

COMPARISON OF THE 2007 LOADS AND YIELDS OF TOTAL NITROGEN, TOTAL PHOSPHORUS, AND SUSPENDED SEDIMENT WITH THE BASELINES

Annual fluctuations of nutrient and SS loads and water discharge create difficulties in determining whether the changes observed were related to land use, nutrient availability, or simply annual water discharge. Ott and others (1991) used the relationship between annual loads and annual water discharge to provide a method to reduce the variability of loadings due to discharge. This was accomplished by plotting the annual yields against the water-discharge ratio. This water-discharge ratio is the ratio of the annual mean discharge to the LTM discharge. Data from the initial five-year study (1985-89) were used to provide a best-fit linear regression line to be used as the baseline relationship between annual yields and water discharge. It was hypothesized that as future yields and water-discharge ratios were plotted against the baseline, any significant deviation from the baseline would indicate that some change in the annual yield had occurred, and that further evaluations to determine the reason for the change were warranted.

Several different baselines were developed for this report. The data collected in 2007 were compared with the 1985-89 baselines, where possible. Monitoring at some of the stations was started after 1987; therefore, a baseline was established for the five-year period following the start of monitoring. Additionally, 2007 yield values were plotted against baselines developed from years prior to 2007 including the first half

of the dataset (usually 1985-1995), the second half of the dataset (usually 1996-2006), and the entire dataset (usually 1985-2006).

The results of these analyses are shown in Table 27. The R^2 value represents the strength of the correlation between the two parameters in the regression. An R^2 of one means that there is perfect correlation between the two variables—flow and the individual parameter. The closer the R^2 is to a value of one, the better the regression line is for accurately using one variable (flow) to predict the other. R^2 values less than 0.5 have poor predictive value (< 50 percent) and have been noted with an asterisk (*) in Tables 27 and 28. The Y' value is the yield value that the regression line predicts for 2007. The Y corresponds to the actual 2007 yield.

R^2 values for TN tend to be close to one as the relationship between TN and flow is very consistent through various ranges of flows. R^2 values for TP and SS tend to vary more, especially towards higher flows. Thus, when regression graphs include high flow events, the resulting correlation tends to be less perfect indicated by a low R^2 value. This is an indication that single high flow events, and not necessarily a high flow year, are the highest contributors to high loads in TP and SS. As has been evident in the last few years, the high loads that have occurred at Towanda and Danville can be linked directly to high flow events, specifically Tropical Storm Ernesto in 2006 and Hurricane Ivan in 2004. Seasonal baselines also were calculated for the initial five years of data at each site. Figure 28 compares these baselines to the 2007 seasonal yields.

Table 27. Comparison of 2007 TN, TP, and SS Yields with Baseline Yields

Site/Parameter		Initial Baseline			First Half Baseline			Second Half Baseline			Full Baseline			2007
		Q	R ²	Y'	Q	R ²	Y'	Q	R ²	Y'	Q	R ²	Y'	Y
Towanda	TN	0.97	0.81	6.61	0.98	0.89	6.26	0.91	0.88	4.81	0.95	0.69	5.48	4.33
	TP	0.97	0.76	0.488	0.98	0.89	0.494	0.91	0.84	0.401	0.95	0.85	0.455	0.465
	SS	0.97	0.47	521	0.98	0.67	669	0.91	0.61	452	0.95	0.56	527.6	354.1
Danville	TN	1.23	0.99	9.73	1.09	0.87	7.54	0.92	0.74	5.18	1.00	0.62	6.21	4.67
	TP	1.23	0.91	0.733	1.09	0.86	0.620	0.92	0.82	0.413	1.00	0.82	0.528	0.519
	SS	1.23	0.99	820	1.09	0.74	480	0.92	0.65	353	1.00	0.66	444	234
Lewisburg	TN	0.91	0.84	5.63	0.83	0.92	4.99	0.80	0.95	3.87	0.82	0.81	4.50	3.34
	TP	0.91	0.86	0.269	0.83	0.84	0.241	0.80	0.92	0.192	0.82	0.88	0.220	0.240
	SS	0.91	0.74	197	0.83	0.75	149	0.80	0.43	112	0.82	0.41	128	99
Newport	TN	0.84	0.85	6.83	0.80	0.87	6.12	0.70	1.00	5.03	0.76	0.97	5.61	5.15
	TP	0.84	0.93	0.350	0.80	0.80	0.300	0.70	0.83	0.183	0.76	0.81	0.246	0.135
	SS	0.84	0.94	190	0.80	0.70	140	0.70	0.86	77	0.76	0.84	109	55
Marietta	TN	1.03	1.00	9.47	0.88	0.96	7.53	0.88	0.98	6.54	0.88	0.92	7.07	6.17
	TP	1.03	0.95	0.481	0.88	0.96	0.395	0.88	0.84	0.355	0.88	0.89	0.380	0.209
	SS	1.03	0.61	392	0.88	0.85	301	0.88	0.68	321	0.88	0.76	317	145
Conestoga	TN	1.05	1.00	40.37	1.03	0.97	38.29	0.90	0.98	31.89	0.97	0.97	34.79	30.65
	TP	1.05	0.30	2.633	1.03	0.72	2.582	0.90	0.67	1.741	0.97	0.64	2.142	0.781
	SS	1.05	0.92	1,649	1.03	0.83	1,509	0.90	0.54	939	0.97	0.59	1,162	310

R² = correlation coefficient

* indicates a R² that is low and thus is less accurate at predicting Y

Table 28. Comparison of 2007 Seasonal TN, TP, and SS Yields with Baseline Yields

Site/Parameter		Winter				Spring				Summer				Fall			
		Q	R ²	Y'	Y07	Q	R ²	Y'	Y07	Q	R ²	Y'	Y07	Q	R ²	Y'	Y07
Towanda	TN	1.18	0.94	2.96	1.98	0.78	0.94	1.74	1.16	0.38	0.99	0.21	0.14	1.11	0.98	1.72	1.14
	TP		0.53	0.964	0.216		0.92	0.085	0.116		0.98	0.013	0.017		0.99	0.142	0.116
	SS		0.01*	138	211		0.87	31	75		0.96	2	1.77		0.86	112	66
Danville	TN	1.21	1.00	3.43	2.03	0.84	1.00	2.01	1.20	0.41	1.00	0.24	0.14	1.17	1.00	2.30	1.30
	TP		0.97	0.258	0.230		1.00	0.153	0.126		0.93	0.019	0.013		0.98	0.165	0.149
	SS		0.90	346	125		0.98	150	53		0.76	4	1.38		0.95	109	54
Lewisburg	TN	1.19	0.98	2.97	1.83	0.74	0.98	1.39	0.86	0.32	0.99	0.23	0.17	0.66	0.99	0.93	0.68
	TP		0.99	0.141	0.132		0.99	0.068	0.054		0.96	0.013	0.008		0.98	0.037	0.046
	SS		0.93	145	70		0.97	39	15		0.39*	2	0.74		0.92	18	13
Newport	TN	0.94	0.95	2.89	2.48	0.67	0.98	1.63	1.26	0.62	1.00	0.50	0.41	0.64	0.99	1.07	1.00
	TP		0.94	0.133	0.060		1.00	0.083	0.035		1.00	0.034	0.017		0.97	0.049	0.022
	SS		0.93	77	29		0.97	38	14		1.00	12	4.96		0.86	14	7
Marietta	TN	1.14	1.00	3.62	2.82	0.77	0.99	2.02	1.50	0.42	0.99	0.36	0.26	0.90	1.00	1.98	1.60
	TP		0.92	0.139	0.108		0.93	0.110	0.052		0.92	0.018	0.008		1.00	0.093	0.042
	SS		0.98	93	87		0.93	89	32		0.91	5	1.85		0.98	69	23
Conestoga	TN	1.13	0.99	15.20	11.83	1.06	1.00	10.72	8.74	0.67	0.98	3.95	3.64	0.83	0.99	7.08	6.44
	TP		0.46*	0.923	0.380		0.99	0.775	0.205		0.22*	0.598	0.074		0.85	0.443	0.122
	SS		0.16*	287	194		0.97	521	86		0.13*	465	8.00		0.93	110	22

Q = discharge ratio

R² = correlation coefficient

* indicates a R² that is low and thus is less accurate at predicting Y