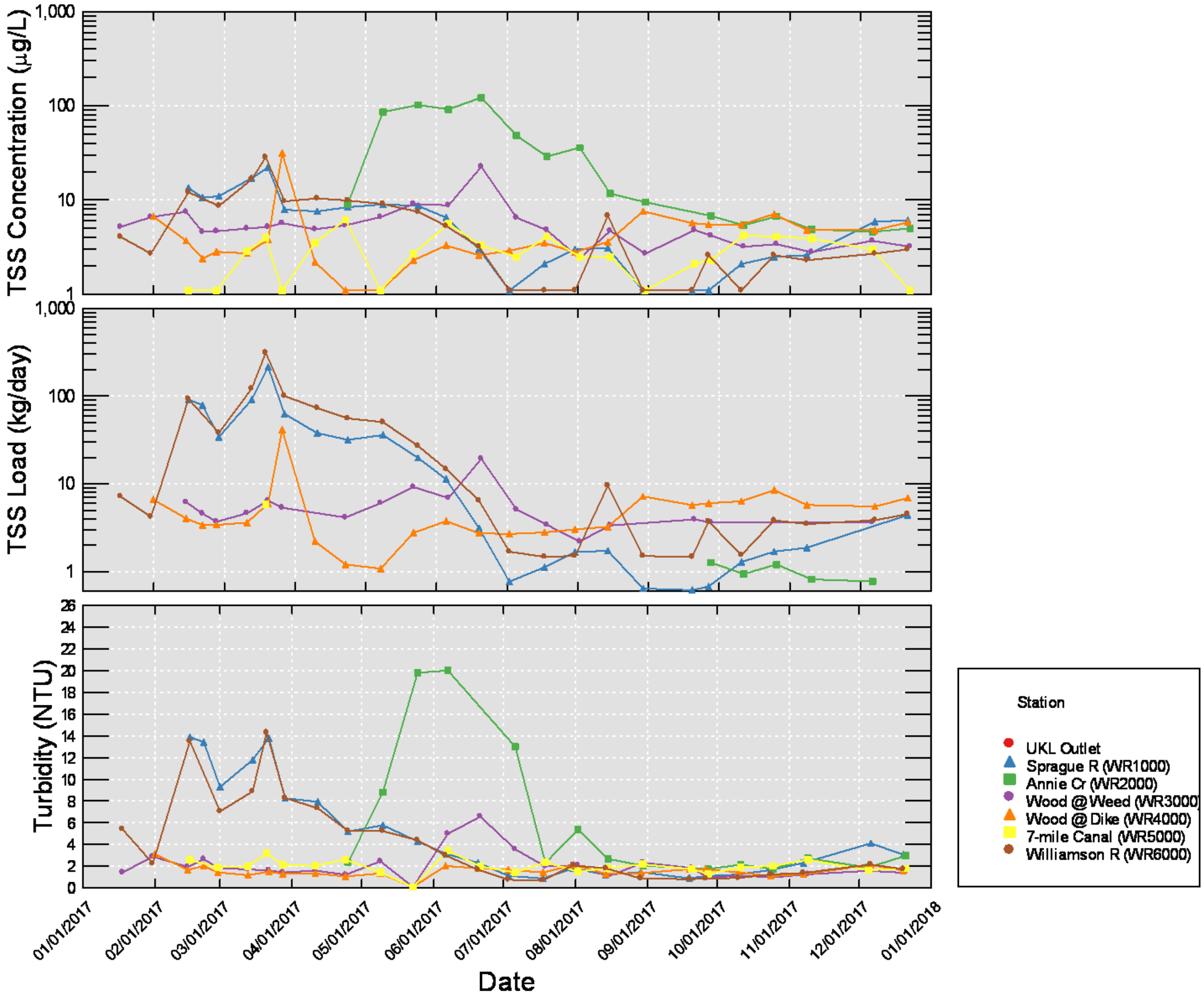


Figure 14. Time series plot of TSS Concentration, load and Turbidity for Upper Klamath Lake tributaries and outflow, 2017.

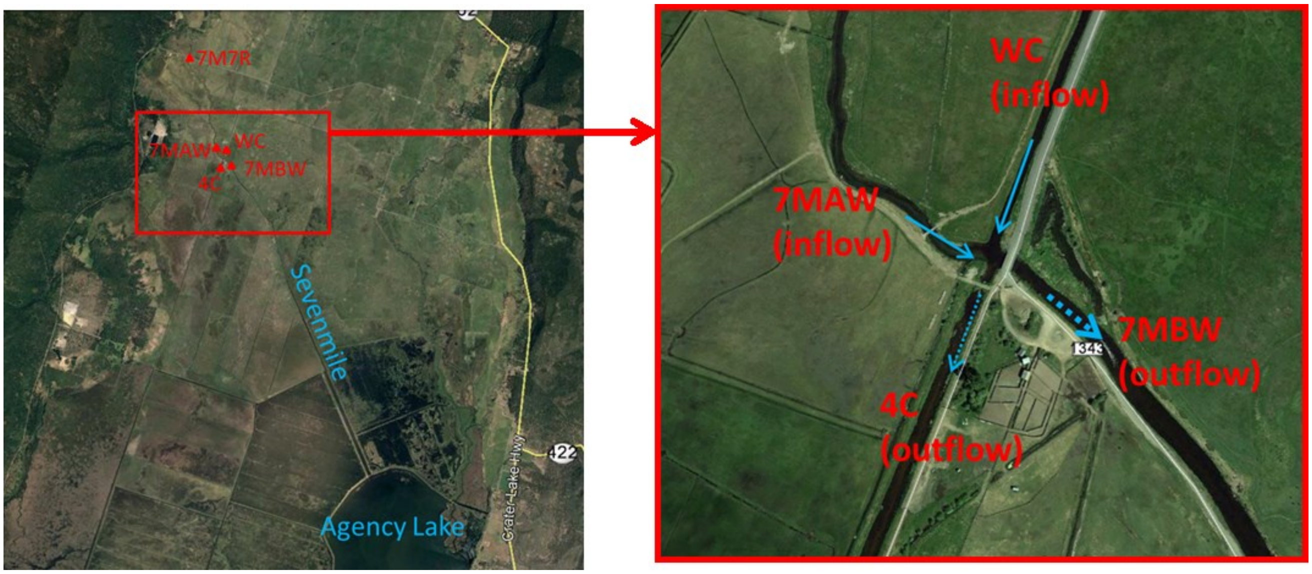


Figure 15. Sevenmile Creek sampling locations; Sevenmile Creek at Sevenmile Rd. (7M7R); Sevenmile above West Canal (7MAW); West Canal (WC); Fourmile Canal (4C); Sevenmile below West Canal (7MBW).

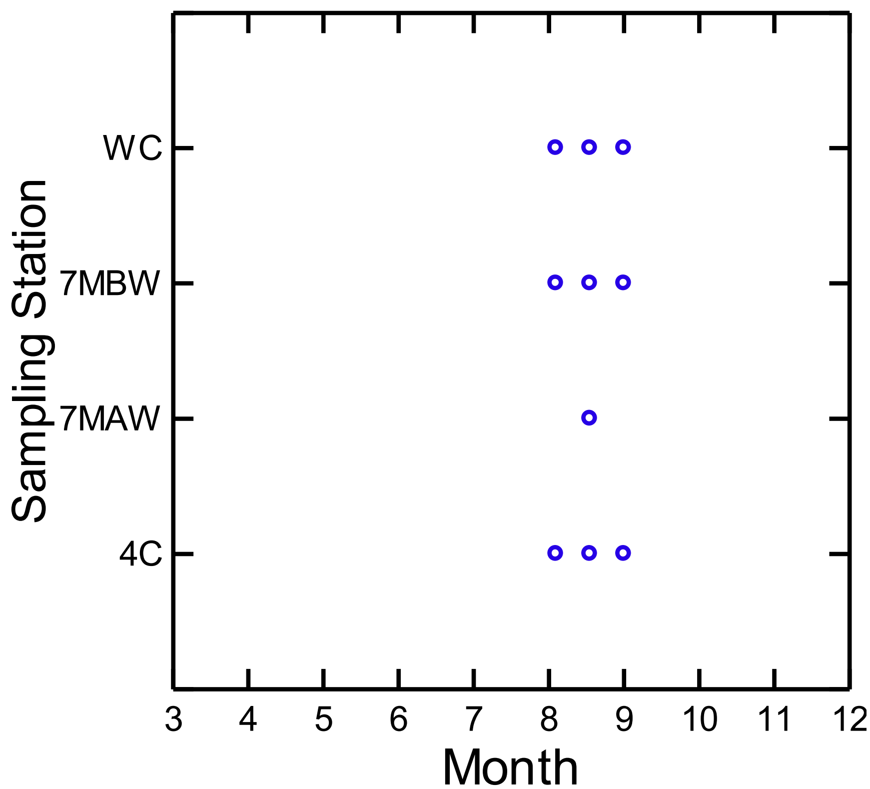


Figure 16. Sampling Frequency for Sevenmile Creek Stations, 2017.

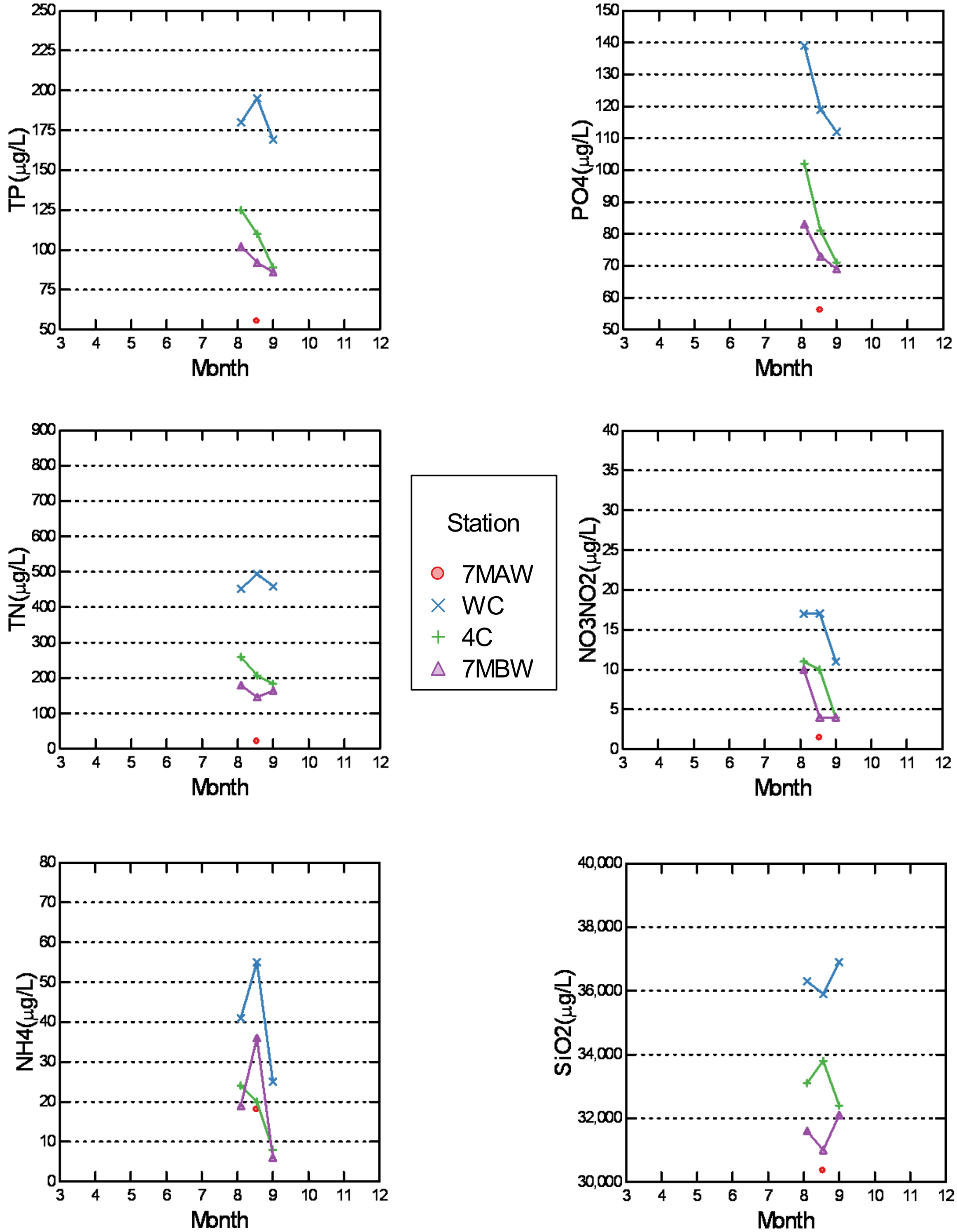


Figure 17. Biweekly time-series of TP, PO4, TN, NO3NO2, NH4, and SiO2 for Sevenmile Creek, 2017.

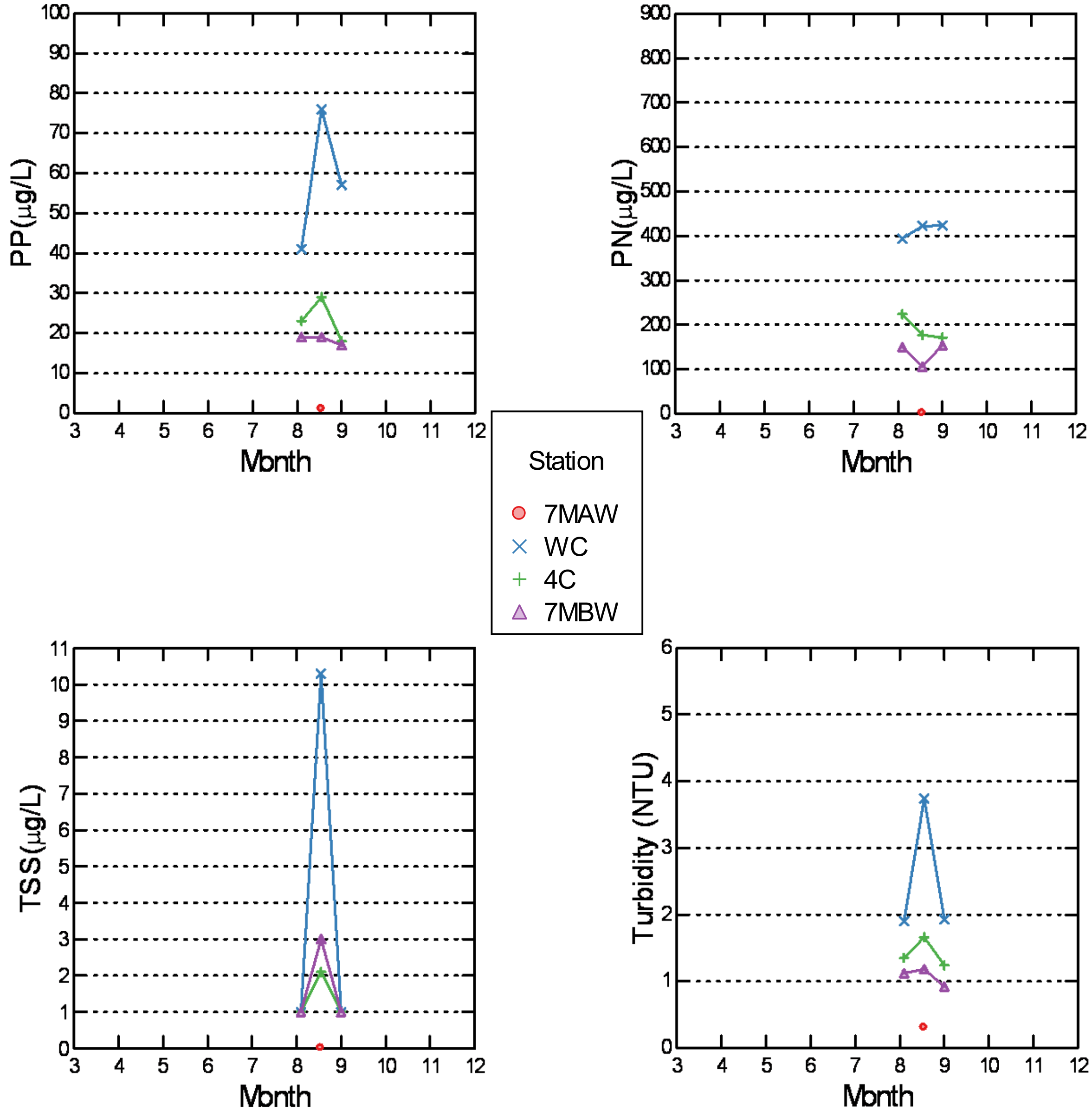


Figure 18. Biweekly time-series for particulate P (PP=TP-PO4), particulate N (PN=TN-(NO3NO2+NH4)), TSS, and Turbidity for Sevenmile Creek, 2017.

Although only representing 3 dates in 2017 the overall median concentrations were similar to 2016, showing lower concentrations in both 7MBW and 4C relative to WC for all phosphorus parameters (Figure 19; note that loading could only be calculated in one date in 2017). Similarly for nitrogen, overall median concentrations (and inter-quartile ranges) were similar to 2016, showing lower concentrations in both 7MBW and 4C relative to WC (Figure 20).

Although 2 of the 3 TSS values were at the detection limit during the collection period (Figure 18), overall concentrations were higher in West Canal (Figure 21). Turbidity concentration also increased below the confluence of WC, which showed the highest turbidity concentrations, both 4C and 7MBW had higher concentrations than 7MAW upstream (Figure 22; only one date for comparison in 2017). Temperature and conductivity were highest in West Canal while dissolved oxygen was lowest (Figure 23). West Canal influenced both temperature and dissolved oxygen below its confluence with Sevenmile in 2016, but with only three data points in 2017 no trend was apparent.

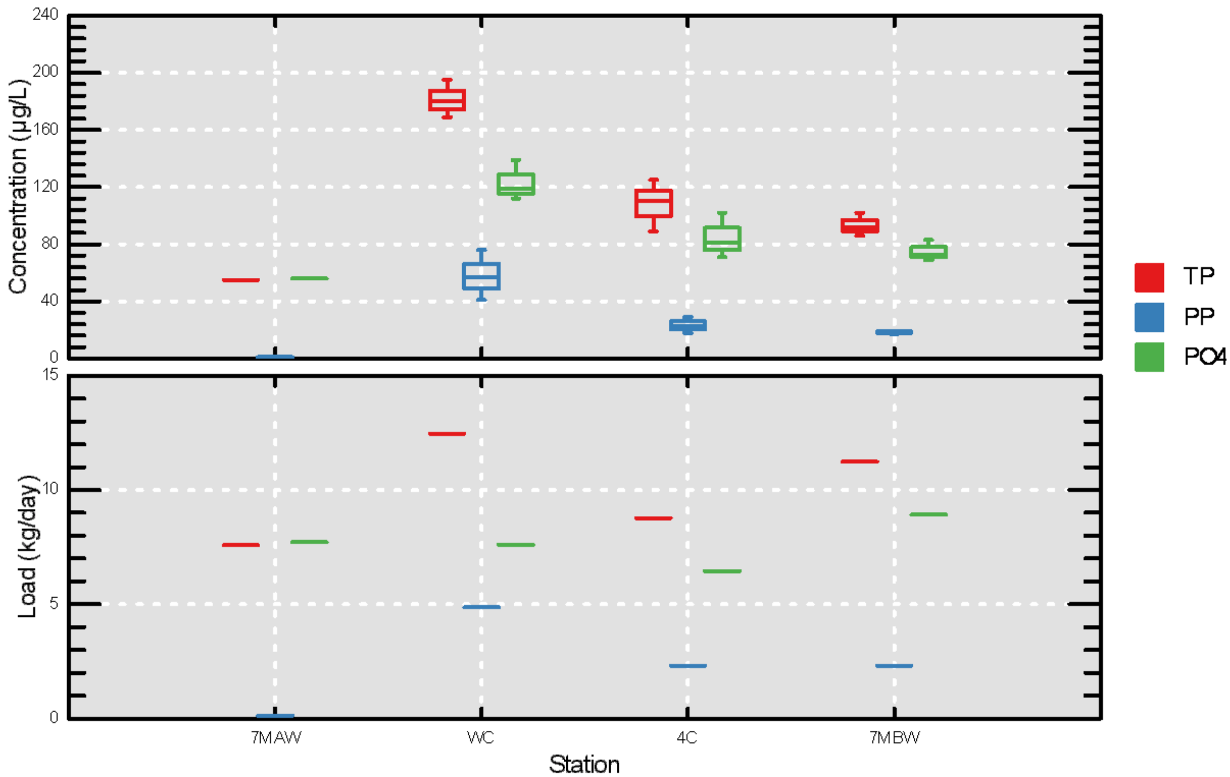


Figure 19. Overall longitudinal trend in phosphorus parameters in Sevenmile Creek during 2017.

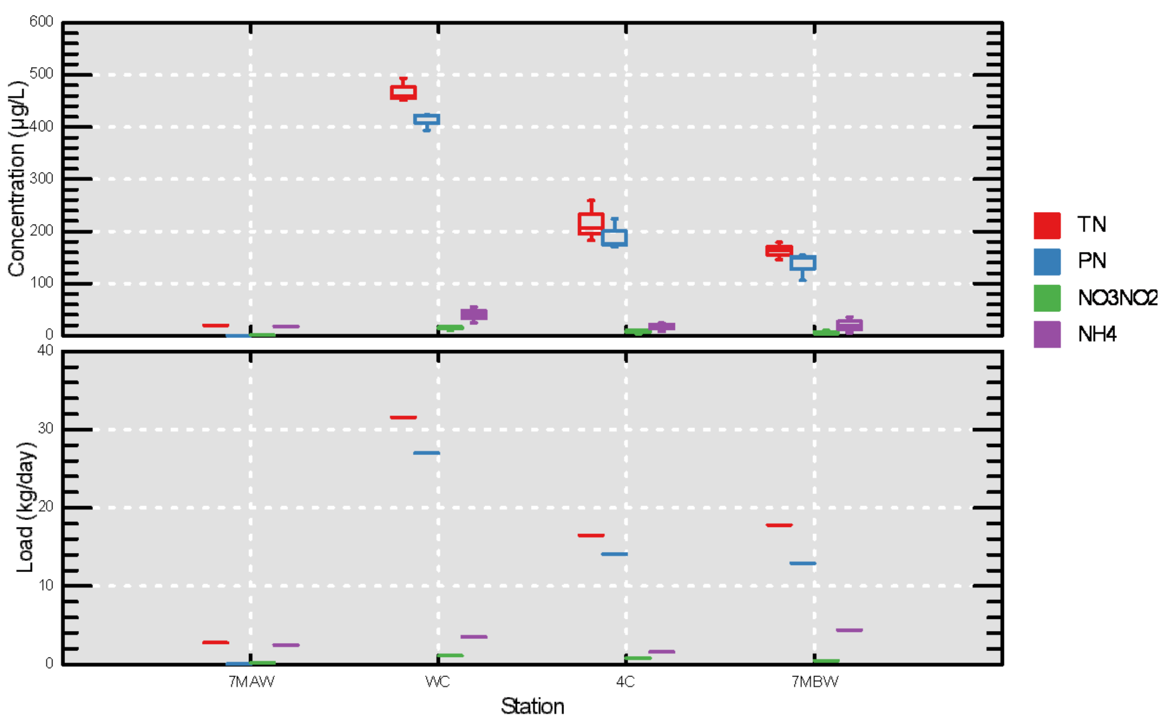


Figure 20. Overall longitudinal trend in nitrogen parameters in Sevenmile Creek during 2017.

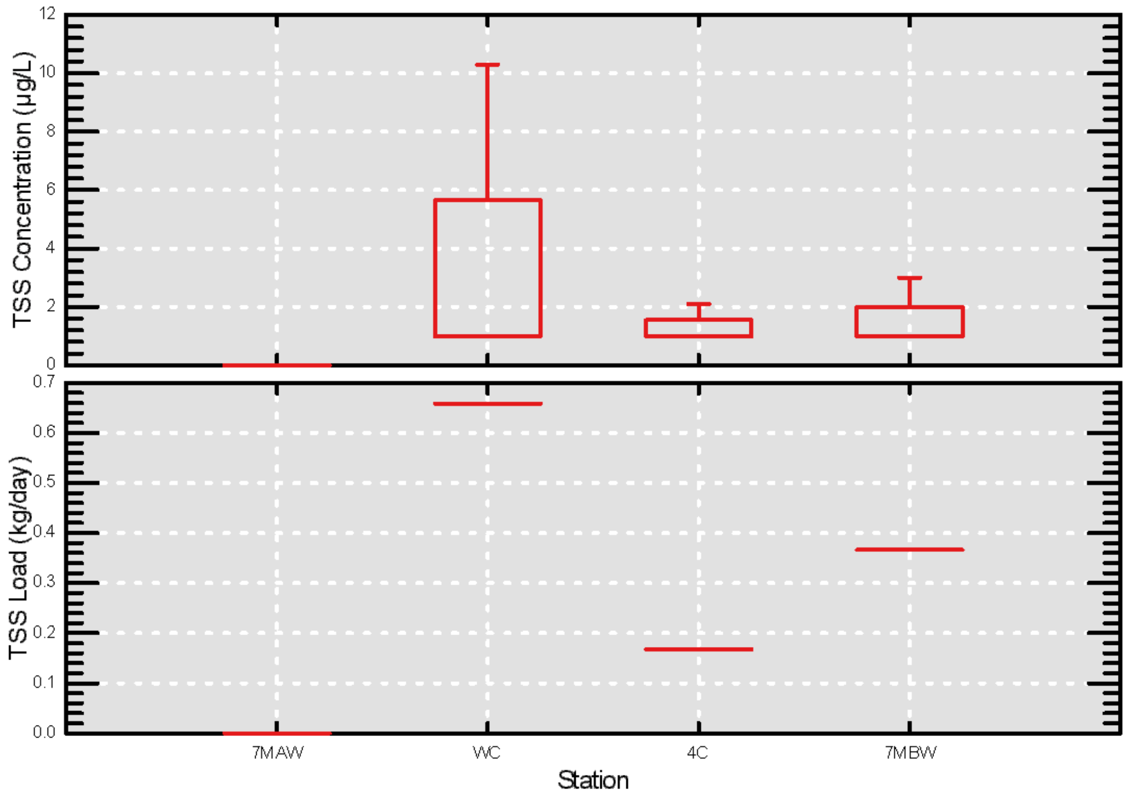


Figure 21. Overall longitudinal trend in TSS in Sevenmile Creek during 2017.

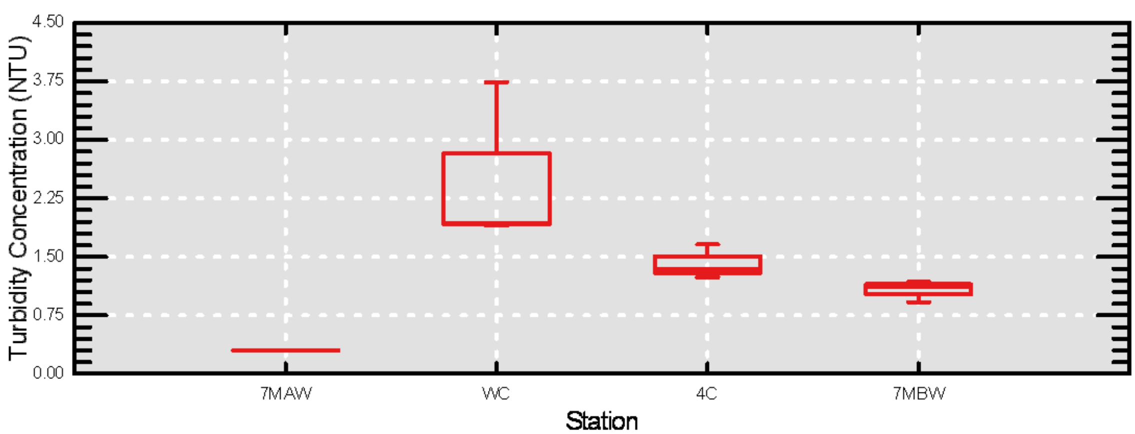


Figure 22. Overall longitudinal trend in Turbidity in Sevenmile Creek during 2017.

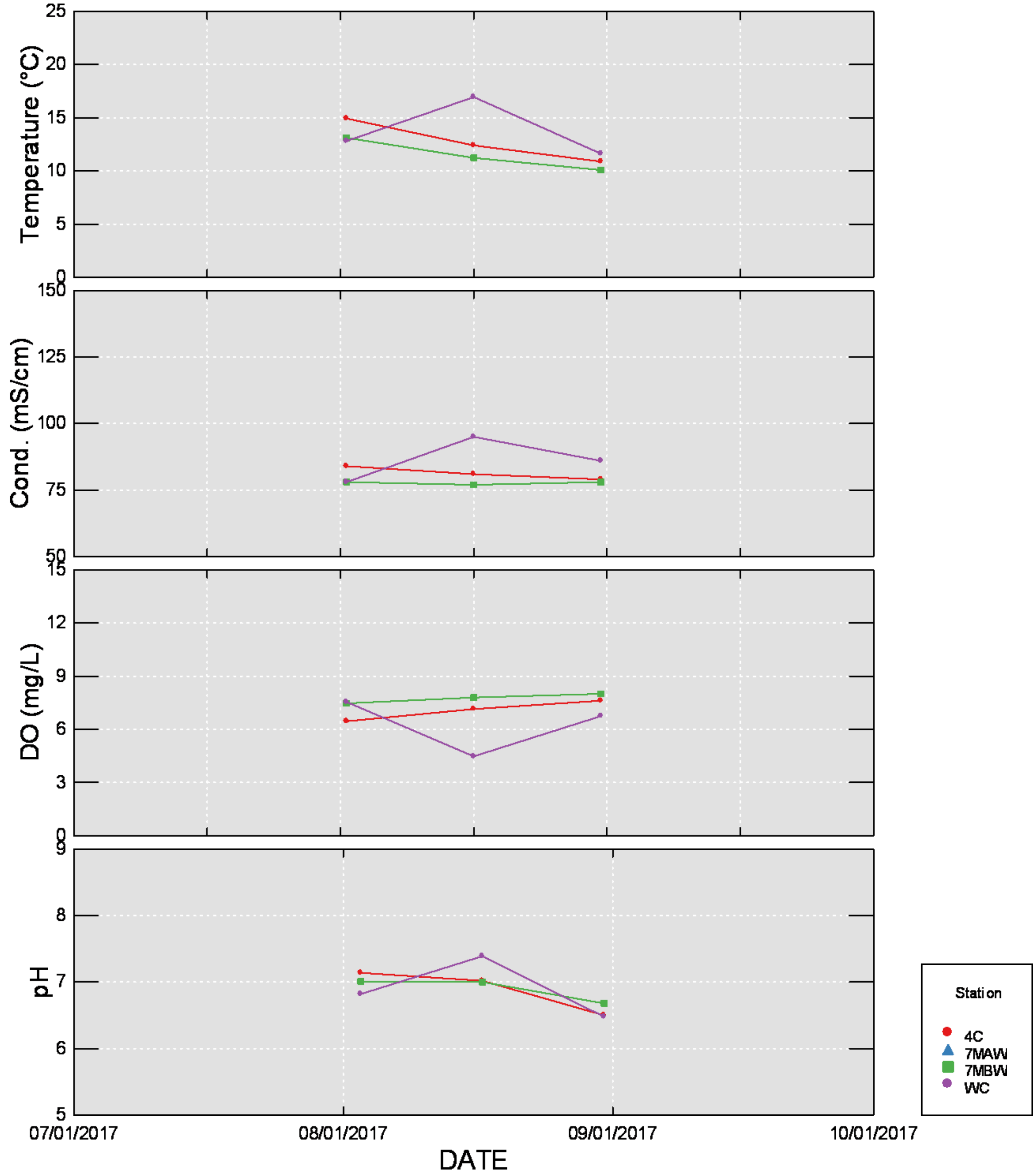


Figure 23. Time series plot of YSI multi-parameter probe water quality measurements for Sevenmile Creek, 2017.

Inter-annual Patterns, 1991-2017

Although it is beyond the scope of this 2017 data summary report to analyze the inter-annual trends in detail, 1991-2017 comparisons for all sampling stations for three periods (all dates, the June-September period, and the Jan-May period) are shown for reference in Appendix I. In addition, a series of tile plots (heat maps) showing monthly mean concentration over the period of record are shown in Appendix IV. Briefly, in 2017 Outflow TP loading for all dates was elevated compared to the previous 7 years, particularly for the upper quartile, and the June - September inter-quartile range for Outflow TP load was also higher than the previous 7 years 2010-2016 (Appendix I Figure 1). A similar pattern to TP load was observed for TN load over all dates, but June to September TN load was not noticeably different than the previous 7-year period (Appendix I Figure 8). However, the pattern of lower overall TN loading in more recent years (2010 to 2017) compared to 1991-2009 for the June-September period continues to be observed. Note that for the UKL outlet station, the June-September period provides the most consistent inter-annual comparison due to changes in the winter and early spring sampling frequency over the period of record. While the distribution of overall loads (and concentrations) can be similar within a given time period among years, there is considerable variability in monthly timing among years (Appendix IV).

June-September TP and TN loading distributions for the Sprague River in 2017 were higher than the previous five years (2012-2016) and were similar to 2011 which was another wet year (although the upper quartile was higher in 2017) (Appendix I Figures 2 and 9). Similarly Williamson River TP and TN loading distributions were higher than many previous years, especially for the upper quartile (Appendix I Figures 7 and 14). In general, for all dates the upper quartile of the TP and TN loads in 2017 was higher than the 2012-2015 dryer years, and also higher than 2016 which was somewhat wetter. The Wood River TP loading distribution for 2017 also tended to be higher relative to previous years. (Appendix I Figures 4 and 5). TN loading distributions for the Wood River stations during 2017 were similar over all dates, but were higher for the June-September period, especially for Weed Rd. (Appendix I Figures 11 and 12). Too few measurements were available for Sevenmile Canal and Anne Creek to evaluate trends for 2017 (Appendix I Figures 3, 10, 6, and 13).

Although the analyses described above provide a relative comparison among years, inter-annual comparisons of nutrient concentration and loading at the various UKL inflow stations requires refined estimation of loading using multiple regression based-algorithms that represent concentration variations associated with flow (i.e., magnitude as well as ascending/descending limb of hydrograph), season (i.e., Julian day), and year (e.g., see Walker et al. 2012; 2015). A comprehensive analysis of time-series trends as well as hydrologic and nutrient budgets based on estimated daily data were completed for UKL through 2010 (Walker et al. 2012). Future comprehensive analyses should be undertaken for additional data collected between 2011-2017.

SUMMARY

With the addition of 2017 data, the UKL tributary nutrient and loading database now includes 27 years of data and includes the years 1991-2017. As with the UKL water quality database, such a long-term monitoring program is essential for assessing change relative to management programs, as well as for understanding inter-annual dynamics. Also similar to recommendations for the UKL water quality database, continued monitoring is recommended to accommodate the restoration time-frame for Klamath Basin activities and to increase statistical power (sample size) for inter-variable analyses. While this data summary report is intended to provide an update of the long-term data base with 2017 tributary and outflow data, Walker et al. (2012) provide a more detailed and comprehensive analysis of the long-term UKL tributary database including statistical trend analyses and construction of hydrologic and nutrient budgets for UKL using the 1991-2010 dataset (Walker et al. 2012). A similar comprehensive treatment of the data is recommended at five year intervals, which is now at 7 years with the addition of 2017 data.

LITERATURE CITED

Graham Matthews and Associates. 2004a. 2003 Pilot Project Monitoring Report Volume 1: Surface Water. Klamath Basin Rangeland Trust, Ashland, OR 97520

Graham Matthews and Associates. 2004b. 2003 Pilot Project Monitoring Report Volume 2: Water Quality Baseline Surveys. Klamath Basin Rangeland Trust, Ashland, OR 97520.

Graham Matthews & Associates (GMA) (2011a). 2007-2010 KBRT Monitoring Report, Volume 1: Surface Water. Prepared for Klamath Basin Rangeland Trust, Klamath Falls, OR. April 2011.

GMA (2011b). 2007-2010 KBRT Monitoring Report, Volume 2: Water Quality Monitoring. Prepared for Klamath Basin Rangeland Trust, Klamath Falls, OR. May 2011.

Kann, J. 1998. Ecology and water quality dynamics of a shallow hypertrophic lake dominated by Cyanobacteria (*Aphanizomenon flos-aquae*). Doctoral Dissertation. University of North Carolina. Curriculum in Ecology. Chapel Hill, North Carolina.

Kann, J. 2011. Upper Klamath Lake Tributary Loading: 2010 Data Summary Report. Technical Memorandum Prepared for the Klamath Tribes Natural Resources Department, Chiloquin, Oregon. Spring 2008.

Kann, J. 2012. Upper Klamath Lake 2011 Data Summary Report. Technical Memorandum Prepared for the Klamath Tribes Natural Resources Department, Chiloquin, Oregon. June 2012

Kann, J. 2013. Upper Klamath Lake 2012 Data Summary Report. Technical Memorandum Prepared for the Klamath Tribes Natural Resources Department, Chiloquin, Oregon. May 2013.

Kann, J. 2014. Upper Klamath Lake 2013 Data Summary Report. Technical Memorandum Prepared for the Klamath Tribes Natural Resources Department, Chiloquin, Oregon. May 2014

Kann, J. 2016. Upper Klamath Lake 2015 Data Summary Report. Technical Memorandum Prepared for the Klamath Tribes Natural Resources Department, Chiloquin, Oregon. Aug 2016

Kann, J. 2017. Upper Klamath Lake 2016 Data Summary Report. Technical Memorandum Prepared for the Klamath Tribes Natural Resources Department, Chiloquin, Oregon. Aug 2016

Kann, J., and W. W. Walker. 1999. Nutrient and hydrologic loading to Upper Klamath Lake, Oregon, 1991-1998. Technical Report submitted to the Klamath Tribes Natural Resources Department, Chiloquin, Oregon, and the U.S. Bureau of Reclamation, Klamath Falls, Oregon.

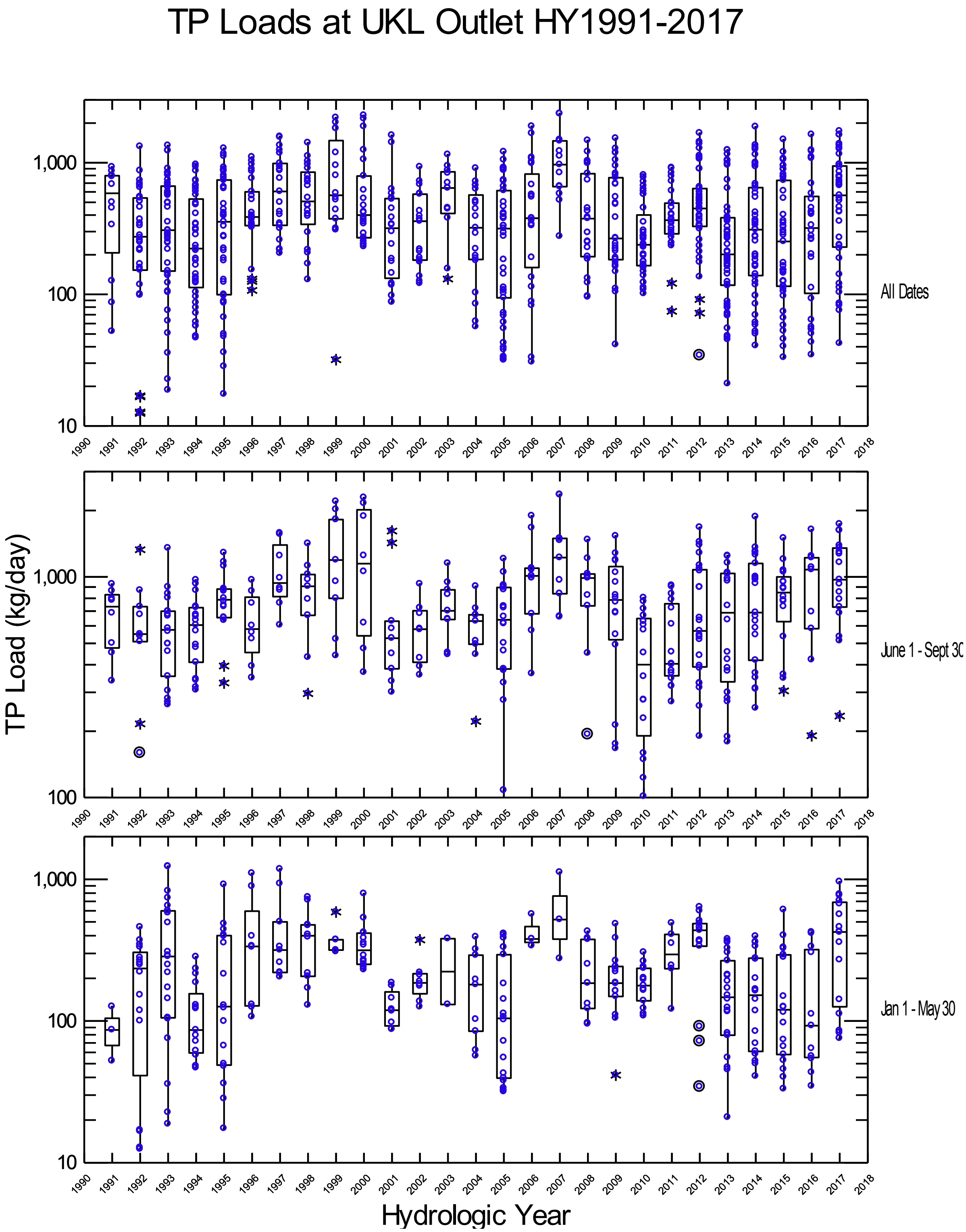
Klamath Tribes 2013. Quality Assurance Project Plan (QAPP). Revision: 2013 v 0. Klamath Tribes Research Station, Klamath Tribes Natural Resources Department, Chiloquin, OR.

Klamath Tribes 2013. Tributary Field Sampling (SOP). Revision: 2013 v 0. Klamath Tribes Research Station, Klamath Tribes Natural Resources Department, Chiloquin, OR.

Walker, W.W., J.D. Walker, and J. Kann, 2012. Evaluation of Water and Nutrient Balances for the Upper Klamath Lake Basin in Water Years 1992-2010. Technical Report to the Klamath Tribes Natural Resources Department, Chiloquin, OR. 49 pp +Appendices.

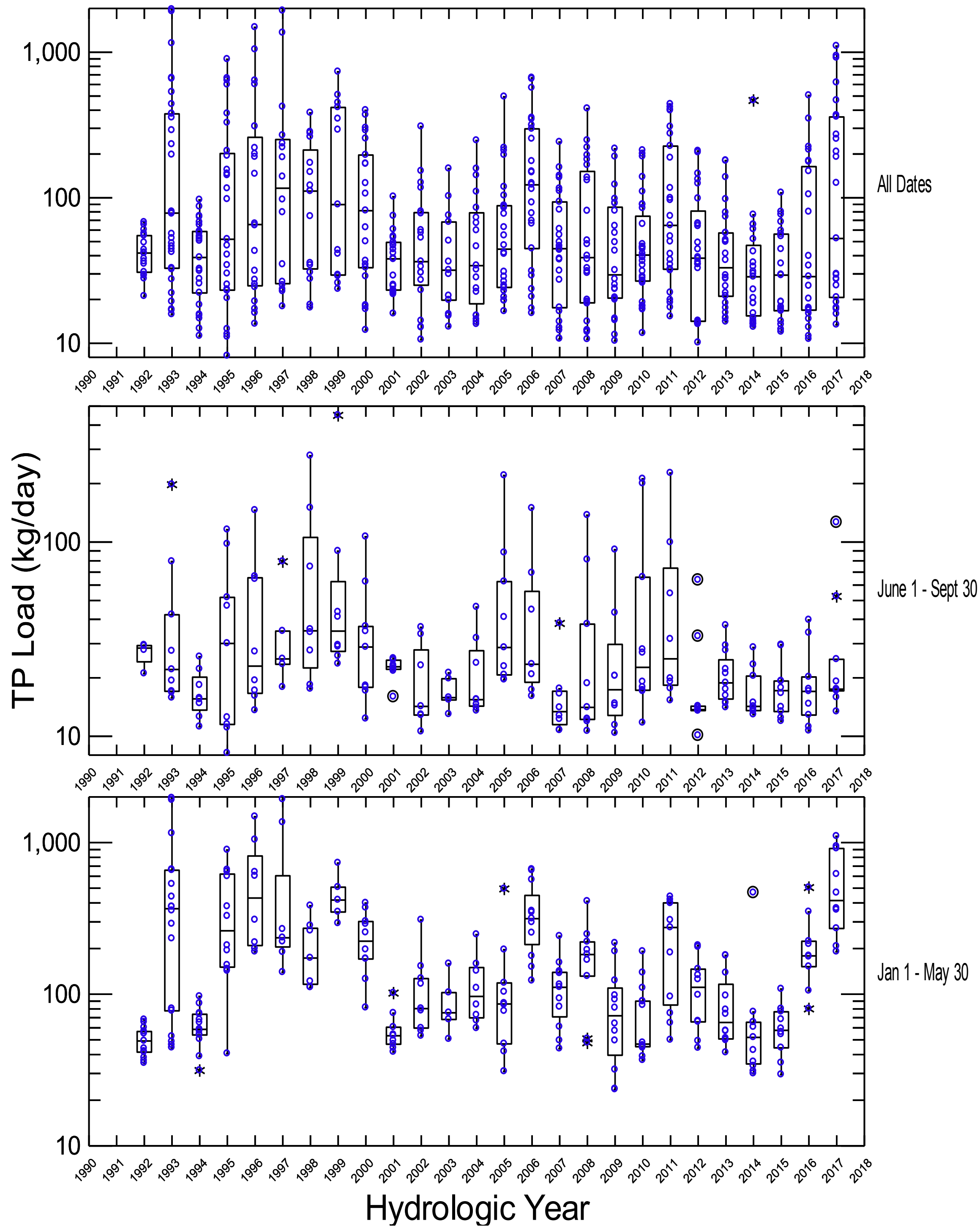
Walker, J. D., J. Kann, and W.W. Walker. 2015. Spatial and temporal nutrient loading dynamics in the Sprague River Basin, Oregon. Prepared by Aquatic Ecosystem Sciences, J. D. Walker, and W. W. Walker for the Klamath Tribes Natural Resources Department. 73p. + appendices.

APPENDIX I: Annual and seasonal distributions of TP and TN loading of Upper Klamath Lake Tributaries and outflow.



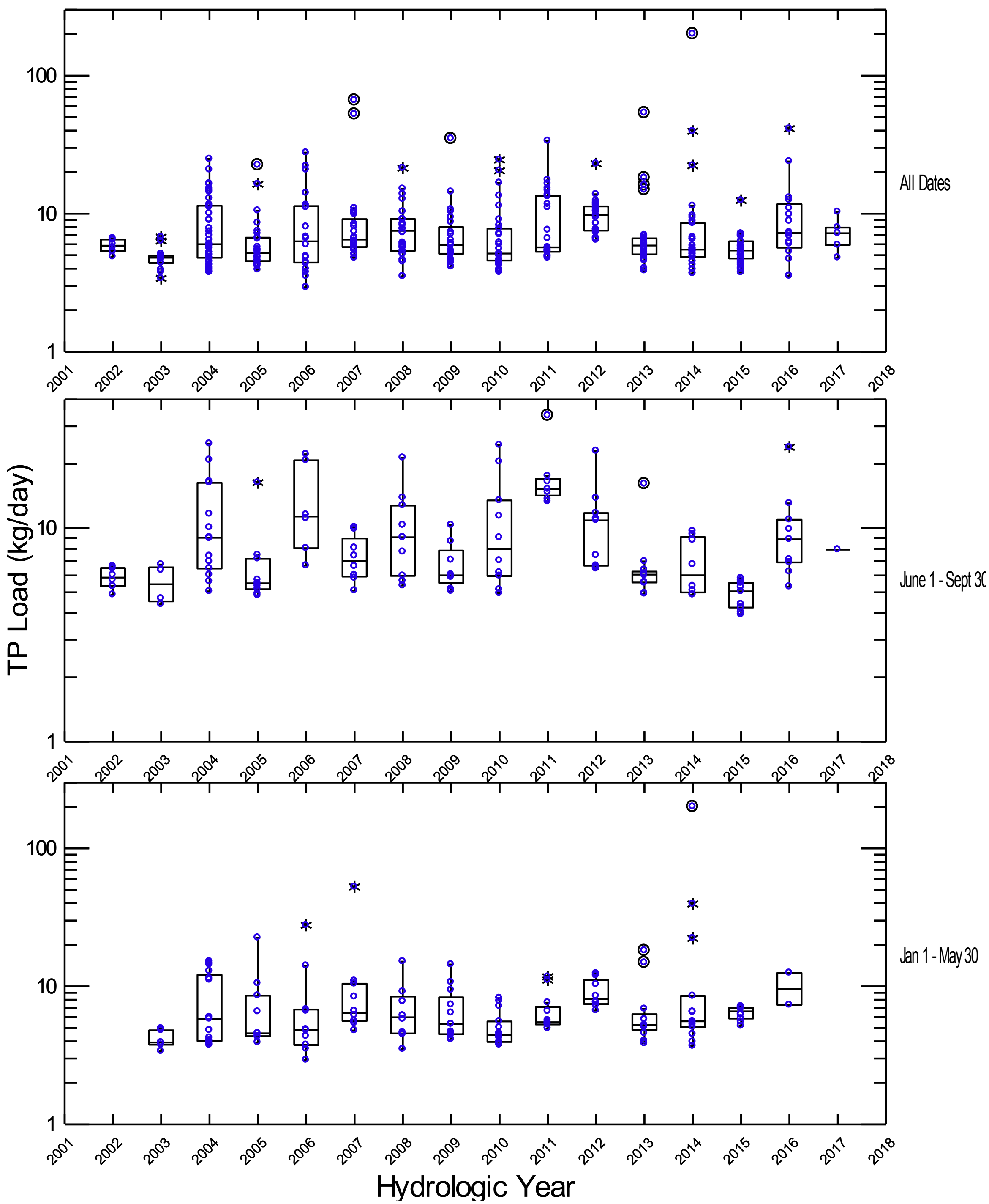
Appendix I Figure 1

TP Loads at Sprague R. @ Kirchers Bridge (W1000) HY1992-2017

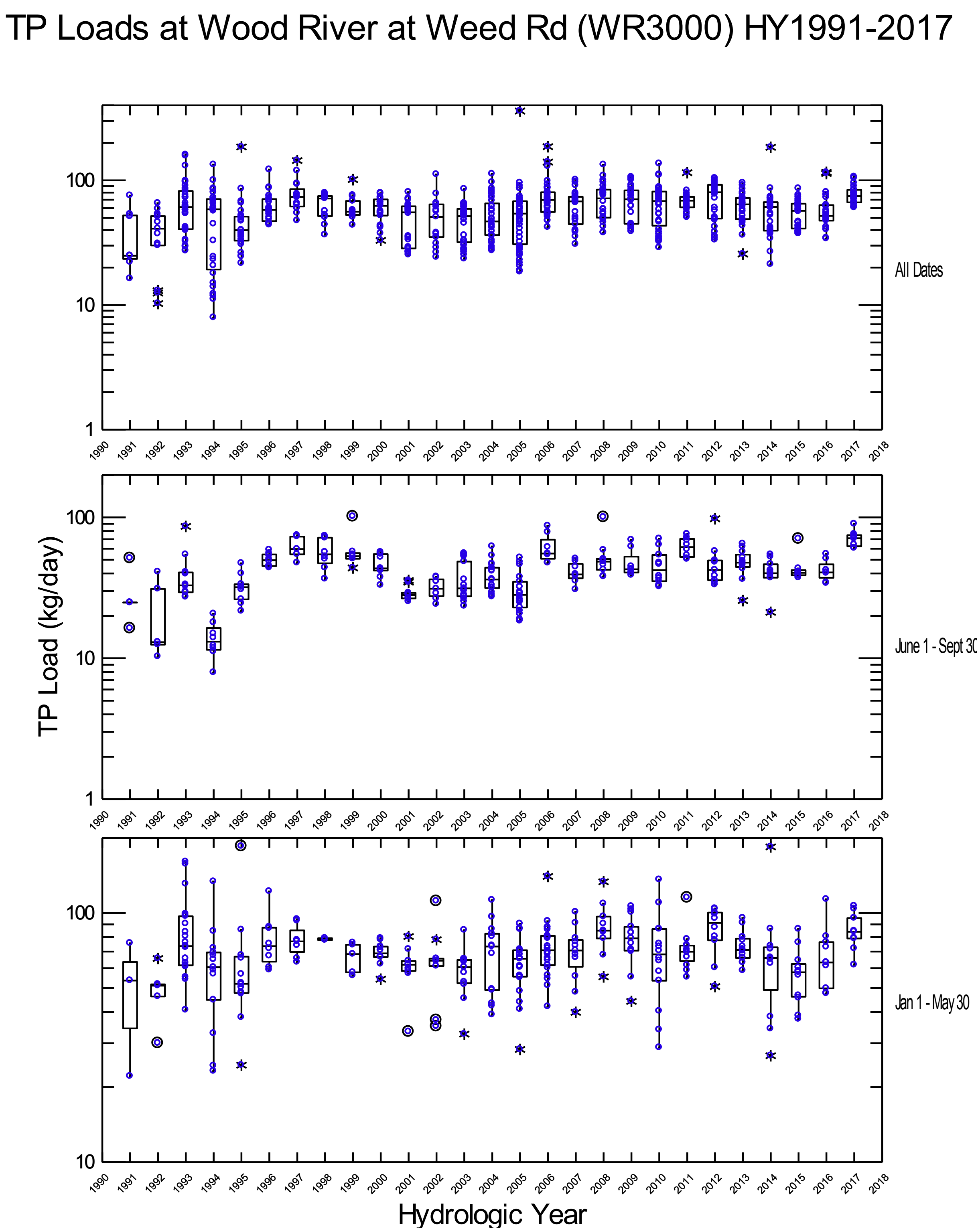


Appendix I Figure 2

TP Loads at Annie Cr at Snow Park (WR2000) HY1991-2017

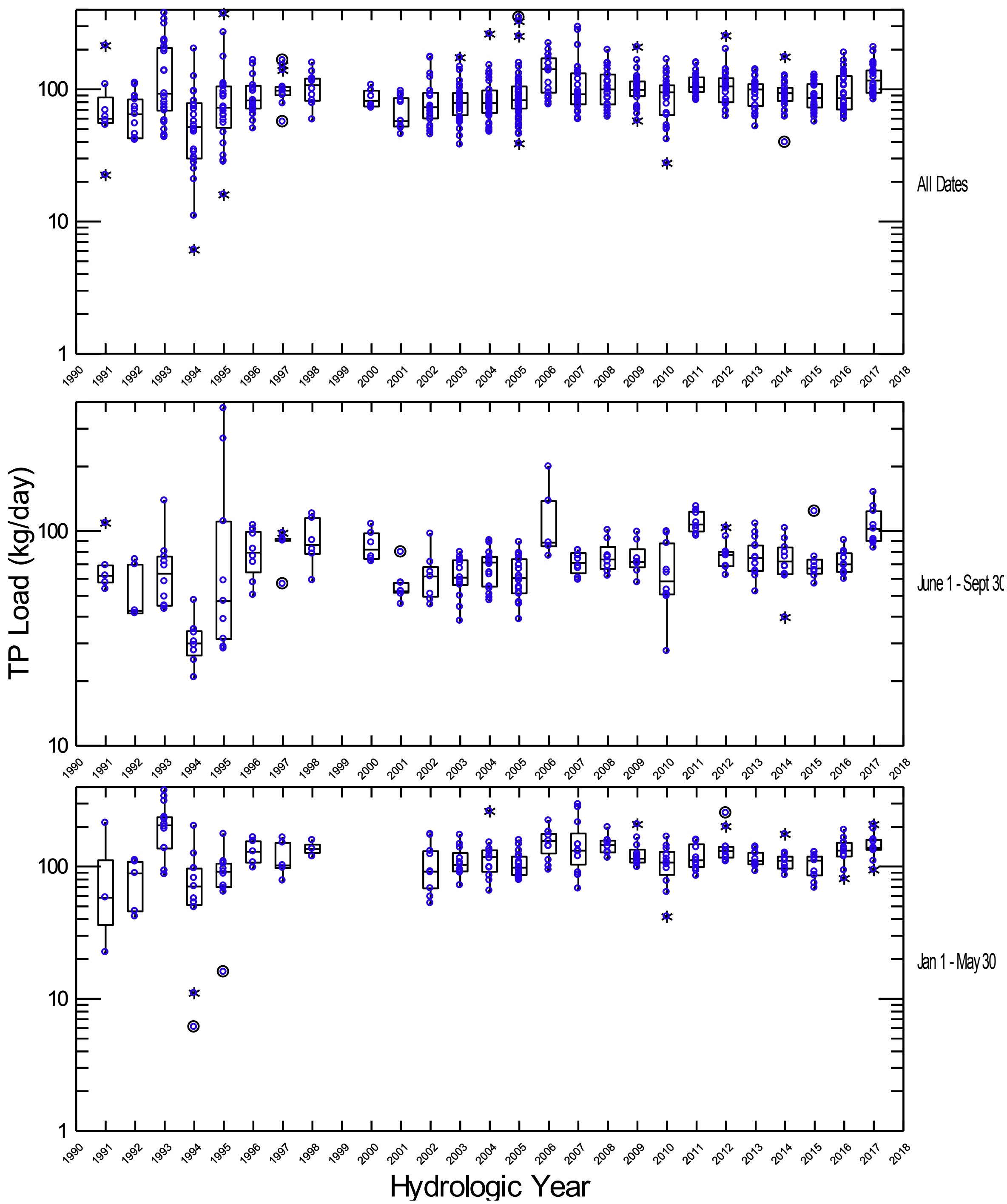


Appendix I Figure 3



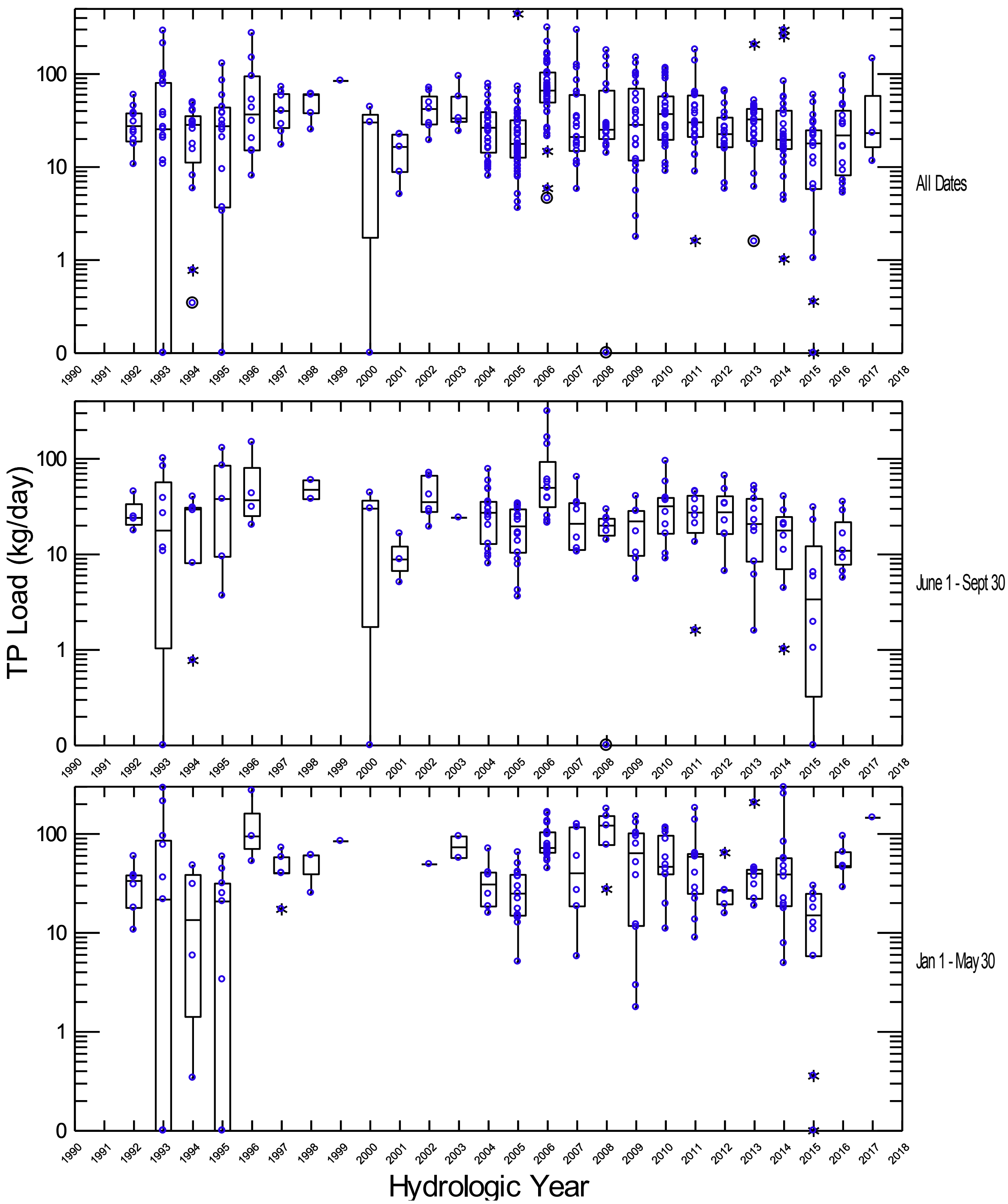
Appendix I Figure 4

TP Loads at Wood River at Dike Rd (WR4000) HY1991-2017



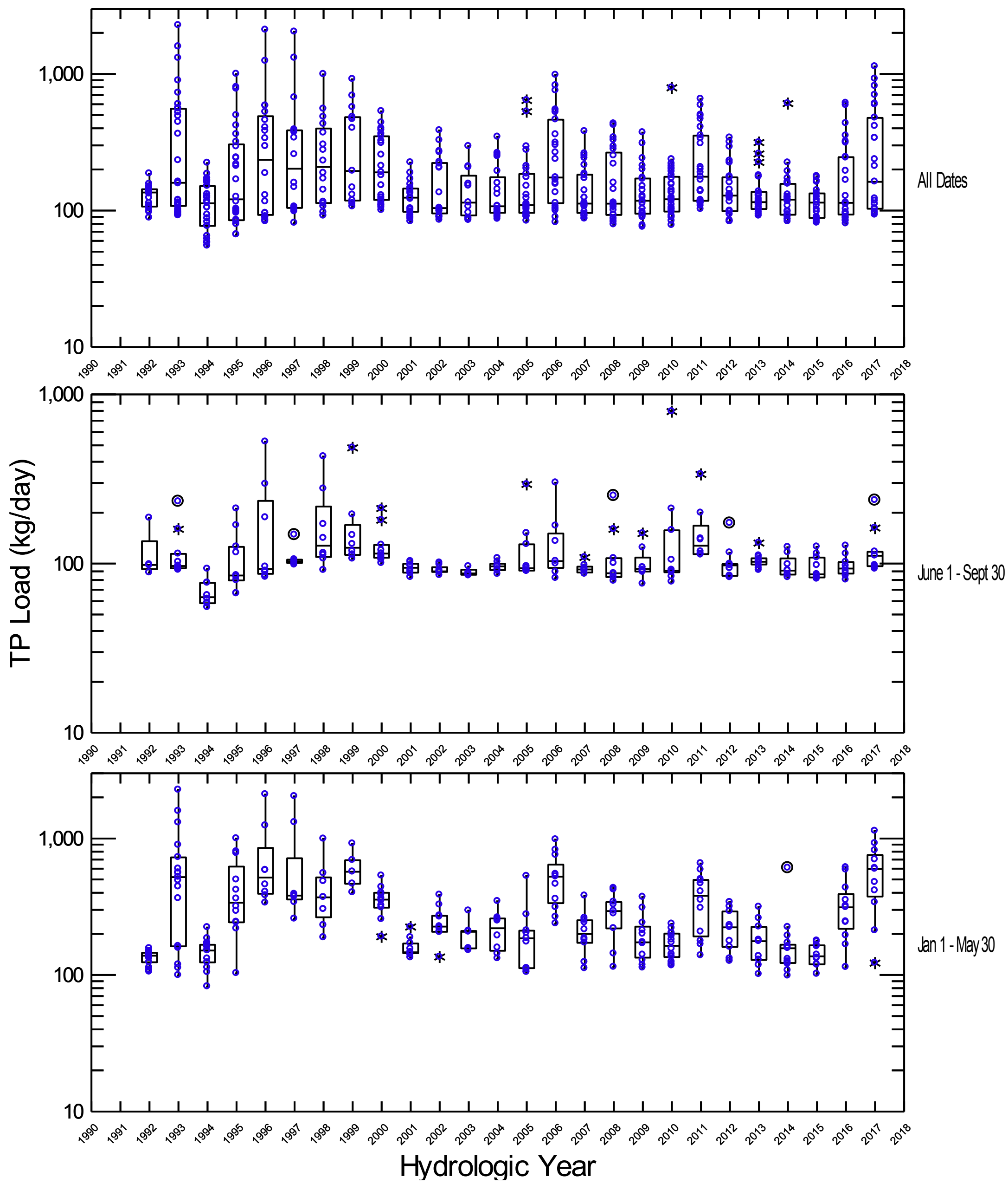
Appendix I Figure 5

TP Loads at Seven-Mile Canal at Dike Rd (WR5000) HY1991-2017



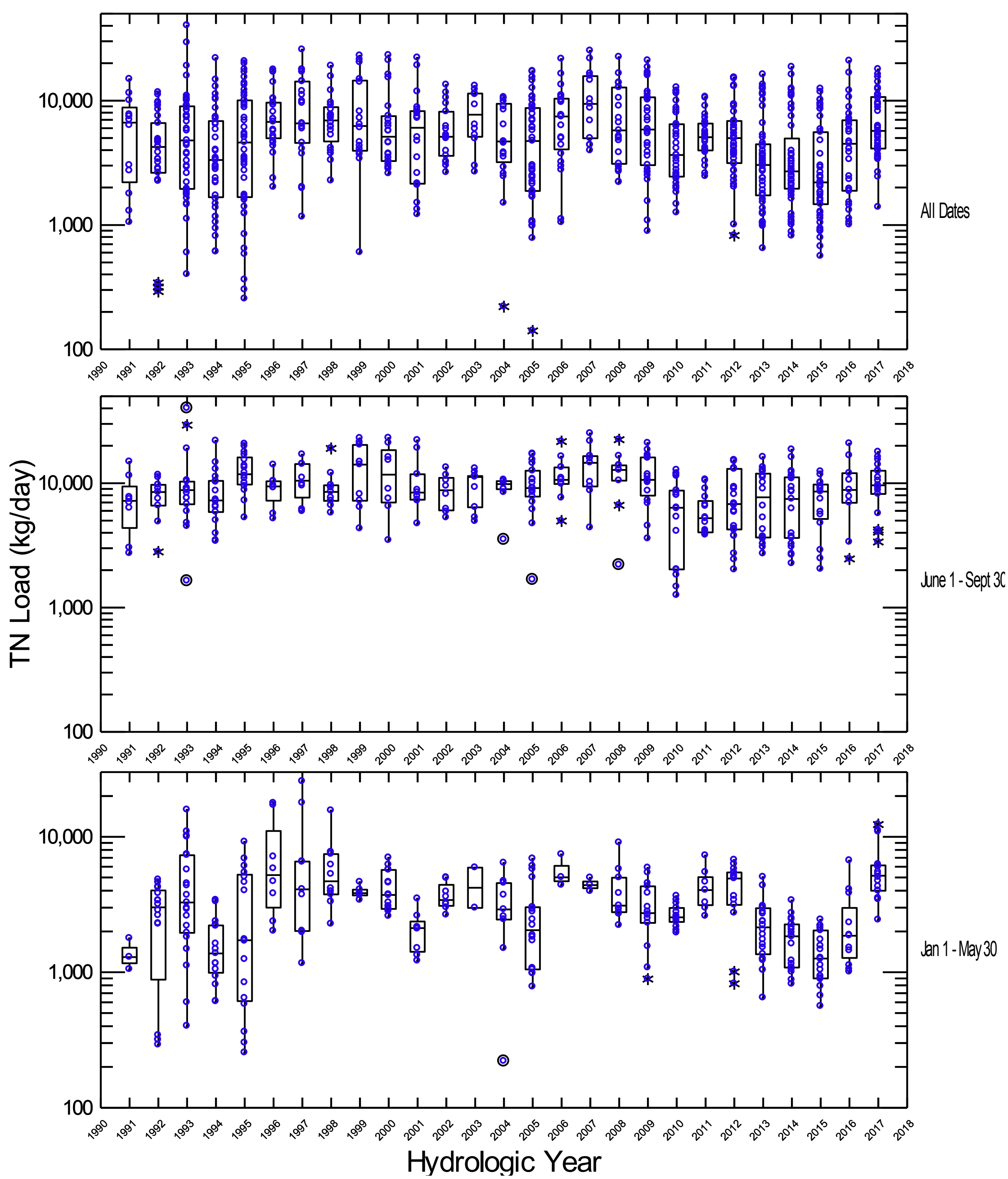
Appendix I Figure 6

TP Loads at Williamson R at Bridge on Modoc Pt. Road (WR6000) HY1991-2017



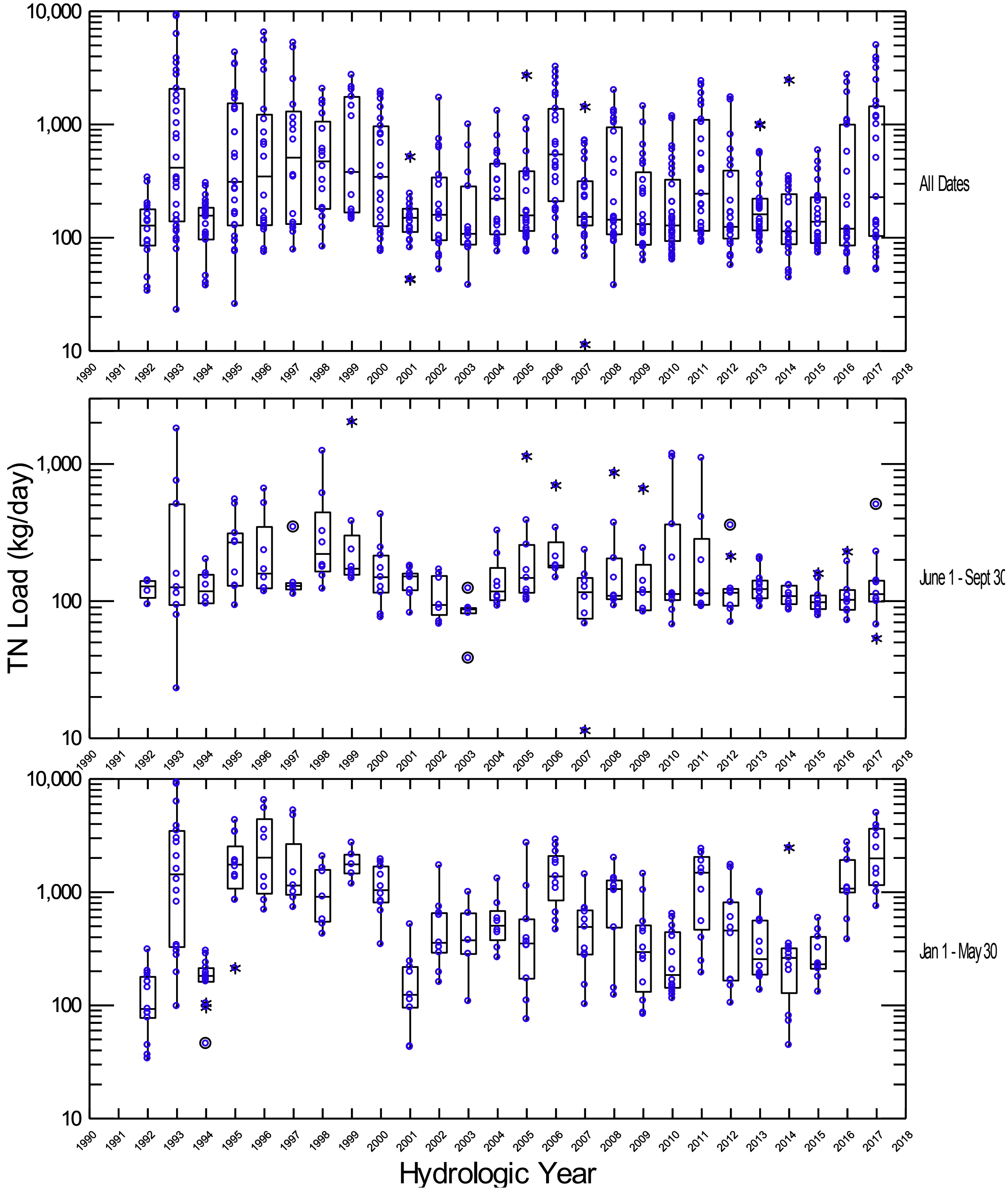
Appendix I Figure 7

TN Loads at UKL Outlet (KL0001) HY1991-2017



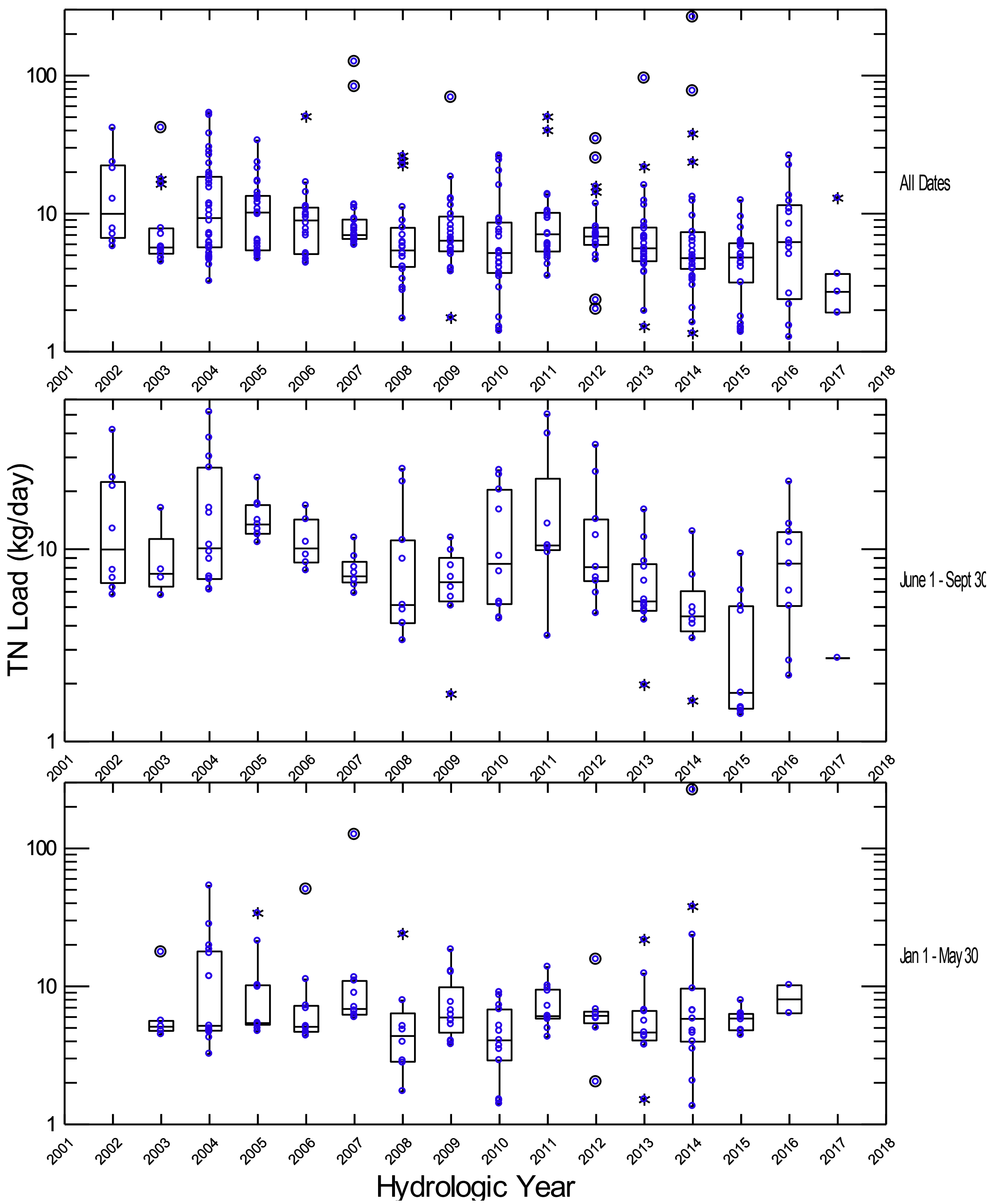
Appendix I Figure 8

TN Loads at Sprague R. @ Kirchers Bridge (W1000) HY1991-2017



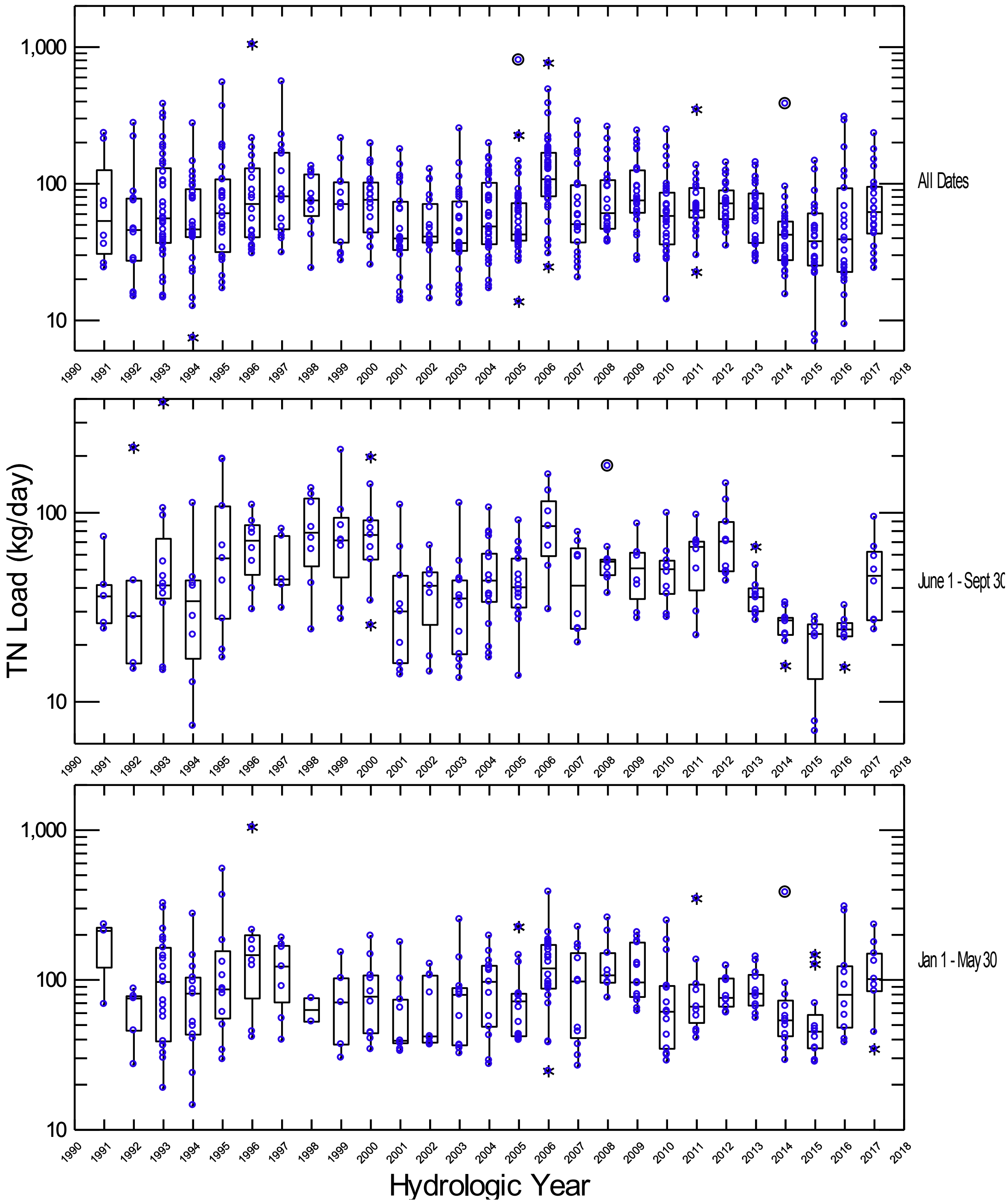
Appendix I Figure 9

TN Loads at Annie Cr at Snow Park (WR2000) HY1991-2017



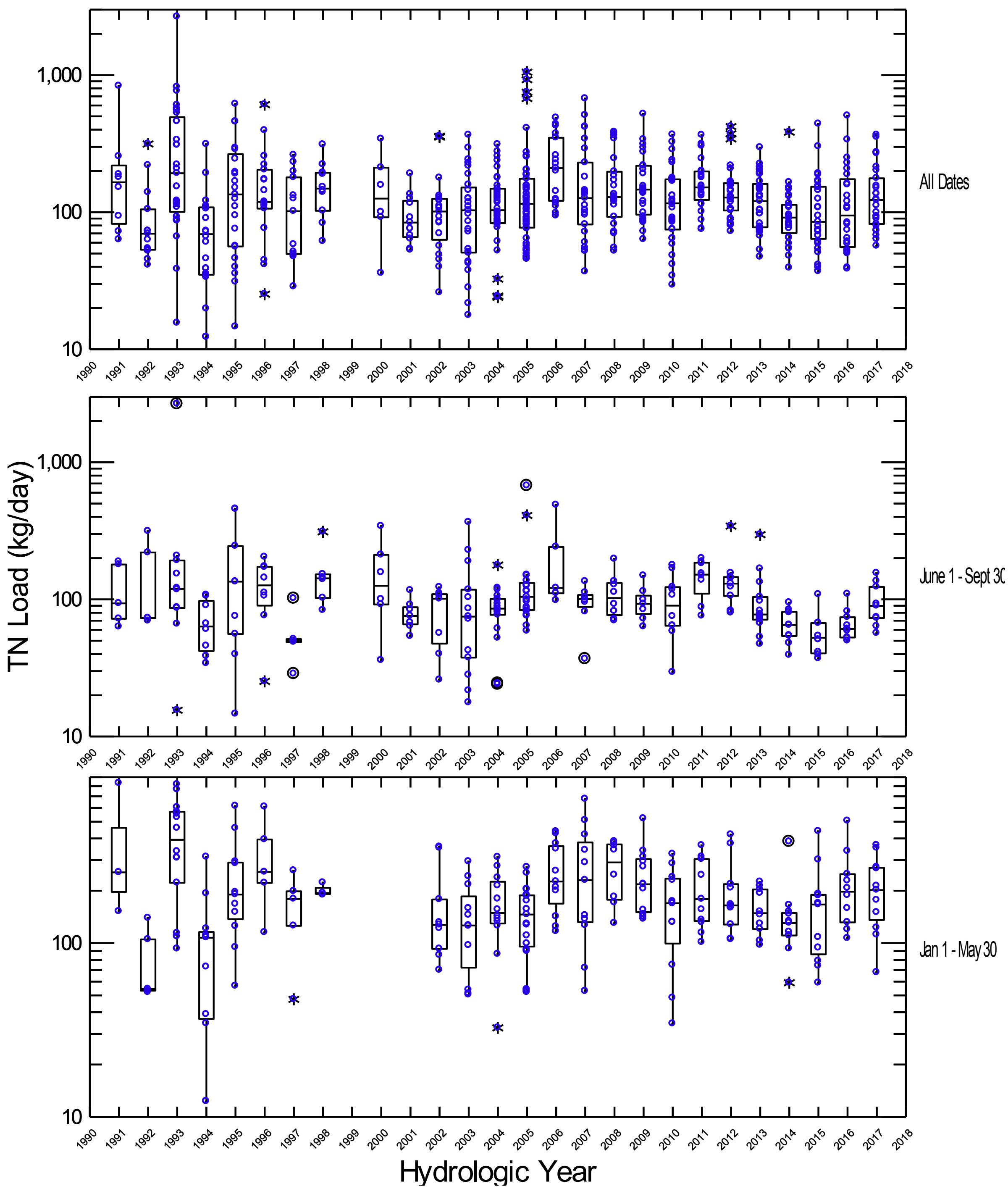
Appendix I Figure 10

TN Loads at Wood River at Weed Rd (WR3000) HY1991-2017



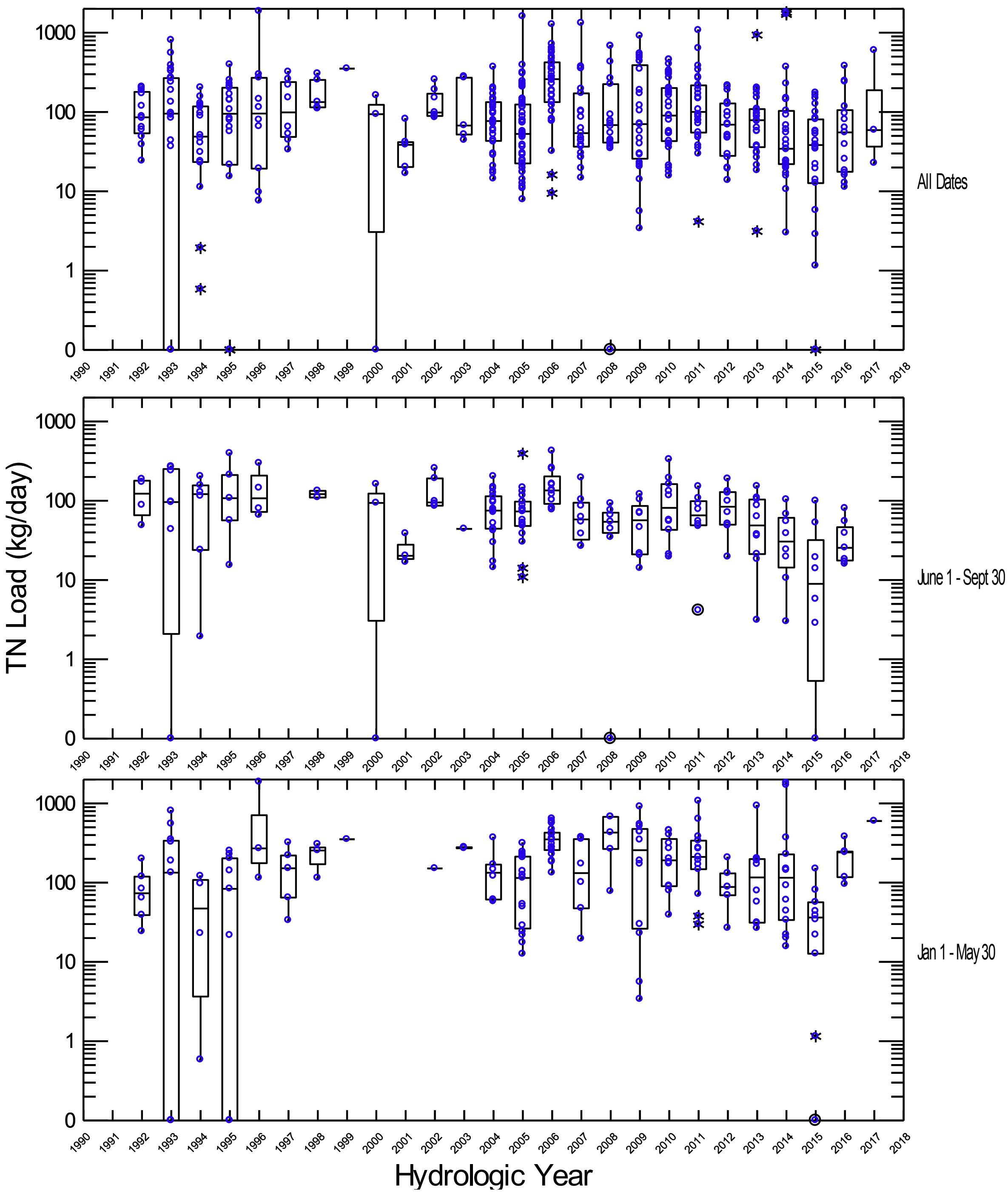
Appendix I Figure 11

TN Loads at Wood River at Dike Rd (WR4000) HY1991-2017



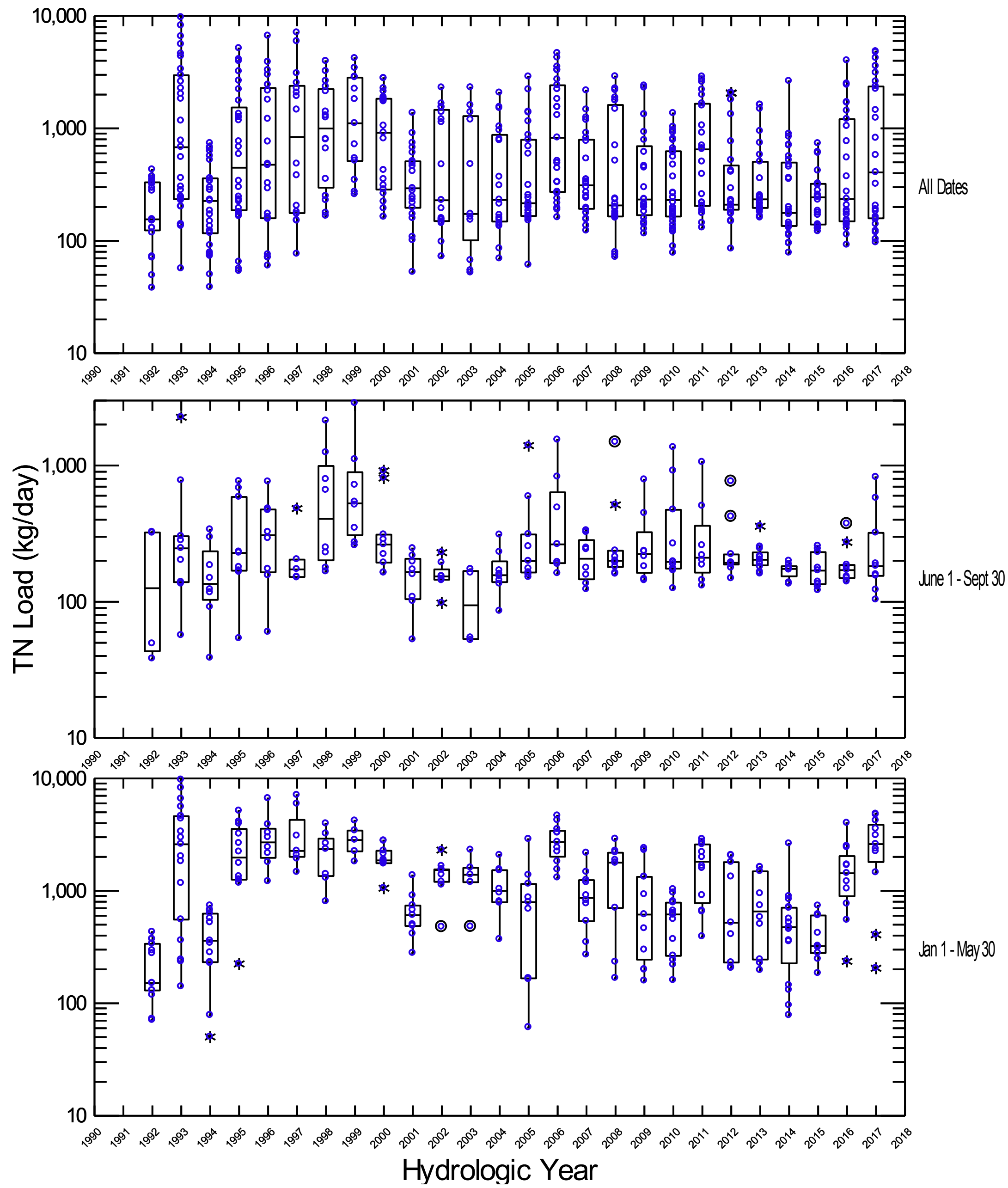
Appendix I Figure 12

TN Loads at Seven-Mile Canal at Dike Rd (WR5000) HY1991-2017



Appendix I Figure 13

TN Loads at Williamson R at Bridge on Modoc Pt. Road (WR6000) HY1991-2017



Appendix I Figure 14

APPENDIX II: Basic monthly statistics by station for TP, SRP, TN, NH_4-N, NO_3+ NO_2-N, SiO_2 concentration, and TP and TN load, Water Year 2017.

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
UKL Out	UKL Outlet	10	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
UKL Out	UKL Outlet	10	Median	74.50	15.00	1535.00	352.50	122.00	40775.00	230.06	4693.42
UKL Out	UKL Outlet	10	Arithmetic Mean	74.50	15.00	1535.00	352.50	122.00	40775.00	230.06	4693.42
UKL Out	UKL Outlet	10	Coefficient of Variation	0.23	0.33	0.33	0.76	0.85	0.01	0.04	0.15
UKL Out	UKL Outlet	10	Pct25	62.50	11.50	1175.00	163.00	48.50	40400.00	223.06	4193.55
UKL Out	UKL Outlet	10	Pct75	86.50	18.50	1895.00	542.00	195.50	41150.00	237.06	5193.30
UKL Out	UKL Outlet	11	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
UKL Out	UKL Outlet	11	Median	68.00	16.00	1835.00	589.00	347.00	38250.00	153.70	4080.02
UKL Out	UKL Outlet	11	Arithmetic Mean	68.00	16.00	1835.00	589.00	347.00	38250.00	153.70	4080.02
UKL Out	UKL Outlet	11	Coefficient of Variation	0.12	0.44	0.05	0.01	0.20	0.03	0.31	0.14
UKL Out	UKL Outlet	11	Pct25	62.00	11.00	1770.00	585.00	297.00	37500.00	120.00	3677.45
UKL Out	UKL Outlet	11	Pct75	74.00	21.00	1900.00	593.00	397.00	39000.00	187.41	4482.60
UKL Out	UKL Outlet	12	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
UKL Out	UKL Outlet	12	Median	59.50	5.75	1725.00	394.00	507.00	37000.00	72.81	2019.60
UKL Out	UKL Outlet	12	Arithmetic Mean	59.50	5.75	1725.00	394.00	507.00	37000.00	72.81	2019.60
UKL Out	UKL Outlet	12	Coefficient of Variation	0.11	1.05	0.07	0.07	0.01	0.03	0.59	0.44
UKL Out	UKL Outlet	12	Pct25	55.00	1.50	1640.00	374.00	503.00	36200.00	42.26	1390.67
UKL Out	UKL Outlet	12	Pct75	64.00	10.00	1810.00	414.00	511.00	37800.00	103.36	2648.52
UKL Out	UKL Outlet	1	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
UKL Out	UKL Outlet	1	Median	51.00	5.00	1680.00	466.00	507.00	38900.00	85.07	3444.45
UKL Out	UKL Outlet	1	Arithmetic Mean	48.00	4.17	1720.00	454.00	491.33	38566.67	90.82	3292.39
UKL Out	UKL Outlet	1	Coefficient of Variation	0.13	0.57	0.05	0.23	0.13	0.02	0.21	0.24
UKL Out	UKL Outlet	1	Pct25	43.50	2.38	1665.00	373.75	443.25	38000.00	77.76	2686.30
UKL Out	UKL Outlet	1	Pct75	51.75	5.75	1785.00	531.25	535.50	39050.00	105.32	3860.45
UKL Out	UKL Outlet	2	N of Cases	3.00	2.00	3.00	3.00	3.00	2.00	3.00	3.00
UKL Out	UKL Outlet	2	Median	55.00	9.50	1370.00	450.00	406.00	34950.00	141.31	4290.64
UKL Out	UKL Outlet	2	Arithmetic Mean	51.67	9.50	1430.00	425.33	375.00	34950.00	298.02	6712.25
UKL Out	UKL Outlet	2	Coefficient of Variation	0.35	0.07	0.15	0.37	0.20	0.11	1.09	0.73
UKL Out	UKL Outlet	2	Pct25	37.75	9.00	1280.00	305.25	318.25	32300.00	96.99	3712.56
UKL Out	UKL Outlet	2	Pct75	64.75	10.00	1595.00	539.25	424.00	37600.00	538.24	10317.35
UKL Out	UKL Outlet	3	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
UKL Out	UKL Outlet	3	Median	59.50	5.50	772.00	13.00	86.00	24800.00	866.36	11034.56
UKL Out	UKL Outlet	3	Arithmetic Mean	59.50	5.50	772.00	13.00	86.00	24800.00	866.36	11034.56
UKL Out	UKL Outlet	3	Coefficient of Variation	0.11	0.13	0.25	0.33	1.27	0.08	0.16	0.02
UKL Out	UKL Outlet	3	Pct25	55.00	5.00	638.00	10.00	9.00	23400.00	770.48	10907.11
UKL Out	UKL Outlet	3	Pct75	64.00	6.00	906.00	16.00	163.00	26200.00	962.24	11162.02

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
UKL Out	UKL Outlet	4	N of Cases	3.00	3.00	3.00	3.00	3.00	2.00	3.00	3.00
UKL Out	UKL Outlet	4	Median	53.00	16.00	600.00	65.00	79.00	23800.00	358.96	5034.66
UKL Out	UKL Outlet	4	Arithmetic Mean	47.00	21.33	619.33	62.00	71.00	23800.00	362.92	5006.21
UKL Out	UKL Outlet	4	Coefficient of Variation	0.38	0.43	0.08	0.30	0.42	0.04	0.26	0.20
UKL Out	UKL Outlet	4	Pct25	33.50	16.00	585.00	47.75	48.25	23100.00	292.04	4250.98
UKL Out	UKL Outlet	4	Pct75	59.00	28.00	658.50	75.50	91.75	24500.00	434.79	5754.31
UKL Out	UKL Outlet	5	N of Cases	5.00	5.00	5.00	5.00	5.00	3.00	5.00	5.00
UKL Out	UKL Outlet	5	Median	69.00	26.00	646.00	21.00	89.00	26950.00	564.77	5492.82
UKL Out	UKL Outlet	5	Arithmetic Mean	67.90	27.30	656.40	42.30	63.10	27483.33	580.95	5559.30
UKL Out	UKL Outlet	5	Coefficient of Variation	0.22	0.32	0.09	0.96	0.63	0.05	0.28	0.11
UKL Out	UKL Outlet	5	Pct25	53.13	21.88	621.75	10.88	23.00	26612.50	426.01	5144.40
UKL Out	UKL Outlet	5	Pct75	81.75	33.75	676.75	80.25	91.38	28487.50	725.69	6104.28
UKL Out	UKL Outlet	6	N of Cases	4.00	4.00	4.00	4.00	4.00	2.00	4.00	4.00
UKL Out	UKL Outlet	6	Median	102.00	44.00	789.00	40.50	13.00	21250.00	524.72	4122.70
UKL Out	UKL Outlet	6	Arithmetic Mean	111.00	52.50	851.25	40.75	13.25	21250.00	552.88	4331.10
UKL Out	UKL Outlet	6	Coefficient of Variation	0.60	0.49	0.33	0.60	0.23	0.16	0.52	0.23
UKL Out	UKL Outlet	6	Pct25	65.50	35.00	643.50	20.00	11.00	18900.00	373.95	3704.04
UKL Out	UKL Outlet	6	Pct75	156.50	70.00	1059.00	61.50	15.50	23600.00	731.82	4958.16
UKL Out	UKL Outlet	7	N of Cases	4.00	4.00	4.00	4.00	4.00	2.00	4.00	4.00
UKL Out	UKL Outlet	7	Median	273.00	100.50	2500.00	37.50	12.50	26800.00	1393.36	13933.16
UKL Out	UKL Outlet	7	Arithmetic Mean	256.50	86.50	2617.50	39.50	13.50	26800.00	1343.38	13759.07
UKL Out	UKL Outlet	7	Coefficient of Variation	0.33	0.66	0.30	0.65	0.25	0.13	0.31	0.27
UKL Out	UKL Outlet	7	Pct25	190.00	44.50	2020.00	17.50	11.00	24400.00	1006.94	10892.68
UKL Out	UKL Outlet	7	Pct75	323.00	128.50	3215.00	61.50	16.00	29200.00	1679.83	16625.46
UKL Out	UKL Outlet	8	N of Cases	5.00	5.00	5.00	5.00	5.00	3.00	5.00	5.00
UKL Out	UKL Outlet	8	Median	327.00	143.00	2800.00	25.00	14.00	40500.00	1351.26	12608.70
UKL Out	UKL Outlet	8	Arithmetic Mean	318.20	133.00	2938.00	48.60	15.40	39866.67	1385.33	12894.63
UKL Out	UKL Outlet	8	Coefficient of Variation	0.14	0.18	0.15	0.72	0.47	0.06	0.10	0.18
UKL Out	UKL Outlet	8	Pct25	276.50	108.75	2697.50	22.50	9.50	38175.00	1290.05	10944.68
UKL Out	UKL Outlet	8	Pct75	358.50	150.25	3220.00	87.00	20.75	41400.00	1445.03	14605.61
UKL Out	UKL Outlet	9	N of Cases	4.00	4.00	4.00	4.00	4.00	2.00	4.00	4.00
UKL Out	UKL Outlet	9	Median	195.00	31.50	2150.00	29.50	12.00	42850.00	760.61	9017.55
UKL Out	UKL Outlet	9	Arithmetic Mean	193.00	37.25	2197.50	37.00	14.00	42850.00	794.49	8962.18
UKL Out	UKL Outlet	9	Coefficient of Variation	0.11	0.43	0.14	0.71	0.74	0.00	0.16	0.07
UKL Out	UKL Outlet	9	Pct25	174.50	28.00	1960.00	17.50	6.50	42700.00	707.81	8490.51
UKL Out	UKL Outlet	9	Pct75	211.50	46.50	2435.00	56.50	21.50	43000.00	881.17	9433.85
WR1000	Sprague R	10	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR1000	Sprague R	10	Median	45.50	28.50	181.50	10.00	6.00	28150.00	25.19	101.07
WR1000	Sprague R	10	Arithmetic Mean	45.50	28.50	181.50	10.00	6.00	28150.00	25.19	101.07
WR1000	Sprague R	10	Coefficient of Variation	0.17	0.17	0.30	0.28	0.47	0.02	0.26	0.39

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR1000	Sprague R	10	Pct25	40.00	25.00	143.00	8.00	4.00	27800.00	20.55	73.48
WR1000	Sprague R	10	Pct75	51.00	32.00	220.00	12.00	8.00	28500.00	29.83	128.66
WR1000	Sprague R	11	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR1000	Sprague R	11	Median	45.50	33.50	148.50	6.50	12.50	29650.00	28.38	91.91
WR1000	Sprague R	11	Arithmetic Mean	45.50	33.50	148.50	6.50	12.50	29650.00	28.38	91.91
WR1000	Sprague R	11	Coefficient of Variation	0.02	0.02	0.24	0.76	0.28	0.05	0.05	0.18
WR1000	Sprague R	11	Pct25	45.00	33.00	123.00	3.00	10.00	28600.00	27.35	80.36
WR1000	Sprague R	11	Pct75	46.00	34.00	174.00	10.00	15.00	30700.00	29.40	103.46
WR1000	Sprague R	12	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR1000	Sprague R	12	Median	110.00	62.00	455.50	24.50	46.50	27350.00	140.47	620.01
WR1000	Sprague R	12	Arithmetic Mean	110.00	62.00	455.50	24.50	46.50	27350.00	140.47	620.01
WR1000	Sprague R	12	Coefficient of Variation	0.86	0.71	1.16	0.95	1.29	0.18	1.14	1.30
WR1000	Sprague R	12	Pct25	43.00	31.00	81.00	8.00	4.00	23800.00	27.57	51.93
WR1000	Sprague R	12	Pct75	177.00	93.00	830.00	41.00	89.00	30900.00	253.36	1188.09
WR1000	Sprague R	2	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR1000	Sprague R	2	Median	130.00	70.00	525.50	27.00	36.00	22500.00	929.11	3758.95
WR1000	Sprague R	2	Arithmetic Mean	130.00	70.00	525.50	27.00	36.00	22500.00	929.11	3758.95
WR1000	Sprague R	2	Coefficient of Variation	0.04	0.02	0.02	0.26	0.27	0.09	0.02	0.05
WR1000	Sprague R	2	Pct25	126.00	69.00	519.00	22.00	29.00	21000.00	914.80	3631.88
WR1000	Sprague R	2	Pct75	134.00	71.00	532.00	32.00	43.00	24000.00	943.43	3886.02
WR1000	Sprague R	3	N of Cases	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
WR1000	Sprague R	3	Median	82.00	46.50	425.50	7.50	14.50	29750.00	542.10	2801.55
WR1000	Sprague R	3	Arithmetic Mean	86.00	50.75	422.00	7.25	20.75	29675.00	598.19	2900.57
WR1000	Sprague R	3	Coefficient of Variation	0.24	0.19	0.20	0.46	0.76	0.08	0.63	0.57
WR1000	Sprague R	3	Pct25	71.50	45.50	355.50	5.00	11.00	27700.00	336.46	1733.63
WR1000	Sprague R	3	Pct75	100.50	56.00	488.50	9.50	30.50	31650.00	859.91	4067.52
WR1000	Sprague R	4	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR1000	Sprague R	4	Median	72.00	46.50	309.50	9.00	10.00	33950.00	319.49	1375.33
WR1000	Sprague R	4	Arithmetic Mean	72.00	46.50	309.50	9.00	10.00	33950.00	319.49	1375.33
WR1000	Sprague R	4	Coefficient of Variation	0.02	0.05	0.03	0.94	0.14	0.01	0.21	0.23
WR1000	Sprague R	4	Pct25	71.00	45.00	302.00	3.00	9.00	33800.00	271.02	1152.78
WR1000	Sprague R	4	Pct75	73.00	48.00	317.00	15.00	11.00	34100.00	367.96	1597.87
WR1000	Sprague R	5	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR1000	Sprague R	5	Median	86.00	51.50	342.50	10.50	10.00	31400.00	274.81	1098.43
WR1000	Sprague R	5	Arithmetic Mean	86.00	51.50	342.50	10.50	10.00	31400.00	274.81	1098.43
WR1000	Sprague R	5	Coefficient of Variation	0.05	0.01	0.07	0.07	0.00	0.05	0.43	0.45
WR1000	Sprague R	5	Pct25	83.00	51.00	326.00	10.00	10.00	30400.00	190.30	747.43
WR1000	Sprague R	5	Pct75	89.00	52.00	359.00	11.00	10.00	32400.00	359.33	1449.42
WR1000	Sprague R	6	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR1000	Sprague R	6	Median	61.00	38.00	253.00	8.00	6.50	31000.00	89.17	366.09

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR1000	Sprague R	6	Arithmetic Mean	61.00	38.00	253.00	8.00	6.50	31000.00	89.17	366.09
WR1000	Sprague R	6	Coefficient of Variation	0.26	0.22	0.20	0.18	0.54	0.01	0.58	0.53
WR1000	Sprague R	6	Pct25	50.00	32.00	218.00	7.00	4.00	30800.00	52.36	228.31
WR1000	Sprague R	6	Pct75	72.00	44.00	288.00	9.00	9.00	31200.00	125.97	503.87
WR1000	Sprague R	7	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
WR1000	Sprague R	7	Median	32.00	13.00	203.00	8.00	4.00	25400.00	17.38	136.10
WR1000	Sprague R	7	Arithmetic Mean	31.67	14.00	218.67	10.33	5.67	26233.33	18.50	125.34
WR1000	Sprague R	7	Coefficient of Variation	0.17	0.33	0.16	0.48	0.51	0.16	0.32	0.18
WR1000	Sprague R	7	Pct25	27.50	10.75	196.25	7.25	4.00	23300.00	14.32	108.43
WR1000	Sprague R	7	Pct75	35.75	17.50	245.00	14.00	7.75	29375.00	22.95	139.54
WR1000	Sprague R	8	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR1000	Sprague R	8	Median	32.00	19.00	199.00	12.00	7.00	25400.00	17.38	108.10
WR1000	Sprague R	8	Arithmetic Mean	32.00	19.00	199.00	12.00	7.00	25400.00	17.38	108.10
WR1000	Sprague R	8	Coefficient of Variation	0.13	0.00	0.06	0.47	0.61	0.01	0.13	0.06
WR1000	Sprague R	8	Pct25	29.00	19.00	191.00	8.00	4.00	25200.00	15.75	103.75
WR1000	Sprague R	8	Pct75	35.00	19.00	207.00	16.00	10.00	25600.00	19.01	112.44
WR1000	Sprague R	9	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR1000	Sprague R	9	Median	31.50	19.00	111.00	5.00	4.00	28000.00	17.18	60.12
WR1000	Sprague R	9	Arithmetic Mean	31.50	19.00	111.00	5.00	4.00	28000.00	17.18	60.12
WR1000	Sprague R	9	Coefficient of Variation	0.07	0.00	0.24	0.57	0.00	0.04	0.01	0.16
WR1000	Sprague R	9	Pct25	30.00	19.00	92.00	3.00	4.00	27300.00	17.04	53.13
WR1000	Sprague R	9	Pct75	33.00	19.00	130.00	7.00	4.00	28700.00	17.32	67.12
WR2000	Annie Cr	10	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR2000	Annie Cr	10	Median	57.00	29.50	49.00	3.00	9.50	39950.00	8.01	7.32
WR2000	Annie Cr	10	Arithmetic Mean	57.00	29.50	49.00	3.00	9.50	39950.00	8.01	7.32
WR2000	Annie Cr	10	Coefficient of Variation	0.22	0.02	0.98	0.00	0.22	0.08	0.39	1.06
WR2000	Annie Cr	10	Pct25	48.00	29.00	15.00	3.00	8.00	37800.00	5.83	1.82
WR2000	Annie Cr	10	Pct75	66.00	30.00	83.00	3.00	11.00	42100.00	10.20	12.83
WR2000	Annie Cr	11	N of Cases	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR2000	Annie Cr	11	Median	59.00	30.00	15.00	3.00	12.00	40800.00	7.12	1.81
WR2000	Annie Cr	11	Arithmetic Mean	59.00	30.00	15.00	3.00	12.00	40800.00	7.12	1.81
WR2000	Annie Cr	11	Coefficient of Variation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR2000	Annie Cr	11	Pct25								
WR2000	Annie Cr	11	Pct75								
WR2000	Annie Cr	12	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00
WR2000	Annie Cr	12	Median	71.00	27.00	64.00	6.50	20.00	40000.00	4.70	3.56
WR2000	Annie Cr	12	Arithmetic Mean	71.00	27.00	64.00	6.50	20.00	40000.00	4.70	3.56
WR2000	Annie Cr	12	Coefficient of Variation	0.60	0.00	0.73	0.11	0.21	0.05	1.00	1.00
WR2000	Annie Cr	12	Pct25	41.00	27.00	31.00	6.00	17.00	38500.00		
WR2000	Annie Cr	12	Pct75	101.00	27.00	97.00	7.00	23.00	41500.00		

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR2000	Annie Cr	4	N of Cases	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
WR2000	Annie Cr	4	Median	49.00	27.00	35.00	7.00	17.00	40500.00		
WR2000	Annie Cr	4	Arithmetic Mean	49.00	27.00	35.00	7.00	17.00	40500.00		
WR2000	Annie Cr	4	Coefficient of Variation	1.00	1.00	1.00	1.00	1.00	1.00		
WR2000	Annie Cr	4	Pct25								
WR2000	Annie Cr	4	Pct75								
WR2000	Annie Cr	5	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	0.00	0.00
WR2000	Annie Cr	5	Median	95.50	22.00	82.50	7.50	19.50	30250.00		
WR2000	Annie Cr	5	Arithmetic Mean	95.50	22.00	82.50	7.50	19.50	30250.00		
WR2000	Annie Cr	5	Coefficient of Variation	0.02	0.06	0.40	0.09	0.11	0.04		
WR2000	Annie Cr	5	Pct25	94.00	21.00	59.00	7.00	18.00	29500.00		
WR2000	Annie Cr	5	Pct75	97.00	23.00	106.00	8.00	21.00	31000.00		
WR2000	Annie Cr	6	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	0.00	0.00
WR2000	Annie Cr	6	Median	114.50	20.00	59.50	7.00	14.50	29100.00		
WR2000	Annie Cr	6	Arithmetic Mean	114.50	20.00	59.50	7.00	14.50	29100.00		
WR2000	Annie Cr	6	Coefficient of Variation	0.17	0.00	0.34	0.00	0.24	0.01		
WR2000	Annie Cr	6	Pct25	101.00	20.00	45.00	7.00	12.00	28900.00		
WR2000	Annie Cr	6	Pct75	128.00	20.00	74.00	7.00	17.00	29300.00		
WR2000	Annie Cr	7	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	0.00	0.00
WR2000	Annie Cr	7	Median	61.00	25.00	24.50	3.00	12.50	35150.00		
WR2000	Annie Cr	7	Arithmetic Mean	61.00	25.00	24.50	3.00	12.50	35150.00		
WR2000	Annie Cr	7	Coefficient of Variation	0.16	0.11	0.55	0.00	0.06	0.06		
WR2000	Annie Cr	7	Pct25	54.00	23.00	15.00	3.00	12.00	33600.00		
WR2000	Annie Cr	7	Pct75	68.00	27.00	34.00	3.00	13.00	36700.00		
WR2000	Annie Cr	8	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	0.00	0.00
WR2000	Annie Cr	8	Median	49.00	30.00	15.00	9.00	4.00	41700.00		
WR2000	Annie Cr	8	Arithmetic Mean	61.67	29.67	15.00	8.00	6.67	41466.67		
WR2000	Annie Cr	8	Coefficient of Variation	0.47	0.02	0.00	0.22	0.69	0.03		
WR2000	Annie Cr	8	Pct25	43.00	29.25	15.00	6.75	4.00	40650.00		
WR2000	Annie Cr	8	Pct75	83.50	30.00	15.00	9.00	10.00	42225.00		
WR2000	Annie Cr	9	N of Cases	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR2000	Annie Cr	9	Median	45.00	30.00	15.00	6.00	11.00	42500.00	7.84	2.61
WR2000	Annie Cr	9	Arithmetic Mean	45.00	30.00	15.00	6.00	11.00	42500.00	7.84	2.61
WR2000	Annie Cr	9	Coefficient of Variation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR2000	Annie Cr	9	Pct25								
WR2000	Annie Cr	9	Pct75								
WR3000	Wood @ Weed	10	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR3000	Wood @ Weed	10	Median	85.50	67.00	56.00	5.00	15.00	40000.00	71.37	47.96
WR3000	Wood @ Weed	10	Arithmetic Mean	85.50	67.00	56.00	5.00	15.00	40000.00	71.37	47.96

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR3000	Wood @ Weed	10	Coefficient of Variation	0.02	0.02	0.40	0.57	0.19	0.02	0.10	0.51
WR3000	Wood @ Weed	10	Pct25	84.00	66.00	40.00	3.00	13.00	39500.00	66.50	30.57
WR3000	Wood @ Weed	10	Pct75	87.00	68.00	72.00	7.00	17.00	40500.00	76.24	65.35
WR3000	Wood @ Weed	11	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR3000	Wood @ Weed	11	Median	80.50	69.00	62.50	6.00	20.00	38200.00	66.67	51.77
WR3000	Wood @ Weed	11	Arithmetic Mean	80.50	69.00	62.50	6.00	20.00	38200.00	66.67	51.77
WR3000	Wood @ Weed	11	Coefficient of Variation	0.01	0.00	0.08	0.71	0.00	0.04	0.01	0.08
WR3000	Wood @ Weed	11	Pct25	80.00	69.00	59.00	3.00	20.00	37000.00	66.16	48.80
WR3000	Wood @ Weed	11	Pct75	81.00	69.00	66.00	9.00	20.00	39400.00	67.18	54.74
WR3000	Wood @ Weed	12	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00
WR3000	Wood @ Weed	12	Median	93.00	69.50	68.50	5.00	22.00	40300.00	79.24	74.07
WR3000	Wood @ Weed	12	Arithmetic Mean	93.00	69.50	68.50	5.00	22.00	40300.00	79.24	74.07
WR3000	Wood @ Weed	12	Coefficient of Variation	0.02	0.01	0.36	0.57	0.13	0.01	1.00	1.00
WR3000	Wood @ Weed	12	Pct25	92.00	69.00	51.00	3.00	20.00	40000.00		
WR3000	Wood @ Weed	12	Pct75	94.00	70.00	86.00	7.00	24.00	40600.00		
WR3000	Wood @ Weed	1	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	0.00	0.00
WR3000	Wood @ Weed	1	Median	96.50	68.50	65.00	9.00	25.50	39100.00		
WR3000	Wood @ Weed	1	Arithmetic Mean	96.50	68.50	65.00	9.00	25.50	39100.00		
WR3000	Wood @ Weed	1	Coefficient of Variation	0.11	0.05	0.04	0.31	0.03	0.03		
WR3000	Wood @ Weed	1	Pct25	89.00	66.00	63.00	7.00	25.00	38200.00		
WR3000	Wood @ Weed	1	Pct75	104.00	71.00	67.00	11.00	26.00	40000.00		
WR3000	Wood @ Weed	2	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
WR3000	Wood @ Weed	2	Median	102.00	79.00	123.00	9.00	25.00	38900.00	83.98	101.28
WR3000	Wood @ Weed	2	Arithmetic Mean	99.00	77.67	139.33	9.00	26.33	38400.00	86.58	123.82
WR3000	Wood @ Weed	2	Coefficient of Variation	0.07	0.04	0.24	0.11	0.09	0.03	0.19	0.38
WR3000	Wood @ Weed	2	Pct25	93.75	75.25	118.50	8.25	25.00	37400.00	74.94	94.67
WR3000	Wood @ Weed	2	Pct75	103.50	79.75	164.25	9.75	28.00	39275.00	98.87	158.60
WR3000	Wood @ Weed	3	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
WR3000	Wood @ Weed	3	Median	86.00	66.00	161.00	6.00	22.00	36500.00	84.61	149.70
WR3000	Wood @ Weed	3	Arithmetic Mean	87.00	64.33	163.67	5.67	19.67	36233.33	90.05	172.08
WR3000	Wood @ Weed	3	Coefficient of Variation	0.04	0.07	0.14	0.44	0.21	0.07	0.16	0.31
WR3000	Wood @ Weed	3	Pct25	84.50	60.75	146.75	3.75	16.75	34250.00	80.30	137.41
WR3000	Wood @ Weed	3	Pct75	89.75	67.50	181.25	7.50	22.00	38150.00	101.17	212.35
WR3000	Wood @ Weed	4	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00
WR3000	Wood @ Weed	4	Median	80.00	66.00	49.50	5.50	18.00	41050.00	61.83	34.35

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR3000	Wood @ Weed	4	Arithmetic Mean	80.00	66.00	49.50	5.50	18.00	41050.00	61.83	34.35
WR3000	Wood @ Weed	4	Coefficient of Variation	0.02	0.00	0.13	0.64	0.00	0.02	1.00	1.00
WR3000	Wood @ Weed	4	Pct25	79.00	66.00	45.00	3.00	18.00	40600.00		
WR3000	Wood @ Weed	4	Pct75	81.00	66.00	54.00	8.00	18.00	41500.00		
WR3000	Wood @ Weed	5	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR3000	Wood @ Weed	5	Median	90.50	60.00	66.00	3.00	10.50	38900.00	87.28	64.39
WR3000	Wood @ Weed	5	Arithmetic Mean	90.50	60.00	66.00	3.00	10.50	38900.00	87.28	64.39
WR3000	Wood @ Weed	5	Coefficient of Variation	0.05	0.02	0.36	0.00	0.20	0.10	0.13	0.43
WR3000	Wood @ Weed	5	Pct25	87.00	59.00	49.00	3.00	9.00	36200.00	79.28	44.65
WR3000	Wood @ Weed	5	Pct75	94.00	61.00	83.00	3.00	12.00	41600.00	95.29	84.14
WR3000	Wood @ Weed	6	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR3000	Wood @ Weed	6	Median	99.50	62.50	93.00	9.50	8.00	36350.00	81.64	76.77
WR3000	Wood @ Weed	6	Arithmetic Mean	99.50	62.50	93.00	9.50	8.00	36350.00	81.64	76.77
WR3000	Wood @ Weed	6	Coefficient of Variation	0.08	0.06	0.27	0.22	0.71	0.01	0.14	0.33
WR3000	Wood @ Weed	6	Pct25	94.00	60.00	75.00	8.00	4.00	36000.00	73.55	58.69
WR3000	Wood @ Weed	6	Pct75	105.00	65.00	111.00	11.00	12.00	36700.00	89.72	94.85
WR3000	Wood @ Weed	7	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR3000	Wood @ Weed	7	Median	88.00	62.50	59.00	7.00	9.00	37100.00	65.56	44.87
WR3000	Wood @ Weed	7	Arithmetic Mean	88.00	62.50	59.00	7.00	9.00	37100.00	65.56	44.87
WR3000	Wood @ Weed	7	Coefficient of Variation	0.03	0.01	0.60	0.81	0.16	0.01	0.11	0.66
WR3000	Wood @ Weed	7	Pct25	86.00	62.00	34.00	3.00	8.00	36900.00	60.69	23.99
WR3000	Wood @ Weed	7	Pct75	90.00	63.00	84.00	11.00	10.00	37300.00	70.44	65.74
WR3000	Wood @ Weed	8	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	2.00	2.00
WR3000	Wood @ Weed	8	Median	82.00	64.00	38.00	10.00	10.00	39700.00	65.96	35.05
WR3000	Wood @ Weed	8	Arithmetic Mean	81.67	64.67	40.00	8.33	9.67	39633.33	65.96	35.05
WR3000	Wood @ Weed	8	Coefficient of Variation	0.04	0.02	0.16	0.57	0.16	0.02	0.12	0.33
WR3000	Wood @ Weed	8	Pct25	79.00	64.00	35.75	4.75	8.50	38950.00	60.38	26.99
WR3000	Wood @ Weed	8	Pct75	84.25	65.50	44.75	11.50	10.75	40300.00	71.53	43.10
WR3000	Wood @ Weed	9	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR3000	Wood @ Weed	9	Median	83.50	63.00	46.00	6.50	12.00	38750.00	69.93	38.29
WR3000	Wood @ Weed	9	Arithmetic Mean	83.50	63.00	46.00	6.50	12.00	38750.00	69.93	38.29
WR3000	Wood @ Weed	9	Coefficient of Variation	0.16	0.02	0.46	0.76	0.35	0.01	0.12	0.42
WR3000	Wood @ Weed	9	Pct25	74.00	62.00	31.00	3.00	9.00	38400.00	63.95	26.79
WR3000	Wood @ Weed	9	Pct75	93.00	64.00	61.00	10.00	15.00	39100.00	75.90	49.79
WR4000	Wood @ Dike	10	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR4000	Wood @ Dike	10	Median	99.50	78.50	103.50	7.50	12.00	38200.00	98.46	103.07
WR4000	Wood @ Dike	10	Arithmetic Mean	99.50	78.50	103.50	7.50	12.00	38200.00	98.46	103.07
WR4000	Wood @ Dike	10	Coefficient of Variation	0.08	0.06	0.25	0.85	0.24	0.02	0.04	0.29
WR4000	Wood @ Dike	10	Pct25	94.00	75.00	85.00	3.00	10.00	37600.00	95.68	81.95
WR4000	Wood @ Dike	10	Pct75	105.00	82.00	122.00	12.00	14.00	38800.00	101.23	124.19
WR4000	Wood @ Dike	11	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR4000	Wood @ Dike	11	Median	92.50	78.00	94.00	6.00	16.50	37750.00	94.87	96.33
WR4000	Wood @ Dike	11	Arithmetic Mean	92.50	78.00	94.00	6.00	16.50	37750.00	94.87	96.33
WR4000	Wood @ Dike	11	Coefficient of Variation	0.05	0.02	0.06	0.71	0.13	0.03	0.07	0.05
WR4000	Wood @ Dike	11	Pct25	89.00	77.00	90.00	3.00	15.00	37000.00	90.38	93.15
WR4000	Wood @ Dike	11	Pct75	96.00	79.00	98.00	9.00	18.00	38500.00	99.36	99.52
WR4000	Wood @ Dike	12	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR4000	Wood @ Dike	12	Median	114.00	85.00	106.50	7.00	19.50	38850.00	115.27	108.00
WR4000	Wood @ Dike	12	Arithmetic Mean	114.00	85.00	106.50	7.00	19.50	38850.00	115.27	108.00
WR4000	Wood @ Dike	12	Coefficient of Variation	0.21	0.08	0.33	0.20	0.18	0.01	0.26	0.37
WR4000	Wood @ Dike	12	Pct25	97.00	80.00	82.00	6.00	17.00	38700.00	93.99	79.46
WR4000	Wood @ Dike	12	Pct75	131.00	90.00	131.00	8.00	22.00	39000.00	136.55	136.55
WR4000	Wood @ Dike	2	N of Cases	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
WR4000	Wood @ Dike	2	Median	139.50	112.50	180.00	11.00	20.00	37350.00	156.39	207.44
WR4000	Wood @ Dike	2	Arithmetic Mean	137.75	113.00	179.75	11.50	20.50	36950.00	163.29	219.83
WR4000	Wood @ Dike	2	Coefficient of Variation	0.06	0.07	0.30	0.29	0.12	0.07	0.20	0.45
WR4000	Wood @ Dike	2	Pct25	130.50	106.00	144.50	9.50	19.00	35250.00	143.14	156.70
WR4000	Wood @ Dike	2	Pct75	145.00	120.00	215.00	13.50	22.00	38650.00	183.43	282.95
WR4000	Wood @ Dike	3	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
WR4000	Wood @ Dike	3	Median	119.00	93.00	203.00	7.00	14.00	34600.00	160.15	273.20
WR4000	Wood @ Dike	3	Arithmetic Mean	115.33	90.33	212.33	7.33	13.67	34566.67	164.01	302.38
WR4000	Wood @ Dike	3	Coefficient of Variation	0.08	0.05	0.08	0.21	0.11	0.05	0.17	0.18
WR4000	Wood @ Dike	3	Pct25	108.50	87.00	203.00	6.25	12.50	33325.00	144.09	269.47
WR4000	Wood @ Dike	3	Pct75	121.25	93.00	224.00	8.50	14.75	35800.00	184.90	342.58
WR4000	Wood @ Dike	4	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR4000	Wood @ Dike	4	Median	115.50	92.50	154.00	8.50	12.50	38650.00	122.71	163.42
WR4000	Wood @ Dike	4	Arithmetic Mean	115.50	92.50	154.00	8.50	12.50	38650.00	122.71	163.42
WR4000	Wood @ Dike	4	Coefficient of Variation	0.08	0.07	0.05	0.25	0.06	0.01	0.15	0.11
WR4000	Wood @ Dike	4	Pct25	109.00	88.00	149.00	7.00	12.00	38400.00	109.89	150.21
WR4000	Wood @ Dike	4	Pct75	122.00	97.00	159.00	10.00	13.00	38900.00	135.53	176.63
WR4000	Wood @ Dike	5	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR4000	Wood @ Dike	5	Median	104.50	83.00	85.00	7.50	4.00	39500.00	115.53	95.02
WR4000	Wood @ Dike	5	Arithmetic Mean	104.50	83.00	85.00	7.50	4.00	39500.00	115.53	95.02
WR4000	Wood @ Dike	5	Coefficient of Variation	0.12	0.09	0.27	0.09	0.00	0.07	0.26	0.41
WR4000	Wood @ Dike	5	Pct25	96.00	78.00	69.00	7.00	4.00	37500.00	94.20	67.70

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR4000	Wood @ Dike	5	Pct75	113.00	88.00	101.00	8.00	4.00	41500.00	136.87	122.33
WR4000	Wood @ Dike	6	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR4000	Wood @ Dike	6	Median	115.50	78.50	127.50	9.50	6.50	35200.00	126.97	139.40
WR4000	Wood @ Dike	6	Arithmetic Mean	115.50	78.50	127.50	9.50	6.50	35200.00	126.97	139.40
WR4000	Wood @ Dike	6	Coefficient of Variation	0.02	0.03	0.22	0.52	0.54	0.01	0.04	0.16
WR4000	Wood @ Dike	6	Pct25	114.00	77.00	108.00	6.00	4.00	35000.00	123.68	123.41
WR4000	Wood @ Dike	6	Pct75	117.00	80.00	147.00	13.00	9.00	35400.00	130.27	155.39
WR4000	Wood @ Dike	7	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
WR4000	Wood @ Dike	7	Median	105.00	72.00	93.00	8.00	4.00	35900.00	102.35	73.96
WR4000	Wood @ Dike	7	Arithmetic Mean	104.67	70.00	102.33	7.00	5.33	35833.33	97.41	94.29
WR4000	Wood @ Dike	7	Coefficient of Variation	0.10	0.05	0.40	0.52	0.43	0.02	0.13	0.38
WR4000	Wood @ Dike	7	Pct25	96.75	67.50	73.50	4.25	4.00	35375.00	88.21	73.21
WR4000	Wood @ Dike	7	Pct75	112.50	72.00	133.50	9.50	7.00	36275.00	105.36	120.46
WR4000	Wood @ Dike	8	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR4000	Wood @ Dike	8	Median	129.00	79.00	80.50	6.00	6.00	37550.00	119.76	74.69
WR4000	Wood @ Dike	8	Arithmetic Mean	129.00	79.00	80.50	6.00	6.00	37550.00	119.76	74.69
WR4000	Wood @ Dike	8	Coefficient of Variation	0.34	0.05	0.31	0.71	0.47	0.02	0.37	0.34
WR4000	Wood @ Dike	8	Pct25	98.00	76.00	63.00	3.00	4.00	37100.00	88.01	56.57
WR4000	Wood @ Dike	8	Pct75	160.00	82.00	98.00	9.00	8.00	38000.00	151.51	92.80
WR4000	Wood @ Dike	9	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR4000	Wood @ Dike	9	Median	86.50	71.00	73.50	9.50	8.00	38650.00	90.70	76.54
WR4000	Wood @ Dike	9	Arithmetic Mean	86.50	71.00	73.50	9.50	8.00	38650.00	90.70	76.54
WR4000	Wood @ Dike	9	Coefficient of Variation	0.07	0.08	0.30	0.07	0.71	0.00	0.01	0.24
WR4000	Wood @ Dike	9	Pct25	82.00	67.00	58.00	9.00	4.00	38600.00	89.89	63.58
WR4000	Wood @ Dike	9	Pct75	91.00	75.00	89.00	10.00	12.00	38700.00	91.52	89.51
WR5000	7-mile Canal	10	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00
WR5000	7-mile Canal	10	Median	119.50	79.50	328.50	38.50	17.00	33150.00	11.45	22.58
WR5000	7-mile Canal	10	Arithmetic Mean	119.50	79.50	328.50	38.50	17.00	33150.00	11.45	22.58
WR5000	7-mile Canal	10	Coefficient of Variation	0.15	0.08	0.51	0.57	0.50	0.07	1.00	1.00
WR5000	7-mile Canal	10	Pct25	107.00	75.00	211.00	23.00	11.00	31600.00		
WR5000	7-mile Canal	10	Pct75	132.00	84.00	446.00	54.00	23.00	34700.00		
WR5000	7-mile Canal	11	N of Cases	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR5000	7-mile Canal	11	Median	122.00	93.00	313.00	29.00	13.00	35600.00	23.05	59.13
WR5000	7-mile Canal	11	Arithmetic Mean	122.00	93.00	313.00	29.00	13.00	35600.00	23.05	59.13
WR5000	7-mile Canal	11	Coefficient of Variation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR5000	7-mile Canal	11	Pct25								
WR5000	7-mile Canal	11	Pct75								
WR5000	7-mile Canal	12	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	0.00	0.00
WR5000	7-mile Canal	12	Median	96.00	71.00	255.50	27.00	18.50	35600.00		
WR5000	7-mile Canal	12	Arithmetic Mean	96.00	71.00	255.50	27.00	18.50	35600.00		

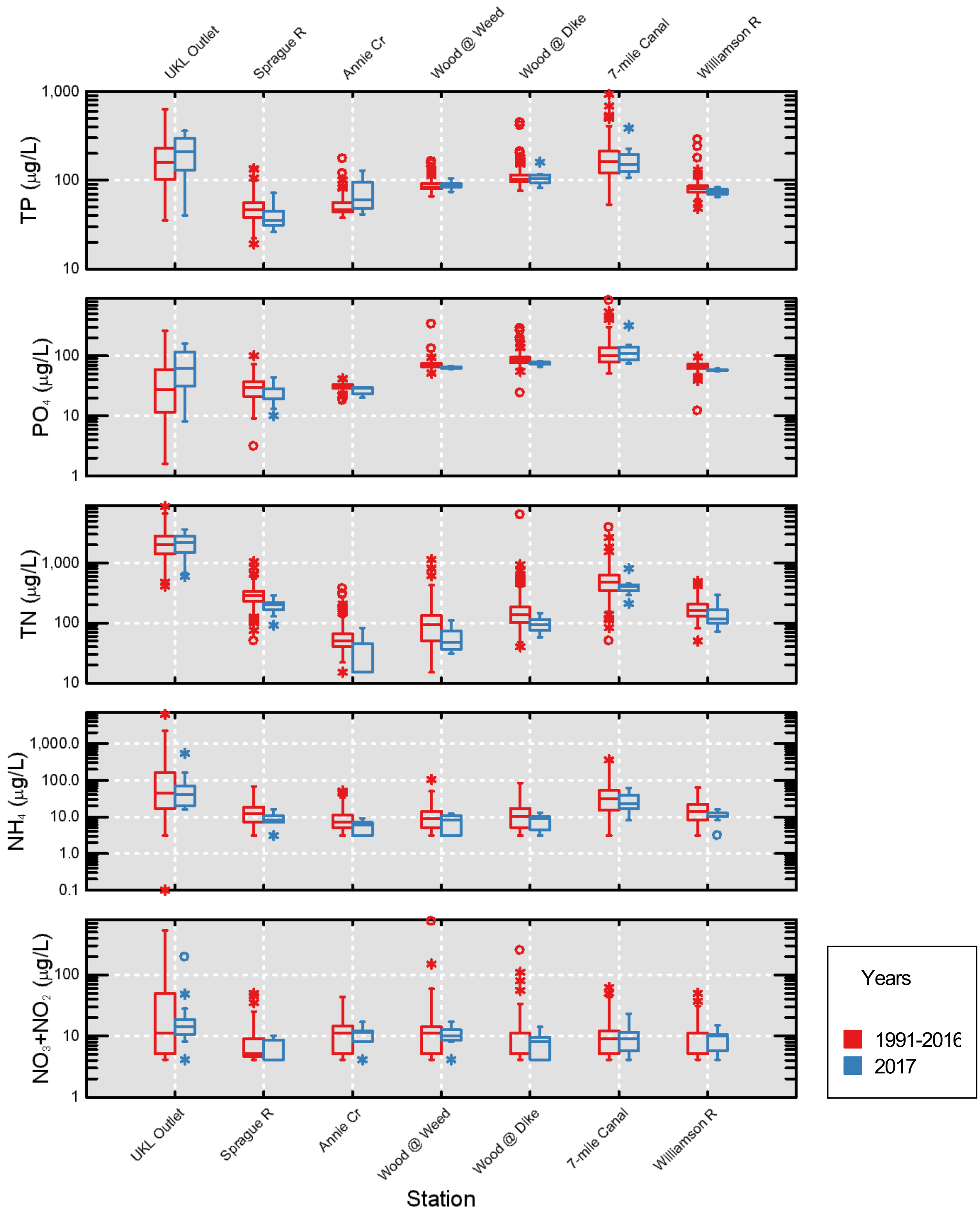
Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR5000	7-mile Canal	12	Coefficient of Variation	0.01	0.04	0.23	0.10	0.19	0.04		
WR5000	7-mile Canal	12	Pct25	95.00	69.00	214.00	25.00	16.00	34700.00		
WR5000	7-mile Canal	12	Pct75	97.00	73.00	297.00	29.00	21.00	36500.00		
WR5000	7-mile Canal	2	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	0.00	0.00
WR5000	7-mile Canal	2	Median	178.00	132.00	546.50	41.50	37.00	28750.00		
WR5000	7-mile Canal	2	Arithmetic Mean	178.00	132.00	546.50	41.50	37.00	28750.00		
WR5000	7-mile Canal	2	Coefficient of Variation	0.15	0.22	0.14	0.22	0.04	0.00		
WR5000	7-mile Canal	2	Pct25	159.00	111.00	493.00	35.00	36.00	28700.00		
WR5000	7-mile Canal	2	Pct75	197.00	153.00	600.00	48.00	38.00	28800.00		
WR5000	7-mile Canal	3	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	1.00	1.00
WR5000	7-mile Canal	3	Median	107.00	71.00	502.00	22.00	23.00	21800.00	145.78	599.34
WR5000	7-mile Canal	3	Arithmetic Mean	125.00	80.67	507.33	19.67	26.33	21800.00	145.78	599.34
WR5000	7-mile Canal	3	Coefficient of Variation	0.31	0.26	0.20	0.30	0.32	0.15	1.00	1.00
WR5000	7-mile Canal	3	Pct25	101.00	67.25	430.75	15.25	20.75	19325.00		
WR5000	7-mile Canal	3	Pct75	153.50	96.50	585.25	23.50	32.75	24275.00		
WR5000	7-mile Canal	4	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	0.00	0.00
WR5000	7-mile Canal	4	Median	281.50	209.50	903.50	17.50	12.00	26400.00		
WR5000	7-mile Canal	4	Arithmetic Mean	281.50	209.50	903.50	17.50	12.00	26400.00		
WR5000	7-mile Canal	4	Coefficient of Variation	0.33	0.36	0.28	0.85	0.12	0.02		
WR5000	7-mile Canal	4	Pct25	215.00	156.00	727.00	7.00	11.00	26000.00		
WR5000	7-mile Canal	4	Pct75	348.00	263.00	1080.00	28.00	13.00	26800.00		
WR5000	7-mile Canal	5	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	0.00	0.00
WR5000	7-mile Canal	5	Median	403.00	348.50	1090.00	23.50	10.50	24000.00		
WR5000	7-mile Canal	5	Arithmetic Mean	403.00	348.50	1090.00	23.50	10.50	24000.00		
WR5000	7-mile Canal	5	Coefficient of Variation	0.06	0.02	0.21	0.15	0.07	0.07		
WR5000	7-mile Canal	5	Pct25	386.00	344.00	930.00	21.00	10.00	22800.00		
WR5000	7-mile Canal	5	Pct75	420.00	353.00	1250.00	26.00	11.00	25200.00		
WR5000	7-mile Canal	6	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	0.00	0.00
WR5000	7-mile Canal	6	Median	263.00	210.00	582.50	17.00	6.00	28500.00		
WR5000	7-mile Canal	6	Arithmetic Mean	263.00	210.00	582.50	17.00	6.00	28500.00		
WR5000	7-mile Canal	6	Coefficient of Variation	0.67	0.73	0.54	0.58	0.47	0.06		
WR5000	7-mile Canal	6	Pct25	139.00	101.00	359.00	10.00	4.00	27300.00		
WR5000	7-mile Canal	6	Pct75	387.00	319.00	806.00	24.00	8.00	29700.00		
WR5000	7-mile Canal	7	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	0.00	0.00
WR5000	7-mile Canal	7	Median	213.00	149.50	433.00	13.50	6.00	31600.00		
WR5000	7-mile Canal	7	Arithmetic Mean	213.00	149.50	433.00	13.50	6.00	31600.00		
WR5000	7-mile Canal	7	Coefficient of Variation	0.09	0.03	0.05	0.58	0.47	0.03		
WR5000	7-mile Canal	7	Pct25	199.00	146.00	418.00	8.00	4.00	30900.00		
WR5000	7-mile Canal	7	Pct75	227.00	153.00	448.00	19.00	8.00	32300.00		
WR5000	7-mile Canal	8	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	0.00	0.00

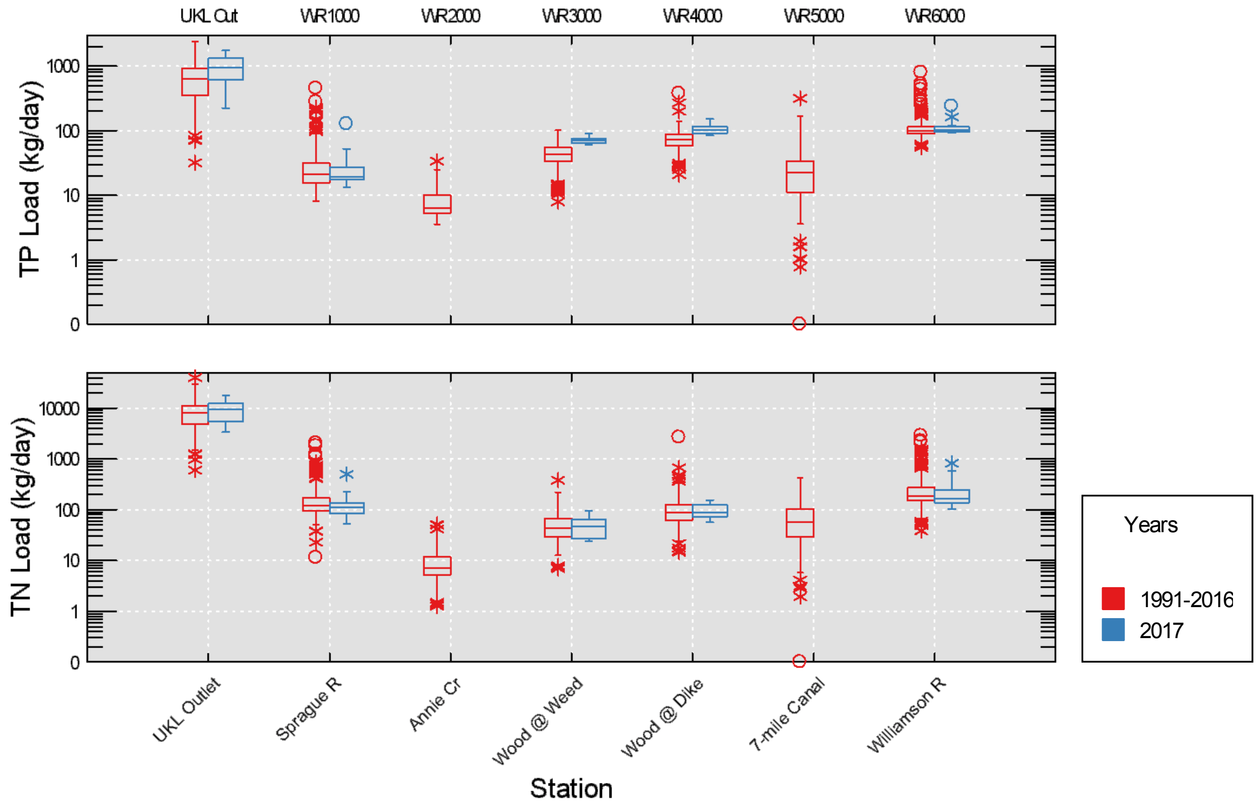
Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR5000	7-mile Canal	8	Median	159.00	121.00	403.00	57.00	12.00	30200.00		
WR5000	7-mile Canal	8	Arithmetic Mean	166.33	121.67	391.33	45.00	12.00	29800.00		
WR5000	7-mile Canal	8	Coefficient of Variation	0.12	0.10	0.06	0.56	0.25	0.03		
WR5000	7-mile Canal	8	Pct25	153.00	112.75	373.75	26.25	9.75	29150.00		
WR5000	7-mile Canal	8	Pct75	181.50	130.75	406.00	60.75	14.25	30350.00		
WR5000	7-mile Canal	9	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	0.00	0.00
WR5000	7-mile Canal	9	Median	115.50	85.00	310.00	22.50	7.50	33600.00		
WR5000	7-mile Canal	9	Arithmetic Mean	115.50	85.00	310.00	22.50	7.50	33600.00		
WR5000	7-mile Canal	9	Coefficient of Variation	0.02	0.05	0.09	0.35	0.66	0.00		
WR5000	7-mile Canal	9	Pct25	114.00	82.00	291.00	17.00	4.00	33600.00		
WR5000	7-mile Canal	9	Pct75	117.00	88.00	329.00	28.00	11.00	33600.00		
WR6000	Williamson R	10	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR6000	Williamson R	10	Median	73.00	60.50	103.50	11.50	13.00	34150.00	98.99	140.80
WR6000	Williamson R	10	Arithmetic Mean	73.00	60.50	103.50	11.50	13.00	34150.00	98.99	140.80
WR6000	Williamson R	10	Coefficient of Variation	0.02	0.01	0.18	0.18	0.22	0.02	0.06	0.22
WR6000	Williamson R	10	Pct25	72.00	60.00	90.00	10.00	11.00	33600.00	94.96	118.70
WR6000	Williamson R	10	Pct75	74.00	61.00	117.00	13.00	15.00	34700.00	103.03	162.90
WR6000	Williamson R	11	N of Cases	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR6000	Williamson R	11	Median	73.00	64.00	99.00	7.00	11.00	34600.00	103.24	140.02
WR6000	Williamson R	11	Arithmetic Mean	73.00	64.00	99.00	7.00	11.00	34600.00	103.24	140.02
WR6000	Williamson R	11	Coefficient of Variation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR6000	Williamson R	11	Pct25								
WR6000	Williamson R	11	Pct75								
WR6000	Williamson R	12	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR6000	Williamson R	12	Median	106.50	73.50	294.00	20.50	42.00	31200.00	220.66	667.05
WR6000	Williamson R	12	Arithmetic Mean	106.50	73.50	294.00	20.50	42.00	31200.00	220.66	667.05
WR6000	Williamson R	12	Coefficient of Variation	0.48	0.26	1.10	0.79	0.84	0.19	0.76	1.21
WR6000	Williamson R	12	Pct25	70.00	60.00	66.00	9.00	17.00	26900.00	102.26	96.41
WR6000	Williamson R	12	Pct75	143.00	87.00	522.00	32.00	67.00	35500.00	339.06	1237.69
WR6000	Williamson R	1	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR6000	Williamson R	1	Median	97.50	69.00	178.00	15.00	49.50	34400.00	166.58	305.29
WR6000	Williamson R	1	Arithmetic Mean	97.50	69.00	178.00	15.00	49.50	34400.00	166.58	305.29
WR6000	Williamson R	1	Coefficient of Variation	0.30	0.06	0.39	0.19	0.10	0.07	0.38	0.47
WR6000	Williamson R	1	Pct25	77.00	66.00	129.00	13.00	46.00	32700.00	122.09	204.54
WR6000	Williamson R	1	Pct75	118.00	72.00	227.00	17.00	53.00	36100.00	211.06	406.03
WR6000	Williamson R	2	N of Cases	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR6000	Williamson R	2	Median	119.00	78.00	461.00	41.00	53.00	22900.00	920.13	3564.55
WR6000	Williamson R	2	Arithmetic Mean	119.00	78.00	461.00	41.00	53.00	22900.00	920.13	3564.55
WR6000	Williamson R	2	Coefficient of Variation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WR6000	Williamson R	2	Pct25								

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR6000	Williamson R	2	Pct75								
WR6000	Williamson R	3	N of Cases	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
WR6000	Williamson R	3	Median	94.00	57.00	482.00	14.00	23.00	28100.00	757.33	4479.32
WR6000	Williamson R	3	Arithmetic Mean	92.25	56.50	491.75	12.00	29.25	26275.00	765.74	4005.33
WR6000	Williamson R	3	Coefficient of Variation	0.11	0.13	0.12	0.53	0.55	0.20	0.39	0.30
WR6000	Williamson R	3	Pct25	85.50	52.00	446.50	7.50	19.00	22500.00	556.93	3224.23
WR6000	Williamson R	3	Pct75	99.00	61.00	537.00	16.50	39.50	30050.00	974.55	4786.43
WR6000	Williamson R	4	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR6000	Williamson R	4	Median	84.00	50.00	427.50	12.50	20.00	33250.00	536.46	2738.35
WR6000	Williamson R	4	Arithmetic Mean	84.00	50.00	427.50	12.50	20.00	33250.00	536.46	2738.35
WR6000	Williamson R	4	Coefficient of Variation	0.00	0.08	0.04	0.51	0.00	0.01	0.16	0.19
WR6000	Williamson R	4	Pct25	84.00	47.00	416.00	8.00	20.00	32900.00	476.85	2361.55
WR6000	Williamson R	4	Pct75	84.00	53.00	439.00	17.00	20.00	33600.00	596.06	3115.15
WR6000	Williamson R	5	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR6000	Williamson R	5	Median	100.50	62.50	431.50	12.00	21.50	31100.00	472.12	2028.32
WR6000	Williamson R	5	Arithmetic Mean	100.50	62.50	431.50	12.00	21.50	31100.00	472.12	2028.32
WR6000	Williamson R	5	Coefficient of Variation	0.11	0.03	0.11	0.24	0.16	0.05	0.40	0.40
WR6000	Williamson R	5	Pct25	93.00	61.00	398.00	10.00	19.00	29900.00	339.07	1451.06
WR6000	Williamson R	5	Pct75	108.00	64.00	465.00	14.00	24.00	32300.00	605.17	2605.58
WR6000	Williamson R	6	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR6000	Williamson R	6	Median	81.50	58.00	286.50	10.00	9.00	32650.00	199.28	699.27
WR6000	Williamson R	6	Arithmetic Mean	81.50	58.00	286.50	10.00	9.00	32650.00	199.28	699.27
WR6000	Williamson R	6	Coefficient of Variation	0.04	0.00	0.03	0.00	0.16	0.00	0.26	0.25
WR6000	Williamson R	6	Pct25	79.00	58.00	281.00	10.00	8.00	32600.00	162.18	576.88
WR6000	Williamson R	6	Pct75	84.00	58.00	292.00	10.00	10.00	32700.00	236.37	821.67
WR6000	Williamson R	7	N of Cases	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
WR6000	Williamson R	7	Median	74.00	57.00	135.00	12.00	8.00	32000.00	111.34	190.27
WR6000	Williamson R	7	Arithmetic Mean	74.33	57.33	150.67	12.33	7.33	32266.67	108.37	222.99
WR6000	Williamson R	7	Coefficient of Variation	0.06	0.03	0.30	0.20	0.42	0.06	0.10	0.38
WR6000	Williamson R	7	Pct25	71.00	56.25	120.00	10.50	5.00	30950.00	100.16	166.39
WR6000	Williamson R	7	Pct75	77.75	58.50	185.25	14.25	9.50	33650.00	115.84	287.78
WR6000	Williamson R	8	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR6000	Williamson R	8	Median	67.50	57.50	119.50	9.50	7.50	32050.00	95.22	168.61
WR6000	Williamson R	8	Arithmetic Mean	67.50	57.50	119.50	9.50	7.50	32050.00	95.22	168.61
WR6000	Williamson R	8	Coefficient of Variation	0.03	0.01	0.11	0.97	0.66	0.04	0.04	0.12
WR6000	Williamson R	8	Pct25	66.00	57.00	110.00	3.00	4.00	31200.00	92.86	154.77
WR6000	Williamson R	8	Pct75	69.00	58.00	129.00	16.00	11.00	32900.00	97.59	182.45
WR6000	Williamson R	9	N of Cases	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WR6000	Williamson R	9	Median	73.00	57.50	80.00	9.50	7.00	34150.00	102.83	112.68
WR6000	Williamson R	9	Arithmetic Mean	73.00	57.50	80.00	9.50	7.00	34150.00	102.83	112.68

Station Code	Station Name	Month	Parameter	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	Silica (µg/L)	Total Phosphorus Load (kg/d)	Total Nitrogen Load (kg/d)
WR6000	Williamson R	9	Coefficient of Variation	0.15	0.04	0.16	0.22	0.61	0.01	0.11	0.12
WR6000	Williamson R	9	Pct25	65.00	56.00	71.00	8.00	4.00	33800.00	94.47	103.20
WR6000	Williamson R	9	Pct75	81.00	59.00	89.00	11.00	10.00	34500.00	111.19	122.17

APPENDIX III: Station distributions of TP, SRP, TN, NH4-N, NO3+ NO2-N concentrations (µg/L) and TP and TN loading (kg/day) during the irrigation season of June-October



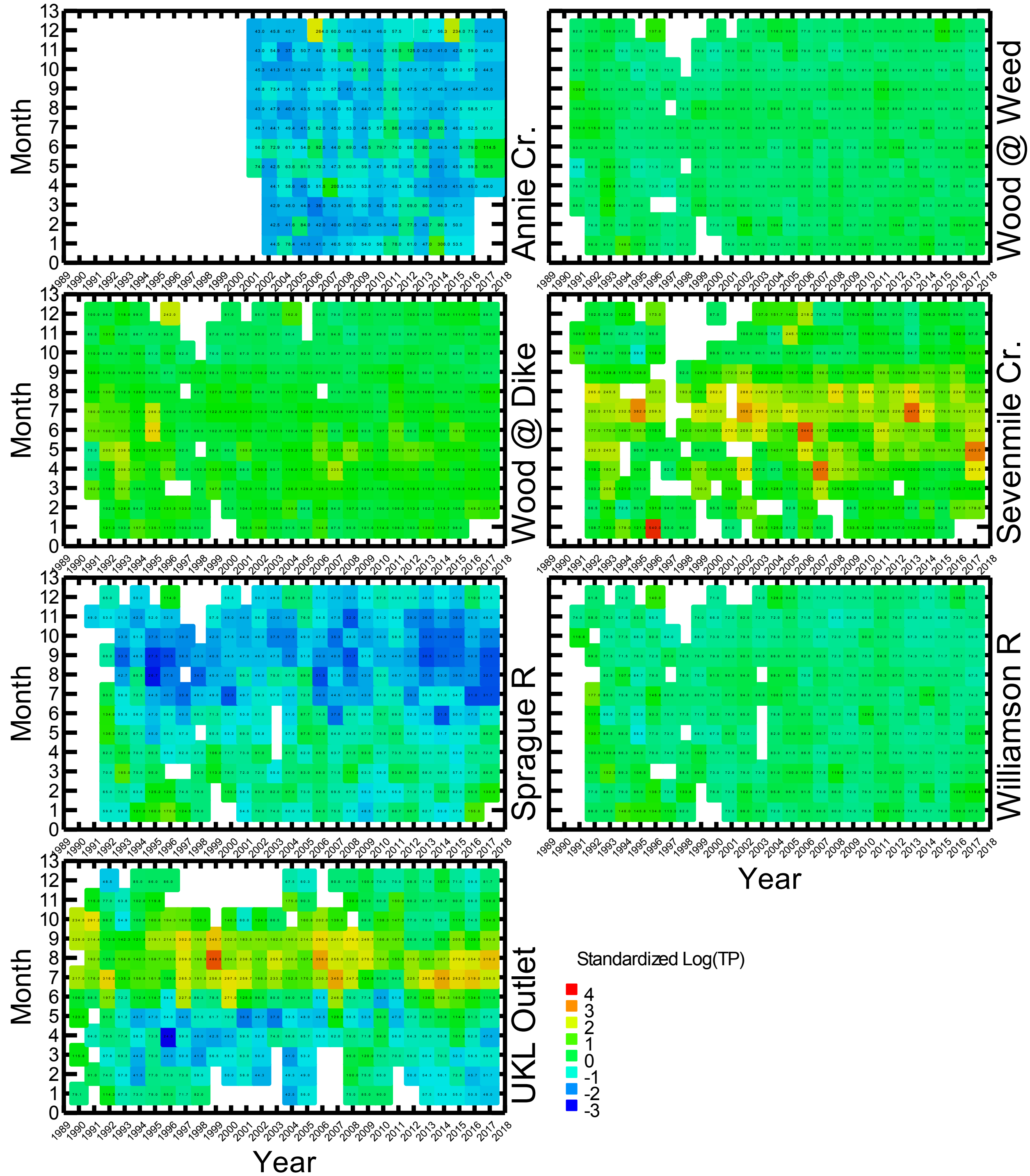


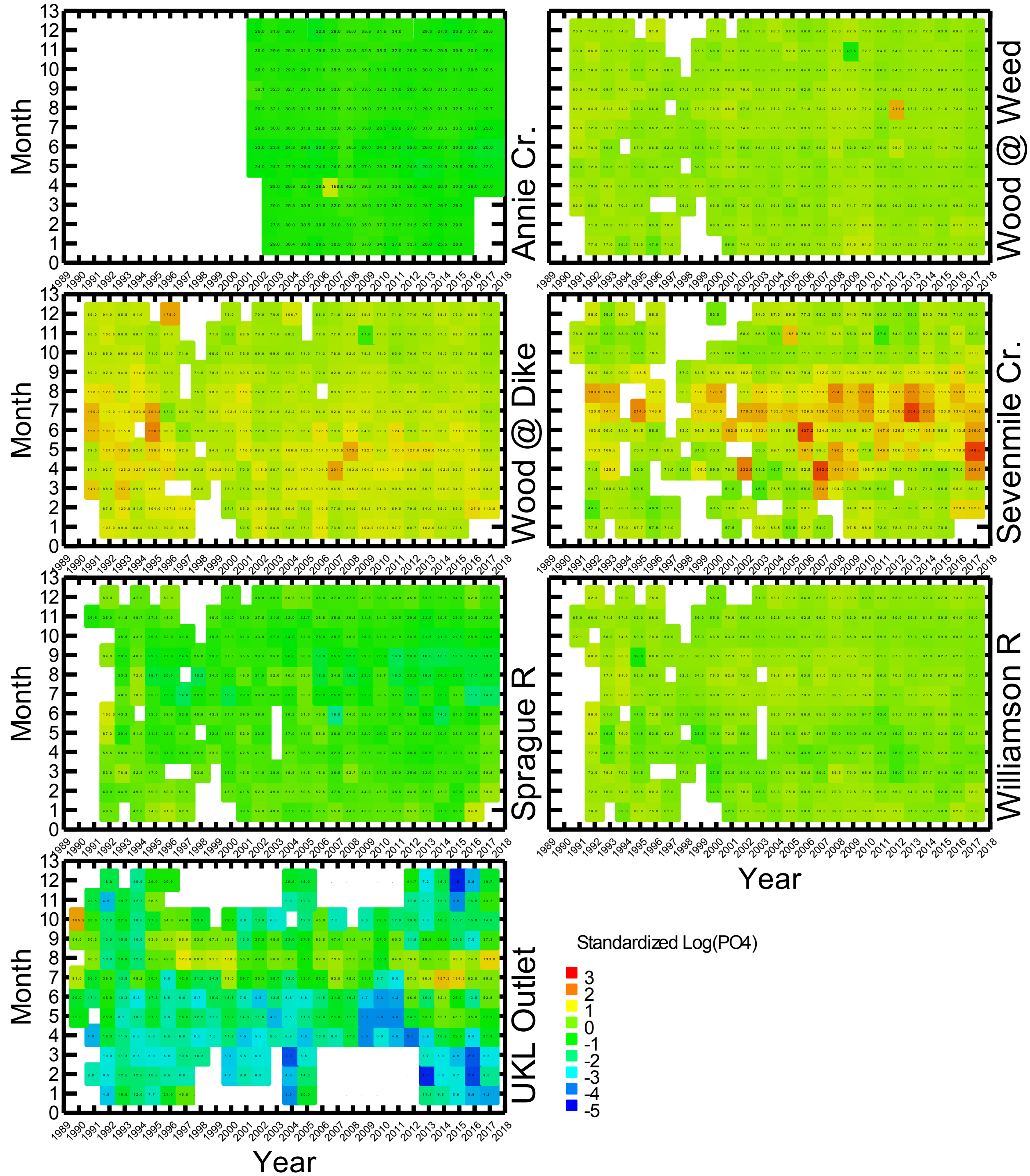
UKL Out
WR1000
WR2000
WR3000
WR4000
WR5000
WR6000
TP Load (kg/day)
1000
100
10
1
0
TN Load (kg/day)
10000
1000
100
10
1
0
UKL Outlet
Sprague R
Annie Cr
Wood @ Weed
Wood @ Dike
7-mile Canal
Williamson R
Station
Years
1991-2016
2017

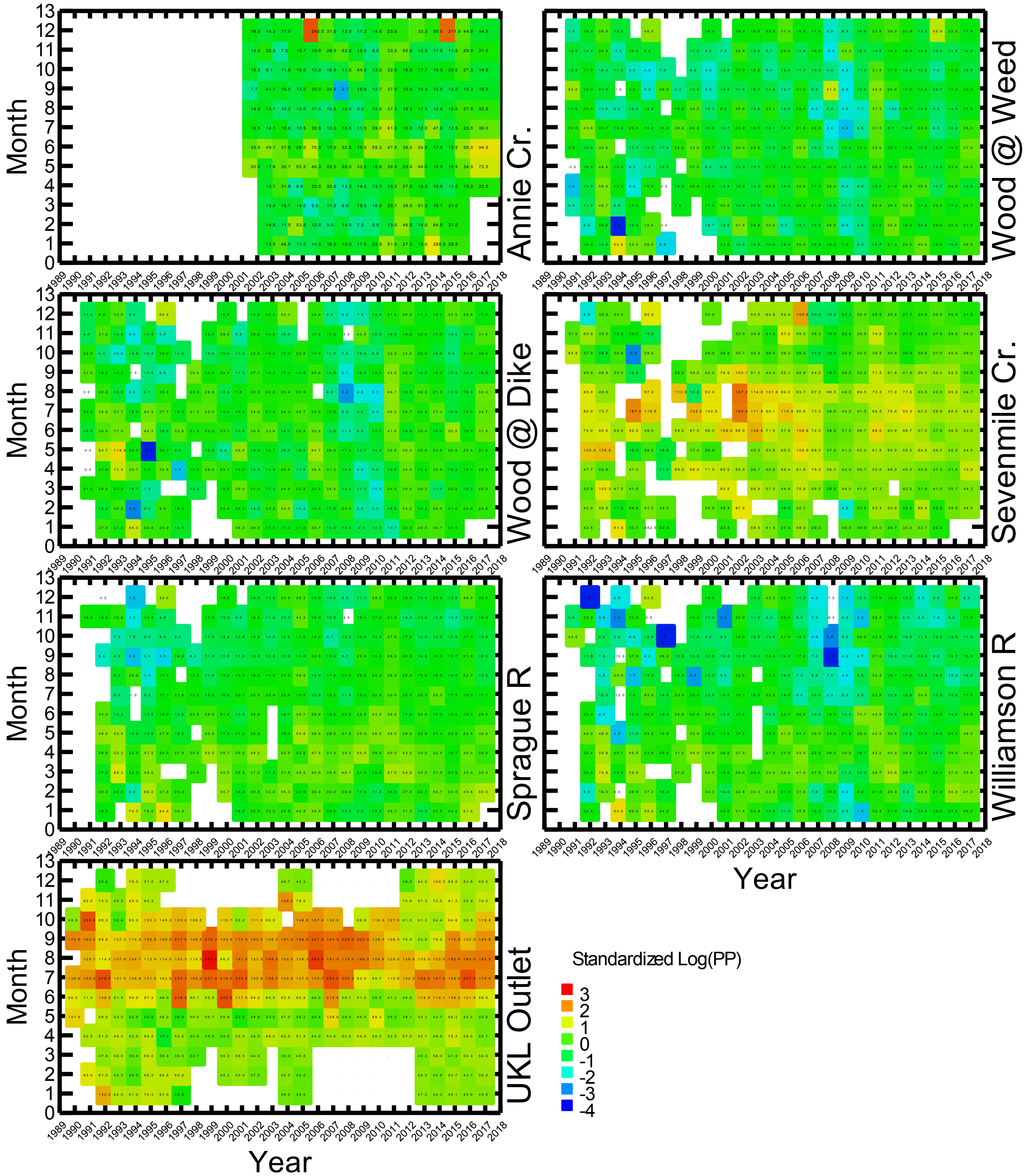
APPENDIX IV: Heat maps of monthly concentrations and loads, 1991-2017

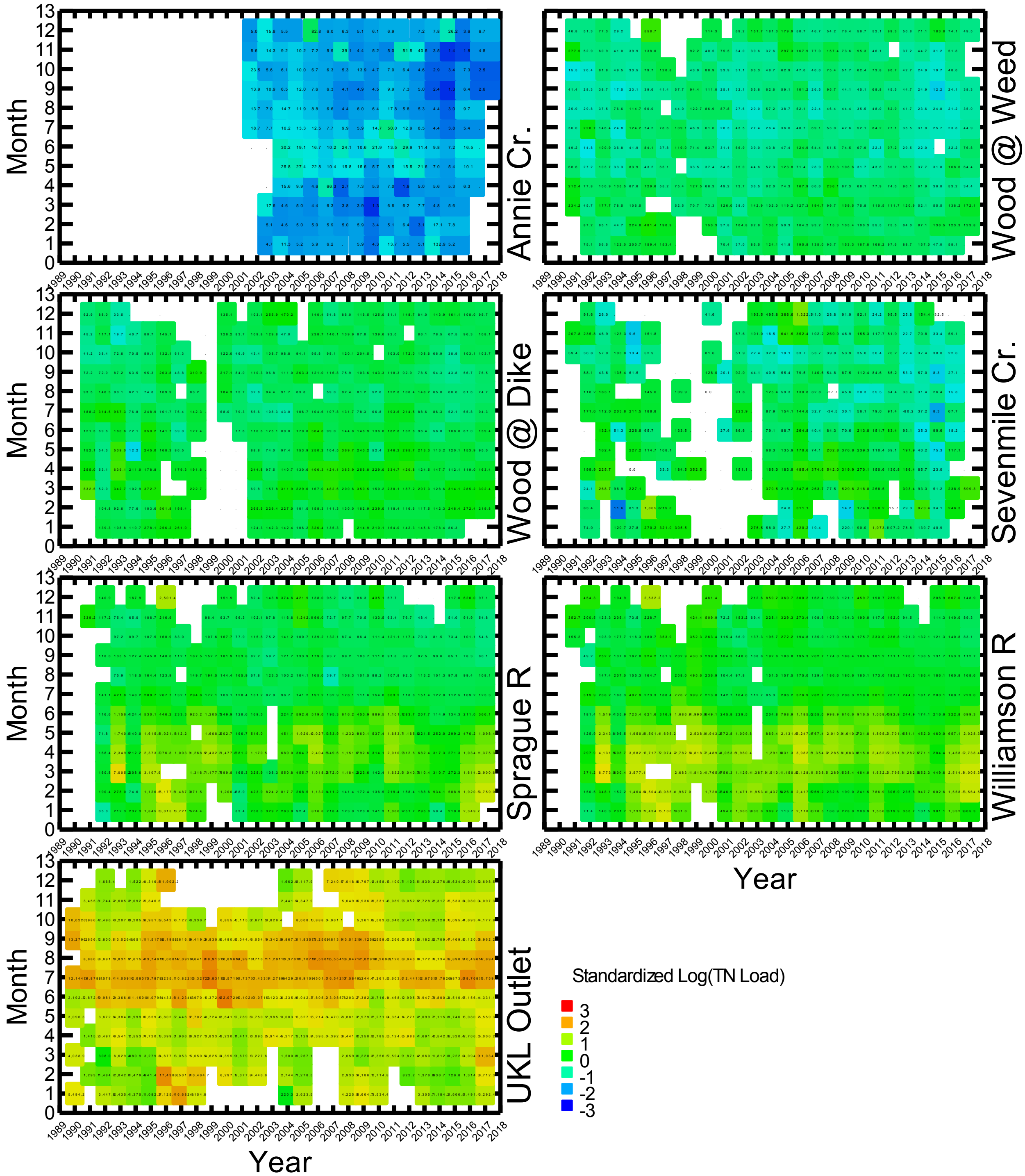
The color of each tile represents an individual value (in this case, monthly concentration). Because the range of values varies seasonally and among stations, the data are standardized in order to use a consistent color scale across all parameters. The values for each parameter were first transformed to a logarithmic scale and then normalized by subtracting the mean and dividing by the standard deviation of all values for that parameter across the stations. The result is a set of standardized monthly values for each water quality parameter which have roughly the same overall distribution (standard normal) and can thus be represented by a single color scale.

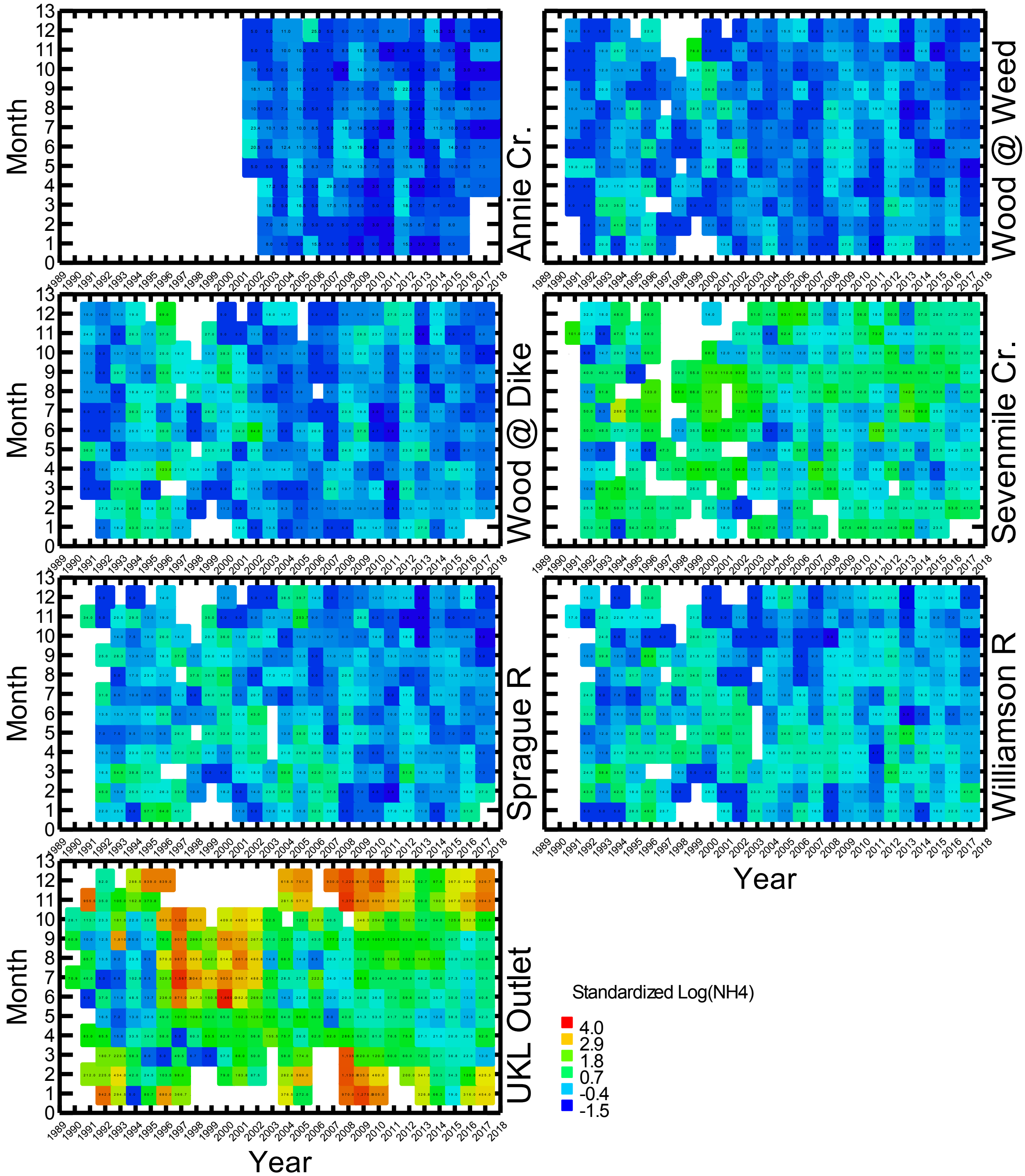
The legend for each page of plots indicates the parameter, and by zooming in on a tile one can see the actual non-transformed value for reference.

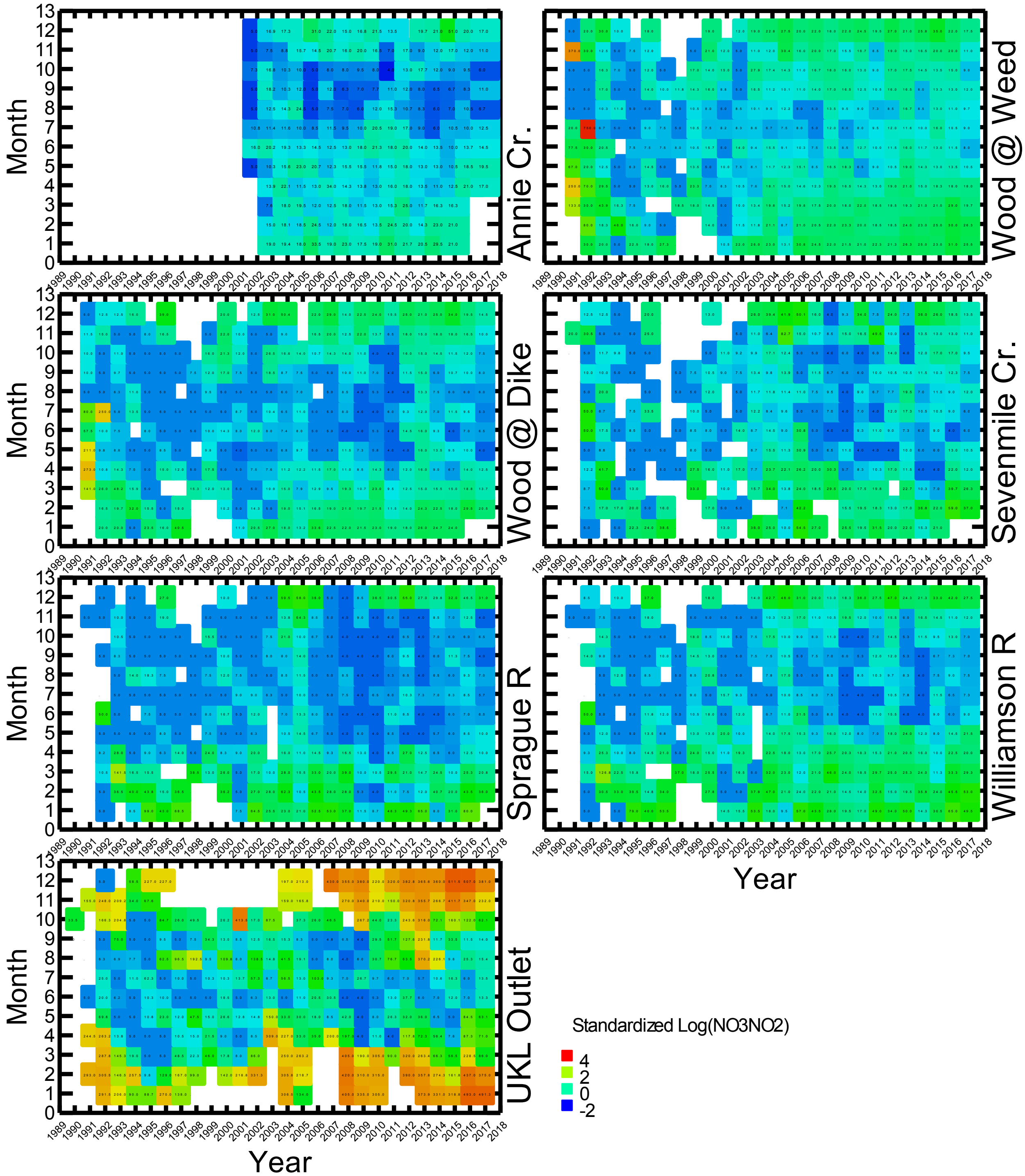

Annie Cr.
Wood @ Weed
Wood @ Dike
Sevenmile Cr.
Sprague R
Williamson R
UKL Outlet
Month
Year
Standardized Log(TP)
4
3
2
1
0
-1
-2
-3

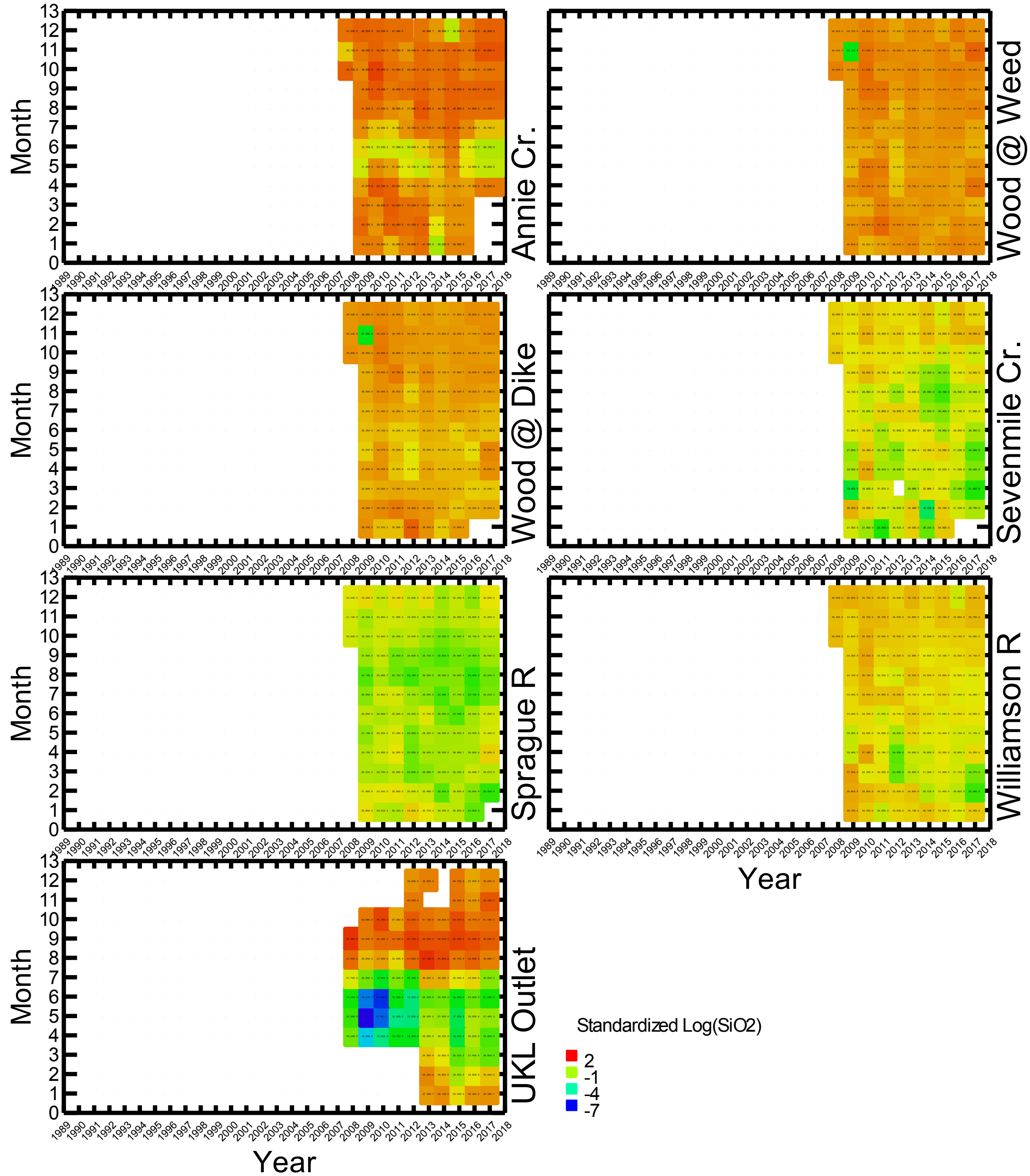

Month
Year
Annie Cr.
Wood @ Weed
Wood @ Dike
Sevenmile Cr.
Sprague R
Williamson R
UKL Outlet
Standardized Log(PO4)
3
2
1
0
-1
-2
-3
-4
-5

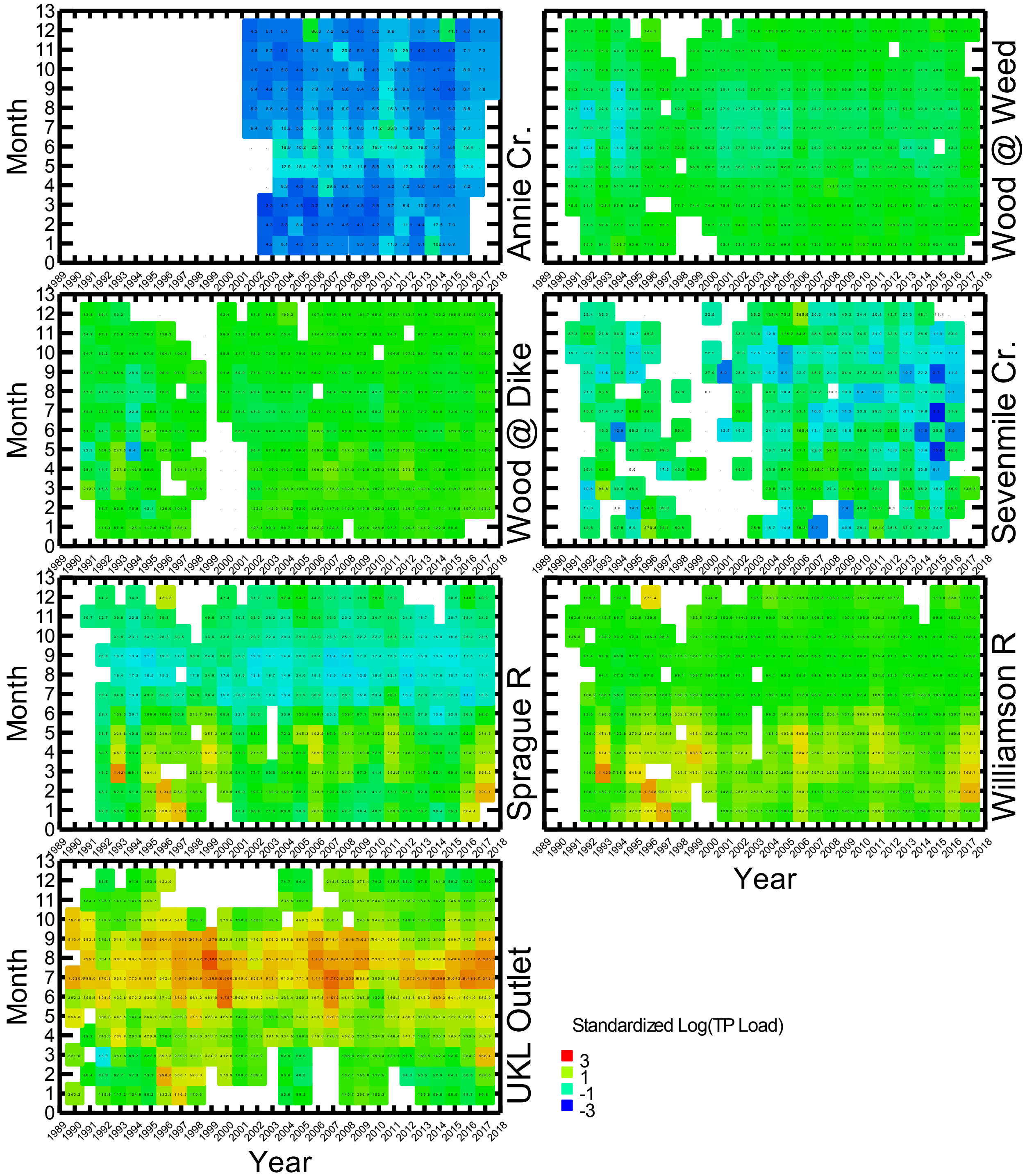

Annie Cr.
Wood @ Weed
Wood @ Dike
Sevenmile Cr.
Sprague R
Williamson R
UKL Outlet
Month
Year
Standardized Log(PP)
3
2
1
0
-1
-2
-3
-4

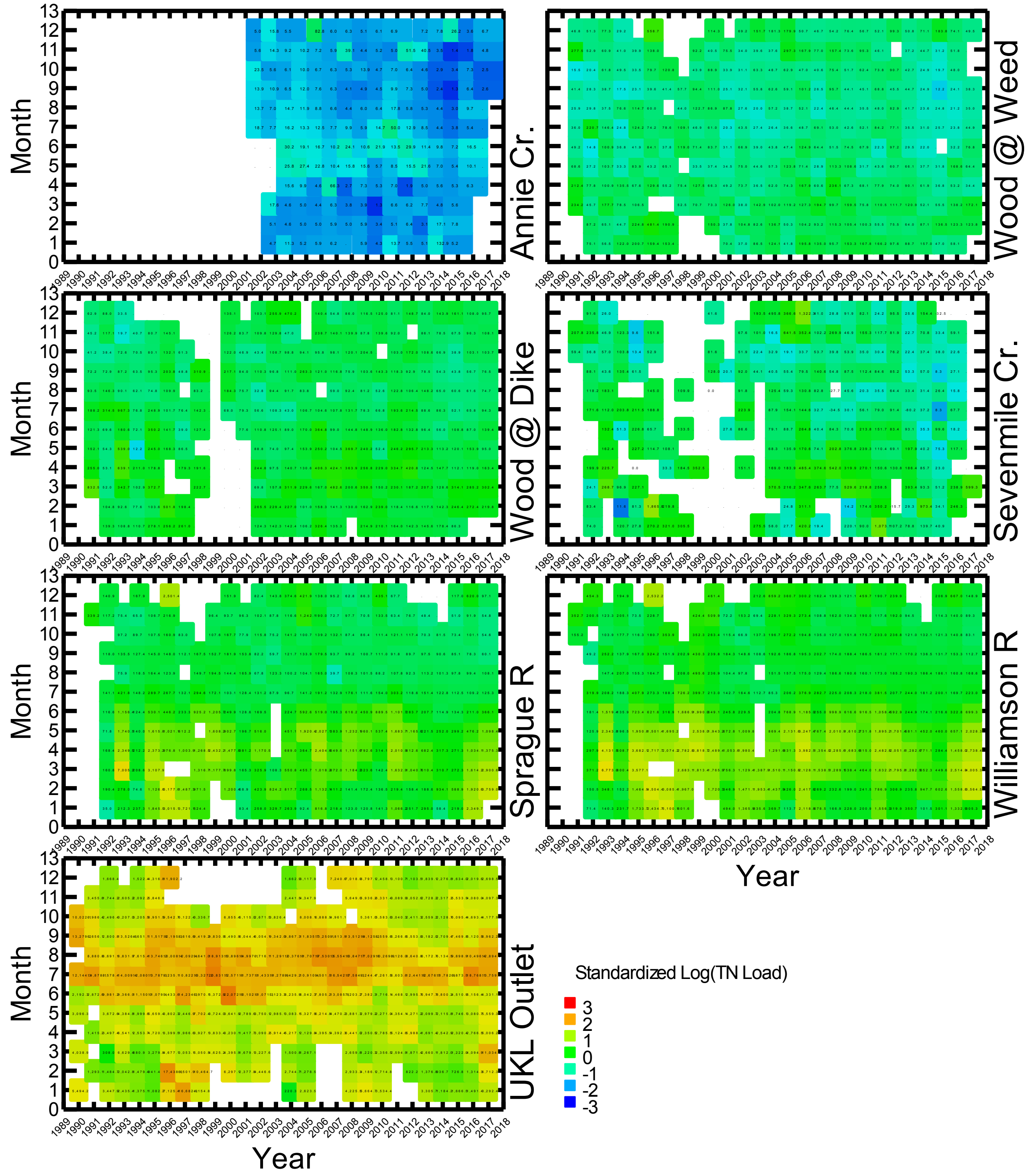

Annie Cr.
Wood @ Weed
Wood @ Dike
Sevenmile Cr.
Sprague R
Williamson R
UKL Outlet
Month
Year
Standardized Log(TN Load)
3
2
1
0
-1
-2
-3


Annie Cr.
Wood @ Weed
Wood @ Dike
Sevenmile Cr.
Sprague R
Williamson R
UKL Outlet
Month
Year
Standardized Log(NH4)
4.0
2.9
1.8
0.7
-0.4
-1.5


Annie Cr.
Wood @ Weed
Wood @ Dike
Sevenmile Cr.
Sprague R
Williamson R
UKL Outlet
Month
Year
Standardized Log(NO3NO2)
4
2
0
-2


Month
Year
Annie Cr.
Wood @ Weed
Wood @ Dike
Sevenmile Cr.
Sprague R
Williamson R
UKL Outlet
Standardized Log(SiO2)
2
-1
-4
-7


Annie Cr.
Wood @ Weed
Wood @ Dike
Sevenmile Cr.
Sprague R
Williamson R
UKL Outlet
Month
Year
Standardized Log(TP Load)
3
1
-1
-3


Month
Year
Annie Cr.
Wood @ Weed
Wood @ Dike
Sevenmile Cr.
Sprague R
Williamson R
UKL Outlet
Standardized Log(TN Load)
3
2
1
0
-1
-2
-3