Project Report

Development of a TMDL for the Wanaque Reservoir and Cumulative WLAs/LAs for the Passaic River Watershed

Submitted To

Division of Watershed Management
NJ Department of Environmental Protection
Trenton, New Jersey

June 2005

Najarian Associates

Engineers • Planners • Scientists • Surveyors

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Executive Summary

The Wanaque Reservoir's storage capacity is supplemented by diverted flows from the Ramapo, Pompton and Passaic Rivers. While the Reservoir maintains a generally high level of water quality, it can experience large fluctuations in phosphorus concentration due to such diversions. During drought and post-drought refill operations, such diversions can increase the Reservoir's native phosphorus concentration by a factor of 3 to 5 – to a level that will exceed the State's criterion for total phosphorus over a period of up to several months. Hence, a TMDL is required to address total phosphorus concentrations in the Reservoir and, by association, its river-intake sites.

To address these issues, separate (but linked) mathematical models were developed to simulate: (a) the water quality response of the Ramapo, Pompton and Passaic Rivers (at the Reservoir's intake sites) to changes in upstream point-source (PS) and nonpoint-source (NPS) discharge loads; and (b) the Reservoir's water quality response to the diversion of intake (river) water, in conjunction with its proposed operation schedule and natural inflow conditions. These models were verified by a favorable comparison with 10 years of field monitoring data. An analysis of the linked-model results highlighted the impact of the cumulative PS discharge load of total phosphorus on both River and Reservoir water quality.

Using the linked River/Reservoir models, the combined Reservoir and intake operation was simulated using actual river flows and purveyor-specified pumpage schedules for the years 1993 through 2002. A number of management scenarios were simulated to reduce corresponding PS and NPS loads. In evaluating the benefits of these strategies, two possible Reservoir endpoints were considered in detail: (a) Endpoint 1 -- full compliance with the current TP criterion for lakes (0.05 mg/l at any time); and (b) Endpoint 2 – compliance with the TP limit of 0.05 mg/l on a summer-average basis (June through September) near Raymond Dam. Model results with regard to these endpoints are summarized below:

Endpoint Compliance based on Model Simulations

Effluent LTA Conc. (mg/l)	Discharge. Load (lbs/day)	Endpoint 1 Maximum Conc. (mg/l)	Endpoint 2 Max. Summer-Average Conc. (mg/l)
0% NPS Load Reductions			
1.0	664.9	0.160	0.083
0.50	347.4	0.099	0.056
0.25	173.7	0.071	**0.043**
0.10	69.5	0.058	**0.036**
40% NPS Load Reductions			
1.0	664.9	0.150	0.075
0.50	347.4	0.089	**0.049**
0.25	173.7	0.058	**0.036**
0.10	69.5	**0.044**	**0.028**

80% NPS Load Reductions			
1.0	664.9	0.140	0.066
0.50	347.4	0.078	**0.040**
0.25	173.7	**0.048**	**0.028**
0.20	139.0	**0.042**	**0.025**
0.10	69.5	**0.030**	**0.021**

In consultation with NJDEP, a specific scenario was selected as the Reservoir TMDL. This scenario was designed to enforce compliance with Endpoint 1 (0.05 mg/l at any time) and require an 80% reduction in all urban and agricultural NPS loads. The TMDL associated with these specifications would limit the total phosphorus load to the Reservoir (from all sources) to 17,496 lbs/yr on an average annual basis (down 68% from the existing 54,574 lbs/yr). Corresponding TMDLs for river diversions are 6,483 lbs/yr (622 lbs/yr from Ramapo River, 2,717 lbs/yr from Pompton River and 3,144 lbs/yr from Passaic River), which represent an average reduction of about 83% based on an effluent LTA concentration of 0.20 mg/l. For nonpoint sources, an 80% load reduction was allocated for the urban/agricultural land uses.

MOS and RC for the Wanaque Reservoir were specified explicitly as 1,049 lbs/yr (6.0%) and 171 lbs/yr (1.0%), respectively. If held in reserve, this MOS/RC would reduce the effluent LTA concentration from about 0.27 mg/l to 0.20 mg/l, and the RC could be used to provide 0.255 mgd of additional flow capacity to the system. Also, reserve capacity issues were addressed implicitly through the following assumptions: (1) the reservoir diversion schedule reflects its ultimate safe-yield capacity; and (2) treatment plant discharge rates reflect each facility's design flow rate. Under this scenario, the long-term (10-year) phosphorus concentration in the Reservoir (at Raymond Dam) would be 0.018 mg/l – a result that is a significant improvement to the existing long-term phosphorus concentration of 0.074 mg/l.

The specified TMDL scenario would require all discharges to remove total phosphorus from their effluents and meet an effluent LTA concentration of 0.20 mg/l. This result implies that the PS TP load must be reduced from its current level (1,154 lbs/day) down to 139 lbs/day (as an ultimate/design load). In developing this cumulative WLA, it was assumed that all concerned discharges would be allocated on an equal basis. However, the implementation of this result could be facilitated by "trade-off" strategies among the involved PS dischargers.

1. Introduction

1.1 TMDL Basis

A Total Maximum Daily Load (TMDL) is a regulatory allocation of the available assimilative capacity of a water body, taking into consideration point and nonpoint sources of pollution, natural background and surface water withdrawals. A TMDL study provides a mechanism for: (1) identifying and quantifying all water quality stressors to that water body; and (2) setting load-reduction goals needed to meet water quality standards or alternate endpoints. TMDLs also provide a mechanism for maintaining and/or improving water quality conditions in waterways that are not deemed impaired.

In September 2002, the New Jersey Department of Environmental Protection (NJDEP), and the U.S. Environmental Protection Agency (USEPA) Region II, entered into a Memorandum of Agreement to provide Total Maximum Daily Loads (TMDLs) for various impaired waterways within New Jersey. In 2004, NJDEP listed such waterways within the New Jersey 2004 Integrated Water Quality Monitoring and Assessment Report, which includes the 305(b) Report & 303(d) List. The 2004 list identified several reaches within the large and populous Passaic River Basin as being impaired for Total Phosphorus (TP).

The 2004 list did not include the Basin's largest water-supply reservoir, the Wanaque Reservoir, although a downstream reach of the Wanaque River was included. Nevertheless, NJDEP determined that a TMDL was needed for the Reservoir since its storage is sometimes augmented by phosphorus-rich diversion flows from the downstream Passaic, Pompton and Ramapo Rivers (NJDEP 2002). Such diversions may cause excess primary productivity in the Reservoir and degrade its aquatic life, recreational and drinking-water uses. The Reservoir was, therefore, designated as a critical location that would have to be considered when addressing river impairments. In the course of development of this TMDL, NJDEP determined that the Reservoir is impaired for phosphorus, as indicated by phosphorus concentrations in excess of the existing lake criterion.

Historic water quality data suggest that the Reservoir is generally in a mesotrophic-to-eutrophic state (e.g., Carlson, 1977). Recent water quality data collected by the North Jersey District Water Supply Commission (NJDWSC) indicate that TP concentrations often exceed NJDEP's lake criterion of 0.05 mg/l following periods of major diversions from the Two Bridges pumping station, which is located at the confluence of the Pompton and Passaic Rivers. Also, episodes of undesirable algae concentrations have been reported.

To address such concerns, this report describes the application of a calibrated/verified water quality model to the Wanaque Reservoir. This model is used to assess water-quality impacts due to all significant TP sources (including river intakes), and to support the development of a TMDL for the Reservoir.

The U.S. EPA regulations [40 CFR 130.2(I)] define a TMDL as the sum of point-source wasteload allocations (WLAs), nonpoint-source load allocation (LAs), margin of safety (MOS) and reserve capacity (if applicable). In order to translate the TMDL into an allocation of loading capacity for the Reservoir's intakes, and into LAs and WLAs for the contributing river systems, a separate model assessment was needed for the river watersheds – one that calculated in-stream concentrations based on upstream inputs (NJDEP 2002). Accordingly, a separate mass-balance model was developed for the relevant portions of the Passaic River Basin. The resulting models for both the River Basin and Reservoir were then linked to provide dynamic simulations of various load reductions to the Wanaque Reservoir. These analyses provided the basis for developing a TMDL for the Wanaque Reservoir.

1.2 Objectives

The overall goal of this study is to develop the TMDL for the Wanaque Reservoir and assess the impact of various management options on Reservoir water quality. Due to the potential linkage between Reservoir status and downstream intake sites, this goal also requires an assessment of river water quality based on the various upstream point-source (PS) and nonpoint-source (NPS) discharges. Given the environmental and economic impact of management decisions, it is important that these assessments be done in a technically defensible manner. The specific objectives of this study are as follows:

1. To re-verify a previously developed water quality model of the Wanaque Reservoir and demonstrate that it provides a suitable platform for TMDL development.

2. To develop background information relevant to candidate Reservoir "endpoints" and demonstrate the implications of different endpoint options.

3. To refine and expand an existing mass-balance model for water quality in the Passaic River and its tributaries, and demonstrate that it provides a suitable platform for TMDL development.

4. To link the Reservoir and river models and demonstrate the impact of various river management options on the Reservoir intake sites and, thus, on the Reservoir itself.

5. To provide a decision matrix that will allow the agency to evaluate the potential benefits of various TMDL PS/NPS trade-off options.

1.3 Approach

To satisfy the above objectives, our general approach builds upon our previous model assessments of the subject waterways. First, the LA-WATERS (Laterally Averaged -

Wind and Temperature Enhanced Reservoir Simulation) model was re-applied to the Wanaque Reservoir for TMDL development. The hydrothermal component of this model was originally developed at Najarian Associates during the mid-1980s for the Wanaque Reservoir and published in the peer-reviewed literature (Huang et al., 1994). Both the hydrothermal component and water quality modules of LA-WATERs were successfully calibrated to the Wanaque Reservoir using data collected as part of the Wanaque South Project (Najarian Associates, 1988), and re-validated for the NJDEP with data from an ongoing field-monitoring program (Najarian Associates, 2000). Working with NJDEP staff, this model was previously applied in a series of management scenarios designed to estimate the impact of reduced phosphorus loadings and to achieve various candidate endpoints for water quality.

Second, the river assessment portion of this study utilized an existing mass-balance model for the Passaic and Pompton Rivers that was previously developed as part of the watershed characterization studies for WMA3, WMA4 and WMA6 (NJDWSC 2002a, 2002b, 2002c). The simplified formulation of this model is based on results of previous detailed numerical modeling studies of the Passaic River (NJDEP, 1987), and on data obtained from the ongoing field-monitoring programs of the USGS/NJDEP and other agencies. This mass-balance model simulates daily concentrations of TP (and ortho-phosphorus) at the various watershed stations, with its result being verified against the long-term water quality data record. Simulated daily concentrations for the Reservoir-intake sites -- along with recorded daily diversion flows – were input to the Reservoir model. This linkage allowed for dynamic simulation of water diversion impacts for the prescribed management scenarios.

Details regarding these modeling approaches for the River Basin and Reservoir are provided in chapters 3 and 4, respectively. Chapter 5 describes the process used to select a TMDL endpoint and to evaluate various management strategies designed to satisfy this endpoint. Chapter 6 presents the resulting TMDL for the reservoir, and translates this TMDL to the Reservoir's intake sites and to four upstream control sites within the Passaic River Basin.

2. Reservoir Characteristics

The Wanaque and Monksville Reservoirs are owned and operated by the North Jersey District Water Supply Commission (NJDWSC). These two “run-of-the-river" reservoirs comprise one of the largest water supply/storage systems in New Jersey (Figures 2.1 and 2.2). This system is the primary source of drinking water for much of Passaic, Essex, Bergen and Hudson Counties. Relevant statistics for these Reservoirs are provided in Table 2.1. Following the completion of the Wanaque South Project in the late 1980s, the long-term safe yield of this combined reservoir system was expanded to 173 mgd. The system currently provides approximately 160 mgd of potable water supply to its customers (including other water companies).

Table 2.1: Geometric Description of Reservoirs

	Wanaque Reservoir	**Monksville Reservoir**
Water surface elevation	302.4 ft.	400.0 ft
Capacity of reservoir	29,630 mg	7,000 mg
Area of water surface	2,310 acres	505 acres
Width at widest point	1.2 mi	0.6
Length	6.6 mi	3.3 mi
Average width	0.5 mi	0.2 mi
Greatest depth	90 ft	100 ft
Average depth	37 ft	42 ft
Watershed area	90.1 mi^2	42.2 mi^2

To maintain this yield, the Wanaque Reservoir utilizes inflows from three separate sources: (1) its natural tributary system, which includes the Monksville Reservoir; (2) the Pompton Lakes intake, which is located on the Ramapo River (Figure 2.1); and (3) the Two Bridges intake, which is located on the Pompton River, about 750 feet upstream from the confluence with the Passaic River. The NJDWSC has the capability of pumping up to 150 mgd from the Pompton Lakes intake, and up to 250 mgd from the Two Bridges intake. By design, when the diversion from the Two Bridges intake exceeds the available flow in the Pompton River, this intake has the ability to reverse flows in the lowermost reach of the Pompton River and tap the locally impounded waters of the Passaic River. Thus, the entire upper Passaic watershed (with a drainage area of 361 square miles) becomes a contributing source to the Reservoir. To maintain water quality in the downstream portions of the Passaic, Pompton and Ramapo Rivers, NJDEP has implemented several restrictions on intake usage, including: (a) no diversions during July and August unless there is a declared drought emergency; (b) no diversions from the Pompton Lakes intake when flows in the Ramapo River are below 40 mgd; and (c) no diversions when flows in the Passaic River at Little Falls are below 17.6 mgd.

When the Reservoir was completed in 1928, its tributary watershed was largely undeveloped. Today, a substantial portion of this watershed has been maintained in its natural state by the establishment of several state parks and preservation areas. The remainder of the watershed has been only moderately developed. Thus, the Reservoir's upstream tributary inflows have maintained a fairly high degree of water quality over the years. However the same is not true for the water quality at the two intake sites. The watersheds upstream of these intakes have been subject to extensive development and contain a number of surface-water discharges (municipal sewage treatment plants). In particular, the upper Passaic River is noted for receiving discharges from over 20 such facilities and for having degraded water quality (NJDWCS, 2003). Previous studies (Najarian, 1988; Najarian; 2000) have shown that the Reservoir may experience transient water quality impacts following periods of extensive pumpage from the Two Bridges intake. Clearly, the issue of river (intake) water quality is linked to Reservoir water quality by these diversions. To examine this issue, the status of the three Reservoir inflow sources is characterized below.

2.1 Reservoir's Tributary Watershed

As previously noted, the Wanaque Reservoir's tributary area (at its intake near Raymond Dam) is 93.9 square miles, with 65.9 square miles located within New Jersey and 28.0 square miles located within New York. Its most important tributary is the Wanaque River, which includes large upstream storage areas within the Monksville Reservoir and Greenwood Lake. Other important tributaries include Ringwood Creek and West Brook (Figure 2.2). Corresponding drainage areas and mean flows for the various tributary sub-watersheds are provided in Table 2.2.

Table 2.2: Reservoir Sub-watershed Statistics

Sub-watershed	**Drainage Area (mi^2)**	**Average Flow (cfs)**
Wanaque River (at Monks)	40.4	82.6
Ringwood Creek	19.1	32.9
Cupsaw Brook	4.4	7.9
Erskine Brook	1.0	1.7
West Brook	11.8	24.0
Blue Mine Brook	1.0	2.3
Direct Drainage*	16.2	27.2
Total	**93.9**	**178.6**

* including the diversion of Posts Brook

For the New Jersey portion of the watershed, basic land-use types have been delineated by NJDEP based on 1995 aerial photography. From these data, composite land use statistics for this watershed have been mapped (Figure 2.3) and tabulated (Table 2.3). This portion of the watershed remains at least 85% undeveloped, with low-to-medium density residential development dominating the urban land cover. The extent of impervious cover in the watershed is about 3.4%. With regard to the extensive forested areas, 14,900 acres (35% of the watershed) are currently being preserved in state-owned parks and natural areas including: Abram S. Hewitt State Park, Ringwood Manor State Park, Norrin Green State Park, Ramapo Mountain State Park, Long Pond Iron Works State Park, French Hill State Park and Wanaque Wildlife Management Area. Additionally, another 10,400 acres within New York are preserved as part of Sterling Forest and Harriman State Park.

Table 2.3: Land Use Data for New Jersey Portion of Reservoir Watershed

Land Use Category	Total Acreage	Percent of Watershed
Agriculture	104	0.2%
Barren	219	0.5%
Forest	28,749	68.1%
Urban	5,709	13.5%
Water	4,562	10.8%
Wetlands	2,850	6.8%

* based on NJDEP GIS data for 1995-1997 conditions

As the developed areas of the watershed are relatively disbursed, they are serviced predominantly by on-site septic systems. However, some domestic wastewater-treatment facilities (WWTFs) are present within this watershed. A review of NJDEP and NYDEC data (NJDEP, 2003; NYDEC, 1999) indicates that there are seven minor WWTFs operating in the watershed; most are located within the West Milford (New Jersey) area upstream of Greenwood Lake. These facilities, and their current/design capacities (in mgd), are listed in Table 2.4. According to discharge monitoring report (DMR) data, all of these facilities are providing treatment for phosphorus, and their overall average effluent TP concentration is 0.42 mg/l.

Table 2.4: Treatment Facilities within the Reservoir's Tributary Watershed

Facility Name	Permit No.	Average Flow	Permitted Flow
West Milford Shopping Center	NJ0024414	0.0047	0.0200
West Milford-Cresent Park STP	NJ0026174	0.0284	0.0640
West Milford MUA-Awosting STP	NJ0027669	0.0623	0.0450
West Milford MUA-Olde Milford Estates	NJ0027677	0.0970	0.1720
West Milford MUA-Birch Hill Park STP	NJ0028541	0.0123	0.0160
Ringwood-Erskine School WTP	NJ0029432	0.0010	0.0080
Reflection Lakes Garden Apts	NJ0027201	0.0013	0.0050
Total		0.2070	0.3300

Currently, the NJDWSC conducts the only ongoing water quality monitoring program within this watershed. This program focuses on the various tributaries near the point where they enter the Reservoir, and on certain points of interest in their upstream watersheds. These data were reviewed to provide a preliminary assessment of water quality. Computed mean and percentile statistics of these data for two important nutrient parameters are provided within Tables 2.5 and 2.6. As shown, many of these streams have a generally similar and relatively high level of water quality. It appears that NJDEP's TP criterion for streams (0.1 mg/l) would be met about 80% of the time, while the TP criterion for lakes (0.05 mg/l) would be met about 50% of the time. Tributary water quality is most dissimilar with regard to nitrate nitrogen, with higher mean concentrations being present in West Brook, Cupsaw Brook and Erskine Brook. The presence of elevated nitrate concentrations is often considered to be an indicator of septic system impact.

Table 2.5: Summary of TP Data for Reservoir Tributaries*

	Wanaque River	Ringwood Creek	West Brook	Blue Mine Brook	Cupsaw Brook	Erskine Brook
# Samples	165	170	162	104	165	91
Mean	0.077	0.096	0.078	0.068	0.066	0.061
5%	0.019	0.016	0.019	0.017	0.016	0.017
10%	0.024	0.020	0.022	0.020	0.020	0.021
25%	0.035	0.033	0.030	0.032	0.030	0.034
50%	0.050	0.052	0.063	0.051	0.050	0.054
75%	0.097	0.085	0.099	0.087	0.080	0.074
90%	0.137	0.147	0.141	0.127	0.132	0.103
95%	0.178	0.178	0.184	0.157	0.161	0.145
Compliance	77.1%	83.1%	79.0%	81.5%	82.6%	89.7%

* sampling data provided in Appendix A

Table 2.6: Summary of Nitrate Data for Reservoir Tributaries*

	Wanaque River	Ringwood Creek	West Brook	Blue Mine Brook	Cupsaw Brook	Erskine Brook
# Samples	154	159	147	89	155	77
Mean	0.134	0.185	0.428	0.118	0.446	0.847
5%	0.005	0.010	0.082	0.004	0.035	0.095
10%	0.006	0.051	0.153	0.005	0.101	0.156
25%	0.033	0.111	0.264	0.012	0.211	0.404
50%	0.100	0.176	0.368	0.045	0.342	0.594
75%	0.172	0.217	0.472	0.127	0.494	1.262
90%	0.300	0.307	0.756	0.263	0.934	1.916
95%	0.344	0.364	0.925	0.389	1.333	2.015

* sampling data provided in Appendix A

2.2 Diversion Intake Sites

At times when the Wanaque Reservoir's natural inflows are unable to meet its water-supply demand, the system depends on diversions from the Pompton Lakes and Two Bridges intakes (Figure 2.1). The Pompton Lakes intake taps flows from the Ramapo

River at a location within its lowermost reach. The Two Bridges intake taps flows from the Pompton River at a location within its lowermost reach, and from an impounded reach of the Passaic River. For this reason, the two Reservoir intakes are considered to have three sources: the Ramapo, Pompton and Passaic Rivers. The general size and characteristics of these watersheds (at the intake locations) are provided in Table 2.7.

Table 2.7: Characteristics of for Reservoir Intake Sites

Characteristic	Ramapo River	Pompton River	Passaic River
Watershed Area	160 mi^2	372 mi^2	361 mi^2
Watershed in NJ	47 mi^2	238 mi^2	361 mi^2
Watershed in NY	113 mi^2	134 mi^2	-
Average Annual Flow	287 cfs	510 cfs	702 cfs
Percent Land use Coverage*			
Agriculture	0.6%	0.4%	2.1%
Barren	1.1%	0.6%	0.9%
Forest	47.9%	58.4%	33.6%
Urban	39.4%	24.3%	43.2%
Water	5.2%	6.7%	2.9%
Wetlands	5.9%	9.5%	17.3%
Impervious Cover	13%	7.7%	14.5%

* based on NJDEP GIS data for 1995-1997 conditions

An initial examination of Table 2.7 would suggest that the Pompton River would be the primary source of diversion water. However, a substantial portion of its water is diverted at upstream locations for water supply purposes. Its tributaries include: (a) the Ramapo River, which can be diverted by the NJDWSC at Pompton Lakes; (b) the Pequannock River, which is diverted daily at Macopin Dam by the Newark Water Department; and (c) the Wanaque River, which is diverted daily at Raymond Dam by NJDWSC. Under most conditions, only a minor (mandated) letdown flow is present in the latter two streams just below these dam sites. These two daily diversions, in many ways, isolate the upper 174 square miles of the Pompton watershed from its outlet. As the Ramapo watershed (above the Pompton Lakes intake) has a watershed of about 160 square miles, the actual drainage area to the Pompton River (downstream of these intakes) is just 38 square miles. Thus, although its watershed is the most developed, the Passaic River represents the largest potential source of water supply for the Reservoir.

A number of domestic wastewater treatment plants are located within the watershed areas that are tributary to these intakes. A review of NJDEP and NYDEC data (NJDEP, 2003, NYDEC, 1999) was conducted to characterize and, to the extent possible, quantify loads from these treatment plants. The geographic distribution of these treatment facilities is shown in Figure 2.4 while a summary of these data is provided within Table 2.8. Further details related to these facilities are contained within section 3.4. In Table 2.8, the magnitude of the discharge load (for phosphorus) in the Passaic River is clearly visible –

it is roughly five times the combined discharge load of the other watersheds. Other related observations are provided below:

a. About 90% of the discharge flow from NY originates with two discharges. The Suffern STP (design flow of 1.8 mgd) is located about 0.25 miles north of the state line, while the Orange County SD#1 STP (design flow of 4.0 mgd) is located about 16 miles north of the state line.

b. Within New Jersey, developed areas within the northern portion of the Ramapo watershed are serviced by the Northwest Bergen County Utilities Authority (NJ0024813) that is located outside of the watershed. As these latter areas obtain their water supply from wells located near the River (see section 3.2), this diversion of flows is a consumptive use of water that may negatively impact streamflows.

c. Within the Pompton watershed (not including the Ramapo River discharges), about 75% of the discharge flow, and over 90% of the phosphorus load, are generated by a single treatment facility (Two Bridges Sewerage Authority), which discharges about 1,000 feet upstream of the Two Bridges intake.

Table 2.8: Wastewater Treatment Plant Data

Data	**Ramapo River - NJ**	**Ramapo River - NY**	**Pompton River***	**Passaic River**
Number of treatment facilities	6	5	6	25
Average current flow	0.107 mgd	5.893 mgd	6.445 mgd	45.180 mgd
Total permitted capacity	0.245 mgd	6.330 mgd	10.018 mgd	67.177 mgd
Number of facilities providing phosphorus treatment	6	0	4	7
Average effluent concentration for total phosphorus	0.12 mg/l	2 mg/l**	1.3 mg/l	2.3 mg/l
Estimated current load	0.1 lbs/day	76 lbs/day	145 lbs/day	1020 lbs/day

* downstream of Pompton Lakes, Macopin and Raymond Dams
** based on NJDWSC data

Relevant water quality data from the USGS and NJDWSC was reviewed to further characterize these river intake sites. The status of these monitoring programs, with respect to the intake sites, is as follows:

- Ramapo River at Pompton Lakes - The NJDWSC currently conducts the only ongoing water quality monitoring program at this site. The USGS' long-term monitoring program at this site was terminated in 1997.

- Pompton River at Two Bridges - The NJDWSC conducts an ongoing water quality monitoring program at this site. The USGS' long-term monitoring program at this site was terminated in 1978.

- Passaic River at Two Bridges – Both the USGS and NJDWSC currently conduct ongoing water quality monitoring programs at this site.

Summary statistics for these monitoring programs, with respect to two important nutrient parameters (TP and nitrate nitrogen), are provided within Table 2.9. As shown, there is a distinct difference in the water quality at these three sites: the Ramapo River has the best water quality and the Passaic River has the worst water quality (i.e., the least desirable for diversion to the Reservoir). Additional observations related to these water quality data are as follows:

a. For the Ramapo River, the water quality at Pompton Lakes is much better than would be expected given the magnitude of the upstream discharges and the water quality observed at the state line (the Ramapo River at Mahwah station). For example, compliance with NJDEP's TP criterion for streams (0.1 mg/l) increases from 36% at the stateline to 61% at Pompton Lakes.

b. For the Pompton River, water quality markedly degrades along its 3-4 mile length. For example, compliance with NJDEP's TP criterion for streams (0.1 mg/l) decreases from 75% within the upper Pompton River (based on a composite of data from the NJDWSC's stations at *Pompton River at Pompton Plains* and *Pompton River at Packanack Lake*) to only 21.6% at Two Bridges.

Table 2.9: Summary of Nutrient Data (mg/l) for River Intake Sites**

	Ramapo River at Pompton Lakes		**Pompton River at Two Bridges**		**Passaic River at Two Bridges**	
Parameter	Total Phosphorus	Nitrate Nitrogen	Total Phosphorus	Nitrate Nitrogen	Total Phosphorus	Nitrate Nitrogen
# Samples	195	217	135	145	256	275
Mean	0.11	0.61	0.32	1.73	0.55	2.97
5%	0.03	0.04	0.05	0.38	0.13	0.55
10%	0.04	0.06	0.07	0.48	0.17	0.76
25%	0.06	0.36	0.11	0.80	0.26	1.46
50%	0.08	0.56	0.19	1.16	0.47	2.46
75%	0.14	0.83	0.37	1.81	0.71	4.11
90%	0.19	1.12	0.80	4.38	1.05	5.77
95%	0.24	1.40	1.04	5.54	1.30	6.89
Compliance*	61.3%		21.6%		2.7%	

* compliance rate with NJDEP's 0.1 mg/l TP criterion
** sampling data provided in Appendix A

Dissolved oxygen is generally considered to be a good indicator of overall stream water quality. The USGS currently collects continuous dissolved oxygen data at a site located about 400 feet downstream of the Two Bridges confluence (*Passaic River below Pompton River at Two Bridges* – station #01389005). These data (daily maximum and minimum concentrations) are displayed in Figure 2.5 for the period of record and are summarized in Table 2.10. Figure 2.5 clearly shows that the mean dissolved oxygen concentration is relatively high, with a summer seasonal mean of 7.6 mg/l. However, there can be a substantial daily variation -- 4 mg/l of daily variation occurs about 5.5% of the time on a long-term basis. On a seasonal basis (June through September), 4 mg/l of variation occurs about 16.5% of the time.

Table 2.10: Summary of Continuous Dissolved Oxygen Data*

	Mean	**Median**
Long-term Max.	10.2	10.2
Seasonal Max.	8.9	8.1
Long-term Min.	8.7	8.3
Seasonal Min.	6.6	6.4
Long-term Mean	9.4	9.2
Seasonal Mean	7.6	7.2

* lateral average of data from three meter sites that are located within a single river cross-section

The effect of the Two Bridges intake on relative flows in the Pompton and Passaic Rivers is illustrated in Figure 2.6. This Figure compares the observed Pompton River streamflows (as represented by the USGS *Pompton River at Pompton Plains* station) to the reported daily intake diversion rates (by both the NJDWSC and PVWC). These data are plotted separately for all flows (upper panel) and for low-flow conditions (middle panel). These plots show that diversion flow can often exceed river flow. In the third panel, a cumulative frequency plot presents the difference between river flow and the diversion flow. Here, a zero value indicates that the diversion rate just equals the river flow; negative values indicate that water from the Passaic River would be tapped by the intake – which occurs on approximately 55% of the intake operation days between 1993 and 2002. Without including drought year 2002, negative values occur on approximately 50 % of the intake operation days.

2.3 Previous Studies of Reservoir Water Quality

As noted above, the Wanaque South Project included the construction of an intake and pipeline from the confluence of the Pompton and Passaic Rivers (at Two Bridges) to the Wanaque Reservoir. While this new source of water would markedly increase the Reservoir's safe yield, there was concern that it would also introduce a major new source of phosphorus and, thus, adversely impact the Reservoir's trophic state. To address these concerns, Najarian Associates conducted a Reservoir modeling study entitled "Influence of the Wanaque South Diversion on the Trophic Level of the Wanaque Reservoir and its

Water Quality Management Program" (Najarian Associates, 1988). In this study, particular emphasis was given to assessing phosphorus concentrations during model development, as phosphorus species were considered to be the prime indicators of eutrophication and algal growth. The resulting model was able to predict both the short-term and long-term fluctuations in the Reservoir's trophic state that could result from the Wanaque South diversions.

The Reservoir model's time-varying, two-dimensional (laterally-averaged) framework couples two sub-models: a hydro-thermal model and a multi-component phosphorus/oxygen sub-module. Najarian Associates developed the hydro-thermal model (LA-WATERS) by modifying the existing Wang-Kravitz model (Wang and Kravitz, 1980) to include a new wind-mixing algorithm, as documented in the American Society of Civil Engineers' *Journal of Hydraulic Engineering* (Huang et al., 1994). The model was calibrated and verified using data collected *prior* to the completion of the Wanaque South Project. Next, long-term simulations were conducted to estimate the potential water quality impacts of the Wanaque South diversions. The basis for these simulations was a projected schedule of diversions (to and from the Reservoir) provided by NJDWSC. This schedule represented the anticipated diversions that would have occurred during critical, historical periods (based on the anticipated reservoir demand and historic rainfall/streamflow conditions). Results indicated that, for the specified diversion schedules, impacts would occur due to the impingement of lower-quality Passaic River water. However, it was concluded that these impacts would be relatively transient and were not expected to cause long-term degradation of Reservoir water quality.

Recently, Najarian Associates (2000) conducted a post-validation of the Wanaque Reservoir model for the period January 1, 1991 through September 30, 1998 – following implementation of Wanaque-South diversions. The data employed included actual pumping records from the NJDWSC and water quality monitoring data compiled for the two Rivers and the Reservoir. The Reservoir model simulated temperature, DO, CBOD, NBOD, and phosphorus. The model successfully reproduced the observed DO regime within the Reservoir. The model satisfactorily simulated the phosphorus loading response due to diversions. Model accuracy was limited by inherent short-term variability in observed TP data, especially for concentrations less than 0.10 mg/l. In fact, for most of the phosphorus data collected at Raymond Dam, sample standard deviations are larger than the corresponding sample means, indicating great variability in the data. In any case, for nearly 8 years of real-time simulation, the computed and observed TP concentrations remained within the same range of values.

The model predicted elevated phosphorus concentrations in the Reservoir following each period of pumping from the Two Bridges diversion. However, it was not possible to verify this effect since the Reservoir was not monitored during the winter when elevated phosphorus concentrations due to pumping were expected.

Based on both the model results and analyses of the observed data, there appeared to be no obvious, long-term trend of increasing phosphorus concentrations in the Reservoir. While the model did reveal some short-term elevated TP concentrations following diversions; nevertheless, the Reservoir invariably returned to the pre-diversion state after several months.

The model shows substantial growth of organic phosphorus (up to 50 ppb) during the summer season, when longer daylight hours provide the energy for algal growth. While organic phosphorus data are unavailable to verify this trend, available chlorophyll-a data do indicate algal growth during certain periods, particularly during warm, dry summers.

3. River Simulation

Water quality conditions at the Reservoir intakes are influenced by several factors, including upstream PS discharges, stormwater inflows, base flows and in-stream processes. Typically, both a significant volume of data, and a detailed model study, would be needed to resolve such interactions in a defensible manner. In this case, available historical databases, and previous field/model studies, filled most of these needs and provided direction for further analysis. NJDEP (1987) previously monitored and modeled the fate and transport of phosphorus throughout the Passaic River during summer conditions. This comprehensive (QUAL-2E) study indicated that TP was essentially a conservative constituent within most of the Passaic River, and that the effects of uptake could only be discerned in the River's lowermost reaches (below Two Bridges). This conclusion does not indicate that in-stream processes have no effect on the phosphorus concentration within these upper reaches – only that such effects are so minor (vs. the observed concentrations) that the expected day-to-day variability in the data renders them nearly non-discernable.

The 1987 NJDEP study successfully modeled phosphorus based on the reported loadings from PS discharges and a relatively minor input from NP (tributary) sources. Subsequent statistical studies of river water quality (Rosensteel et al., 1991; Najarian Associates, 2000) substantiated that PS loads are dominant controls under most flow conditions. These studies actually reveal a clear *inverse* relation between phosphorus concentrations and stream flow -- most notably for the important *Passaic River at Two Bridges* site.

In a loading analysis conducted for the recent Passaic River Watershed Characterization Studies (NJDWSC 2002a, 2002b, 2002c), Najarian Associates used the above findings to develop a simple and effective modeling methodology for long-term water quality simulation. This approach was essentially a mass-balance model (within a spreadsheet format) based primarily on known discharge loads and river flows applied on a continuous/long-term basis. The output from this model was then verified using data from long-term monitoring programs. For many sites within this watershed, the results from this simple methodology seemed to rival those expected from more sophisticated and costly approaches.

For this analysis, the mass-balance model for the Passaic River was refined and extended to better meet the needs of the Wanaque Reservoir TMDL study, as described below.

3.1 Model Development

As noted above, a simplified river modeling methodology was developed based on the model and loading analysis developed for the Passaic River Watershed Characterization Studies (NJDWSC 2002a, 2002b, 2002c). This approach assumes that the dominant factor in determining in-stream concentrations of phosphorus (and inorganic nitrogen) is the dilution of a significant and relatively constant effluent load. In-stream concentrations then vary based primarily on the level of dilution available (for a cumulative effluent discharge) due to daily streamflows. NPS loadings were considered a “background” concentration that becomes apparent only under high-flow conditions. Accordingly, a simple and clear relationship should exist between in-stream concentrations and streamflow (due to the dilution process). Such a relationship would be an idealization since other secondary processes (such as respiration, uptake, settling, etc.) do exist. However, previous studies indicated that these secondary processes (and treatment plant variability) would result in only a moderate degree of scatter about the primary relation. Thus, phosphorus may be simulated as a conservative constituent. An additional assumption of this procedure is flow continuity – that streamflow is essentially a conservative quantity when various discharges and withdrawals are considered.

The simplified mass-balance formulation of in-stream concentrations (i.e., a simple dilution model for a conservative constituent) is very similar to that set forth in *Protocol for Developing Pathogen* TMDLs (USEPA 2001). The initial approach can be summarized as

$$C_{Riv}Q_{Riv} = \sum C_{Dis}Q_{Dis} + C_{NP}\left(Q_{Riv} - Q_{Dis}\right) \qquad (1)$$

where C_{Riv} = observed concentration in river; C_{Dis} = reported effluent concentration; C_{NP} = estimated NPS concentration; Q_{Riv} = observed daily flow in river, and Q_{Dis} = reported effluent flow rate. The left side of Eq. 1 represents the constituent mass flux at an instream site; the right side represents the cumulative upstream discharge load plus the total NPS load. Note that while such a formulation may be considered “basic,” it is the logical extension of a more complex model (QUAL-2E) applied in NJDEP (1987).

The in-stream concentration, C_{Riv}, was then computed from Eq. (1), on a daily basis, as the total projected load (PS and NPS) divided by the observed daily streamflow, Q_{Riv}. The PS load was represented, on a monthly basis, as the cumulative upstream facility load (based on reported mean DMR data loads for the upstream facilities, or computed as reported effluent concentration times flow for each facility).

For the current study, NJDEP requested that the NPS estimation technique provide an estimate of impacts due to stormwater runoff loads. Thus, a realistic (rather than a data-based) approach was used to formulate the last term in Eq.1. First, the long-term stream flow record was separated into its surface runoff and base flow components using the HYSEP model (USGS, 1996). This model’s algorithm simulates manual hydrograph separation techniques (in this case, the sliding interval method) to provide an initial estimate of daily runoff and base flow quantities. Thus, the NPS load equals the sum of the daily runoff and base loads as follows:

$$L_{NP} = C_{NP}\left(Q_{Riv} - Q_{Dis}\right) = C_{Run}Q_{Run} + C_{BF}\left(Q_{BF} - Q_{Dis}\right) \qquad (2)$$

where L_{NP} = estimated NPS load; C_{NP} = estimated NPS concentration; C_{Run} = runoff concentration; C_{BF} = base flow concentration; Q_{Run} = estimated daily runoff flow; Q_{BF} = estimated daily base flow; and Q_{Dis} = reported effluent flow rate. Note that in the last term in Eq.2, the effluent flow (Q_{Dis}) must be subtracted from the HYSEP-estimated base flow component (Q_{BF}) to generate the natural base flow.

To develop values for C_{BF} in Eq.2, it was assumed that most of the NPS load was associated with stormwater runoff. Thus, the value of C_{BF} was set to a minimal value (0.01 mg/l for phosphorus) – an appropriate procedure, as phosphorus is generally immobile in ground water. For example, at a relatively un-impacted site (*Rockaway River above Boonton Reservoir*, USGS station 01380500), the observed TP concentrations during year 2002 ranged from less than 0.01 mg/l to 0.04 mg/l. Since these concentrations reflect the quality of both surface runoff and base flow components, it follows that the selected minimal value for base flow concentrations (C_{BF} =0.01 mg/l) is representative.

The concentration associated with stormwater runoff (C_{Run}) was computed in accordance with universal areal-loading (UAL) procedures. First, annual-average watershed loads were developed using GIS-based watershed land use/land cover (lulc) statistics (NJDEP, 1998) and the respective UAL coefficients that were developed for use in New Jersey (NJDEP, 2003). A representative and constant value of C_{Run} for each water quality constituent was then calculated in accordance with the following equation using an iterative procedure:

$$\sum_{annual} L_{run} = \sum_{annual} C_{run} Q_{run} = C_{run} \sum_{annual} Q_{run} = \sum_{lulc} K_{ual} A_{lulc} \qquad (3)$$

where L_{run} = stormwater runoff load; K_{ual} = land-use appropriate UAL coefficient (lbs/ac/yr); and A_{lulc} = total watershed area associated with a specific land use/land cover type (in acres). Note that the middle term in Eq. 3 sums products of the runoff concentration (assumed constant) and the daily runoff flow over a one-year period.

In addition to the revised NPS-estimation technique, the previous mass-balance approach (NJDWSC 2002a, 2002b, 2002c) was enhanced in several ways: (a) reaches with flow continuity questions (such as the Ramapo River) were further investigated to provide for a more defensible model result; (b) the simulation period was expanded to eleven years (1992-2002) which includes the Reservoir simulation period; and (c) the modeling approach was expanded to simulate ortho-phosphorus concentrations. Application of the revised mass-balance phosphorus model is described below, with an accompanying discussion of the above enhancements.

3.2 Data Preparation

The mass-balance approach requires a large quantity of hydrologic and water quality data. Fortunately, a large historical water quality database already exists for the Passaic River and its tributaries. The USGS, Passaic Valley Water Commission (PVWC), Passaic Valley Sewage Commission (PVSC) and North Jersey District Water Supply Commission conduct separate (and ongoing), long-term monitoring programs at as many as 24 sites (per agency) within the overall watershed. Sampling frequencies can range from weekly to quarterly. However, sampling locations, available parameters and monitoring frequencies vary considerably between these programs.

In utilizing available data from different agencies, the possible role of different sampling and quality assurance protocols was considered. To minimize the possible skewing of results due to protocol-induced biases, data collected under the USGS/NJDEP cooperative monitoring agreement (the most comprehensive database) were utilized to the extent possible. However, data collection at many of these sites terminated in 1997. In such cases, other data sources were accessed. Specifically, NJDWSC could provide data within the Pompton and Lower Passaic Watersheds, while PVWC could provide data within the Upper Passaic Watershed. Note that the mass-balance model was based on a slightly longer simulation period (1992-2003) than the Reservoir model (1993-2002) in order to maximize the use of USGS water quality data.

The resulting inventory of monitoring sites was culled from stations that have a good long-term data record and are located at critical locations within the Passaic Watershed (often at locations near the confluence of important tributaries). "Control points" were established at these locations to provide the basis for model development.

The Two Bridges and Pompton Lakes intakes, plus the New York State boundary, were considered to be of primary importance. Thus, control points were specified at the following data-collection sites: *Passaic River at Two Bridges*, *Pompton River at Two Bridges*, *Ramapo River at Pompton Lakes*, and *Ramapo River at Mahwah*. Additionally, a number of secondary control sites were established for the purpose of better evaluating river model reliability. The secondary sites include: *Passaic River at Chatham*, *Rockaway River at Pine Brook*, *Whippany River near Pine Brook*, and *Passaic River at Little Falls*. The location of these stations is shown in Figure 3.1.

To facilitate the mass-balance simulation, daily hydrologic data were also required at these control sites. Fortunately, at most sites the USGS provides daily streamflow data from its continuous gaging-station network. For the remaining sites, instantaneous streamflow measurements (conducted by the USGS) were available for a number of sampling dates. These data were then correlated with nearby gaging station data (NJDWSC 2002a, 2002b, 2002c). A least-squares regression procedure yielded linear and/or power curve relations that had very high correlation coefficients. Power curve relations often provided a better fit to low-flow data in cases where reservoir letdowns comprised a substantial portion of the base-flow condition. Additionally, consideration was given to the possible influence of river intakes and groundwater withdrawals on the river's dilution capacity.

The issue of groundwater withdrawals and flow continuity was most relevant to the assessment of the Ramapo and Passaic Rivers. Within the Ramapo watershed, a series of four continuous flow gages suggests the loss of water during low-flow conditions, and that the River can actually have less flow than the cumulative upstream treatment plant discharge. Within a support document related to the sole-source aquifer petition for the

Ramapo River aquifer system (USEPA, 1992), multiple sources document a clear hydraulic connection between the River and sand/gravel valley fill deposits which provide potable water for a number of communities. In fact, pump test results determined that "the river was the recharging boundary and that it is hydraulically continuous with the aquifer." While such data cannot fully quantify this effect on streamflow on a watershed-wide basis, information related to these groundwater withdrawals is available. Within New York, USEPA reports a service population of about 120,000, which, at a 75-gpd consumption rate, would suggest a cumulative withdrawal of about 9 mgd (13.9 cfs). Within New Jersey, an annual pumpage rate of 2,243 million gallons per year (6.15 mgd or 9.5 cfs) is reported by NJDEP for the Ramapo Watershed for the period between 1990 and 1999 (Hoffman, 2001). Similarly, an annual pumpage rate of 7,821 million gallons per year (21.4 mgd or 33 cfs) is reported by NJDEP for the upper Passaic Watershed (near Summit) for the period between 1990 and 1999 (Hoffman, 2001). For this assessment, it was conservatively assumed that these quantities were directly withdrawn from streamflow on a daily basis. Thus, an "adjusted" streamflow (equal to the observed streamflow plus the withdrawal) was used to simulate dilution of upstream discharges. Results for the more downstream locations were then calculated by transferring the calculated upstream concentrations and observed downstream flows. While such an approach is a clear simplification of a relatively complex process, its usefulness was determined by the model's ability to simulate long-term monitoring data at relevant locations.

To evaluate the PS contribution to these waterways, monthly discharge self-monitoring data were supplied by NJDEP and NYDEC for a four-year period (1997-2000). These data provided a time series of monthly average effluent flows and effluent concentrations within this time span. These data were applied directly within the model, on a month-by-month basis, for the period from 1997 through 2000. The available four-year average discharge for each facility was then used to represent the remaining 7 years of the 11-year simulation period. The basis for this extrapolation is that: (a) the most recent period of major treatment plant upgrading concluded in the early-1990s; (b) there has been no detected trend for in-stream phosphorus concentrations since 1992 (NJDWSC 2002a, 2002b, 2002c); and (c) with one exception, data showed no change in effluent quality between 1997 and 2000. That exception was the Rockaway Valley Regional Sewerage Authority, which implemented new operational procedures during this period, and, thus, was represented by separate "before" and "after" averages. Data relating to TP loads were available for almost all facilities. Otherwise, a representative load was calculated based on reported effluent flows and the mean effluent TP concentration (for all facilities). Additionally, no facility provides monitoring data for ortho-phosphorus or dissolved phosphorus. To estimate such loads, it was assumed that ortho-phosphorus constituted 80% of the discharge TP load – a value that represents an approximate average of data reported in previous studies (NJDEP, 1987).

3.3 River Model Application – Current Condition

As described above, an 11-year time series (from 1992 through 2002) of in-stream concentrations was generated using an input of observed USGS flow data, reported discharger monitoring data and GIS-based land-use statistics. The usefulness of this simplified procedure was verified by comparing simulated results with observed in-stream concentrations on a real-time (daily) basis for the entire simulation period at each control site. Figures 3.2 through 3.9 present results of such comparisons for total and dissolved (ortho-) phosphorus concentrations. In these Figures, observed concentrations are indicated in red while simulated concentrations are blue. An analogous approach was employed to assess nitrate nitrogen concentrations (NJDWSC, 2002a, 2002b, 2002c). In each case, the eleven years of simulated data are compared to data collected during the same period.

As shown, the mass-balance model can simulate the overall magnitude, variability and trend of the observed data over the long-term (10-year) simulation period. This includes periods of relatively high streamflow – when PS loads may become less dominant over NPS loadings. The "fit" to the data is generally good despite the fact that that the model neglects many water quality processes. The result suggests that, within an effluent-dominated environment, in-stream processes can be of secondary (minor) importance for certain parameters. Deviations from the observed data are most marked during extreme low-flow periods – periods when discharge variability or in-stream processes would have the greatest impact on water quality.

The model appears to be best adapted to the lower portions of these waterways – especially for the Passaic, Rockaway, Whippany and Pompton Rivers. To some degree, the model's visual fit is improved by the larger available datasets for these reaches – a function of more frequent sampling schedules. However all of these rivers are effluent dominated, with the cumulative effluent discharge equaling 25%-50% of the low-flow volume. A prime example is the *Rockaway River at Pine Brook* (Figure 3.3). Here, a large wastewater discharge is located just below a relatively constant reservoir letdown, with the discharge contributing about 30% of the base flow during most summer conditions. For this site, the model simulation reveals water quality improvements (around 1999) that mirrored operational improvements in the effluent discharge quality (there was an approximate 4-fold reduction in the PS load following the operational improvements). Note that the performance of the model in this case demonstrates model applicability even when point sources become less dominant.

The largest datasets are available for the *Passaic River at Two Bridges* (Figure 3.5), which allows for the most detailed assessment of the model accuracy. Several characteristics of the upstream watershed combine to provide a useful simulation at this site. Again, this location is effluent dominated, with discharge flow often comprising over 50% of stream flow during typical mid-summer conditions, and with typical effluent TP concentrations being about 50-100 times greater than apparent background concentrations. Data from earlier surveys of the River (NJDEP 1987) indicate little biological productivity or nutrient uptake in these upstream reaches, probably due to high levels of turbidity.

Short-term variability in the cumulative upstream discharge probably accounts for much of the scatter shown in Figure 3.5. Results indicate that almost 80% of the annualized TP load can be attributed to the cumulative treatment plant discharge. Similarly, over 95% of the drought load can be attributed to this source. During such low-flow conditions, TP concentrations can reach almost 2 mg/l. At such levels, the generalized impact of discharge variability would exceed any in-stream processes.

Model vs. data accuracy was quantified using several well-established techniques. First, the *distributions* of observed and simulated TP concentrations were compared at the various stream monitoring sites (Figures 3.10 through 3.17). Results indicate that the model generally tracked the observed distributions, including the observed medians, upper quartiles and lower quartiles. Even the low end of the distribution is tracked – where streamflows are often higher and where NPS contributions may increase.

Next, observed vs. simulated TP concentration data were plotted for each monitoring site (Figures 3.18 through 3.25). Computed correlation coefficients (r-values), coefficients of determination (r^2-values) and probabilities (p-values) were computed. Although there is considerable scatter, the results indicate a statistically significant correlation between observed and simulated values at <u>all</u> monitoring sites (based on a Pearson Correlation test at a 95% level). Thus, the model maintains a fair degree of validity even at locations (such as *Ramapo River at Pompton Lakes)* where effluent impacts do not clearly dominate.

Computed correlation coefficients (i.e., r-values) (Figures 3.18 through 3.25) range from relatively high values of 0.94 (at *Ramapo River at Mahwah*) and 0.96 (at *Rockaway River at Pine Brook*) to a low value of 0.47 (at *Pompton River at Two Bridges*). The corresponding coefficients of determination (i.e., r^2-values, the proportion of variability explained by the regression) range from 0.93 to 0.22. Correlations are generally highest at the more degraded (effluent-dominated) sites. At a station having one of the weakest correlations (*Ramapo River at Pompton Lakes*), most of the observed data fall below 0.10 mg/l and approach the Minimum Detection Limit (0.02 mg/l) - a region where data accuracy is somewhat diminished (reporting levels are often set about 3 to 5 times the MDL, USEPA, 1985; USEPA, 1993).

Finally, the absolute mean error statistic, the root-mean-square (RMS) error statistics and the relative error statistic were all calculated (Table 3.1). These statistics provide an indication of the average magnitude of the deviation between model predictions and observations. As expected, the calculated absolute errors mirror the level of water quality at each station. That is, lower errors are computed for low-quality stations, and vice versa. The computed relative error (the absolute mean error divided by the mean) ranges from about 21% to 54% for the various sites with an overall average of about 32%. This range -- which was obtained without any spatial or temporal averaging of model results -- compares favorably with a 20% to 45% range reported in a review of long-term TP model studies (TetraTech, 2000). Locations that had larger relative errors also displayed a relatively high level of water quality and were located below impoundments – a finding that suggests some degree of data dispersion due to local in-stream processes.

Table 3.1: Error Statistics for River Simulation Sites

Location	Absolute Mean Error Statistic (mg/l)	RMS Statistic (mg/l)	Relative Error Statistic (%)	Coefficient of Determination* r^2
Passaic River at Chatham	0.093	0.126	23	0.901
Rockaway River at Pine Brook	0.138	0.188	31	0.925
Whippany River at Pine Brook	0.093	0.113	34	0.631
Passaic River at Two Bridges	0.106	0.153	21	0.772
Ramapo River at Mahwah	0.050	0.070	27	0.876
Ramapo River at Pompton Lakes	0.032	0.042	43	0.244
Pompton River at Two Bridges	0.101	0.139	54	0.222
Passaic River at Little Falls	0.092	0.124	21	0.779

* results indicate a statistically significant correlation between observed and simulated values at all monitoring sites (based on a Pearson Correlation test at a 95% level)

3.4 River Model Projections – Future Condition

The river mass-balance model was used to project long-term phosphorus concentrations at the river intake sites under alternate treatment/discharge scenarios. To this end, river-model inputs of discharge flows and loads were varied to produce a matrix of possible results for the observed eleven-year hydrologic regime (changes in flow directly attributable to effluent discharge rate were incorporated). Since nonpoint (runoff) loads were not varied, the PS/NPS ratio would clearly change. To evaluate the importance of this change on the overall model result, a sensitivity analysis was conducted (see Section 3.5).

In conducting these river-model projections, agency needs were considered. NJDEP requested that the projection be conducted in accordance with the following: (1) the boundary condition (for the Ramapo River) at the New York State line should reflect full compliance with the stream standard for TP of 0.1 mg/l; (2) treatment plant discharge flow rates should reflect the facility's current permitted flow rate (to address reserve capacity issues); (3) load delivered from Greenwood Lake reflects implementation of NJDEP's TMDL which was completed for that waterbody (NJDEP, 2004); and (4) effluent concentration be specified as a long-term average (LTA) concentration. *Note that for the present multi-year, real-time analysis, the direct specification of an LTA (as model input) is appropriate based on USEPA-TSD (1991) procedures.*

In-stream concentrations were initially simulated for a range of prescribed effluent LTA concentrations: 1.0 mg/l, 0.50 mg/l, 0.25 mg/l and 0.10 mg/l, respectively. The following sections provide a summary of results of river-model projections for the intake locations and the New York State boundary.

<u>New York (NY) State Boundary</u>

The *Ramapo River at Mahwah* station is located near the boundary between the two States and was considered to be the best representation of NY inflows. According to

NYDEC data, there are five municipal treatment plants discharging upstream of this location (NYDEC, 1999). These facilities, and their average discharge flows, are listed in Table 3.2.

None of these facilities reports effluent data for phosphorus. Limited sampling data by the NJDWSC suggest that, while two of the facilities (Orange County SD#1 and Village of Tuxedo Park) may be achieving some degree of phosphorus removal, the other facilities are discharging at concentrations of about 3-4 mg/l. Note that the Orange County SD#1 discharge was not included in the simulation due to: (a) its distance (16 miles) above the NY State boundary; (b) the loss of downstream river flow due to local groundwater withdrawals; and (c) an assessment of the model/data result, which suggests that a significant portion of this discharge load is lost in transit.

The simulation of the existing condition for the *Ramapo River at Mahwah* station indicated a long-term average in-stream concentration of 0.16 mg/l and a long-term median concentration of 0.09 mg/l, with NJDEP's target concentration of 0.10 mg/l being achieved 54% of the time. To achieve NJDEP's objective at the State boundary, the cumulative upstream discharge load was reduced as appropriate. This approach resulted in a long-term average (and median) concentration of 0.03 mg/l. Further, NJDEP's target concentration of 0.10 mg/l would be achieved approximately at all times. As previously discussed, this simulation is linked to the downstream simulation and, thus, served as a boundary condition for further projections.

Table 3.2: Treatment Facilities Located in the NY Portion of the Ramapo Watershed

Facility Name	Permit No.	Average Flow	Permitted Flow
Orange County SD#1	#002 7901	4.189	4.000
Sloatsburg	#010 5198	0.021	0.030
Suffern WWTP	#002 2748	1.446	1.800
Tuxedo Hamlet	#003 1224	0.059	0.100
Village of Tuxedo Park	#003 1216	0.178	0.400
Total		5.893	6.330

Pompton Lakes Intake

The *Ramapo River at Pompton Lakes* station is located just downstream of the NJDWSC Ramapo River intake. According to NJDEP data, there are six minor municipal treatment plants discharging upstream of this location (NJDEP, 2002) and downstream of *Ramapo River at Mahwah*. These facilities, and their average/permitted discharge flows (in mgd), are listed in Table 3.3.

Table 3.3: Treatment Facilities Located in the NJ Portion of the Ramapo Watershed

Facility Name	Permit No.	Average Flow	Permitted Flow
Oakland Care Center	NJ0029858	0.0239	0.0300
Oakland-Chapel Hill Estates STP	NJ0053112	0.0069	0.0100
Ramapo River Club STP	NJ0080811	0.0696	0.1137
Oakland-Oakwood Knolls WWTP	NJ0027774	0.0177	0.0350
Ramapo-Indian Hills H.S. WTP	NJ0021253	0.0068	0.0336
Oakland-Skyview-High Brook STP	NJ0021342	0.0130	0.0230
Total		0.1071	0.2453

Based on the reported DMR data, it appears that these six facilities all provide treatment for phosphorus, with their overall average effluent concentration being 0.12 mg/l. The simulation of the existing condition for the *Ramapo River at Pompton Lakes* station indicated a long-term average concentration of 0.093 mg/l and a long-term median concentration of 0.080 mg/l (Figure 3.15), with NJDEP's target concentration of 0.10 mg/l being achieved 62.4% of the time. The results of the prescribed effluent discharge scenarios are summarized in Table 3.4. As shown, all scenarios resulted in improved water quality and an improved compliance with the 0.1 mg/l in-stream standard – even though all scenarios result in an increase in discharge load from the existing condition. The improved rate of compliance is the result of the water quality improvement specified for the boundary condition at the New York state line. As previously discussed, this simulation is also linked to the downstream simulation and, thus, serves as a boundary condition for further projections.

Table 3.4: Simulation of Future Conditions at *Ramapo River at Pompton Lakes*

Effluent LTA Conc.	Daily Discharge Load (lbs/day)	Long-Term Mean Conc.	Long-Term Median Conc.	Long-Term Compliance with 0.1 Std.
1.0	2.05	0.038	0.030	96.8%
0.50	1.02	0.035	0.027	97.0%
0.25	0.51	0.034	0.026	97.1%
0.10	0.20	0.033	0.026	97.2%

<u>Two Bridges Intake- Pompton River</u>

The *Pompton River at Two Bridges* station is located just downstream of the NJDWSC Pompton River/Two Bridges intake and was considered to be the best representation of the Pompton River's contribution to this intake. According to NJDEP data, there are six municipal treatment plants discharging upstream of this location (NJDEP, 2002) and downstream of the River's three upstream boundaries: the *Ramapo River at Pompton Lakes* intake, the Wanaque Reservoir intake and the Macopin intake. These referenced facilities, and their average/permitted discharge flows (in mgd), are listed in Table 3.5. While conditions relevant to the Ramapo River have been previously discussed, the other two water supply intake withdrawals effectively remove the upstream discharge load and effectively isolate the impact of these minor upstream discharges. (Note that there are 7 minor discharges with a permitted flow of 0.330 mgd located upstream of the Wanaque Reservoir intake, and 3 minor discharges with a permitted flow of 0.231 mgd located upstream of the Macopin intake, almost all of which appear to treat for phosphorus – see Table 3.6).

Table 3.5: Treatment Facilities Located in the Lower Pompton Watershed

Facility Name	Permit No.	Average Flow	Permitted Flow
Wanaque Valley Reg S.A.*	NJ0053759	0.9181	1.2500
Two Bridges Sewerage Authority	NJ0029386	4.7503	10.0000
Pompton Lakes Borough MUA*	NJ0023698	0.7377	1.2000
Ringwood Plaza STP*	NJ0032395	0.0066	0.0117
Ringwood Acres STP*	NJ0027006	0.0231	0.0360
Plains Plaza Shopping Center	NJ0026514	0.0093	0.0200
Total		6.4449	12.5177

* provides treatment for phosphorus removal

Table 3.6: Treatment Facilities Located in the Upper Pompton Watershed

Facility Name	Permit No.	Average Flow	Permitted Flow
West Milford Shopping Center[1]	NJ0024414	0.0047	0.0200
West Milford-Cresent Park STP[1]	NJ0026174	0.0284	0.0640
West Milford MUA-Awosting STP[1]	NJ0027669	0.0623	0.0450
West Milford MUA-Olde Milford Estates[1]	NJ0027677	0.0970	0.1720
West Milford MUA-Birch Hill Park STP[1]	NJ0028541	0.0123	0.0160
Ringwood-Erskine School WTP[1]	NJ0029432	0.0010	0.0080
Reflection Lakes Garden Apts[1]	NJ0027201	0.0013	0.0050
Kinnelon Twp High School[2]	NJ0022284	0.0051	0.0300
Our Lady Of The Magnificat[2]	NJ0024457	0.0009	0.0012
West Milford MUA-Highview Acres STP[2]	NJ0027685	0.0534	0.2000
Total		0.2664	0.5612

1 = Upper Wanaque Watershed 2 = Upper Pequannock Watershed

Based on the reported DMR data, it appears that four of the Pompton River facilities provide treatment for phosphorus (see Table 3.5), and the average effluent concentration for these facilities is 0.33 mg/l. These data also indicate that the single largest facility (Two Bridges Sewerage Authority) does not provide such treatment. The simulation of the existing condition for the *Pompton River at Two Bridges* station indicated a long-term average concentration of 0.241 mg/l and a long-term median concentration of 0.188 mg/l (Figure 3.16), with NJDEP's target concentration of 0.10 mg/l being achieved 16.50% of the time. The results of the prescribed effluent discharge scenarios are summarized in Table 3.7. As shown, all scenarios result in improved water quality and an improved compliance rate with the 0.1 mg/l criterion.

Table 3.7: Simulation of Future Conditions at *Pompton River at Two Bridges*

Effluent LTA Conc.	Daily Discharge Load (lbs/day)	Long-Term Mean Conc.	Long-Term Median Conc.	Long-Term Compliance with 0.1 Std.
1.0	108.4	0.152	0.123	36.1%
0.50	54.2	0.094	0.084	61.2%
0.25	27.1	0.066	0.063	90.0%
0.10	10.8	0.049	0.044	96.0%

Two Bridges Intake- Passaic River

The *Passaic River at Two Bridges* station is located just upstream of the Two Bridges (Pompton/Passaic) confluence and was considered to be the best representation of the Passaic River's contribution to this intake (due to backflow conditions). According to NJDEP data, there are 26 municipal treatment plants discharging upstream of this location (NJDEP, 2002). These referenced facilities, and their average/permitted discharge flows (in mgd), are listed in Table 3.8. Of these facilities, only seven appear to treat for phosphorus.

Table 3.8: Treatment Facilities Located in the Upper Passaic Watershed

Facility Name	Permit No.	Average Flow	Permitted Flow
Chatham Hill Sewage Treatment	NJ0020281	0.0071	0.0300
Chatham Twp Main STP*	NJ0020290	0.6596	1.0000
Caldwell Boro STP	NJ0020427	3.3667	4.5000
Veterans Admin Medical Center-Lyons	NJ0021083	0.0999	0.4000
Jefferson Twp High-Middle School*	NJ0021091	0.0101	0.0275
New Providence WWTP	NJ0021636	0.0275	1.5000
Stonybrook School	NJ0022276	0.0011	0.0100
Rockaway Valley Reg SA	NJ0022349	9.3000	12.0000
Warren Twp Stage I-II STP	NJ0022489	0.3344	0.4700
Warren Twp Stage IV STP	NJ0022497	0.3129	0.8000
Bernards Sa - Harrison Brook STP	NJ0022845	1.7288	2.5000
Long Hill Twp-Stirling Hills STP	NJ0024465	0.9091	0.9000
Livingston Twp STP	NJ0024511	2.8492	4.6000
Hanover Sewerage Authority	NJ0024902	1.9508	4.6100
Morris Twp - Butterworth STP	NJ0024911	1.6506	3.3000
Morris Twp - Woodland STP*	NJ0024929	1.2567	2.0000
Madison-Chatham Jt Mtg - Molitor	NJ0024937	2.2971	3.5000
Parsippany Troy Hills	NJ0024970	12.5092	16.0000
Morristown Town STP	NJ0025496	2.9079	6.3000
Florham Park S.A.	NJ0025518	0.8793	1.4000
NJDHS-Greystone Park Psych Hosp	NJ0026689	0.2153	0.4000
Jefferson Twp-White Rock STP*	NJ0026867	0.0978	0.1295
Berkeley Hts WPCP	NJ0027961	1.5494	3.1000
NJDOT-Harding Rest Area (Oct-April)*	NJ0029912	0.0014	0.0250
Warren Twp Stage V STP	NJ0050369	0.1377	0.3800
Chatham Twp-Chatham Glen STP	NJ0052256	0.1214	0.1550
Total		45.1810	70.0370

* provides treatment for phosphorus removal

Based on the reported DMR data, it appears that overall average effluent concentration for these treatment facilities is about 2.3 mg/l. The simulation of the existing condition for the *Passaic River at Two Bridges* station indicated a long-term average concentration of 0.550 mg/l and a long-term median concentration of 0.491 mg/l, with NJDEP's target concentration of 0.10 mg/l being achieved 0.6% of the time. The results of the prescribed effluent discharge scenarios are summarized in Table 3.9. As shown, all scenarios result in an improved water quality and an improved compliance rate with the 0.1 mg/l criterion.

Table 3.9: Simulation of Future Conditions at *Passaic River at Two Bridges*

Effluent LTA Conc.	Daily Discharge Load (lbs/day)	Long-Term Mean Conc.	Long-Term Median Conc.	Long-Term Compliance with 0.1 Std.
1.0	586.9	0.300	0.290	6.0%
0.50	293.4	0.174	0.174	21.2%
0.25	146.7	0.110	0.108	44.5%
0.10	58.7	0.073	0.059	83.3%

3.5 River Model Sensitivity

As noted above, the fact that point sources dominate the subject Rivers allowed for use of a simplified mass-balance procedure. An underlying assumption of this procedure is that the effect of the discharge load (and its dilution) is sufficiently large to mask secondary influences. However, NPS impacts are present in the watershed and, at NJDEP's direction, these contributions were incorporated into the NPS module using the UAL approach. The resulting NPS module could not be tested independently or calibrated since: (a) all stations represent a combination of PS and NPS impacts; and (b) the PS impact could, by itself, account for the observed water quality data. Only sensitivity analyses can be performed to evaluate potential uncertainties in the UAL approach.

While multiple sets of coefficients are available for UAL applications, the current study utilized the same set of coefficients that is currently used by NJDEP to estimate NPS TP loads. The resulting breakdown of runoff, baseflow, and point source loads at selected control sites is presented in Table 3.10 for the baseline (existing) condition. To evaluate the appropriateness of this choice, a sensitivity analysis was conducted with regard to the specified runoff load. To this end, two additional model simulations were conducted for the three primary control sites for the baseline condition. For these simulations, the runoff load was varied by ± 50% from the load specified for a standard UAL application. Such a variation would encompass most comparable UAL coefficient sets, including that developed in the Whippany River study (Omni, 1999). Results of this sensitivity analysis are shown in Figure 3.26 and summarized in Table 3.11. As shown, the visual difference between these simulations is minimal, and the difference between their median concentrations is about ±5%. Thus, the choice of UAL coefficients represents a minor source of uncertainty for the model results.

An additional sensitivity analysis was conducted to evaluate the impact to in-stream concentrations due to changes in either the PS or NPS load. In this case, the previous simulations were re-run with the NPS (runoff) load being input at only 60% of the previous rate. That is, treatment plant upgrades were simulated with both a 0% and a 40% NPS removal rate. Results of these simulations (Figures 3.27-3.29) were then compared to assess the relative importance of the PS and NPS loads. As shown, the 40% change in the NPS load results in a reduction of about 0.01 mg/l - 0.03 mg/l in the mean (and median) in-stream TP concentrations. This result is fairly constant for all effluent treatment levels. However, these results also show that the NPS reductions can be an important factor in improving compliance with NJDEP's in-stream criteria (0.1 mg/l) – but only after the PS load had been substantially reduced.

Table 3.10: Annual TP Loading (lbs) Breakdown for Selected Control Sites

Location	Point Source	Runoff	Base flow	Let-down	Ramapo NY	Total
Passaic River at Chatham	59,288	38,014 +/-19,007	1,897			99,199
Whippany River at Pine Brook	36,158	28,980 +/-14,490	1,578			66,716
Rockaway River at Pine Brook[1]	50,447	6,728 +/-3,364	342	6,151		63,668
Passaic River at Two Bridges[2]	367,672	96,438 +/-48,219	5,011	6,151		474,158
Ramapo River at Mahwah[3]	15,709	14,682 +/-7,341	2,816			33,207
Ramapo River at Pompton Lakes[4]	37	14,399 +/-1,634	1,630		33,207	49,274
Pompton River at Two Bridges[5]	53,449	43,120 +/-21,560	3,925	4,143	33,207	137,845

1 runoff and baseflow loads for reach below Boonton Reservoir, Reservoir load estimated from Boonton gage and mean upstream inflow concentration
2 includes Boonton Reservoir letdown load in lieu of the runoff load from the Reservoir's watershed
3 does not include discharge by Orange County SD #1
4 point source, runoff and baseflow loads for reach between Mahwah and Pompton Lakes, Ramapo-NY load was calculated for Mahwah
5 point source, runoff and baseflow loads for Ramapo, Pompton/Pequannock sub-watersheds, Reservoir load was extrapolated from Wanaque outlet gage and monitoring data

Table 3.11: Results from Sensitivity Analysis

Location	Median Conc. UAL +50%	Median Conc. UAL -50%
Passaic River at Two Bridges	0.527 mg/l	0.462 mg/l
Pompton River at Two Bridges	0.205 mg/l	0.172 mg/l
Ramapo River at Pompton Lakes	0.090 mg/l	0.071 mg/l

The various results from this sensitivity analysis highlight the differences in how the PS and NPS loads are applied. The PS load is essentially constant and can become a dominating influence during low-flow and moderate-flow conditions, which are present most of the time. By contrast, the NPS (runoff) load is directly associated with (and proportional to) stormwater flows. Thus, most of the NPS load is discharged during a comparatively short period and under high-flow conditions. Further, the runoff load can often be diluted by a substantial base flow contribution during many high-flow conditions. Therefore, it is an expected and realistic result that the River is comparatively less sensitive to runoff loads than to PS loads.

4. Reservoir Simulation

4.1 Reservoir Model Description

LA-WATERS (Laterally Averaged Wind and Temperature-Enhanced Reservoir Simulation) is a two-dimensional (longitudinal and vertical) hydrothermal/water quality model. The model was developed under a joint contract with NJWSC and United Waters (the "Wanaque South Project Partners"). The model was used in the mid-1980's to evaluate potential impacts of the planned/permitted diversions from the Ramapo, Pompton and Passaic Rivers on the water quality and trophic state of both the Wanaque and Monksville Reservoirs.

A detailed description of LA-WATERS is provided in Najarian (1988). The hydrothermal component of the model is fully documented in a refereed journal publication (Huang, et. al., 1994). It consists of a time-variable, two-dimensional hydrodynamic and transport model capable of simulating fluctuating water surface elevations, laterally averaged currents and water temperatures. It accounts for fluctuating storage volumes and for variable influent/effluent flow rates. The model can be used to analyze implications of various water supply operating policies.

The two-dimensional framework of LA-WATERS is appropriate for relatively narrow reservoirs like the Wanaque Reservoir, where lateral variations are generally insignificant. As noted above, the Reservoir's length is approximately 6.6 miles; the average width is about 0.5 miles. Thus, to a first approximation, the Reservoir may be considered laterally well mixed.

LA-WATERS' multi-component phosphorus/oxygen demand (MPOD) kinetics module is illustrated schematically in Figure 4.1. This module incorporates the kinetics of the Princeton Model of Phosphorus Dynamics in Reservoirs (PMPDR) (Griffin and Ferrara, 1984), but is extended to a two-dimensional, finite-difference framework. As illustrated in Figure 4.1, the kinetic module specifies three phosphorus state variables, incorporates sediment zone interaction, and couples the growth and respiration of the organic phosphorus component with dissolved oxygen. Three forms of phosphorus, plus dissolved oxygen, are modeled in each grid cell. All organic forms (e.g., phosphorus incorporated into algal cells) are combined and represented by the organic phosphorus (OP) variable. Organism growth is limited by temperature, light and nutrient (i.e., dissolved inorganic phosphorus) availability. The module assumes that particulate inorganic phosphorus (PIP) is non-reactive in the water column, but settles to the sediment zone where it may react and, subsequently, be released as dissolved inorganic phosphorus (DIP). TP, a primary indicator of trophic state, is obtained by summation of the three phosphorus forms in the model (i.e., DIP, PIP and OP). A dissolved oxygen balance is included in the model and serves as a controlling factor in the release of DIP from the sediments. DO, CBOD, NBOD comprise three additional state variables.

LA-WATERS' kinetic formulation is amenable to long-term (decadal) simulations of water quality since the phosphorus state variable is used as the primary water quality indicator. As noted above, MPOD uses three phosphorus state variables as trophic state indicators, and lumps algal processes into the simulated organic phosphorus kinetics. More complex ecosystem models deal directly with the ecological response of reservoirs to nutrient inputs by focusing on simulation of phytoplankton dynamics and numerous algal state variables. However, such models are always limited by: (1) added uncertainties in input requirements (e.g., numerous algal kinetic coefficients and detailed external loadings); (2) intensive data requirements to characterize the patchy nature of phytoplankton distributions (both spatial and temporal); (3) intensive data needed for other model input, calibration and verification; and (4) the need for additional computational resources for long-term simulations. Hence, such complex ecosystem models are best suited for applications at short-to-intermediate time frames (Griffin and Ferrara, 1984) rather than decadal time scales.

The computer code of LA-WATERS is numerically efficient inasmuch as a one-year simulation can be executed within minutes on a personal computer. This aspect of the model is advantageous for conducting decade-long simulations of various diversion scenarios and changes in consumptive uses of Reservoir waters. As a fully integrated model, LA-WATERS can simulate regulatory changes in Reservoir operation, and provide an assessment of related impacts on the water quality and trophic state of the Reservoir.

4.2 Reservoir Model Modifications

In Najarian (2000), Monksville Reservoir dynamics were simulated using a one-dimensional hydrothermal model (MITEMP) and a two-layer water quality/phosphorus cycle model (PMPDR). For the present study, Monksville Reservoir dynamics were simulated using LA-WATERS to simplify and unify the modeling process. To this end, Monksville Reservoir geometry was discretized into a grid of eight columns and three vertical layers. The longitudinal intervals between the columns are set at 2000 feet, and the vertical intervals are set at 25 feet.

One inflow time series simulates all inflows to the Monskville Reservoir, while one outflow time series accounts for overflows/let-down through the Monksville Dam. To arrive at the inflow discharge rate, reported daily flows at the USGS Ringwood station were prorated by a factor of 0.7 to reflect the drainage area between Awosting (along the Wanaque River) and the Monksville Reservoir, plus the flow at Awosting (USGS gaged).

For the present study, the model schematization of the Wanaque Reservoir remains the same as in the Najarian (2000) study, except that the tributary inflows to the Wanaque Reservoir are now split into the following three components:(1) Ringwood Creek; (2) the remainder of the watershed area; and (3) the outflow from Monksville Reservoir. Also, the same time step of 90 seconds was employed. Likewise, the same kinetic coefficients, friction/dispersion coefficients and other model-input parameters used in the Najarian-2000 study were specified for the present study.

Also, the diversion inflow concentration data was modified for the present study. The previous study utilized observed concentration data collected at monthly intervals for each diversion inflow, and interpolated those data to daily values. The present study computes daily concentrations by linkage to a separate Passaic River model (see chapter 3).

To simulate Wanaque Reservoir outflows, a new mechanism was added to the program code to allow for multi-layer withdrawals. This addition was needed because the NJDWSC water treatment plant intake structure can withdraw water from the Reservoir (near Raymond Dam) from both an upper intake and an intermediate intake whose elevations range from 256 ft. to 285 ft. Also, a lower intake at the bottom of the Reservoir near Raymond Dam is now available to discharge water from the hypolimnic layers of the Reservoir.

4.3 Model Inputs for Simulation of Baseline Conditions (1993-2002)

A simulation of baseline (existing) conditions was conducted over the selected 10-year period (1993-2002). To this end, time series were assembled for relevant forcing variables and diversion sources.

Long-term water quality and river diversion data for the Wanaque Reservoir and its source streams (including the Monksville Reservoir) have been collected by various agencies, including NJDWSC, USGS and PVWC. In the Najarian Associates (2000) study, such model-input data were compiled for the period 1/1/1991 through 9/30/1998. For the present study, this database was extended up to 12/31/2002. As a result, a ten-year simulation period (1/1/1993-12/31/2002) was established for the baseline simulation of “existing” Reservoir conditions.

Meteorological input data -- including air temperature, relative humility, wind speed and sky cover – were obtained from the National Climatic Data Center’s (NCDCs) Newark International Airport weather station. Although other weather stations exist closer to the Reservoirs, only the Newark Airport station provides reliable, continuous long-term data required by the model. Figures 4.2 and 4.3 show air temperature and precipitation data at Newark International Airport for the selected ten-year simulation period (1/1/1993-12/31/2002). Recently, NCDC discontinued their publishing of sky-cover data from their database. Consequently, representative sky cover data for Newark Airport were obtained from the Northeast Regional Climate Center of Cornell University.

Streamflow data was obtained for the available U.S. Geological Survey (USGS) gaging stations listed in Table 4.1:

Table 4.1 USGS gaging stations

Station Name	Station ID	Drainage Area (Sq. mi.)	Location
Wanaque River at Awosting	01383500	27.1	700 ft. downstream from dam at outlet of Greenwood Lake at Awosting
Ringwood Creek near Wanaque	01384500	19.1	500 ft upstream from Wanaque Reservoir
Pompton River at Pompton Plains	01388500	355	800 ft. below confluence of Pequannock and Ramapo Rivers
Passaic River at Little Falls	01389500	762	0.6 miles downstream from Beatties Dam in Little Falls

Figure 4.4 displays time series of streamflow data at the listed Ringwood Creek, Pompton River and Passaic River stations for the ten-year simulation period (1/1/1993-12/31/2002).

The reservoir model requires an input of daily inflow loadings (i.e., daily inflow rates and daily inflow concentrations) to the Wanaque Reservoir from three separate sources: (1) the Reservoir’s tributary watershed; (2) the Pompton Lakes intake; and (3) the Two Bridges intake. The specific methodology used to prepare time series of Reservoir influent loads from each of these sources is described below.

1. For the tributary watershed, daily streamflow data was obtained from USGS stations along the Wanaque River, Ringwood Creek and West Brook. These data were used to compile time series of tributary inflows from the Wanaque River, Ringwood Creek and several ungaged tributaries. Inflows to the Reservoir from each ungaged tributary were extrapolated from daily Ringwood Creek flows by multiplying such flows by the ratio of the ungaged tributary area to the corresponding gaged area for Ringwood Creek. The drainage area at the USGS gaging station in Ringwood Creek is 19.1 sq. mi. Other ungaged tributaries draining the remainder of the watershed area total 34.9 sq. mi. (This includes a 4 sq. mi. area that drains to Post Creek, which is diverted into the Wanaque Reservoir). For comparison, the total watershed area draining into the Wanaque Reservoir is 94.4 sq. mi., with 40.4 sq. mi. draining into the Monksville Reservoir.

   Daily phosphorus concentrations for the tributary inflows were estimated using two different techniques. First, the monthly phosphorus data collected at the NJDWSC Ringwood Creek station was interpolated to form a daily time series. This technique fully utilized the available data, but incurred errors when interpolating from a monthly to a daily time scale. Alternatively, tributary inflow loads were generated using GIS land use data (for both the New Jersey and New York portions of the watershed) and standard UAL coefficients. These annual loads were then converted into a time series of daily concentration using the methodology described in Chapter 3. Model tests were then conducted to determine which technique best simulated the reservoir TP response to the computed influent loads. The UAL method was found to provide the most accurate (and consistent) methodology, and was adopted for this purpose.

2. For the Pompton Lakes intake, a record of daily diversion flows was made available by the NJDWSC. A corresponding time series of daily phosphorus concentrations was developed for this site using a mass-balance simulation model (see Chapter 3). Thus, the associated daily flows and concentrations were multiplied to form a time series of daily diversion input loads.

3. For the Two Bridges intake, a record of daily diversion flows was made available by the NJDWSC. When the diversion flow exceeded the gaged flows in the Pompton River, the balance of the diversion flow was allocated to the Passaic River. Thus, pumpage from the Two Bridges intake was treated as two separate diversions originating from two distinct rivers. Corresponding, and separate, time series of daily phosphorus concentrations were developed for both Rivers (at the Two Bridges location) using a mass-balance simulation model (see Chapter 3). Thus, the associated daily flows and concentrations were multiplied separately, for each River source, to form two time series of daily diversion input loads.

A resulting time history of monthly diversion flows to the Reservoir from the Pompton, Passaic and Ramapo rivers was plotted (Figure 4.5). These diversion time series were developed externally to the model and applied (as input to the model) at a common discharge point (Dam 4).

Figure 4.6 displays a 10-year time history of monthly TP loadings contributed separately to the Reservoir by each river diversion source. Figure 4.7 provides corresponding monthly *total* diversion-inflow loads and total tributary-inflow loads. As illustrated, diversion loadings were prominent during drought years of 1995, 1999, 2001 and 2002. Phosphorus loadings from Pompton River diversions are a major source (Figure 4.6), with spiked contributions from Passaic River diversions during drought years. Ramapo River diversions occurred infrequently and, thus, represented a minor source of TP loads.

Table 4.2 and Figure 4.8 display distributions of inflow volumes and TP loadings (by source) for the 10-year (1993-2002) assessment period. The Reservoir's tributary watershed contributes 71% of the total inflow volume, but accounts only for 28% of the TP loads. In contrast, the Passaic River diversion provides about 6% of the total inflow volume but contributes 35% of the total load. Given the differences in source water quality, it is hardly unexpected that diversions from a degraded source (the Passaic River) would have a far greater impact on the overall loading budget than on the Reservoir's hydrologic budget. Among all TP loading sources, the Pompton River diversion appears to be the second largest source (31%) due to its relatively large volume contributions. On the other hand, TP loads contributed by the Ramapo River diversion are relatively insignificant (6%) due to its relatively small diversion volume (about 7%) and good water quality.

Table 4.2: Reservoir Hydrologic and Phosphorus Loading Budget

Source	**Percent of Hydrologic Budget**	**Percent of Phosphorus Loading Budget**
Tributary Watershed	71%	28%
Ramapo River	7%	6%
Pompton River	16%	31%
Passaic River	6%	35%

NJDWSC collects monthly water quality data in most tributaries to the Monksville and Wanaque Reservoirs, and monthly water quality data (including temperature, dissolved oxygen (DO), TP, ortho-phosphate and ammonia) at locations where diversions occur within the Ramapo River, Pompton River and Passaic River. The Passaic River model described in Chapter 3 was used to generate *daily* diversion water quality data for the phosphorus input species (i.e., TP and Ortho-P) for the three river diversion streams (i.e., Pompton, Passaic and Ramapo Rivers). For the ancillary state variables (Temperature, DO, CBOD and NBOD), the available monthly data were linearly interpolated to daily values. Daily diversion loadings to the Wanaque Reservoir were then computed using daily diversion flows provided by the NJDWSC from both the Ramapo River pumping station and the Two Bridges pumping station.

Reservoir operation data needed for modeling include outflows from the Monksville and Wanaque Reservoirs, water supply withdrawals to the NJDWSC treatment plant, diversions to Oradell Reservoir (United Waters of New Jersey), and reservoir elevation records. During the last ten years, the Monksville Reservoir was kept at full capacity at all times except during the year-2001 drought emergency when water was released from the Monksville Reservoir to the Wanaque Reservoir.

Figure 4.9 shows monthly operational data for the Wanaque Reservoir, including total inflows, diversions, withdrawal and Reservoir storage. Water supply withdrawals varied between 7 and 12 billion gallons per month. Withdrawal demands were generally higher during the summer season and lower during winter season -- except when Reservoir storage is extremely high or low. When storage reserves were low, conservation efforts were initiated, driving down the demand, and vice versa.

Also as shown in Figure 4.9, Reservoir storages were typically at their lowest levels during late summer and fall -- when demands increase and stream flows typically decrease. To compensate for lost volume, diversions generally “kicked-in” during the fall and winter months, except during wet years, (e.g., water year 1997).

Finally, available water quality data were compiled to facilitate model-to-data comparisons. These include NJDWSC data collected in the Monksville Reservoir at two locations, and in the Wanaque Reservoir at four stations: (1) upstream near Erskine; (2) mid-reservoir near West Brook; (3) downstream near the Wanaque South diversion outlet at Dam 4; and (4) downstream near Raymond Dam. Water quality samples were collected at the following depths: surface, 10 ft, 20 ft and 30 ft below the surface, and 5 ft above the bottom. Sampling frequencies in the reservoirs were generally once per month. Besides the suite of water quality constituents collected in the stream monitoring program, chlorophyll-a data were collected at the Reservoir sampling stations.

4.4 Model Output for Simulation of Baseline Conditions (1993-2002)

In response to model inputs described above, LA-WATERS generates output time series of laterally averaged velocities, water temperature and constituent concentrations at all grid locations for the period 1/1/1991-12/31/2002 (i.e., the “baseline” condition). Simulated constituents include organic phosphorus [OP], dissolved inorganic phosphorus [DIP], particulate inorganic phosphorus [PIP], dissolved oxygen [DO], carbonaceous biological oxygen demand [CBOD], nitrogenous biological oxygen demand [NBOD] and temperature. Model outputs of [OP], [DIP] and [PIP] are summed to yield corresponding TP concentrations.

For the selected baseline period, the simulated water quality response of the Monskville Reservoir is illustrated in Figures 4.10 and 4.11. The upper part of the Figure 4.10 shows the model input of daily TP loads into the Monksville Reservoir. The Monksville Reservoir receives letdowns from Greenwood Lake (at Awosting) through the upper Wanaque River and tributaries. Thus, TP loadings into the Monksville Reservoir are contributed primarily by nonpoint sources. The lower curve of Figure 4.10 shows the simulated TP concentration response at the water surface near the Monksville Dam. Model results indicate that there are occasional short-term excursions above NJDEP’s lake criterion (0.05 mg/l) within the Monksville Reservoir (i.e., a total of 19 days over a ten-year period).

Figure 4.11 shows the observed and simulated DO concentration response near the Monksville Dam. The simulated DO concentrations compare favorably with observed values.

Figure 4.12 displays total TP loadings into the Wanaque Reservoir (diversion loads plus tributary-inflow loads) for the selected baseline simulation period (1/1/1993-12/31/2002). Figure 4.13-4.15 display the corresponding Reservoir TP concentration response at the Raymond Dam, West Brook and Erskine stations, respectively (see Figure 2.5 for locations). A comparison of these figures indicates that the model generates surges of TP following peak loadings. This trend is most apparent in the lower Reservoir near Raymond Dam station (Figure 4.13). While the average total phosphorous concentration at Raymond Dam over the selected period is 0.074 mg/l, substantial increases (over 0.1 mg/l) occur immediately following large diversions from the Passaic and Pompton Rivers during the fall/winter seasons. For example, during the severe drought year of 2002, the model simulates elevated concentrations in response to a prolonged period of diversions. Also, at the end of year 1993, the model simulates an intense concentration peak of short duration in response to a series of diversion made during relatively low flow (high concentration) river conditions. Overall, the model output generally tracks the observed TP concentrations at Raymond Dam, except for some simulated peak values (Figure 4.13).

Figures 4.14 and Figure 4.15 display simulated surface TP concentrations at the West Brook Bridge (mid-Reservoir) and Erskine (upper Reservoir) stations, respectively. As diversion sources are discharged at the lower part of the Reservoir -- and natural inflows are predominantly from the upper watershed -- simulated TP concentrations at West Brook Bridge are lower than those simulated at Raymond Dam. As expected, TP concentrations at Erskine are the lowest among the three stations.

Figure 4.16 displays the cumulative distribution of simulated TP concentrations at the three locations for the selected 10-year period. As illustrated, compliance with the water quality standard for TP (0.05 mg/l) occurred approximately 56.0 % of the time at Raymond Dam (89.3 % at Erskine) for this 10-year baseline simulation of existing conditions.

Figure 4.17 compares the observed and simulated cumulative distributions of TP concentrations at Raymond Dam. As noted above, the simulated distribution generally tracks the observed distribution. About 56% of the simulated daily concentrations fall below the 0.05-mg/l standard, compared to about 58% of the observed values. This favorable comparison provides a quantitative estimate of the uncertainty in the overall modeling approach.

Figures 4.18 - 4.20 display simulated versus observed DO concentrations at the same three Reservoir stations. As illustrated, the model generally tracks the observed seasonal DO variations.

Finally, model results can be compared to observed chlorophyll-a concentrations using an approach developed in a previous related study (Najarian 2000). This study revealed an association between simulated *organic phosphorus* concentrations in the lower Wanaque Reservoir and chlorophyll-a concentrations, the latter being an important indicator of primary productivity. As illustrated in Figure 4.21 (from that report), relatively high organic phosphorus concentrations in the Wanaque Reservoir are associated with relatively high chlorophyll-a concentrations (as observed by NJDWSC). However, observed chlorophyll-a concentrations appear to be almost unrelated to variations in *total* phosphorous concentrations in the Reservoir.

Total phosphorous concentrations exhibit a strong relationship with the magnitude of flow diversions. While the average total phosphorous concentration is below 50 ppb (Figure 4.21), substantial increases (over 50 ppb) occur immediately following large diversions from the Passaic and Pompton Rivers during the fall/winter seasons.

The strong association between organic phosphorous and chlorophyll-a suggests that most of the organic phosphorous is tied up in living biomass. This phenomenon provides an opportunity to address the seasonal variations in chlorophyll-a concentration via the simulation of various phosphorous components in the Reservoir.

The chlorophyll-a concentrations plotted in 4.21 show episodic increases during the optimum primary productivity (summer) seasons. While the average observed concentrations of chlorophyll-a remain below 10–15 ppb in the Reservoir, concentrations above 20 ppb have been measured during the spring/summer growing seasons. Based on such evidence, LA-WATERS can be used as a diagnostic tool to address eutrophication concerns in the Reservoir.

Accordingly, simulated organic phosphorus concentrations for the extended baseline period (1993-2002) were converted into estimated chlorophyll-a concentrations using the same linear regression technique. Figure 4.22 compares the resulting computed chlorophyll-a concentrations with observed surface chlorophyll-a concentrations near Raymond Dam. In most cases, the simulated chlorophyll-a concentrations match well with observed data for the selected period, where available. As expected, simulated chlorophyll-a concentrations peak during summer growth seasons. Unusually high primary productivities are indicated during the drought years of 1999, 2001 and 2002 following major diversion events.

5. Evaluation of Reservoir Endpoints

As noted in Chapter 1, a TMDL is a regulatory measure of the assimilative load capacity of a receiving waterbody, taking into consideration natural background, PS loads, NPS loads, water diversions/withdrawals and future/additional load allocations. The TMDL process determines what source reductions are needed to achieve compliance with existing water quality standards or an alternate endpoint, and must consider a natural (historical) reference condition. In this study, such reference conditions and endpoint criteria were considered as part of the TMDL process.

5.1 Reference Conditions

An *historical* reference condition scenario for the Wanaque Reservoir was defined as follows: (1) only natural inflows and outflows were included (no water supply withdrawals or river diversions were simulated); (2) all tributary inflows were fixed at levels observed during 1993-2002; and (3) land uses within the tributary watersheds were based on current GIS data. Figure 5.1 displays representative tributary inflow concentrations derived from the UAL approach (Chapter 4). Tributary inflow concentrations exceed NJDEP's 0.05 mg/l criterion about 10% of the time.

Model results for the historical reference condition scenario are displayed in Figures 5.2 through 5.4. Without water diversions/withdrawals, the simulated Reservoir TP concentration approached (but did not exceed) the current SWQS of 0.05 mg/l TP (Figure 5.2). The maximum simulated Reservoir TP concentration was about 0.03 mg/l (Figure 5.3); the maximum summer-average TP concentration was about 0.02 mg/l (Figure 5.4).

A *natural* reference condition for the Wanaque Reservoir could be defined as above, except the tributary watershed would still be in a natural state (i.e., if all land cover categories were forest, wetland and water). For such a scenario, the simulated TP concentration would be even lower. Thus, the existing water quality criterion would be met under both historical and natural reference conditions.

5.2 Alternate Endpoints

Based on discussions with NJDEP, the implications of both the existing criterion and an alternate endpoint were investigated. These endpoint definitions are: (1) full (100%) compliance with the existing 0.05 mg/l TP criterion over the ten-year simulation period; and (2) compliance with the existing 0.05 mg/l TP criterion as a summer average (June-September) for every year of the simulation period. The Raymond Dam sampling location was selected to test for compliance with these endpoints because of its proximity to the water supply intake. A discussion of the candidate endpoints is provided below:

<u>Endpoint 1: Compliance with Criterion</u>

Any discussion of endpoints starts with New Jersey's Surface Water Quality Standards (SWQS), which include both numeric and narrative water quality criteria for TP (N.J.A.C. 7:9B-1.14(c)5.i). For FW2 freshwater lakes and streams, which include the Wanaque Reservoir, the SWQS state that:

"Phosphorus as total P shall not exceed 0.05 (mg/L) in any lake, pond or reservoir, or in a tributary at the point where it enters such bodies or water, except where watershed or site-specific criteria are developed pursuant to N.J.A.C. 7:9B-1.5(g)3."

N.J.A.C. 7:9B-1.5(g)3 states that.

"The Department may establish watershed or site-specific water quality criteria for nutrients in lakes, ponds, reservoirs or streams, in addition to or in place of the criteria in N.J.A.C. 7:9B-1.14, when necessary to protect existing or designated uses. Such criteria shall become part of these Water Quality Standards.

According to the SWQS, the application of this criterion would be on an anytime/anywhere basis. Inspection of Figure 4.13 reveals that this criterion was not satisfied during 1993-2002. In fact, the criterion was exceeded at times during each of these years.

<u>Endpoint 2: Maintain Summer-Average Compliance with Criterion</u>
An alternate endpoint criterion could be based on the summer-average TP concentration. Specifically, a summer-average criterion may be defined as *compliance with the 0.05 mg/l TP criterion (at the water surface) near Raymond Dam on a seasonally averaged basis (i.e., June through September) during any year.*

The basic rationale for considering this candidate endpoint is as follows. In a lake or reservoir, primary productivity is higher during the summer season due to longer daylight periods and warmer water temperatures. Therefore, seasonal -- rather than annual -- phosphorus levels are more indicative of the Reservoir's trophic state.

Figure 5.5 displays the corresponding summer-averaged TP concentration simulated at Raymond Dam for the baseline period 1993-2002. As shown, the summer-average endpoint criterion was not satisfied throughout the simulation period. Simulated TP concentrations exceeded the summer-averaged 0.05 mg/l criterion during four summer seasons over the ten-year simulation period.

5.3 Discussion of Endpoint Alternatives

Each of the candidate endpoints has advantages and disadvantages. Implications of these alternatives were discussed in detail with NJDEP and the New Jersey Ecocomplex (NJEC). Based on these discussions, the following items were put forward for consideration:

<u>Endpoint 1:</u> This endpoint ensures compliance with the existing criterion, would maximize water quality benefits to the Reservoir, and ensure full support of the Reservoir's designated uses.

Endpoint 2: This endpoint would require compliance with the relevant criterion on a seasonal (summer) mean basis. Reasons for considering this alternative include the following characteristics:

- some literature studies have demonstrated a valid connection between seasonally averaged phosphorus concentrations and the trophic state of a lake or impoundment;

- Reservoir operations optimize use of the Reservoir for water supply potential and, thus, the Reservoir is subject to hydrologic and water quality fluctuations that are atypical of natural water bodies;

- the Reservoir's peak nutrient concentrations typically occur during winter or early spring (due to the availability of river flows and diversion schedules) – during the winter period, biological activity is reduced;

- diversion-induced concentration peaks decay rapidly (often before the start of summer) due to the Reservoir's short residence times (typically a few months); and

- in accordance with the conditions of the water allocation permit, river diversions are not allowed during the months of July and August.

The following sections explore the viability of these candidate endpoints through model scenarios of both PS and NPS load reductions.

5.4 Conditions for TMDL Development

Any TMDL decision will require consideration of alternative schemes for reducing both PS and NPS loads (i.e., "trade-offs"). Agency procedures require that a TMDL be developed for an appropriate set of critical conditions and, thereby, ensure that the proposed allocation would be conservative and protective of the designated uses of the waterbodies under study. For the current study, these conditions were set forth during a series of discussion with NJDEP. Due to the complicated nature of the model linkage, and the large number of potential influences, a number of specifications were laid down in these meetings. They are as follows:

1. the boundary condition for the Ramapo River (at the New York State line) should reflect full compliance with the TP stream standard of 0.1 mg/l;

2. treatment plant discharge flow rates should reflect each facility's permitted flow rate (to partially address reserve capacity issues);

3. PS load allocations would be initially determined by specifying the same long-term average (LTA) concentration for all dischargers.

4. NPS load reductions should be applied uniformly within the river (intake) and tributary (reservoir) watersheds; NPS load reductions should be applied only to those land uses for which BMPs can be practically implemented;

5. Reservoir diversion schedule should reflect its ultimate safe yield capacity (173 mgd) based on a scenario provided by the NJDWSC (to partially address reserve capacity issues for the Reservoir); and

6. simulation conditions should otherwise reflect the period from 1993 through 2002 for both the river and reservoir simulations.

Year 2002 was the most critical year included within the ten-year model simulation period due to prevailing drought conditions and the large-scale diversions needed to restore Reservoir capacity. Accordingly, results for this year effectively controlled endpoint compliance. This determination is consistent with requirements that TMDLs be developed for critical conditions, and is consistent with future trends. As population increases, so will water demand and the likelihood of such drought conditions.

Historical rainfall records at NCDC's Newark Airport Station were examined to characterize drought year 2002. On an annual (i.e., calendar-year) basis, year 2002 was not an unusual hydrological event. Total precipitation for the calendar year 2002 was 43.37 inches. This total ranks near the median value; that is, the 24^{th} lowest total recorded over the past 48 years of record (1956-2003). However, total precipitation for the corresponding water year (October 1, 2001 through September 30, 2002) was 31.44 inches – ranking 3^{rd} lowest over the past 48 water years. Thus, critical year 2002 was considered in the analysis.

With regard to the river simulation, an independent (separate) endpoint was not established. Due to the direct linkage between the river and reservoir simulations, the Reservoir endpoint was essentially used as the endpoint for the river simulation. As a result, the load reductions identified will attain compliance only with the established Reservoir endpoint. Measures needed to ensure compliance with the in-stream criterion (where it is applicable) will require further analysis and a second-phase TMDL.

5.5 Endpoint Compliance for PS and NPS Load Reductions

To assess compliance with each endpoint criterion, the river and reservoir models were exercised repeatedly, in linked-mode fashion, for a range of reduced PS and NPS loads. Specifically, the simulated cumulative discharge loads ranged from 1,153.8 lbs/day to 69.5 lbs/day, and percent NPS removal rates ranged from 0% to 80%. All simulations were conducted for the period 1993-2002 in accordance with conditions listed within section 5.4. Results of these simulations are listed in Table 5.1 (for 0% NPS load reduction), Table 5.2 (for 40% NPS load reduction) and Table 5.3 (for 80% NPS load reduction). Figures 5.6 and 5.8 display the results in terms of compliance with Endpoints 1 and 2, respectively. Figure 5.7 displays the corresponding reservoir concentration response at Raymond Dam for an 80% NPS load reduction and an effluent LTA of 0.25 mg/l.

Table 5.1: Endpoint Compliance for 0% NPS Load Reductions

Effluent LTA (mg/l)	Discharge. Load (lbs/day)	Endpoint 1 Maximum Conc. (mg/l)	Endpoint 2 Max. Summer-Average Conc. (mg/l)
baseline	1153.8		
1.0	694.9	0.160	0.083
0.5	347.4	0.099	0.056
0.25	173.7	0.071	**0.043**
0.1	69.5	0.058	**0.036**

Table 5.2: Endpoint Compliance for 40% NPS Load Reductions

Effluent LTA (mg/l)	Discharge. Load (lbs/day)	Endpoint 1 Maximum Conc. (mg/l)	Endpoint 2 Max. Summer-Average Conc. (mg/l)
baseline	1153.8		
1	694.9	0.150	0.075
0.5	347.4	0.089	**0.049**
0.25	173.7	0.058	**0.036**
0.1	69.5	**0.044**	**0.028**

Table 5.3: Endpoint Compliance for 80% NPS Load Reductions

Effluent LTA (mg/l)	Discharge. Load (lbs/day)	Endpoint 1 Maximum Conc. (mg/l)	Endpoint 2 Max. Summer-Average Conc. (mg/l)
baseline	1153.8		
1	694.9	0.140	0.066
0.5	347.4	0.078	**0.040**
0.25	173.7	**0.048**	**0.028**
0.1	69.5	**0.030**	**0.021**

As illustrated in Figures 5.6 and 5.8, simulated reservoir TP concentrations decrease at a near-constant rate in response to the PS load reductions needed for endpoint compliance. In response to reduced *NPS* loads, simulated concentrations decrease at nearly the same rate. Thus, the model sensitivity displayed in these figures is essentially a series of parallel lines. These lines may be interpolated to estimate endpoint compliance for other load-reduction combinations.

It should be noted that the near-linear relations discussed above were derived for a specific set of assumptions and circumstances. Clearly, they are only applicable to these endpoints. Data suggests that a different relationship could be derived for other endpoint conditions. Limitations and specifications for these results (in addition to those listed in section 5.4) are listed below:

a) cumulative effluent loadings are based on each discharger's LTA concentration and permitted flow;

b) the regression lines are based on a limited number of points; and

c) any management policy must be applied to both the Pompton and Passaic watershed. While the approach does not distinguish between different facility discharges within each watershed (the total load is utilized), it assumes that the proportion of loading from each watershed will not change.

The implementation of these two endpoints would have different effects on Reservoir water quality with regard to its degree of biological/algal activity (as represented by its concentration of chlorophyll a. Figure 5.9 displays concentrations of chlorophyll a simulated for three scenarios: (1) the baseline/reserve capacity condition; (2) an 80% NPS load reduction and an LTA TP concentration of 0.25 mg/l, which approximately satisfies Endpoint 1 (Figure 5.6); and (3) an 80% NPS load reduction and an LTA TP concentration of 0.5 mg/l, which approximately satisfies Endpoint 2 (Figure 5.8). As shown, the implementation of either loading reduction scheme would result in a significant reduction in existing chlorophyll a concentrations. As shown in Table 5.4, a peak chlorophyll a concentration of about 12 µg/l is simulated for the first loading reduction scheme. This maximum chlorophyll a concentration falls within the mesotrophic range (about 5.7 µg/l to 18.8 µg/l) predicted by Vollenweider's Management Model for a reservoir having about a 5-month residence time (http://lakes.chebucto.org/TPMODELS/OECD/management.html; Figure 7). For comparison, the 47 µg/l maximum chlorophyll a concentration for the baseline simulation falls within the eutrophic range (18.8 µg/l to 63.7 µg/l).

As also shown in Table 5.4, a peak chlorophyll a concentration of about 18 µg/l simulated for the second loading reduction scheme. This maximum chlorophyll a concentration falls within the upper mesotrophic range (about 5.7 µg/l to 18.8 µg/l).

Table 5.4: Comparison of Potential Implementation Strategies

Scenario	Effluent LTA	% NPS Removal	Maximum Chlorophyll a Concentration	Trophic State Based on Max Chl a*	Mean Total Phosphorus Concentration	Trophic State Based on Mean TP Conc.*
Baseline	2.65 mg/l	0%	47 µg/l	Eutrophic (18.8-63.7 µg/l)	62 µg/l	Eutrophic (25-80 µg/l)
Scheme 2	0.50 mg/l	80%	18 µg/l	Mesotrophic (5.7-18.8 µg/l).	24 µg/l	Mesotrophic (5-25 µg/l).
Scheme 1	0.25 mg/l	80%	12 µg/l	Mesotrophic (5.7-18.8 µg/l).	19 µg/l	Mesotrophic (5-25 µg/l).

* Vollenweider's Management Model for a reservoir having about a 5-month residence time

5.6 Endpoint Selection

The assessment of the candidate endpoints and historical-reference conditions suggests that Endpoint 1 (not to exceed 0.05 mg/l at all times) is a viable endpoint for the Wanaque Reservoir TMDL and would result in a mesotrophic condition in the Reservoir. Endpoint 1 is the existing criterion in the Department's adopted (and EPA-approved) Surface Water Quality Standards and, thus, requires no regulatory justification. A seasonal-average endpoint (Endpoint 2) was considered because of the unique circumstances presented by a water supply reservoir with pump-storage volumes that are significant at times.

The adoption of Endpoint 1 will provide the greatest degree of protection for the Reservoir's designated uses and its ecology. The adoption of Endpoint 2 may result in a borderline mesotrophic/eutrophic state for the Reservoir. However, it will still provide a significant improvement in the Reservoir's current trophic status. **Based on NJDEP's consideration of these issues, Endpoint 1 was selected.**

While not selected, Endpoint 2 may be considered as a basis for a phased-implementation strategy for the long-term improvement of Reservoir water quality and ecology. In the final analysis, a Reservoir endpoint must balance the degree of water quality improvement with technological, economic and regulatory considerations.

6. Development of TMDL

A TMDL analysis provides a regulatory strategy for attaining a designated endpoint within a specific water body -- in this case the Wanaque Reservoir. As defined by the USEPA, a TMDL consists of wasteload allocations (for point sources), load allocations (for non-point sources), consideration of reserve capacity (RC) and a specified margin of safety (MOS). For the purpose of TMDL development, USEPA's distinction between point and non-point sources must be used. Point sources are discharges to surface waters that are subject to regulation under the National Pollutant Discharge Elimination System while non-point sources are all other sources.

Unlike a typical lake, the Wanaque Reservoir receives significant TP loads from river diversion sources in addition to TP loads from PS/NPS within the Reservoir's watershed. Thus, the proposed Reservoir TMDL consists of load allocations for diversion inputs and for the Reservoir watershed. These allocations are further disaggregated to WLAs and LAs, a MOS and RC. The development of each component of the TMDL for the Reservoir is provided below. The diversion input load allocations must be further allocated between point and non-point sources in order to address river impairments for TP, which is beyond the scope of this study.

6.1 Wanaque Reservoir TMDL

The linked models were exercised repeatedly to determine a suitable combination of effluent LTA and NPS reductions that would satisfy the selected endpoint criterion. The combination of an LTA of 0.27 mg/l and an 80% NPS reduction was found to satisfy Endpoint 1 (Figure 5.6). Based on this combination (assumed uniform throughout the study area), PS/NPS/diversion loads were computed on a daily basis for the period 1993-2002. The respective LAs/WLAs for the Reservoir watershed (including the LAs for the diversion loads) were then computed to be the annual average of the ten-year time series of daily loads.

In the development of a TMDL, Section 303(d) of Clean Water Act requires specification of a Margin of Safety (MOS) – an unallocated portion of the assimilative capacity. MOS is needed to account for a "lack of knowledge concerning the relationship between effluent limitations and water quality" (33 U.S.C. 1313(d)). In particular, a MOS accounts for uncertainties in the loading estimates, physical parameters and the linked models themselves – uncertainties that may influence simulated Reservoir TP concentrations. The MOS, as described in USEPA guidance (Sutfin, 2002), can be either explicit or implicit (i.e., addressed through conservative assumptions used in establishing the TMDL). An *explicit* MOS was used for this study based on requests from U.S. EPA and NJDEP staff. This explicit MOS was designed to account for potential errors in the simulated Reservoir TP concentrations due to uncertainties in the data and model algorithms. As per NJDEP's request, the final TMDL was developed to include an MOS of 6% and an RC of 1%.

Figure 5.6 was re-examined to determine combinations of effluent LTA and NPS removal rates that would satisfy the specified endpoint and MOS/RC constraints. As noted above, the combination of an effluent LTA of 0.27 mg/l and an 80% NPS removal rate would satisfy the endpoint constraint. The inclusion of the MOS/RC constraint would further restrict this result – the acceptable combination becomes an effluent LTA of 0.20 mg/l and an 80% NPS removal rate.

For the Wanaque Reservoir, this acceptable combination (0.20 mg/l and an 80% NPS removal) would result in a Reservoir TMDL of 17,496 lbs/yr for TP (see Table 6.1). This corresponds to a 68% overall loading reduction (from the existing load of 57,574 lbs/yr). TMDLs for river diversions total 6,483 lbs/yr (622 lbs/yr from Ramapo River, 2,717 lbs/yr from Pompton River and 3,144 lbs/yr from Passaic River). Collectively, the load allocations for river diversions represent an average reduction of about 83% based on an effluent LTA concentration of 0.20 mg/l. For nonpoint sources, an 80% load reduction was allocated for the urban/agricultural land uses. USEPA directives require that both MOS and RC be expressed as pollutant loads (lbs/yr). Thus, the MOS and RC for the Wanaque Reservoir are specified as 1,049 lbs/yr (6.4%) and 171 lbs/yr (1.0%), respectively. Under this scenario, the long-term (10-year) phosphorus concentration in the Reservoir (at Raymond Dam) would be 0.018 mg/l – a result that is a significant improvement over the long-term phosphorus concentration from the baseline simulation of the existing condition (0.074 mg/l) (section 4.4).

6.2 Ramapo/Pompton/Passaic River Load Allocations

Besides providing the effluent LTA and NPS reductions that satisfy the selected Reservoir endpoint, the model database provides the corresponding PS/NPS load reductions for the contributing watersheds of the three diversion streams. Due to the intermittent diversion schedule, diversion loads comprise only about 3.5 % to 7.5 % of the respective river loads on a long-term basis.

A cumulative summary of load allocations for each intake site (corresponding to its Reservoir TMDL component) is presented within Tables 6.2-6.4. In Tables 6.5-6.8, the Reservoir TMDL is further translated to four upstream control sites within impaired segments of the upper Passaic River watershed. Again, these Tables provide WLAs for the cumulative (upstream) PS discharge load, LAs for the NPS load, MOS and RC. Here, the MOS and RC are specified as being 6.0% and 1.0% of the cumulative watershed load – percentages that are consistent with those used within the Reservoir TMDL. Table 6.9 presents the corresponding areal distribution of watershed land uses associated with the NPS loads listed in Tables 6.2-6.8. Note that these tables are based on an assumed effluent LTA of 0.20 mg/l and an 80% NPS removal rate.

A listing of the affected treatment plants for the Passaic and Pompton watersheds is provided in Tables 6.10 and 6.11. In accordance with NJDEP's directive, these Tables were developed based on an assumption that the specified TMDL would be allocated equally to the various facilities based on their permitted discharge flow volume – other allocation (and/or trading) strategies could be developed at a later date. Again, this table shows each facility's WLA and percent load reductions (based on a comparison of the facility's WLA with its reported 1997-2000 discharge load). In some cases, the percent load reduction was left blank. In these cases, the calculated allocation is greater than the facility's reported discharge load – so no reduction may be needed. Facilities located within New York are not listed separately, but are addressed by a lump sum reduction of the boundary condition load.

As indicated in Tables 6.3 through 6.8, the PS loads for the various sub-watersheds would be reduced from 83%-88%, while NPS loads in urban and agricultural areas would be reduced by 80%. The resulting PS/NPS ratios range from 1.3 to 2.6 (this excludes the Ramapo River results since PS/NPS loads from New York State are lumped within the boundary condition of Table 6.2). For comparison, the minimum ratio of the average PS load to NPS load in the model calibration comparisons (Figures 3.2-3.9) was about 1.6. Thus, the river model was not used to project conditions far beyond its calibration range for these sub-watersheds.

Given that the cumulative design flow of PS discharges within the Pompton and Passaic watersheds is 83.32 mgd, the corresponding PS discharge load to the Pompton/Passaic River system is calculated as 50,700 lbs/yr (139 lbs/day). This cumulative watershed load (CLA) assumes that the load reduction would be applied equally within the Pompton and Passaic watersheds.

6.3 Margin of Safety and Reserve Capacity

As noted above, the explicit MOS selected for the Wanaque Reservoir was 6.0%, and an additional 1.0% was held as Reserve Capacity (RC) (Table 6.1). USEPA directives require that both MOS and RC be expressed in terms of a pollutant load (lbs/yr). The MOS plus RC for the Wanaque Reservoir is 1,220 lbs/year, or 7.4 % of the TMDL (16,501 lbs/year). If held in reserve, this MOS/RC would reduce the effluent LTA concentration from about 0.27 mg/l to 0.20 mg/l (Figure 5.6). At the proposed effluent LTA concentration, the RC could be used to provide 0.255 mgd of additional flow capacity to the system, beyond the unused capacity (difference between the actual flow and permitted flow) available in existing treatment plants. This approach was chosen as the best way to compensate for load/model uncertainties based on our assessment of model sensitivity to load reductions (i.e., MOS) and for the potential need for new wastewater treatment infrastructure where connection to existing plants is not feasible (i.e., RC). To maintain a consistent approach, the same percentages were used to calculate the MOS and RC at various control sites in the diversion river watersheds (Table 6.2-6.8).

6.4 Compatibility with Other Studies

A number of studies have been -- or currently are being conducted -- as part of the ongoing TMDL process. For the Passaic Basin (WMAs 3, 4 and 6), three notable studies have been completed to date. These studies are for the Whippany River (Omni, 1999), Greenwood Lake (NJDEP, 2004) and Pompton Lakes (QEA, 2003). Areas of overlap between the current study and these others are briefly described below:

Whippany River: The Whippany River study (Omni 1999) developed UAL loading rates based on data collected within the Passaic/Whippany River Basins. However, these rates were applicable to a limited number of land uses and may be less accurate within areas with a different geologic character (such as the upper Pompton watershed). Thus, NJDEP's recommended UAL rates were used in this study. These rates are somewhat more stringent than those developed in the Whippany River study. In section 3.5, a model sensitivity analysis was conducted with a range (±50%) that encompassed the Whippany River UAL rates and, thus, showed that such an alternate specification of UAL rates would have a minimal effect on the overall model result.

Pompton Lake: The recent Pompton Lakes study specified that the inflow to Pompton Lakes must be in compliance with NJDEP's lake standard (0.05 mg/l). While the current study did not specifically investigate conditions in Pompton Lakes, its outflow data was reviewed and analyzed. Based on the river (mass-balance) model results, it was determined that the scenario specified for Endpoint 1 (see Table 6.2) would result in virtually 100% compliance with this criterion within Pompton Lakes.

Greenwood Lake: The Greenwood Lake study (NJDEP 2004) specifies a 43% reduction in NPS loadings from all urban land uses within the watershed and a cumulative point source discharge (for total phosphorus) of 70 kg/yr (154 lbs/yr). The scenario specified for the Wanaque Reservoir TMDL is compatible with the results of the Greenwood Lake study.

Table 6.1: TMDL calculations for Wanaque Reservoir (average annual loads based on 1993-2002 model simulation)

	Existing Conditions[1]		TMDL Specification		Percent
	lbs TP/yr	% of LC	lbs TP/yr	% of LC	Reduction[2]
Loading Capacity (LC)	54,574	100%	17,496	100%	68%
Point Sources other than Stormwater					
NJPDES Dischargers[3,4]	257	0.5%	157	0.9%	39%
Loading from Intake Diversions					
Diversions from Ramapo River[5]	2,240	4.1%	622	3.6%	72%
Diversions from Pompton River[6]	13,449	24.6%	2,717	15.5%	80%
Diversions from Passaic River[7]	24,165	44.3%	3,144	18.0%	87%
Internal Loading					
Sediment/Base Flow	2,525	4.6%	2,525	14.4%	0%
Land Use Surface Runoff[8]					
Low Intensity Residential	1,529	2.8%	520	3.0%	66%[9]
High Intensity Residential	3,333	6.1%	1,133	6.5%	66%[9]
Commercial/Industrial/Transportation	1,465	2.7%	498	2.8%	66%[9]
Mixed Urban/Recreational	538	1.0%	183	1.0%	66%[9]
Crops/Pasture/Hay	447	0.8%	152	0.9%	66%[9]
Deciduous Forest	2,714	5.0%	2,714	15.5%	0%
Evergreen Forest	273	0.5%	273	1.6%	0%
Mixed Forest	665	1.2%	665	3.8%	0%
Shrubland	39	0.1%	39	0.2%	0%
Woody Wetlands	237	0.4%	237	1.4%	0%
Herbaceous Wetlands	27	0.0%	27	0.2%	0%
Open Water	539	1.0%	539	3.1%	0%
Disturbed Areas	130	0.2%	130	0.7%	0%
Other Allocations					
Margin of Safety	n/a	n/a	1,049	6.0%	n/a
Reserve Capacity	n/a	n/a	171	1.0%	n/a

1 average annual loads based on 1993-2002 model simulation
2 = 1 - (TMDL load /Existing load)*100
3 facilities within Reservoir tributary watershed -- existing condition based on 1997-2000 DMR data
4 WLA derived from NJDEP TMDL study for Greenwood Lake (2004)
5 diversion load typically equals about 3%-5% of the annual river load - for river load see Table 6.2
6 diversion load typically equals about 7%-9% of the annual river load - for river load see Table 6.3
7 diversion load typically equals about 3%-5% of the annual river load - for river load see Table 6.4
8 see Table 6.9 for associated land use areas
9 percent reduction equals 43% for Greenwood Lake watershed and 80% for other tributary watersheds

Table 6.2: TMDL calculations for Ramapo River Watershed (at Pompton Lakes) (average annual loads and percent reductions)

	Existing Conditions[1]		TMDL Specification		Percent
	lbs TP/yr	% of CWL	lbs TP/yr	% of CWL	Reduction[2]
Cumulative Watershed Load (CWL)	43,925	100%	13,780	100%	69%
Point Sources other than Stormwater					
NJPDES Dischargers[3]	37	0.1%	149	1.1%	0%
Internal Loading					
Sediment/Base Flow	1,634	3.7%	1,634	11.9%	0%
Boundary Inputs					
New York[4]	28,320	64.5%	6,851	49.7%	76%
Land Use Surface Runoff[5]					
Low Intensity Residential	3,087	7.0%	617	4.5%	80%
High Intensity Residential	4,739	10.8%	948	6.9%	80%
Commercial/Industrial/Transportation	2,758	6.3%	552	4.0%	80%
Mixed Urban/Recreational	1,426	3.2%	285	2.1%	80%
Crops/Pasture/Hay	191	0.4%	38	0.3%	80%
Deciduous Forest	1,206	2.7%	1,206	8.8%	0%
Evergreen Forest	6	0.0%	6	0.0%	0%
Mixed Forest	44	0.1%	44	0.3%	0%
Shrubland	36	0.1%	36	0.3%	0%
Woody Wetlands	138	0.3%	138	1.0%	0%
Herbaceous Wetlands	10	0.0%	10	0.1%	0%
Open Water	142	0.3%	142	1.0%	0%
Disturbed Areas	150	0.3%	150	1.1%	0%
Other Allocations					
Margin of Safety	n/a	n/a	832	6.0%	n/a
Reserve Capacity	n/a	n/a	141	1.0%	n/a

1 average annual loads based on 1993-2002 model simulation
2 = 1 - (TMDL load /Existing load)*100
3 detailed listing of individual discharge facilities is provided with Table 6.10
4 includes PS and NPS discharges to Ramapo River within New York State
5 see Table 6.9 for associated land use areas

Table 6.3: TMDL calculations for Pompton River Watershed (average annual loads and percent reductions)

	Existing Conditions[1]		TMDL Specification		Percent
	lbs TP/yr	% of CWL	lbs TP/yr	% of CWL	Reduction[2]
Cumulative Watershed Load (CWL)	133,838	100%	36,894	100%	72%
Point Sources other than Stormwater					
NJPDES Dischargers[3]	53,348	39.9%	7,915	21.5%	85%
Internal Loading					
Sediment/Base Flow	3,929	2.9%	3,929	10.6%	0%
Boundary Inputs					
Wanaque Reservoir	4,143	3.1%	1,357	3.7%	55%
New York[4]	28,320	21.2%	6,851	18.6%	76%
Land Use Surface Runoff[5]					
Low Intensity Residential	6,465	4.8%	1,293	3.5%	80%
High Intensity Residential	19,190	14.3%	3,838	10.4%	80%
Commercial/Industrial/Transportation	7,625	5.7%	1,525	4.1%	80%
Mixed Urban/Recreational	3,072	2.3%	614	1.7%	80%
Crops/Pasture/Hay	976	0.7%	195	0.5%	80%
Deciduous Forest	4,308	3.2%	4,308	11.7%	0%
Evergreen Forest	261	0.2%	261	0.7%	0%
Mixed Forest	303	0.2%	303	0.8%	0%
Shrubland	78	0.1%	78	0.2%	0%
Woody Wetlands	777	0.6%	777	2.1%	0%
Herbaceous Wetlands	147	0.1%	147	0.4%	0%
Open Water	476	0.4%	476	1.3%	0%
Disturbed Areas	420	0.3%	420	1.1%	0%
Other Allocations					
Margin of Safety	n/a	n/a	2,229	6.0%	n/a
Reserve Capacity	n/a	n/a	377	1.0%	n/a

1 average annual loads based on 1993-2002 model simulation[2]
2 = 1 - (TMDL load /Existing load)*100
3 detailed listing of individual discharge facilities is provided with Table 6.10
4 includes PS and NPS discharges to Ramapo River within New York State
5 see Table 6.9 for associated land use areas

Table 6.4: TMDL calculations for Passaic River Watershed (above Pompton confluence) (average annual loads and percent reductions)

	Existing Conditions[1]		TMDL Specification		Percent
	lbs TP/yr	% of CWL	lbs TP/yr	% of CWL	Reduction[2]
Cumulative Watershed Load (CWL)	479,918	100%	85,887	100%	82%
Point Sources other than Stormwater					
NJPDES Dischargers[3]	367,672	76.6%	42,838	49.9%	86%
Internal Loading					
Sediment/Base Flow	5,074	1.1%	5,074	5.9%	0%
Boundary Inputs					
Boonton Reservoir[4]	6,151	1.3%	6,151	7.2%	0%
Land Use Surface Runoff[5]					
Low Intensity Residential	14,682	3.1%	2,936	3.4%	80%
High Intensity Residential	41,931	8.7%	8,386	9.8%	80%
Commercial/Industrial/Transportation	19,930	4.2%	3,986	4.6%	80%
Mixed Urban/Recreational	10,661	2.2%	2,132	2.5%	80%
Crops/Pasture/Hay	6,875	1.4%	1,375	1.6%	80%
Deciduous Forest	2,780	0.6%	2,780	3.2%	0%
Evergreen Forest	30	0.0%	30	0.0%	0%
Mixed Forest	57	0.0%	57	0.1%	0%
Shrubland	384	0.1%	384	0.4%	0%
Woody Wetlands	1,853	0.4%	1,853	2.2%	0%
Herbaceous Wetlands	766	0.2%	766	0.9%	0%
Open Water	228	0.0%	228	0.3%	0%
Disturbed Areas	844	0.2%	844	1.0%	0%
Other Allocations					
Margin of Safety	n/a	n/a	5,188	6.0%	n/a
Reserve Capacity	n/a	n/a	878	1.0%	n/a

1 average annual loads based on 1993-2002 model
2 = 1 - (TMDL load /Existing load)*100
3 detailed listing of individual discharge facilities is provided with Table 6.11
4 = observed flow * mean reported concentration
5 see Table 6.9 for associated land use areas

Table 6.5: TMDL calculations for Whippany River Watershed (average annual loads and percent reductions)

	Existing Conditions[1]		TMDL Specification		Percent
	lbs TP/yr	% of CWL	lbs TP/yr	% of CWL	Reduction[2]
Cumulative Watershed Load (CWL)	192,291	100%	30,469	100%	84%
Point Sources other than Stormwater NJPDES Dischargers[3]	158,597	82.5%	18,824	61.8%	88%
Internal Loading					
Sediment/Base Flow	1,579	0.8%	1,579	5.2%	0%
Land Use Surface Runoff[4]					
Low Intensity Residential	3,272	1.7%	654	2.1%	80%
High Intensity Residential	13,723	7.1%	2,745	9.0%	80%
Commercial/Industrial/Transportation	8,358	4.3%	1,672	5.5%	80%
Mixed Urban/Recreational	4,145	2.2%	829	2.7%	80%
Crops/Pasture/Hay	754	0.4%	151	0.5%	80%
Deciduous Forest	924	0.5%	924	3.0%	0%
Evergreen Forest	5	0.0%	5	0.0%	0%
Mixed Forest	12	0.0%	12	0.0%	0%
Shrubland	110	0.1%	110	0.4%	0%
Woody Wetlands	334	0.2%	334	1.1%	0%
Herbaceous Wetlands	182	0.1%	182	0.6%	0%
Open Water	71	0.0%	71	0.2%	0%
Disturbed Areas	225	0.1%	225	0.7%	0%
Other Allocations					
Margin of Safety	n/a	n/a	1,841	6.0%	n/a
Reserve Capacity	n/a	n/a	311	1.0%	n/a

1 average annual loads based on 1993-2002 model simulation
2 = 1 - (TMDL load /Existing load)*100
3 detailed listing of individual discharge facilities is provided with Table 6.11
4 see Table 6.9 for associated land use areas

Table 6.6: TMDL calculations for Rockaway River Watershed (average annual loads and percent reductions)

	Existing Conditions[1]		TMDL Specification		Percent
	lbs TP/yr	% of CWL	lbs TP/yr	% of CWL	Reduction[2]
Cumulative Watershed Load (CWL)	63,695	100%	16,842	100%	74%
Point Sources other than Stormwater					
NJPDES Dischargers[3]	50,447	79.2%	7,413	44.0%	85%
Internal Loading					
Sediment/Base Flow	342	0.5%	342	2.0%	0%
Boundary Inputs					
Boonton Reservoir[4]	6,151	9.7%	6,151	36.5%	0%
Land Use Surface Runoff[5]					
Low Intensity Residential	822	1.3%	164	1.0%	80%
High Intensity Residential	3,446	5.4%	689	4.1%	80%
Commercial/Industrial/Transportation	1,073	1.7%	215	1.3%	80%
Mixed Urban/Recreational	741	1.2%	148	0.9%	80%
Crops/Pasture/Hay	179	0.3%	36	0.2%	80%
Deciduous Forest	239	0.4%	239	1.4%	0%
Evergreen Forest	3	0.0%	3	0.0%	0%
Mixed Forest	2	0.0%	2	0.0%	0%
Shrubland	15	0.0%	15	0.1%	0%
Woody Wetlands	96	0.2%	96	0.6%	0%
Herbaceous Wetlands	25	0.0%	25	0.1%	0%
Open Water	22	0.0%	22	0.1%	0%
Disturbed Areas	92	0.1%	92	0.5%	0%
Other Allocations					
Margin of Safety	n/a	n/a	1,017	6.0%	n/a
Reserve Capacity	n/a	n/a	172	1.0%	n/a

1 average annual loads based on 1993-2002 model simulation
2 = 1 - (TMDL load /Existing load)*100
3 detailed listing of individual discharge facilities is provided with Table 6.11
4 = observed flow * mean reported concentration
5 see Table 6.9 for associated land use areas

Table 6.7: TMDL calculations for Upper Passaic Watershed (above Rockaway confluence) (average annual loads and percent reductions)

	Existing Conditions[1]		TMDL Specification		Percent
	lbs TP/yr	% of CWL	lbs TP/yr	% of CWL	Reduction[2]
Cumulative Watershed Load (CWL)	219,005	100%	36,737	100%	83%
Point Sources other than Stormwater					
NJPDES Dischargers[3]	157,981	72.1%	16,601	45.2%	83%
Internal Loading					
Sediment/Base Flow	2,566	1.2%	2,566	7.0%	0%
Land Use Surface Runoff[4]					
Low Intensity Residential	10,321	4.7%	2,064	5.6%	80%
High Intensity Residential	23,164	10.6%	4,633	12.6%	80%
Commercial/Industrial/Transportation	9,505	4.3%	1,901	5.2%	80%
Mixed Urban/Recreational	5,522	2.5%	1,104	3.0%	80%
Crops/Pasture/Hay	5,841	2.7%	1,168	3.2%	80%
Deciduous Forest	1,566	0.7%	1,566	4.3%	0%
Evergreen Forest	23	0.0%	23	0.1%	0%
Mixed Forest	32	0.0%	32	0.1%	0%
Shrubland	245	0.1%	245	0.7%	0%
Woody Wetlands	1,197	0.5%	1,197	3.3%	0%
Herbaceous Wetlands	456	0.2%	456	1.2%	0%
Open Water	107	0.0%	107	0.3%	0%
Disturbed Areas	479	0.2%	479	1.3%	0%
Other Allocations					
Margin of Safety	n/a	n/a	2,219	6.0%	n/a
Reserve Capacity	n/a	n/a	376	1.0%	n/a

1 average annual loads based on 1993-2002 model simulation
2 = 1 - (TMDL load /Existing load)*100
3 detailed listing of individual discharge facilities is provided with Table 6.11
4 see Table 6.9 for associated land use areas

Table 6.8: TMDL calculations for Upper Passaic Watershed (above Canoe Brook confluence) (average annual loads and percent reductions)

	Existing Conditions[1]		TMDL Specification		Percent
	lbs TP/yr	% of CWL	lbs TP/yr	% of CWL	Reduction[2]
Cumulative Watershed Load (CWL)	99,845	100%	22,685	100%	77%
Point Sources other than Stormwater					
NJPDES Dischargers[3]	59,288	59.4%	7,981	35.2%	87%
Internal Loading					
Sediment/Base Flow	1,944	1.9%	1,944	8.6%	0%
Land Use Surface Runoff[4]					
Low Intensity Residential	8,360	8.4%	1,672	7.4%	80%
High Intensity Residential	11,536	11.6%	2,307	10.2%	80%
Commercial/Industrial/Transportation	7,162	7.2%	1,432	6.3%	80%
Mixed Urban/Recreational	1,630	1.6%	326	1.4%	80%
Crops/Pasture/Hay	5,631	5.6%	1,126	5.0%	80%
Deciduous Forest	2,323	2.3%	2,323	10.2%	0%
Evergreen Forest	14	0.0%	14	0.1%	0%
Mixed Forest	23	0.0%	23	0.1%	0%
Shrubland	217	0.2%	217	1.0%	0%
Woody Wetlands	912	0.9%	912	4.0%	0%
Herbaceous Wetlands	377	0.4%	377	1.7%	0%
Open Water	48	0.0%	48	0.2%	0%
Disturbed Areas	380	0.4%	380	1.7%	0%
Other Allocations					
Margin of Safety	n/a	n/a	1,370	6.0%	n/a
Reserve Capacity	n/a	n/a	232	1.0%	n/a

1 average annual loads based on 1993-2002 model simulation

2 = 1 - (TMDL load /Existing load)*100

3 detailed listing of individual discharge facilities is provided with Table 6.11

4 see Table 6.9 for associated land use areas

Table 6.9: Watershed Land Use Areas (in acres) used in TMDL Calculations

Land Use Categories	UAL Coeff. (kg/hc/yr)	UAL Coeff. (lb/ac/yr)	Wanaque Reservoir[1]	Passaic above Canoe Bk.	Passaic above Rockaway	Rockaway River[2]	Whippany River	Passaic above Pompton[3]	Ramapo River[4]	Pompton River[5]
Low Intensity Residential	0.7	0.623	2,453	13,419	16,567	1,320	5,251	23,561	4,956	10,377
High Intensity Residential	1.6	1.424	2,341	8,101	16,267	2,420	9,637	29,446	3,328	13,476
Comm./Ind./Trans[6]	2/1.7/1	1.8/1.5/.9	1,072	5,741	6,407	739	5,449	13,282	1,789	5,100
Mixed Urban/Recreational	1.0	0.890	605	1,832	6,204	833	4,657	11,979	1,603	3,452
Crops/Pasture/Hay	1.5	1.335	587	4,218	4,375	134	565	5,150	143	732
Deciduous Forest	0.1	0.089	30,445	13,208	17,599	2,681	10,385	31,238	13,556	48,107
Evergreen Forest	0.1	0.089	3,067	161	254	33	52	339	70	2,940
Mixed Forest	0.1	0.089	7,477	253	355	22	130	644	492	3,400
Shrubland	0.1	0.089	440	2,433	2,752	165	1,240	4,310	404	1,214
Woody Wetlands	0.1	0.089	2,663	10,242	13,449	1,079	3,752	20,825	1,590	8,725
Herbaceous Wetlands	0.1	0.089	302	4,239	5,120	285	2,045	8,613	113	1,654
Open Water	0.1	0.089	6,059	539	1,199	245	803	2,561	1,551	5,346
Disturbed Areas	0.1	0.089	292	854	1,076	207	506	1,898	336	943
Total			57,805	65,240	91,624	10,163	44,472	153,846	29,931	105,466

[1] Including portion of watershed within New York
[2] Excluding portion of watershed above Boonton Reservoir
[3] Excluding portion of watershed above Boonton Reservoir
[4] Excluding portion of watershed within New York and below Pompton Lakes Dam
[5] Excluding portion of watershed within New York and above Wanaque Reservoir
[6] UALs for commercial = 2 kg/hc/yr, industrial=1.7 kg/hc/yr, transportation = 1 kg/hc/yr

Table 6.10: WLAs for Treatment Facilities on the Pompton River upstream of the Two Bridges Intake

Sub-Shed[1]	NJPDES #	Facility Name	Current Flow (mgd)[2]	Current Load (lbs/yr)[3]	Permitted Flow (mgd)	WLA (lbs/yr)[4]	Load % Reduction*
1	NJ0029858	OAKLAND CARE CENTER	0.0239	9.5	0.0300	18.3	*
1	NJ0053112	OAKLAND-CHAPEL HILL ESTATES STP	0.0069	0.5	0.0100	6.1	*
1	NJ0080811	RAMAPO RIVER CLUB STP	0.0696	14.2	0.1137	69.2	*
1	NJ0027774	OAKLAND-OAKWOOD KNOLLS WWTP	0.0177	2.4	0.0350	21.3	*
1	NJ0021253	RAMAPO-INDIAN HILLS H.S. WTP	0.0068	7.1	0.0336	20.5	*
1	NJ0021342	OAKLAND-SKYVIEW-HIGH BROOK STP	0.0130	2.3	0.0230	14.0	*
2	NJ0053759	WANAQUE VALLEY REG S.A.	0.9181	927.2	1.2500	761.0	18%
2	NJ0029386	TWO BRIDGES SEWERAGE AUTHORITY	4.7503	51,868.8	10.0000	6,088.2	88%
2	NJ0023698	POMPTON LAKES BOROUGH MUA	0.7377	655.3	1.2000	730.6	*
2	NJ0032395	RINGWOOD PLAZA STP	0.0066	7.4	0.0117	7.1	4%
2	NJ0027006	RINGWOOD ACRES STP	0.0231	29.4	0.0360	21.9	25%
2	NJ0026514	PLAINS PLAZA SHOPPING CENTER	0.0093	165.7	0.0200	12.2	93%
3	NJ0022284	KINNELON TWP HIGH SCHOOL	0.0051	29.8	0.0300	18.3	39%
3	NJ0024457	OUR LADY OF THE MAGNIFICAT	0.0009	0.7	0.0012	0.7	*
3	NJ0027685	WEST MILFORD MUA-HIGHVIEW ACRES STP	0.0534	84.5	0.2000	121.8	*
	TOTAL		6.6423	53,805	12.9942	7,911	85%

[1] subshed 1 = Ramapo, subshed 2 = Pompton, subshed 3 = Pequanock
[2] current flows are based on NJDEP's Municipal STP Flow Database for 2002
[3] current loads are based on facility's reported 1997-2000 discharge load
[4] based on a LTA effluent concentration of 0.20 mg/l
* denotes that projected TMDL is greater than the reported discharge load

Table 6.11: WLAs for Treatment Facilities on the Passaic River upstream of the Two Bridges Intake

Sub-Shed[1]	NJPDES #	Facility Name	Current Flow (mgd)[2]	Current Load (lbs/yr)[3]	Permitted Flow (mgd)	WLA (lbs/yr)[4]	Load % Reduction*
1	NJ0020281	CHATHAM HILL SEWAGE TREATMENT	0.0071	35.6	0.0300	18	49%
1	NJ0020290	CHATHAM TWP MAIN STP	0.6596	1,203.1	1.0000	609	49%
1	NJ0021083	VETERANS ADMIN MEDICAL CENTER-LYONS	0.0999	1,229.3	0.4000	244	80%
1	NJ0021636	NEW PROVIDENCE WWTP	0.0275	167.4	1.5000	913	*
1	NJ0022489	WARREN TWP STAGE I-II STP	0.3344	3,009.9	0.4700	286	90%
1	NJ0022497	WARREN TWP STAGE IV STP	0.3129	4,713.3	0.8000	487	90%
1	NJ0022845	BERNARDS SA - HARRISON BROOK STP	1.7288	20,924.2	2.5000	1,522	93%
1	NJ0024465	LONG HILL TWP-STIRLING HILLS STP	0.9091	8,551.6	0.9000	548	94%
1	NJ0024929	MORRIS TWP - WOODLAND STP	1.2567	2,396.8	2.0000	1,218	49%
1	NJ0027961	BERKELEY HTS WPCP	1.5494	18,522.0	3.1000	1,887	90%
1	NJ0029912	NJDOT-HARDING REST AREA (Oct-April)	0.0014	5.7	0.0250	15	*
1	NJ0050369	WARREN TWP STAGE V STP	0.1377	1,542.2	0.3800	231	85%
2	NJ0020427	CALDWELL BORO STP	3.3667	34,510.6	4.5000	2,740	92%
2	NJ0024511	LIVINGSTON TWP STP	2.8492	29,565.1	4.6000	2,801	91%
2	NJ0024937	MADISON-CHATHAM JT MTG - MOLITOR	2.2971	27,824.8	3.5000	2,131	92%
2	NJ0025518	FLORHAM PARK S.A.	0.8793	6,088.5	1.4000	852	86%
2	NJ0052256	CHATHAM TWP-CHATHAM GLEN STP	0.1214	1,280.0	0.1550	94	93%
3	NJ0003476	EXXONMOBIL RESEARCH & ENGINEERING	0.0499	576.1	0.2900	177	69%
3	NJ0024902	HANOVER SEWERAGE AUTHORITY	1.9508	22,570.1	4.6100	2,807	88%
3	NJ0024911	MORRIS TWP - BUTTERWORTH STP	1.6506	8,668.8	3.3000	2,009	77%
3	NJ0024970	PARSIPPANY TROY HILLS	12.5092	122,347.7	16.0000	9,741	92%
3	NJ0025496	MORRISTOWN TOWN STP	2.9079	5,566.2	6.3000	3,836	31%
3	NJ0026689	NJDHS-GREYSTONE PARK PSYCH HOSP	0.2153	156.7	0.4000	244	*
4	NJ0021091	JEFFERSON TWP HIGH-MIDDLE SCHOOL	0.0101	22.3	0.0275	17	25%
4	NJ0022276	STONYBROOK SCHOOL	0.0011	3.6	0.0100	6	*
4	NJ0022349	ROCKAWAY VALLEY REG SA	9.3000	50,472.3	12.0000	7,306	86%
4	NJ0026867	JEFFERSON TWP-WHITE ROCK STP	0.0978	39.2	0.1295	79	*
	TOTAL		45.231	371,993.1	70.327	42,816	88%

1 subshed 1 = Upper Passaic above Canoe., subshed 2 = Upper Passaic above Rockaway, 3 = Whippany, 4 = Rockaway
2 current flows are based on NJDEP's Municipal STP Flow Database for 2002
3 current loads are based on facility's reported 1997-2000 discharge load
4 based on a LTA effluent concentration of 0.20 mg/l
* denotes that projected TMDL is greater than the reported discharge load

7. Summary of Results

NJDEP sponsored this study as part of its continuing effort to develop TMDLs for the Passaic River and its tributaries. The current study focused on the Wanaque Reservoir – the largest water supply facility in the Basin. This Reservoir's primary source of inflow is a series of tributaries that originate within its relatively undeveloped upstream watershed. However, the Reservoir's safe yield was augmented in the late-1980s with the completion of the Wanaque South project, which diverted flows from the Ramapo, Pompton and Passaic Rivers. These diversions (particularly those from the Passaic River) are a source of concern since their water quality is degraded as a result of wastewater discharges and watershed development. Thus, it is necessary to address the water quality in these downstream Rivers (the intake source waters) in order to safeguard the Reservoir's water quality.

Accordingly, a model study was conducted to address water quality issues in both the intake source waters and the Reservoir itself. Separate (but linked) models were developed to simulate: (a) the water quality response of both the Ramapo, Pompton and Passaic Rivers (at the intake sites) to changes in upstream PS and NPS discharge loads; and (b) the Reservoir's water quality response to the diversion of intake (river) water in conjunction with its proposed operation schedule and natural inflow conditions. To this end, a previously developed mass-balance model of the Passaic River and its tributaries was utilized in conjunction with a two-dimensional model of Reservoir hydrodynamics and water quality. The performance of both models was satisfactorily verified based on a comparison of simulated results and long-term monitoring data. As a result of this combined investigation, the following trends are apparent:

1. At the Reservoir intake sites, the water quality of these Rivers (in particular the Pompton and Passaic Rivers) is degraded with regard to phosphorus concentrations. Model analyses show that, for this parameter, the River's water quality is strongly influenced by the magnitude of the upstream point source discharge and the available level of dilution. Other processes (such as in-stream uptake and non-point source loadings) appear to be secondary at this time. Thus, control and reduction of this discharge load will be the most important facet of improving water quality at the intake sites.

2. While the Reservoir has a generally high level of water quality, it can experience large fluctuations in phosphorus concentration due the diversion of water from the downstream Ramapo, Pompton and Passaic Rivers. During drought and post-drought refill conditions, the large-scale diversion of river water can increase the Reservoir's native phosphorus concentration by factors of 3-5. As the heaviest diversions generally occur during the winter or early spring, peak concentrations occur during a time of diminished biological activity. While these concentration peaks diminish rapidly when pumping ends (as the Reservoir returns to its native state), increases in concentration and biological activity still occur during the summer. Due to the presence of these concentration peaks and their extended impact, a TMDL is required for the Reservoir and its intake sites.

At the request of NJDEP, the study investigated the use of two possible endpoints for the Reservoir TMDL. Endpoint 1 reflects full compliance with the current criterion for lakes (0.05 mg/l at any time) while Endpoint 2 requires that the summer (June through September) average TP concentration near Raymond Dam does not exceed 0.05 mg/l during any year. Results of these endpoint simulations are summarized below:

> Endpoint 1: In order to achieve this endpoint (full compliance with the current lake criterion), the simulated cumulative contributing discharge load was reduced from an average value of 1,154 lbs/day to only 139 lbs/day, and the overall non-point load was reduced by 80%. The specified discharge load is equivalent to a long-term average (LTA) effluent concentration of 0.2 mg/l of total phosphorus for all contributing dischargers.
>
> Endpoint 2: This alternate endpoint (mean summer compliance with the current lake criterion) can be achieved by reducing PS and NPS loads in several combinations (Figure 5.8). For example, compliance with the 0.05 mg/l (summer-average) target concentration could be achieved with an 80% NPS load reduction and an effluent LTA concentration of 0.5 mg/l.

Based on discussions with NJDEP, a TMDL for the Reservoir was developed for Endpoint 1 (TP concentration of 0.05 mg/l at all times). Endpoint 1 is the existing criterion in the Department's adopted (and EPA-approved) Surface Water Quality Standards, and requires no further regulatory justification. Endpoint 2 was not selected by the NJDEP as it was not deemed to be "necessary to protect existing or designated uses".

The proposed Reservoir TMDL consists of the cumulative load from the diversion inputs to the Reservoir, PS loads from the tributary watershed, the cumulative NPS load from the entire watershed contributing flow to the Reservoir (listed by land use category), internal sources (base flow and boundary inputs), an MOS and a RC. The final TMDL scenario included the following assumptions: (1) the reservoir diversion schedule reflects its ultimate safe-yield capacity; and (2) treatment plant discharge rates reflect each facility's permitted flow rate. MOS was specified as approximately 6% while reserve capacity was specified as approximately 1%.

With this MOS/RC, the proposed TMDL scenario for the Wanaque Reservoir is presented in Table 6.1. Likewise, TMDLs for the Reservoir intake sites (based on the Reservoir TMDL) are presented within Tables 6.2-6.4. In Tables 6.5-6.8, this TMDL is further translated to four upstream control sites within the upper Passaic River watershed.

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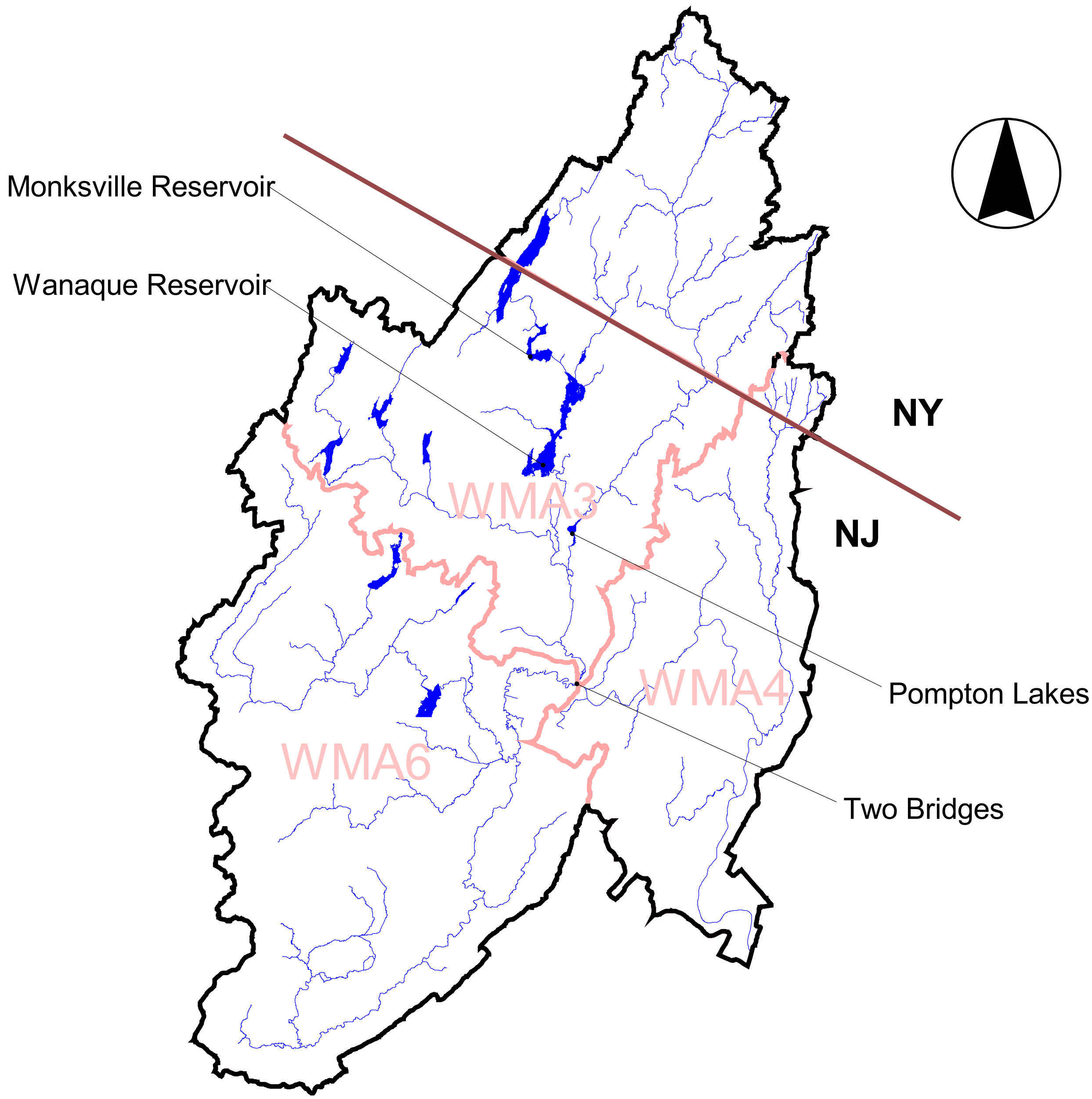
FIGURES

Figure 2.1: Passaic Watershed



Legend

Watershed Management Area

5 0 5 10 15 Miles

Figure 2.2: Wanaque and Monksville Reservoirs

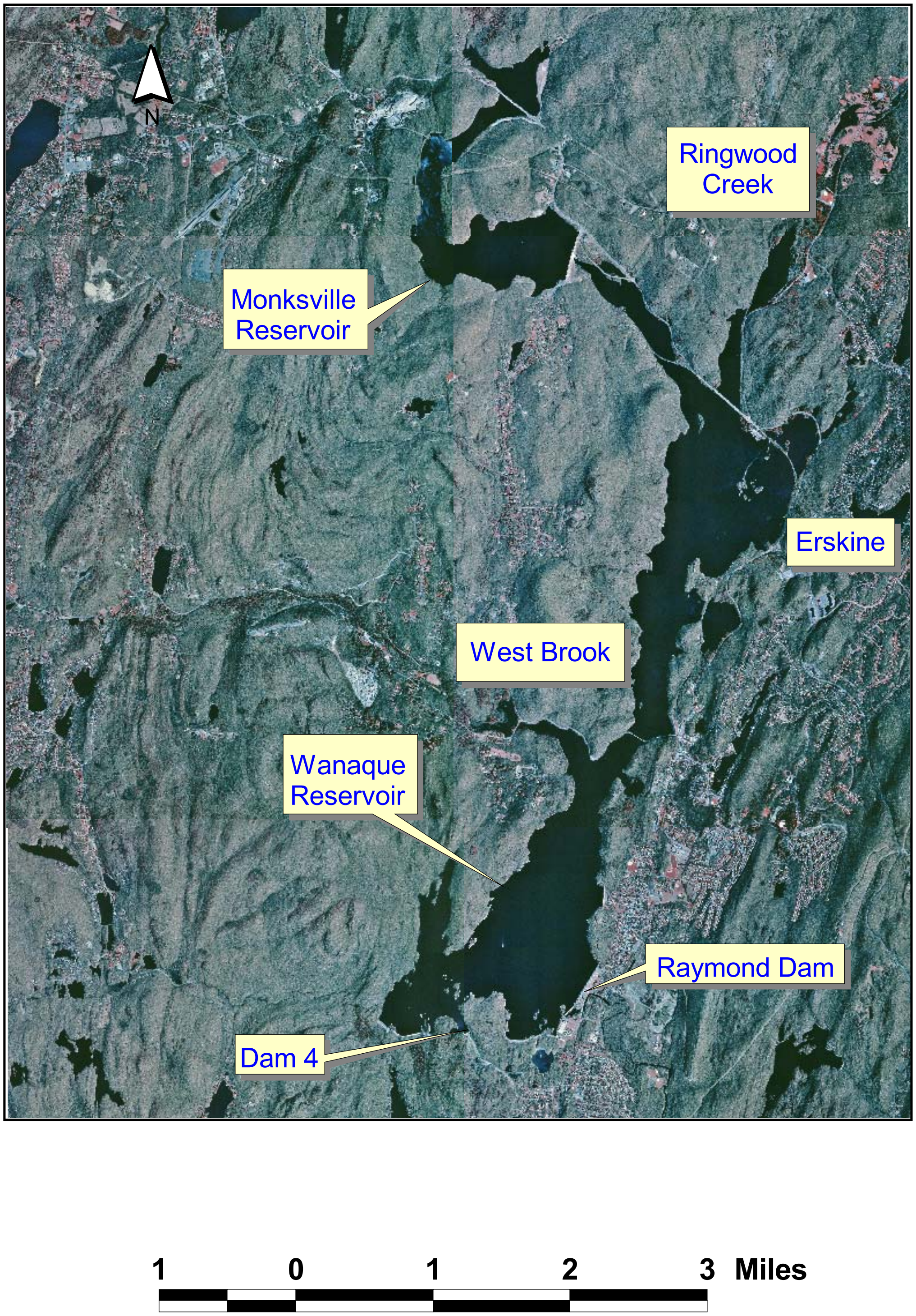


Figure 2.3: Land Use Distribution in the Wanaque Reservoir Watershed

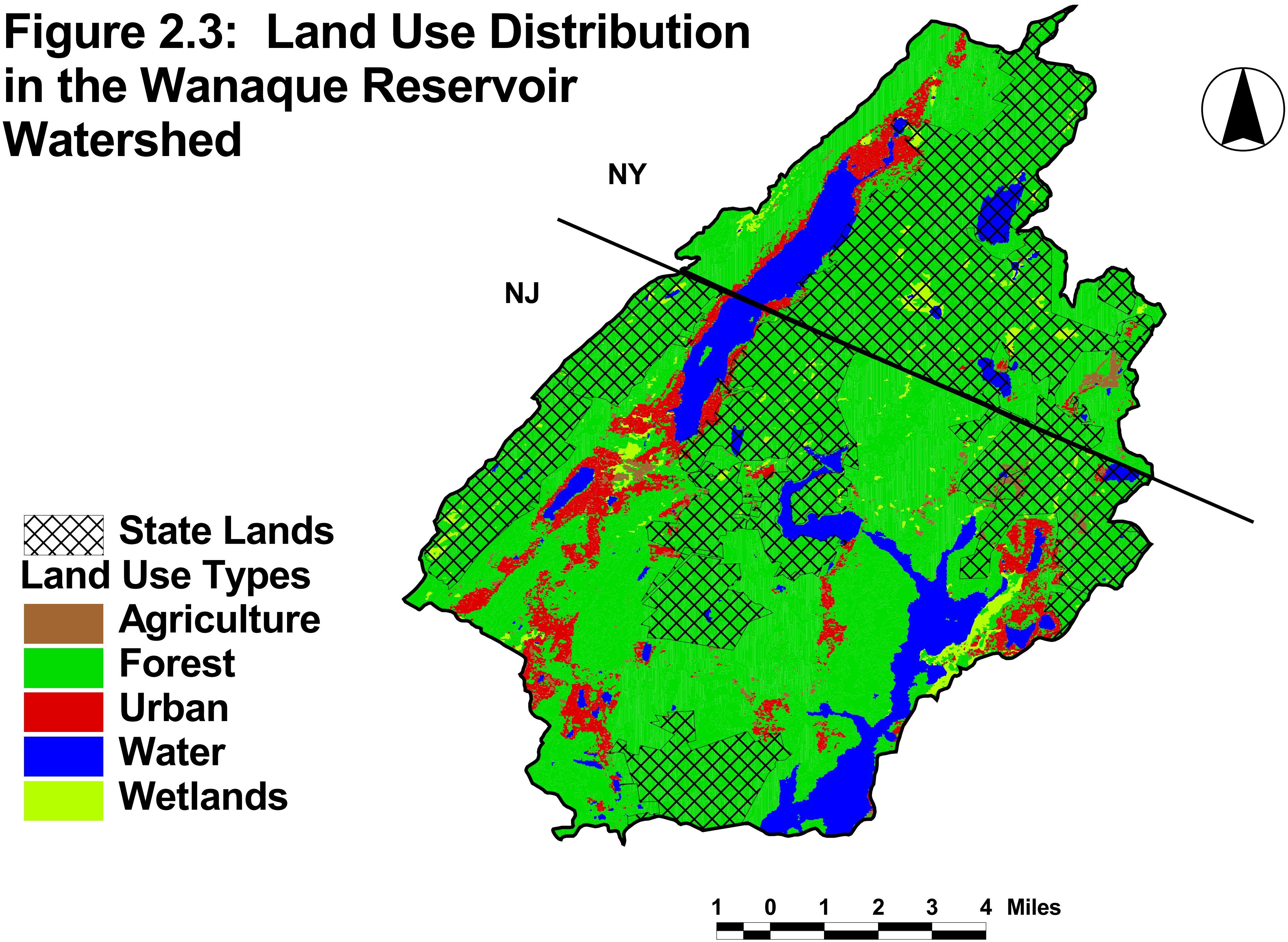
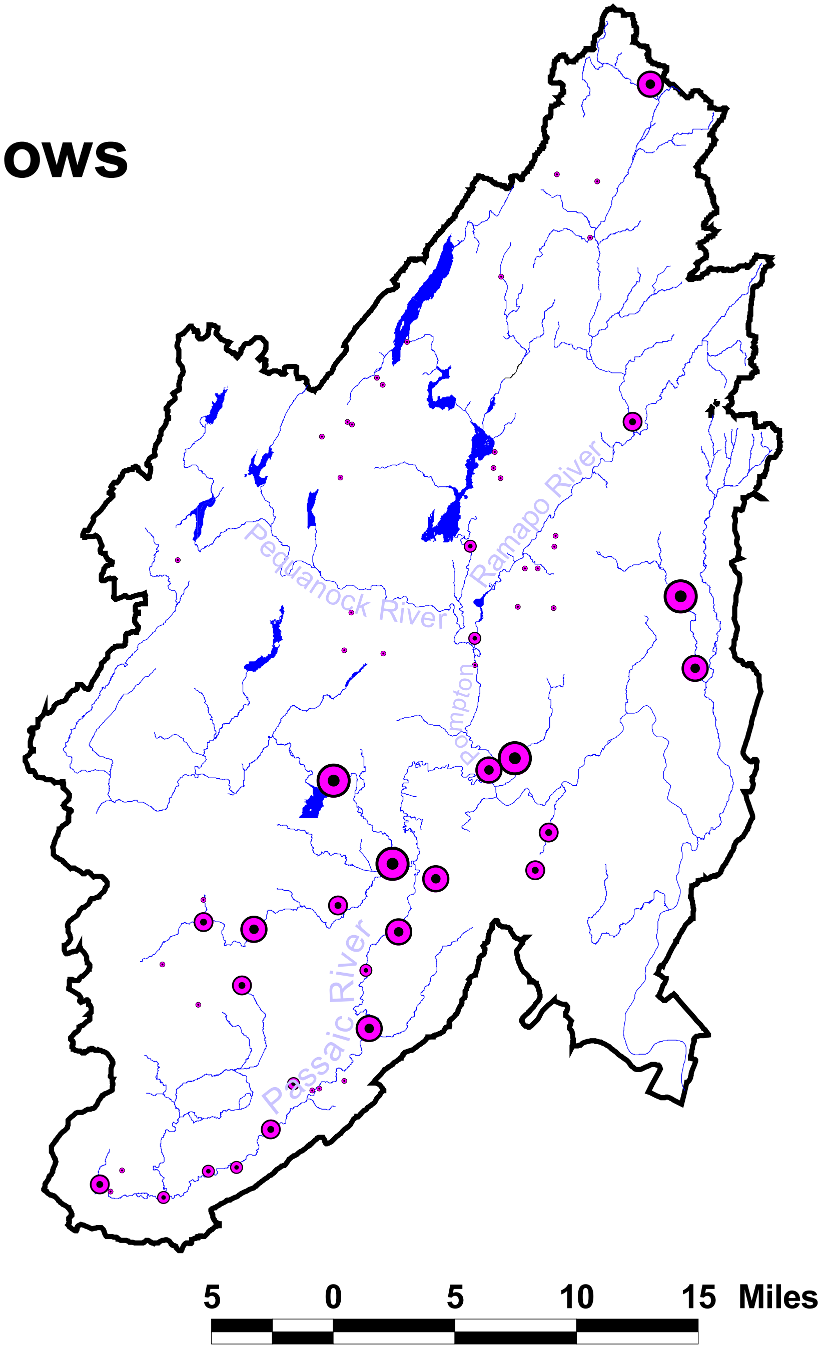


Figure 2.4: Distribution of Wastewater Treatment Plant Flows



Legend

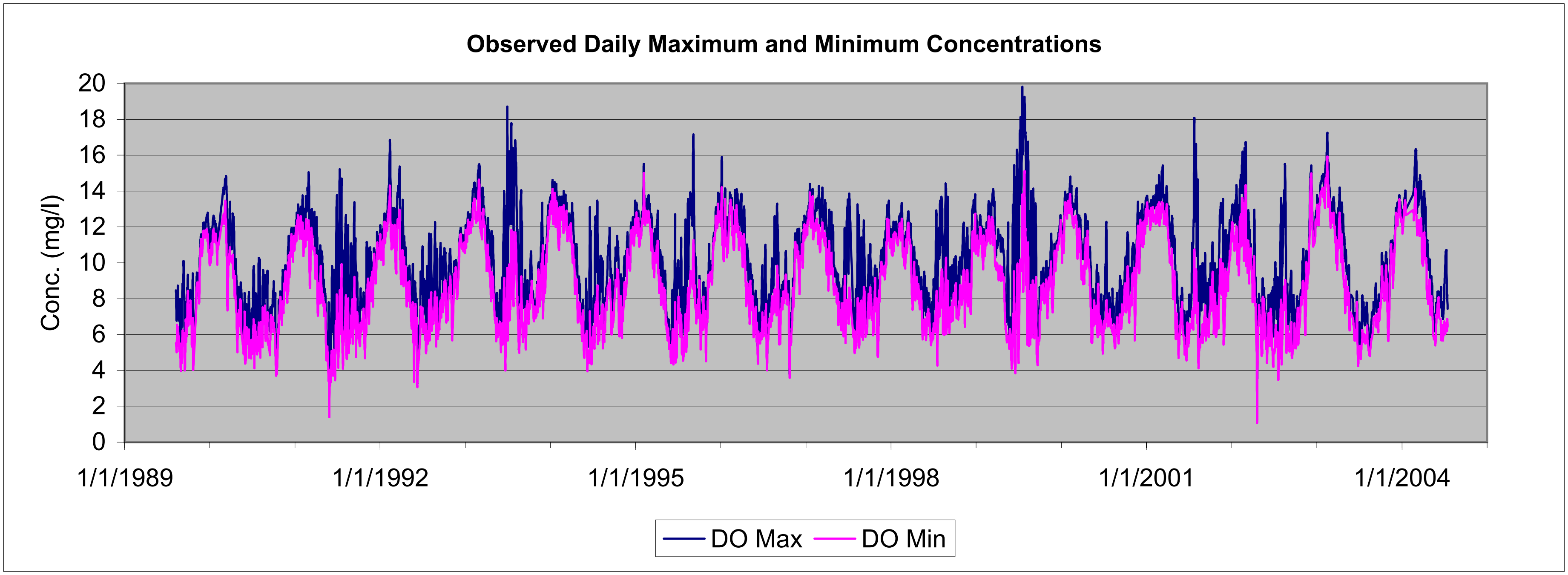
Treatment Plant Capacities*

- <0.25 mgd
- 0.25 - 1,0 mgd
- 1.0 - 2.5 mgd
- 2.5 - 5.0 mgd
- 5.0 - 15 mgd

* based on 2002 discharge flow data

Figure 2.5: Daily Dissolved Oxygen Variation for the Passaic River below Two Bridges

USGS Data for Station # 01389005



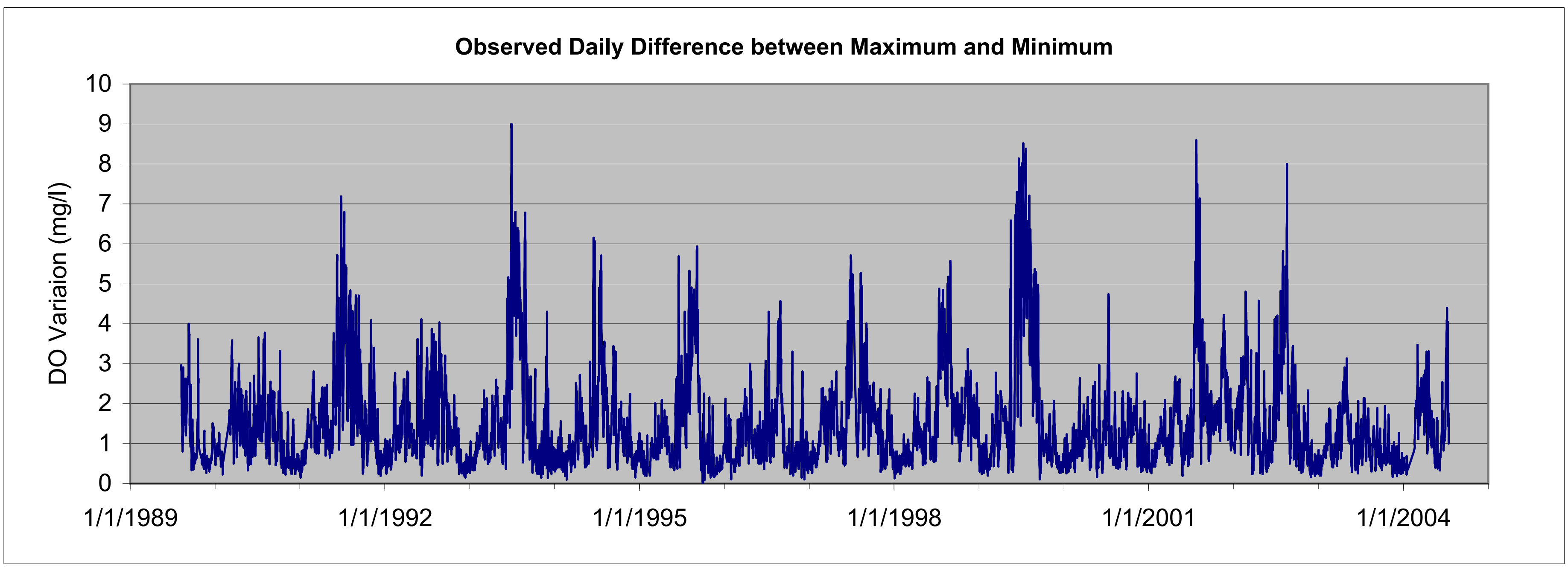
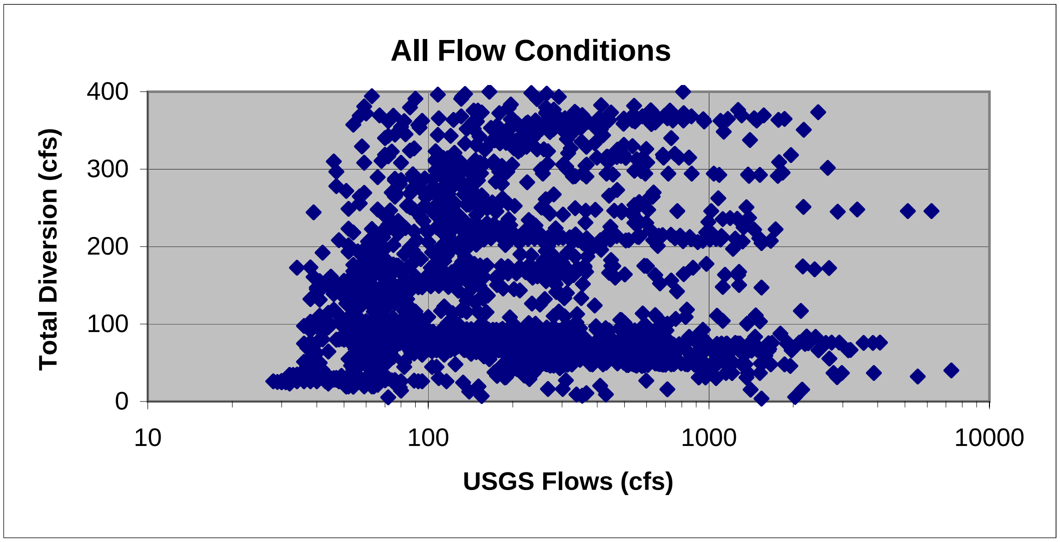
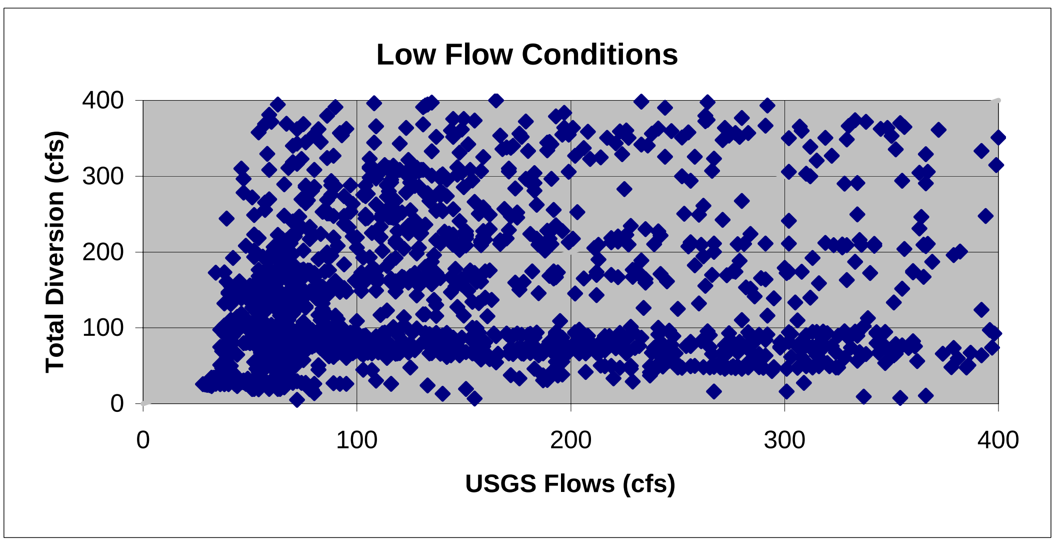


Figure 2.6: Observed Flows at Pompton River at Pompton Plains vs. Pumpage from Two Bridges Intake (1992-2002)





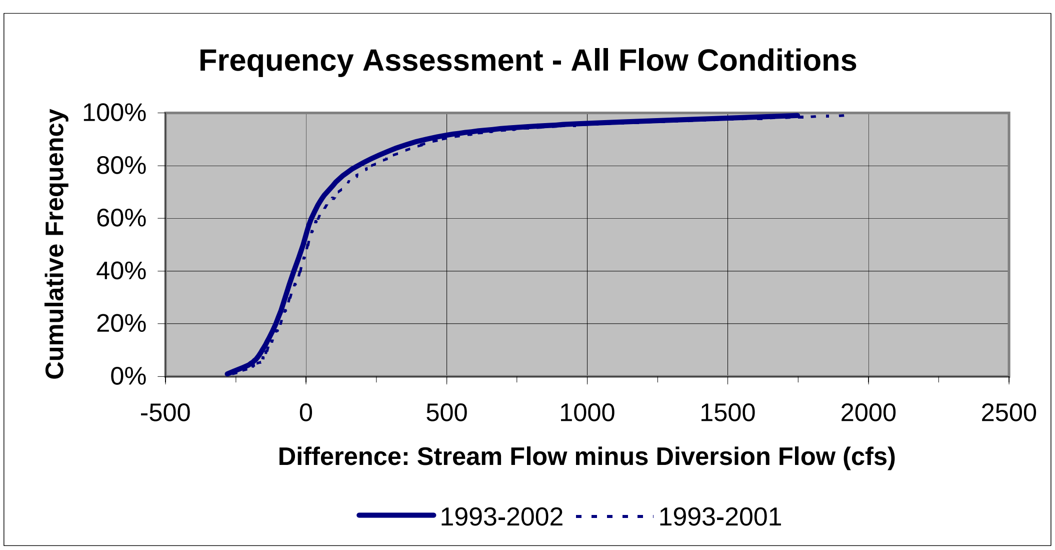


Figure 3.1: Study Area and Selected Monitoring Locations - Passaic River Watershed -

Station	Location
1	Passaic River near Chatham NJ
2	Rockaway River at Pine Brook NJ
3	Whippany River near Pine Brook NJ
4	Passaic River at Two Bridges NJ
5	Ramapo River near Mahwah NJ
6	Ramapo River at Pompton Lakes NJ
7	Pompton River at Two Bridges NJ
8	Passaic River at Little Falls NJ

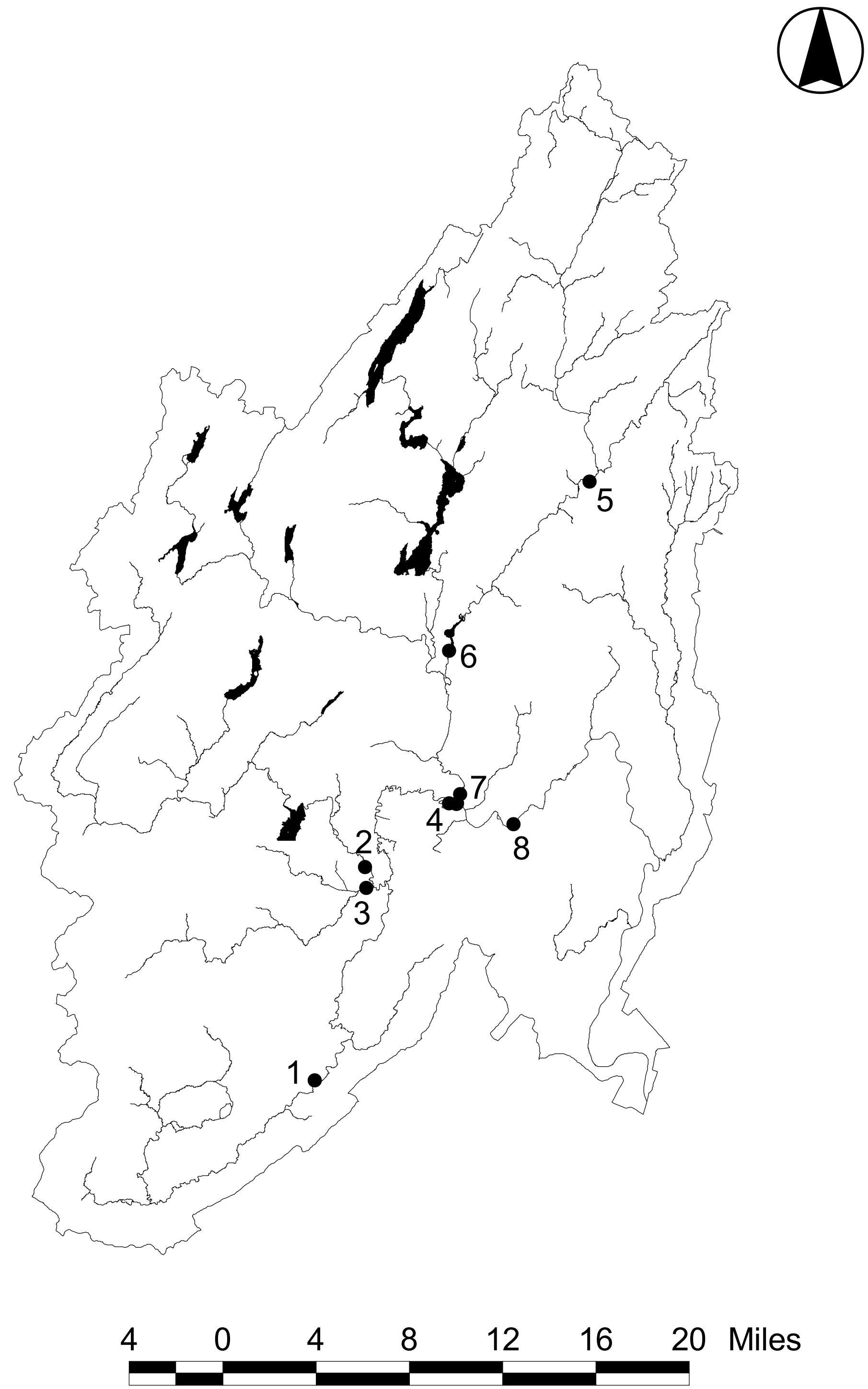
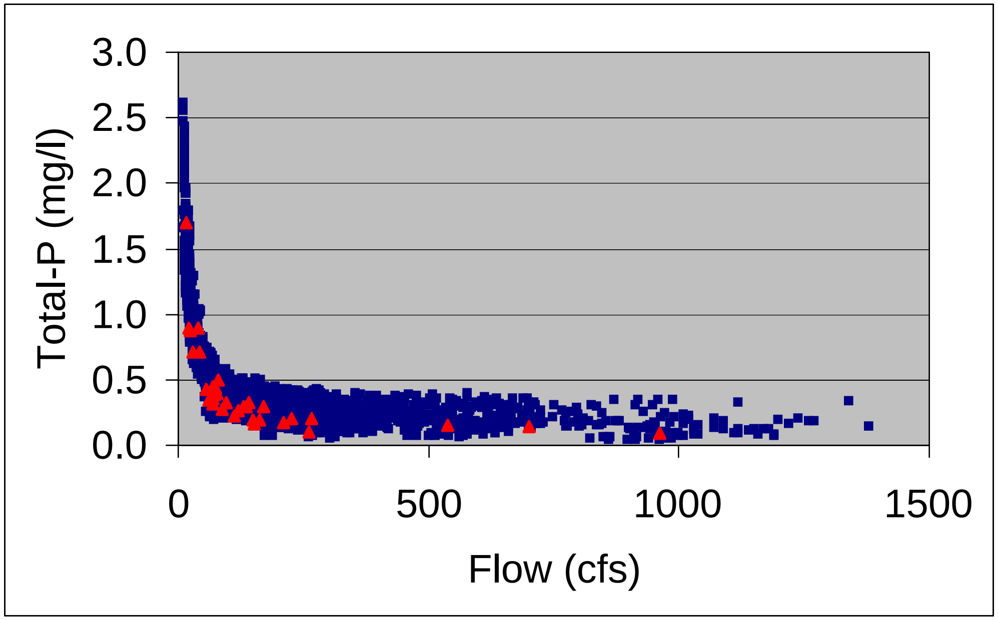


Figure 3.2a: Mass Balance Simulation of Total Phosphorus for the Passaic River at Chatham -- Station 01379500 (1997-2000)

▲ Observed Data ▪ / ▬ Model Projection



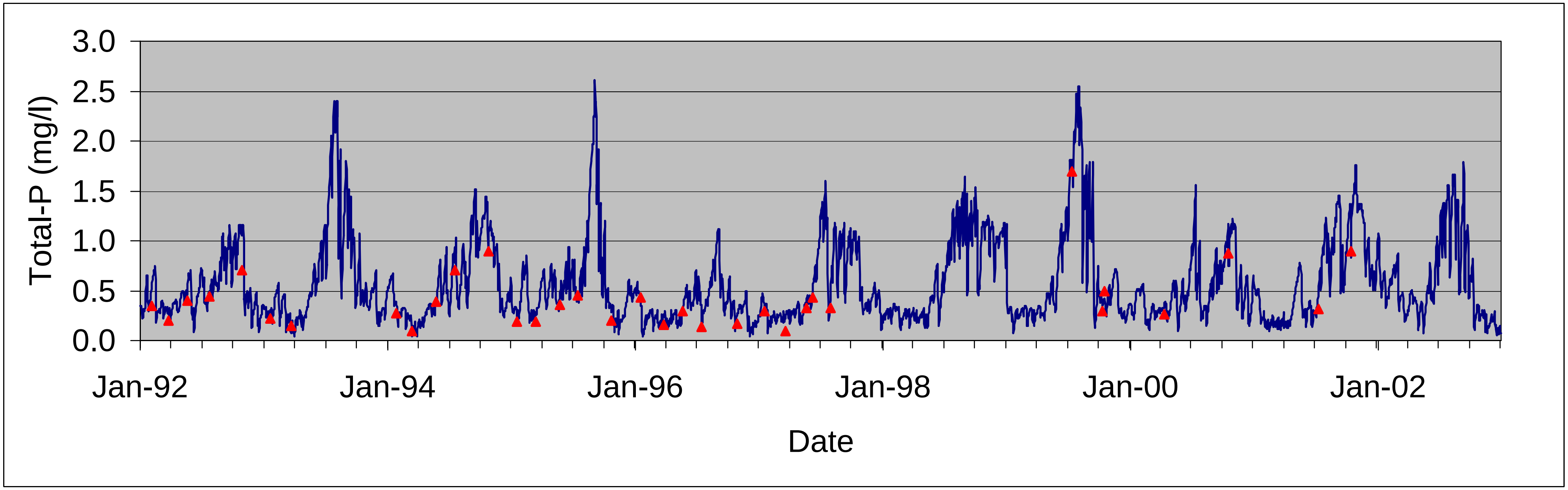
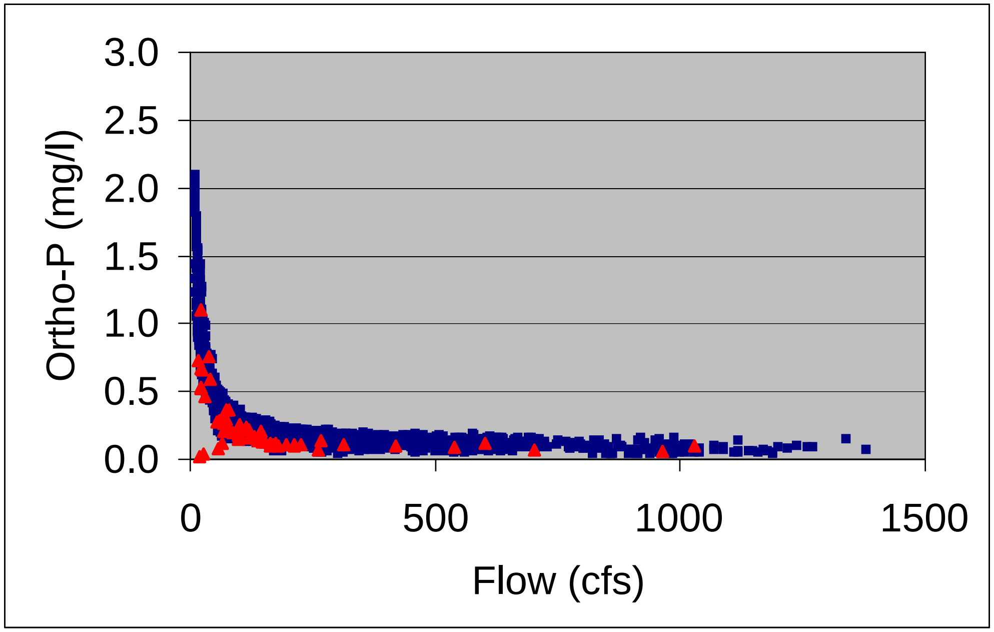


Figure 3.2b: Mass Balance Simulation of Ortho-Phosphorus for the Passaic River at Chatham -- Station 01379500 (1997-2000)

▲ Observed Data ▪ / ▬ Model Projection



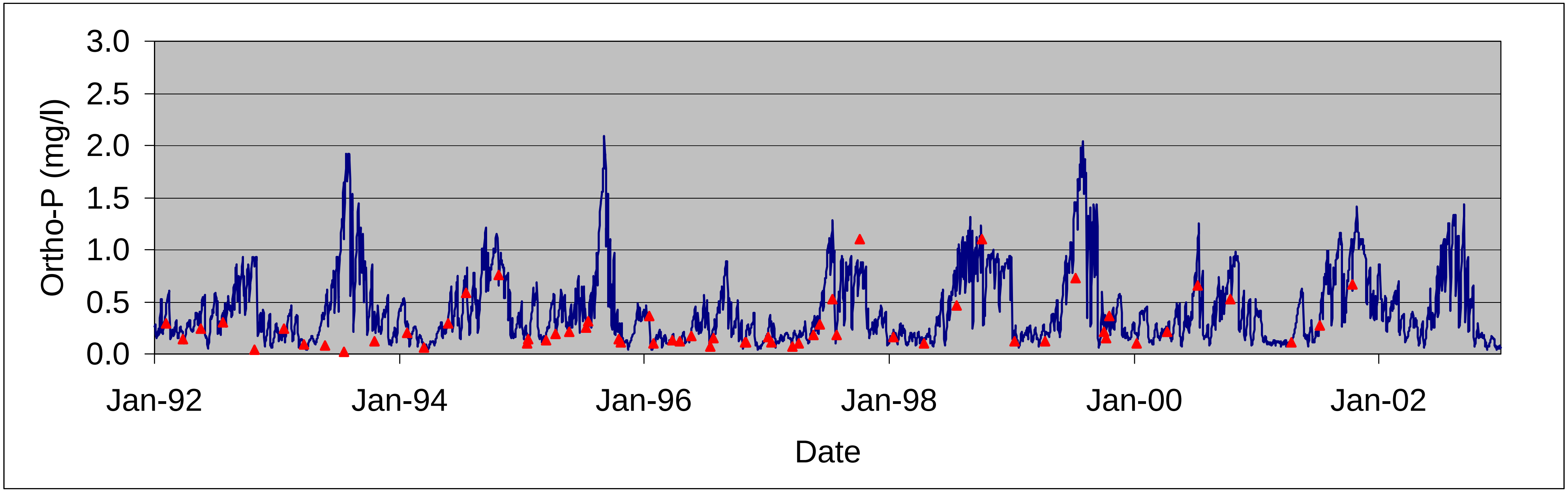
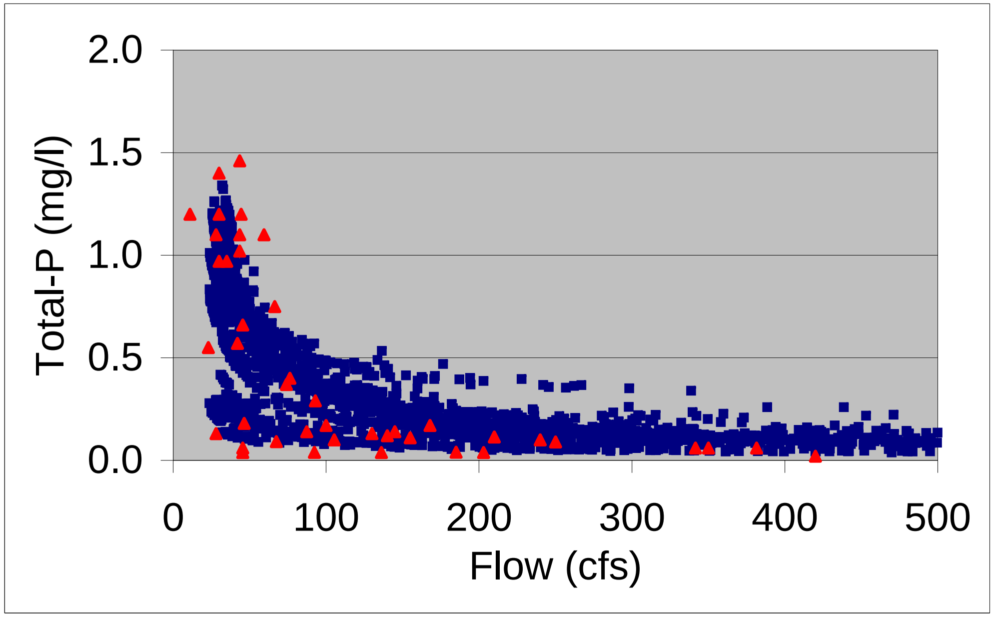


Figure 3.3a: Mass Balance Simulation of Total Phosphorus for the Rockaway River at Pine Brook -- Station 01381500 (1992-2002)

▲ Observed Data ▪ / ▬ Model Projection



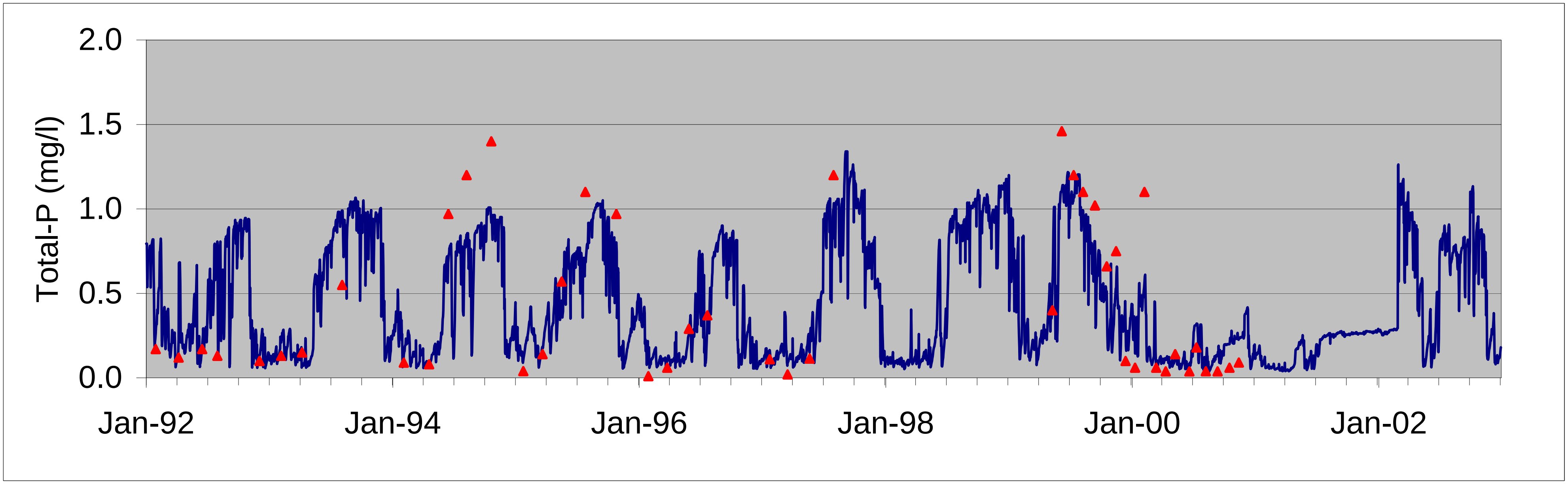
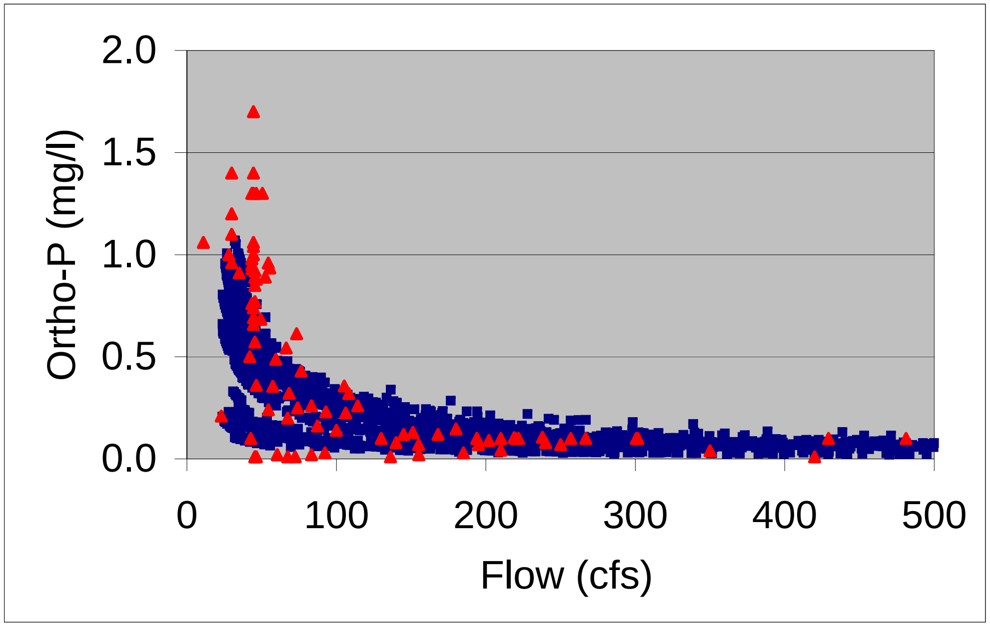


Figure 3.3b: Mass Balance Simulation of Ortho-Phosphorus for the Rockaway River at Pine Brook -- Station 01381500 (1992-2002)

▲ Observed Data ▪ / ▬ Model Projection



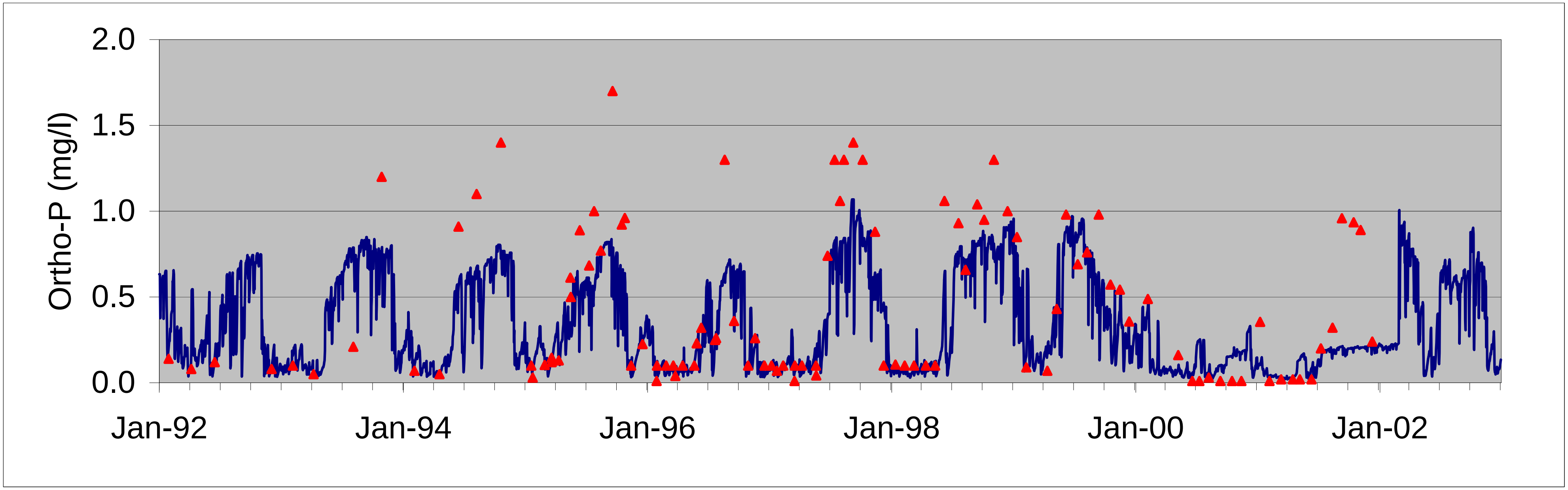
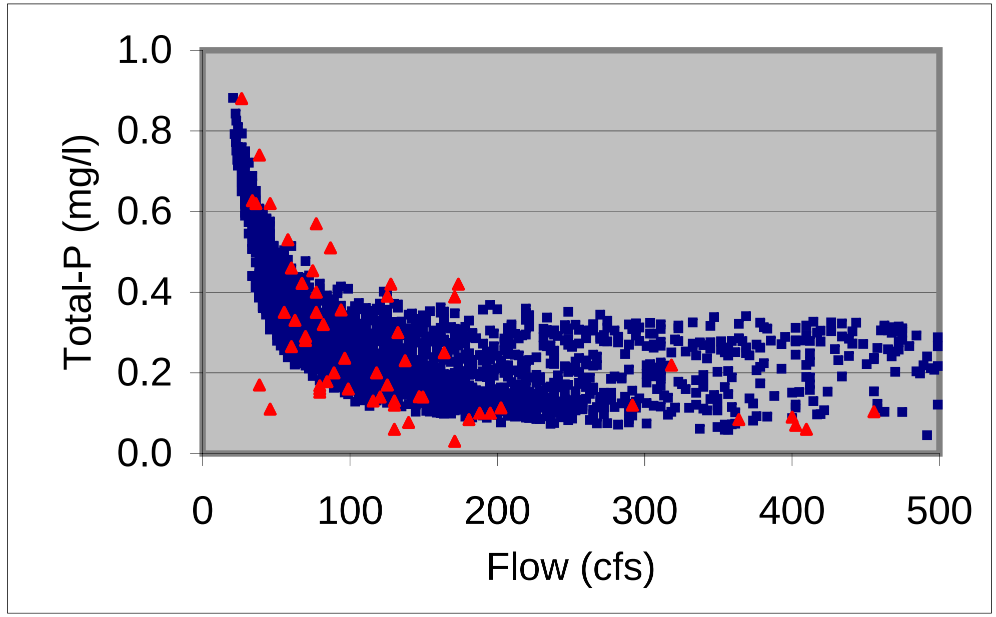


Figure 3.4a: Mass Balance Simulation of Total Phosphorus for the Whippany River at Pine Brook -- Station 01381800 (1992-2002)

▲ Observed Data ▪ / ▬ Model Projection



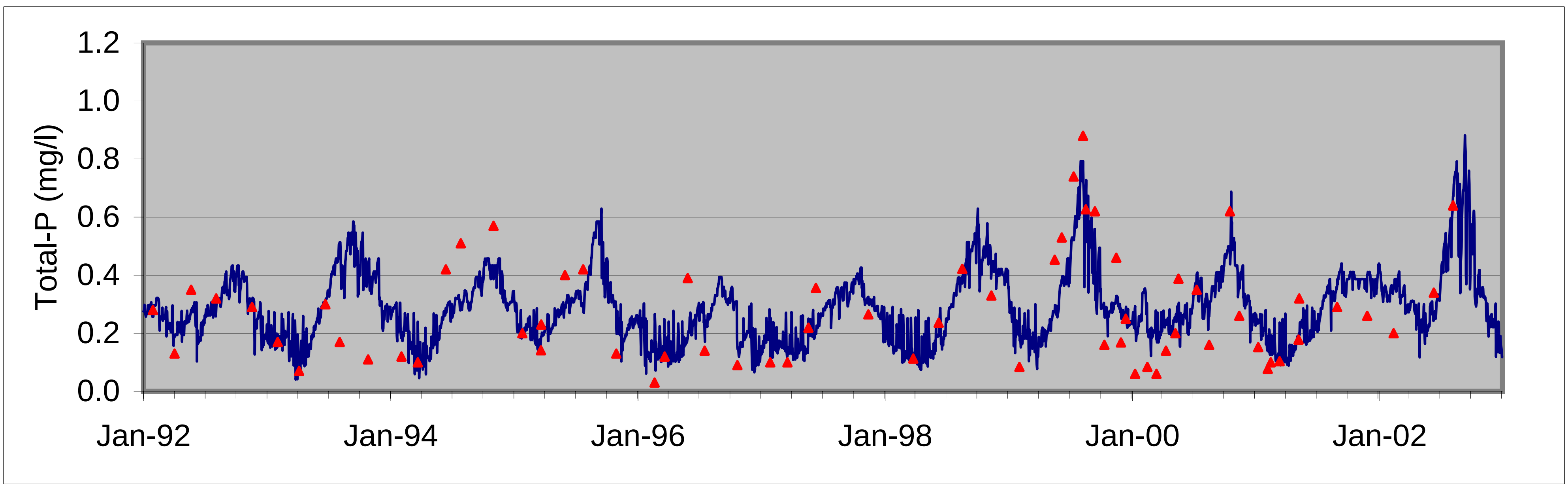
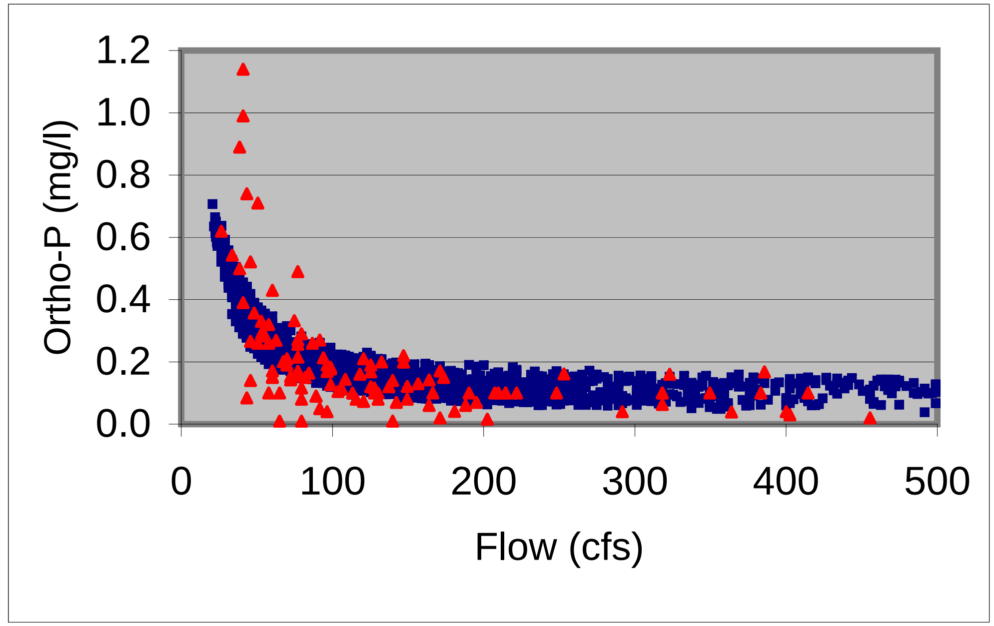


Figure 3.4b: Mass Balance Simulation of Ortho-Phosphorus for the Whippany River at Pine Brook -- Station 01381800 (1992-2002)

▲ Observed Data ▪/ ━━ Model Projection



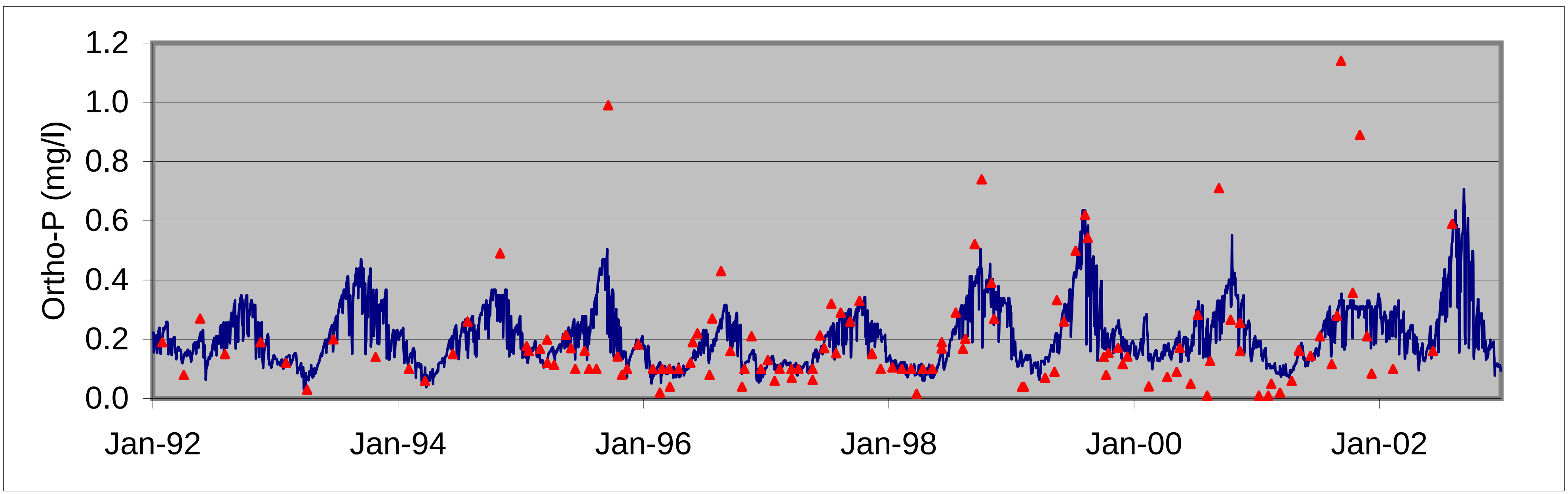
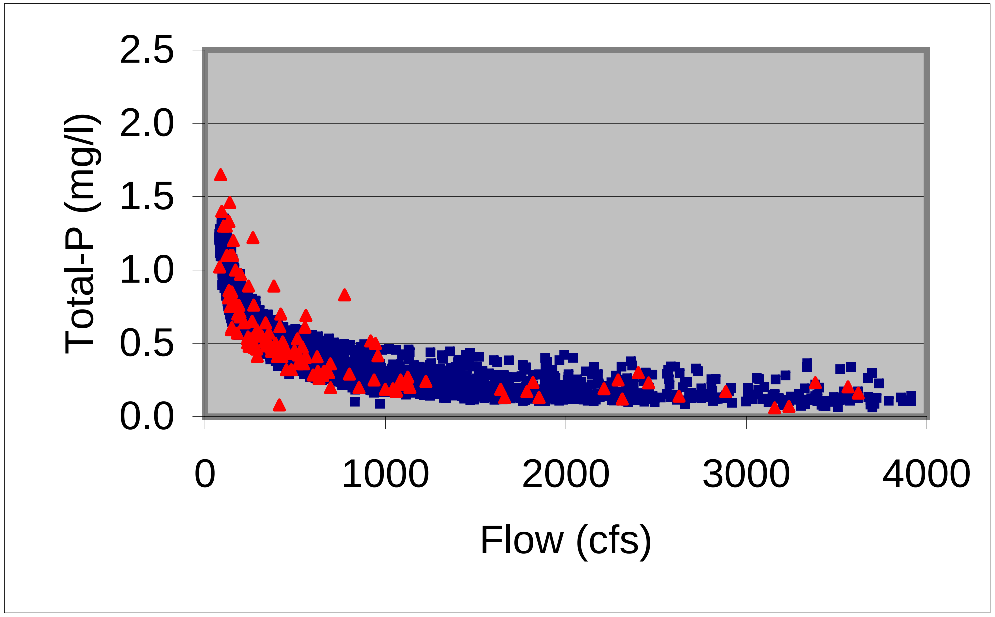


Figure 3.5a: Mass Balance Simulation of Total Phosphorus for the Passaic River at Two Bridges -- Station 01382000 (1992-2002)

▲ Observed Data ▪ / ─── Model Projection



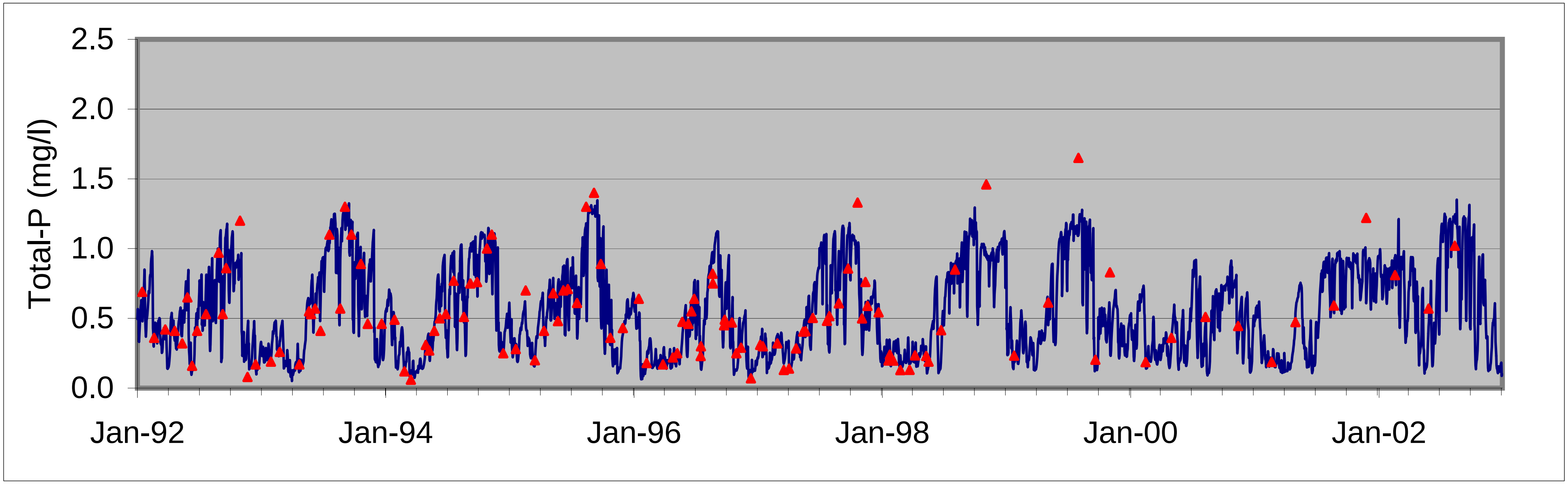
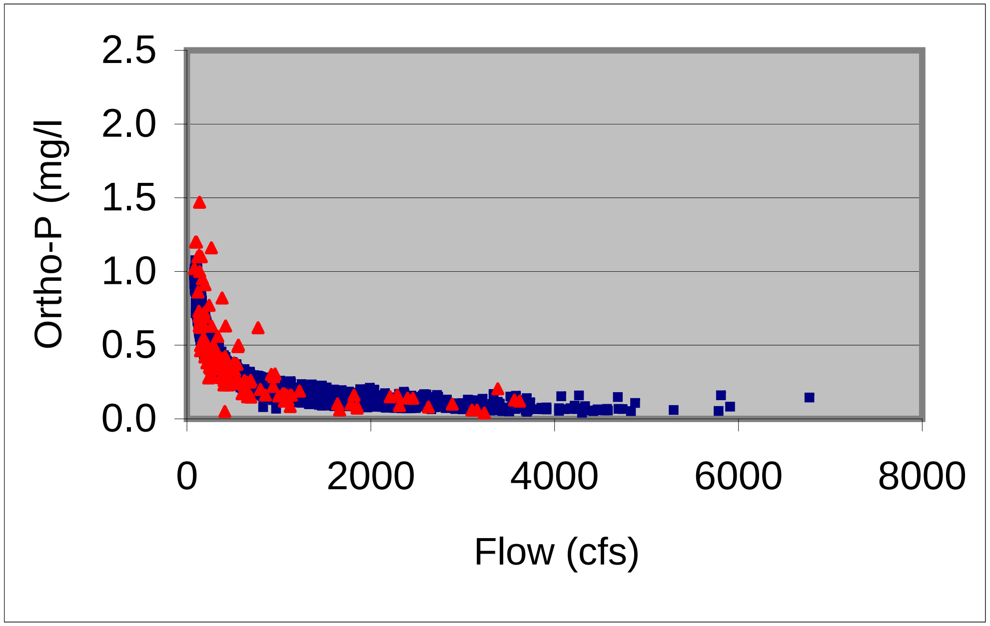


Figure 3.5b: Mass Balance Simulation of Ortho-Phosphorus for the Passaic River at Two Bridges -- Station 01382000 (1992-2002)

▲ Observed Data ■ / ▬ Model Projection



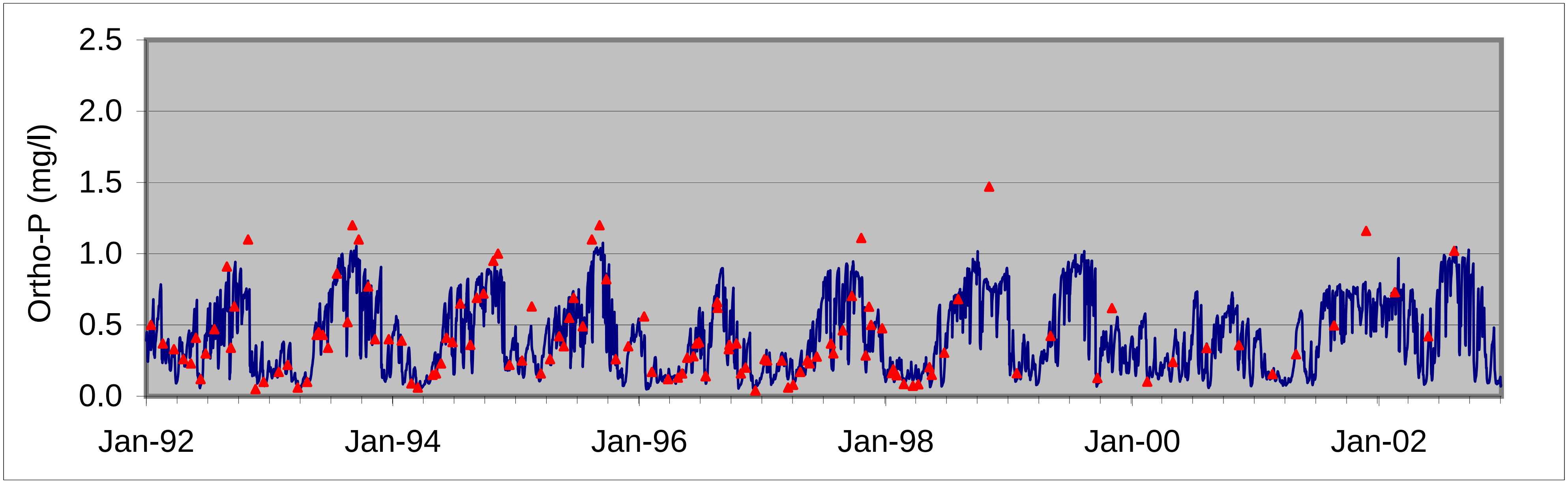
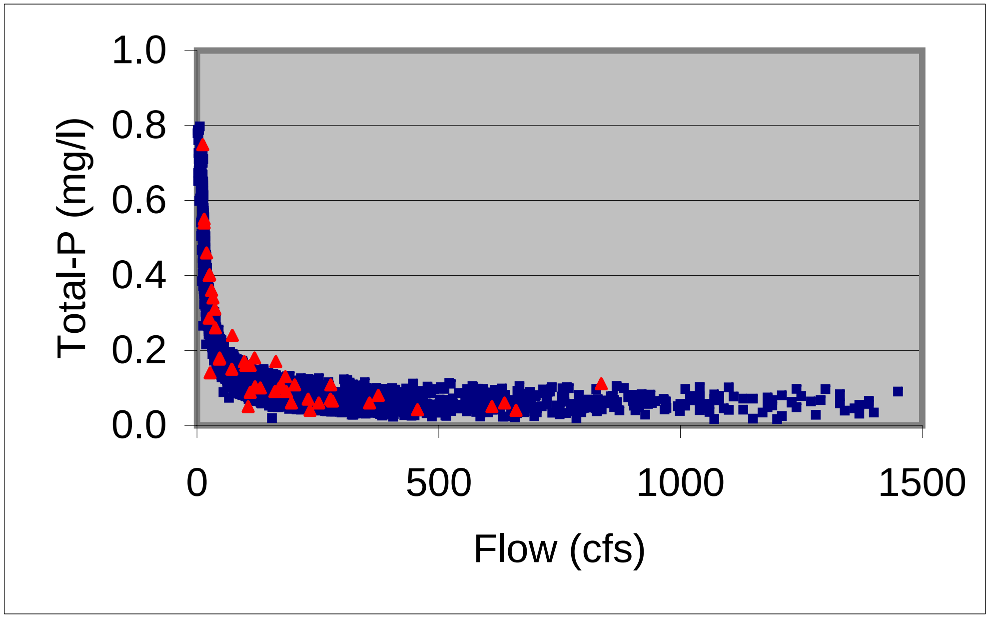


Figure 3.6a: Mass Balance Simulation of Total Phosphorus for the Ramapo River at Mahwah -- Station 01387500 (1992-2002)

Observed Data ▪/ —— Model Projection



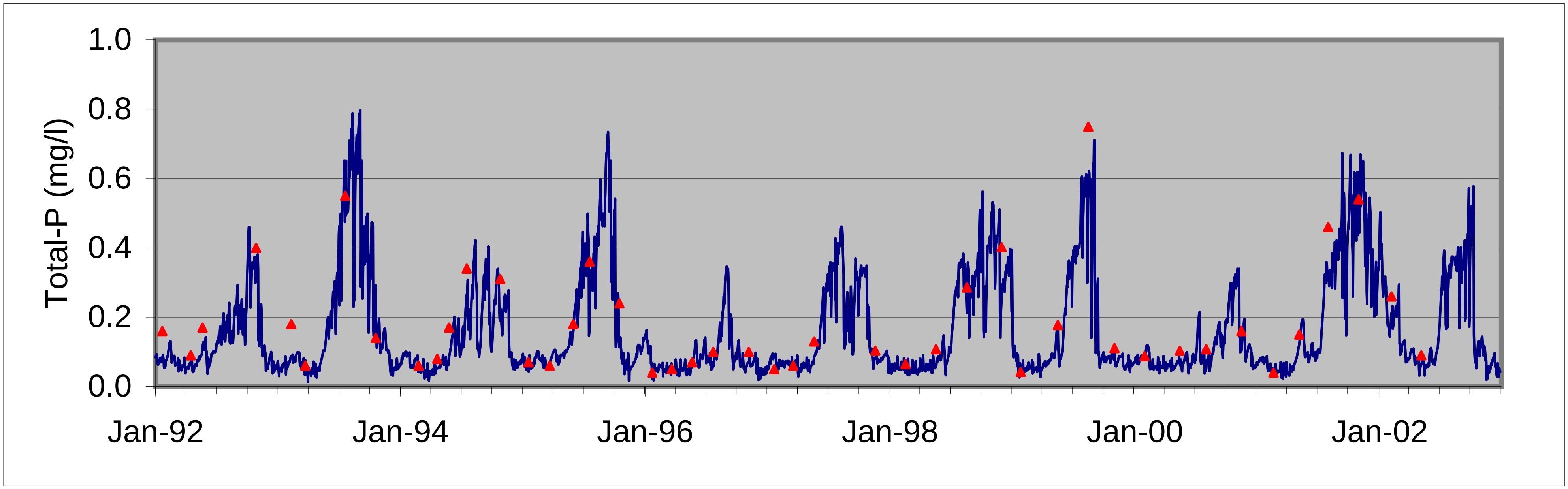
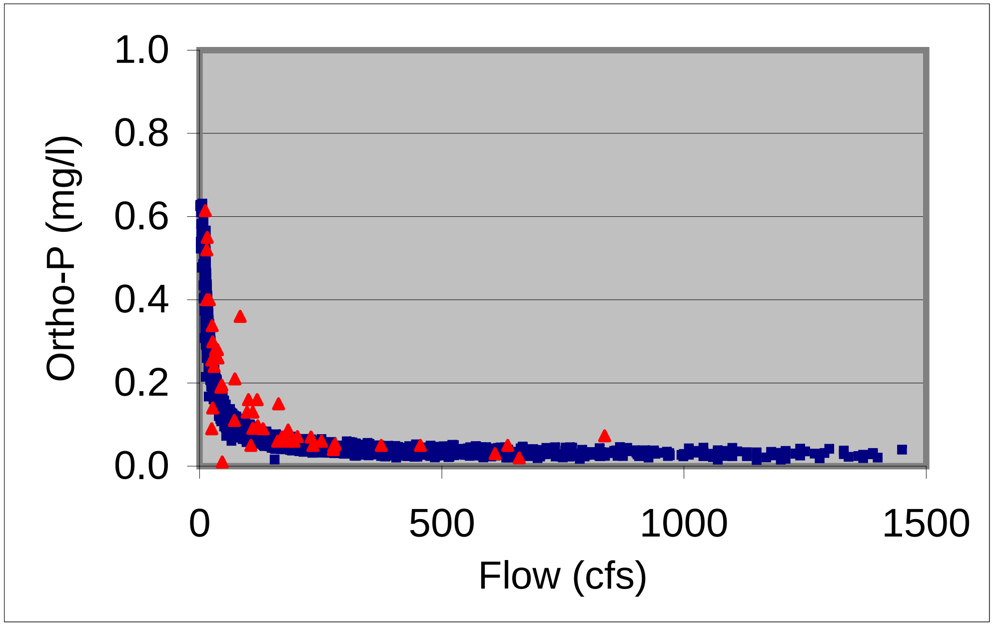


Figure 3.6b: Mass Balance Simulation of Ortho-Phosphorus for the Ramapo River at Mahwah -- Station 01387500 (1992-2002)

▲ Observed Data ▪/ ━ Model Projection



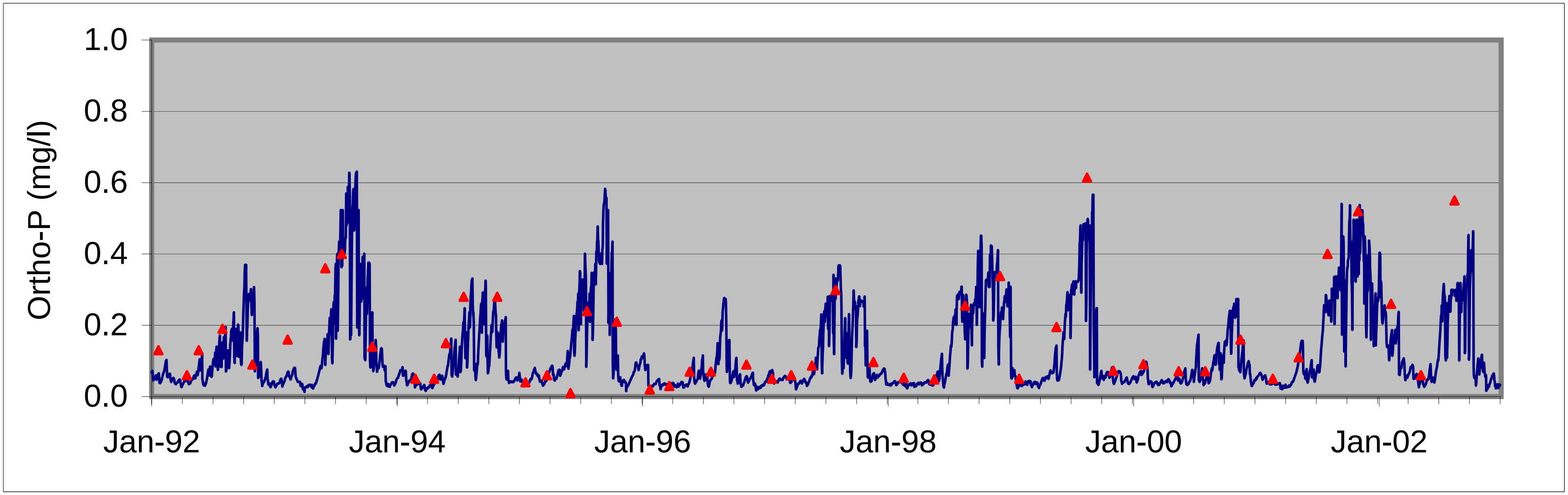
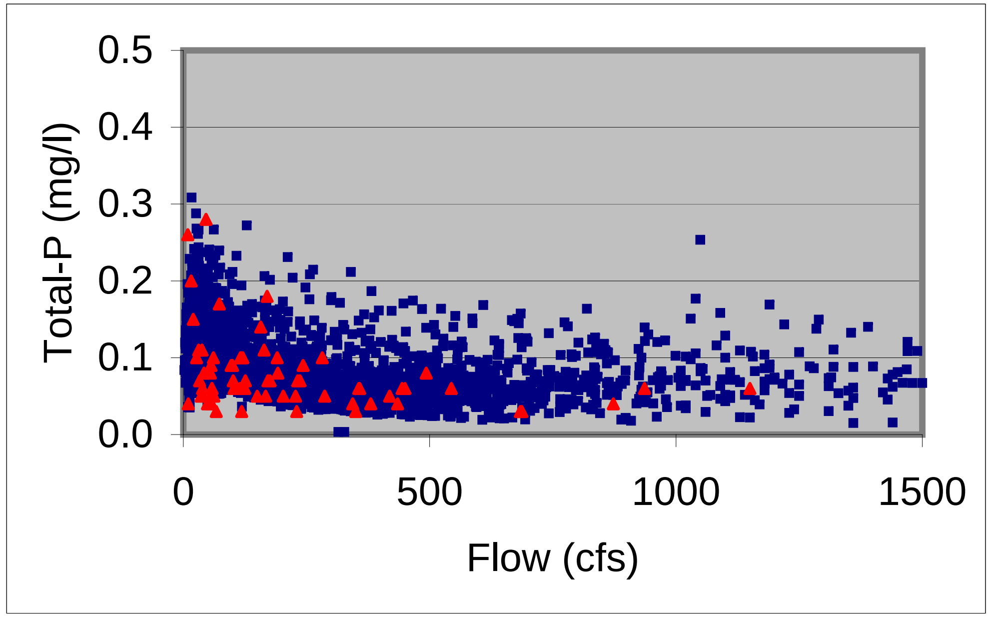


Figure 3.7a: Mass Balance Simulation of Total Phosphorus for the Ramapo River at Pompton Lakes -- Station 01388000 (1992-2002)

▲ Observed Data ▪ / ―― Model Projection



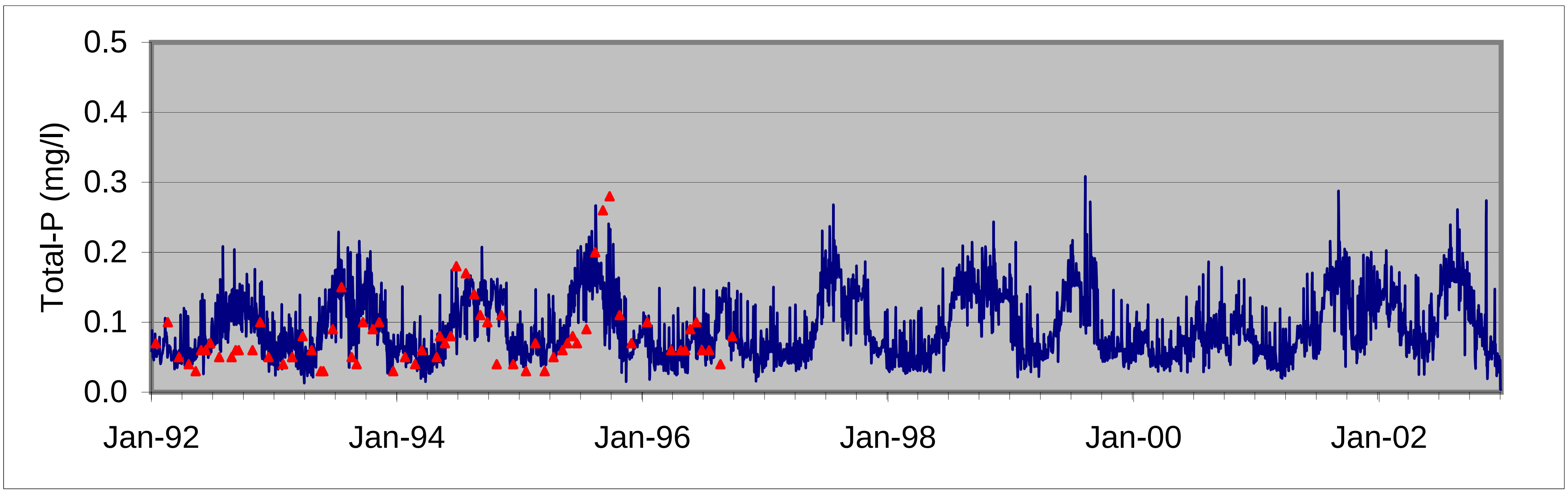
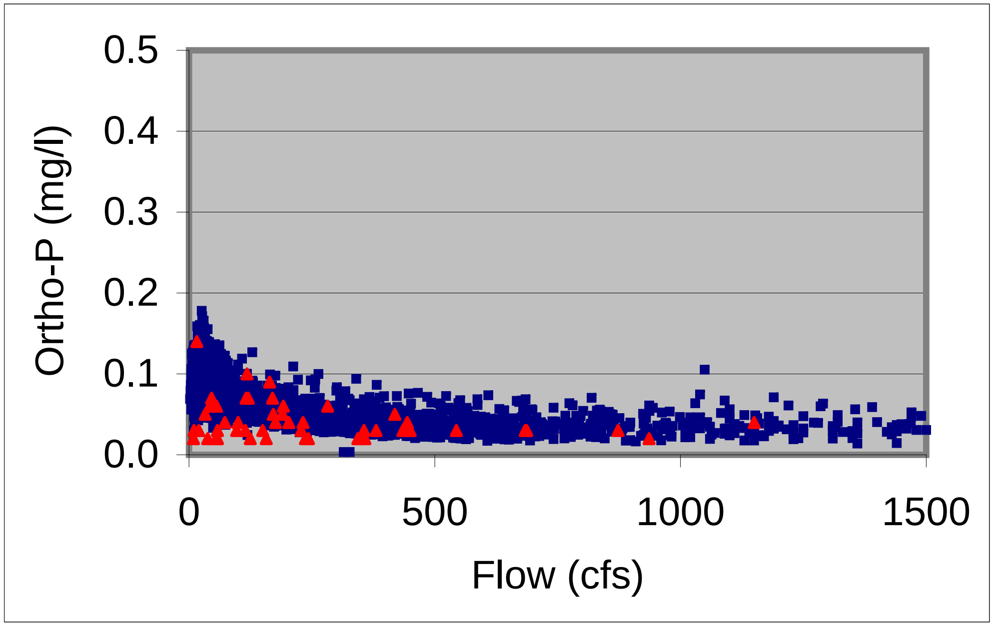


Figure 3.7b: Mass Balance Simulation of Ortho-Phosphorus for the Ramapo River at Pompton Lakes -- Station 01388000 (1992-2002)

▲ Observed Data ▪ / ── Model Projection



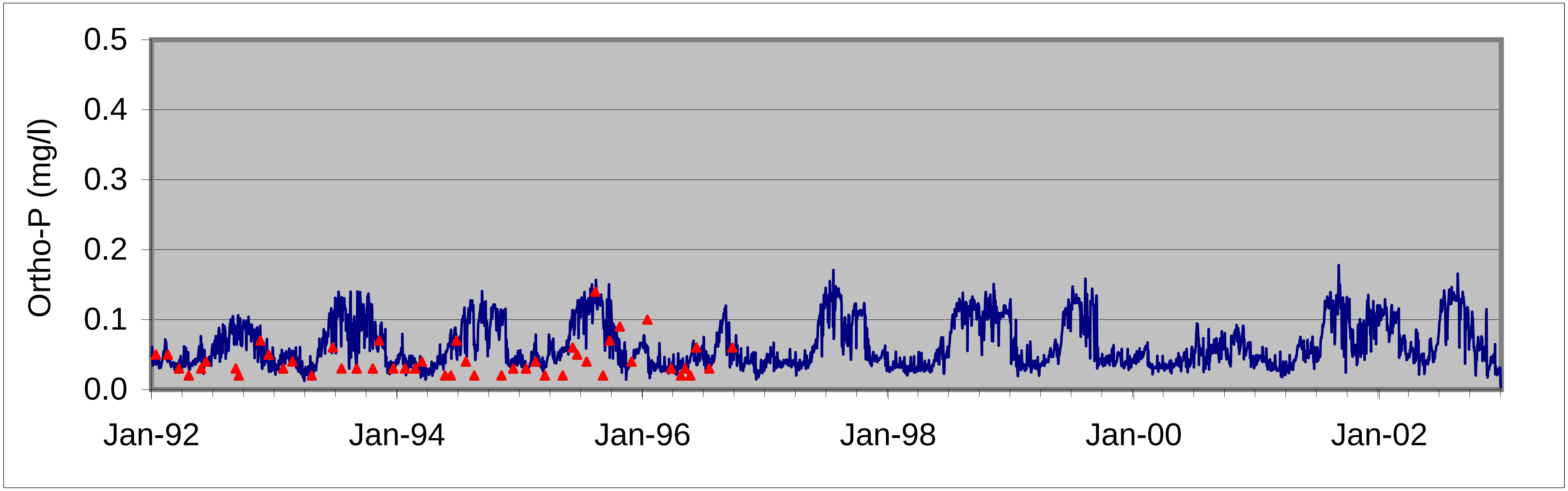
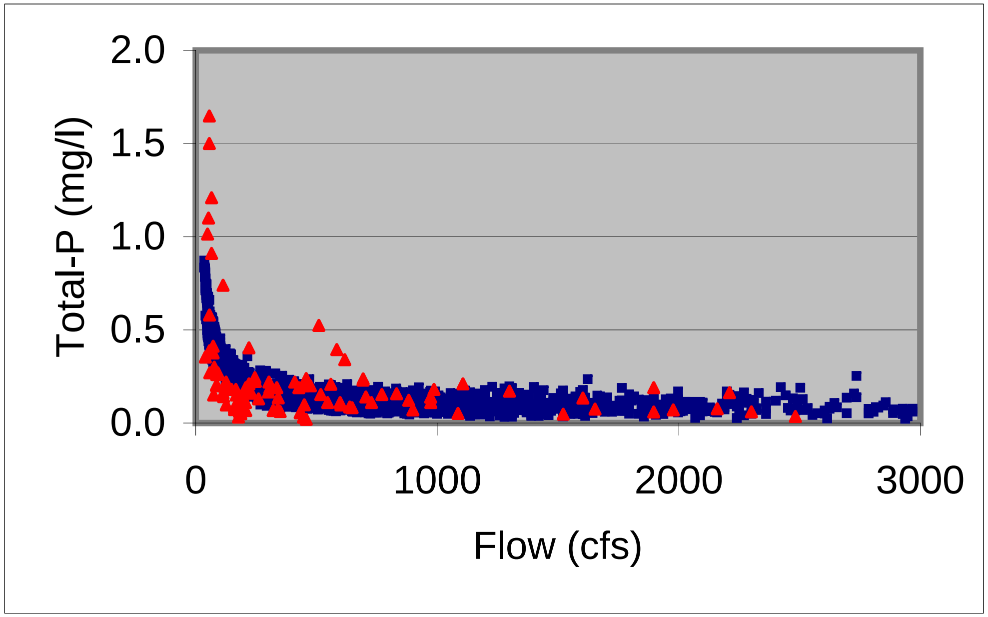


Figure 3.8a: Mass Balance Simulation of Total Phosphorus for the Pompton River at Two Bridges -- Station 01388600 (1992-2002)

▲ Observed Data ▪ / ▬ Model Projection



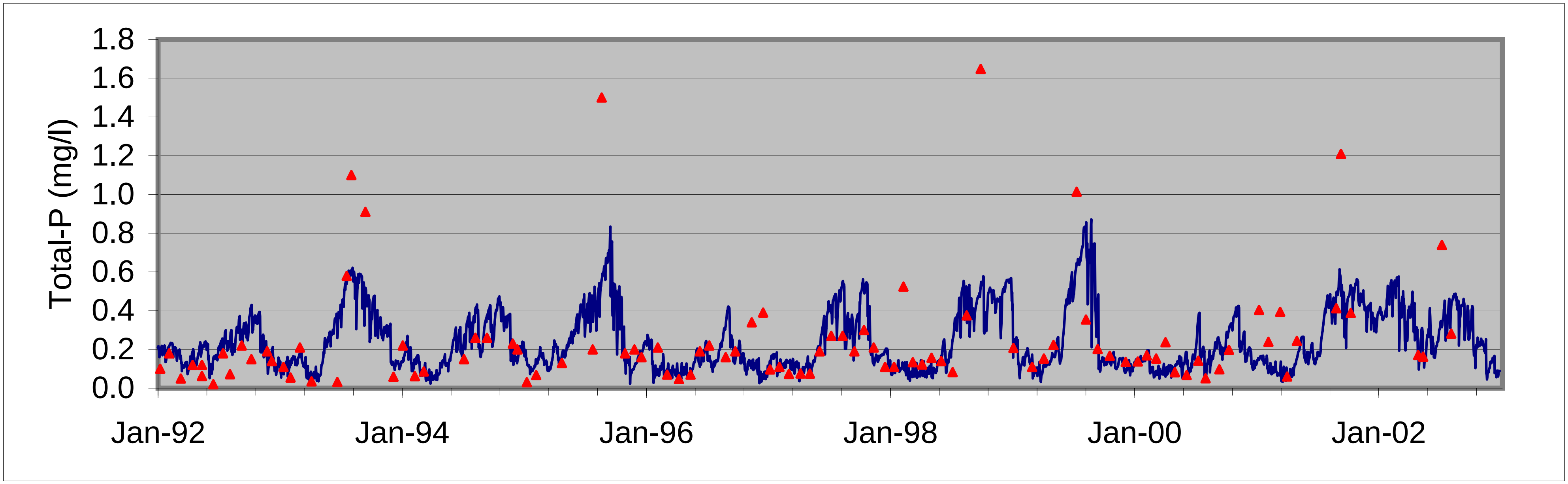
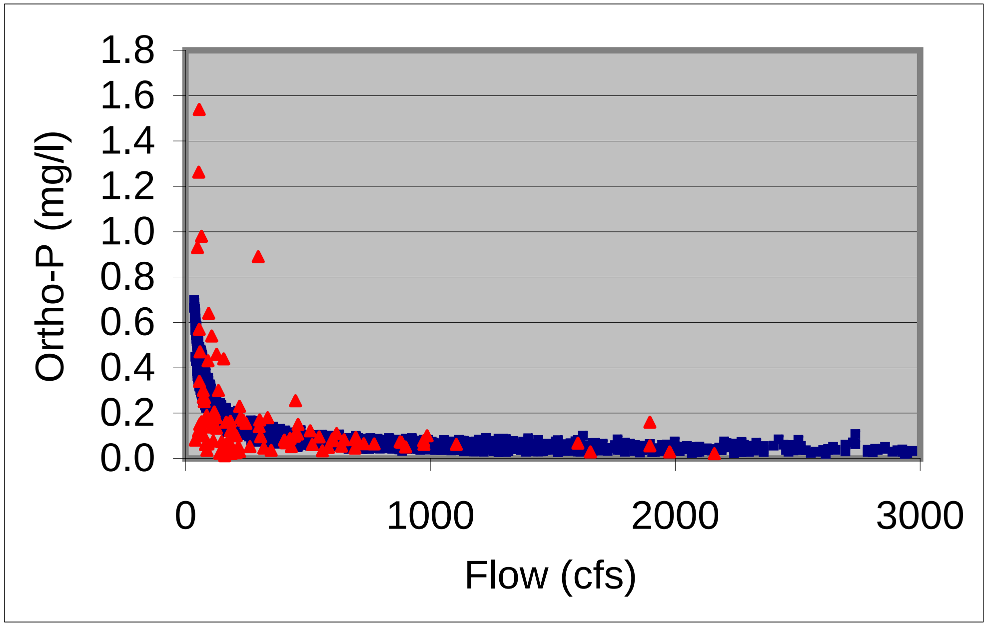


Figure 3.8b: Mass Balance Simulation of Ortho-Phosphorus for the Pompton River at Two Bridges -- Station 01388600 (1992-2002)

▲ Observed Data ▪ / ▬ Model Projection



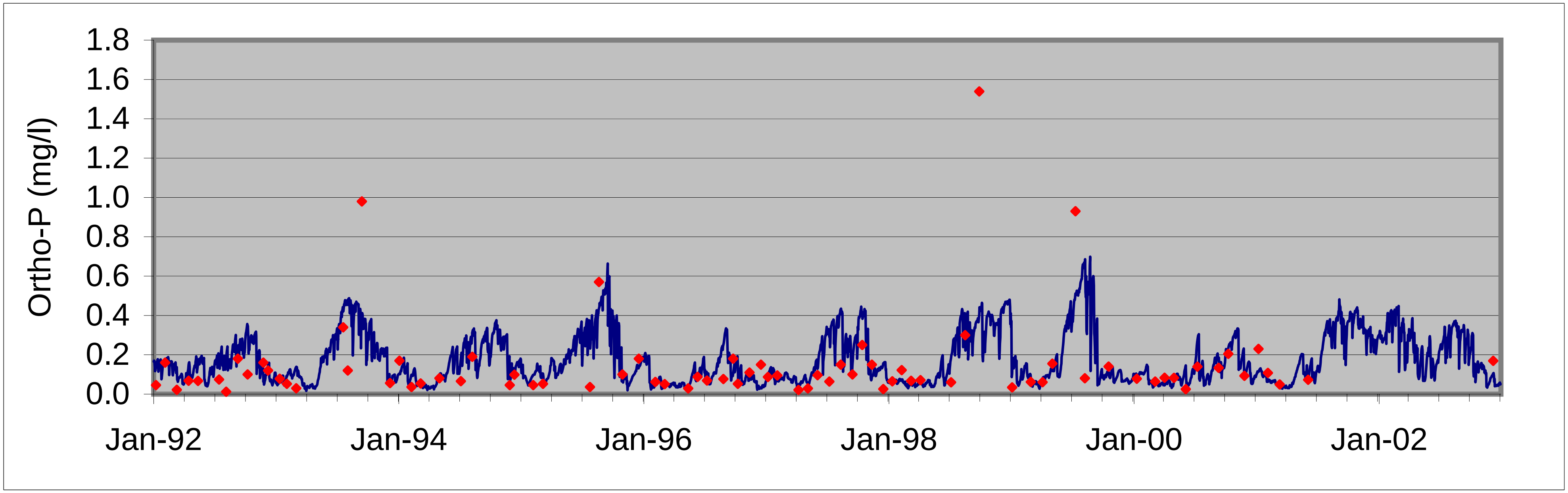
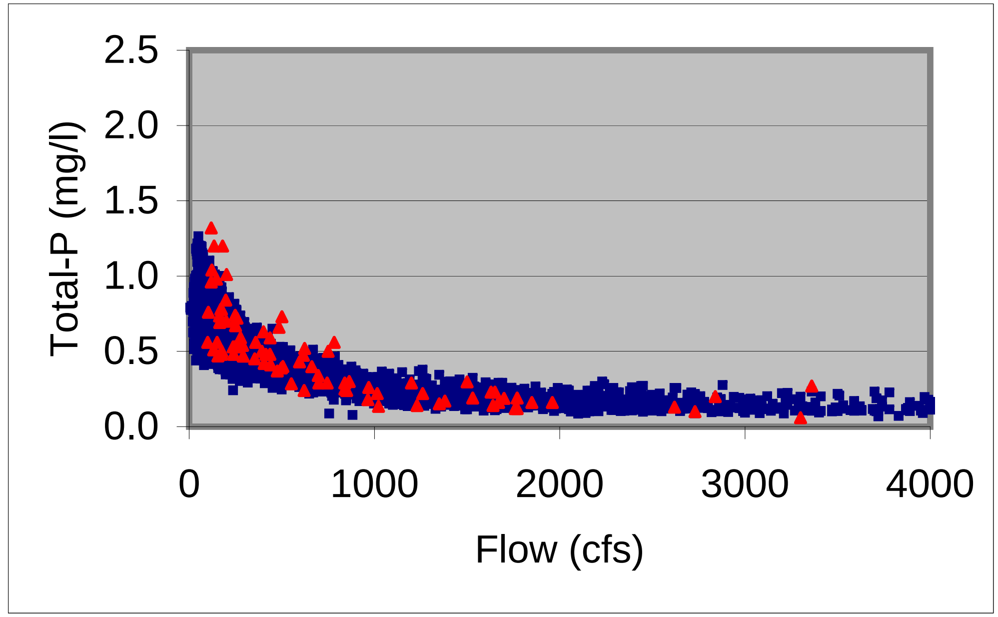


Figure 3.9a: Mass Balance Simulation of Total Phosphorus for the Passaic River at Little Falls -- Station 01389500 (1992-2002)

▲ Observed Data ▪ / ▬ Model Projection



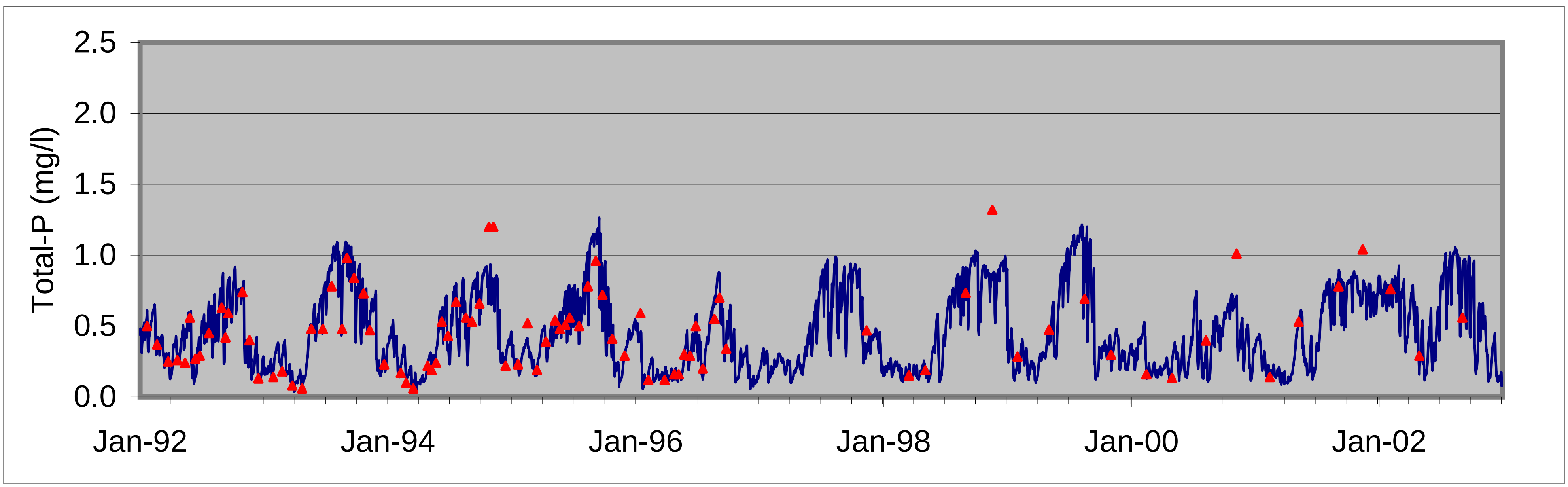
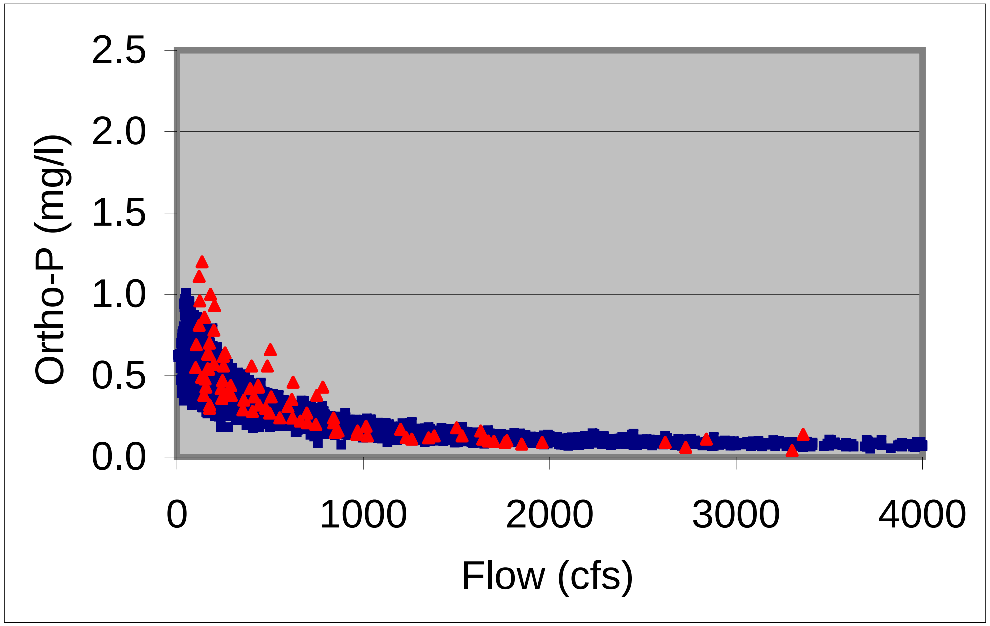


Figure 3.9b: Mass Balance Simulation of Ortho-Phosphorus for the Passaic River at Little Falls -- Station 01389500 (1992-2002)

▲ Observed Data ▪ / ── Model Projection



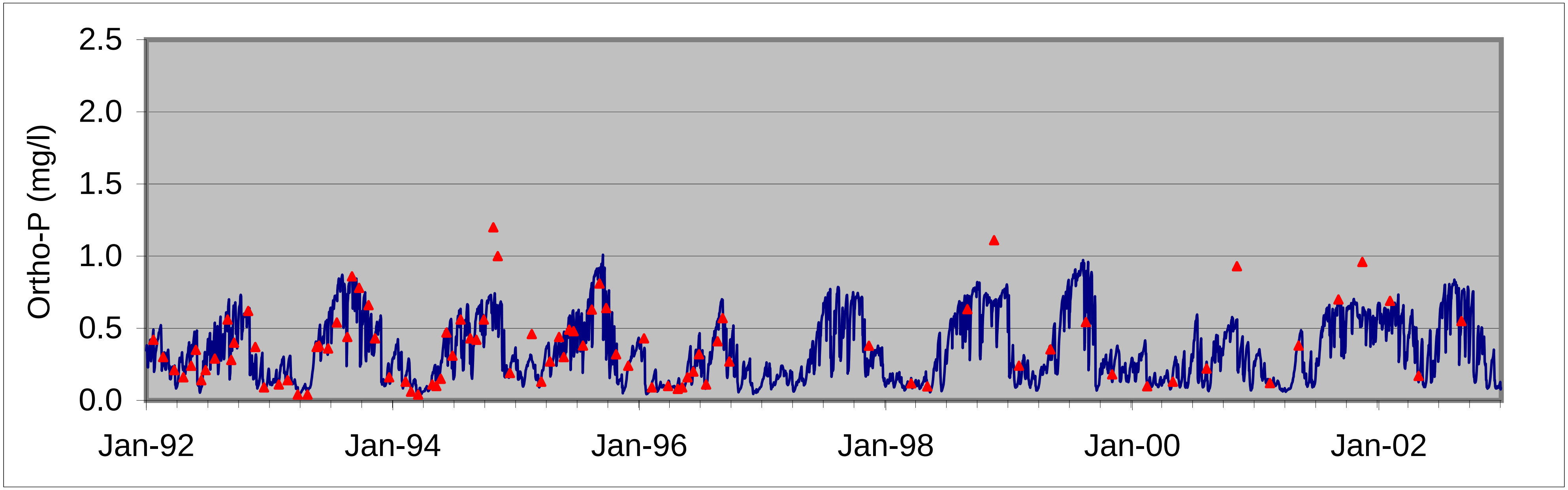


Figure 3.10: Cumulative Frequency Distribution for Passaic River at Chatham

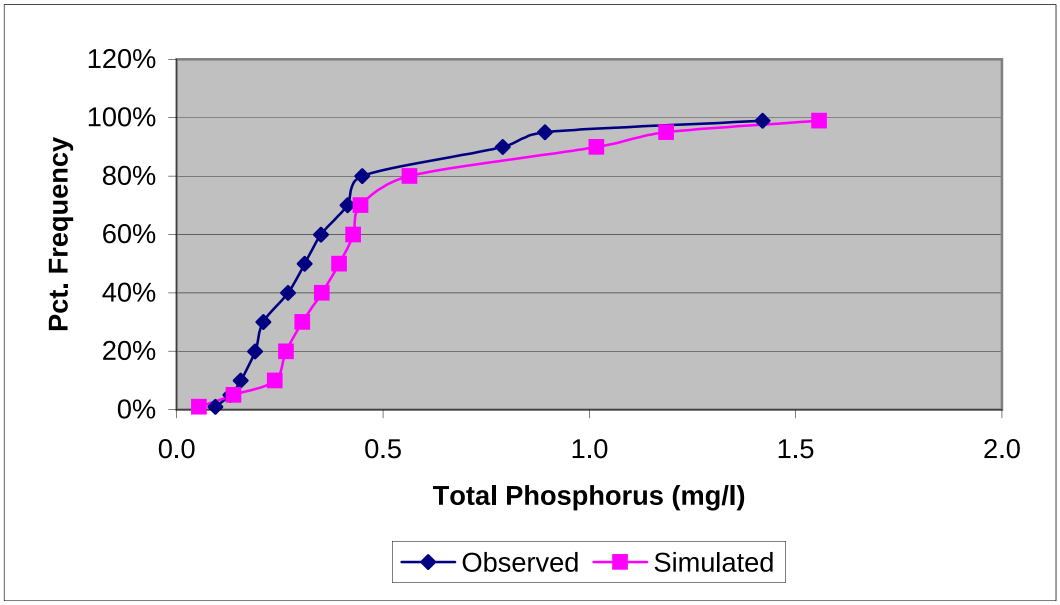


Figure 3.11: Cumulative Frequency Distribution for Rockaway River at Pine Brook

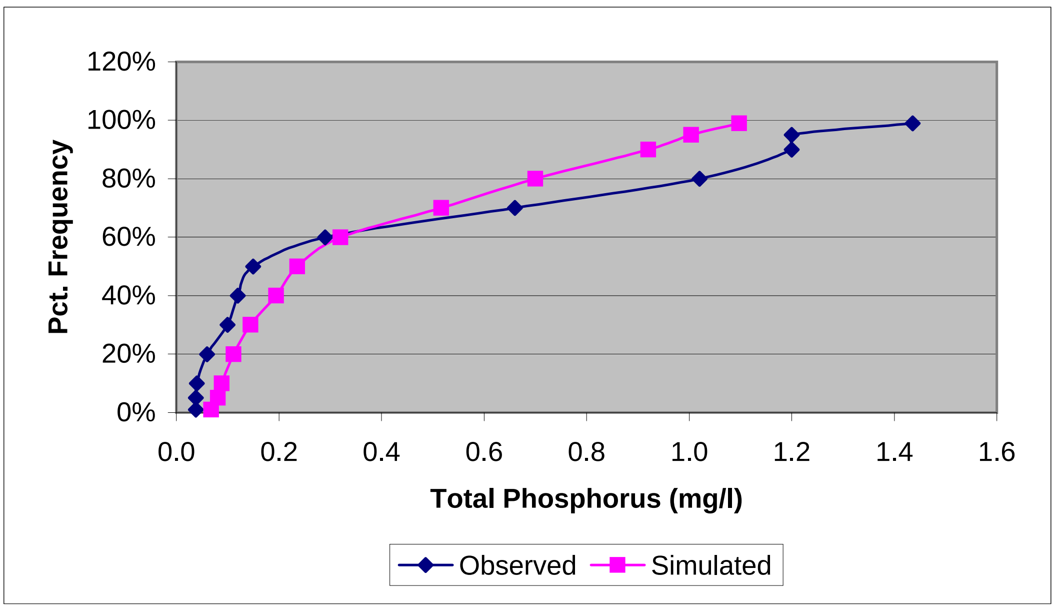


Figure 3.12: Cumulative Frequency Distribution for Whippany River at Pine Brook

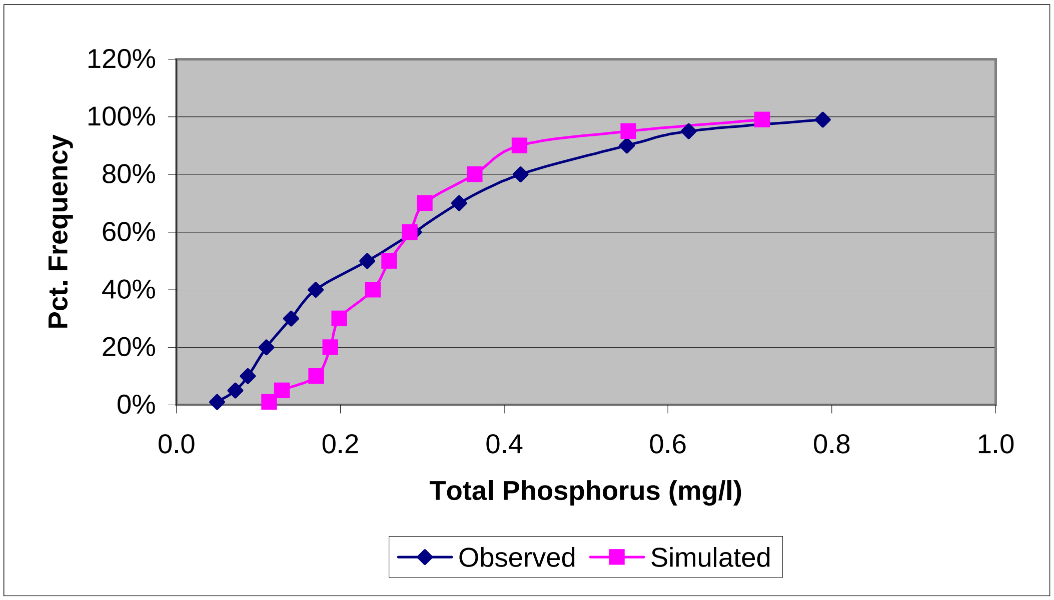


Figure 3.13: Cumulative Frequency Distribution for Passaic River at Two Bridges

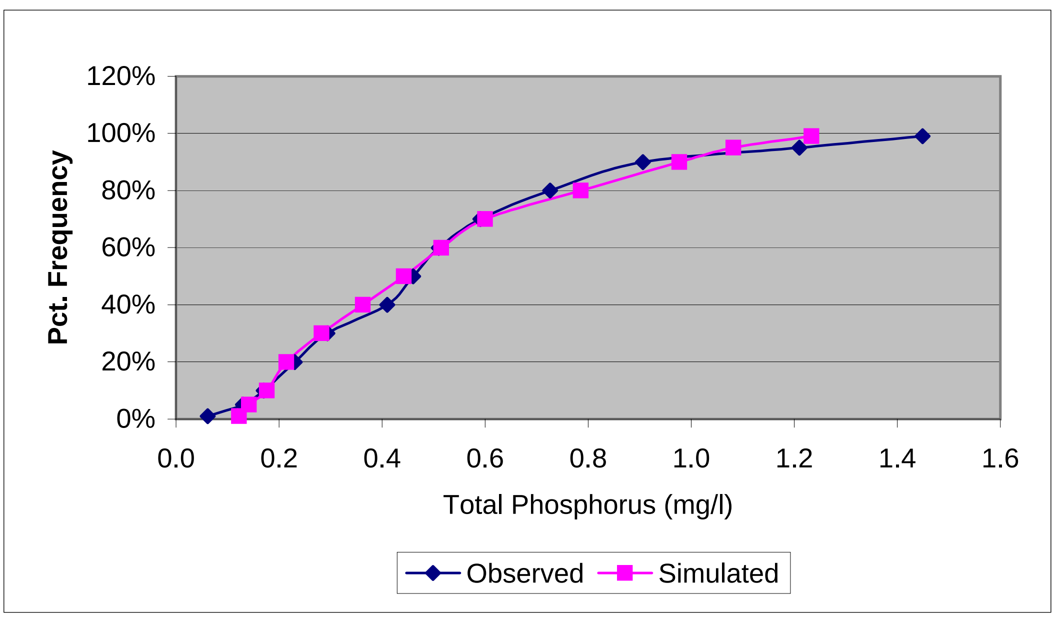


Figure 3.14: Cumulative Frequency Distribution for Ramapo River at Mahwah

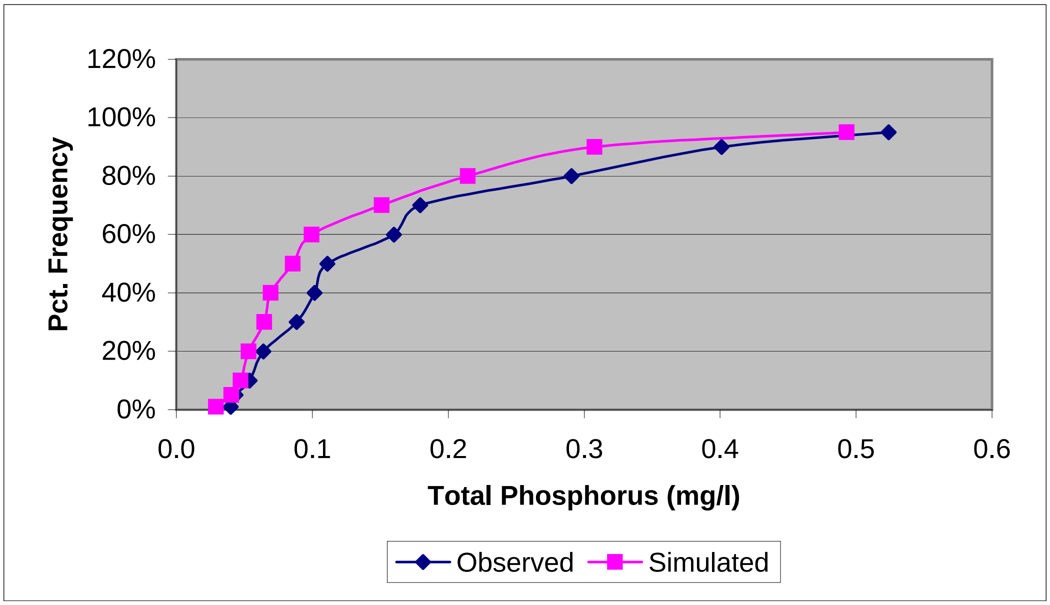


Figure 3.15: Cumulative Frequency Distribution for Ramapo River at Pompton Lakes

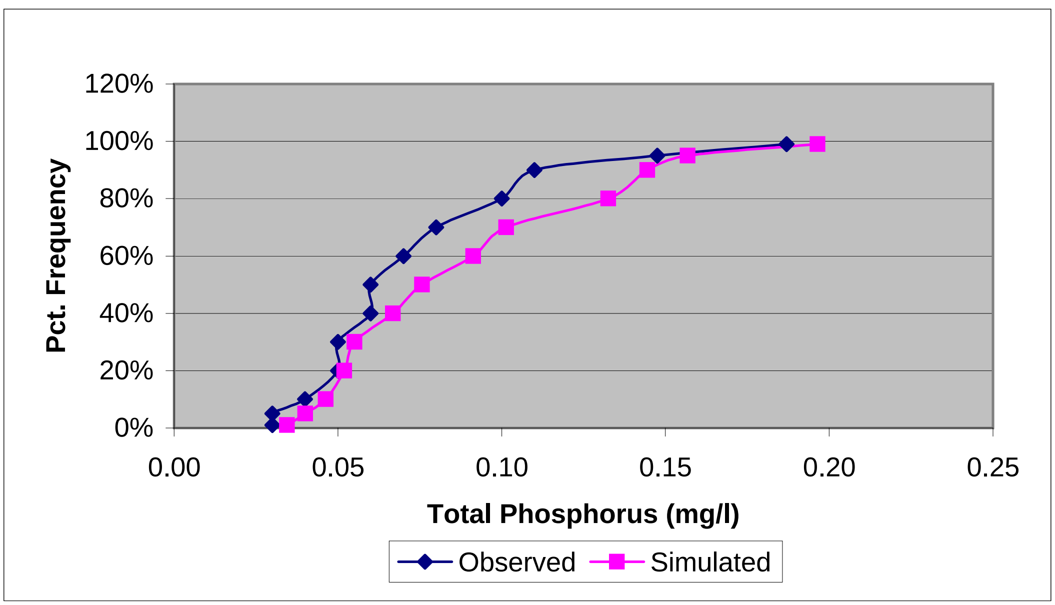


Figure 3.16: Cumulative Frequency Distribution for Pompton River at Two Bridges

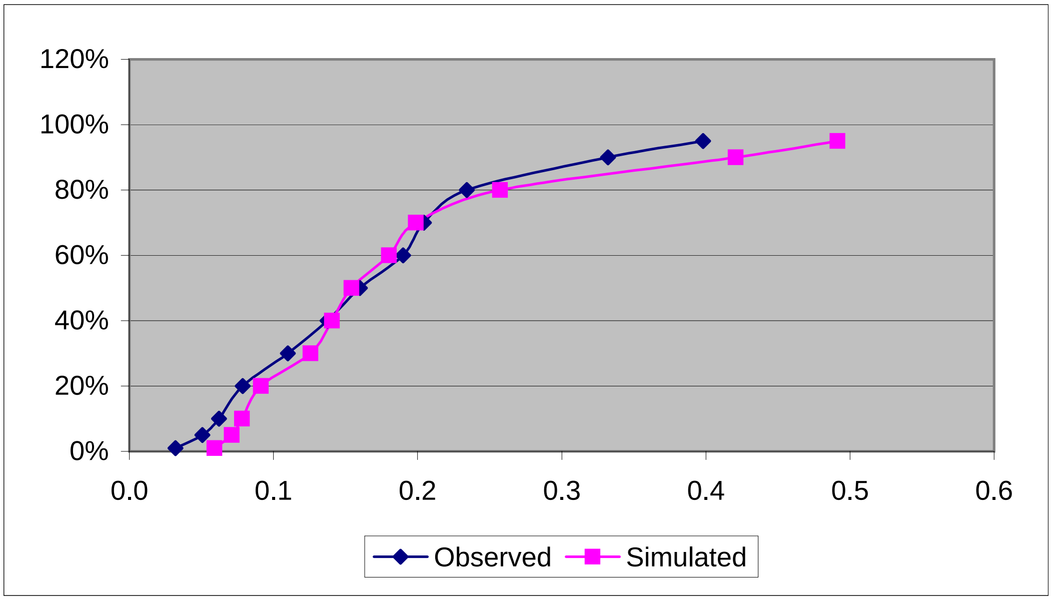


Figure 3.17: Cumulative Frequency Distribution for Passaic River at Little Falls

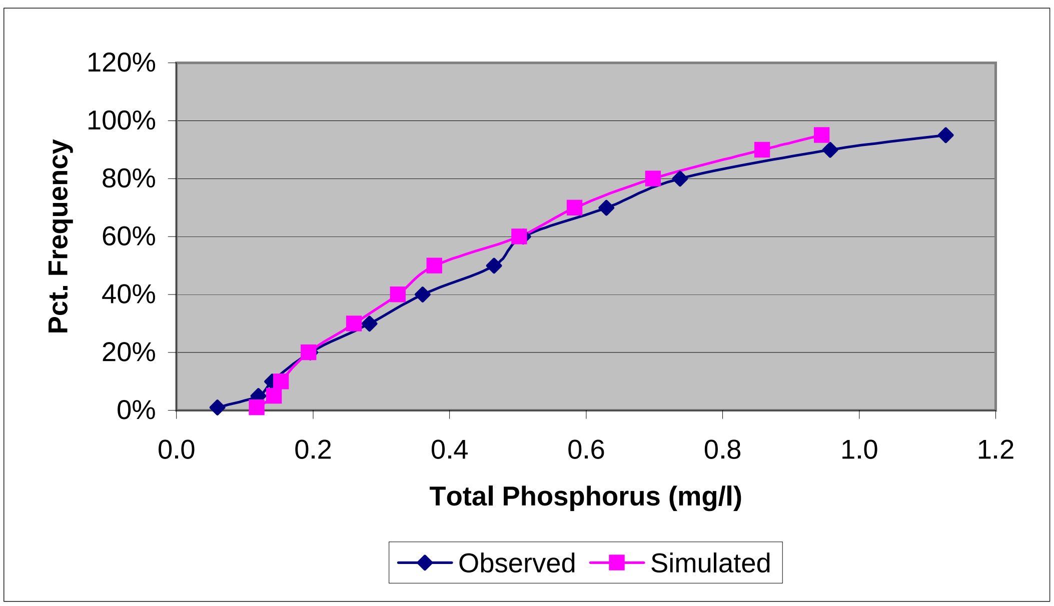


Figure 3.18: Correlation between Simulated and Observed Data for Passaic River at Chatham

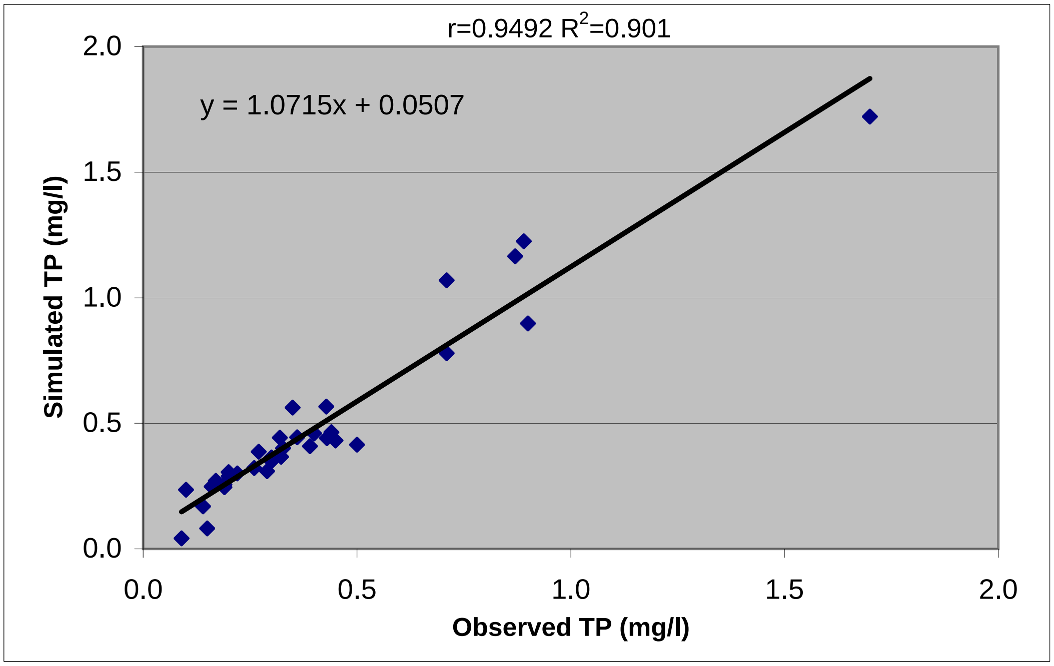


Figure 3.19: Correlation between Simulated and Observed Data for Rockaway River at Pine Brook

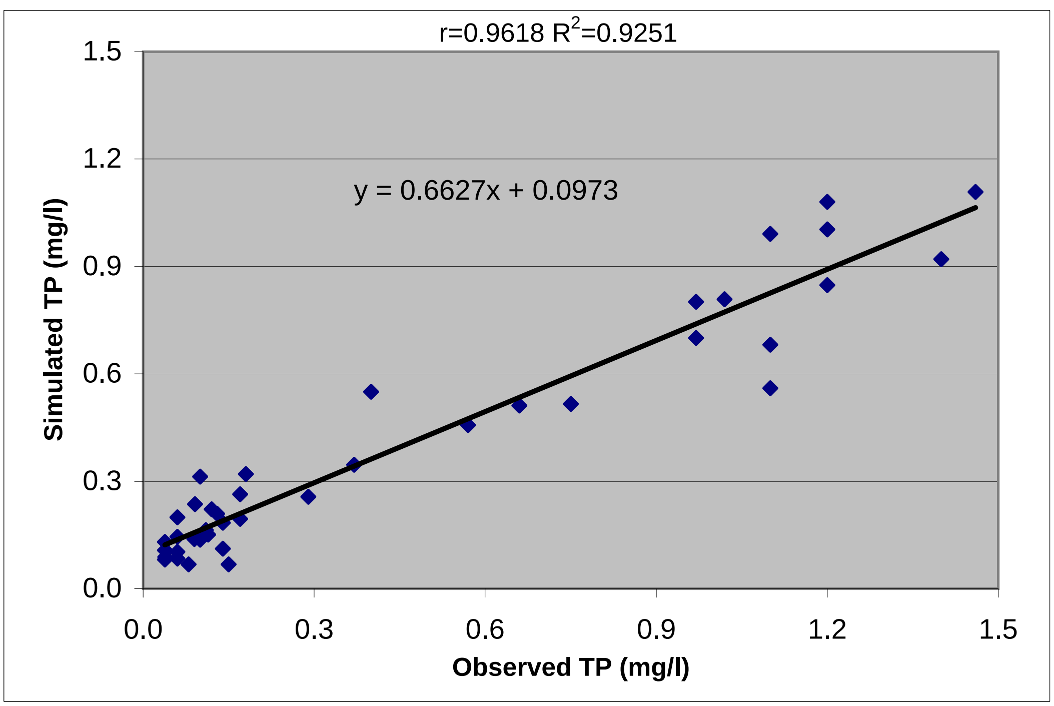


Figure 3.20: Correlation between Simulated and Observed Data for Whippany River at Pine Brook

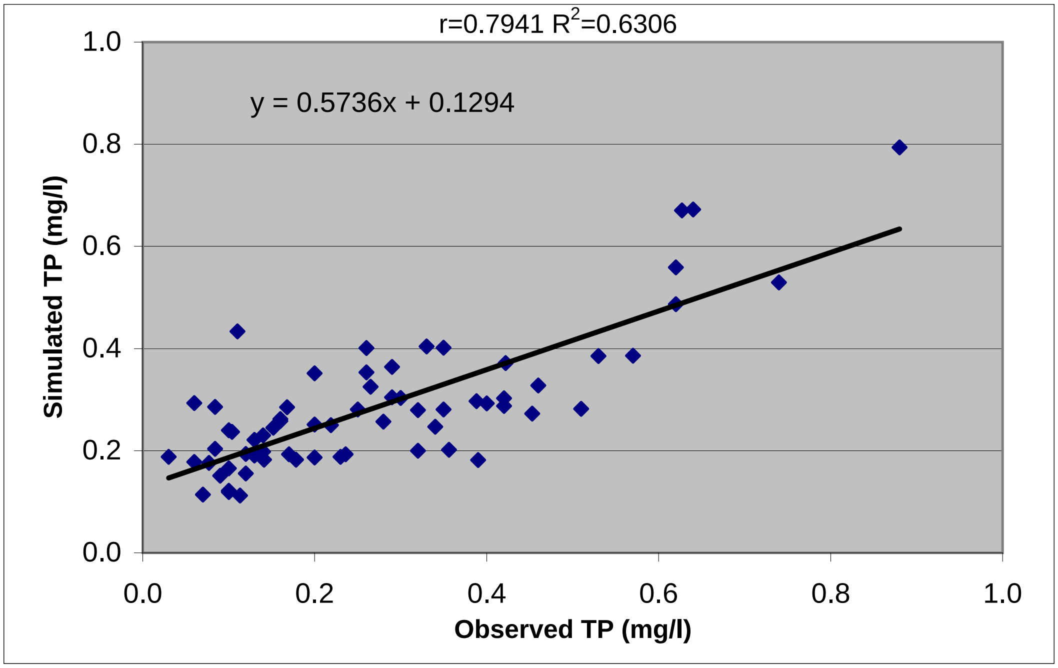


Figure 3.21: Correlation between Simulated and Observed Data for Passaic River at Two Bridges

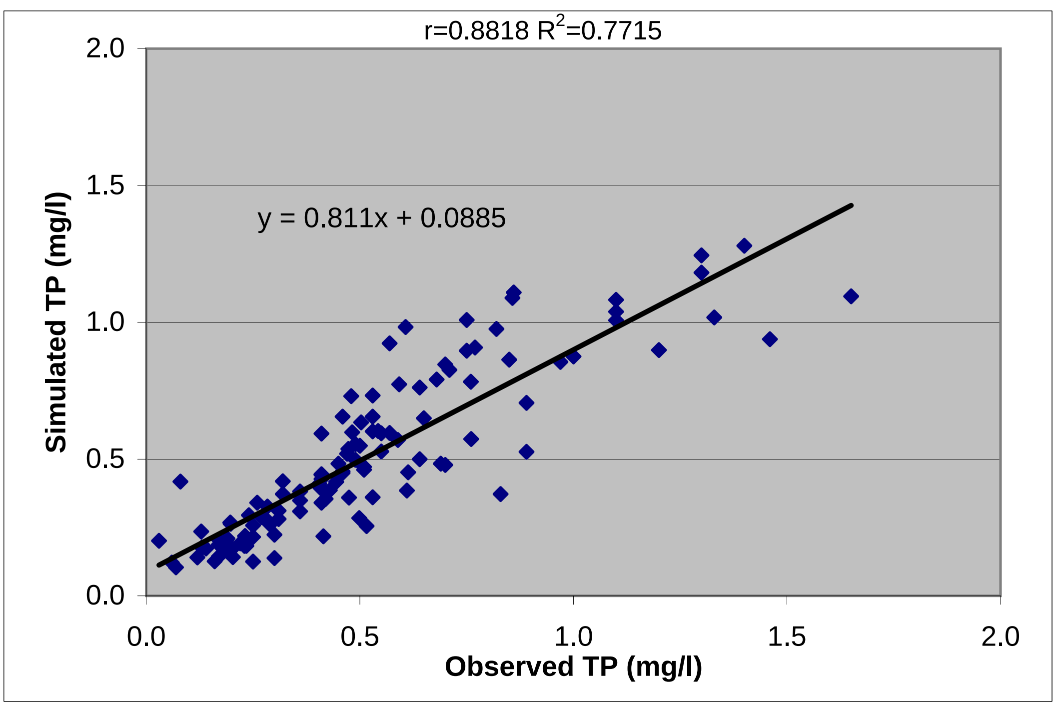


Figure 3.22: Correlation between Simulated and Observed Data for Ramapo River at Mahwah

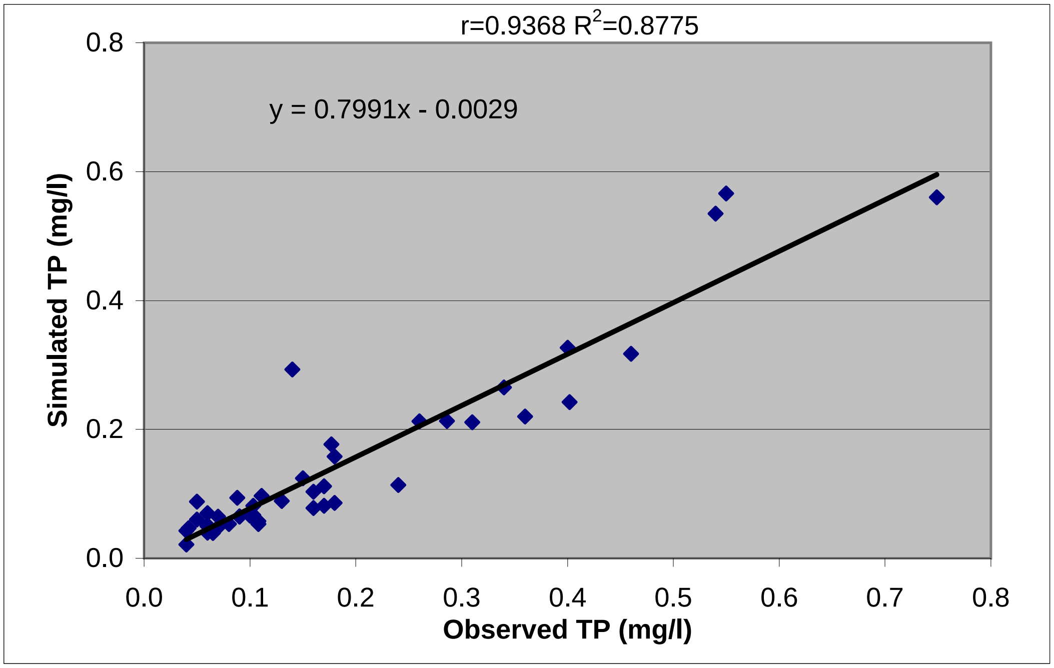


Figure 3.23: Correlation between Simulated and Observed Data for Ramapo River at Pompton Lakes

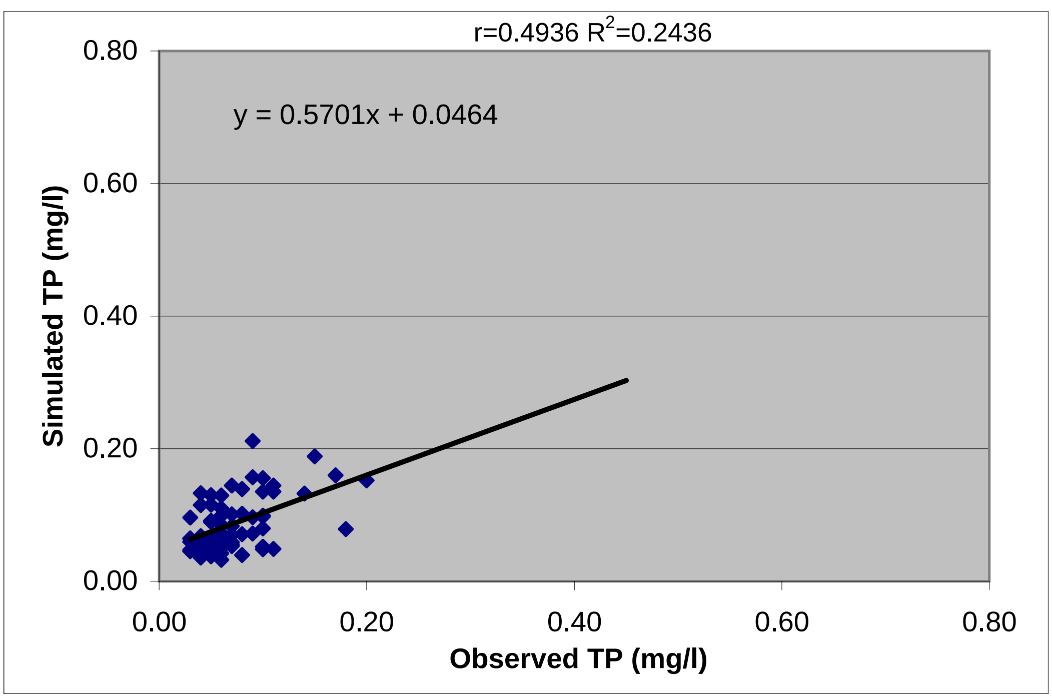


Figure 3.24: Correlation between Simulated and Observed Data for Pompton River at Two Bridges

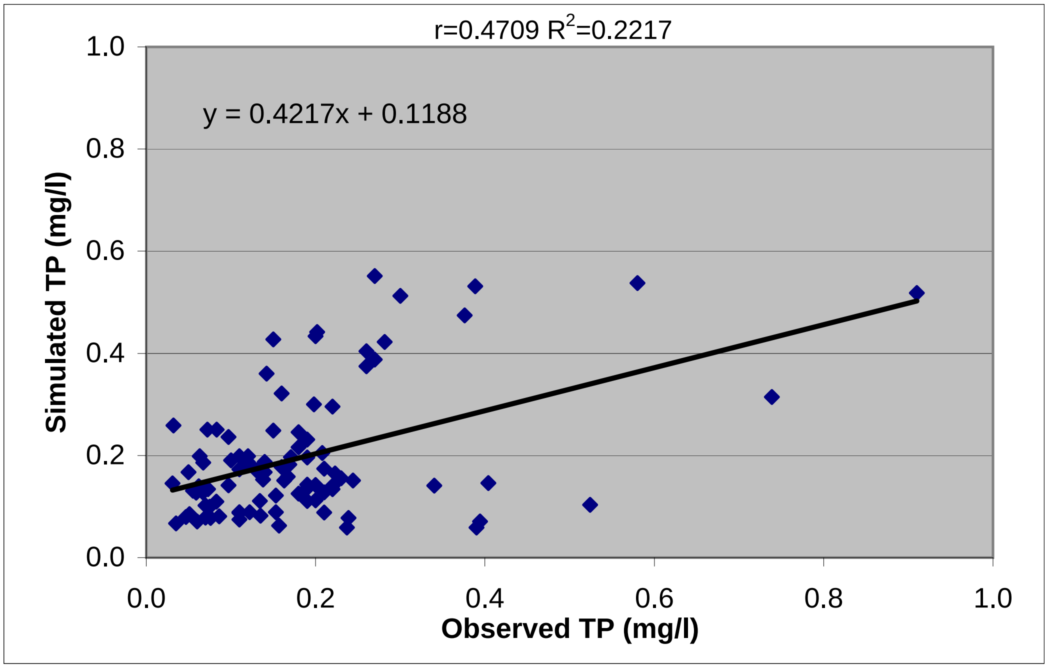


Figure 3.25: Correlation between Simulated and Observed Data for Passaic River at Little Falls

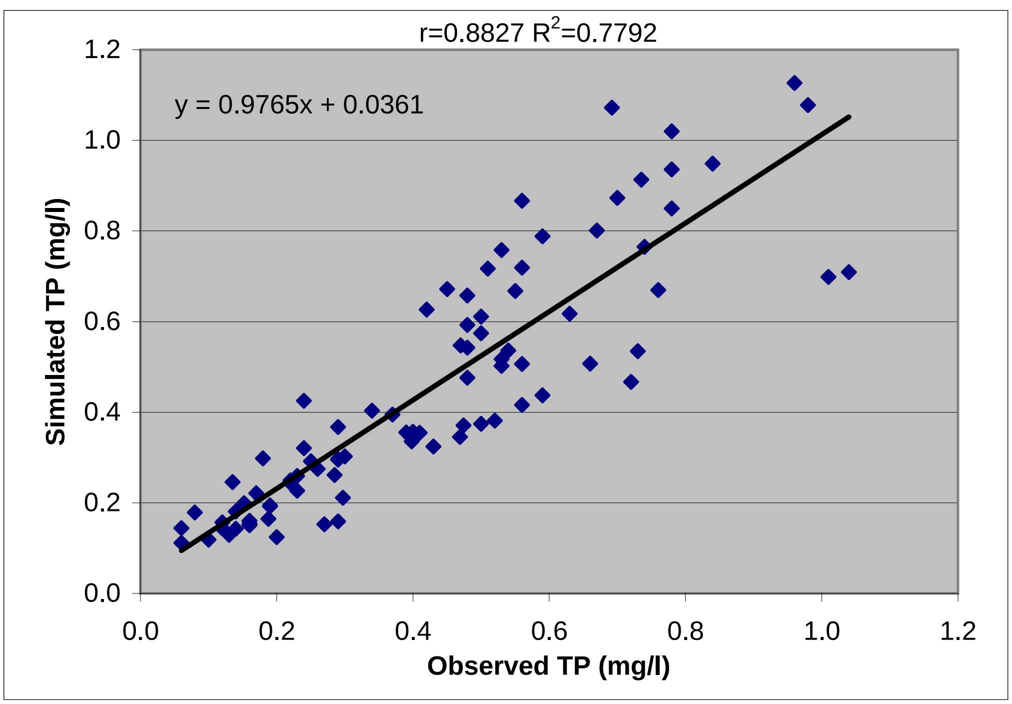
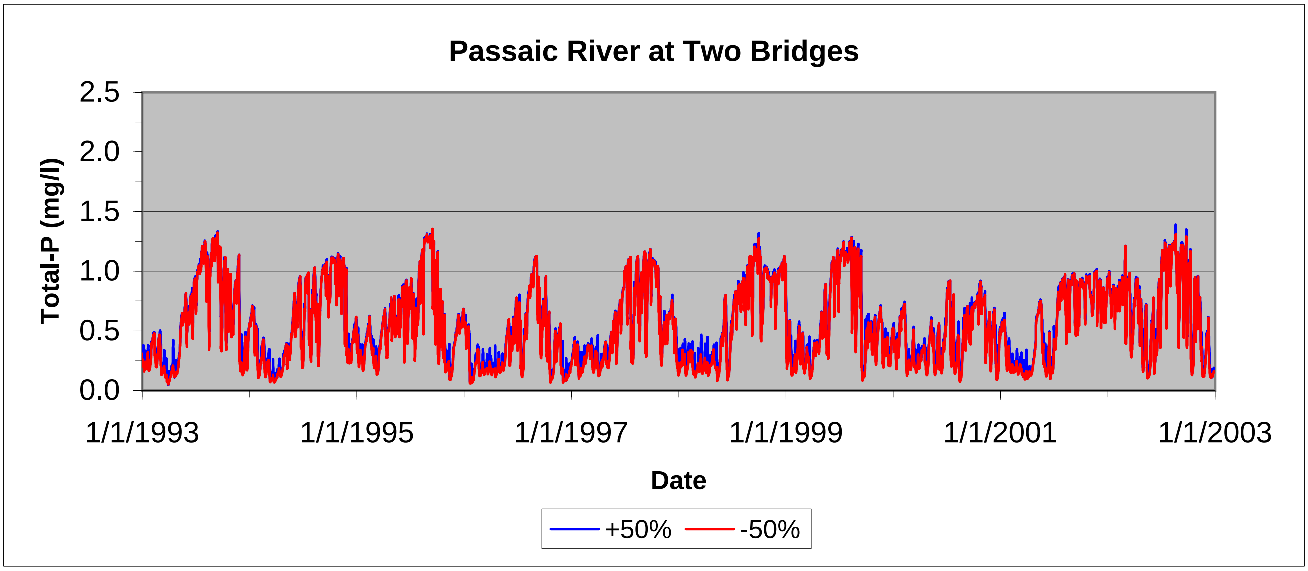
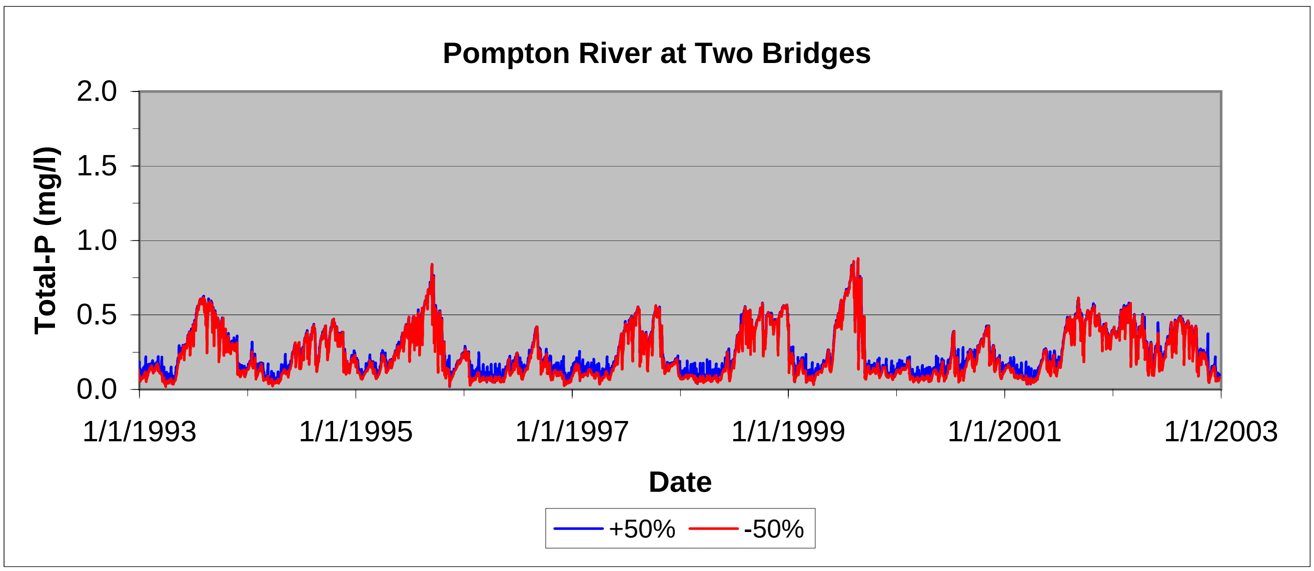


Figure 3.26: Model Sensitivity to Runoff Loads





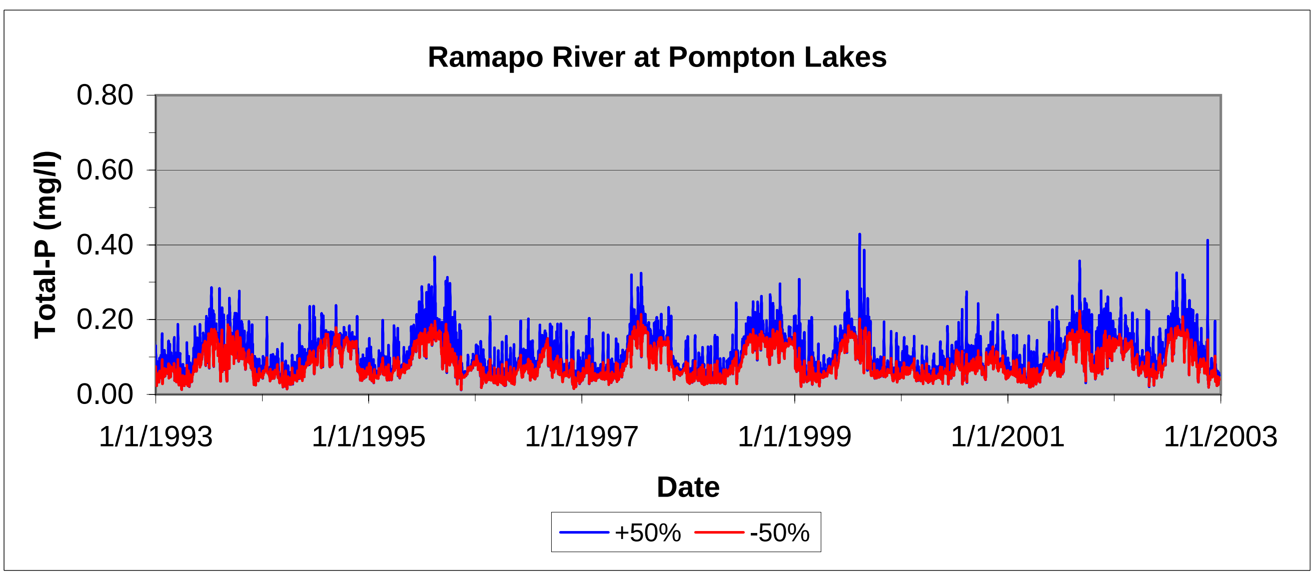
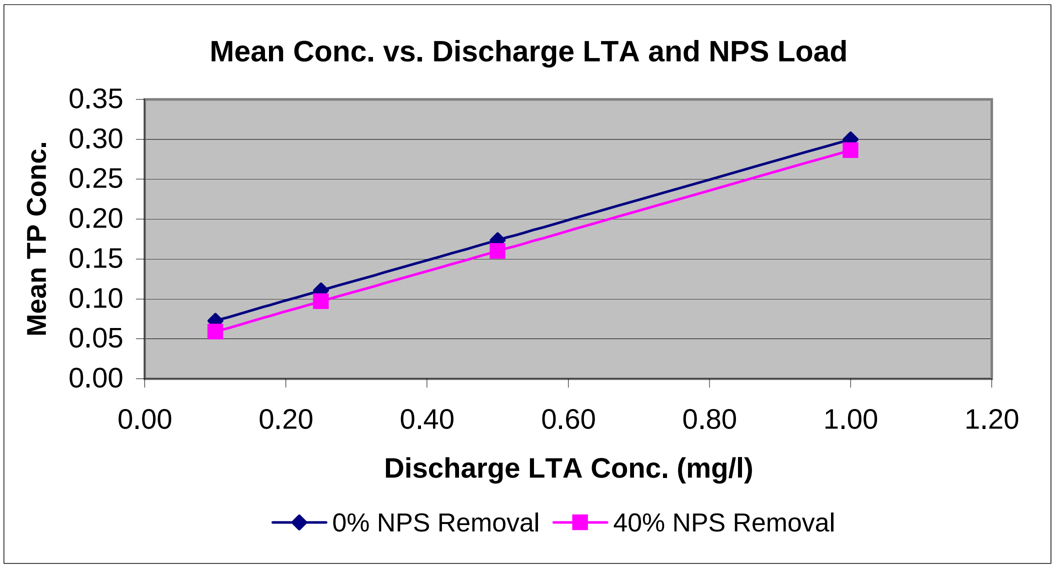
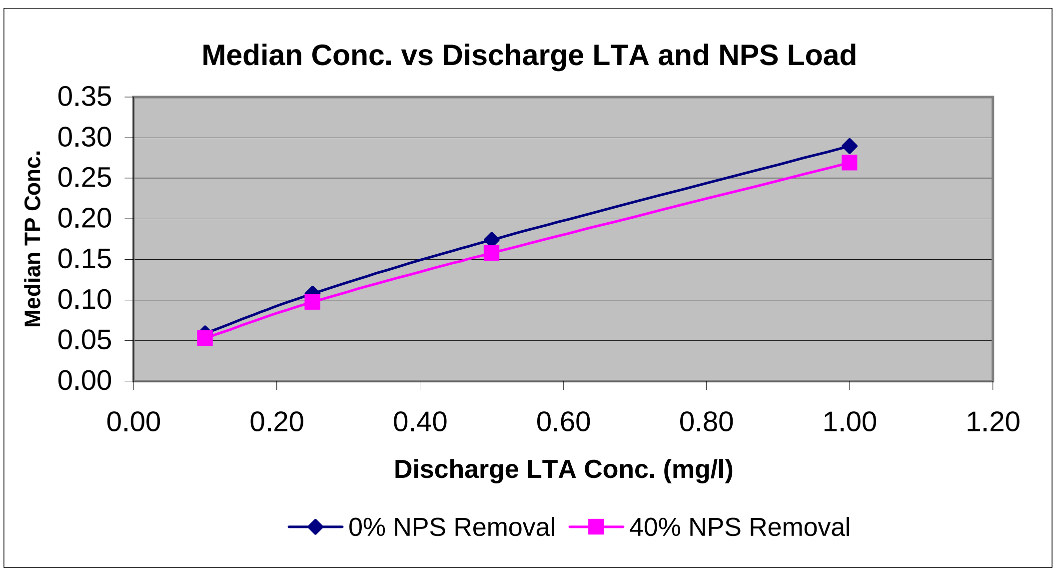


Figure 3.27: Sensitivity Analysis for Passaic River at Two Bridges





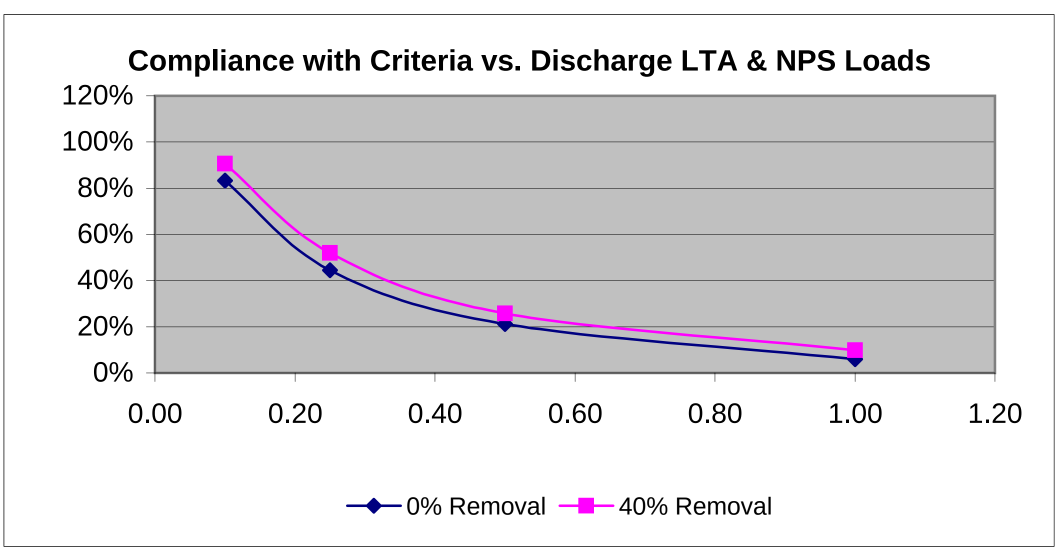
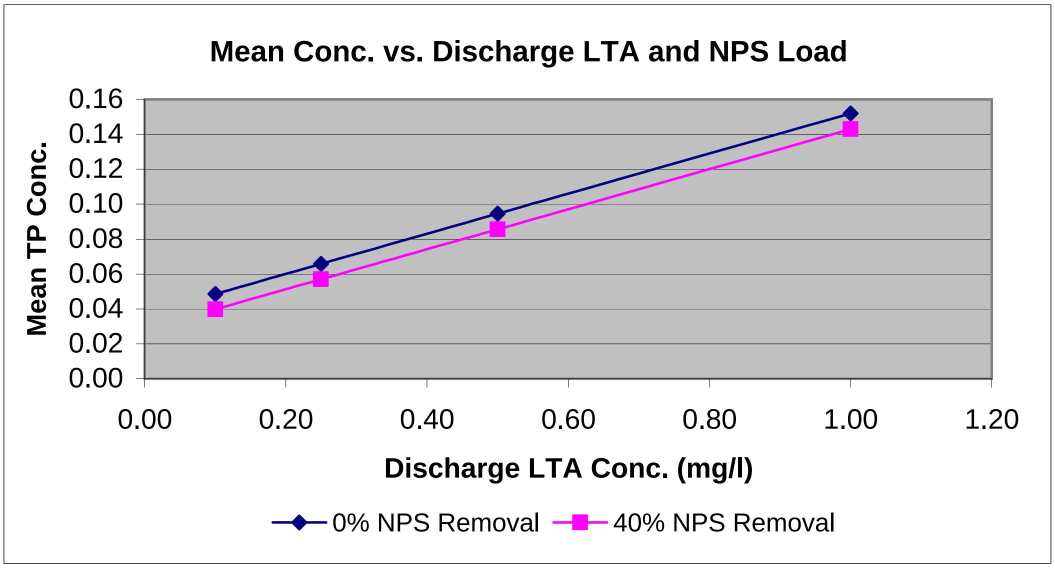
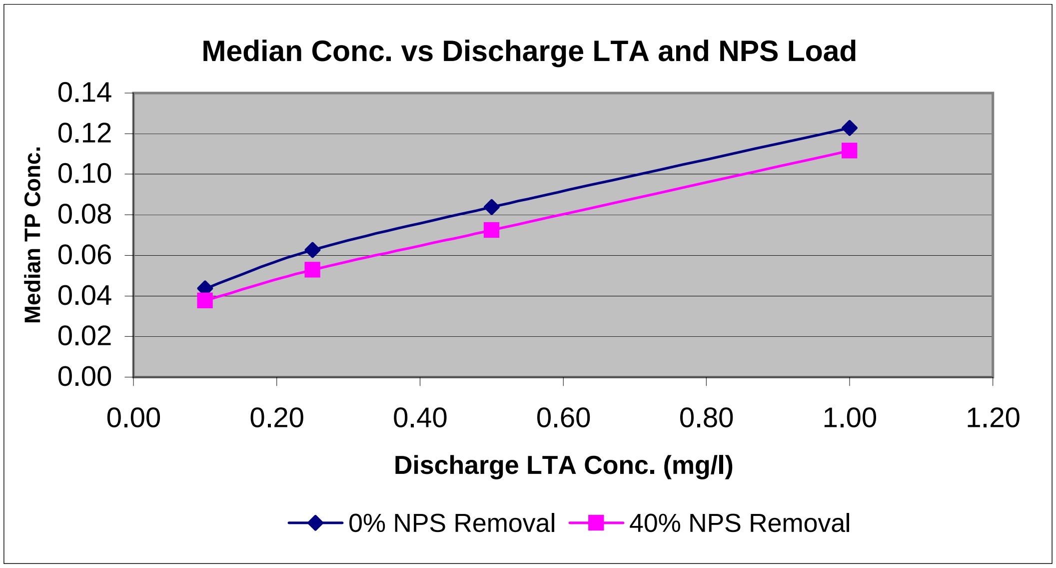


Figure 3.28: Sensitivity Analysis for Pompton River at Two Bridges





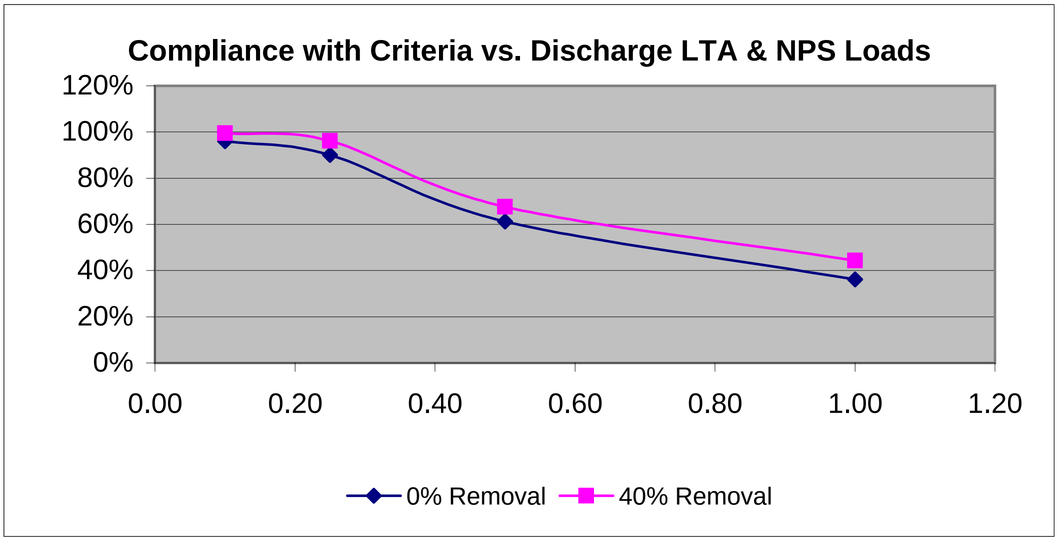
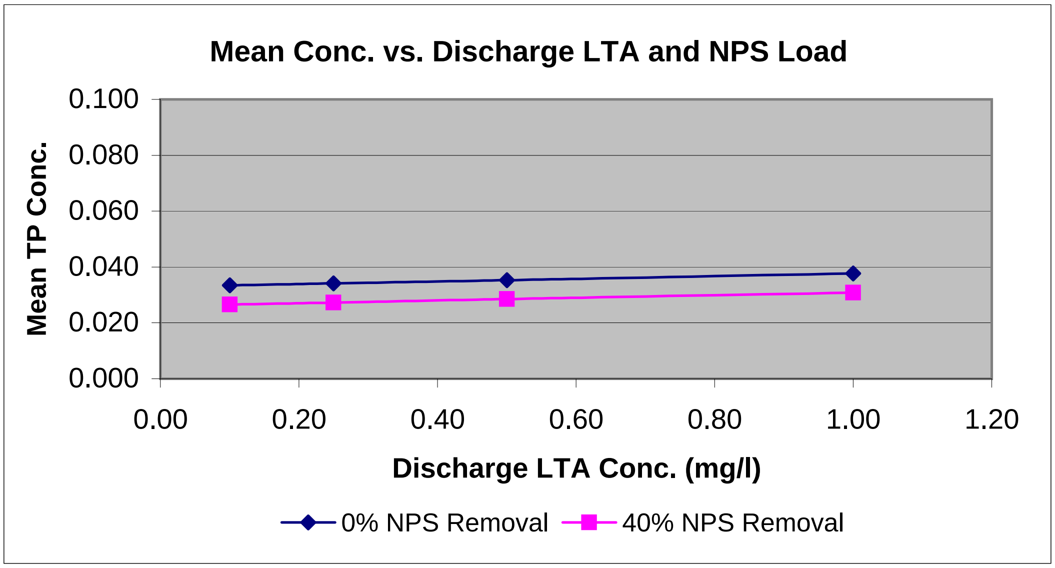
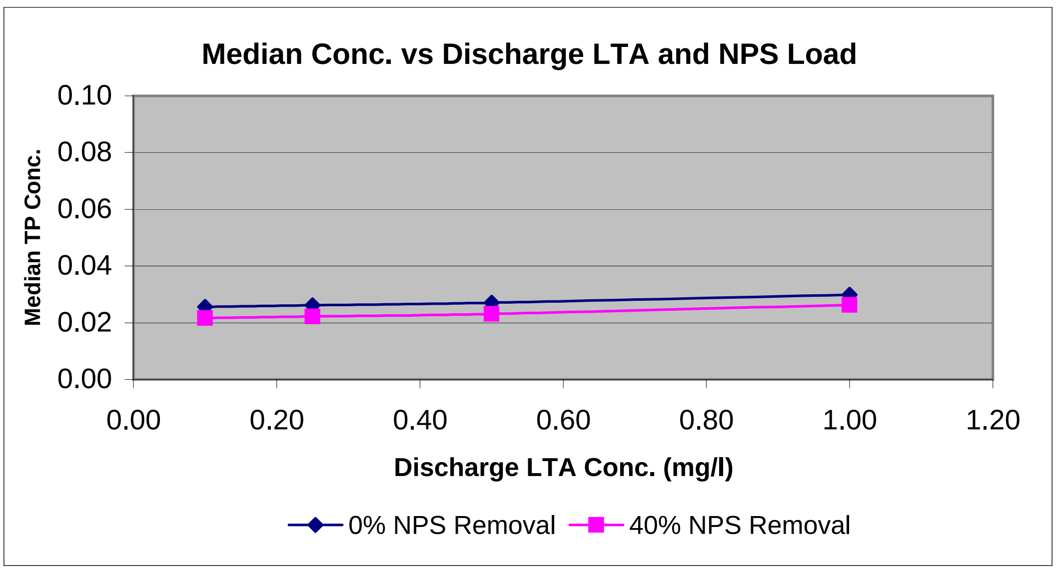


Figure 3.29: Sensitivity Analysis for Ramapo River at Two Bridges





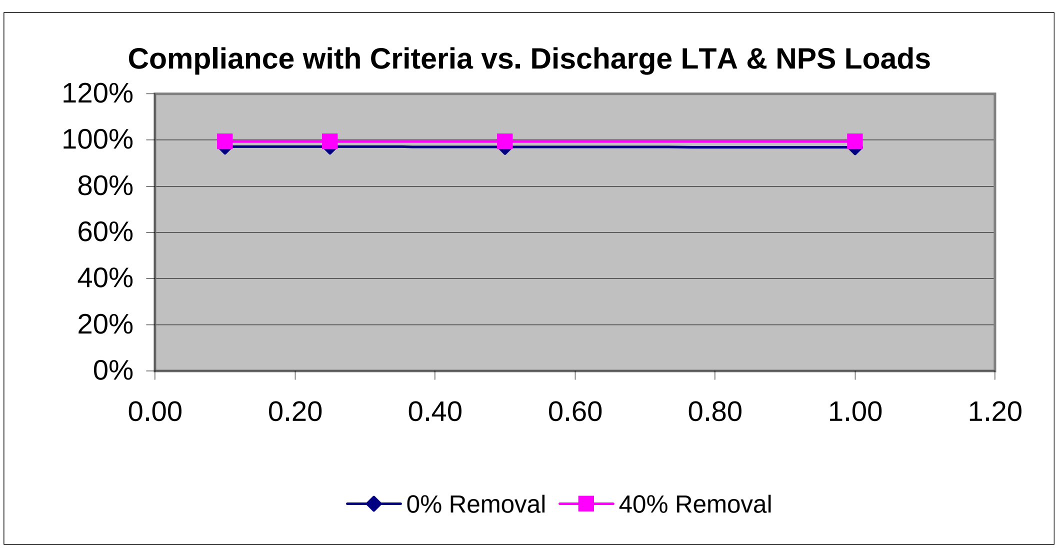


Figure 4.1: MPOD Kinetics Conceptualization

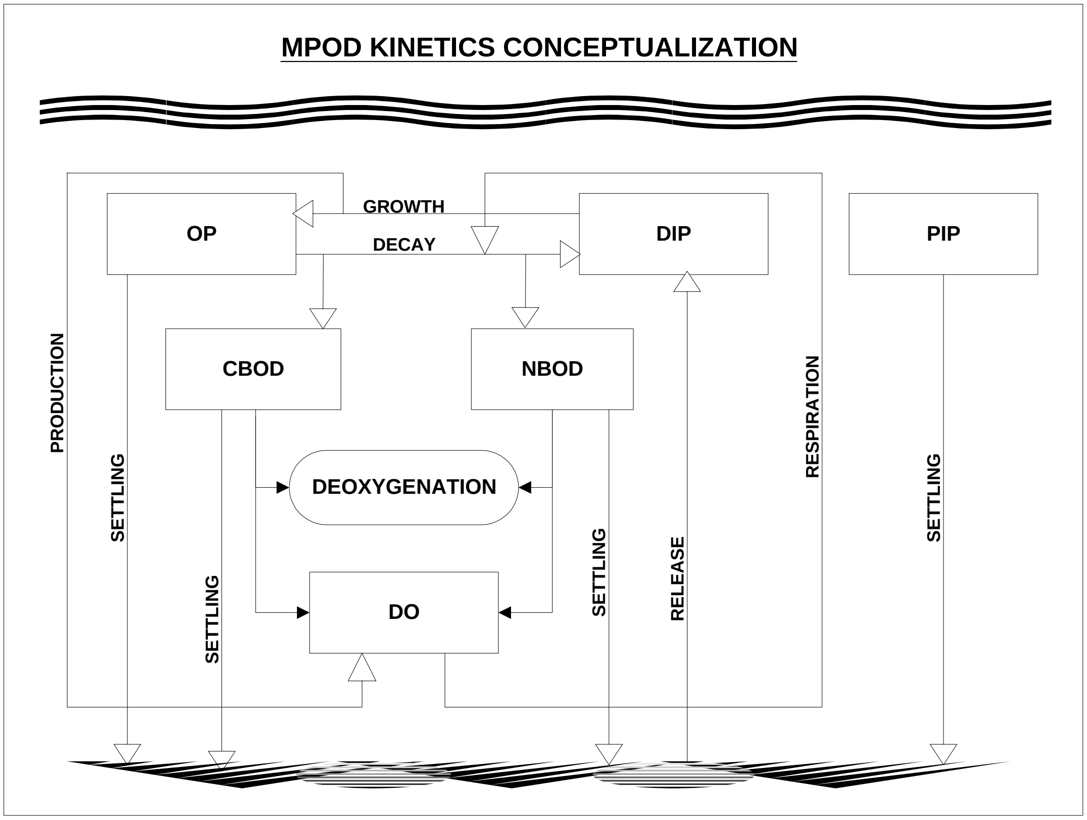


Figure 4.2: Air Temperature Data at Newark International Airport

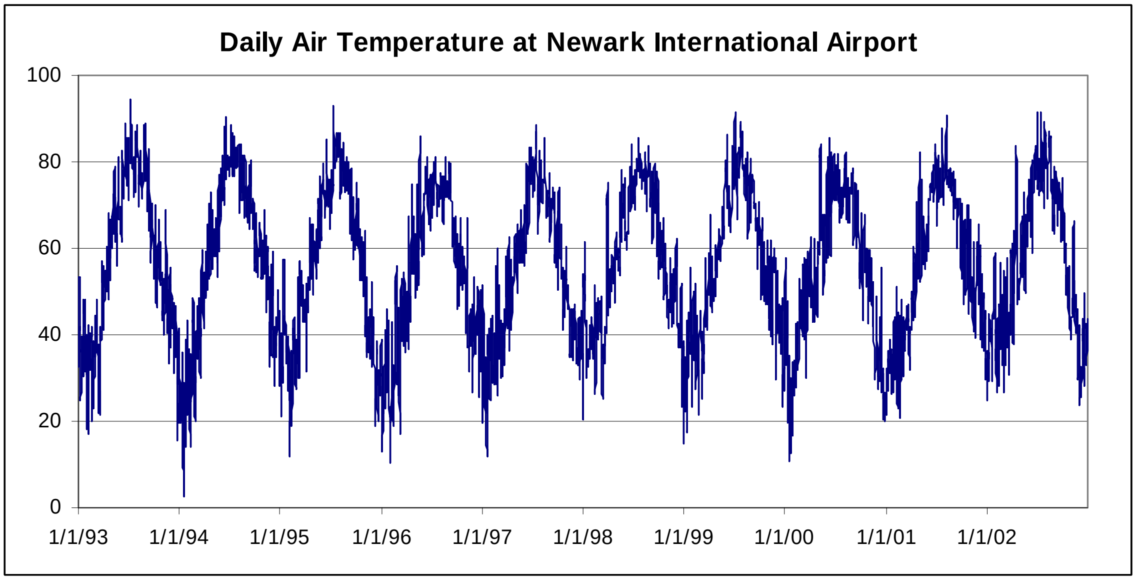
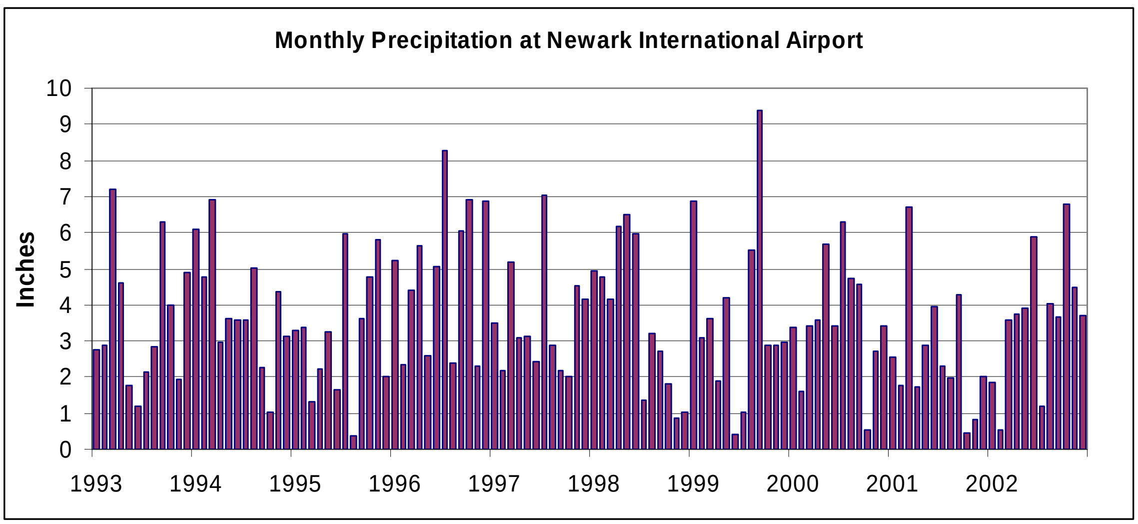


Figure 4.3: Precipitation Data at Newark International Airport



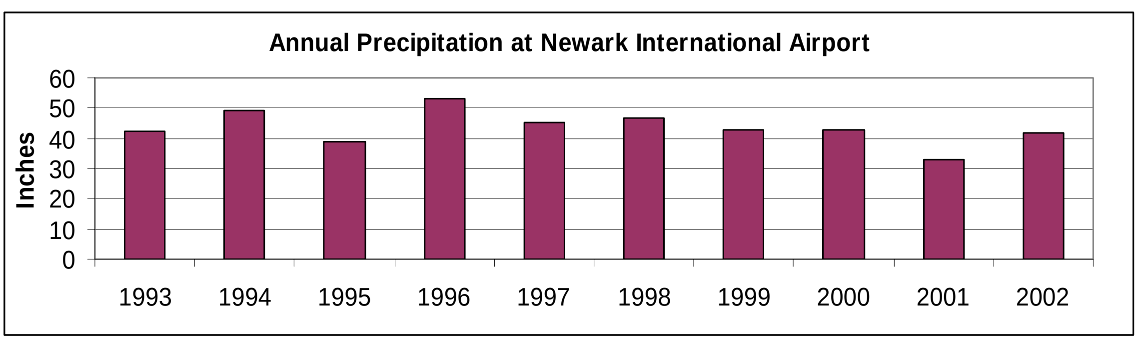
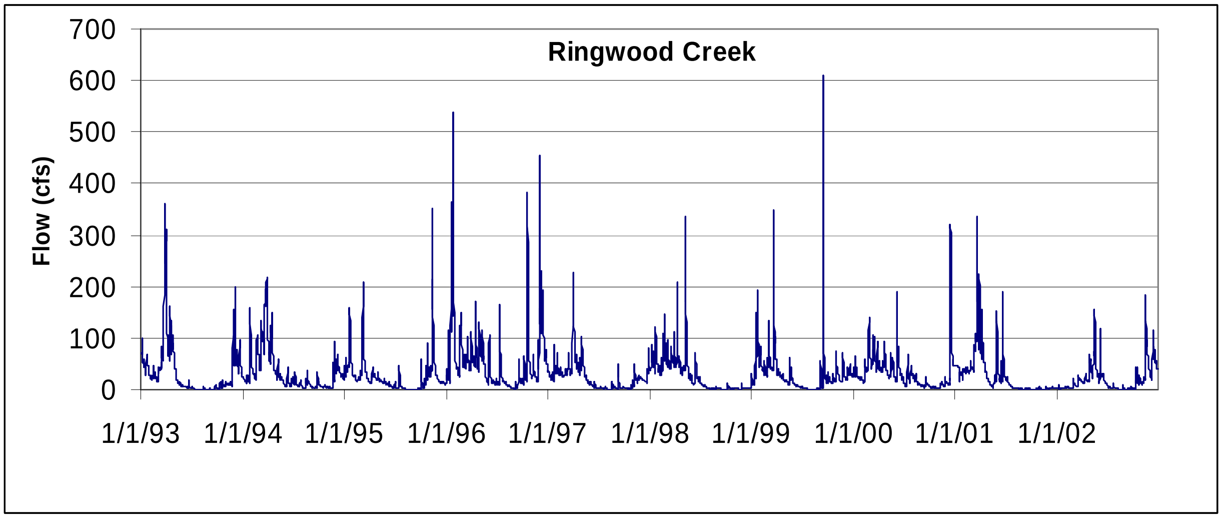
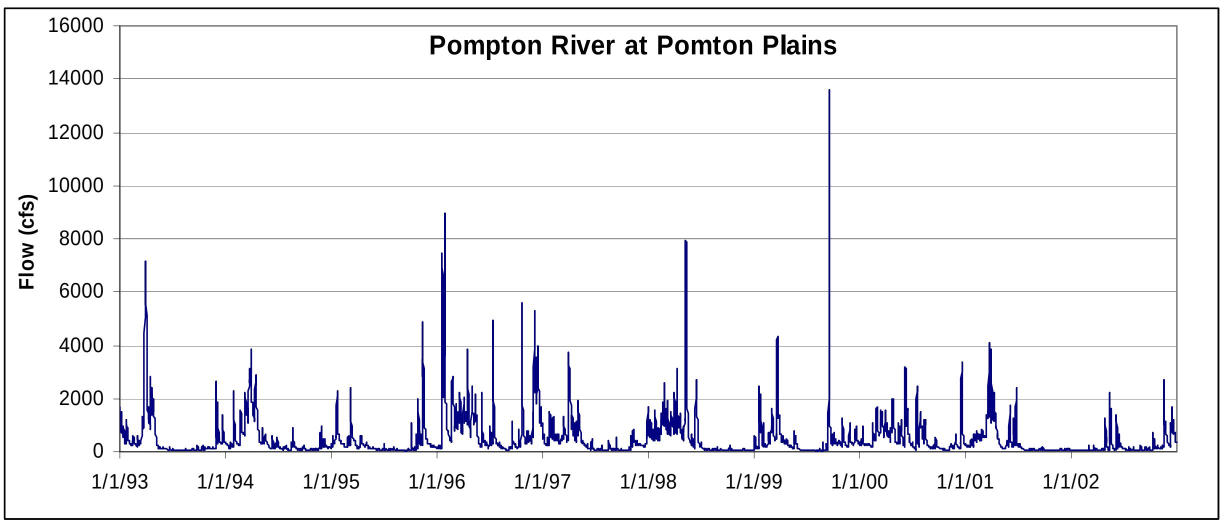


Figure 4.4: Stream Flow Data at Ringwood Creek, Pompton River and Passaic River Stations for the Ten-Year Simulation Period





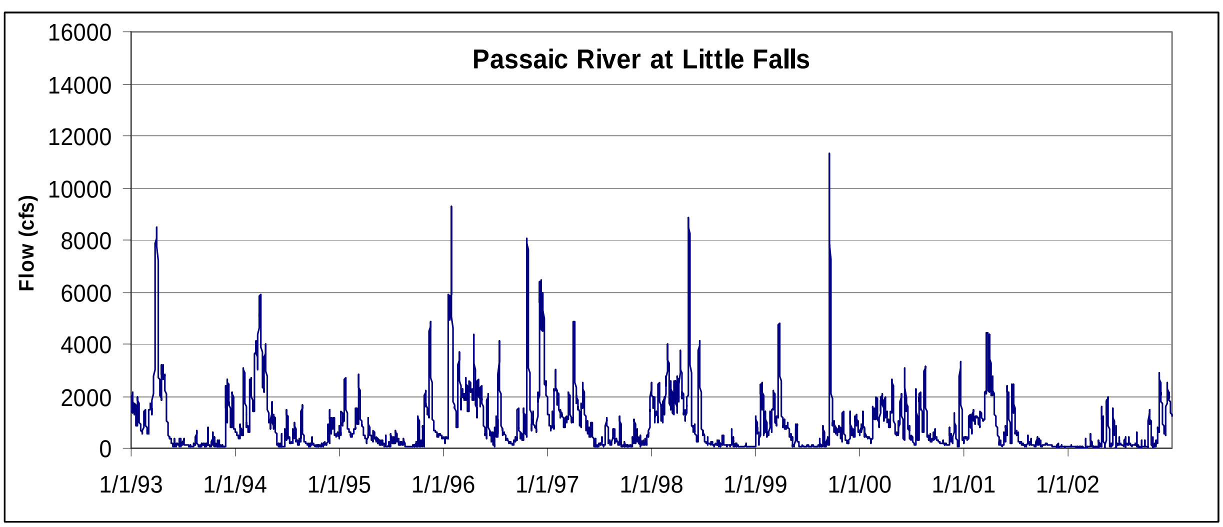


Figure 4.5: River Diversion Flows to Wanaque Reservoir

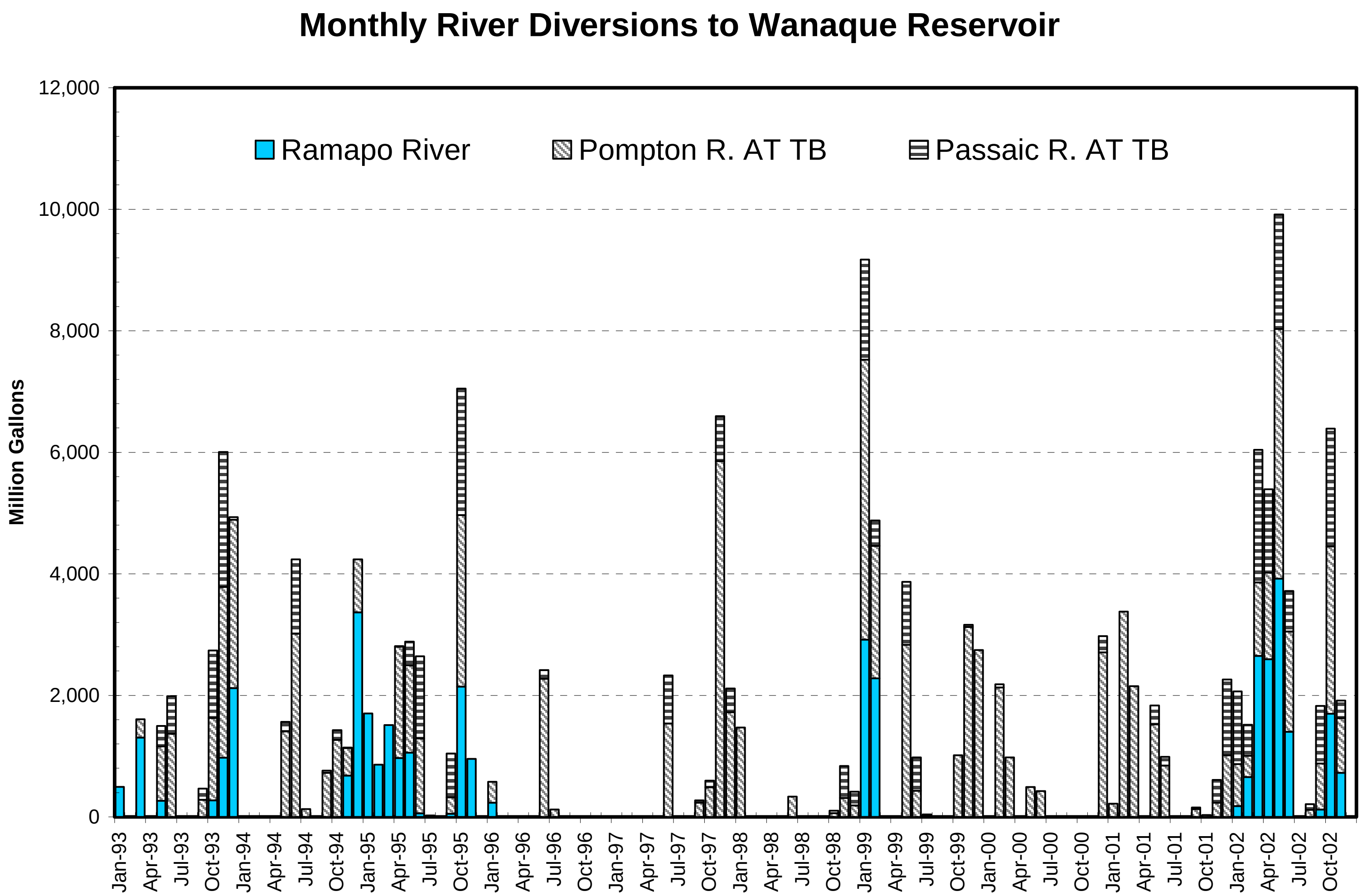
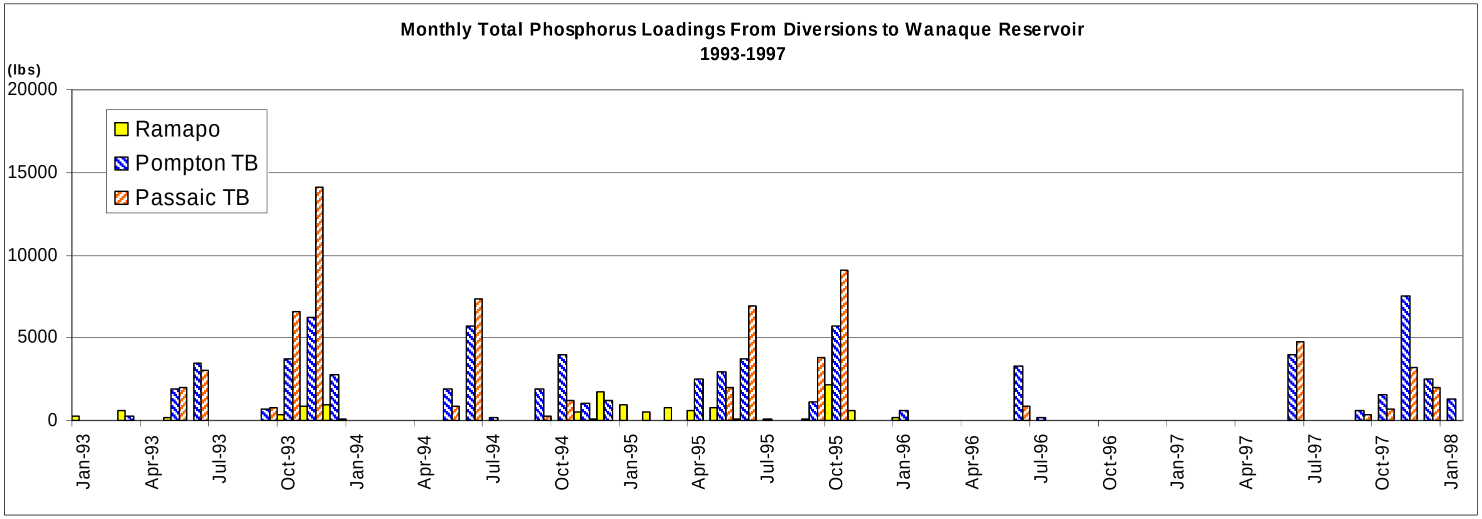


Figure 4.6: Monthly Total Phosphorus Loadings from River Diversion Sources



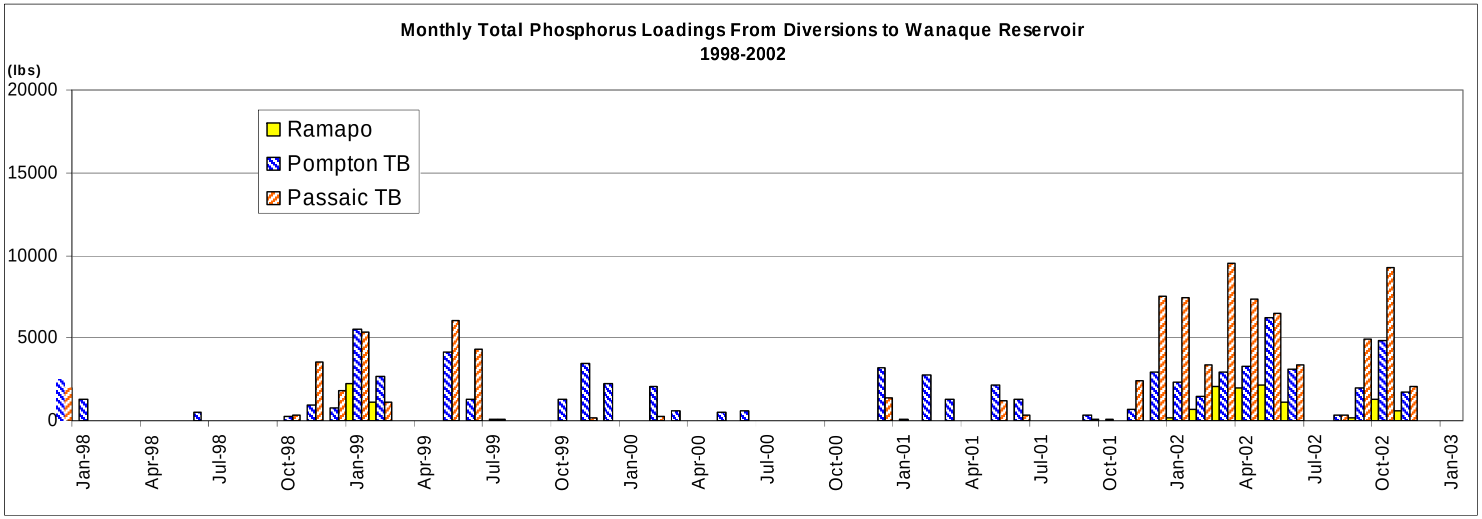


Figure 4.7: Monthly Total Phosphorus Loadings to Wanaque Reservoir From Tributary and Diversion Sources

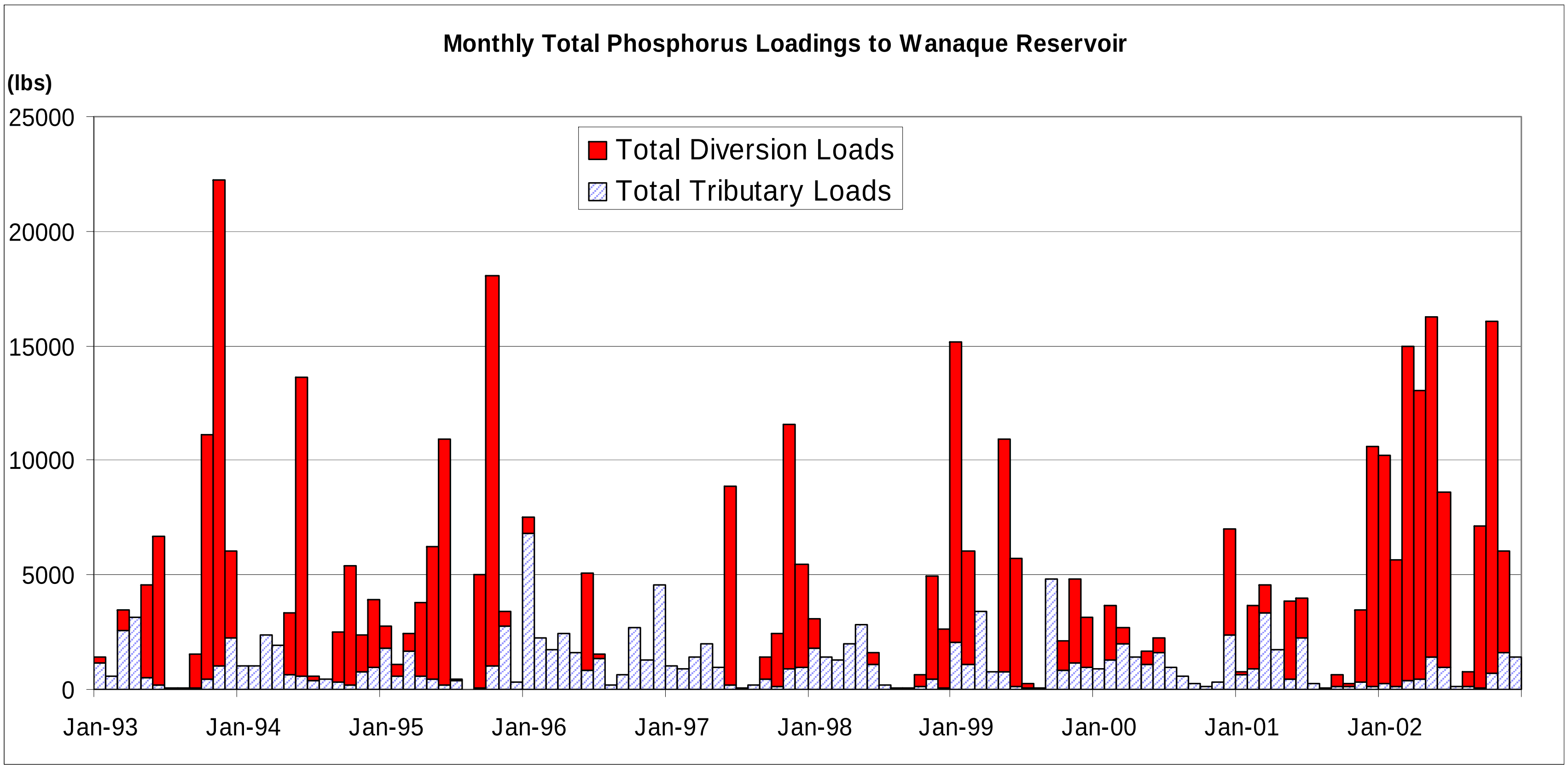
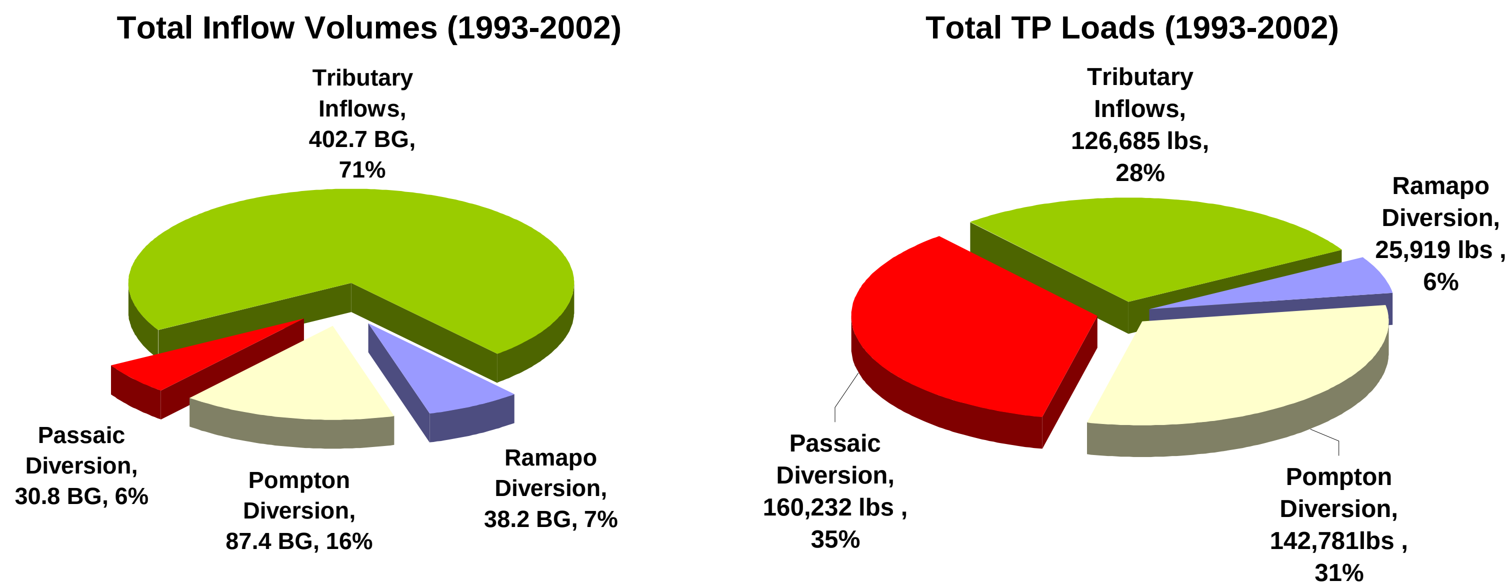


Figure 4.8 Volume and TP Load Distribution from Tributary and Diversion Inflows



	Tributary Inflows	Ramapo Diversion	Pompton Diversion	Passaic Diversion	All Sources
Volume (BG)	402.7	38.2	87.4	30.8	559.1
Loads (Pounds)	126,685	25,919	142,781	160,232	455,618
Pounds/BG	315	679	1,634	5,194	815
mg/l	0.038	0.081	0.196	0.623	0.098

Figure 4.9: Wanaque Reservoir Operations

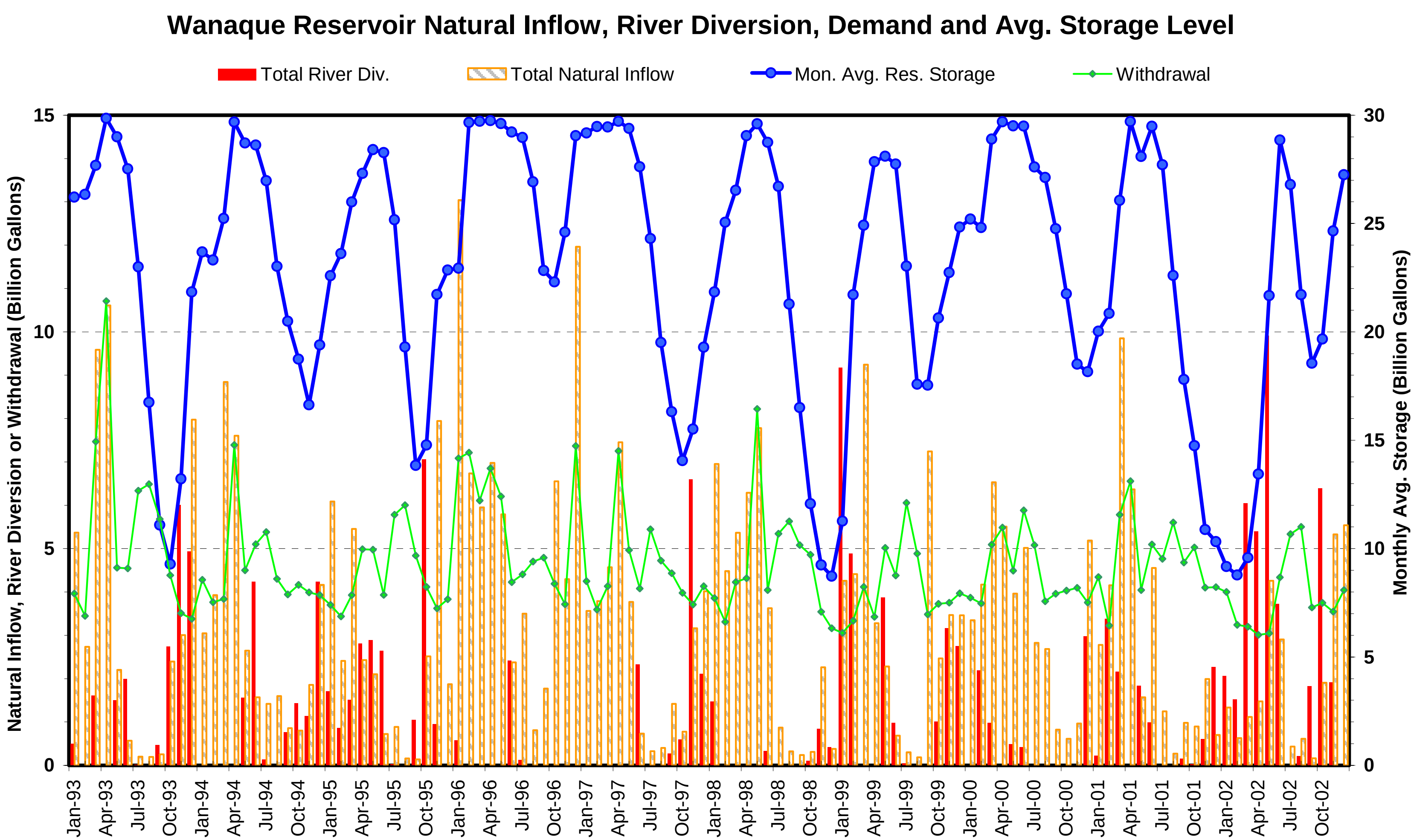


Figure 4.10: TP Loadings and TP Concentration Response at Surface Near Monksville Dam

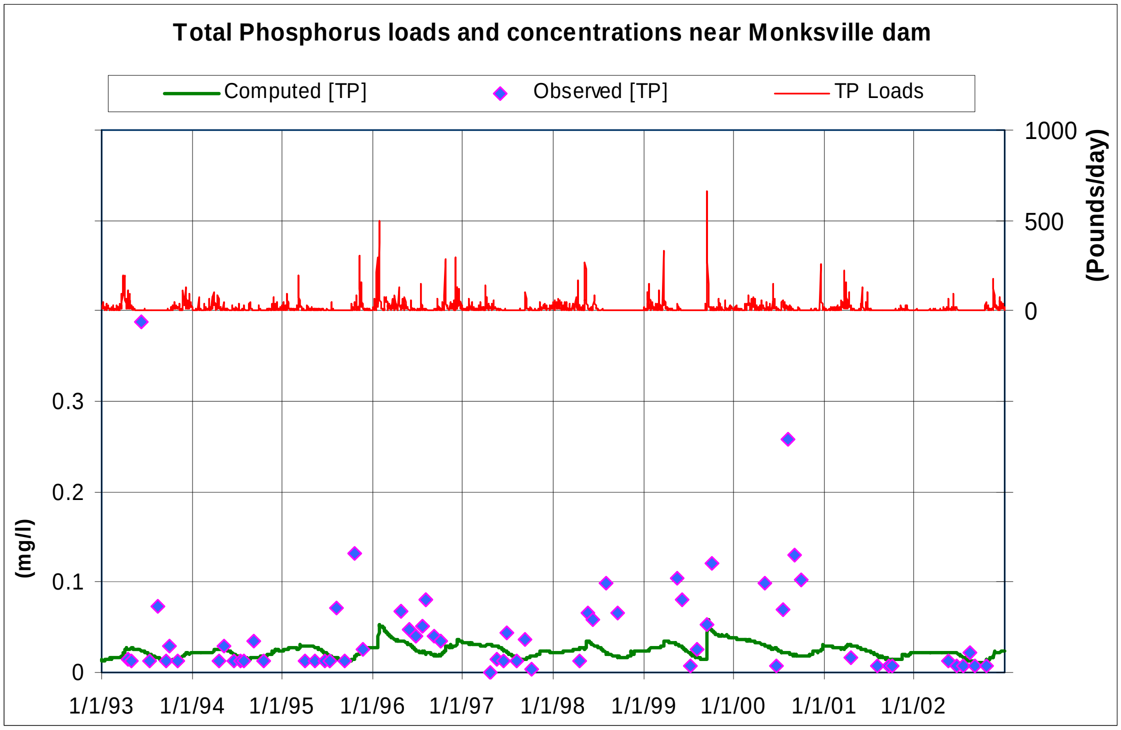


Figure 4.11: Dissolved Oxygen Concentration Response at Surface Near Monksville Dam

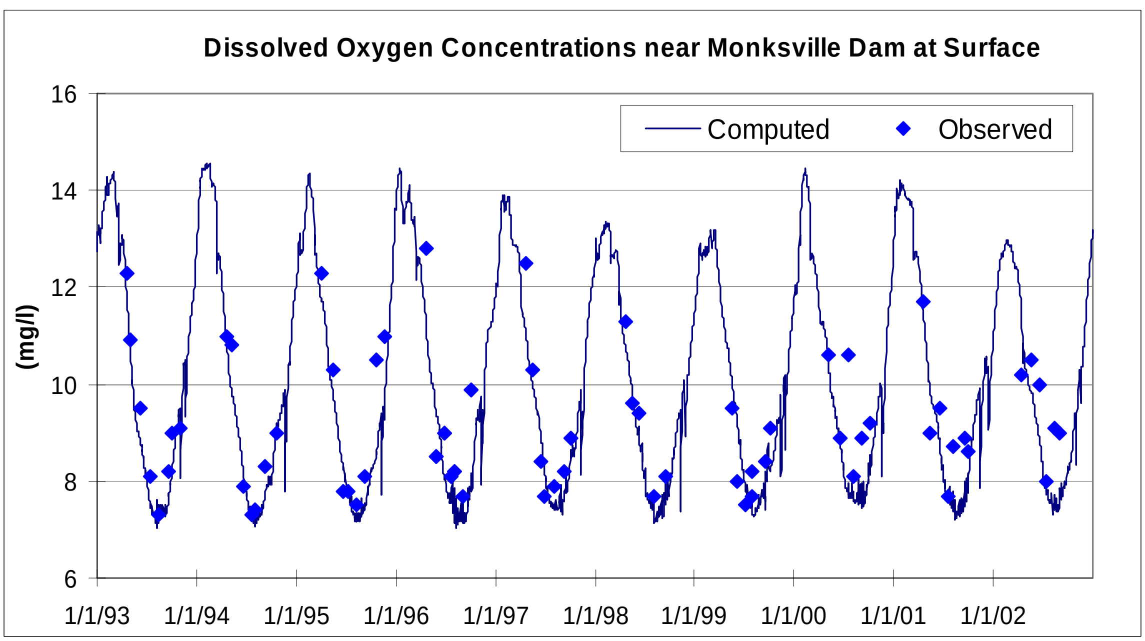


Figure 4.12: Monthly TP Loadings to Wanaque Reservoir

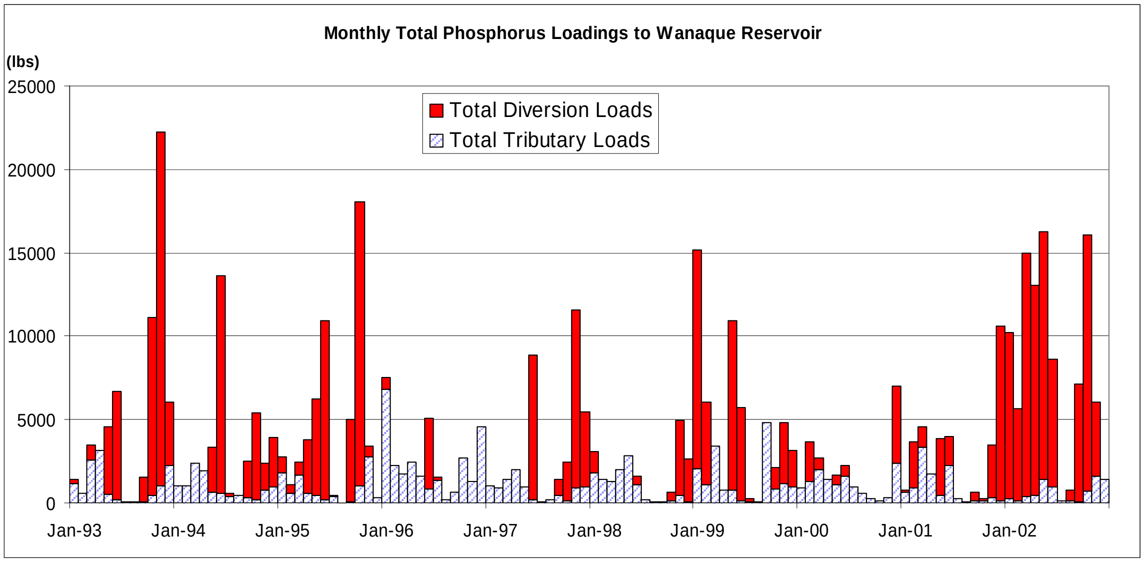


Figure 4.13: TP Concentrations at Surface Near Raymond Dam

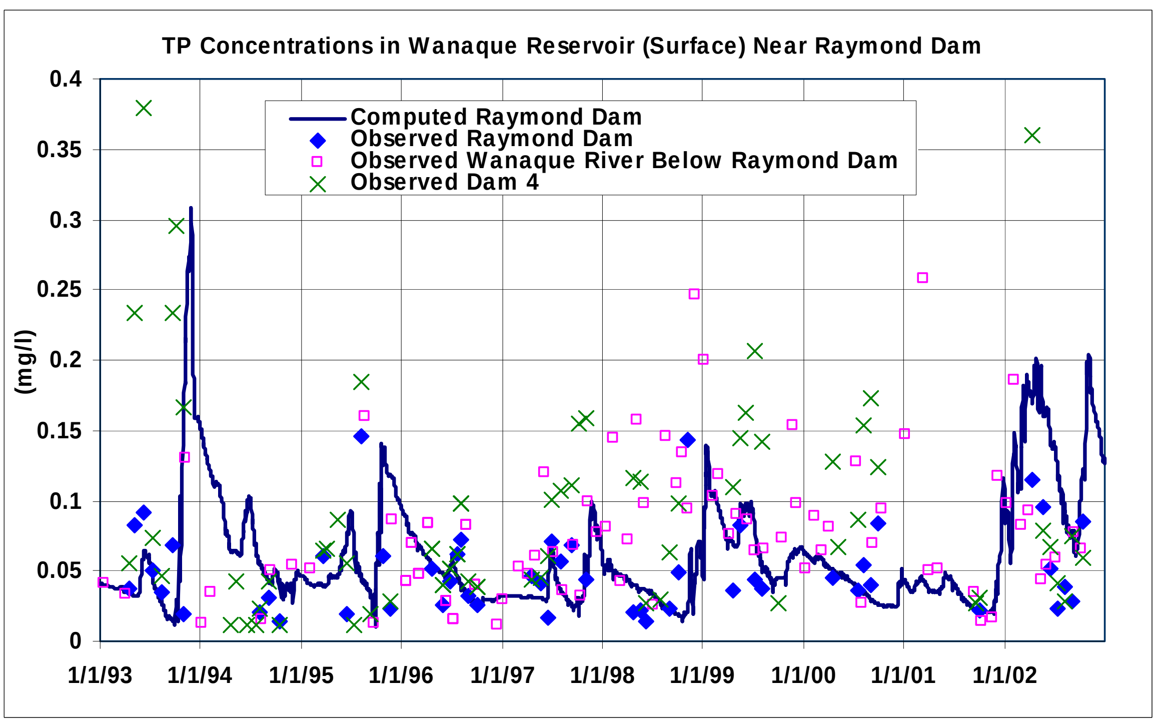


Figure 4.14: TP Concentrations at Surface Near West Brook

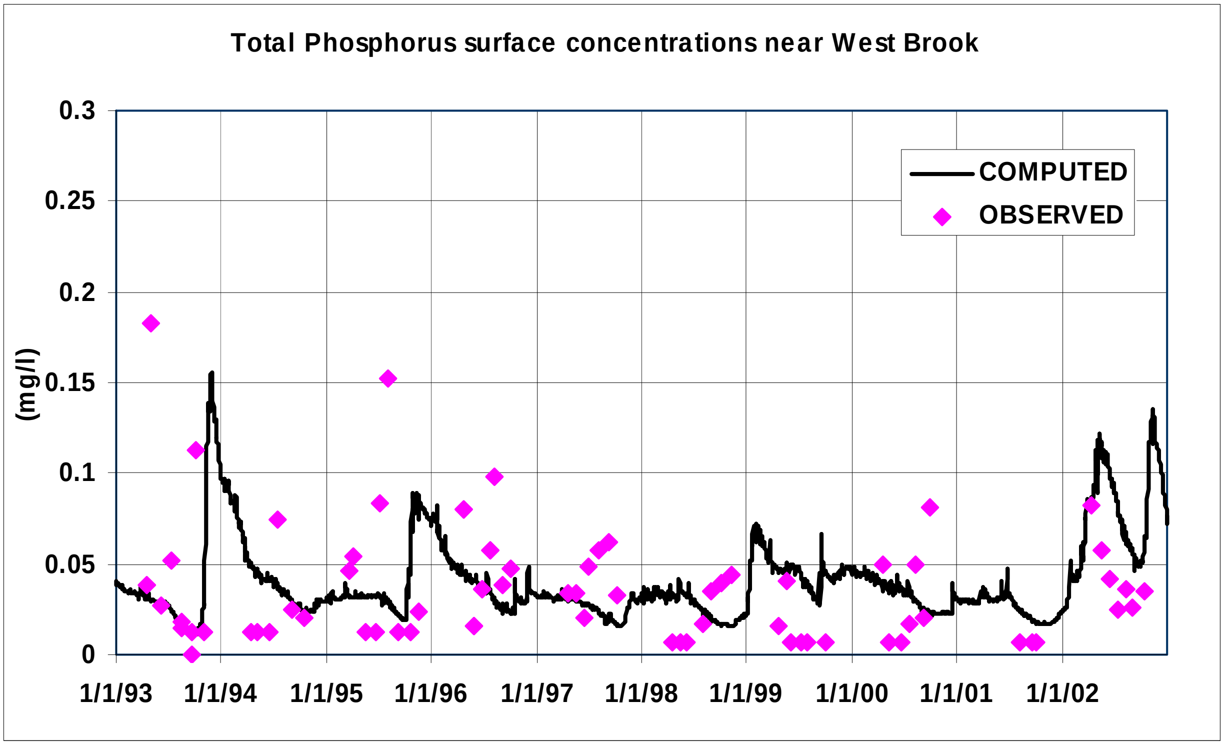


Figure 4.15: TP concentrations at Surface Near Erskine

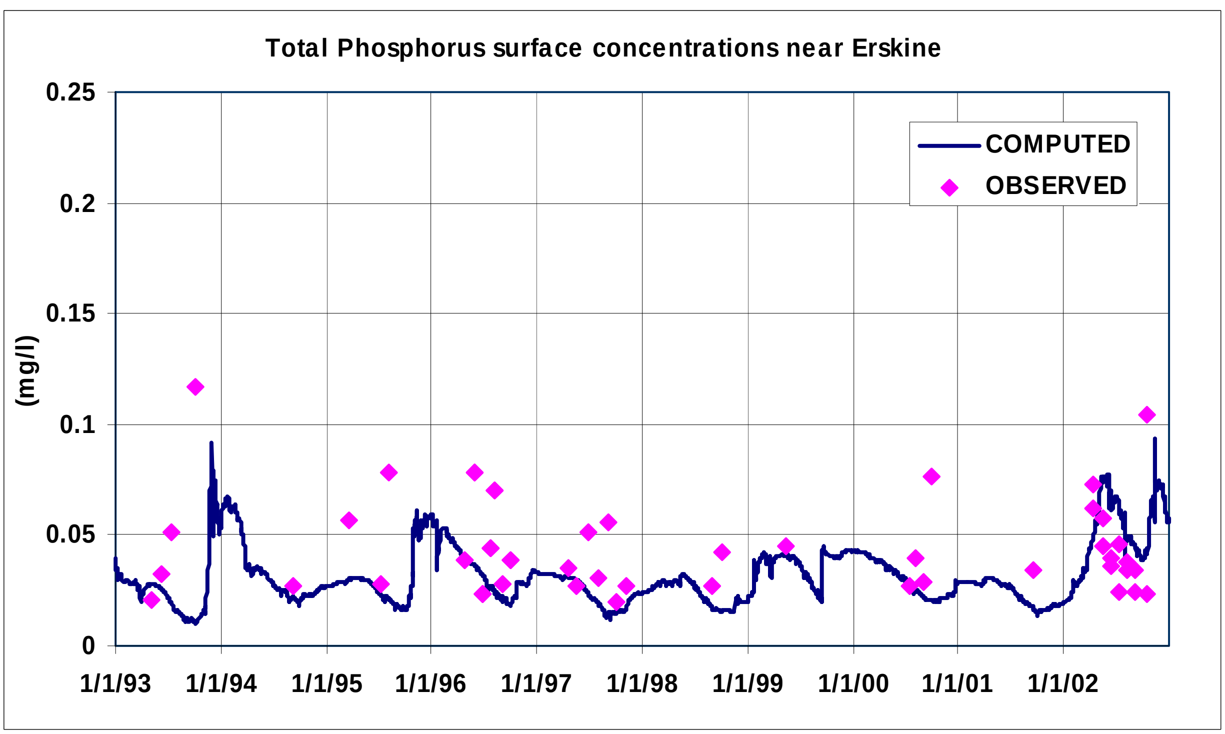


Figure 4.16: Cumulative Distribution of Simulated TP Concentrations at Various Locations in Wanaque Reservoir

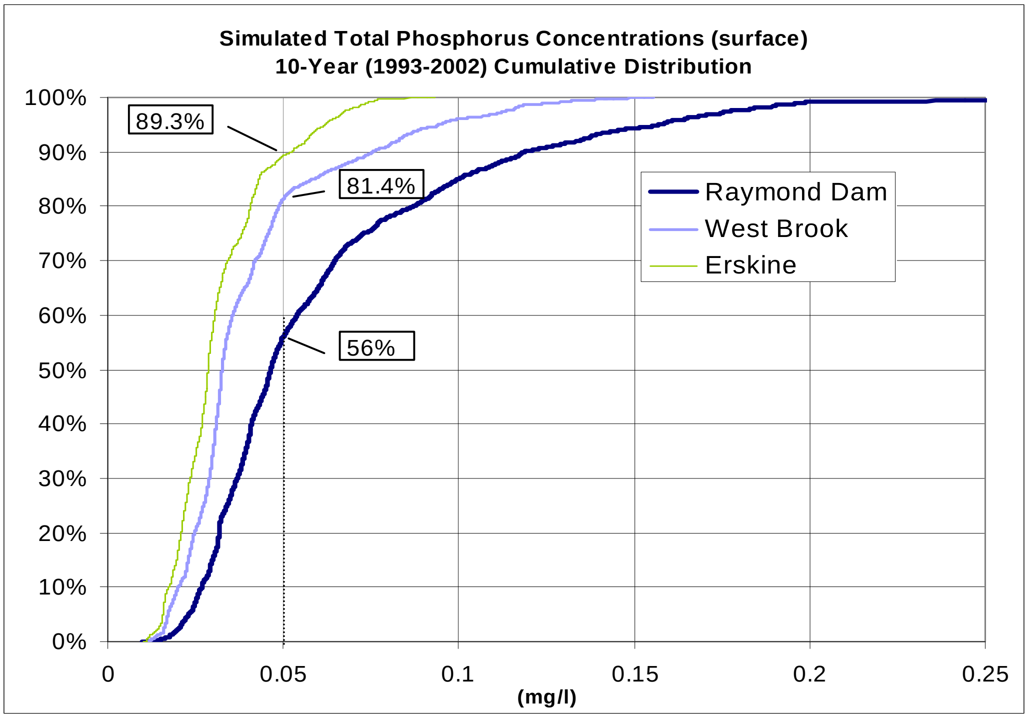


Figure 4.17: Cumulative Distribution of Observed and Simulated TP Concentrations at Surface Near Raymond Dam

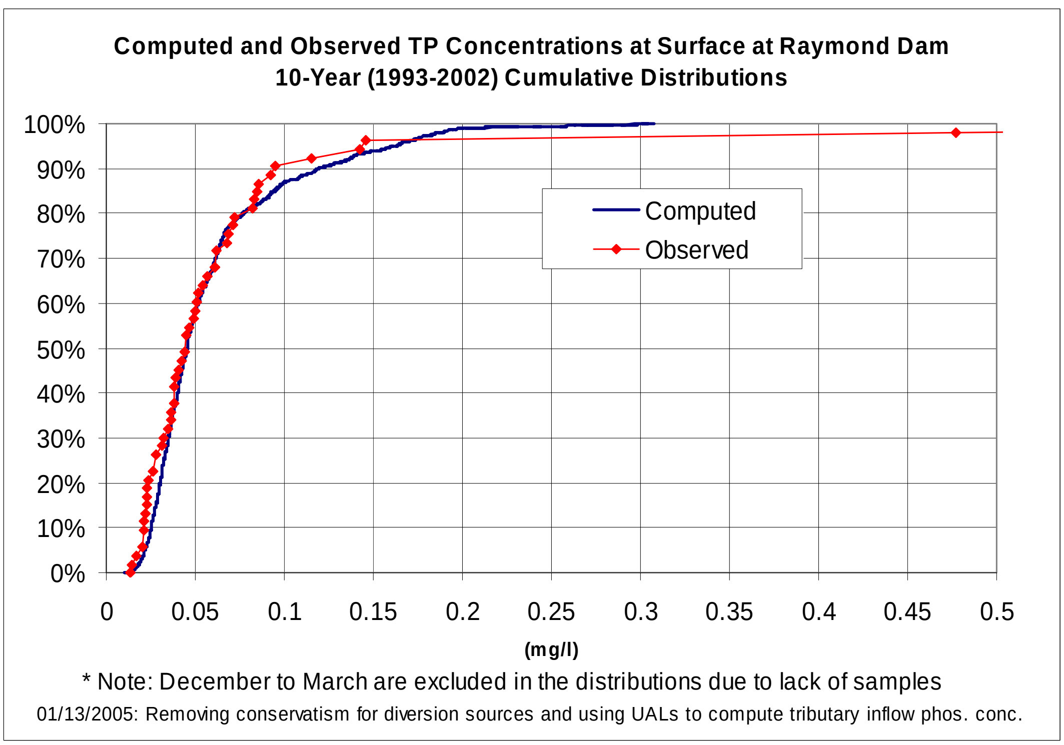


Figure 4.18: Dissolved Oxygen Concentration Response Near Raymond Dam

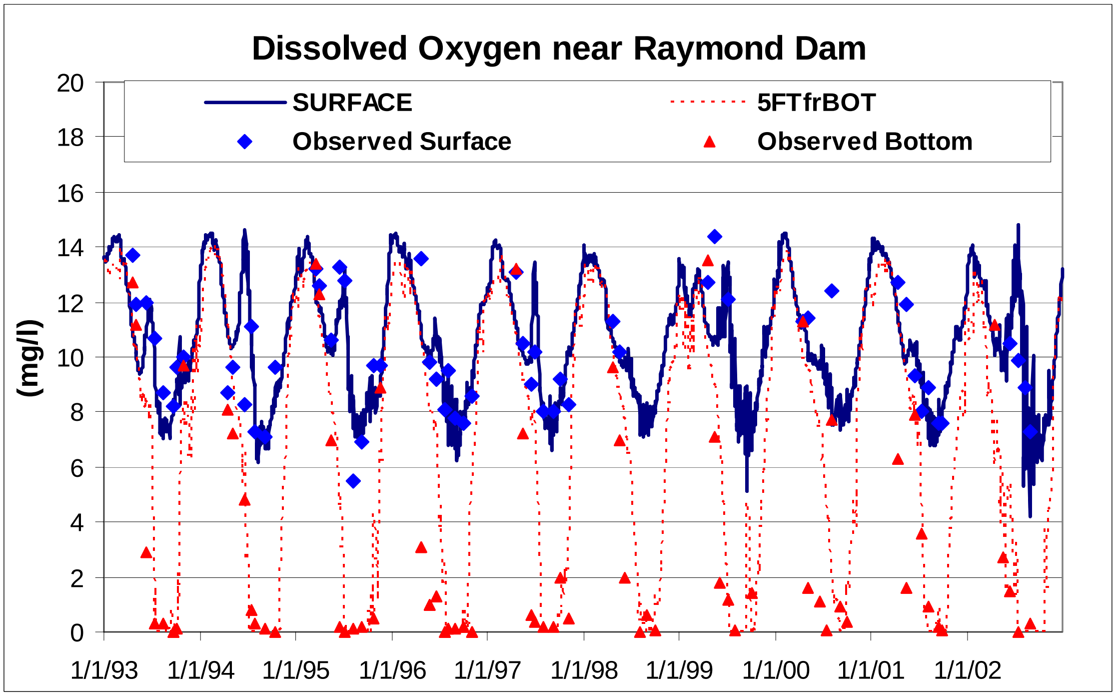


Figure 4.19: Dissolved Oxygen Concentration Response at Surface Near West Brook Bridge

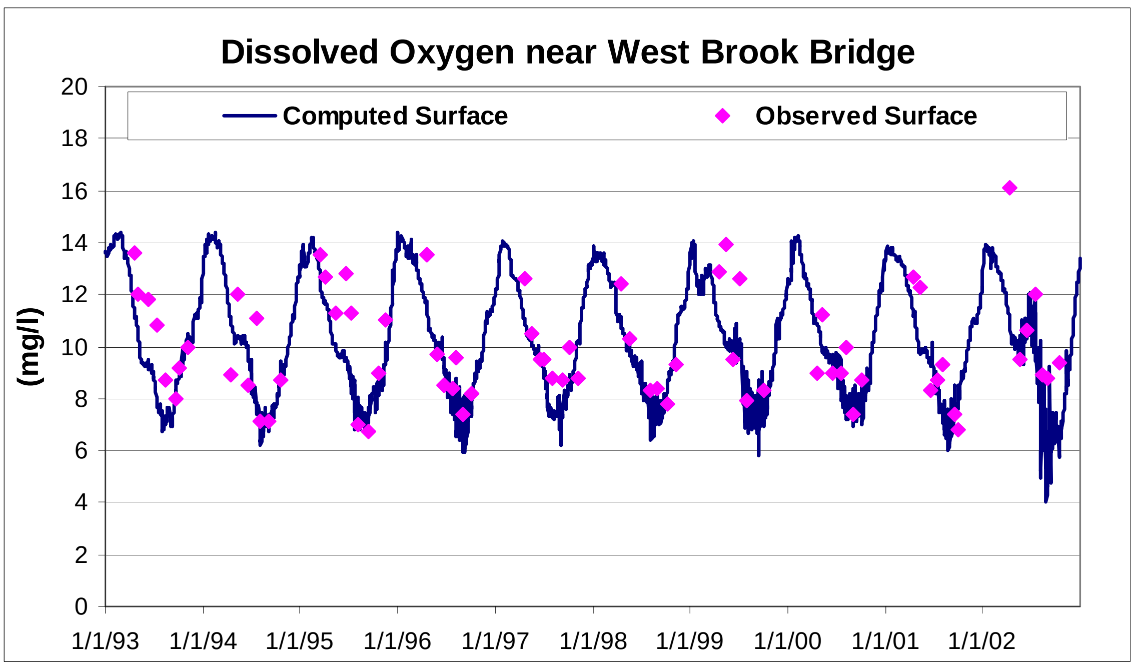


Figure 4.20: Dissolved Oxygen Concentration Response at Surface Near Erskine

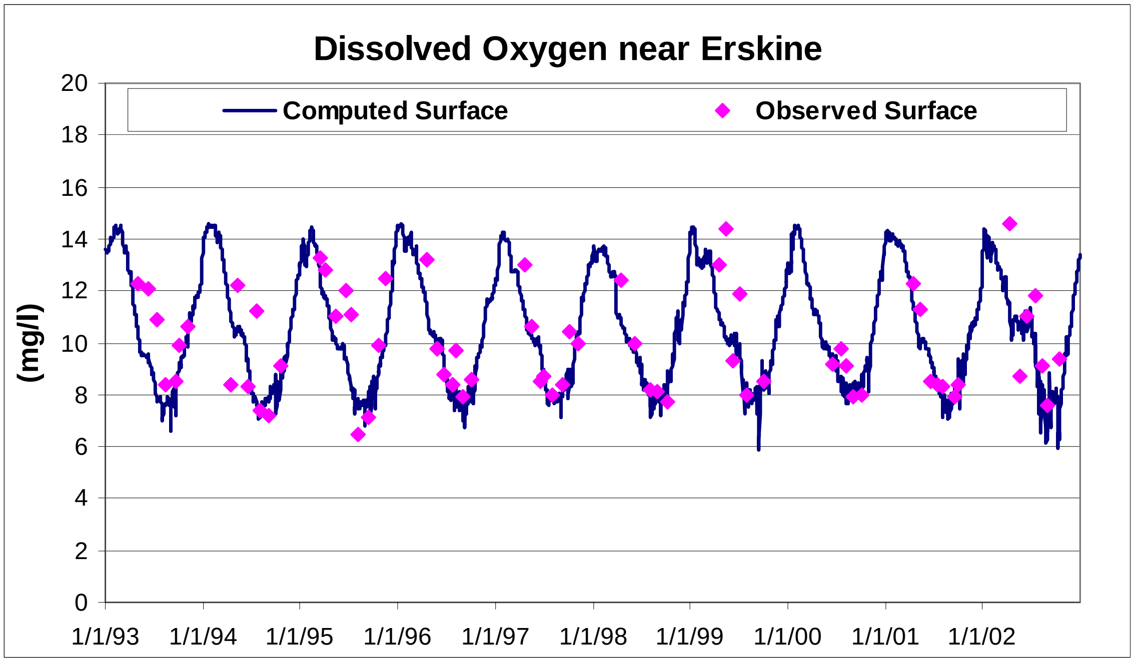


Figure 4.21: Comparisons Between Simulated Organic Phosphorus and Observed Chlorophyll-a Concentrations in Surface Waters Near Raymond Dam

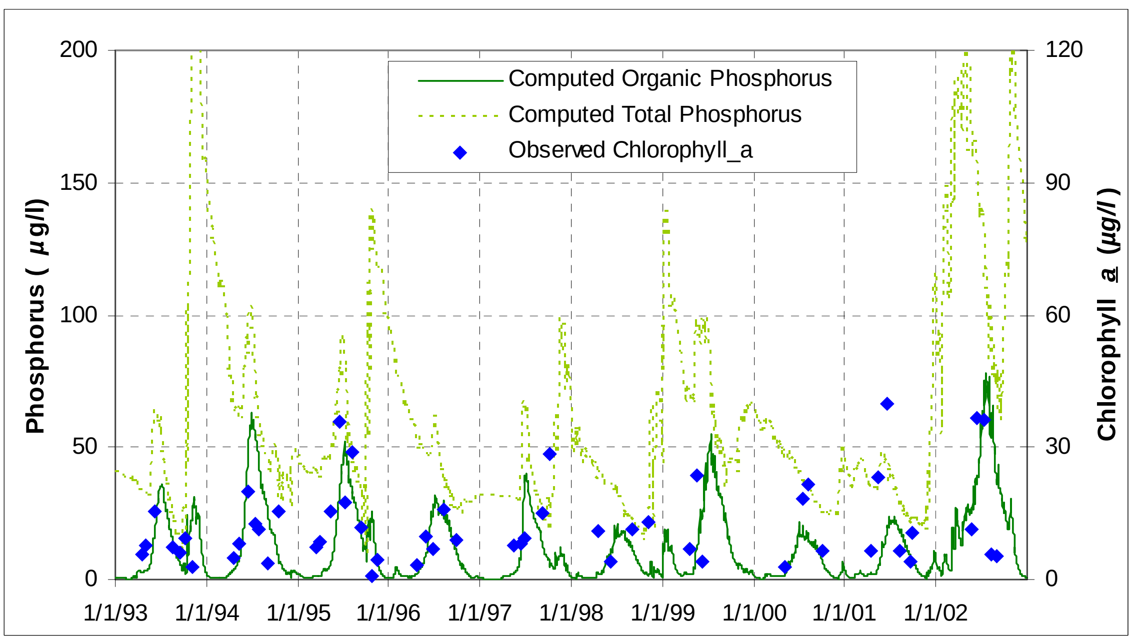


Figure 4.22: Simulated Chlorophyll_*a* Concentration Response Near Raymond Dam at Surface

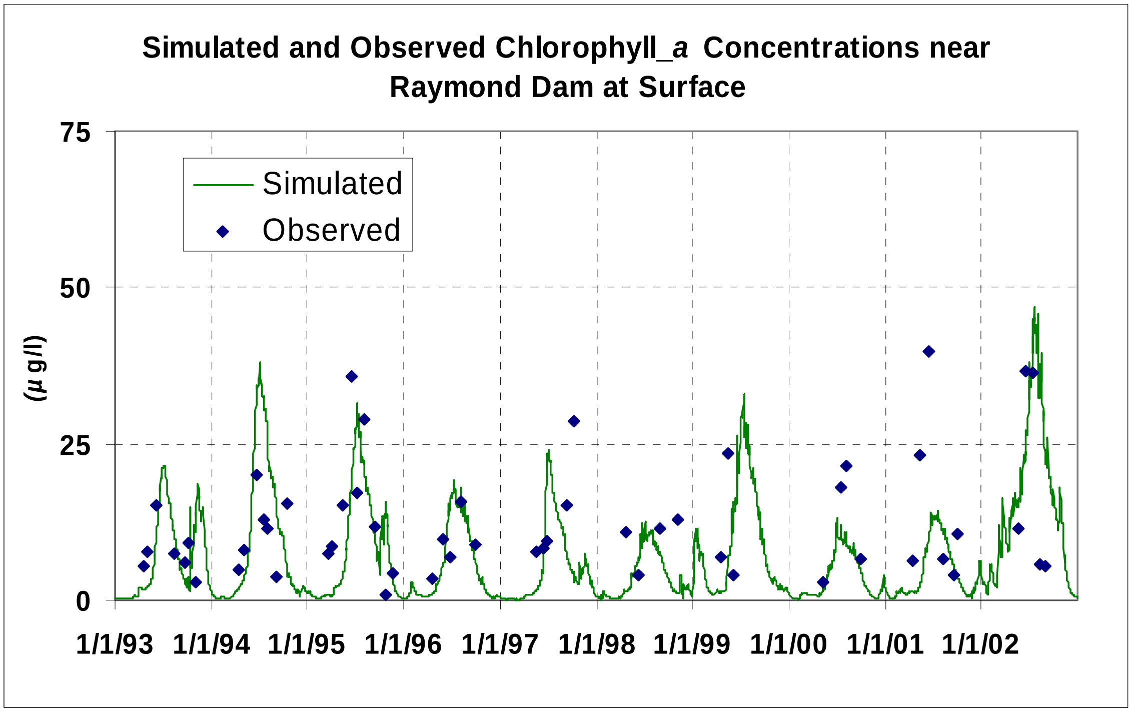


Figure 5.1: Cumulative Distribution of Tributary Inflow TP Concentrations

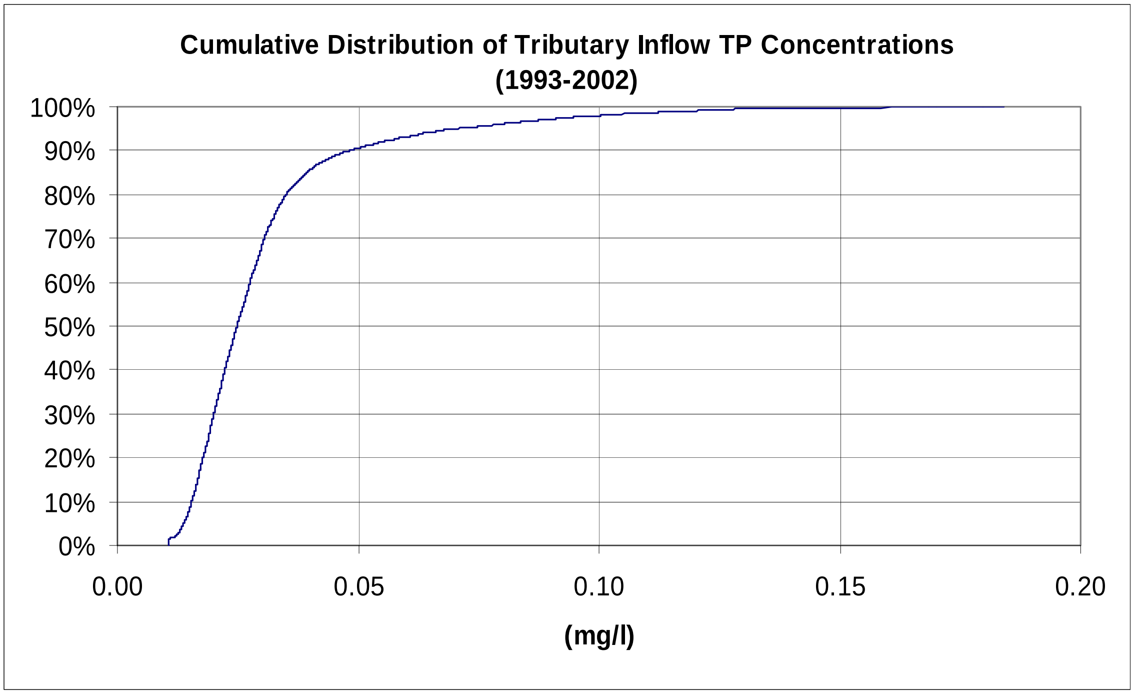


Figure 5.2: Simulated TP Concentrations at Surface Near Raymond Dam for Historical Reference Simulation and Existing Condition (Baseline Simulation)

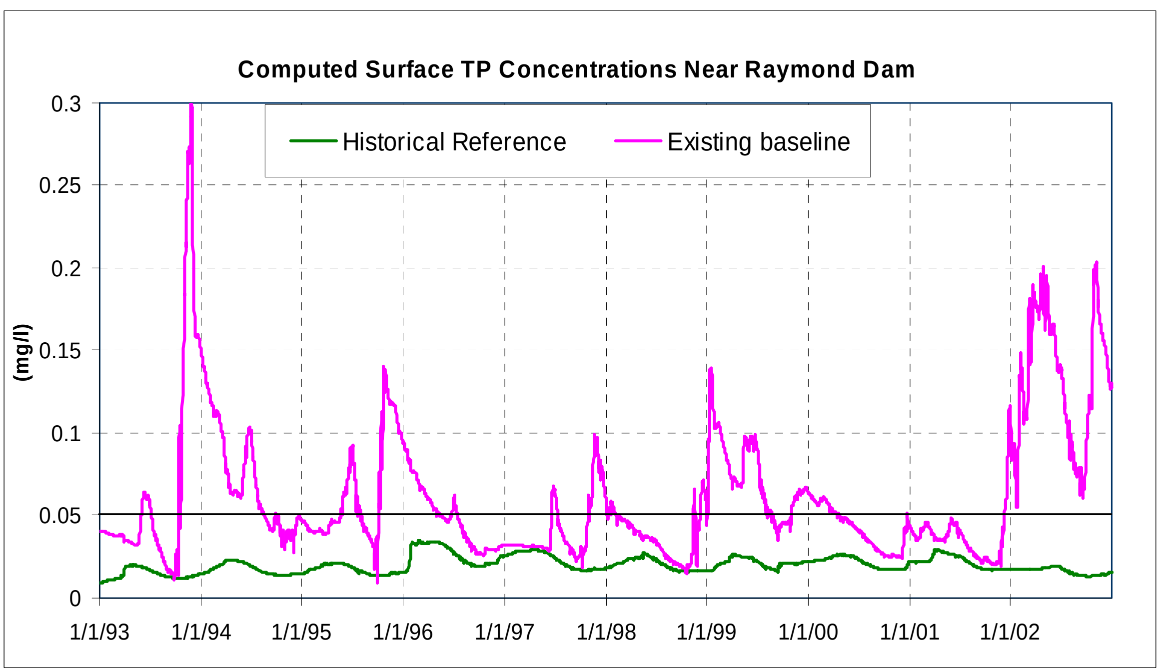


Figure 5.3: Cumulative Distribution of TP Concentrations Near Raymond Dam at Surface for Historical Reference Simulation and Existing Condition (Baseline Simulation)

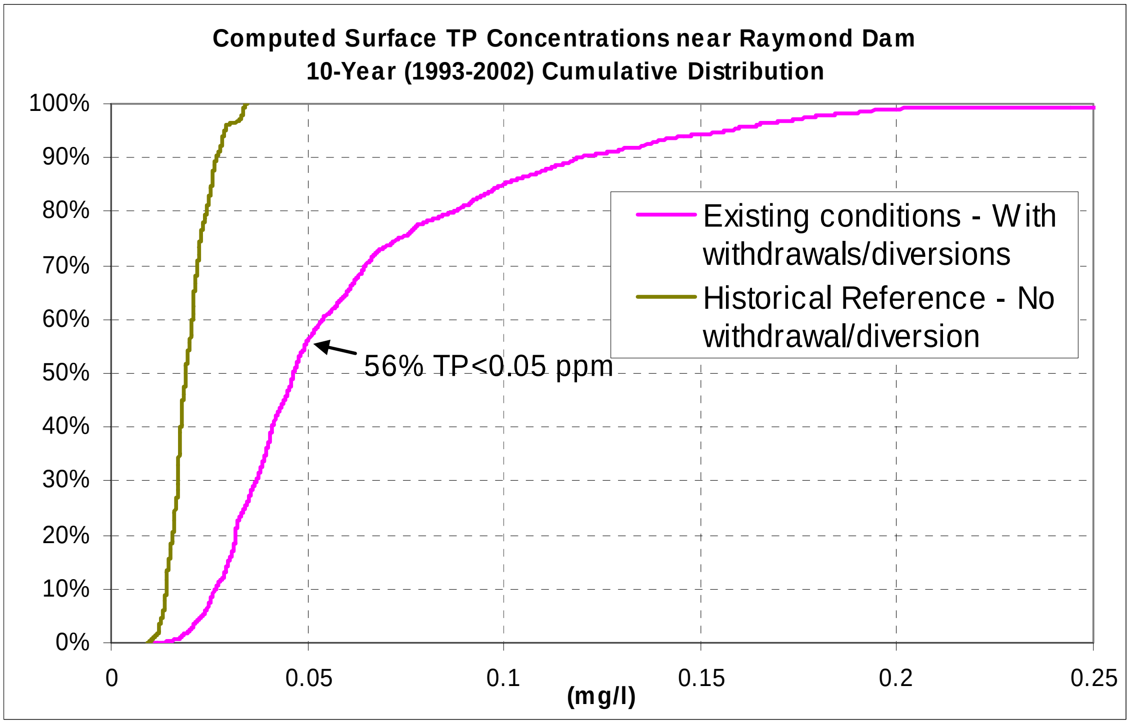


Figure 5.4: Summer Average TP Concentrations at Surface Near Raymond Dam for Historical Reference Simulation

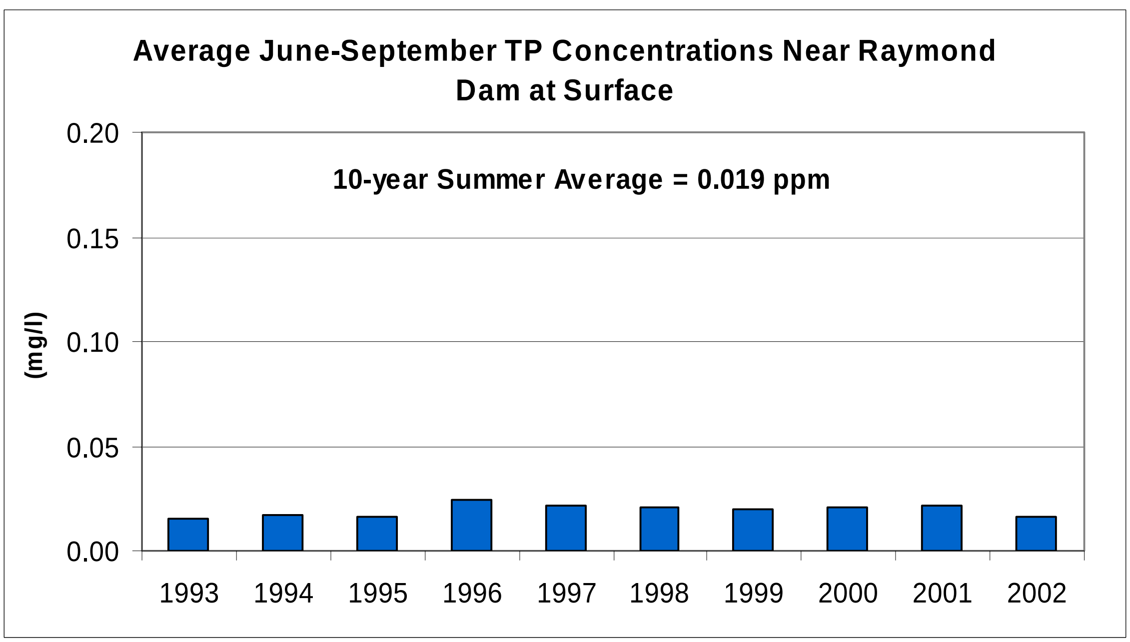
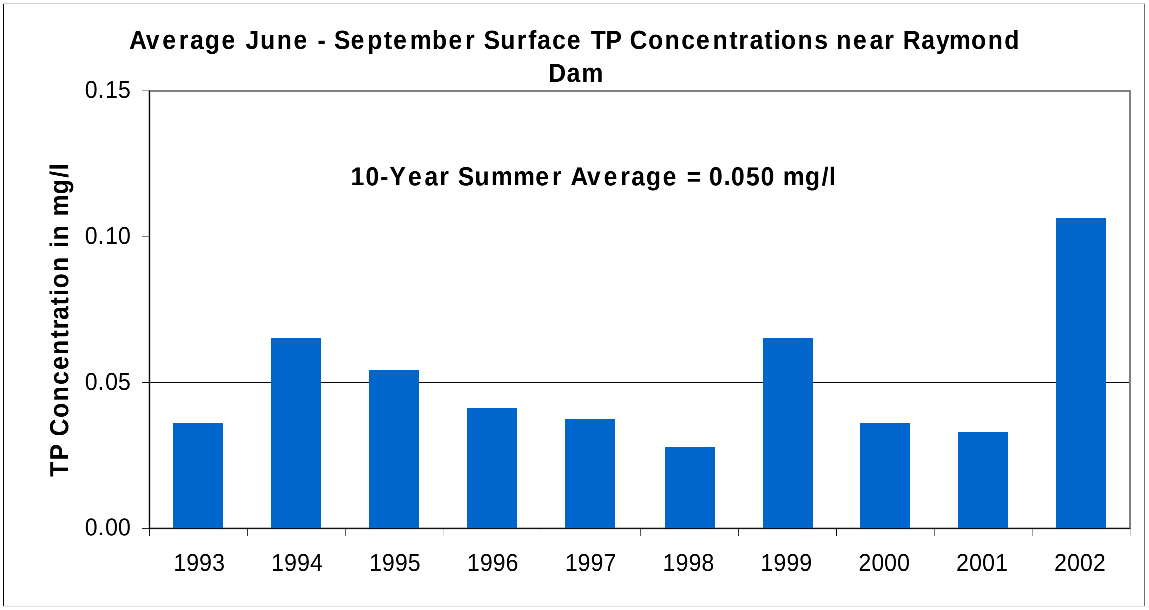


Figure 5.5: Summer Average TP Concentrations at Surface Near Raymond Dam and Loadings from River Diversions (Baseline Simulation With No Reserve Capacity)



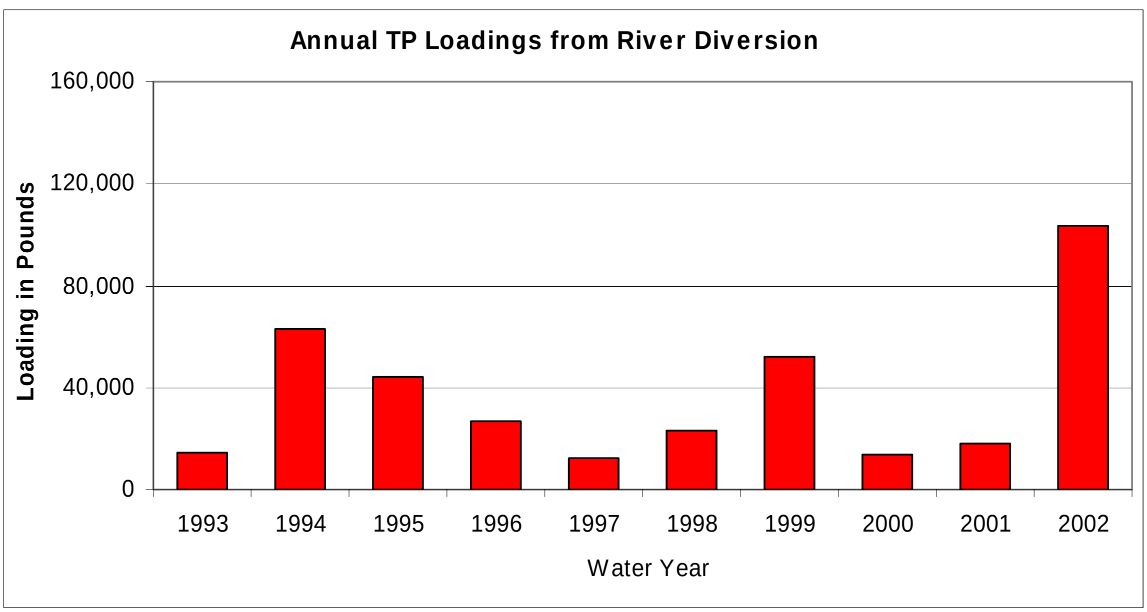


Figure 5.6: Effect of PS and NPS Load Reductions on Simulated Maximum Reservoir TP Concentration at Raymond Dam

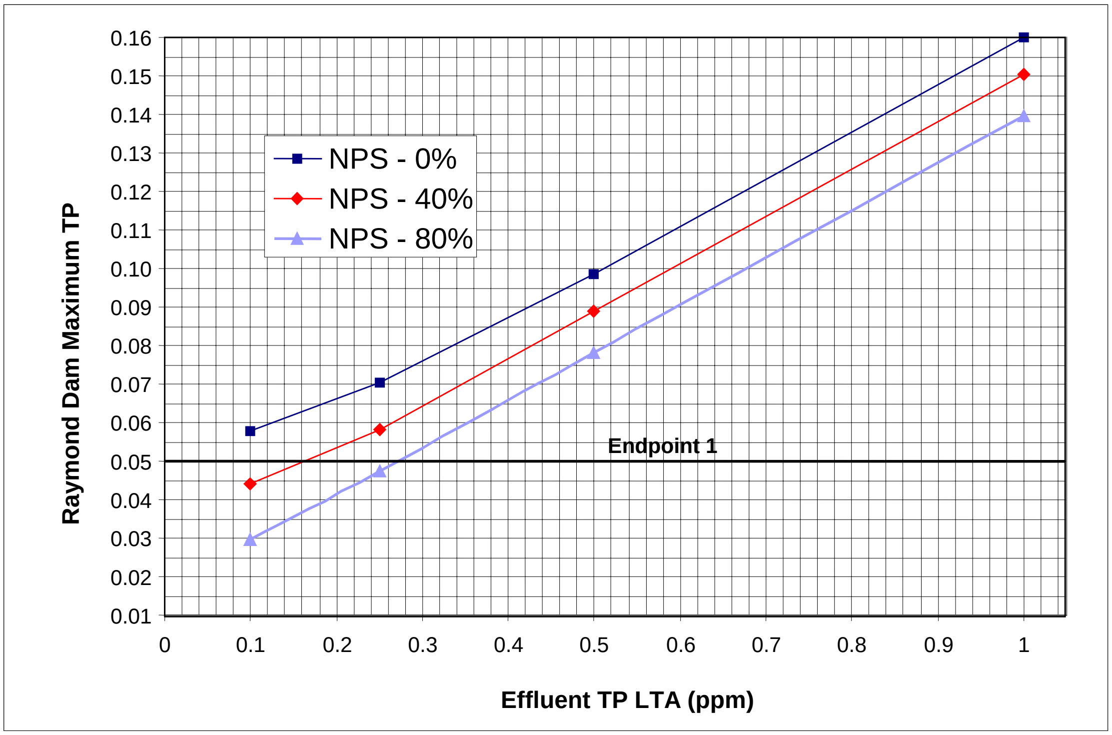


Figure 5.7: Simulated TP Concentration at Raymond Dam with Point Source LTA=0.25 mg/l and 80% NPS Load Reduction

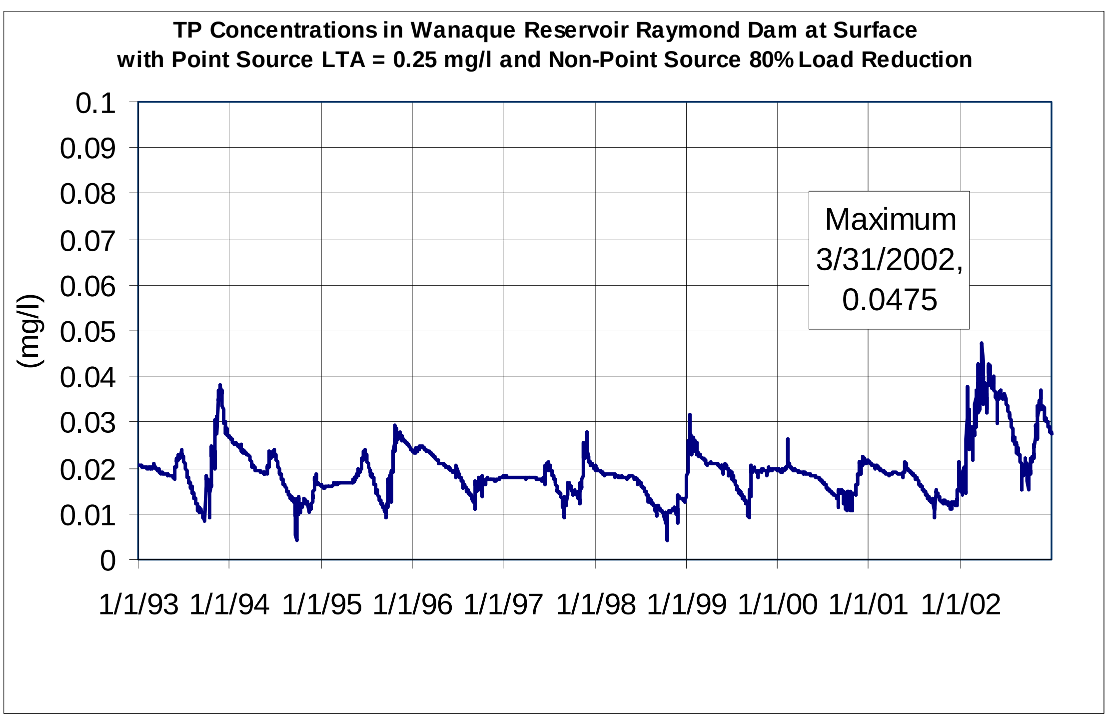


Figure 5.8: Effect of PS and NPS Load Reductions on Simulated Summer-Average Reservoir TP Concentration at Raymond Dam

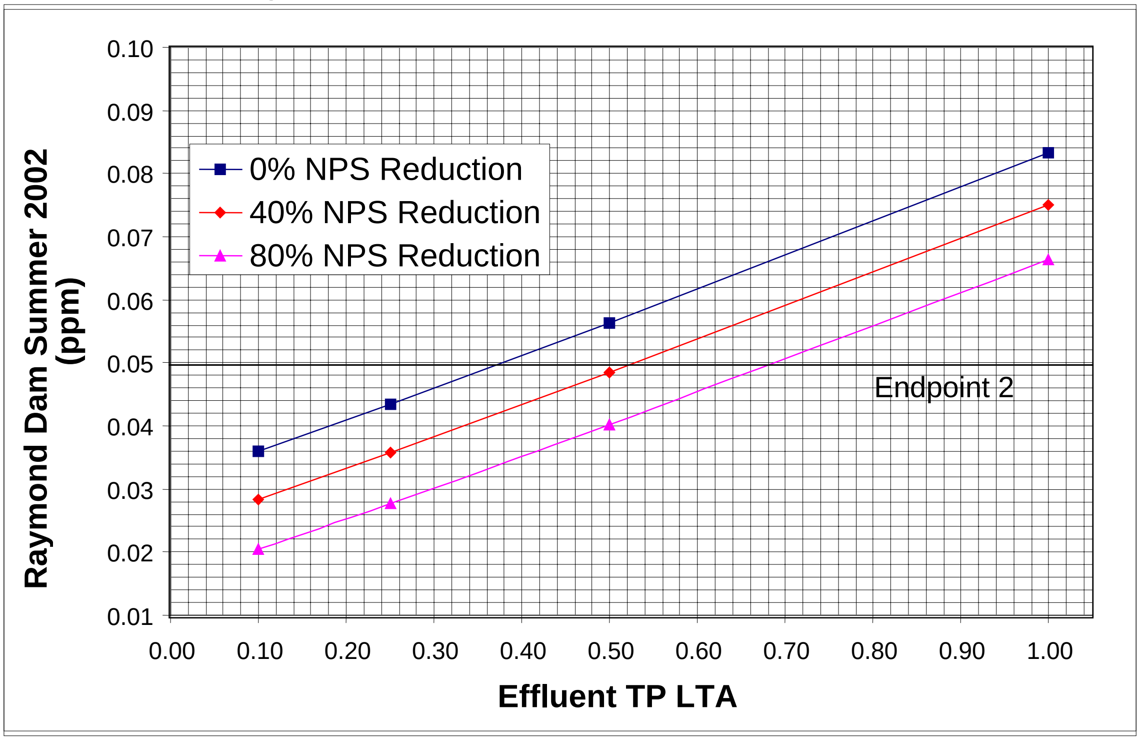
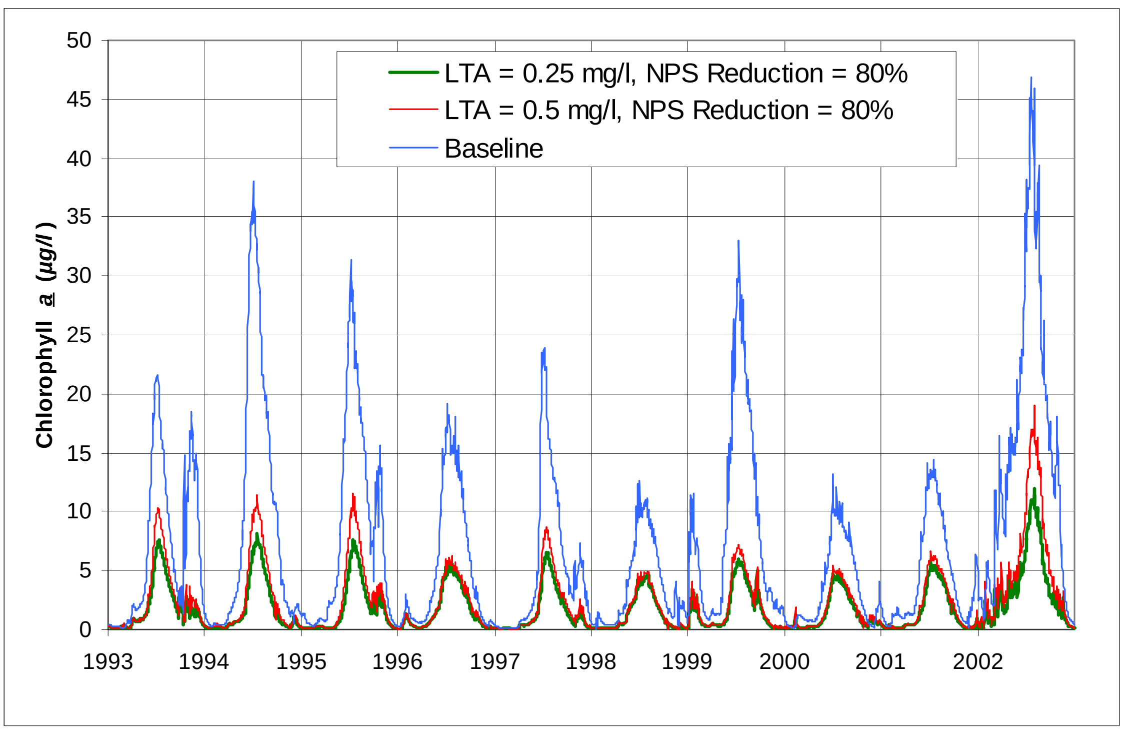


Figure 5.9: Simulated Chlorophyll a Concentrations for Reservoir Endpoints



APPENDIX A

WATER QUALITY MONITORING DATA

Monitoring Data for Wanaque River at Awosting

Agency	Sample Date	Station ID	Station Location	Ortho Phosphate	Total Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	01/12/88	WQ01	Wanaque River USGS Awosting		0.040	0.002	0.029	0.210	16.90
NJDWSC	02/02/88	WQ01	Wanaque River USGS Awosting	0.006	0.040	0.002	0.467	0.220	6.64
NJDWSC	03/15/88	WQ01	Wanaque River USGS Awosting	0.006	0.010	0.002	0.300	0.170	1.55
NJDWSC	04/19/88	WQ01	Wanaque River USGS Awosting	0.006	0.010	0.002	0.005	0.160	6.90
NJDWSC	05/24/88	WQ01	Wanaque River USGS Awosting	0.006	0.030	0.002	0.005	0.230	0.66
NJDWSC	06/28/88	WQ01	Wanaque River USGS Awosting	0.006	0.030	0.002	0.007	0.360	3.70
NJDWSC	07/19/88	WQ01	Wanaque River USGS Awosting	0.006	0.040	0.002	0.005	0.250	2.80
NJDWSC	08/10/88	WQ01	Wanaque River USGS Awosting	0.006	0.030	0.002	0.005	0.380	19.90
NJDWSC	09/20/88	WQ01	Wanaque River USGS Awosting	0.010	0.050	0.002	0.690	0.270	2.90
NJDWSC	10/18/88	WQ01	Wanaque River USGS Awosting	0.010	0.020	0.002	0.005	0.220	4.70
NJDWSC	11/15/88	WQ01	Wanaque River USGS Awosting	0.010	0.030	0.010	0.005	0.260	7.30
NJDWSC	12/13/88	WQ01	Wanaque River USGS Awosting	0.010		0.010		0.220	8.00
NJDWSC	01/17/89	WQ01	Wanaque River USGS Awosting	0.006	0.012	0.010	0.005	0.120	2.40
NJDWSC	02/07/89	WQ01	Wanaque River USGS Awosting	0.006	0.012	0.002	0.005	0.180	8.20
NJDWSC	01/10/90	WQ01	Wanaque River USGS Awosting	< 0.050	0.025	< 0.025	0.277	0.106	7.60
NJDWSC	02/06/90	WQ01	Wanaque River USGS Awosting	< 0.050	< 0.05	< 0.025	0.233	< 0.050	6.00
NJDWSC	03/12/90	WQ01	Wanaque River USGS Awosting	< 0.050	< 0.05	< 0.025	0.148	0.072	5.70
NJDWSC	04/03/90	WQ01	Wanaque River USGS Awosting	< 0.050	< 0.05	< 0.025	0.125	< 0.050	3.40
NJDWSC	05/15/90	WQ01	Wanaque River USGS Awosting	< 0.050	< 0.05	< 0.025	0.046	0.068	0.20
NJDWSC	06/27/90	WQ01	Wanaque River USGS Awosting	< 0.050	0.018	< 0.025	0.008	< 0.05	5.30
NJDWSC	07/17/90	WQ01	Wanaque River USGS Awosting	0.041	0.113	< 0.025	0.048	0.036	8.20
NJDWSC	08/07/90	WQ01	Wanaque River USGS Awosting	< 0.050	0.067	< 0.025	0.009	< 0.050	10.20
NJDWSC	09/04/90	WQ01	Wanaque River USGS Awosting	< 0.05	0.041	< 0.025	0.157	0.057	6.60
NJDWSC	10/16/90	WQ01	Wanaque River USGS Awosting	< 0.05	0.039	< 0.025	< 0.025	0.108	0.60
NJDWSC	11/13/90	WQ01	Wanaque River USGS Awosting	< 0.05	< 0.05	0.009	0.130	0.009	1.20
NJDWSC	12/04/90	WQ01	Wanaque River USGS Awosting	0.010	0.098	< 0.025	0.164	0.041	4.20
NJDWSC	01/15/91	WQ01	Wanaque River USGS Awosting	< 0.006	0.012	0.002	0.199	0.034	
NJDWSC	01/15/91	WQ01	Wanaque River USGS Awosting	0.000	0.000	0.002	0.199	0.000	
NJDWSC	01/15/91	WQ01	Wanaque River USGS Awosting	0.000	0.000	0.002	0.199	0.000	
NJDWSC	02/05/91	WQ01	Wanaque River USGS Awosting	< 0.006	0.018	0.007	0.205	0.043	
NJDWSC	03/06/91	WQ01	Wanaque River USGS Awosting	< 0.006	< 0.013	0.002	0.149	0.035	
NJDWSC	04/03/91	WQ01	Wanaque River USGS Awosting	< 0.006	< 0.013	0.002	0.065	0.031	
NJDWSC	04/03/91	WQ01	Wanaque River USGS Awosting	0.000	0.000	0.000		0.000	
NJDWSC	05/21/91	WQ01	Wanaque River USGS Awosting	< 0.006	0.019	< 0.002	0.033	0.051	
NJDWSC	06/25/91	WQ01	Wanaque River USGS Awosting	< 0.006	0.036	< 0.002	0.035	0.042	
NJDWSC	07/30/91	WQ01	Wanaque River USGS Awosting	< 0.006	0.049	0.004	0.030	0.016	
NJDWSC	08/27/91	WQ01	Wanaque River USGS Awosting	< 0.006	0.027	0.004	0.075	0.035	
NJDWSC	08/27/91	WQ01	Wanaque River USGS Awosting	0.000	0.027	0.000		0.000	
NJDWSC	09/24/91	WQ01	Wanaque River USGS Awosting	0.011	0.035	< 0.002	0.080	0.055	

Monitoring Data for Wanaque River at Awosting

Agency	Sample Date	Station ID	Station Location		Ortho Phosphate		Total Phosphate		Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	09/24/91	WQ01	Wanaque River USGS Awosting		0.000		0.000		0.000		0.000	
NJDWSC	10/22/91	WQ01	Wanaque River USGS Awosting	<	0.006		0.014		0.008	0.067	0.022	
NJDWSC	11/19/91	WQ01	Wanaque River USGS Awosting	<	0.006	<	0.013	<	0.002	0.029	0.017	
NJDWSC	12/11/91	WQ01	Wanaque River USGS Awosting	<	0.006	<	0.013	<	0.002	0.076	0.019	
NJDWSC	01/07/92	WQ01	Wanaque River USGS Awosting		0.022		0.049		0.006	0.823	0.030	
NJDWSC	02/04/92	WQ01	Wanaque River USGS Awosting		0.007		0.022		0.004	0.689	0.059	
NJDWSC	03/10/92	WQ01	Wanaque River USGS Awosting	<	0.006		0.018	<	0.002	0.138	0.028	
NJDWSC	04/14/92	WQ01	Wanaque River USGS Awosting	<	0.006	<	0.013	<	0.002	0.092	0.061	
NJDWSC	04/14/92	WQ01	Wanaque River USGS Awosting		0.000		0.000		0.000		0.000	
NJDWSC	04/14/92	WQ01	Wanaque River USGS Awosting		0.000		0.000		0.000		0.000	
NJDWSC	05/12/92	WQ01	Wanaque River USGS Awosting	<	0.006		0.035				0.119	
NJDWSC	05/12/92	WQ01	Wanaque River USGS Awosting		0.000		0.028		0.000		0.119	
NJDWSC	06/15/92	WQ01	Wanaque River USGS Awosting			<	0.013				0.000	
NJDWSC	06/15/92	WQ01	Wanaque River USGS Awosting		0.000		0.000		0.000		0.000	
NJDWSC	07/13/92	WQ01	Wanaque River USGS Awosting	<	0.006		0.024	<	0.002	0.013	0.113	
NJDWSC	07/13/92	WQ01	Wanaque River USGS Awosting		0.000		0.024		0.000		0.000	
NJDWSC	08/04/92	WQ01	Wanaque River USGS Awosting	<	0.006		0.013	<	0.002	0.036	0.007	
NJDWSC	09/08/92	WQ01	Wanaque River USGS Awosting		0.041		0.047		0.003	0.019	0.059	
NJDWSC	10/06/92	WQ01	Wanaque River USGS Awosting	<	0.006	<	0.013		0.003	0.015	0.008	
NJDWSC	11/24/92	WQ01	Wanaque River USGS Awosting	<	0.006	<	0.013		0.002	0.037	0.001	
NJDWSC	12/08/92	WQ01	Wanaque River USGS Awosting	<	0.006	<	0.013		0.006	0.101	0.000	
NJDWSC	01/11/93	WQ01	Wanaque River USGS Awosting		0.024		0.014	<	0.002	0.093	0.033	
NJDWSC	01/11/93	WQ01	Wanaque River USGS Awosting		0.000		0.000		0.000		0.000	
NJDWSC	01/11/93	WQ01	Wanaque River USGS Awosting		0.000		0.000		0.000		0.000	
NJDWSC	02/02/93	WQ01	Wanaque River USGS Awosting	<	0.006		0.028		0.002	0.376	0.003	
NJDWSC	03/02/93	WQ01	Wanaque River USGS Awosting		0.007	<	0.013		0.005	0.139	0.027	
NJDWSC	04/06/93	WQ01	Wanaque River USGS Awosting	<	0.006		0.035	<	0.002	0.079	0.068	
NJDWSC	05/10/93	WQ01	Wanaque River USGS Awosting		0.006		0.012		0.002	0.142	0.038	
NJDWSC	05/10/93	WQ01	Wanaque River USGS Awosting		0.000		0.000		0.000		0.000	
NJDWSC	06/22/93	WQ01	Wanaque River USGS Awosting		0.006		0.012		0.005	0.021	0.002	
NJDWSC	06/22/93	WQ01	Wanaque River USGS Awosting		0.000		0.000		0.000		0.000	
NJDWSC	07/20/93	WQ01	Wanaque River USGS Awosting		0.006	<	0.013		0.005	0.098	0.014	
NJDWSC	08/03/93	WQ01	Wanaque River USGS Awosting		0.006		0.012		0.003	0.174	0.005	
NJDWSC	09/13/93	WQ01	Wanaque River USGS Awosting		0.006		0.012		0.004	0.067	0.025	
NJDWSC	10/19/93	WQ01	Wanaque River USGS Awosting		0.006		0.030		0.002	0.024	0.016	
NJDWSC	11/08/93	WQ01	Wanaque River USGS Awosting		0.006		0.012		0.003	0.027	0.035	
NJDWSC	11/08/93	WQ01	Wanaque River USGS Awosting		0.000		0.000		0.000		0.000	
NJDWSC	12/07/93	WQ01	Wanaque River USGS Awosting		0.014		0.012		0.007	0.161	0.029	
NJDWSC	01/04/94	WQ01	Wanaque River USGS Awosting		0.006		0.036		0.004	0.299	0.007	

Monitoring Data for Wanaque River at Awosting

Agency	Sample Date	Station ID	Station Location	Ortho Phosphate		Total Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	02/08/94	WQ01	Wanaque River USGS Awosting	0.006		0.012	0.003	0.312	0.090	
NJDWSC	03/08/94	WQ01	Wanaque River USGS Awosting	0.006		0.012	0.007	0.357	0.075	
NJDWSC	04/05/94	WQ01	Wanaque River USGS Awosting	0.006		0.012	0.006	0.219	0.032	
NJDWSC	05/03/94	WQ01	Wanaque River USGS Awosting	0.006		0.012	0.004	0.087	0.042	
NJDWSC	05/03/94	WQ01	Wanaque River USGS Awosting	0.000		0.000	0.000		0.000	
NJDWSC	06/07/94	WQ01	Wanaque River USGS Awosting	0.006		0.012	0.006	0.082	0.007	
NJDWSC	07/06/94	WQ01	Wanaque River USGS Awosting	0.006		0.012	0.002	0.005	0.007	
NJDWSC	08/08/94	WQ01	Wanaque River USGS Awosting	0.006		0.012	0.008	0.214	0.012	
NJDWSC	09/12/94	WQ01	Wanaque River USGS Awosting	0.006		0.045	0.002	0.021	0.007	
NJDWSC	10/03/94	WQ01	Wanaque River USGS Awosting	0.006		0.016	0.002	0.005	0.015	
NJDWSC	11/29/94	WQ01	Wanaque River USGS Awosting	0.006		0.088	0.002	1.017	0.023	
NJDWSC	12/13/94	WQ01	Wanaque River USGS Awosting	0.006		0.012	0.002	0.108	0.007	
NJDWSC	01/10/95	WQ01	Wanaque River USGS Awosting	0.006		0.012	0.002	0.118	0.080	
NJDWSC	02/07/95	WQ01	Wanaque River USGS Awosting	0.027		0.044	0.002	0.120	0.062	
NJDWSC	03/06/95	WQ01	Wanaque River USGS Awosting	0.006		0.012	0.002	0.159	0.007	
NJDWSC	04/25/95	WQ01	Wanaque River USGS Awosting	0.006		0.012	0.002	0.005	0.007	
NJDWSC	05/31/95	WQ01	Wanaque River USGS Awosting	0.006		0.012	0.008	0.005	0.032	
NJDWSC	06/26/95	WQ01	Wanaque River USGS Awosting	0.006		0.012	0.002	0.043	0.073	
NJDWSC	07/24/95	WQ01	Wanaque River USGS Awosting	0.006		0.012	0.002	0.014	0.007	
NJDWSC	08/22/95	WQ01	Wanaque River USGS Awosting	0.006		0.180	0.002	0.026	0.025	
NJDWSC	09/26/95	WQ01	Wanaque River USGS Awosting	0.006		0.022	0.002	0.057	0.039	
NJDWSC	10/30/95	WQ01	Wanaque River USGS Awosting	0.076		0.093	0.002	0.077	0.041	
NJDWSC	11/28/95	WQ01	Wanaque River USGS Awosting	0.006		0.110	0.003	0.145	0.008	
NJDWSC	12/18/95	WQ01	Wanaque River USGS Awosting	0.039		0.047	0.002	0.115	0.083	
NJDWSC	02/05/96	WQ01	Wanaque River USGS Awosting	0.009		0.057	0.002	0.312	0.084	
NJDWSC	02/05/96	WQ01	Wanaque River USGS Awosting	0.009		0.057	0.002	0.312	0.084	
NJDWSC	03/05/96	WQ01	Wanaque River USGS Awosting	0.013		0.041	0.002	0.344	0.007	
NJDWSC	03/05/96	WQ01	Wanaque River USGS Awosting	0.013		0.041	0.002	0.344	0.007	
NJDWSC	04/08/96	WQ01	Wanaque River USGS Awosting	0.006		0.096	0.002	0.147	0.124	
NJDWSC	04/08/96	WQ01	Wanaque River USGS Awosting	0.006		0.096	0.002	0.147	0.124	
NJDWSC	05/14/96	WQ01	Wanaque River USGS Awosting	0.006		0.013	0.002	0.019	0.150	
NJDWSC	05/14/96	WQ01	Wanaque River USGS Awosting	0.006		0.013	0.002	0.019	0.150	
NJDWSC	06/11/96	WQ01	Wanaque River USGS Awosting	0.011		0.031	0.006	0.003	0.025	
NJDWSC	06/11/96	WQ01	Wanaque River USGS Awosting	0.011		0.031	0.006	0.003	0.025	
NJDWSC	07/09/96	WQ01	Wanaque River USGS Awosting	0.006	<	0.013	0.002	0.011	0.007	
NJDWSC	07/09/96	WQ01	Wanaque River USGS Awosting	0.006	<	0.013	0.002	0.011	0.007	
NJDWSC	08/26/96	WQ01	Wanaque River USGS Awosting	0.013		0.086	0.002	0.052	0.007	
NJDWSC	08/26/96	WQ01	Wanaque River USGS Awosting	0.013		0.086	0.002	0.052	0.007	
NJDWSC	09/25/96	WQ01	Wanaque River USGS Awosting	0.026		0.064	0.004	0.124	0.007	

Monitoring Data for Wanaque River at Awosting

Agency	Sample Date	Station ID	Station Location		Ortho Phosphate	Total Phosphate		Nitrite	Nitrate		Ammonia	Chlorophyll-a
NJDWSC	09/25/96	WQ01	Wanaque River USGS Awosting		0.026	0.064		0.004	0.124		0.007	
NJDWSC	10/07/96	WQ01	Wanaque River USGS Awosting		0.000			0.000			0.007	
NJDWSC	10/07/96	WQ01	Wanaque River USGS Awosting								0.007	
NJDWSC	11/12/96	WQ01	Wanaque River USGS Awosting		0.006			0.002	0.086		0.007	
NJDWSC	12/16/96	WQ01	Wanaque River USGS Awosting		0.006	0.032		0.074	0.214		0.007	
NJDWSC	01/07/97	WQ01	Wanaque River USGS Awosting		0.006	0.054		0.002	0.253		0.007	
NJDWSC	02/04/97	WQ01	Wanaque River USGS Awosting		0.006	0.081		0.002	0.172		0.018	
NJDWSC	02/04/97	WQ01	Wanaque River USGS Awosting		0.000	0.000		0.000			0.018	
NJDWSC	03/04/97	WQ01	Wanaque River USGS Awosting	<	0.005	0.330	<	0.002	0.032		0.007	
NJDWSC	04/08/97	WQ01	Wanaque River USGS Awosting	<	0.005	0.093	<	0.002	0.021		0.007	
NJDWSC	05/05/97	WQ01	Wanaque River USGS Awosting	<	0.005	0.079	<	0.002	0.014		0.012	
NJDWSC	06/02/97	WQ01	Wanaque River USGS Awosting	<	0.005	0.160	<	0.002	0.108		0.145	
NJDWSC	07/07/97	WQ01	Wanaque River USGS Awosting		0.016	0.085	<	0.002	0.016		0.036	
NJDWSC	08/12/97	WQ01	Wanaque River USGS Awosting	<	0.005	0.110	<	0.002	0.060		0.091	
NJDWSC	09/16/97	WQ01	Wanaque River USGS Awosting	<	0.005	0.068	<	0.002	0.014		0.007	
NJDWSC	10/15/97	WQ01	Wanaque River USGS Awosting		0.044	0.049	<	0.002	0.039		0.103	
NJDWSC	11/13/97	WQ01	Wanaque River USGS Awosting	<	0.005	0.056	<	0.002	0.006		0.006	
NJDWSC	12/16/97	WQ01	Wanaque River USGS Awosting	<	0.005	0.035	<	0.002	0.096		0.061	
NJDWSC	01/12/98	WQ01	Wanaque River USGS Awosting	<	0.005	0.098	<	0.002	0.178		0.087	11.98
NJDWSC	02/10/98	WQ01	Wanaque River USGS Awosting	<	0.005	0.307	<	0.002	0.190		0.010	4.47
NJDWSC	03/09/98	WQ01	Wanaque River USGS Awosting	<	0.005	0.062	<	0.002	0.049		0.012	14.65
NJDWSC	04/07/98	WQ01	Wanaque River USGS Awosting	<	0.005	0.102	<	0.002	0.064		0.009	13.73
NJDWSC	05/05/98	WQ01	Wanaque River USGS Awosting	<	0.005	0.157	<	0.002	0.075	<	0.007	8.71
NJDWSC	06/01/98	WQ01	Wanaque River USGS Awosting	<	0.005	0.129	<	0.002	0.068		0.086	10.15
NJDWSC	07/07/98	WQ01	Wanaque River USGS Awosting	<	0.005	0.081	<	0.002	0.088		0.061	7.33
NJDWSC	08/18/98	WQ01	Wanaque River USGS Awosting	<	0.005	0.155	<	0.002	0.090		0.018	4.00
NJDWSC	09/29/98	WQ01	Wanaque River USGS Awosting	<	0.005	0.132		0.040	0.137		0.044	5.55
NJDWSC	10/20/98	WQ01	Wanaque River USGS Awosting	<	0.005	0.165	<	0.002	0.080		0.011	0.85
NJDWSC	11/04/98	WQ01	Wanaque River USGS Awosting	<	0.005	0.129	<	0.002	0.129		0.015	3.31
NJDWSC	12/02/98	WQ01	Wanaque River USGS Awosting	<	0.005	0.178	<	0.002	0.081	<	0.007	6.73
NJDWSC	02/09/99	WQ01	Wanaque River USGS Awosting	<	0.005	0.072	<	0.002	0.277		0.012	4.27
NJDWSC	03/02/99	WQ01	Wanaque River USGS Awosting	<	0.005	0.094	<	0.002	0.226		0.015	9.72
NJDWSC	04/06/99	WQ01	Wanaque River USGS Awosting	<	0.005	0.095	<	0.002	0.073		0.040	12.60
NJDWSC	05/04/99	WQ01	Wanaque River USGS Awosting	<	0.005	0.130	<	0.002	0.075		0.039	7.48
NJDWSC	06/14/99	WQ01	Wanaque River USGS Awosting		0.040	0.151	<	0.002	0.100		0.070	2.56
NJDWSC	07/13/99	WQ01	Wanaque River USGS Awosting	<	0.005	0.100		0.070	0.140		0.102	15.06
NJDWSC	08/10/99	WQ01	Wanaque River USGS Awosting		0.041	0.075	<	0.002	0.337		0.029	6.19
NJDWSC	09/07/99	WQ01	Wanaque River USGS Awosting									4.91
NJDWSC	10/18/99	WQ01	Wanaque River USGS Awosting	<	0.005	0.113	<	0.002	0.100	<	0.007	8.54

Monitoring Data for Wanaque River at Awosting

Agency	Sample Date	Station ID	Station Location	Ortho Phosphate	Total Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	11/22/99	WQ01	Wanaque River USGS Awosting	0.056	0.106	< 0.002	0.148	0.023	
NJDWSC	12/07/99	WQ01	Wanaque River USGS Awosting	< 0.005	0.114	< 0.002	0.162	0.017	13.88
NJDWSC	01/10/00	WQ01	Wanaque River USGS Awosting	< 0.005	0.061	< 0.002	0.292	0.040	3.74
NJDWSC	02/07/00	WQ01	Wanaque River USGS Awosting	< 0.005	0.209	< 0.002	0.371	0.087	1.17
NJDWSC	03/06/00	WQ01	Wanaque River USGS Awosting	< 0.005	0.052	< 0.002	0.311	0.017	6.84
NJDWSC	04/04/00	WQ01	Wanaque River USGS Awosting	< 0.005	0.129	< 0.002	0.222	0.010	8.54
NJDWSC	05/02/00	WQ01	Wanaque River USGS Awosting	N.D.	< 0.012	N.D.	0.146	< 0.007	9.51
NJDWSC	06/06/00	WQ01	Wanaque River USGS Awosting	< 0.005	< 0.012	< 0.002	0.165	0.091	3.03
NJDWSC	07/11/00	WQ01	Wanaque River USGS Awosting	< 0.005	0.133	< 0.002	< 0.001	0.116	20.29
NJDWSC	08/01/00	WQ01	Wanaque River USGS Awosting	< 0.005	0.030	< 0.002	0.108	0.056	18.58
NJDWSC	09/12/00	WQ01	Wanaque River USGS Awosting	< 0.005	0.075	< 0.002	0.103	0.054	7.80
NJDWSC	10/11/00	WQ01	Wanaque River USGS Awosting		0.088	< 0.002		0.176	15.91
NJDWSC	11/28/00	WQ01	Wanaque River USGS Awosting	< 0.005	< 0.012	< 0.002	0.122		7.26
NJDWSC	12/11/00	WQ01	Wanaque River USGS Awosting	< 0.005	< 0.012	< 0.002	0.154	0.056	8.97
NJDWSC	01/09/01	WQ01	Wanaque River USGS Awosting	< 0.005	0.106	< 0.002	0.301	< 0.007	7.37
NJDWSC	02/06/01	WQ01	Wanaque River USGS Awosting	< 0.005	0.579	< 0.002	0.298	0.245	5.34
NJDWSC	03/13/01	WQ01	Wanaque River USGS Awosting	< 0.005	0.264	< 0.002	0.300	0.067	7.90
NJDWSC	04/02/01	WQ01	Wanaque River USGS Awosting	< 0.005	0.038	< 0.002	0.298	0.033	38.77
NJDWSC	05/02/01	WQ01	Wanaque River USGS Awosting	< 0.005	0.037	< 0.002	0.091	0.053	24.56
NJDWSC	06/06/01	WQ01	Wanaque River USGS Awosting	< 0.005		< 0.002	< 0.001	0.015	

Monitoring Data for Ringwood Creek

Agency	Sample Date	Station ID	Station Location	Ortho Phosphate	Total Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	01/12/88	RG01	Ringwood River USGS - Ringwood	0.006	0.012				
NJDWSC	02/02/88	RG01	Ringwood River USGS - Ringwood	0.020	0.020	0.002	0.120	0.220	1.62
NJDWSC	03/15/88	RG01	Ringwood River USGS - Ringwood	0.006	0.010	0.002	0.005	0.190	0.32
NJDWSC	04/19/88	RG01	Ringwood River USGS - Ringwood	0.006	0.010	0.002	0.005	0.180	2.80
NJDWSC	05/24/88	RG01	Ringwood River USGS - Ringwood	0.006	0.040	0.002	0.005	0.290	0.68
NJDWSC	06/28/88	RG01	Ringwood River USGS - Ringwood	0.020	0.030	0.002	0.140	0.320	4.70
NJDWSC	07/19/88	RG01	Ringwood River USGS - Ringwood	0.006	0.030	0.002	0.150	0.270	19.90
NJDWSC	08/10/88	RG01	Ringwood River USGS - Ringwood	0.020	0.020	0.002	0.005	0.280	0.20
NJDWSC	09/20/88	RG01	Ringwood River USGS - Ringwood	0.010	0.020	0.002	0.730	0.210	1.00
NJDWSC	10/18/88	RG01	Ringwood River USGS - Ringwood	0.006	0.010	0.002	0.005	0.200	4.00
NJDWSC	11/15/88	RG01	Ringwood River USGS - Ringwood	0.010	0.030	0.010	0.005	0.320	6.90
NJDWSC	12/13/88	RG01	Ringwood River USGS - Ringwood	0.006	0.012	0.010		0.530	9.00
NJDWSC	01/17/89	RG01	Ringwood River USGS - Ringwood	0.006	0.012	0.002	0.005	1.340	10.40
NJDWSC	02/07/89	RG01	Ringwood River USGS - Ringwood	0.006	0.012	0.002	0.005	0.240	1.30
NJDWSC	01/10/90	RG01	Ringwood River USGS - Ringwood	< 0.050	0.039	< 0.025	0.246	0.066	2.10
NJDWSC	02/06/90	RG01	Ringwood River USGS - Ringwood	< 0.050	< 0.05	< 0.025	0.160	< 0.050	0.20
NJDWSC	03/12/90	RG01	Ringwood River USGS - Ringwood	< 0.050	< 0.05	< 0.025	0.103	0.058	1.50
NJDWSC	04/03/90	RG01	Ringwood River USGS - Ringwood	< 0.050	< 0.05	< 0.025	0.146	0.053	3.00
NJDWSC	05/15/90	RG01	Ringwood River USGS - Ringwood	< 0.050	< 0.05	< 0.025	0.086	0.068	0.40
NJDWSC	06/27/90	RG01	Ringwood River USGS - Ringwood	< 0.050	0.032	< 0.025	0.155	< 0.05	3.40
NJDWSC	07/17/90	RG01	Ringwood River USGS - Ringwood	0.030	0.073	< 0.025	0.178	0.028	7.60
NJDWSC	08/07/90	RG01	Ringwood River USGS - Ringwood	< 0.050	0.096	< 0.025	0.143	< 0.050	3.80
NJDWSC	09/04/90	RG01	Ringwood River USGS - Ringwood	< 0.05	0.025	< 0.025	0.059	0.014	3.60
NJDWSC	10/16/90	RG01	Ringwood River USGS - Ringwood	< 0.05	0.043	< 0.025	0.074	0.090	2.30
NJDWSC	11/13/90	RG01	Ringwood River USGS - Ringwood	< 0.05	< 0.05	0.002	0.103	0.004	4.30
NJDWSC	12/04/90	RG01	Ringwood River USGS - Ringwood	0.010	0.068	< 0.025	0.111	0.027	8.10
NJDWSC	01/15/91	RG01	Ringwood River USGS - Ringwood	0.007	0.014	< 0.002	0.181	0.105	
NJDWSC	01/15/91	RG01	Ringwood River USGS - Ringwood	0.000	0.000	< 0.002	0.181	0.000	
NJDWSC	01/15/91	RG01	Ringwood River USGS - Ringwood	0.000	0.000	< 0.002	0.181	0.000	
NJDWSC	02/05/91	RG01	Ringwood River USGS - Ringwood	< 0.006	0.021	<	0.205	0.119	
NJDWSC	03/06/91	RG01	Ringwood River USGS - Ringwood	< 0.006	0.016	< 0.002	1.469	0.055	
NJDWSC	04/03/91	RG01	Ringwood River USGS - Ringwood	< 0.006	< 0.013	0.003	0.059	0.014	
NJDWSC	04/03/91	RG01	Ringwood River USGS - Ringwood	0.000	0.000	0.000		0.000	
NJDWSC	05/21/91	RG01	Ringwood River USGS - Ringwood	< 0.006	0.036	0.010	0.345	0.070	
NJDWSC	06/25/91	RG01	Ringwood River USGS - Ringwood	< 0.006	0.033	0.005	0.303	0.060	
NJDWSC	07/30/91	RG01	Ringwood River USGS - Ringwood	0.008	0.018	0.003	0.240	0.017	
NJDWSC	08/27/91	RG01	Ringwood River USGS - Ringwood	< 0.006	< 0.013	< 0.002	0.180	0.005	
NJDWSC	08/27/91	RG01	Ringwood River USGS - Ringwood	0.000	< 0.013	0.000		0.000	
NJDWSC	09/24/91	RG01	Ringwood River USGS - Ringwood	< 0.006	0.016	< 0.002	0.094	0.003	

Monitoring Data for Ringwood Creek

Agency	Sample Date	Station ID	Station Location		Ortho Phosphate		Total Phosphate		Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	09/24/91	RG01	Ringwood River USGS - Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	10/22/91	RG01	Ringwood River USGS - Ringwood	<	0.006	<	0.013	<	0.002	0.018	0.011	
NJDWSC	11/19/91	RG01	Ringwood River USGS - Ringwood	<	0.006	<	0.013	<	0.002	0.035	0.032	
NJDWSC	12/11/91	RG01	Ringwood River USGS - Ringwood	<	0.006	<	0.013	<	0.002	0.075	0.027	
NJDWSC	01/07/92	RG01	Ringwood River USGS - Ringwood		0.046		0.063	<	0.002	0.555	0.027	
NJDWSC	02/04/92	RG01	Ringwood River USGS - Ringwood	<	0.006		0.019	<	0.002	0.563	0.048	
NJDWSC	03/10/92	RG01	Ringwood River USGS - Ringwood	<	0.006	<	0.013	<	0.002	0.089	0.038	
NJDWSC	04/14/92	RG01	Ringwood River USGS - Ringwood		0.009	<	0.013	<	0.002	0.060	0.068	
NJDWSC	04/14/92	RG01	Ringwood River USGS - Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	04/14/92	RG01	Ringwood River USGS - Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	05/12/92	RG01	Ringwood River USGS - Ringwood	<	0.006	<	0.013				0.042	
NJDWSC	05/12/92	RG01	Ringwood River USGS - Ringwood		0.000		0.013		0.000		0.042	
NJDWSC	06/15/92	RG01	Ringwood River USGS - Ringwood			<	0.013				0.000	
NJDWSC	06/15/92	RG01	Ringwood River USGS - Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	07/13/92	RG01	Ringwood River USGS - Ringwood	<	0.006		0.016		0.003	0.110	0.073	
NJDWSC	07/13/92	RG01	Ringwood River USGS - Ringwood		0.000		0.016		0.000		0.000	
NJDWSC	08/04/92	RG01	Ringwood River USGS - Ringwood		0.061		0.053	<	0.002	0.046	0.006	
NJDWSC	09/08/92	RG01	Ringwood River USGS - Ringwood		0.530		0.021		0.003	0.147	0.035	
NJDWSC	10/06/92	RG01	Ringwood River USGS - Ringwood	<	0.006		0.014		0.004	0.168	0.001	
NJDWSC	11/24/92	RG01	Ringwood River USGS - Ringwood	<	0.006	<	0.013		0.006	0.163	0.025	
NJDWSC	12/08/92	RG01	Ringwood River USGS - Ringwood	<	0.006	<	0.013		0.006	0.218	0.151	
NJDWSC	01/11/93	RG01	Ringwood River USGS - Ringwood		0.015		0.061	<	0.002	0.126	0.120	
NJDWSC	01/11/93	RG01	Ringwood River USGS - Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	01/11/93	RG01	Ringwood River USGS - Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	02/02/93	RG01	Ringwood River USGS - Ringwood	<	0.006		0.013		0.002	0.260	0.217	
NJDWSC	03/02/93	RG01	Ringwood River USGS - Ringwood	<	0.006	<	0.013		0.008	0.341	0.156	
NJDWSC	04/06/93	RG01	Ringwood River USGS - Ringwood	<	0.006	<	0.013	<	0.002	0.043	0.040	
NJDWSC	05/10/93	RG01	Ringwood River USGS - Ringwood		0.006		0.012		0.007	0.328	0.025	
NJDWSC	05/10/93	RG01	Ringwood River USGS - Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	06/22/93	RG01	Ringwood River USGS - Ringwood		0.006		0.029		0.010	0.234	0.007	
NJDWSC	06/22/93	RG01	Ringwood River USGS - Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	07/20/93	RG01	Ringwood River USGS - Ringwood		0.006		0.012		0.005	0.362	0.000	
NJDWSC	08/03/93	RG01	Ringwood River USGS - Ringwood		0.006		0.022		0.003	0.190	0.032	
NJDWSC	09/13/93	RG01	Ringwood River USGS - Ringwood		0.006		0.012		0.003	0.216	0.012	
NJDWSC	10/19/93	RG01	Ringwood River USGS - Ringwood		0.006		0.015		0.002	0.113	0.012	
NJDWSC	10/19/93	RG01	Ringwood River USGS - Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	11/08/93	RG01	Ringwood River USGS - Ringwood		0.006		0.012		0.002	0.281	0.076	
NJDWSC	11/08/93	RG01	Ringwood River USGS - Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	12/07/93	RG01	Ringwood River USGS - Ringwood		0.006		0.012		0.007	0.144	0.101	

Monitoring Data for Ringwood Creek

Agency	Sample Date	Station ID	Station Location	Ortho Phosphate	Total Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	01/04/94	RG01	Ringwood River USGS - Ringwood	0.006	0.012	0.003	0.141	0.024	
NJDWSC	02/08/94	RG01	Ringwood River USGS - Ringwood	0.006	0.012	0.004	0.394	0.060	
NJDWSC	03/08/94	RG01	Ringwood River USGS - Ringwood	0.006	0.012	0.006	0.355	0.007	
NJDWSC	04/05/94	RG01	Ringwood River USGS - Ringwood	0.006	0.012	0.003	0.110	0.054	
NJDWSC	05/03/94	RG01	Ringwood River USGS - Ringwood	0.006	0.012	0.002	0.169	0.004	
NJDWSC	05/03/94	RG01	Ringwood River USGS - Ringwood	0.000	0.000	0.008	0.169	0.000	
NJDWSC	06/07/94	RG01	Ringwood River USGS - Ringwood	0.006	0.013	0.002	0.151	0.008	
NJDWSC	07/06/94	RG01	Ringwood River USGS - Ringwood	0.006	0.012	0.002	0.171	0.007	
NJDWSC	08/08/94	RG01	Ringwood River USGS - Ringwood	0.006	0.012	0.010	0.365	0.007	
NJDWSC	09/12/94	RG01	Ringwood River USGS - Ringwood	0.006	0.054	0.002	0.086	0.007	
NJDWSC	10/03/94	RG01	Ringwood River USGS - Ringwood	0.006	0.016	0.002	0.190	0.007	
NJDWSC	11/29/94	RG01	Ringwood River USGS - Ringwood	0.006	0.048	0.002	0.060	0.017	
NJDWSC	12/13/94	RG01	Ringwood River USGS - Ringwood	0.006	0.012	0.002	0.139	0.019	
NJDWSC	01/10/95	RG01	Ringwood River USGS - Ringwood	0.006	0.015	0.002	0.180	0.118	
NJDWSC	02/07/95	RG01	Ringwood River USGS - Ringwood	0.029	0.043	0.002	0.124	0.064	
NJDWSC	03/06/95	RG01	Ringwood River USGS - Ringwood	0.006	0.012	0.002	0.211	0.048	
NJDWSC	04/25/95	RG01	Ringwood River USGS - Ringwood	0.006	0.012	0.002	0.005	0.007	
NJDWSC	05/31/95	RG01	Ringwood River USGS - Ringwood	0.006	0.012	0.013	0.181	0.009	
NJDWSC	06/26/95	RG01	Ringwood River USGS - Ringwood	0.006	0.390	0.002	0.208	0.045	
NJDWSC	07/24/95	RG01	Ringwood River USGS - Ringwood	0.006	0.057	0.002	0.156	0.007	
NJDWSC	08/22/95	RG01	Ringwood River USGS - Ringwood	0.006	0.240	0.002	0.215	0.558	
NJDWSC	09/26/95	RG01	Ringwood River USGS - Ringwood	0.006	0.049	0.002	0.154	0.000	
NJDWSC	10/30/95	RG01	Ringwood River USGS - Ringwood	0.041	0.160	0.027	0.149	0.047	
NJDWSC	11/28/95	RG01	Ringwood River USGS - Ringwood	0.006	0.180	0.002	0.166	0.075	
NJDWSC	12/18/95	RG01	Ringwood River USGS - Ringwood	0.220	0.036	0.002	0.103	0.139	
NJDWSC	01/22/96	RG01	Ringwood River USGS - Ringwood	0.016	0.034	0.002	0.195	0.096	
NJDWSC	01/22/96	RG01	Ringwood River USGS - Ringwood	0.016	0.034	0.002	0.195	0.096	
NJDWSC	02/05/96	RG01	Ringwood River USGS - Ringwood	0.006	0.110	0.002	0.117	0.082	
NJDWSC	02/05/96	RG01	Ringwood River USGS - Ringwood	0.006	0.110	0.002	0.117	0.082	
NJDWSC	03/05/96	RG01	Ringwood River USGS - Ringwood	0.013	0.062	0.002	0.127	0.007	
NJDWSC	03/05/96	RG01	Ringwood River USGS - Ringwood	0.013	0.062	0.002	0.127	0.007	
NJDWSC	04/08/96	RG01	Ringwood River USGS - Ringwood	0.006	0.071	0.002	0.078	0.175	
NJDWSC	04/08/96	RG01	Ringwood River USGS - Ringwood	0.006	0.071	0.002	0.078	0.175	
NJDWSC	05/14/96	RG01	Ringwood River USGS - Ringwood	0.006	0.061	0.002	0.032	0.158	
NJDWSC	05/14/96	RG01	Ringwood River USGS - Ringwood	0.006	0.061	0.002	0.032	0.158	
NJDWSC	06/11/96	RG01	Ringwood River USGS - Ringwood	0.036	0.066	0.005	0.165	0.025	
NJDWSC	06/11/96	RG01	Ringwood River USGS - Ringwood	0.036	0.066	0.005	0.165	0.025	
NJDWSC	07/09/96	RG01	Ringwood River USGS - Ringwood	0.006	0.054	0.002	0.123	0.007	
NJDWSC	07/09/96	RG01	Ringwood River USGS - Ringwood	0.006	0.054	0.002	0.123	0.007	

Monitoring Data for Ringwood Creek

Agency	Sample Date	Station ID	Station Location		Ortho Phosphate	Total Phosphate		Nitrite		Nitrate		Ammonia	Chlorophyll-a
NJDWSC	08/26/96	RG01	Ringwood River USGS - Ringwood		0.011	0.099		0.002		0.181		0.007	
NJDWSC	08/26/96	RG01	Ringwood River USGS - Ringwood		0.011	0.099		0.002		0.181		0.007	
NJDWSC	09/25/96	RG01	Ringwood River USGS - Ringwood		0.034	0.078		0.003		0.129		0.004	
NJDWSC	09/25/96	RG01	Ringwood River USGS - Ringwood		0.034	0.078		0.003		0.129		0.004	
NJDWSC	10/07/96	RG01	Ringwood River USGS - Ringwood		0.006			0.002		0.073		0.007	
NJDWSC	10/07/96	RG01	Ringwood River USGS - Ringwood		0.006			0.002		0.073		0.007	
NJDWSC	11/12/96	RG01	Ringwood River USGS - Ringwood		0.006			0.002		0.069		0.007	
NJDWSC	12/16/96	RG01	Ringwood River USGS - Ringwood		0.006	0.012		0.056		0.120		0.007	
NJDWSC	01/07/97	RG01	Ringwood River USGS - Ringwood		0.006	0.012		0.002		0.163		0.007	
NJDWSC	02/04/97	RG01	Ringwood River USGS - Ringwood		0.006	0.059		0.002		0.177		0.043	
NJDWSC	02/04/97	RG01	Ringwood River USGS - Ringwood		0.000	0.000		0.000				0.043	
NJDWSC	03/04/97	RG01	Ringwood River USGS - Ringwood	<	0.005	3.700	<	0.002		0.033		0.011	
NJDWSC	04/08/97	RG01	Ringwood River USGS - Ringwood	<	0.005	0.062	<	0.002		0.026		0.007	
NJDWSC	05/05/97	RG01	Ringwood River USGS - Ringwood	<	0.005	0.072	<	0.002		0.066		0.041	
NJDWSC	06/02/97	RG01	Ringwood River USGS - Ringwood	<	0.005	0.140	<	0.002		0.375		0.065	
NJDWSC	07/07/97	RG01	Ringwood River USGS - Ringwood	<	0.005	0.078	<	0.002		0.052		0.010	
NJDWSC	08/12/97	RG01	Ringwood River USGS - Ringwood	<	0.005	0.050	<	0.002		0.240		0.040	
NJDWSC	09/16/97	RG01	Ringwood River USGS - Ringwood	<	0.005	0.067	<	0.002		0.106		0.007	
NJDWSC	10/15/97	RG01	Ringwood River USGS - Ringwood		0.024	0.014	<	0.002		0.069		0.093	
NJDWSC	11/13/97	RG01	Ringwood River USGS - Ringwood	<	0.005	0.050	<	0.002		0.036		0.007	
NJDWSC	12/16/97	RG01	Ringwood River USGS - Ringwood	<	0.005	0.057	<	0.002		0.125		0.044	
NJDWSC	01/12/98	RG01	Ringwood River USGS - Ringwood	<	0.005	0.064	<	0.002	<	0.001		0.117	
NJDWSC	02/10/98	RG01	Ringwood River USGS - Ringwood	<	0.005	0.175	<	0.002		0.177		0.051	1.07
NJDWSC	03/09/98	RG01	Ringwood River USGS - Ringwood	<	0.005	0.071	<	0.002		0.057	<	0.007	2.30
NJDWSC	04/07/98	RG01	Ringwood River USGS - Ringwood	<	0.005	0.048	<	0.002		0.136		0.047	1.07
NJDWSC	05/05/98	RG01	Ringwood River USGS - Ringwood	<	0.005	0.157	<	0.002		0.143	<	0.007	4.36
NJDWSC	06/01/98	RG01	Ringwood River USGS - Ringwood	<	0.005	0.126	<	0.002		0.212		0.024	4.27
NJDWSC	07/07/98	RG01	Ringwood River USGS - Ringwood	<	0.005	0.032	<	0.002		0.199		0.022	3.84
NJDWSC	08/18/98	RG01	Ringwood River USGS - Ringwood	<	0.005	0.137	<	0.002		0.203	<	0.007	3.63
NJDWSC	09/29/98	RG01	Ringwood River USGS - Ringwood	<	0.005	0.056	<	0.002		0.145		0.056	5.02
NJDWSC	10/20/98	RG01	Ringwood River USGS - Ringwood	<	0.005	0.149	<	0.002		0.081	<	0.007	3.20
NJDWSC	11/04/98	RG01	Ringwood River USGS - Ringwood	<	0.005	0.054	<	0.002		0.081	<	0.007	4.38
NJDWSC	12/02/98	RG01	Ringwood River USGS - Ringwood	<	0.005	0.107	<	0.002		0.085	<	0.007	2.46
NJDWSC	01/05/99	RG01	Ringwood River USGS - Ringwood	<	0.005	0.097	<	0.002		0.303	<	0.007	3.52
NJDWSC	02/09/99	RG01	Ringwood River USGS - Ringwood	<	0.005	0.044	<	0.002		0.220		0.153	2.35
NJDWSC	03/02/99	RG01	Ringwood River USGS - Ringwood	<	0.005	0.088	<	0.002		0.208		0.038	16.23
NJDWSC	04/06/99	RG01	Ringwood River USGS - Ringwood	<	0.005	0.085	<	0.002		0.180		0.050	1.39
NJDWSC	05/04/99	RG01	Ringwood River USGS - Ringwood	<	0.005	0.103	<	0.002		0.183		0.018	2.46
NJDWSC	05/04/99	RG01	Ringwood River USGS - Ringwood		0.000	0.000		0.000				0.000	0.00

Monitoring Data for Ringwood Creek

Agency	Sample Date	Station ID	Station Location	Ortho Phosphate	Total Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	06/14/99	RG01	Ringwood River USGS - Ringwood	< 0.005	0.048	< 0.002	0.220	0.080	0.32
NJDWSC	07/13/99	RG01	Ringwood River USGS - Ringwood	< 0.005	0.037	< 0.002	0.210	0.023	1.82
NJDWSC	08/10/99	RG01	Ringwood River USGS - Ringwood	< 0.005	0.268	< 0.002	0.250	0.017	24.56
NJDWSC	09/07/99	RG01	Ringwood River USGS - Ringwood						1.07
NJDWSC	10/18/99	RG01	Ringwood River USGS - Ringwood	0.040	0.147	< 0.002	0.220	< 0.007	1.92
NJDWSC	11/22/99	RG01	Ringwood River USGS - Ringwood	< 0.005	0.063	< 0.002	0.248	< 0.007	
NJDWSC	12/07/99	RG01	Ringwood River USGS - Ringwood	< 0.005	0.074	< 0.002	0.197	0.056	2.78
NJDWSC	01/10/00	RG01	Ringwood River USGS - Ringwood	< 0.005	0.047	< 0.002	0.317	0.025	1.71
NJDWSC	02/07/00	RG01	Ringwood River USGS - Ringwood	< 0.005	0.158	< 0.002	0.363	0.057	0.11
NJDWSC	03/06/00	RG01	Ringwood River USGS - Ringwood	< 0.005	0.055	< 0.002	0.179	< 0.007	4.06
NJDWSC	04/04/00	RG01	Ringwood River USGS - Ringwood	< 0.005	0.099	< 0.002	0.222	0.026	9.51
NJDWSC	05/02/00	RG01	Ringwood River USGS - Ringwood	N.D.	< 0.012	< 0.002	0.187	< 0.007	4.17
NJDWSC	06/06/00	RG01	Ringwood River USGS - Ringwood	< 0.005	< 0.012	< 0.002	0.455	0.065	4.06
NJDWSC	07/11/00	RG01	Ringwood River USGS - Ringwood	< 0.005	0.086	< 0.002	0.202	0.121	4.17
NJDWSC	08/01/00	RG01	Ringwood River USGS - Ringwood	< 0.005	0.030	< 0.002	0.248	< 0.007	2.56
NJDWSC	10/11/00	RG01	Ringwood River USGS - Ringwood		0.105	< 0.002	0.189	0.105	< 0.01
NJDWSC	11/28/00	RG01	Ringwood River USGS - Ringwood	< 0.005	< 0.012	< 0.002	0.235		0.43
NJDWSC	12/11/00	RG01	Ringwood River USGS - Ringwood	< 0.005	< 0.012	0.078	0.203	0.109	1.60
NJDWSC	01/09/01	RG01	Ringwood River USGS - Ringwood	< 0.005	0.194	< 0.002	0.329	0.109	1.92
NJDWSC	02/06/01	RG01	Ringwood River USGS - Ringwood	< 0.005	0.169	< 0.002	0.295	0.240	1.17
NJDWSC	03/13/01	RG01	Ringwood River USGS - Ringwood	< 0.005	0.296	< 0.002	0.776	0.037	2.99
NJDWSC	04/02/01	RG01	Ringwood River USGS - Ringwood	< 0.005	0.051	< 0.002	0.193	0.117	18.90
NJDWSC	05/02/01	RG01	Ringwood River USGS - Ringwood	< 0.005	0.063	< 0.002	0.158	0.056	11.00
NJDWSC	06/06/01	RG01	Ringwood River USGS - Ringwood	< 0.005		< 0.002	0.226	0.020	

Monitoring Data for West Brook

Agency	Sample Date	Station ID	Station Location	Ortho Phosphate	Total Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	01/12/88	WB01	West Brook River USGS, Ringwood						
NJDWSC	02/02/88	WB01	West Brook River USGS, Ringwood	0.006	0.020	0.002	0.521	0.200	1.90
NJDWSC	03/15/88	WB01	West Brook River USGS, Ringwood	0.006	0.010	0.002	0.300	0.150	0.42
NJDWSC	04/19/88	WB01	West Brook River USGS, Ringwood	0.006	0.010	0.002	0.005	0.120	2.20
NJDWSC	05/24/88	WB01	West Brook River USGS, Ringwood	0.006	0.020	0.002	0.410	0.210	1.50
NJDWSC	06/28/88	WB01	West Brook River USGS, Ringwood	0.006	0.010	0.002	0.710	0.160	4.10
NJDWSC	07/19/88	WB01	West Brook River USGS, Ringwood	0.006	0.020	0.002	0.530	0.180	5.20
NJDWSC	08/10/88	WB01	West Brook River USGS, Ringwood	0.006	0.010	0.002	0.310	0.110	2.40
NJDWSC	09/20/88	WB01	West Brook River USGS, Ringwood	0.006	0.010	0.002	0.650	0.140	3.60
NJDWSC	10/18/88	WB01	West Brook River USGS, Ringwood	0.006	0.012	0.002	0.005	0.130	2.50
NJDWSC	11/15/88	WB01	West Brook River USGS, Ringwood	0.006	0.020	0.002	0.005	0.260	6.80
NJDWSC	12/13/88	WB01	West Brook River USGS, Ringwood	0.006	0.012	0.002		0.130	8.80
NJDWSC	02/07/89	WB01	West Brook River USGS, Ringwood	0.006	0.012	0.002	0.005	0.150	1.00
NJDWSC	01/15/91	WB01	West Brook River USGS, Ringwood	0.007	< 0.013	< 0.002	0.368	0.049	
NJDWSC	01/15/91	WB01	West Brook River USGS, Ringwood	0.000	0.000	< 0.002	0.368	0.000	
NJDWSC	01/15/91	WB01	West Brook River USGS, Ringwood	0.000	0.000	< 0.002	0.368	0.000	
NJDWSC	02/05/91	WB01	West Brook River USGS, Ringwood	< 0.006	< 0.013	< 0.002	0.479	0.042	
NJDWSC	03/06/91	WB01	West Brook River USGS, Ringwood	< 0.006	0.018	< 0.002	0.291	0.033	
NJDWSC	04/03/91	WB01	West Brook River USGS, Ringwood	< 0.006	< 0.013	< 0.002	0.268	0.023	
NJDWSC	04/03/91	WB01	West Brook River USGS, Ringwood	0.000	0.000	0.000		0.000	
NJDWSC	05/21/91	WB01	West Brook River USGS, Ringwood	< 0.006	0.022	0.004	0.355	0.048	
NJDWSC	06/25/91	WB01	West Brook River USGS, Ringwood	< 0.006	0.033	0.005	0.495	0.068	
NJDWSC	07/30/91	WB01	West Brook River USGS, Ringwood	0.007	0.015	< 0.002	0.352	0.012	
NJDWSC	08/27/91	WB01	West Brook River USGS, Ringwood	< 0.006	< 0.013	< 0.002	0.308	0.010	
NJDWSC	08/27/91	WB01	West Brook River USGS, Ringwood	0.000	< 0.013	0.000		0.000	
NJDWSC	09/24/91	WB01	West Brook River USGS, Ringwood	0.014	0.019	< 0.002	0.365	0.016	
NJDWSC	09/24/91	WB01	West Brook River USGS, Ringwood	0.000	0.000	0.000		0.000	
NJDWSC	10/22/91	WB01	West Brook River USGS, Ringwood	< 0.006	0.014	0.004	0.109	0.015	
NJDWSC	11/19/91	WB01	West Brook River USGS, Ringwood	< 0.006	< 0.013	< 0.002	0.139	0.020	
NJDWSC	12/11/91	WB01	West Brook River USGS, Ringwood	< 0.006	< 0.013	0.003	0.144	0.113	
NJDWSC	01/08/92	WB01	West Brook River USGS, Ringwood	0.034	0.150	< 0.002	0.269	0.009	
NJDWSC	02/04/92	WB01	West Brook River USGS, Ringwood	0.006	0.026	0.002	0.336	0.008	
NJDWSC	03/10/92	WB01	West Brook River USGS, Ringwood	< 0.006	0.023	0.003	0.278	0.047	
NJDWSC	04/14/92	WB01	West Brook River USGS, Ringwood	< 0.006	< 0.013	< 0.002	0.236	0.061	
NJDWSC	04/14/92	WB01	West Brook River USGS, Ringwood	0.000	0.000	0.000		0.000	
NJDWSC	04/14/92	WB01	West Brook River USGS, Ringwood	0.000	0.000	0.000		0.000	
NJDWSC	05/12/92	WB01	West Brook River USGS, Ringwood	< 0.006	< 0.013			0.017	
NJDWSC	05/12/92	WB01	West Brook River USGS, Ringwood	0.000	0.012	0.000		0.017	
NJDWSC	06/15/92	WB01	West Brook River USGS, Ringwood		< 0.013			0.000	

Monitoring Data for West Brook

Agency	Sample Date	Station ID	Station Location		Ortho Phosphate		Total Phosphate		Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	06/15/92	WB01	West Brook River USGS, Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	07/13/92	WB01	West Brook River USGS, Ringwood	<	0.006	<	0.013	<	0.002	0.400	0.010	
NJDWSC	07/13/92	WB01	West Brook River USGS, Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	08/04/92	WB01	West Brook River USGS, Ringwood	<	0.006		0.077	<	0.002	0.022	0.003	
NJDWSC	09/08/92	WB01	West Brook River USGS, Ringwood		0.007		0.038	<	0.002	0.269	0.011	
NJDWSC	10/06/92	WB01	West Brook River USGS, Ringwood	<	0.006		0.014	<	0.002	0.289	0.001	
NJDWSC	11/24/92	WB01	West Brook River USGS, Ringwood	<	0.006	<	0.013		0.009	0.210	0.009	
NJDWSC	12/08/92	WB01	West Brook River USGS, Ringwood	<	0.006	<	0.013		0.004	0.317	0.001	
NJDWSC	01/11/93	WB01	West Brook River USGS, Ringwood		0.007		0.089		0.002	0.324	0.044	
NJDWSC	01/11/93	WB01	West Brook River USGS, Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	01/11/93	WB01	West Brook River USGS, Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	02/02/93	WB01	West Brook River USGS, Ringwood		0.027		0.082	<	0.002	0.396	0.003	
NJDWSC	03/02/93	WB01	West Brook River USGS, Ringwood		0.023	<	0.013		0.003	0.398	0.014	
NJDWSC	04/06/93	WB01	West Brook River USGS, Ringwood	<	0.006	<	0.013		0.012	0.201	0.031	
NJDWSC	05/10/93	WB01	West Brook River USGS, Ringwood		0.006		0.012		0.002	0.268	0.058	
NJDWSC	05/10/93	WB01	West Brook River USGS, Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	06/22/93	WB01	West Brook River USGS, Ringwood		0.006		0.022		0.009	0.449	0.007	
NJDWSC	06/22/93	WB01	West Brook River USGS, Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	07/20/93	WB01	West Brook River USGS, Ringwood		0.006		0.026		0.005	0.553	0.001	
NJDWSC	08/03/93	WB01	West Brook River USGS, Ringwood		0.006		0.024		0.003	0.406	0.018	
NJDWSC	09/13/93	WB01	West Brook River USGS, Ringwood		0.006		0.012	<	0.002	0.407	0.006	
NJDWSC	10/19/93	WB01	West Brook River USGS, Ringwood		0.006		0.085		0.002	0.082	0.009	
NJDWSC	11/08/93	WB01	West Brook River USGS, Ringwood		0.006		0.012		0.002	0.145	0.062	
NJDWSC	11/08/93	WB01	West Brook River USGS, Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	12/07/93	WB01	West Brook River USGS, Ringwood		0.014		0.012		0.007	0.303	0.027	
NJDWSC	01/04/94	WB01	West Brook River USGS, Ringwood		0.006		0.012		0.003	0.392	0.007	
NJDWSC	02/08/94	WB01	West Brook River USGS, Ringwood		0.006		0.012	<	0.002	0.463	0.065	
NJDWSC	03/08/94	WB01	West Brook River USGS, Ringwood		0.006		0.012		0.006	0.359	0.461	
NJDWSC	04/05/94	WB01	West Brook River USGS, Ringwood		0.006		0.021		0.003	0.264	0.017	
NJDWSC	05/03/94	WB01	West Brook River USGS, Ringwood		0.006		0.012		0.002	0.164	0.020	
NJDWSC	05/03/94	WB01	West Brook River USGS, Ringwood		0.000		0.000		0.002	0.164	0.000	
NJDWSC	06/07/94	WB01	West Brook River USGS, Ringwood		0.006		0.022		0.013	0.449	0.007	
NJDWSC	07/06/94	WB01	West Brook River USGS, Ringwood		0.006		0.016		0.002	0.356	0.007	
NJDWSC	08/08/94	WB01	West Brook River USGS, Ringwood		0.006		0.012		0.011	0.416	0.007	
NJDWSC	09/12/94	WB01	West Brook River USGS, Ringwood		0.006		0.076		0.024	1.943	0.007	
NJDWSC	10/03/94	WB01	West Brook River USGS, Ringwood		0.006		0.022		0.002	0.235	0.007	
NJDWSC	11/29/94	WB01	West Brook River USGS, Ringwood		0.006		0.067		0.002	2.343	0.007	
NJDWSC	12/13/94	WB01	West Brook River USGS, Ringwood		0.006		0.015		0.002	0.260	0.007	
NJDWSC	01/10/95	WB01	West Brook River USGS, Ringwood		0.006		0.020		0.002	0.303	0.033	

Monitoring Data for West Brook

Agency	Sample Date	Station ID	Station Location	Ortho Phosphate	Total Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	02/07/95	WB01	West Brook River USGS, Ringwood	0.031	0.051	0.002	0.429	0.069	
NJDWSC	03/06/95	WB01	West Brook River USGS, Ringwood	0.006	0.012	0.002	0.311	0.016	
NJDWSC	04/25/95	WB01	West Brook River USGS, Ringwood	0.006	0.034	0.009	0.243	0.007	
NJDWSC	05/31/95	WB01	West Brook River USGS, Ringwood	0.006	0.012	0.009	0.308	0.016	
NJDWSC	06/26/95	WB01	West Brook River USGS, Ringwood	0.006	0.012	0.002	0.382	0.016	
NJDWSC	07/24/95	WB01	West Brook River USGS, Ringwood	0.006	0.012	0.004	0.420	1.419	
NJDWSC	08/22/95	WB01	West Brook River USGS, Ringwood	0.006	0.420	0.002	0.336	0.200	
NJDWSC	09/25/95	WB01	West Brook River USGS, Ringwood	0.006	0.037	0.002	0.355	0.000	
NJDWSC	10/30/95	WB01	West Brook River USGS, Ringwood	0.091	0.190	0.005	0.141	0.053	
NJDWSC	11/28/95	WB01	West Brook River USGS, Ringwood	0.006	0.200	0.002	0.217	0.012	
NJDWSC	12/18/95	WB01	West Brook River USGS, Ringwood	0.032	0.043	0.002	0.216	0.102	
NJDWSC	01/22/96	WB01	West Brook River USGS, Ringwood	0.006	0.054	0.002	0.368	0.010	
NJDWSC	01/22/96	WB01	West Brook River USGS, Ringwood	0.006	0.054	0.002	0.368	0.010	
NJDWSC	02/05/96	WB01	West Brook River USGS, Ringwood	0.006	0.110	0.002	0.422	0.078	
NJDWSC	02/05/96	WB01	West Brook River USGS, Ringwood	0.006	0.110	0.002	0.422	0.078	
NJDWSC	03/05/96	WB01	West Brook River USGS, Ringwood	0.034	0.082	0.002	0.431	0.007	
NJDWSC	03/05/96	WB01	West Brook River USGS, Ringwood	0.034	0.082	0.002	0.431	0.007	
NJDWSC	04/08/96	WB01	West Brook River USGS, Ringwood	0.006	0.090	0.002	0.190	0.056	
NJDWSC	04/08/96	WB01	West Brook River USGS, Ringwood	0.006	0.090	0.002	0.190	0.056	
NJDWSC	05/14/96	WB01	West Brook River USGS, Ringwood	0.006	0.081	0.002	0.167	0.116	
NJDWSC	05/14/96	WB01	West Brook River USGS, Ringwood	0.006	0.081	0.002	0.167	0.116	
NJDWSC	06/11/96	WB01	West Brook River USGS, Ringwood	0.040	0.120	0.010	0.500	0.009	
NJDWSC	06/11/96	WB01	West Brook River USGS, Ringwood	0.040	0.120	0.010	0.500	0.009	
NJDWSC	07/09/96	WB01	West Brook River USGS, Ringwood	0.025	0.092	0.002	0.361	0.007	
NJDWSC	07/09/96	WB01	West Brook River USGS, Ringwood	0.025	0.092	0.002	0.361	0.007	
NJDWSC	08/26/96	WB01	West Brook River USGS, Ringwood	0.019	0.140	0.002	0.407	0.007	
NJDWSC	08/26/96	WB01	West Brook River USGS, Ringwood	0.000	0.000	0.000		0.000	
NJDWSC	08/26/96	WB01	West Brook River USGS, Ringwood	0.019	0.140	0.002	0.407	0.007	
NJDWSC	08/26/96	WB01	West Brook River USGS, Ringwood	0.000	0.000	0.000		0.000	
NJDWSC	09/25/96	WB01	West Brook River USGS, Ringwood	0.027	0.084	0.003	0.358	0.007	
NJDWSC	09/25/96	WB01	West Brook River USGS, Ringwood	0.027	0.084	0.003	0.358	0.007	
NJDWSC	10/08/96	WB01	West Brook River USGS, Ringwood	0.006		0.002	0.470	0.007	
NJDWSC	10/08/96	WB01	West Brook River USGS, Ringwood	0.006		0.002	0.470	0.007	
NJDWSC	11/12/96	WB01	West Brook River USGS, Ringwood	0.006		0.002	0.105	0.007	
NJDWSC	12/17/96	WB01	West Brook River USGS, Ringwood	0.006	0.012	0.063	0.318	0.007	
NJDWSC	01/07/97	WB01	West Brook River USGS, Ringwood	0.006	0.056	0.002	0.272	0.007	
NJDWSC	02/04/97	WB01	West Brook River USGS, Ringwood	0.006	0.085	0.002	0.317	0.016	
NJDWSC	02/04/97	WB01	West Brook River USGS, Ringwood	0.000	0.000	0.000		0.016	
NJDWSC	03/04/97	WB01	West Brook River USGS, Ringwood	< 0.005	0.110	< 0.002	0.082	0.007	

Monitoring Data for West Brook

Agency	Sample Date	Station ID	Station Location		Ortho Phosphate		Total Phosphate		Nitrite	Nitrate		Ammonia	Chlorophyll-a
NJDWSC	04/08/97	WB01	West Brook River USGS, Ringwood	<	0.005		0.068	<	0.002	0.065		0.007	
NJDWSC	05/05/97	WB01	West Brook River USGS, Ringwood	<	0.005		0.075	<	0.002	0.168		0.014	
NJDWSC	06/02/97	WB01	West Brook River USGS, Ringwood	<	0.005		0.140	<	0.002	0.416		0.037	
NJDWSC	07/07/97	WB01	West Brook River USGS, Ringwood	<	0.005		0.085	<	0.002	0.158		0.007	
NJDWSC	08/12/97	WB01	West Brook River USGS, Ringwood	<	0.005		0.099	<	0.002	0.690		0.123	
NJDWSC	09/16/97	WB01	West Brook River USGS, Ringwood	<	0.005		0.064	<	0.002	0.323		0.007	
NJDWSC	10/15/97	WB01	West Brook River USGS, Ringwood	<	0.005		0.039	<	0.002	0.498		0.039	
NJDWSC	11/13/97	WB01	West Brook River USGS, Ringwood	<	0.005		0.066	<	0.002	0.155		0.001	
NJDWSC	12/16/97	WB01	West Brook River USGS, Ringwood	<	0.005		0.054	<	0.002	0.366		0.066	
NJDWSC	01/12/98	WB01	West Brook River USGS, Ringwood	<	0.005		0.068	<	0.002	0.287		0.102	2.46
NJDWSC	02/10/98	WB01	West Brook River USGS, Ringwood	<	0.005		0.186	<	0.002	0.391	<	0.007	1.05
NJDWSC	03/09/98	WB01	West Brook River USGS, Ringwood	<	0.005		0.080	<	0.002	0.181	<	0.007	3.95
NJDWSC	04/07/98	WB01	West Brook River USGS, Ringwood	<	0.005		0.085	<	0.002	0.238		0.178	3.88
NJDWSC	05/05/98	WB01	West Brook River USGS, Ringwood	<	0.005		0.157	<	0.002	0.234		0.077	2.24
NJDWSC	06/01/98	WB01	West Brook River USGS, Ringwood	<	0.005		0.137	<	0.002	0.298		0.021	2.35
NJDWSC	07/07/98	WB01	West Brook River USGS, Ringwood	<	0.005		0.057	<	0.002	0.528		0.043	1.13
NJDWSC	08/18/98	WB01	West Brook River USGS, Ringwood		0.042		0.156	<	0.002	0.586	<	0.007	3.42
NJDWSC	09/29/98	WB01	West Brook River USGS, Ringwood	<	0.005		0.047	<	0.002	0.613		0.040	0.96
NJDWSC	10/20/98	WB01	West Brook River USGS, Ringwood	<	0.005		0.160	<	0.002	0.268	<	0.007	0.98
NJDWSC	11/04/98	WB01	West Brook River USGS, Ringwood	<	0.005		0.072	<	0.002	0.531		0.007	1.71
NJDWSC	12/02/98	WB01	West Brook River USGS, Ringwood	<	0.005		0.123	<	0.002	0.669	<	0.007	0.43
NJDWSC	01/05/99	WB01	West Brook River USGS, Ringwood	<	0.005		0.100	<	0.002	0.484	<	0.007	5.23
NJDWSC	01/05/99	WB01	West Brook River USGS, Ringwood	<	0.005		0.100	<	0.002	0.484	<	0.007	
NJDWSC	02/09/99	WB01	West Brook River USGS, Ringwood	<	0.005		0.032	<	0.002	0.719		0.029	0.21
NJDWSC	03/02/99	WB01	West Brook River USGS, Ringwood	<	0.005		0.080	<	0.002	0.844		0.027	18.80
NJDWSC	04/06/99	WB01	West Brook River USGS, Ringwood		0.032		0.087	<	0.002	0.449		0.022	2.56
NJDWSC	05/04/99	WB01	West Brook River USGS, Ringwood	<	0.005		0.115	<	0.002	0.790		0.023	2.99
NJDWSC	06/14/99	WB01	West Brook River USGS, Ringwood	<	0.005		0.082	<	0.002	0.630		0.015	0.64
NJDWSC	07/13/99	WB01	West Brook River USGS, Ringwood		0.050		0.073	<	0.002	0.670		0.026	1.07
NJDWSC	09/07/99	WB01	West Brook River USGS, Ringwood										0.32
NJDWSC	10/18/99	WB01	West Brook River USGS, Ringwood	<	0.005		0.207	<	0.002	0.240	<	0.007	25.10
NJDWSC	11/22/99	WB01	West Brook River USGS, Ringwood	<	0.005		0.062	<	0.002	0.415		0.008	
NJDWSC	12/07/99	WB01	West Brook River USGS, Ringwood	<	0.005		0.770	<	0.002	0.835		0.033	1.07
NJDWSC	01/10/00	WB01	West Brook River USGS, Ringwood	<	0.005		0.046	<	0.002	0.464		0.014	5.23
NJDWSC	02/07/00	WB01	West Brook River USGS, Ringwood	<	0.005		0.159	<	0.002	0.570		0.015	0.64
NJDWSC	03/06/00	WB01	West Brook River USGS, Ringwood	<	0.005		0.054	<	0.002	0.424		0.022	1.71
NJDWSC	04/04/00	WB01	West Brook River USGS, Ringwood	<	0.005		0.094	<	0.002	0.420		0.032	3.63
NJDWSC	05/02/00	WB01	West Brook River USGS, Ringwood	<	0.005	<	0.012	<	0.002	0.622	<	0.007	1.60
NJDWSC	06/06/00	WB01	West Brook River USGS, Ringwood	<	0.005	<	0.012	<	0.002	0.336		0.079	17.07

Monitoring Data for West Brook

Agency	Sample Date	Station ID	Station Location	Ortho Phosphate	Total Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	07/11/00	WB01	West Brook River USGS, Ringwood	< 0.005	0.108	< 0.002	0.440	0.133	1.60
NJDWSC	08/01/00	WB01	West Brook River USGS, Ringwood	< 0.005	0.027	< 0.002	0.316	0.010	3.52
NJDWSC	09/12/00	WB01	West Brook River USGS, Ringwood	< 0.005	0.052	< 0.002	0.103	0.040	1.17
NJDWSC	10/11/00	WB01	West Brook River USGS, Ringwood		0.078	< 0.002	0.110	0.241	14.10
NJDWSC	11/28/00	WB01	West Brook River USGS, Ringwood	< 0.005	< 0.012	< 0.002	0.308		1.82
NJDWSC	12/11/00	WB01	West Brook River USGS, Ringwood	< 0.005	< 0.012	< 0.002	0.526	0.048	1.50
NJDWSC	01/09/01	WB01	West Brook River USGS, Ringwood	< 0.005	0.181	< 0.002	0.586	< 0.007	0.75
NJDWSC	02/06/01	WB01	West Brook River USGS, Ringwood	< 0.005	0.111	< 0.002	0.494	0.153	1.50
NJDWSC	03/13/01	WB01	West Brook River USGS, Ringwood	< 0.005	0.274	< 0.002	0.562	0.067	2.78
NJDWSC	04/02/01	WB01	West Brook River USGS, Ringwood	< 0.005	0.053	< 0.002	0.598	0.034	16.45
NJDWSC	05/02/01	WB01	West Brook River USGS, Ringwood	< 0.005	0.066	< 0.002	1.142	0.068	9.08
NJDWSC	06/06/01	WB01	West Brook River USGS, Ringwood	< 0.005		< 0.002	0.444	0.020	

Monitoring Data for Blue Mine Brook

Agency	Sample Date	Station ID	Station Location		Ortho Phosphate		Total Phosphate		Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	05/21/91	BM01	Blue Mine Brook USGS Ringwood		0.007		0.020		0.003	0.080	0.038	
NJDWSC	06/25/91	BM01	Blue Mine Brook USGS Ringwood	<	0.006		0.020	<	0.002	0.158	0.026	
NJDWSC	07/30/91	BM01	Blue Mine Brook USGS Ringwood	<	0.006		0.021		0.004	0.151	0.017	
NJDWSC	08/27/91	BM01	Blue Mine Brook USGS Ringwood	<	0.006		0.039	<	0.002	0.136	0.011	
NJDWSC	08/27/91	BM01	Blue Mine Brook USGS Ringwood		0.000		0.039		0.000		0.000	
NJDWSC	09/24/91	BM01	Blue Mine Brook USGS Ringwood	<	0.006	<	0.013	<	0.002	0.361	0.010	
NJDWSC	09/24/91	BM01	Blue Mine Brook USGS Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	10/22/91	BM01	Blue Mine Brook USGS Ringwood	<	0.006	<	0.013	<	0.002	0.013	0.019	
NJDWSC	11/19/91	BM01	Blue Mine Brook USGS Ringwood	<	0.006	<	0.013	<	0.002	0.010	0.023	
NJDWSC	12/10/91	BM01	Blue Mine Brook USGS Ringwood	<	0.006	<	0.013	<	0.002	0.012	0.032	
NJDWSC	01/08/92	BM01	Blue Mine Brook USGS Ringwood		0.016		0.094	<	0.002	0.007	0.000	
NJDWSC	02/04/92	BM01	Blue Mine Brook USGS Ringwood	<	0.006		0.014	<	0.002	0.004	0.003	
NJDWSC	03/10/92	BM01	Blue Mine Brook USGS Ringwood	<	0.006	<	0.013	<	0.002	0.015	0.041	
NJDWSC	04/14/92	BM01	Blue Mine Brook USGS Ringwood	<	0.006	<	0.013	<	0.002	0.010	0.059	
NJDWSC	04/14/92	BM01	Blue Mine Brook USGS Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	04/14/92	BM01	Blue Mine Brook USGS Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	05/11/92	BM01	Blue Mine Brook USGS Ringwood		0.100	<	0.013				0.044	
NJDWSC	05/11/92	BM01	Blue Mine Brook USGS Ringwood		0.000		0.033		0.000		0.044	
NJDWSC	06/16/92	BM01	Blue Mine Brook USGS Ringwood			<	0.013				0.000	
NJDWSC	06/16/92	BM01	Blue Mine Brook USGS Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	07/14/92	BM01	Blue Mine Brook USGS Ringwood		0.007	<	0.013	<	0.002	0.105	0.037	
NJDWSC	07/14/92	BM01	Blue Mine Brook USGS Ringwood		0.000	<	0.013		0.000		0.000	
NJDWSC	08/03/92	BM01	Blue Mine Brook USGS Ringwood	<	0.006		0.034		0.002	0.067	0.005	
NJDWSC	09/09/92	BM01	Blue Mine Brook USGS Ringwood		0.170		0.034	<	0.002	0.024	0.058	
NJDWSC	11/23/92	BM01	Blue Mine Brook USGS Ringwood	<	0.006	<	0.013		0.004	0.039	0.015	
NJDWSC	12/07/92	BM01	Blue Mine Brook USGS Ringwood	<	0.006	<	0.013		0.003	0.010	0.002	
NJDWSC	12/07/92	BM01	Blue Mine Brook USGS Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	02/01/93	BM01	Blue Mine Brook USGS Ringwood	<	0.006		0.013		0.002	0.005	0.007	
NJDWSC	03/01/93	BM01	Blue Mine Brook USGS Ringwood	<	0.006	<	0.013		0.002	0.031	0.015	
NJDWSC	03/01/93	BM01	Blue Mine Brook USGS Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	04/05/93	BM01	Blue Mine Brook USGS Ringwood	<	0.006		0.014	<	0.002	0.001	0.029	
NJDWSC	05/11/93	BM01	Blue Mine Brook USGS Ringwood		0.006		0.012	<	0.002	0.024	0.023	
NJDWSC	06/21/93	BM01	Blue Mine Brook USGS Ringwood		0.006		0.012	<	0.002	0.345	0.004	
NJDWSC	06/21/93	BM01	Blue Mine Brook USGS Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	10/18/93	BM01	Blue Mine Brook USGS Ringwood		0.006		0.016		0.002	0.027	0.007	
NJDWSC	11/09/93	BM01	Blue Mine Brook USGS Ringwood		0.006		0.012		0.002	0.011	0.096	
NJDWSC	11/09/93	BM01	Blue Mine Brook USGS Ringwood		0.000		0.000		0.000		0.000	
NJDWSC	12/06/93	BM01	Blue Mine Brook USGS Ringwood		0.095		0.012		0.007	0.026	0.044	
NJDWSC	01/03/94	BM01	Blue Mine Brook USGS Ringwood		0.006		0.012		0.002	0.005	0.007	

Monitoring Data for Blue Mine Brook

Agency	Sample Date	Station ID	Station Location	Ortho Phosphate	Total Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	02/07/94	BM01	Blue Mine Brook USGS Ringwood	0.006	0.012	0.007	0.006	0.065	
NJDWSC	03/07/94	BM01	Blue Mine Brook USGS Ringwood	0.006	0.012	0.007	0.008	0.037	
NJDWSC	04/05/94	BM01	Blue Mine Brook USGS Ringwood	0.006	0.012	0.002	0.006	0.007	
NJDWSC	05/02/94	BM01	Blue Mine Brook USGS Ringwood	0.006	0.025	0.002	0.005	0.023	
NJDWSC	05/02/94	BM01	Blue Mine Brook USGS Ringwood	0.000	0.000	0.002	0.005	0.000	
NJDWSC	06/06/94	BM01	Blue Mine Brook USGS Ringwood	0.006	0.013	0.002	0.111	0.007	
NJDWSC	07/05/94	BM01	Blue Mine Brook USGS Ringwood	0.006	0.012	0.002	0.062	0.007	
NJDWSC	08/09/94	BM01	Blue Mine Brook USGS Ringwood	0.010	0.080	0.002	0.005	0.007	
NJDWSC	09/13/94	BM01	Blue Mine Brook USGS Ringwood	0.006	0.092	0.002	0.120	0.007	
NJDWSC	10/04/94	BM01	Blue Mine Brook USGS Ringwood	0.006	0.014	0.002	0.005	0.012	
NJDWSC	11/28/94	BM01	Blue Mine Brook USGS Ringwood	0.006	0.120	0.002	0.005	0.012	
NJDWSC	12/13/94	BM01	Blue Mine Brook USGS Ringwood	0.006	0.012	0.002	0.000	0.007	
NJDWSC	12/13/94	BM01	Blue Mine Brook USGS Ringwood	0.000	0.000	0.000		0.000	
NJDWSC	01/09/95	BM01	Blue Mine Brook USGS Ringwood	0.006	0.012	0.002	0.005	0.031	
NJDWSC	02/06/95	BM01	Blue Mine Brook USGS Ringwood	0.034	0.048	0.002	0.008	0.070	
NJDWSC	03/07/95	BM01	Blue Mine Brook USGS Ringwood	0.006	0.012	0.002	0.028	0.007	
NJDWSC	04/24/95	BM01	Blue Mine Brook USGS Ringwood	0.006	0.019	0.002	0.048	0.007	
NJDWSC	05/30/95	BM01	Blue Mine Brook USGS Ringwood	0.006	0.012	0.007	0.005	0.007	
NJDWSC	06/27/95	BM01	Blue Mine Brook USGS Ringwood	0.006	0.012	0.002	0.135	0.053	
NJDWSC	10/31/95	BM01	Blue Mine Brook USGS Ringwood	0.036	0.130	0.012	0.108	0.007	
NJDWSC	11/27/95	BM01	Blue Mine Brook USGS Ringwood	0.006	0.180	0.002	0.050	0.012	
NJDWSC	12/19/95	BM01	Blue Mine Brook USGS Ringwood	0.460	0.033	0.002	0.045	0.160	
NJDWSC	01/22/96	BM01	Blue Mine Brook USGS Ringwood	0.017	0.017	0.002	0.025	0.072	
NJDWSC	01/22/96	BM01	Blue Mine Brook USGS Ringwood	0.017	0.017	0.002	0.025	0.072	
NJDWSC	02/06/96	BM01	Blue Mine Brook USGS Ringwood	0.006	0.150	0.002	0.017	0.064	
NJDWSC	02/06/96	BM01	Blue Mine Brook USGS Ringwood	0.006	0.150	0.002	0.017	0.064	
NJDWSC	03/04/96	BM01	Blue Mine Brook USGS Ringwood	0.006	0.040	0.002	0.033	0.030	
NJDWSC	03/04/96	BM01	Blue Mine Brook USGS Ringwood	0.006	0.040	0.002	0.033	0.030	
NJDWSC	05/13/96	BM01	Blue Mine Brook USGS Ringwood	0.006	0.027	0.002	0.005	0.104	
NJDWSC	05/13/96	BM01	Blue Mine Brook USGS Ringwood	0.006	0.027	0.002	0.005	0.104	
NJDWSC	06/10/96	BM01	Blue Mine Brook USGS Ringwood	0.006	0.079	0.002	0.016	0.007	
NJDWSC	06/10/96	BM01	Blue Mine Brook USGS Ringwood	0.000	0.000	0.000		0.000	
NJDWSC	06/10/96	BM01	Blue Mine Brook USGS Ringwood	0.006	0.079	0.002	0.016	0.007	
NJDWSC	06/10/96	BM01	Blue Mine Brook USGS Ringwood	0.000	0.000	0.000		0.000	
NJDWSC	07/08/96	BM01	Blue Mine Brook USGS Ringwood	0.006	0.120	0.002	0.167	0.007	
NJDWSC	07/08/96	BM01	Blue Mine Brook USGS Ringwood	0.006	0.120	0.002	0.167	0.007	
NJDWSC	09/24/96	BM01	Blue Mine Brook USGS Ringwood	0.026	0.087	0.002	0.023	0.007	
NJDWSC	09/24/96	BM01	Blue Mine Brook USGS Ringwood	0.026	0.087	0.002	0.023	0.007	
NJDWSC	10/08/96	BM01	Blue Mine Brook USGS Ringwood	0.000		0.000		0.007	

Monitoring Data for Blue Mine Brook

Agency	Sample Date	Station ID	Station Location		Ortho Phosphate		Total Phosphate		Nitrite		Nitrate		Ammonia	Chlorophyll-a
NJDWSC	10/08/96	BM01	Blue Mine Brook USGS Ringwood										0.007	
NJDWSC	11/13/96	BM01	Blue Mine Brook USGS Ringwood		0.006				0.002		0.147		0.007	
NJDWSC	12/17/96	BM01	Blue Mine Brook USGS Ringwood		0.006		0.012		0.041		0.055		0.007	
NJDWSC	01/06/97	BM01	Blue Mine Brook USGS Ringwood		0.006		0.051		0.002		0.068		0.007	
NJDWSC	02/03/97	BM01	Blue Mine Brook USGS Ringwood		0.006		0.039		0.002		0.054		0.018	
NJDWSC	02/03/97	BM01	Blue Mine Brook USGS Ringwood		0.000		0.000		0.000				0.018	
NJDWSC	03/03/97	BM01	Blue Mine Brook USGS Ringwood	<	0.005		0.058	<	0.002		0.002		0.007	
NJDWSC	04/07/97	BM01	Blue Mine Brook USGS Ringwood	<	0.005		0.045	<	0.002		0.130		0.007	
NJDWSC	05/06/97	BM01	Blue Mine Brook USGS Ringwood	<	0.005		0.071	<	0.002		0.018		0.016	
NJDWSC	06/03/97	BM01	Blue Mine Brook USGS Ringwood	<	0.005		0.110	<	0.002		0.036		0.000	
NJDWSC	09/15/97	BM01	Blue Mine Brook USGS Ringwood		0.007		0.066	<	0.002		0.028		0.007	
NJDWSC	11/12/97	BM01	Blue Mine Brook USGS Ringwood		0.007		0.028	<	0.002		0.015		0.004	
NJDWSC	12/15/97	BM01	Blue Mine Brook USGS Ringwood	<	0.005		0.180	<	0.002		0.013		0.068	
NJDWSC	01/13/98	BM01	Blue Mine Brook USGS Ringwood	<	0.005	<	0.012		0.016		0.072		0.098	
NJDWSC	02/09/98	BM01	Blue Mine Brook USGS Ringwood	<	0.005		0.074	<	0.002		0.072		0.076	1.88
NJDWSC	03/10/98	BM01	Blue Mine Brook USGS Ringwood	<	0.005		0.050	<	0.002		0.003	<	0.007	2.15
NJDWSC	04/06/98	BM01	Blue Mine Brook USGS Ringwood	<	0.005		0.068	<	0.002		0.065		0.007	2.09
NJDWSC	05/04/98	BM01	Blue Mine Brook USGS Ringwood	<	0.005		0.158	<	0.002		0.072	<	0.007	1.15
NJDWSC	06/02/98	BM01	Blue Mine Brook USGS Ringwood	<	0.005		0.072	<	0.002		0.063	<	0.007	2.88
NJDWSC	07/06/98	BM01	Blue Mine Brook USGS Ringwood	<	0.005		0.060	<	0.002		0.120		0.028	2.99
NJDWSC	03/01/99	BM01	Blue Mine Brook USGS Ringwood	<	0.005		0.087	<	0.002		0.094		0.025	58.74
NJDWSC	04/05/99	BM01	Blue Mine Brook USGS Ringwood		0.035		0.089	<	0.002		0.074	<	0.007	1.17
NJDWSC	05/03/99	BM01	Blue Mine Brook USGS Ringwood	<	0.005		0.111	<	0.002		0.074	<	0.007	0.43
NJDWSC	12/06/99	BM01	Blue Mine Brook USGS Ringwood	<	0.005		0.055	<	0.002	<	0.001		0.035	0.00
NJDWSC	04/03/00	BM01	Blue Mine Brook USGS Ringwood	<	0.005		0.080	<	0.002	<	0.001	<	0.007	1.07
NJDWSC	08/01/00	BM01	Blue Mine Brook USGS Ringwood	<	0.005		0.045	<	0.002		0.104	<	0.007	1.07
NJDWSC	03/12/01	BM01	Blue Mine Brook USGS Ringwood	<	0.005		0.327	<	0.002		0.384		0.020	3.31
NJDWSC	04/03/01	BM01	Blue Mine Brook USGS Ringwood	<	0.005		0.037	<	0.002		0.390		0.031	21.25
NJDWSC	05/01/01	BM01	Blue Mine Brook USGS Ringwood	<	0.005		0.079	<	0.002		0.120		0.051	10.89
NJDWSC	06/05/01	BM01	Blue Mine Brook USGS Ringwood	<	0.005			<	0.002		0.167		0.040	

Monitoring Data for Cupsaw Brook

Agency	Sample Date	Station ID	Station Location	Ortho Phosphate	Total Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	01/12/88	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.030	0.002	0.740	0.180	19.40
NJDWSC	02/02/88	L18	Cupsaw Lake L5 Cupsaw Brook	0.060	0.060	0.002	0.996	0.290	19.20
NJDWSC	03/15/88	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.010	0.002	0.450	0.180	0.35
NJDWSC	04/19/88	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.010	0.002	0.220	0.130	6.70
NJDWSC	05/24/88	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.030	0.002	0.005	0.260	1.23
NJDWSC	06/28/88	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.020	0.002	0.870	0.140	2.20
NJDWSC	07/19/88	L18	Cupsaw Lake L5 Cupsaw Brook	0.040	0.050	0.002	0.570	0.280	2.40
NJDWSC	08/10/88	L18	Cupsaw Lake L5 Cupsaw Brook	0.020	0.020	0.002	0.560	0.110	1.00
NJDWSC	09/20/88	L18	Cupsaw Lake L5 Cupsaw Brook	0.010	0.020	0.002	0.950	0.130	2.90
NJDWSC	10/18/88	L18	Cupsaw Lake L5 Cupsaw Brook	0.010	0.030	0.010	0.005	0.360	14.00
NJDWSC	11/15/88	L18	Cupsaw Lake L5 Cupsaw Brook	0.020	0.020	0.010	2.080	0.140	8.80
NJDWSC	12/13/88	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.010	0.010		0.530	10.60
NJDWSC	01/17/89	L18	Cupsaw Lake L5 Cupsaw Brook	0.010	0.020	0.010	0.005	0.210	10.50
NJDWSC	02/07/89	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.020	0.002	0.005	0.210	3.90
NJDWSC	01/10/90	L18	Cupsaw Lake L5 Cupsaw Brook	0.126	0.133	0.059	1.850	0.141	4.10
NJDWSC	02/06/90	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.050	< 0.05	< 0.025	0.489	< 0.050	2.40
NJDWSC	03/12/90	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.050	< 0.05	< 0.025	0.542	0.051	4.70
NJDWSC	04/03/90	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.050	< 0.05	0.027	0.357	< 0.050	8.00
NJDWSC	05/15/90	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.050	< 0.05	< 0.025	0.061	0.046	1.10
NJDWSC	06/27/90	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.050	0.027	< 0.025	0.495	0.080	4.50
NJDWSC	07/17/90	L18	Cupsaw Lake L5 Cupsaw Brook	0.027	0.056	< 0.025	0.144	0.068	10.00
NJDWSC	08/07/90	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.050	0.082	< 0.025	0.041	< 0.050	18.60
NJDWSC	09/04/90	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.050	0.031	< 0.025	0.478	0.013	5.70
NJDWSC	10/16/90	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.05	0.054	< 0.025	< 0.025	0.121	16.10
NJDWSC	11/13/90	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.05	< 0.05	0.012	0.260	0.064	0.40
NJDWSC	12/04/90	L18	Cupsaw Lake L5 Cupsaw Brook	0.046	0.103	< 0.025	1.420	0.097	2.50
NJDWSC	01/15/91	L18	Cupsaw Lake L5 Cupsaw Brook	0.007	0.015	< 0.002	2.156	0.100	
NJDWSC	01/15/91	L18	Cupsaw Lake L5 Cupsaw Brook	0.000	0.000	< 0.002	2.156	0.000	
NJDWSC	01/15/91	L18	Cupsaw Lake L5 Cupsaw Brook	0.000	0.000	< 0.002	2.156	0.000	
NJDWSC	02/05/91	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.006	0.019	< 0.002	0.468	0.033	
NJDWSC	03/06/91	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.006	0.022	0.004	0.391	0.036	
NJDWSC	04/03/91	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.006	0.015	0.005	0.337	0.029	
NJDWSC	04/03/91	L18	Cupsaw Lake L5 Cupsaw Brook	0.000	0.000	0.000		0.000	
NJDWSC	05/21/91	L18	Cupsaw Lake L5 Cupsaw Brook	0.010	0.031	0.011	0.417	0.112	
NJDWSC	06/25/91	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.006	0.030	0.005	0.744	0.068	
NJDWSC	07/30/91	L18	Cupsaw Lake L5 Cupsaw Brook	0.008	0.046	< 0.002	0.944	0.060	
NJDWSC	08/27/91	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.006	< 0.013	0.004	0.498	0.008	
NJDWSC	08/27/91	L18	Cupsaw Lake L5 Cupsaw Brook	0.000	< 0.013	0.000		0.000	
NJDWSC	09/24/91	L18	Cupsaw Lake L5 Cupsaw Brook	0.020	0.021	< 0.002	0.403	0.013	

Monitoring Data for Cupsaw Brook

Agency	Sample Date	Station ID	Station Location		Ortho Phosphate		Total Phosphate		Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	09/24/91	L18	Cupsaw Lake L5 Cupsaw Brook		0.000		0.000		0.000		0.000	
NJDWSC	10/22/91	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.006		0.020		0.004	0.278	0.045	
NJDWSC	11/19/91	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.006	<	0.013	<	0.002	0.484	0.028	
NJDWSC	12/11/91	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.006		0.018		0.003	0.280	0.025	
NJDWSC	01/07/92	L18	Cupsaw Lake L5 Cupsaw Brook		0.015		0.034	<	0.002	0.374	0.029	
NJDWSC	02/04/92	L18	Cupsaw Lake L5 Cupsaw Brook		0.013		0.026		0.010	0.929	0.059	
NJDWSC	03/10/92	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.006		0.015		0.004	0.424	0.039	
NJDWSC	04/14/92	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.006	<	0.013	<	0.002	0.388	0.079	
NJDWSC	04/14/92	L18	Cupsaw Lake L5 Cupsaw Brook		0.000		0.000		0.000		0.000	
NJDWSC	04/14/92	L18	Cupsaw Lake L5 Cupsaw Brook		0.000		0.000		0.000		0.000	
NJDWSC	05/12/92	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.006		0.033				0.014	
NJDWSC	05/12/92	L18	Cupsaw Lake L5 Cupsaw Brook		0.000	<	0.013		0.000		0.014	
NJDWSC	06/15/92	L18	Cupsaw Lake L5 Cupsaw Brook			<	0.013				0.000	
NJDWSC	06/15/92	L18	Cupsaw Lake L5 Cupsaw Brook		0.000		0.000		0.000		0.000	
NJDWSC	07/13/92	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.006		0.046		0.004	0.249	0.045	
NJDWSC	07/13/92	L18	Cupsaw Lake L5 Cupsaw Brook		0.000		0.046		0.000		0.000	
NJDWSC	08/04/92	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.006		0.048	<	0.002	0.032	0.016	
NJDWSC	09/08/92	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.006		0.033		0.003	0.221	0.012	
NJDWSC	10/06/92	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.006	<	0.013		0.003	0.768	0.001	
NJDWSC	11/24/92	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.006		0.031		0.013	0.324	0.008	
NJDWSC	12/08/92	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.006	<	0.013		0.008	0.379	0.020	
NJDWSC	01/11/93	L18	Cupsaw Lake L5 Cupsaw Brook		0.016		0.064		0.003	0.422	0.033	
NJDWSC	01/11/93	L18	Cupsaw Lake L5 Cupsaw Brook		0.000		0.000		0.000		0.000	
NJDWSC	01/11/93	L18	Cupsaw Lake L5 Cupsaw Brook		0.000		0.000		0.000		0.000	
NJDWSC	02/02/93	L18	Cupsaw Lake L5 Cupsaw Brook		0.006	<	0.013	<	0.002	0.497	0.013	
NJDWSC	03/02/93	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.006	<	0.013		0.006	0.476	0.016	
NJDWSC	04/06/93	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.006		0.028	<	0.002	0.383	0.007	
NJDWSC	05/10/93	L18	Cupsaw Lake L5 Cupsaw Brook		0.006		0.012		0.002	0.170	0.053	
NJDWSC	05/10/93	L18	Cupsaw Lake L5 Cupsaw Brook		0.000		0.000		0.000		0.000	
NJDWSC	06/22/93	L18	Cupsaw Lake L5 Cupsaw Brook		0.006		0.012		0.004	0.080	0.004	
NJDWSC	06/22/93	L18	Cupsaw Lake L5 Cupsaw Brook		0.000		0.000		0.000		0.000	
NJDWSC	07/20/93	L18	Cupsaw Lake L5 Cupsaw Brook		0.006		0.012		0.005	1.170	0.007	
NJDWSC	08/03/93	L18	Cupsaw Lake L5 Cupsaw Brook		0.006		0.016		0.003	1.140	0.032	
NJDWSC	09/13/93	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.006		0.012	<	0.002	0.753	0.008	
NJDWSC	10/19/93	L18	Cupsaw Lake L5 Cupsaw Brook		0.006		0.210		0.002	0.684	0.009	
NJDWSC	10/19/93	L18	Cupsaw Lake L5 Cupsaw Brook		0.000		0.012		0.000		0.000	
NJDWSC	11/08/93	L18	Cupsaw Lake L5 Cupsaw Brook		0.006		0.012		0.024	0.402	0.281	
NJDWSC	11/08/93	L18	Cupsaw Lake L5 Cupsaw Brook		0.000		0.000		0.000		0.000	
NJDWSC	12/07/93	L18	Cupsaw Lake L5 Cupsaw Brook		0.010		0.012		0.002	0.284	0.043	

Monitoring Data for Cupsaw Brook

Agency	Sample Date	Station ID	Station Location	Ortho Phosphate	Total Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	01/04/94	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.012	0.004	0.394	0.007	
NJDWSC	04/05/94	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.012	0.004	0.447	0.007	
NJDWSC	05/03/94	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.012	0.002	0.443	0.183	
NJDWSC	05/03/94	L18	Cupsaw Lake L5 Cupsaw Brook	0.000	0.000	0.002	0.443	0.000	
NJDWSC	06/07/94	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.014	0.002	0.277	0.033	
NJDWSC	07/06/94	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.012	0.002	0.299	0.007	
NJDWSC	08/08/94	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.014	0.002	0.005	0.007	
NJDWSC	09/12/94	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.069	0.002	0.534	0.007	
NJDWSC	10/03/94	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.014	0.002	0.272	0.012	
NJDWSC	11/29/94	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.056	0.002	1.693	0.007	
NJDWSC	12/13/94	L18	Cupsaw Lake L5 Cupsaw Brook	0.007	0.012	0.002	0.292	0.007	
NJDWSC	01/10/95	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.012	0.002	0.231	0.006	
NJDWSC	02/07/95	L18	Cupsaw Lake L5 Cupsaw Brook	0.038	0.060	0.002	0.362	0.073	
NJDWSC	03/06/95	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.012	0.002	0.397	0.007	
NJDWSC	04/25/95	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.012	0.002	0.169	0.007	
NJDWSC	05/31/95	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.012	0.014	0.347	0.034	
NJDWSC	06/26/95	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.012	0.002	0.399	0.036	
NJDWSC	07/24/95	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.013	0.002	0.432	0.007	
NJDWSC	08/22/95	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.130	0.002	0.686	0.007	
NJDWSC	09/26/95	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.067	0.002	0.635	0.000	
NJDWSC	11/28/95	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.160	0.002	0.225	0.007	
NJDWSC	12/18/95	L18	Cupsaw Lake L5 Cupsaw Brook	0.086	0.016	0.004	0.217	0.140	
NJDWSC	02/05/96	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.150	0.002	0.380	0.070	
NJDWSC	02/05/96	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.150	0.002	0.380	0.070	
NJDWSC	03/05/96	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.032	0.002	0.552	0.007	
NJDWSC	03/05/96	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.032	0.002	0.552	0.007	
NJDWSC	04/08/96	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.057	0.002	0.332	0.120	
NJDWSC	04/08/96	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.057	0.002	0.332	0.120	
NJDWSC	05/14/96	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.029	0.002	0.135	0.111	
NJDWSC	05/14/96	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.029	0.002	0.135	0.111	
NJDWSC	06/11/96	L18	Cupsaw Lake L5 Cupsaw Brook	0.021	0.048	0.002	0.108	0.044	
NJDWSC	06/11/96	L18	Cupsaw Lake L5 Cupsaw Brook	0.021	0.048	0.002	0.108	0.044	
NJDWSC	07/09/96	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.032	0.002	0.013	0.007	
NJDWSC	07/09/96	L18	Cupsaw Lake L5 Cupsaw Brook	0.006	0.032	0.002	0.013	0.007	
NJDWSC	08/26/96	L18	Cupsaw Lake L5 Cupsaw Brook	0.018	0.110	0.002	0.417	0.012	
NJDWSC	08/26/96	L18	Cupsaw Lake L5 Cupsaw Brook	0.018	0.110	0.002	0.417	0.012	
NJDWSC	09/25/96	L18	Cupsaw Lake L5 Cupsaw Brook	0.026	0.095	0.002	0.230	0.005	
NJDWSC	09/25/96	L18	Cupsaw Lake L5 Cupsaw Brook	0.026	0.095	0.002	0.230	0.005	
NJDWSC	10/07/96	L18	Cupsaw Lake L5 Cupsaw Brook	0.006		0.002	0.043	0.034	

Monitoring Data for Cupsaw Brook

Agency	Sample Date	Station ID	Station Location		Ortho Phosphate	Total Phosphate		Nitrite	Nitrate		Ammonia	Chlorophyll-a
NJDWSC	10/07/96	L18	Cupsaw Lake L5 Cupsaw Brook		0.006			0.002	0.043		0.034	
NJDWSC	11/12/96	L18	Cupsaw Lake L5 Cupsaw Brook		0.006			0.002	0.178		0.007	
NJDWSC	12/17/96	L18	Cupsaw Lake L5 Cupsaw Brook		0.006	0.012		0.074	0.373		0.007	
NJDWSC	01/07/97	L18	Cupsaw Lake L5 Cupsaw Brook		0.006	0.054		0.002	0.461		0.007	
NJDWSC	02/04/97	L18	Cupsaw Lake L5 Cupsaw Brook		0.006	0.047		0.002	0.327		0.029	
NJDWSC	02/04/97	L18	Cupsaw Lake L5 Cupsaw Brook		0.000	0.000		0.000			0.029	
NJDWSC	03/04/97	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.089	<	0.002	0.083		0.007	
NJDWSC	04/08/97	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.053	<	0.002	0.065		0.007	
NJDWSC	05/05/97	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.069	<	0.002	0.141		0.013	
NJDWSC	06/02/97	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.130	<	0.002	0.250		0.158	
NJDWSC	07/07/97	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.066	<	0.002	0.136		0.007	
NJDWSC	08/12/97	L18	Cupsaw Lake L5 Cupsaw Brook		0.012	0.064	<	0.002	1.133		0.033	
NJDWSC	09/16/97	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.067	<	0.002	0.384		0.007	
NJDWSC	10/15/97	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.012	<	0.002	0.075		0.096	
NJDWSC	11/13/97	L18	Cupsaw Lake L5 Cupsaw Brook		0.014	0.044		0.008	1.079		0.012	
NJDWSC	11/13/97	L18	Cupsaw Lake L5 Cupsaw Brook		0.000	0.000		0.000			0.000	
NJDWSC	12/16/97	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.077	<	0.002	1.442		0.072	
NJDWSC	01/12/98	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.048	<	0.002	0.357		0.070	7.00
NJDWSC	02/10/98	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.164	<	0.002	0.400	<	0.007	2.29
NJDWSC	03/09/98	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.066	<	0.002	0.220	<	0.007	20.08
NJDWSC	04/07/98	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.065	<	0.002	0.257		0.012	8.99
NJDWSC	05/05/98	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.157	<	0.002	0.166	<	0.007	4.40
NJDWSC	06/01/98	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.096	<	0.002	0.114	<	0.007	9.93
NJDWSC	06/09/98	L18	Cupsaw Lake L5 Cupsaw Brook									
NJDWSC	07/07/98	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.040	<	0.002	0.554		0.058	4.27
NJDWSC	08/18/98	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.123	<	0.002	0.128	<	0.007	2.35
NJDWSC	09/29/98	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.072	<	0.002	0.792		0.035	5.23
NJDWSC	10/20/98	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.156	<	0.002	0.326	<	0.007	1.07
NJDWSC	11/04/98	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.059	<	0.002	0.552		0.007	1.82
NJDWSC	12/02/98	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.079	<	0.002	0.258	<	0.007	2.78
NJDWSC	01/05/99	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.064	<	0.002	0.292	<	0.007	7.16
NJDWSC	02/09/99	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.029	<	0.002	0.441		0.027	4.06
NJDWSC	03/02/99	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.086	<	0.002	0.490		0.022	10.68
NJDWSC	04/06/99	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.070		0.028	0.325		0.020	16.02
NJDWSC	05/04/99	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.071	<	0.002	0.209		0.028	0.52
NJDWSC	06/14/99	L18	Cupsaw Lake L5 Cupsaw Brook	<	0.005	0.034	<	0.002	0.450		0.009	0.21
NJDWSC	07/13/99	L18	Cupsaw Lake L5 Cupsaw Brook		0.050	0.053	<	0.002	0.910		0.026	1.07
NJDWSC	08/10/99	L18	Cupsaw Lake L5 Cupsaw Brook		0.048	0.091	<	0.002	1.117		0.017	0.67
NJDWSC	09/07/99	L18	Cupsaw Lake L5 Cupsaw Brook									1.07

Monitoring Data for Cupsaw Brook

Agency	Sample Date	Station ID	Station Location	Ortho Phosphate	Total Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	10/18/99	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.005	0.100	< 0.002	0.250	0.042	5.34
NJDWSC	11/22/99	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.005	0.032	< 0.002	0.141	0.015	
NJDWSC	12/07/99	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.005	0.062	< 0.002	0.118	0.014	3.20
NJDWSC	01/10/00	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.005	0.381	< 0.002	0.494	0.016	0.96
NJDWSC	02/07/00	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.005	0.044	< 0.002	0.481	0.015	1.07
NJDWSC	03/06/00	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.005	0.116	< 0.002	0.503	0.012	4.49
NJDWSC	04/04/00	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.005	0.098	< 0.002	0.248	0.024	1.28
NJDWSC	05/03/00	L18	Cupsaw Lake L5 Cupsaw Brook	N.D.	< 0.012	N.D.	0.169	< 0.007	1.39
NJDWSC	06/06/00	L18	Cupsaw Lake L5 Cupsaw Brook	0.058	< 0.012	< 0.002	0.205	0.048	3.86
NJDWSC	07/11/00	L18	Cupsaw Lake L5 Cupsaw Brook	0.041	0.105	< 0.002	0.194	0.104	< 0.01
NJDWSC	08/01/00	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.005	0.039	< 0.002	0.235	0.025	2.14
NJDWSC	09/12/00	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.005	0.047	< 0.002	0.193	0.033	1.82
NJDWSC	10/11/00	L18	Cupsaw Lake L5 Cupsaw Brook		0.194	< 0.002	0.159	0.093	< 0.01
NJDWSC	11/28/00	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.005	< 0.012	< 0.002	0.170		1.17
NJDWSC	12/11/00	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.005	< 0.012	< 0.002	0.322	0.043	1.50
NJDWSC	01/09/01	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.005	0.166	< 0.002	0.291	0.066	1.17
NJDWSC	03/13/01	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.005	0.307	< 0.002	0.286	0.081	3.63
NJDWSC	04/02/01	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.005	0.050	< 0.002	0.223	0.048	16.34
NJDWSC	05/02/01	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.005	0.059	< 0.002	0.680	0.068	6.62
NJDWSC	06/06/01	L18	Cupsaw Lake L5 Cupsaw Brook	< 0.005		< 0.002	0.154	0.020	

Monitoring Data for Erskine Brook

Agency	Sample Date	Station ID	Station Location		Ortho Phosphate		Total Phosphate		Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	05/21/91	L22	Erskine Lower K7 Erskine Brook		0.010		0.025		0.006	0.986	0.044	
NJDWSC	03/10/92	L22	Erskine Lower K7 Erskine Brook	<	0.006	<	0.013	<	0.002	0.635	0.048	
NJDWSC	04/14/92	L22	Erskine Lower K7 Erskine Brook	<	0.006	<	0.013	<	0.002	1.019	0.059	
NJDWSC	04/14/92	L22	Erskine Lower K7 Erskine Brook		0.000		0.000		0.000		0.000	
NJDWSC	04/14/92	L22	Erskine Lower K7 Erskine Brook		0.000		0.000		0.000		0.000	
NJDWSC	05/12/92	L22	Erskine Lower K7 Erskine Brook	<	0.006		0.180				0.006	
NJDWSC	05/12/92	L22	Erskine Lower K7 Erskine Brook		0.000	<	0.013		0.000		0.006	
NJDWSC	06/16/92	L22	Erskine Lower K7 Erskine Brook			<	0.013				0.000	
NJDWSC	06/16/92	L22	Erskine Lower K7 Erskine Brook		0.000		0.000		0.000		0.000	
NJDWSC	07/14/92	L22	Erskine Lower K7 Erskine Brook	<	0.006		0.018	<	0.002	0.602	0.033	
NJDWSC	07/14/92	L22	Erskine Lower K7 Erskine Brook		0.000		0.018		0.000		0.000	
NJDWSC	08/03/92	L22	Erskine Lower K7 Erskine Brook	<	0.006		0.038	<	0.002	0.057	0.018	
NJDWSC	09/09/92	L22	Erskine Lower K7 Erskine Brook		0.150		0.084		0.005	0.529	0.132	
NJDWSC	11/23/92	L22	Erskine Lower K7 Erskine Brook	<	0.006	<	0.013		0.017	0.404	0.073	
NJDWSC	12/07/92	L22	Erskine Lower K7 Erskine Brook	<	0.006	<	0.013		0.014	0.375	0.106	
NJDWSC	12/07/92	L22	Erskine Lower K7 Erskine Brook		0.000		0.000		0.000		0.000	
NJDWSC	12/07/92	L22	Erskine Lower K7 Erskine Brook		0.000		0.000		0.000		0.000	
NJDWSC	01/12/93	L22	Erskine Lower K7 Erskine Brook		0.006		0.015		0.008	0.638	0.091	
NJDWSC	01/12/93	L22	Erskine Lower K7 Erskine Brook		0.000		0.000		0.000		0.000	
NJDWSC	01/12/93	L22	Erskine Lower K7 Erskine Brook		0.000		0.000		0.000		0.000	
NJDWSC	02/01/93	L22	Erskine Lower K7 Erskine Brook		0.006	<	0.013		0.002	1.918	0.001	
NJDWSC	02/01/93	L22	Erskine Lower K7 Erskine Brook		0.000		0.012		0.000		0.000	
NJDWSC	03/02/93	L22	Erskine Lower K7 Erskine Brook		0.006		0.012		0.008	3.099	0.027	
NJDWSC	04/05/93	L22	Erskine Lower K7 Erskine Brook	<	0.006		0.029		0.010	1.837	0.067	
NJDWSC	04/05/93	L22	Erskine Lower K7 Erskine Brook		0.000		0.000		0.000		0.000	
NJDWSC	05/11/93	L22	Erskine Lower K7 Erskine Brook		0.006		0.012	<	0.002	0.365	0.029	
NJDWSC	06/21/93	L22	Erskine Lower K7 Erskine Brook		0.006	<	0.013		0.003	1.303	0.005	
NJDWSC	06/21/93	L22	Erskine Lower K7 Erskine Brook		0.000		0.000		0.000		0.000	
NJDWSC	11/09/93	L22	Erskine Lower K7 Erskine Brook		0.006		0.012		0.030	0.294	0.085	
NJDWSC	11/09/93	L22	Erskine Lower K7 Erskine Brook		0.000		0.000		0.000		0.000	
NJDWSC	12/06/93	L22	Erskine Lower K7 Erskine Brook		0.006		0.012		0.004	1.402	0.010	
NJDWSC	01/03/94	L22	Erskine Lower K7 Erskine Brook		0.006		0.097		0.002	1.914	0.010	
NJDWSC	04/05/94	L22	Erskine Lower K7 Erskine Brook		0.006		0.012		0.002	1.657	0.019	
NJDWSC	05/02/94	L22	Erskine Lower K7 Erskine Brook		0.006		0.012		0.002	0.520	0.027	
NJDWSC	05/02/94	L22	Erskine Lower K7 Erskine Brook		0.000		0.000		0.002	0.520	0.000	
NJDWSC	07/05/94	L22	Erskine Lower K7 Erskine Brook		0.006		0.012		0.002	0.599	0.008	
NJDWSC	11/28/94	L22	Erskine Lower K7 Erskine Brook		0.006		0.055		0.002	0.876	0.007	
NJDWSC	12/13/94	L22	Erskine Lower K7 Erskine Brook		0.007		0.012		0.002	1.881	0.007	
NJDWSC	03/07/95	L22	Erskine Lower K7 Erskine Brook		0.006		0.012		0.002	0.274	0.007	

Monitoring Data for Erskine Brook

Agency	Sample Date	Station ID	Station Location		Ortho Phosphate		Total Phosphate		Nitrite	Nitrate		Ammonia	Chlorophyll-a
NJDWSC	04/24/95	L22	Erskine Lower K7 Erskine Brook		0.006		0.012		0.002	0.629		0.007	
NJDWSC	05/30/95	L22	Erskine Lower K7 Erskine Brook		0.006		0.012		0.008	0.543		0.007	
NJDWSC	09/25/95	L22	Erskine Lower K7 Erskine Brook		0.006		0.012		0.002	0.015		0.000	
NJDWSC	10/31/95	L22	Erskine Lower K7 Erskine Brook		0.050		0.100		0.023	1.242		0.007	
NJDWSC	12/19/95	L22	Erskine Lower K7 Erskine Brook		0.100		0.042		0.006	0.288		0.197	
NJDWSC	03/04/96	L22	Erskine Lower K7 Erskine Brook		0.006		0.053		0.002	1.444		0.034	
NJDWSC	03/04/96	L22	Erskine Lower K7 Erskine Brook		0.006		0.053		0.002	1.444		0.034	
NJDWSC	04/09/96	L22	Erskine Lower K7 Erskine Brook		0.006		0.028		0.002	0.755		0.160	
NJDWSC	04/09/96	L22	Erskine Lower K7 Erskine Brook		0.006		0.028		0.002	0.755		0.160	
NJDWSC	05/13/96	L22	Erskine Lower K7 Erskine Brook		0.006		0.012		0.002	0.543		0.135	
NJDWSC	05/13/96	L22	Erskine Lower K7 Erskine Brook		0.006		0.012		0.002	0.543		0.135	
NJDWSC	06/10/96	L22	Erskine Lower K7 Erskine Brook		0.006		0.017		0.002	0.430		0.007	
NJDWSC	06/10/96	L22	Erskine Lower K7 Erskine Brook		0.000		0.000		0.000			0.000	
NJDWSC	06/10/96	L22	Erskine Lower K7 Erskine Brook		0.006		0.017		0.002	0.430		0.007	
NJDWSC	06/10/96	L22	Erskine Lower K7 Erskine Brook		0.000		0.000		0.000			0.000	
NJDWSC	07/09/96	L22	Erskine Lower K7 Erskine Brook		0.006		0.049		0.002	0.022		0.007	
NJDWSC	07/09/96	L22	Erskine Lower K7 Erskine Brook		0.006		0.049		0.002	0.022		0.007	
NJDWSC	09/24/96	L22	Erskine Lower K7 Erskine Brook		0.029		0.058		0.002	0.802		0.007	
NJDWSC	09/24/96	L22	Erskine Lower K7 Erskine Brook		0.029		0.058		0.002	0.802		0.007	
NJDWSC	10/08/96	L22	Erskine Lower K7 Erskine Brook		0.006				0.002	0.109		0.007	
NJDWSC	10/08/96	L22	Erskine Lower K7 Erskine Brook		0.006				0.002	0.109		0.007	
NJDWSC	11/13/96	L22	Erskine Lower K7 Erskine Brook		0.006				0.002	0.207		0.007	
NJDWSC	12/17/96	L22	Erskine Lower K7 Erskine Brook		0.006		0.012		0.130	0.726		0.007	
NJDWSC	01/06/97	L22	Erskine Lower K7 Erskine Brook		0.006		0.043		0.002	0.483		0.007	
NJDWSC	02/04/97	L22	Erskine Lower K7 Erskine Brook		0.006		0.078		0.002	1.966		0.036	
NJDWSC	02/04/97	L22	Erskine Lower K7 Erskine Brook		0.000		0.000		0.000			0.036	
NJDWSC	03/03/97	L22	Erskine Lower K7 Erskine Brook	<	0.005		0.067	<	0.002	0.769		0.007	
NJDWSC	04/07/97	L22	Erskine Lower K7 Erskine Brook	<	0.005		0.041	<	0.002	0.167		0.007	
NJDWSC	05/06/97	L22	Erskine Lower K7 Erskine Brook	<	0.005		0.067	<	0.002	0.590		0.043	
NJDWSC	06/03/97	L22	Erskine Lower K7 Erskine Brook	<	0.005		0.130	<	0.002	0.569		0.012	
NJDWSC	09/15/97	L22	Erskine Lower K7 Erskine Brook	<	0.005		0.055		0.006	0.199		0.015	
NJDWSC	10/14/97	L22	Erskine Lower K7 Erskine Brook	<	0.005	<	0.013		0.047	0.235		0.059	
NJDWSC	11/12/97	L22	Erskine Lower K7 Erskine Brook	<	0.005		0.066		0.008	0.458		0.051	
NJDWSC	02/09/98	L22	Erskine Lower K7 Erskine Brook	<	0.005		0.175	<	0.002	1.262	<	0.007	14.35
NJDWSC	03/10/98	L22	Erskine Lower K7 Erskine Brook	<	0.005		0.042	<	0.002	0.594	<	0.007	4.41
NJDWSC	04/06/98	L22	Erskine Lower K7 Erskine Brook	<	0.005		0.032	<	0.002	0.658		0.021	8.85
NJDWSC	05/04/98	L22	Erskine Lower K7 Erskine Brook	<	0.005		0.157	<	0.002	0.486	<	0.007	3.27
NJDWSC	06/02/98	L22	Erskine Lower K7 Erskine Brook	<	0.005		0.070	<	0.002	0.422	<	0.007	1.28
NJDWSC	07/06/98	L22	Erskine Lower K7 Erskine Brook		0.044		0.023	<	0.002	0.569		0.013	4.19

Monitoring Data for Erskine Brook

Agency	Sample Date	Station ID	Station Location	Ortho Phosphate	Total Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	10/19/98	L22	Erskine Lower K7 Erskine Brook	< 0.005	0.127	< 0.002	0.104	0.008	4.27
NJDWSC	11/05/98	L22	Erskine Lower K7 Erskine Brook	< 0.005	0.014	< 0.002	0.139	0.035	0.32
NJDWSC	02/08/99	L22	Erskine Lower K7 Erskine Brook	0.128	< 0.012	< 0.002	2.027	0.023	0.75
NJDWSC	03/01/99	L22	Erskine Lower K7 Erskine Brook	< 0.005	0.083	< 0.002	1.854	< 0.007	25.63
NJDWSC	04/05/99	L22	Erskine Lower K7 Erskine Brook	< 0.005	0.056	< 0.002	0.567	< 0.007	3.63
NJDWSC	05/03/99	L22	Erskine Lower K7 Erskine Brook	< 0.005	0.075	< 0.002	0.818	< 0.007	0.53
NJDWSC	06/15/99	L22	Erskine Lower K7 Erskine Brook						2.14
NJDWSC	11/23/99	L22	Erskine Lower K7 Erskine Brook	< 0.005	0.049	< 0.002	0.271	0.030	0.00
NJDWSC	12/06/99	L22	Erskine Lower K7 Erskine Brook	< 0.005	0.070	< 0.002	1.467	0.040	0.75
NJDWSC	01/11/00	L22	Erskine Lower K7 Erskine Brook	< 0.005	0.031	< 0.002	2.012	0.022	8.97
NJDWSC	03/07/00	L22	Erskine Lower K7 Erskine Brook	< 0.005	0.070	< 0.002	2.295	0.016	1.28
NJDWSC	04/03/00	L22	Erskine Lower K7 Erskine Brook	< 0.005	0.082	< 0.002	1.071	< 0.007	0.43
NJDWSC	05/01/00	L22	Erskine Lower K7 Erskine Brook	< 0.005	0.021	< 0.002	1.762	< 0.007	1.07
NJDWSC	08/01/00	L22	Erskine Lower K7 Erskine Brook	< 0.005	0.046	< 0.002	0.419	< 0.007	3.52
NJDWSC	09/12/00	L22	Erskine Lower K7 Erskine Brook	< 0.005	0.087	< 0.002	0.179	0.044	8.54
NJDWSC	04/03/01	L22	Erskine Lower K7 Erskine Brook	< 0.005	0.053	< 0.002	2.746	0.042	12.39
NJDWSC	05/01/01	L22	Erskine Lower K7 Erskine Brook	< 0.005	0.056	< 0.002	1.952	0.045	2.88
NJDWSC	06/05/01	L22	Erskine Lower K7 Erskine Brook	< 0.005		< 0.002	0.522	0.043	

Monitoring Data for Ramapo River at Pompton Lakes

Agency	Sample Date	Station ID	Station Location	Ortho Phosphate	Total Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	01/12/88	P01	Ramapo River 700 Pump Station	0.090	0.100	0.010	1.450	0.180	3.17
NJDWSC	02/02/88	P01	Ramapo River 700 Pump Station	0.070	0.070	0.020	1.200	0.220	2.75
NJDWSC	03/15/88	P01	Ramapo River 700 Pump Station	0.030	0.060	0.010	0.490	0.140	11.6
NJDWSC	04/19/88	P01	Ramapo River 700 Pump Station	0.030	0.090	0.020	0.520	0.290	4.8
NJDWSC	05/24/88	P01	Ramapo River 700 Pump Station	0.050	0.120	0.020	0.550	0.260	6.4
NJDWSC	06/28/88	P01	Ramapo River 700 Pump Station	0.030	0.130	0.020	0.180	0.640	42.9
NJDWSC	07/19/88	P01	Ramapo River 700 Pump Station	0.040	0.140	0.010	0.005	0.260	45.8
NJDWSC	08/10/88	P01	Ramapo River 700 Pump Station	0.030	0.100	0.010	0.020	0.300	21.2
NJDWSC	09/20/88	P01	Ramapo River 700 Pump Station	0.060	0.100	0.020	1.520	0.320	4.7
NJDWSC	10/18/88	P01	Ramapo River 700 Pump Station	0.020	0.060	0.050	0.790	0.370	41
NJDWSC	11/15/88	P01	Ramapo River 700 Pump Station	0.080	0.100	0.030	1.040	0.430	4.9
NJDWSC	12/13/88	P01	Ramapo River 700 Pump Station	0.060	0.080	0.120		0.370	9
NJDWSC	01/17/89	P01	Ramapo River 700 Pump Station	0.080	0.100	0.060	1.300	0.420	7.5
NJDWSC	02/07/89	P01	Ramapo River 700 Pump Station	0.030	0.090	0.010	1.530	0.210	7.8
NJDWSC	01/10/90	P01	Ramapo River 700 Pump Station	0.074	0.11	0.05	1.25	0.347	0.4
NJDWSC	02/06/90	P01	Ramapo River 700 Pump Station	0.02	< 0.05	< 0.025	0.986	0.131	1.7
NJDWSC	03/12/90	P01	Ramapo River 700 Pump Station	< 0.05	< 0.05	< 0.025	0.748	0.053	7.7
NJDWSC	04/03/90	P01	Ramapo River 700 Pump Station	< 0.05	< 0.05	< 0.025	0.688	0.052	3
NJDWSC	05/15/90	P01	Ramapo River 700 Pump Station	< 0.05	< 0.05	< 0.025	0.398	0.062	3.6
NJDWSC	06/27/90	P01	Ramapo River 700 Pump Station	< 0.05	0.063	< 0.025	0.616	0.139	5
NJDWSC	07/17/90	P01	Ramapo River 700 Pump Station	0.003	0.093	0.029	0.617	0.05	29.7
NJDWSC	08/07/90	P01	Ramapo River 700 Pump Station	0.115	0.143	0.039	0.808	0.233	6.7
NJDWSC	09/04/90	P01	Ramapo River 700 Pump Station	< 0.05	0.066	< 0.025	0.345	0.118	3.8
NJDWSC	10/16/90	P01	Ramapo River 700 Pump Station	0.114	0.129	0.033	0.998	0.114	2.1
NJDWSC	11/13/90	P01	Ramapo River 700 Pump Station	< 0.05	< 0.05	0.009	0.416	0.005	2.2
NJDWSC	12/04/90	P01	Ramapo River 700 Pump Station	0.04	0.075	< 0.025	0.837	0.051	0.3
NJDWSC	01/15/91	P01	Ramapo River 700 Pump Station	0.041	0.048	0.014	0.876	0.100	
NJDWSC	01/15/91	P01	Ramapo River 700 Pump Station	0.000	0.000	0.014	0.876	0.000	
NJDWSC	01/15/91	P01	Ramapo River 700 Pump Station	0.000	0.000	0.014	0.876	0.000	
NJDWSC	02/05/91	P01	Ramapo River 700 Pump Station	0.015	0.041	0.022	0.871	0.070	
NJDWSC	03/06/91	P01	Ramapo River 700 Pump Station	0.035	0.053	0.013	0.433	0.079	
NJDWSC	04/03/91	P01	Ramapo River 700 Pump Station	0.010	0.048	0.012	0.622	0.013	
NJDWSC	04/03/91	P01	Ramapo River 700 Pump Station	0.000	0.000	0.000		0.000	
NJDWSC	04/08/91	P01	Ramapo River 700 Pump Station	0.008	0.027	0.013	0.596	0.004	
NJDWSC	04/08/91	P01	Ramapo River 700 Pump Station	0.000	0.000	0.000		0.000	
NJDWSC	05/21/91	P01	Ramapo River 700 Pump Station	0.023	0.088	0.030	0.469	0.058	
NJDWSC	06/25/91	P01	Ramapo River 700 Pump Station	0.023	0.110	0.040	0.281	0.101	
NJDWSC	07/30/91	P01	Ramapo River 700 Pump Station	0.031	0.072	0.058	0.602	0.071	
NJDWSC	08/27/91	P01	Ramapo River 700 Pump Station	0.042	0.120	0.045	0.771	0.219	

Monitoring Data for Ramapo River at Pompton Lakes

Agency	Sample Date	Station ID	Station Location	Ortho Phosphate	Total Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	08/27/91	P01	Ramapo River 700 Pump Station	0.000	0.120	0.000		0.000	
NJDWSC	09/24/91	P01	Ramapo River 700 Pump Station	0.025	0.069	0.009	0.051	0.008	
NJDWSC	09/24/91	P01	Ramapo River 700 Pump Station	0.000	0.000	0.000		0.000	
NJDWSC	09/24/91	P01	Ramapo River 700 Pump Station	0.000	0.000	0.000		0.000	
NJDWSC	10/22/91	P01	Ramapo River 700 Pump Station	0.057	0.160	0.013	0.655	0.037	
NJDWSC	11/19/91	P01	Ramapo River 700 Pump Station	0.022	0.100	0.010	0.524	0.003	
NJDWSC	12/10/91	P01	Ramapo River 700 Pump Station	0.036	0.043	0.006	0.522	0.051	
NJDWSC	01/08/92	P01	Ramapo River 700 Pump Station	0.060	0.092	0.009	0.953	0.042	
NJDWSC	02/04/92	P01	Ramapo River 700 Pump Station	0.036	0.052	0.007	0.864	0.014	
NJDWSC	03/10/92	P01	Ramapo River 700 Pump Station	0.029	0.039	0.008	0.396	0.045	
NJDWSC	04/14/92	P01	Ramapo River 700 Pump Station	0.013	0.072	0.023	0.486	0.007	
NJDWSC	05/12/92	P01	Ramapo River 700 Pump Station	0.013	0.044			0.001	
NJDWSC	05/12/92	P01	Ramapo River 700 Pump Station	0.000	0.072	0.000		0.001	
NJDWSC	06/15/92	P01	Ramapo River 700 Pump Station		0.052			0.000	
NJDWSC	06/15/92	P01	Ramapo River 700 Pump Station	0.000	0.000	0.000		0.000	
NJDWSC	07/14/92	P01	Ramapo River 700 Pump Station	0.016	0.034	0.021	0.293	0.039	
NJDWSC	07/14/92	P01	Ramapo River 700 Pump Station	0.000	0.034	0.000		0.000	
NJDWSC	08/04/92	P01	Ramapo River 700 Pump Station	0.019	0.120	< 0.002	0.038	0.010	
NJDWSC	09/08/92	P01	Ramapo River 700 Pump Station	0.170	0.071	0.031	0.610	0.190	
NJDWSC	10/07/92	P01	Ramapo River 700 Pump Station	0.008	0.049	0.025	0.628	0.063	
NJDWSC	11/23/92	P01	Ramapo River 700 Pump Station	0.042	0.076	0.010	0.783	0.039	
NJDWSC	12/07/92	P01	Ramapo River 700 Pump Station	0.053	0.069	0.020	0.769	0.109	
NJDWSC	12/07/92	P01	Ramapo River 700 Pump Station	0.000	0.000	0.000		0.000	
NJDWSC	01/11/93	P01	Ramapo River 700 Pump Station	0.037	0.078	0.012	0.602	0.034	
NJDWSC	01/11/93	P01	Ramapo River 700 Pump Station	0.000	0.000	0.000		0.000	
NJDWSC	01/11/93	P01	Ramapo River 700 Pump Station	0.000	0.000	0.000		0.000	
NJDWSC	02/01/93	P01	Ramapo River 700 Pump Station	0.019	0.046	0.012	0.667	0.024	
NJDWSC	03/01/93	P01	Ramapo River 700 Pump Station	< 0.006	< 0.013	0.015	1.106	0.018	
NJDWSC	04/05/93	P01	Ramapo River 700 Pump Station	< 0.006	0.026	0.007	0.472	0.059	
NJDWSC	05/10/93	P01	Ramapo River 700 Pump Station	0.006	0.012	0.014	0.461	0.027	
NJDWSC	05/10/93	P01	Ramapo River 700 Pump Station	0.000	0.000	0.000		0.000	
NJDWSC	06/21/93	P01	Ramapo River 700 Pump Station	0.006	0.021	0.020	0.163	0.159	
NJDWSC	06/21/93	P01	Ramapo River 700 Pump Station	0.000	0.000	0.000		0.000	
NJDWSC	07/19/93	P01	Ramapo River 700 Pump Station	0.006	0.030	0.005	0.041	0.002	
NJDWSC	08/02/93	P01	Ramapo River 700 Pump Station	0.006	0.012	0.003	0.007	0.001	
NJDWSC	09/13/93	P01	Ramapo River 700 Pump Station	0.006	0.012	0.007	0.112	0.094	
NJDWSC	10/18/93	P01	Ramapo River 700 Pump Station	0.006	0.048	0.002	1.455	0.117	
NJDWSC	11/09/93	P01	Ramapo River 700 Pump Station	0.006	0.054	0.002	1.202	0.046	
NJDWSC	11/09/93	P01	Ramapo River 700 Pump Station	0.000	0.000	0.000		0.000	

Monitoring Data for Ramapo River at Pompton Lakes

Agency	Sample Date	Station ID	Station Location	Ortho Phosphate	Total Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	12/06/93	P01	Ramapo River 700 Pump Station	0.020	0.012	0.019	0.462	0.073	
NJDWSC	01/03/94	P01	Ramapo River 700 Pump Station	0.008	0.031	0.012	0.974	0.038	
NJDWSC	02/08/94	P01	Ramapo River 700 Pump Station	0.006	0.026	0.004	0.848	0.065	
NJDWSC	03/07/94	P01	Ramapo River 700 Pump Station	0.006	0.012	0.005	0.888	0.111	
NJDWSC	04/05/94	P01	Ramapo River 700 Pump Station	0.006	0.012	0.012	0.441	0.015	
NJDWSC	05/02/94	P01	Ramapo River 700 Pump Station	0.006	0.012	0.015	0.439	0.079	
NJDWSC	05/02/94	P01	Ramapo River 700 Pump Station	0.000	0.000	0.000		0.000	
NJDWSC	06/06/94	P01	Ramapo River 700 Pump Station	0.460	0.770	0.076	0.612	0.036	
NJDWSC	07/05/94	P01	Ramapo River 700 Pump Station	0.006	0.012	0.013	0.103	0.007	
NJDWSC	08/08/94	P01	Ramapo River 700 Pump Station	0.022	0.043	0.010	0.381	0.007	
NJDWSC	09/12/94	P01	Ramapo River 700 Pump Station	0.160	0.093	0.004	1.611	0.007	
NJDWSC	09/16/94	P01	Ramapo River 700 Pump Station					0.000	
NJDWSC	10/03/94	P01	Ramapo River 700 Pump Station	0.006	0.021	0.023	0.945	0.058	
NJDWSC	11/28/94	P01	Ramapo River 700 Pump Station	0.006	0.330	0.019	0.552	0.053	
NJDWSC	12/13/94	P01	Ramapo River 700 Pump Station	0.087	0.120	0.005	0.625	0.014	
NJDWSC	01/09/95	P01	Ramapo River 700 Pump Station	0.006	0.039	0.005	0.621	0.020	
NJDWSC	02/06/95	P01	Ramapo River 700 Pump Station	0.038	0.040	0.003	0.910	0.075	
NJDWSC	03/07/95	P01	Ramapo River 700 Pump Station	0.065	0.012	0.005	0.561	0.007	
NJDWSC	04/24/95	P01	Ramapo River 700 Pump Station	0.006	0.016	0.003	0.281	0.007	
NJDWSC	05/30/95	P01	Ramapo River 700 Pump Station	0.027	0.012	0.047	0.569	0.007	
NJDWSC	06/26/95	P01	Ramapo River 700 Pump Station	0.006	0.490	0.044	0.064	0.040	
NJDWSC	07/25/95	P01	Ramapo River 700 Pump Station	0.006	0.270	0.002	0.005	0.007	
NJDWSC	08/21/95	P01	Ramapo River 700 Pump Station	0.006	0.580	0.002	0.005	0.007	
NJDWSC	09/25/95	P01	Ramapo River 700 Pump Station	0.006	0.140	0.002	0.002	0.236	
NJDWSC	10/30/95	P01	Ramapo River 700 Pump Station	0.094	0.095	0.032	0.359	0.033	
NJDWSC	11/27/95	P01	Ramapo River 700 Pump Station	0.006	0.220	0.005	0.381	0.025	
NJDWSC	12/18/95	P01	Ramapo River 700 Pump Station	0.160	0.130	0.022	0.655	0.112	
NJDWSC	01/22/96	P01	Ramapo River 700 Pump Station	0.037	0.033	0.002	0.563	0.117	
NJDWSC	01/22/96	P01	Ramapo River 700 Pump Station	0.037	0.033	0.002	0.563	0.117	
NJDWSC	02/05/96	P01	Ramapo River 700 Pump Station	0.023	0.120	0.015	0.711	0.111	
NJDWSC	02/05/96	P01	Ramapo River 700 Pump Station	0.023	0.120	0.015	0.711	0.111	
NJDWSC	03/04/96	P01	Ramapo River 700 Pump Station	0.023	0.075	0.004	0.623	0.031	
NJDWSC	03/04/96	P01	Ramapo River 700 Pump Station	0.023	0.075	0.004	0.623	0.031	
NJDWSC	04/08/96	P01	Ramapo River 700 Pump Station	0.006	0.038	0.009	0.402	0.121	
NJDWSC	04/08/96	P01	Ramapo River 700 Pump Station	0.006	0.038	0.009	0.402	0.121	
NJDWSC	05/13/96	P01	Ramapo River 700 Pump Station	0.006	0.120	0.012	0.400	0.101	
NJDWSC	05/13/96	P01	Ramapo River 700 Pump Station	0.006	0.120	0.012	0.400	0.101	
NJDWSC	06/10/96	P01	Ramapo River 700 Pump Station	0.006	0.085	0.003	0.442	0.007	
NJDWSC	06/10/96	P01	Ramapo River 700 Pump Station	0.006	0.085	0.003	0.442	0.007	

Monitoring Data for Ramapo River at Pompton Lakes

Agency	Sample Date	Station ID	Station Location		Ortho Phosphate	Total Phosphate		Nitrite	Nitrate		Ammonia	Chlorophyll-a
NJDWSC	07/08/96	P01	Ramapo River 700 Pump Station		0.006	0.089		0.005	0.495		0.007	
NJDWSC	07/08/96	P01	Ramapo River 700 Pump Station		0.006	0.089		0.005	0.495		0.007	
NJDWSC	08/26/96	P01	Ramapo River 700 Pump Station		0.009	0.094		0.002	0.520		0.007	
NJDWSC	08/26/96	P01	Ramapo River 700 Pump Station		0.009	0.094		0.002	0.520		0.007	
NJDWSC	09/24/96	P01	Ramapo River 700 Pump Station		0.079	0.140		0.009	0.726		0.007	
NJDWSC	09/24/96	P01	Ramapo River 700 Pump Station		0.079	0.140		0.009	0.726		0.007	
NJDWSC	10/08/96	P01	Ramapo River 700 Pump Station		0.006			0.002	0.928		0.066	
NJDWSC	10/08/96	P01	Ramapo River 700 Pump Station		0.006			0.002	0.928		0.066	
NJDWSC	11/12/96	P01	Ramapo River 700 Pump Station		0.006	0.057		0.002	0.899		0.007	
NJDWSC	12/16/96	P01	Ramapo River 700 Pump Station		0.006	0.012		0.097	0.406		0.019	
NJDWSC	01/06/97	P01	Ramapo River 700 Pump Station		0.006	0.076		0.002	0.910		0.007	
NJDWSC	02/03/97	P01	Ramapo River 700 Pump Station		0.006	0.060		0.002	0.765		0.015	
NJDWSC	02/03/97	P01	Ramapo River 700 Pump Station		0.000	0.000		0.000			0.015	
NJDWSC	03/03/97	P01	Ramapo River 700 Pump Station	<	0.005	0.086	<	0.002	0.199		0.036	
NJDWSC	04/07/97	P01	Ramapo River 700 Pump Station	<	0.005	0.100	<	0.002	0.074		0.007	
NJDWSC	05/05/97	P01	Ramapo River 700 Pump Station	<	0.005	0.089		0.021	0.262		0.058	
NJDWSC	06/03/97	P01	Ramapo River 700 Pump Station		0.017	0.140		0.022	0.649		0.103	
NJDWSC	07/08/97	P01	Ramapo River 700 Pump Station		0.005	0.130		0.002	0.241		0.017	
NJDWSC	08/11/97	P01	Ramapo River 700 Pump Station	<	0.005	0.190	<	0.002	0.036		0.034	
NJDWSC	09/15/97	P01	Ramapo River 700 Pump Station		0.009	0.150		0.079	0.833		0.008	
NJDWSC	10/14/97	P01	Ramapo River 700 Pump Station		0.019	0.082	<	0.002	0.905		0.509	
NJDWSC	11/12/97	P01	Ramapo River 700 Pump Station		0.043	0.140	<	0.002	0.584		0.048	
NJDWSC	12/16/97	P01	Ramapo River 700 Pump Station		0.039	0.077	<	0.002	0.967		0.000	
NJDWSC	02/09/98	P01	Ramapo River 700 Pump Station		0.065	0.196	<	0.002	0.610	<	0.007	7.520
NJDWSC	03/09/98	P01	Ramapo River 700 Pump Station		0.006	0.168	<	0.002	0.431	<	0.007	6.300
NJDWSC	04/06/98	P01	Ramapo River 700 Pump Station		0.059	0.150		0.035	0.361		0.033	6.700
NJDWSC	05/04/98	P01	Ramapo River 700 Pump Station	<	0.005	0.157		0.058	0.491	<	0.007	15.250
NJDWSC	06/02/98	P01	Ramapo River 700 Pump Station	<	0.005	0.161		0.043	0.470		0.034	23.600
NJDWSC	07/06/98	P01	Ramapo River 700 Pump Station		0.042	0.142		0.058	0.498		0.074	4.480
NJDWSC	08/17/98	P01	Ramapo River 700 Pump Station		0.060	0.247	<	0.002	0.058	<	0.007	42.290
NJDWSC	09/28/98	P01	Ramapo River 700 Pump Station	<	0.005	0.174	<	0.002	0.061		0.024	26.170
NJDWSC	10/19/98	P01	Ramapo River 700 Pump Station	<	0.005	0.209		0.068	1.055		0.045	42.610
NJDWSC	11/05/98	P01	Ramapo River 700 Pump Station		0.037	0.163		0.112	1.399		0.007	59.270
NJDWSC	12/01/98	P01	Ramapo River 700 Pump Station		0.035	0.208		0.093	1.557	<	0.007	31.400
NJDWSC	01/04/99	P01	Ramapo River 700 Pump Station		0.051	0.178		0.065	1.422		0.050	9.510
NJDWSC	02/08/99	P01	Ramapo River 700 Pump Station		0.006	0.140		0.041	0.636		0.048	2.350
NJDWSC	03/01/99	P01	Ramapo River 700 Pump Station	<	0.005	0.130		0.049	0.774		0.032	15.270
NJDWSC	04/05/99	P01	Ramapo River 700 Pump Station	<	0.005	0.174		0.050	0.406	<	0.007	126.600
NJDWSC	05/04/99	P01	Ramapo River 700 Pump Station	<	0.005	0.174		0.066	0.365		0.039	31.080

Monitoring Data for Ramapo River at Pompton Lakes

Agency	Sample Date	Station ID	Station Location		Ortho Phosphate		Total Phosphate		Nitrite	Nitrate		Ammonia	Chlorophyll-a
NJDWSC	06/14/99	P01	Ramapo River 700 Pump Station		0.080		0.209		0.080	0.240		0.144	7.690
NJDWSC	07/12/99	P01	Ramapo River 700 Pump Station		0.060		0.172	<	0.002	0.080		0.013	32.040
NJDWSC	08/09/99	P01	Ramapo River 700 Pump Station		0.179		0.306	<	0.002	<0.001		0.017	80.100
NJDWSC	09/13/99	P01	Ramapo River 700 Pump Station				0.116		0.122	1.081	<	0.007	67.710
NJDWSC	10/19/99	P01	Ramapo River 700 Pump Station		0.041		0.219	<	0.002	0.829	<	0.007	15.590
NJDWSC	11/22/99	P01	Ramapo River 700 Pump Station		0.091		0.168	<	0.002	0.857	<	0.007	
NJDWSC	12/06/99	P01	Ramapo River 700 Pump Station	<	0.005		0.158	<	0.002	0.644		0.015	1.820
NJDWSC	01/11/00	P01	Ramapo River 700 Pump Station	<	0.005		0.168	<	0.002	0.939		0.037	1.600
NJDWSC	02/07/00	P01	Ramapo River 700 Pump Station	<	0.005		0.232	<	0.002	1.130		0.101	0.530
NJDWSC	03/06/00	P01	Ramapo River 700 Pump Station	<	0.005		0.148	<	0.002	0.596		0.022	4.810
NJDWSC	04/03/00	P01	Ramapo River 700 Pump Station	<	0.005		0.225	<	0.002	0.557		0.017	9.180
NJDWSC	05/01/00	P01	Ramapo River 700 Pump Station	<	0.005		0.015		N.D.	0.599	<	0.007	9.180
NJDWSC	06/05/00	P01	Ramapo River 700 Pump Station	<	0.005	<	0.012	<	0.002	0.414		0.059	24.990
NJDWSC	07/10/00	P01	Ramapo River 700 Pump Station	<	0.005		0.119	<	0.002	0.549		0.218	16.554
NJDWSC	08/01/00	P01	Ramapo River 700 Pump Station	<	0.005		0.066	<	0.002	0.479		0.065	29.690
NJDWSC	09/11/00	P01	Ramapo River 700 Pump Station	<	0.005		0.066	<	0.002	0.510		0.015	11.107
NJDWSC	10/10/00	P01	Ramapo River 700 Pump Station				0.121	<	0.002	0.895		0.071	4.592
NJDWSC	11/27/00	P01	Ramapo River 700 Pump Station		0.073	<	0.012	<	0.002	1.330			2.136
NJDWSC	12/12/00	P01	Ramapo River 700 Pump Station		0.061	<	0.012	<	0.002	1.230		0.047	5.233
NJDWSC	01/08/01	P01	Ramapo River 700 Pump Station		0.054		0.233		0.055	1.267		0.069	1.495
NJDWSC	02/05/01	P01	Ramapo River 700 Pump Station	<	0.005		0.162	<	0.002	0.914		0.155	1.388
NJDWSC	03/12/01	P01	Ramapo River 700 Pump Station	<	0.005		0.326	<	0.002	0.773		0.056	2.350
NJDWSC	04/02/01	P01	Ramapo River 700 Pump Station	<	0.005		0.056	<	0.002	0.497		0.107	18.476
NJDWSC	05/01/01	P01	Ramapo River 700 Pump Station	<	0.005		0.062	<	0.002	0.280		0.055	134.248
NJDWSC	06/05/01	P01	Ramapo River 700 Pump Station	<	0.005			<	0.002	0.456		0.061	
USGS	01/14/92	01388000	Ramapo River at Pompton Lakes		0.050		0.070		0.010	0.890		0.030	
USGS	02/19/92	01388000	Ramapo River at Pompton Lakes		0.050		0.100		0.010	0.990		0.030	
USGS	03/23/92	01388000	Ramapo River at Pompton Lakes		0.030		0.050		0.010	0.590		0.030	
USGS	04/21/92	01388000	Ramapo River at Pompton Lakes		0.020		0.040		0.020	0.680		0.060	
USGS	05/12/92	01388000	Ramapo River at Pompton Lakes				0.030		0.020	0.480		0.010	
USGS	05/28/92	01388000	Ramapo River at Pompton Lakes		0.030		0.060		0.020	0.280		0.020	
USGS	06/11/92	01388000	Ramapo River at Pompton Lakes		0.040		0.060		0.010	0.390		0.050	
USGS	06/24/92	01388000	Ramapo River at Pompton Lakes				0.070		0.030	0.570		0.110	
USGS	07/21/92	01388000	Ramapo River at Pompton Lakes				0.050		0.030	0.640		0.020	
USGS	08/27/92	01388000	Ramapo River at Pompton Lakes				0.050		0.020	0.380		0.010	
USGS	09/08/92	01388000	Ramapo River at Pompton Lakes		0.030		0.060		0.040	0.660		0.360	
USGS	09/17/92	01388000	Ramapo River at Pompton Lakes		0.020		0.060		0.020	0.480		0.010	
USGS	10/28/92	01388000	Ramapo River at Pompton Lakes				0.060		0.020	0.580		0.010	
USGS	11/20/92	01388000	Ramapo River at Pompton Lakes		0.070		0.100		0.030	0.770		0.070	

Monitoring Data for Ramapo River at Pompton Lakes

Agency	Sample Date	Station ID	Station Location	Ortho Phosphate	Total Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
USGS	12/15/92	01388000	Ramapo River at Pompton Lakes	0.050	0.050	0.030	0.670	0.100	
USGS	01/27/93	01388000	Ramapo River at Pompton Lakes	0.030	0.040	0.040	0.600	0.040	
USGS	02/23/93	01388000	Ramapo River at Pompton Lakes	0.040	0.050	0.020	0.970	0.020	
USGS	03/26/93	01388000	Ramapo River at Pompton Lakes		0.080	0.010	0.540	0.100	
USGS	04/22/93	01388000	Ramapo River at Pompton Lakes	0.020	0.060	0.010	0.390	0.050	
USGS	05/19/93	01388000	Ramapo River at Pompton Lakes		0.030	0.020	0.430	0.050	
USGS	05/27/93	01388000	Ramapo River at Pompton Lakes		0.030	0.040	0.720	0.060	
USGS	06/24/93	01388000	Ramapo River at Pompton Lakes	0.060	0.090	0.020	0.220	0.060	
USGS	07/20/93	01388000	Ramapo River at Pompton Lakes	0.030	0.150	0.010	0.042	0.030	
USGS	08/19/93	01388000	Ramapo River at Pompton Lakes		0.050	0.010	0.040	0.020	
USGS	09/03/93	01388000	Ramapo River at Pompton Lakes	0.030	0.040	0.010	0.040	0.020	
USGS	09/22/93	01388000	Ramapo River at Pompton Lakes		0.100	0.010	0.100	0.070	
USGS	10/21/93	01388000	Ramapo River at Pompton Lakes	0.030	0.090	0.040	1.260	0.140	
USGS	11/09/93	01388000	Ramapo River at Pompton Lakes	0.070	0.100	0.020	1.080	0.060	
USGS	12/21/93	01388000	Ramapo River at Pompton Lakes	0.030	0.030	0.010	0.750	0.040	
USGS	01/25/94	01388000	Ramapo River at Pompton Lakes	0.030	0.050	0.030	1.270	0.110	
USGS	02/24/94	01388000	Ramapo River at Pompton Lakes	0.030	0.040	0.020	0.540	0.140	
USGS	03/16/94	01388000	Ramapo River at Pompton Lakes	0.040	0.060	0.020	0.470	0.150	
USGS	04/29/94	01388000	Ramapo River at Pompton Lakes		0.050	0.010	0.130	0.030	
USGS	05/09/94	01388000	Ramapo River at Pompton Lakes		0.080	0.020	0.590	0.060	
USGS	05/24/94	01388000	Ramapo River at Pompton Lakes	0.020	0.070	0.020	0.510	0.020	
USGS	06/10/94	01388000	Ramapo River at Pompton Lakes	0.020	0.080	0.030	0.460	0.180	
USGS	06/27/94	01388000	Ramapo River at Pompton Lakes	0.070	0.180	0.030	0.630	0.190	
USGS	07/25/94	01388000	Ramapo River at Pompton Lakes	0.040	0.170	0.010	0.040	0.020	
USGS	08/19/94	01388000	Ramapo River at Pompton Lakes	0.020	0.140	0.010	0.040	0.010	
USGS	09/06/94	01388000	Ramapo River at Pompton Lakes		0.110	0.010	0.040	0.020	
USGS	09/27/94	01388000	Ramapo River at Pompton Lakes		0.100	0.010	0.063	0.020	
USGS	10/25/94	01388000	Ramapo River at Pompton Lakes		0.040	0.010	0.620	0.290	
USGS	11/08/94	01388000	Ramapo River at Pompton Lakes	0.020	0.110	0.020	0.760	0.015	
USGS	12/13/94	01388000	Ramapo River at Pompton Lakes	0.030	0.040	0.010	0.560	0.070	
USGS	01/20/95	01388000	Ramapo River at Pompton Lakes	0.030	0.030	0.010	0.550	0.020	
USGS	02/17/95	01388000	Ramapo River at Pompton Lakes	0.040	0.070	0.010	0.990	0.015	
USGS	03/17/95	01388000	Ramapo River at Pompton Lakes	0.020	0.030	0.010	0.340	0.015	
USGS	04/12/95	01388000	Ramapo River at Pompton Lakes		0.050	0.020	0.480	0.015	
USGS	05/09/95	01388000	Ramapo River at Pompton Lakes	0.020	0.060	0.010	0.290	0.015	
USGS	05/23/95	01388000	Ramapo River at Pompton Lakes		0.070		0.240	0.015	
USGS	06/08/95	01388000	Ramapo River at Pompton Lakes	0.060	0.080	0.040	0.300	0.060	
USGS	06/21/95	01388000	Ramapo River at Pompton Lakes	0.050	0.070	0.020	0.180	0.015	
USGS	07/19/95	01388000	Ramapo River at Pompton Lakes	0.040	0.090	0.010	0.040	0.015	

Monitoring Data for Ramapo River at Pompton Lakes

Agency	Sample Date	Station ID	Station Location	Ortho Phosphate	Total Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
USGS	08/14/95	01388000	Ramapo River at Pompton Lakes	0.140	0.200	0.010	0.040	0.015	
USGS	09/06/95	01388000	Ramapo River at Pompton Lakes	0.020	0.260	0.010	0.055	0.030	
USGS	09/26/95	01388000	Ramapo River at Pompton Lakes	0.070	0.280	0.010	0.040	0.070	
USGS	10/26/95	01388000	Ramapo River at Pompton Lakes	0.090	0.110	0.020	2.380	0.030	
USGS	11/30/95	01388000	Ramapo River at Pompton Lakes	0.040	0.070	0.020	0.870	0.050	
USGS	01/16/96	01388000	Ramapo River at Pompton Lakes	0.100	0.100	0.040	1.560	0.110	
USGS	02/08/96	01388000	Ramapo River at Pompton Lakes			0.030	1.070	0.080	
USGS	03/27/96	01388000	Ramapo River at Pompton Lakes	0.030	0.060	0.010	0.520	0.015	
USGS	04/25/96	01388000	Ramapo River at Pompton Lakes	0.020	0.060	0.010	0.340	0.030	
USGS	05/08/96	01388000	Ramapo River at Pompton Lakes	0.030	0.060	0.010	0.400	0.050	
USGS	05/23/96	01388000	Ramapo River at Pompton Lakes	0.020	0.090	0.020	0.320	0.020	
USGS	06/10/96	01388000	Ramapo River at Pompton Lakes	0.060	0.100	0.020	0.390	0.090	
USGS	06/27/96	01388000	Ramapo River at Pompton Lakes		0.060	0.040	0.570	0.030	
USGS	07/18/96	01388000	Ramapo River at Pompton Lakes	0.030	0.060	0.020	0.300	0.110	
USGS	08/21/96	01388000	Ramapo River at Pompton Lakes		0.040	0.020	0.560	0.060	
USGS	09/05/96	01388000	Ramapo River at Pompton Lakes						
USGS	09/25/96	01388000	Ramapo River at Pompton Lakes	0.060	0.080	0.020	0.610	0.040	
USGS	03/02/00	01388000	Ramapo River at Pompton Lakes				0.513		

Monitoring Data for Pompton River at Two Bridges

Agency	Sample Date	Station ID	Station Location		Ortho Phosphate	Total Phosphate		Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	1/12/1988	PN01	Pompton R. Two Bridges, Lincoln Pk		0.200	0.220		0.010	2.050	0.840	2.19
NJDWSC	2/2/1988	PN01	Pompton R. Two Bridges, Lincoln Pk		0.140	0.150		0.020	1.640	0.510	4.59
NJDWSC	3/15/1988	PN01	Pompton R. Two Bridges, Lincoln Pk		0.050	0.080		0.010	0.640	0.240	5.24
NJDWSC	4/19/1988	PN01	Pompton R. Two Bridges, Lincoln Pk		0.700	0.840		0.090	2.920	0.740	11.4
NJDWSC	5/24/1988	PN01	Pompton R. Two Bridges, Lincoln Pk		0.100	0.210		0.020	0.550	0.470	5.3
NJDWSC	6/28/1988	PN01	Pompton R. Two Bridges, Lincoln Pk		0.290	0.330		0.090	2.030	0.760	11.3
NJDWSC	7/19/1988	PN01	Pompton R. Two Bridges, Lincoln Pk		0.320	0.440		0.080	0.940	0.400	46.5
NJDWSC	8/10/1988	PN01	Pompton R. Two Bridges, Lincoln Pk		0.300	0.340		0.080	1.460	0.590	26.5
NJDWSC	9/20/1988	PN01	Pompton R. Two Bridges, Lincoln Pk		0.230	0.250		0.070	2.500	0.560	5.2
NJDWSC	10/18/1988	PN01	Pompton R. Two Bridges, Lincoln Pk		0.320	0.370		0.080	2.430	0.750	11.8
NJDWSC	11/15/1988	PN01	Pompton R. Two Bridges, Lincoln Pk		0.210	0.230		0.050	1.000	1.130	5.8
NJDWSC	12/13/1988	PN01	Pompton R. Two Bridges, Lincoln Pk		0.170	0.210		0.120		0.670	0.8
NJDWSC	1/17/1989	PN01	Pompton R. Two Bridges, Lincoln Pk		0.130	0.150		0.040	1.760	0.480	1.3
NJDWSC	2/7/1989	PN01	Pompton R. Two Bridges, Lincoln Pk		0.670	0.770		0.030	2.460	1.110	7.6
NJDWSC	1/10/1990	PN01	Pompton R. Two Bridges, Lincoln Pk		0.21	0.241		0.04	1.75	0.469	0.2
NJDWSC	2/6/1990	PN01	Pompton R. Two Bridges, Lincoln Pk		0.024	< 0.05	<	0.025	0.918	0.14	4
NJDWSC	3/12/1990	PN01	Pompton R. Two Bridges, Lincoln Pk		0.159	0.165	<	0.025	1.75	0.118	24
NJDWSC	4/3/1990	PN01	Pompton R. Two Bridges, Lincoln Pk		0.081	0.123	<	0.025	1.26	0.132	5.2
NJDWSC	5/15/1990	PN01	Pompton R. Two Bridges, Lincoln Pk	<	0.05	< 0.05	<	0.025	0.538	0.094	4.7
NJDWSC	6/27/1990	PN01	Pompton R. Two Bridges, Lincoln Pk		0.152	0.197		0.055	1.4	0.273	7.2
NJDWSC	7/17/1990	PN01	Pompton R. Two Bridges, Lincoln Pk		0.104	0.211		0.037	1.16	0.089	53
NJDWSC	8/7/1990	PN01	Pompton R. Two Bridges, Lincoln Pk		0.112	0.143		0.068	0.927	0.232	9.4
NJDWSC	9/4/1990	PN01	Pompton R. Two Bridges, Lincoln Pk		0.151	0.16	<	0.025	1.44	0.015	4.1
NJDWSC	10/16/1990	PN01	Pompton R. Two Bridges, Lincoln Pk		0.099	0.142	<	0.025	1.19	0.06	2.9
NJDWSC	11/13/1990	PN01	Pompton R. Two Bridges, Lincoln Pk		0.056	0.065		0.01	0.748	0.017	1.6
NJDWSC	12/4/1990	PN01	Pompton R. Two Bridges, Lincoln Pk		0.081	0.172		0.029	1.04	0.095	2.5
NJDWSC	1/15/1991	PN01	Pompton R. Two Bridges, Lincoln Pk		0.072	0.099		0.011	1.016	0.626	
NJDWSC	1/15/1991	PN01	Pompton R. Two Bridges, Lincoln Pk		0.000	0.000		0.011	1.016	0.000	
NJDWSC	1/15/1991	PN01	Pompton R. Two Bridges, Lincoln Pk		0.000	0.000		0.011	1.016	0.000	
NJDWSC	2/5/1991	PN01	Pompton R. Two Bridges, Lincoln Pk		0.270	0.310		0.036	1.674	0.525	
NJDWSC	3/6/1991	PN01	Pompton R. Two Bridges, Lincoln Pk		0.014	0.048		0.012	0.664	0.054	
NJDWSC	4/3/1991	PN01	Pompton R. Two Bridges, Lincoln Pk		0.044	0.087		0.010	0.900	0.044	
NJDWSC	4/3/1991	PN01	Pompton R. Two Bridges, Lincoln Pk		0.000	0.000		0.000		0.000	
NJDWSC	4/8/1991	PN01	Pompton R. Two Bridges, Lincoln Pk		0.054	0.120		0.017	1.046	0.016	
NJDWSC	4/8/1991	PN01	Pompton R. Two Bridges, Lincoln Pk		0.000	0.000		0.000		0.000	
NJDWSC	5/21/1991	PN01	Pompton R. Two Bridges, Lincoln Pk		0.210	0.260		0.036	1.713	0.141	
NJDWSC	6/25/1991	PN01	Pompton R. Two Bridges, Lincoln Pk		0.510	0.540		0.130	3.568	0.189	
NJDWSC	7/30/1991	PN01	Pompton R. Two Bridges, Lincoln Pk		0.270	0.400		0.027	1.789	0.017	
NJDWSC	8/27/1991	PN01	Pompton R. Two Bridges, Lincoln Pk		0.200	0.300		0.032	1.700	0.029	

Monitoring Data for Pompton River at Two Bridges

NJDWSC	8/27/1991	PN01	Pompton R. Two Bridges, Lincoln Pk		0.000	0.300		0.000		0.000
NJDWSC	9/24/1991	PN01	Pompton R. Two Bridges, Lincoln Pk		0.160	0.240		0.015	1.807	0.007
NJDWSC	9/24/1991	PN01	Pompton R. Two Bridges, Lincoln Pk		0.000	0.000		0.000		0.000
NJDWSC	10/22/1991	PN01	Pompton R. Two Bridges, Lincoln Pk		0.051	0.095		0.014	0.647	0.052
NJDWSC	11/19/1991	PN01	Pompton R. Two Bridges, Lincoln Pk		0.140	0.240		0.029	1.745	0.002
NJDWSC	12/10/1991	PN01	Pompton R. Two Bridges, Lincoln Pk		0.100	0.130		0.018	1.007	0.289
NJDWSC	1/8/1992	PN01	Pompton R. Two Bridges, Lincoln Pk		0.046	0.100		0.010	1.015	0.025
NJDWSC	2/4/1992	PN01	Pompton R. Two Bridges, Lincoln Pk		0.160	0.180		0.013	1.827	0.116
NJDWSC	3/10/1992	PN01	Pompton R. Two Bridges, Lincoln Pk		0.022	0.050		0.013	0.785	0.055
NJDWSC	4/14/1992	PN01	Pompton R. Two Bridges, Lincoln Pk		0.068	0.120		0.034	2.160	0.106
NJDWSC	5/12/1992	PN01	Pompton R. Two Bridges, Lincoln Pk		0.067	0.063				0.106
NJDWSC	5/12/1992	PN01	Pompton R. Two Bridges, Lincoln Pk		0.000	0.120		0.000		0.106
NJDWSC	6/15/1992	PN01	Pompton R. Two Bridges, Lincoln Pk			0.020				0.000
NJDWSC	6/15/1992	PN01	Pompton R. Two Bridges, Lincoln Pk		0.000	0.000		0.000		0.000
NJDWSC	7/14/1992	PN01	Pompton R. Two Bridges, Lincoln Pk		0.074	0.180		0.032	1.175	0.205
NJDWSC	7/14/1992	PN01	Pompton R. Two Bridges, Lincoln Pk		0.000	0.180		0.000		0.000
NJDWSC	8/4/1992	PN01	Pompton R. Two Bridges, Lincoln Pk		0.012	0.072	<	0.002	0.086	0.029
NJDWSC	9/8/1992	PN01	Pompton R. Two Bridges, Lincoln Pk		0.180	0.220		0.016	1.987	0.006
NJDWSC	10/7/1992	PN01	Pompton R. Two Bridges, Lincoln Pk		0.100	0.150		0.012	1.850	0.004
NJDWSC	10/7/1992	PN01	Pompton R. Two Bridges, Lincoln Pk		0.000	0.000		0.000		0.000
NJDWSC	11/23/1992	PN01	Pompton R. Two Bridges, Lincoln Pk		0.160	0.190		0.027	1.020	0.066
NJDWSC	12/7/1992	PN01	Pompton R. Two Bridges, Lincoln Pk		0.120	0.140		0.014	1.506	0.071
NJDWSC	12/7/1992	PN01	Pompton R. Two Bridges, Lincoln Pk		0.000	0.000		0.000		0.000
NJDWSC	1/11/1993	PN01	Pompton R. Two Bridges, Lincoln Pk		0.078	0.110		0.009	1.032	0.048
NJDWSC	1/11/1993	PN01	Pompton R. Two Bridges, Lincoln Pk		0.000	0.000		0.000		0.000
NJDWSC	1/11/1993	PN01	Pompton R. Two Bridges, Lincoln Pk		0.000	0.000		0.000		0.000
NJDWSC	2/1/1993	PN01	Pompton R. Two Bridges, Lincoln Pk		0.052	0.055		0.010	1.013	0.012
NJDWSC	3/1/1993	PN01	Pompton R. Two Bridges, Lincoln Pk		0.030	0.210		0.016	1.880	0.023
NJDWSC	4/5/1993	PN01	Pompton R. Two Bridges, Lincoln Pk	<	0.006	0.035		0.003	0.420	0.054
NJDWSC	5/10/1993	PN01	Pompton R. Two Bridges, Lincoln Pk		0.006	0.012		0.011	1.168	0.016
NJDWSC	5/10/1993	PN01	Pompton R. Two Bridges, Lincoln Pk		0.000	0.000		0.000		0.000
NJDWSC	6/21/1993	PN01	Pompton R. Two Bridges, Lincoln Pk		0.006	0.032		0.021	0.167	0.161
NJDWSC	6/21/1993	PN01	Pompton R. Two Bridges, Lincoln Pk		0.000	0.000		0.000		0.000
NJDWSC	7/19/1993	PN01	Pompton R. Two Bridges, Lincoln Pk		0.340	0.580		0.042	0.181	0.006
NJDWSC	8/2/1993	PN01	Pompton R. Two Bridges, Lincoln Pk		0.120	1.100		0.014	1.641	0.002
NJDWSC	9/13/1993	PN01	Pompton R. Two Bridges, Lincoln Pk		0.980	0.910		0.040	6.872	0.017
NJDWSC	10/18/1993	PN01	Pompton R. Two Bridges, Lincoln Pk		0.640	0.058		0.011	5.188	0.098
NJDWSC	11/9/1993	PN01	Pompton R. Two Bridges, Lincoln Pk		0.460	0.890		0.002	2.872	0.037
NJDWSC	11/9/1993	PN01	Pompton R. Two Bridges, Lincoln Pk		0.000	0.000		0.000		0.000
NJDWSC	12/6/1993	PN01	Pompton R. Two Bridges, Lincoln Pk		0.056	0.059		0.015	0.664	0.062

Monitoring Data for Pompton River at Two Bridges

NJDWSC	12/6/1993	PN01	Pompton R. Two Bridges, Lincoln Pk	0.000	0.000	0.000		0.000
NJDWSC	12/6/1993	PN01	Pompton R. Two Bridges, Lincoln Pk	0.000	0.000	0.000		0.000
NJDWSC	1/3/1994	PN01	Pompton R. Two Bridges, Lincoln Pk	0.170	0.220	0.012	1.672	0.036
NJDWSC	2/8/1994	PN01	Pompton R. Two Bridges, Lincoln Pk	0.036	0.062	0.005	1.075	0.075
NJDWSC	3/7/1994	PN01	Pompton R. Two Bridges, Lincoln Pk	0.054	0.086	0.007	0.995	0.020
NJDWSC	4/5/1994	PN01	Pompton R. Two Bridges, Lincoln Pk	0.006	0.012	0.007	0.382	0.047
NJDWSC	5/2/1994	PN01	Pompton R. Two Bridges, Lincoln Pk	0.081	0.058	0.017	1.033	0.264
NJDWSC	5/2/1994	PN01	Pompton R. Two Bridges, Lincoln Pk	0.000	0.000	0.017	1.033	0.000
NJDWSC	6/6/1994	PN01	Pompton R. Two Bridges, Lincoln Pk	0.023	0.120	0.075	2.407	0.070
NJDWSC	7/5/1994	PN01	Pompton R. Two Bridges, Lincoln Pk	0.066	0.150	0.010	1.102	0.008
NJDWSC	8/8/1994	PN01	Pompton R. Two Bridges, Lincoln Pk	0.190	0.260	0.002	0.005	0.007
NJDWSC	9/12/1994	PN01	Pompton R. Two Bridges, Lincoln Pk	0.006	0.260	0.002	0.004	0.007
NJDWSC	9/16/1994	PN01	Pompton R. Two Bridges, Lincoln Pk					0.000
NJDWSC	10/3/1994	PN01	Pompton R. Two Bridges, Lincoln Pk	0.006	0.012	0.005	1.806	0.024
NJDWSC	11/28/1994	PN01	Pompton R. Two Bridges, Lincoln Pk	0.046	0.230	0.016	0.978	0.033
NJDWSC	12/12/1994	PN01	Pompton R. Two Bridges, Lincoln Pk	0.099	0.200	0.002	1.153	0.007
NJDWSC	1/9/1995	PN01	Pompton R. Two Bridges, Lincoln Pk	0.006	0.031	0.002	0.686	0.007
NJDWSC	2/6/1995	PN01	Pompton R. Two Bridges, Lincoln Pk	0.046	0.067	0.002	0.890	0.065
NJDWSC	3/7/1995	PN01	Pompton R. Two Bridges, Lincoln Pk	0.052	0.012	0.006	0.804	0.007
NJDWSC	4/24/1995	PN01	Pompton R. Two Bridges, Lincoln Pk	0.006	0.130	0.002	1.311	0.007
NJDWSC	5/30/1995	PN01	Pompton R. Two Bridges, Lincoln Pk	0.300	0.460	0.083	2.398	0.217
NJDWSC	6/26/1995	PN01	Pompton R. Two Bridges, Lincoln Pk	0.540	0.012	0.060	2.113	0.221
NJDWSC	7/25/1995	PN01	Pompton R. Two Bridges, Lincoln Pk	0.036	0.200	0.013	0.723	0.007
NJDWSC	8/21/1995	PN01	Pompton R. Two Bridges, Lincoln Pk	0.570	1.500	0.002	8.510	0.888
NJDWSC	9/25/1995	PN01	Pompton R. Two Bridges, Lincoln Pk	0.470	0.480	0.002	3.480	0.064
NJDWSC	10/30/1995	PN01	Pompton R. Two Bridges, Lincoln Pk	0.100	0.180	0.110	0.539	0.029
NJDWSC	11/27/1995	PN01	Pompton R. Two Bridges, Lincoln Pk	0.006	0.200	0.004	0.411	0.050
NJDWSC	12/18/1995	PN01	Pompton R. Two Bridges, Lincoln Pk	0.180	0.160	0.002	1.005	0.041
NJDWSC	1/22/1996	PN01	Pompton R. Two Bridges, Lincoln Pk	0.013	0.013	0.002	0.666	0.112
NJDWSC	1/22/1996	PN01	Pompton R. Two Bridges, Lincoln Pk	0.013	0.013	0.002	0.666	0.112
NJDWSC	2/5/1996	PN01	Pompton R. Two Bridges, Lincoln Pk	0.062	0.210	0.002	0.799	0.089
NJDWSC	2/5/1996	PN01	Pompton R. Two Bridges, Lincoln Pk	0.062	0.210	0.002	0.799	0.089
NJDWSC	3/4/1996	PN01	Pompton R. Two Bridges, Lincoln Pk	0.051	0.070	0.002	0.967	0.030
NJDWSC	3/4/1996	PN01	Pompton R. Two Bridges, Lincoln Pk	0.051	0.070	0.002	0.967	0.030
NJDWSC	4/8/1996	PN01	Pompton R. Two Bridges, Lincoln Pk	0.006	0.047	0.002	0.458	0.007
NJDWSC	4/8/1996	PN01	Pompton R. Two Bridges, Lincoln Pk	0.006	0.047	0.002	0.458	0.007
NJDWSC	5/13/1996	PN01	Pompton R. Two Bridges, Lincoln Pk	0.029	0.070	0.002	0.285	0.104
NJDWSC	5/13/1996	PN01	Pompton R. Two Bridges, Lincoln Pk	0.029	0.070	0.002	0.285	0.104
NJDWSC	6/10/1996	PN01	Pompton R. Two Bridges, Lincoln Pk	0.088	0.190	0.007	0.830	0.069
NJDWSC	6/10/1996	PN01	Pompton R. Two Bridges, Lincoln Pk	0.088	0.190	0.007	0.830	0.069

Monitoring Data for Pompton River at Two Bridges

NJDWSC	7/8/1996	PN01	Pompton R. Two Bridges, Lincoln Pk		0.069	0.220		0.004	1.143		0.007	
NJDWSC	7/8/1996	PN01	Pompton R. Two Bridges, Lincoln Pk		0.069	0.220		0.004	1.143		0.007	
NJDWSC	8/26/1996	PN01	Pompton R. Two Bridges, Lincoln Pk		0.077	0.160		0.002	0.960		0.007	
NJDWSC	8/26/1996	PN01	Pompton R. Two Bridges, Lincoln Pk		0.077	0.160		0.002	0.960		0.007	
NJDWSC	9/24/1996	PN01	Pompton R. Two Bridges, Lincoln Pk		0.180	0.190		0.008	1.453		0.007	
NJDWSC	9/24/1996	PN01	Pompton R. Two Bridges, Lincoln Pk		0.180	0.190		0.008	1.453		0.007	
NJDWSC	10/8/1996	PN01	Pompton R. Two Bridges, Lincoln Pk		0.052			0.002	1.250		0.009	
NJDWSC	10/8/1996	PN01	Pompton R. Two Bridges, Lincoln Pk		0.052			0.002	1.250		0.009	
NJDWSC	11/12/1996	PN01	Pompton R. Two Bridges, Lincoln Pk		0.110	0.340		0.002	1.285		0.007	
NJDWSC	11/12/1996	PN01	Pompton R. Two Bridges, Lincoln Pk		0.000	0.000		0.000			0.007	
NJDWSC	12/16/1996	PN01	Pompton R. Two Bridges, Lincoln Pk		0.150	0.390		0.088	0.407		0.102	
NJDWSC	1/6/1997	PN01	Pompton R. Two Bridges, Lincoln Pk		0.087	0.097		0.056	1.009		0.007	
NJDWSC	2/3/1997	PN01	Pompton R. Two Bridges, Lincoln Pk		0.095	0.110		0.002	1.122		0.020	
NJDWSC	2/3/1997	PN01	Pompton R. Two Bridges, Lincoln Pk		0.000	0.000		0.000			0.020	
NJDWSC	3/3/1997	PN01	Pompton R. Two Bridges, Lincoln Pk		0.005	0.073		0.002	0.911		0.027	
NJDWSC	4/7/1997	PN01	Pompton R. Two Bridges, Lincoln Pk		0.021	0.076	<	0.002	0.102		0.007	
NJDWSC	5/5/1997	PN01	Pompton R. Two Bridges, Lincoln Pk		0.029	0.075		0.027	0.517		0.067	
NJDWSC	6/3/1997	PN01	Pompton R. Two Bridges, Lincoln Pk		0.096	0.190		0.055	5.017		0.107	
NJDWSC	6/3/1997	PN01	Pompton R. Two Bridges, Lincoln Pk		0.000	0.000		0.000			0.000	
NJDWSC	7/8/1997	PN01	Pompton R. Two Bridges, Lincoln Pk		0.064	0.270	<	0.002	0.382		0.007	
NJDWSC	8/11/1997	PN01	Pompton R. Two Bridges, Lincoln Pk		0.150	0.270	<	0.002	1.455		0.012	
NJDWSC	9/15/1997	PN01	Pompton R. Two Bridges, Lincoln Pk		0.100	0.190	<	0.002	1.180		0.007	
NJDWSC	10/14/1997	PN01	Pompton R. Two Bridges, Lincoln Pk		0.250	0.300	<	0.002	1.481		0.102	
NJDWSC	11/12/1997	PN01	Pompton R. Two Bridges, Lincoln Pk		0.150	0.210		0.002	0.662		0.327	
NJDWSC	12/16/1997	PN01	Pompton R. Two Bridges, Lincoln Pk		0.026	0.110	<	0.002	1.010		0.000	
NJDWSC	1/12/1998	PN01	Pompton R. Two Bridges, Lincoln Pk		0.065	0.110		0.040	0.393		0.177	6.050
NJDWSC	2/9/1998	PN01	Pompton R. Two Bridges, Lincoln Pk		0.122	0.524	<	0.002	0.985	<	0.007	7.050
NJDWSC	3/9/1998	PN01	Pompton R. Two Bridges, Lincoln Pk		0.068	0.134		0.060	0.485		0.065	7.010
NJDWSC	4/6/1998	PN01	Pompton R. Two Bridges, Lincoln Pk		0.071	0.122		0.051	0.555		0.020	9.380
NJDWSC	5/4/1998	PN01	Pompton R. Two Bridges, Lincoln Pk	<	0.005	0.157		0.046	0.471	<	0.007	7.480
NJDWSC	6/2/1998	PN01	Pompton R. Two Bridges, Lincoln Pk	<	0.005	0.140		0.039	0.548		0.049	20.290
NJDWSC	7/6/1998	PN01	Pompton R. Two Bridges, Lincoln Pk		0.060	0.083		0.056	0.814		0.027	4.060
NJDWSC	8/17/1998	PN01	Pompton R. Two Bridges, Lincoln Pk		0.300	0.376	<	0.002	1.696	<	0.007	49.020
NJDWSC	9/28/1998	PN01	Pompton R. Two Bridges, Lincoln Pk		1.539	1.648	<	0.002	1.395		0.028	13.240
NJDWSC	10/19/1998	PN01	Pompton R. Two Bridges, Lincoln Pk		0.061	0.245		0.047	1.056		0.048	2.560
NJDWSC	11/5/1998	PN01	Pompton R. Two Bridges, Lincoln Pk		1.263	1.395		0.068	7.198		0.007	2.880
NJDWSC	12/1/1998	PN01	Pompton R. Two Bridges, Lincoln Pk		0.267	0.171		0.096	2.064		0.516	2.560
NJDWSC	1/4/1999	PN01	Pompton R. Two Bridges, Lincoln Pk		0.034	0.208		0.072	1.732		0.068	15.380
NJDWSC	2/8/1999	PN01	Pompton R. Two Bridges, Lincoln Pk		0.890	0.179		1.131	1.811		0.140	3.630
NJDWSC	3/1/1999	PN01	Pompton R. Two Bridges, Lincoln Pk		0.062	0.110		0.075	0.851		0.037	29.160

Monitoring Data for Pompton River at Two Bridges

NJDWSC	4/5/1999	PN01	Pompton R. Two Bridges, Lincoln Pk		0.061	0.153		0.046	0.499		0.448	7.370
NJDWSC	5/4/1999	PN01	Pompton R. Two Bridges, Lincoln Pk		0.155	0.223		0.324	0.548		0.395	24.880
NJDWSC	6/14/1999	PN01	Pompton R. Two Bridges, Lincoln Pk		0.431	0.690		0.160	4.750		0.021	1.500
NJDWSC	7/12/1999	PN01	Pompton R. Two Bridges, Lincoln Pk		0.930	1.014		0.180	3.830		0.064	79.570
NJDWSC	8/9/1999	PN01	Pompton R. Two Bridges, Lincoln Pk		0.081	0.354	<	0.002	1.620		0.009	24.140
NJDWSC	9/13/1999	PN01	Pompton R. Two Bridges, Lincoln Pk			0.202						75.830
NJDWSC	10/19/1999	PN01	Pompton R. Two Bridges, Lincoln Pk		0.140	0.167	<	0.002	1.260	<	0.007	11.750
NJDWSC	11/22/1999	PN01	Pompton R. Two Bridges, Lincoln Pk	<	0.005	0.150	<	0.002	1.050		0.325	
NJDWSC	12/6/1999	PN01	Pompton R. Two Bridges, Lincoln Pk	<	0.005	0.135	<	0.002	0.770		0.365	1.070
NJDWSC	1/11/2000	PN01	Pompton R. Two Bridges, Lincoln Pk		0.078	0.138	<	0.002	1.036		0.060	2.670
NJDWSC	2/7/2000	PN01	Pompton R. Two Bridges, Lincoln Pk	<	0.005	0.169	<	0.002	1.380		0.050	1.280
NJDWSC	3/6/2000	PN01	Pompton R. Two Bridges, Lincoln Pk		0.064	0.153	<	0.002	0.823	<	0.007	5.020
NJDWSC	4/3/2000	PN01	Pompton R. Two Bridges, Lincoln Pk		0.083	0.237	<	0.002	0.818		0.027	8.970
NJDWSC	5/1/2000	PN01	Pompton R. Two Bridges, Lincoln Pk		0.083	0.083		N.D.	0.791	<	0.007	8.000
NJDWSC	6/5/2000	PN01	Pompton R. Two Bridges, Lincoln Pk		0.025	0.067	<	0.002	1.293		0.066	14.520
NJDWSC	7/10/2000	PN01	Pompton R. Two Bridges, Lincoln Pk		0.140	0.142	<	0.002	1.433		0.130	7.903
NJDWSC	8/1/2000	PN01	Pompton R. Two Bridges, Lincoln Pk	<	0.005	0.051	<	0.002	0.604		0.038	24.030
NJDWSC	9/11/2000	PN01	Pompton R. Two Bridges, Lincoln Pk		0.134	0.097	<	0.002	1.386		0.025	11.428
NJDWSC	10/10/2000	PN01	Pompton R. Two Bridges, Lincoln Pk		0.205	0.198	<	0.002	1.380		0.047	2.029
NJDWSC	11/27/2000	PN01	Pompton R. Two Bridges, Lincoln Pk		0.093	0.033	<	0.002	1.450		0.049	12.421
NJDWSC	12/12/2000	PN01	Pompton R. Two Bridges, Lincoln Pk		0.439	0.756		0.074	3.650		0.488	2.990
NJDWSC	1/8/2001	PN01	Pompton R. Two Bridges, Lincoln Pk		0.230	0.404	<	0.002	1.730		0.124	1.495
NJDWSC	2/5/2001	PN01	Pompton R. Two Bridges, Lincoln Pk		0.108	0.239	<	0.002	1.252		0.229	3.311
NJDWSC	3/12/2001	PN01	Pompton R. Two Bridges, Lincoln Pk		0.049	0.394	<	0.002	1.073		0.045	4.486
NJDWSC	4/2/2001	PN01	Pompton R. Two Bridges, Lincoln Pk	<	0.005	0.060	<	0.002	0.556		0.059	19.865
NJDWSC	5/1/2001	PN01	Pompton R. Two Bridges, Lincoln Pk	<	0.005	0.244	<	0.002	1.161		0.048	86.828
NJDWSC	6/5/2001	PN01	Pompton R. Two Bridges, Lincoln Pk		0.073		<	0.002	0.768		0.062	

Monitoring Data for Passaic River at Two Bridges

Agency	Sample Date	Station ID	Station Location	Total Phosphate	Ortho Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
USGS	01/15/92	01382000	Passaic River at Two Bridges	0.500	0.690		3.170	0.360	
USGS	02/19/92	01382000	Passaic River at Two Bridges	0.370	0.360		1.980	0.240	
USGS	03/23/92	01382000	Passaic River at Two Bridges	0.330	0.420		2.670	0.130	
USGS	04/20/92	01382000	Passaic River at Two Bridges	0.260	0.410		2.460	0.190	
USGS	05/12/92	01382000	Passaic River at Two Bridges	0.230	0.320		2.170	0.090	
USGS	05/27/92	01382000	Passaic River at Two Bridges	0.410	0.650		3.250	0.190	
USGS	06/10/92	01382000	Passaic River at Two Bridges	0.120	0.160		0.280	0.060	
USGS	06/25/92	01382000	Passaic River at Two Bridges	0.300	0.410		4.040	0.200	
USGS	07/21/92	01382000	Passaic River at Two Bridges	0.470	0.530		3.650	0.050	
USGS	08/27/92	01382000	Passaic River at Two Bridges	0.910	0.970		5.970	0.010	
USGS	09/08/92	01382000	Passaic River at Two Bridges	0.340	0.530		3.080	0.140	
USGS	09/18/92	01382000	Passaic River at Two Bridges	0.630	0.860		5.670	0.030	
USGS	10/29/92	01382000	Passaic River at Two Bridges	1.100	1.200		7.090	0.080	
USGS	11/20/92	01382000	Passaic River at Two Bridges	0.050	0.080		0.990	0.050	
USGS	12/14/92	01382000	Passaic River at Two Bridges	0.100	0.170		0.880	0.060	
USGS	01/28/93	01382000	Passaic River at Two Bridges	0.170	0.190		1.570	0.120	
USGS	02/23/93	01382000	Passaic River at Two Bridges	0.220	0.260		2.070	0.090	
USGS	03/25/93	01382000	Passaic River at Two Bridges	0.060			0.940	0.050	
USGS	04/22/93	01382000	Passaic River at Two Bridges	0.100	0.170		0.630	0.030	
USGS	05/20/93	01382000	Passaic River at Two Bridges	0.430	0.550		4.040	0.270	
USGS	05/26/93	01382000	Passaic River at Two Bridges	0.450	0.530		3.950	0.170	
USGS	06/07/93	01382000	Passaic River at Two Bridges	0.430	0.570		4.350	0.180	
USGS	06/23/93	01382000	Passaic River at Two Bridges	0.340	0.410		2.940	0.130	
USGS	07/19/93	01382000	Passaic River at Two Bridges	0.860	1.100		5.860	0.060	
USGS	08/20/93	01382000	Passaic River at Two Bridges	0.520	0.570		3.960	0.150	
USGS	09/03/93	01382000	Passaic River at Two Bridges	1.200	1.300		7.470	0.030	
USGS	09/22/93	01382000	Passaic River at Two Bridges	1.100	1.100		7.870	0.100	
USGS	10/20/93	01382000	Passaic River at Two Bridges	0.770	0.890		5.080	0.090	
USGS	11/09/93	01382000	Passaic River at Two Bridges	0.400	0.460		2.780	0.070	
USGS	12/20/93	01382000	Passaic River at Two Bridges	0.400	0.460		2.690	0.120	
USGS	01/27/94	01382000	Passaic River at Two Bridges	0.390	0.490		2.930	0.430	
USGS	02/25/94	01382000	Passaic River at Two Bridges	0.090	0.120		1.190	0.150	
USGS	03/16/94	01382000	Passaic River at Two Bridges	0.060	0.060		0.740	0.060	
USGS	04/29/94	01382000	Passaic River at Two Bridges	0.150	0.310		1.380	0.090	
USGS	05/09/94	01382000	Passaic River at Two Bridges	0.160	0.270		1.380	0.100	
USGS	05/24/94	01382000	Passaic River at Two Bridges	0.230	0.410		2.360	0.180	
USGS	06/09/94	01382000	Passaic River at Two Bridges	0.410	0.500		2.930	0.250	
USGS	06/27/94	01382000	Passaic River at Two Bridges	0.380	0.530		2.020	0.200	
USGS	07/20/94	01382000	Passaic River at Two Bridges	0.650	0.770		5.060	0.040	

Monitoring Data for Passaic River at Two Bridges

Agency	Sample Date	Station ID	Station Location	Total Phosphate	Ortho Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
USGS	08/19/94	01382000	Passaic River at Two Bridges	0.360	0.510		2.480	0.070	
USGS	09/07/94	01382000	Passaic River at Two Bridges	0.690	0.750		5.770	0.030	
USGS	09/27/94	01382000	Passaic River at Two Bridges	0.720	0.760		5.770	0.090	
USGS	10/26/94	01382000	Passaic River at Two Bridges	0.950	1.000		5.790	0.030	
USGS	11/09/94	01382000	Passaic River at Two Bridges	1.000	1.100		6.070	0.080	
USGS	12/13/94	01382000	Passaic River at Two Bridges	0.220	0.250		1.590	0.110	
USGS	01/19/95	01382000	Passaic River at Two Bridges	0.250	0.280		1.790	0.070	
USGS	02/17/95	01382000	Passaic River at Two Bridges	0.630	0.700		4.860	0.190	
USGS	03/16/95	01382000	Passaic River at Two Bridges	0.160	0.200		1.190	0.020	
USGS	04/12/95	01382000	Passaic River at Two Bridges	0.260	0.410		2.670	0.110	
USGS	05/09/95	01382000	Passaic River at Two Bridges	0.420	0.680		3.860	0.130	
USGS	05/23/95	01382000	Passaic River at Two Bridges	0.350	0.480		3.100	0.170	
USGS	06/08/95	01382000	Passaic River at Two Bridges	0.550	0.700		4.530	0.110	
USGS	06/21/95	01382000	Passaic River at Two Bridges	0.690	0.710		4.750	0.015	
USGS	07/18/95	01382000	Passaic River at Two Bridges	0.490	0.610		3.190	0.060	
USGS	08/14/95	01382000	Passaic River at Two Bridges	1.100	1.300		6.070	0.015	
USGS	09/06/95	01382000	Passaic River at Two Bridges	1.200	1.400		7.170	0.030	
USGS	09/26/95	01382000	Passaic River at Two Bridges	0.820	0.890		4.990	0.070	
USGS	10/24/95	01382000	Passaic River at Two Bridges	0.260	0.360		1.380	0.020	
USGS	11/30/95	01382000	Passaic River at Two Bridges	0.350	0.430		2.490	0.090	
USGS	01/16/96	01382000	Passaic River at Two Bridges	0.560	0.640		3.770	0.320	
USGS	02/08/96	01382000	Passaic River at Two Bridges	0.170	0.180		1.580	0.110	
USGS	03/27/96	01382000	Passaic River at Two Bridges	0.120	0.170		0.960	0.020	
USGS	04/25/96	01382000	Passaic River at Two Bridges	0.130	0.220		0.670	0.060	
USGS	05/08/96	01382000	Passaic River at Two Bridges	0.160	0.250		1.080	0.070	
USGS	05/23/96	01382000	Passaic River at Two Bridges	0.270	0.475		1.600	0.205	
USGS	06/10/96	01382000	Passaic River at Two Bridges	0.280	0.460		2.040	0.260	
USGS	06/19/96	01382000	Passaic River at Two Bridges	0.370	0.550		3.530	0.230	
USGS	06/27/96	01382000	Passaic River at Two Bridges	0.380	0.640		3.940	0.070	
USGS	07/16/96	01382000	Passaic River at Two Bridges	0.140	0.230		0.310	0.110	
USGS	07/17/96	01382000	Passaic River at Two Bridges	0.140	0.300		0.320	0.090	
USGS	08/20/96	01382000	Passaic River at Two Bridges	0.660	0.820		4.770	0.030	
USGS	08/21/96	01382000	Passaic River at Two Bridges	0.620	0.750		4.770	0.015	
USGS	09/23/96	01382000	Passaic River at Two Bridges	0.330	0.450				
USGS	09/25/96	01382000	Passaic River at Two Bridges	0.360	0.490		2.580	0.120	
USGS	10/16/96	01382000	Passaic River at Two Bridges	0.370	0.470		2.180	0.060	
USGS	10/29/96	01382000	Passaic River at Two Bridges	0.160	0.250		2.180	0.090	
USGS	11/12/96	01382000	Passaic River at Two Bridges	0.200	0.290		0.184	0.030	
USGS	12/11/96	01382000	Passaic River at Two Bridges	0.040	0.070		1.360	0.080	

Monitoring Data for Passaic River at Two Bridges

Agency	Sample Date	Station ID	Station Location	Total Phosphate	Ortho Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
USGS	01/07/97	01382000	Passaic River at Two Bridges	0.260	0.310		0.550	0.030	
USGS	01/15/97	01382000	Passaic River at Two Bridges	0.250	0.300		1.780	0.110	
USGS	02/27/97	01382000	Passaic River at Two Bridges	0.250	0.320		2.077	0.070	
USGS	03/18/97	01382000	Passaic River at Two Bridges	0.060	0.130				
USGS	04/02/97	01382000	Passaic River at Two Bridges	0.080	0.140		2.490	0.040	
USGS	04/23/97	01382000	Passaic River at Two Bridges	0.170	0.284		1.087	0.030	
USGS	05/14/97	01382000	Passaic River at Two Bridges	0.251	0.405		0.740	0.050	
USGS	05/21/97	01382000	Passaic River at Two Bridges	0.231	0.408		1.522	0.150	
USGS	06/11/97	01382000	Passaic River at Two Bridges	0.278	0.503		1.940	0.200	
USGS	07/23/97	01382000	Passaic River at Two Bridges	0.369	0.482		2.148	0.152	
USGS	07/30/97	01382000	Passaic River at Two Bridges	0.301	0.516		3.031	0.129	
USGS	08/27/97	01382000	Passaic River at Two Bridges	0.462	0.607		2.361	0.074	
USGS	09/23/97	01382000	Passaic River at Two Bridges	0.703	0.857		0.980	0.110	
USGS	10/21/97	01382000	Passaic River at Two Bridges	1.110	1.330		3.593	0.015	
USGS	11/03/97	01382000	Passaic River at Two Bridges	0.286	0.499		4.816	0.089	
USGS	11/13/97	01382000	Passaic River at Two Bridges	0.628	0.761		5.396	0.108	
USGS	11/19/97	01382000	Passaic River at Two Bridges	0.500	0.589		0.878	0.015	
USGS	12/22/97	01382000	Passaic River at Two Bridges	0.476	0.543		3.120	0.080	
USGS	01/20/98	01382000	Passaic River at Two Bridges	0.162	0.198		3.335	0.395	
USGS	01/24/98	01382000	Passaic River at Two Bridges	0.189	0.240		3.005	0.104	
USGS	02/03/98	01382000	Passaic River at Two Bridges	0.147	0.197		1.540	0.020	
USGS	02/24/98	01382000	Passaic River at Two Bridges	0.085	0.129		1.760	0.057	
USGS	03/23/98	01382000	Passaic River at Two Bridges	0.073	0.131		1.488	0.060	
USGS	04/08/98	01382000	Passaic River at Two Bridges	0.083	0.234		0.744	0.020	
USGS	05/11/98	01382000	Passaic River at Two Bridges	0.204	0.231		0.640	0.066	
USGS	05/18/98	01382000	Passaic River at Two Bridges	0.150	0.190		0.376	0.035	
USGS	06/24/98	01382000	Passaic River at Two Bridges	0.305	0.415		0.607	0.122	
USGS	08/04/98	01382000	Passaic River at Two Bridges	0.681	0.850		0.387	0.100	
USGS	11/04/98	01382000	Passaic River at Two Bridges	1.470	1.460				
USGS	01/25/99	01382000	Passaic River at Two Bridges	0.161	0.232				
USGS	05/05/99	01382000	Passaic River at Two Bridges	0.423	0.613		0.971	0.170	
USGS	08/02/99	01382000	Passaic River at Two Bridges		1.650		3.952	0.030	
USGS	09/21/99	01382000	Passaic River at Two Bridges	0.128	0.203				
USGS	11/03/99	01382000	Passaic River at Two Bridges	0.618	0.830				
USGS	02/16/00	01382000	Passaic River at Two Bridges	0.102	0.186		6.598	0.030	
USGS	05/02/00	01382000	Passaic River at Two Bridges	0.240	0.360		1.508	0.050	
USGS	08/10/00	01382000	Passaic River at Two Bridges	0.338	0.510		2.939	0.100	
USGS	11/14/00	01382000	Passaic River at Two Bridges	0.358	0.445			0.030	
USGS	02/21/01	01382000	Passaic River at Two Bridges	0.155	0.187		0.648	0.031	

Monitoring Data for Passaic River at Two Bridges

Agency	Sample Date	Station ID	Station Location	Total Phosphate	Ortho Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
USGS	05/02/01	01382000	Passaic River at Two Bridges	0.294	0.473		3.462	0.040	
USGS	08/23/01	01382000	Passaic River at Two Bridges	0.497	0.592		1.132	0.140	
USGS	11/26/01	01382000	Passaic River at Two Bridges	1.160	1.220		1.342	0.080	
USGS	02/19/02	01382000	Passaic River at Two Bridges	0.730	0.810				
USGS	05/29/02	01382000	Passaic River at Two Bridges	0.420	0.570				
USGS	06/20/02	01382000	Passaic River at Two Bridges						
USGS	06/27/02	01382000	Passaic River at Two Bridges						
USGS	07/02/02	01382000	Passaic River at Two Bridges						
USGS	07/10/02	01382000	Passaic River at Two Bridges				1.963	0.050	
USGS	07/17/02	01382000	Passaic River at Two Bridges				1.620	0.076	
USGS	08/14/02	01382000	Passaic River at Two Bridges	1.020	1.020		1.480	0.506	
NJDWSC	01/12/88	PS01	Passaic R. at Two Bridges, Lincoln	0.910	0.910	0.030	3.240	5.500	9.16
NJDWSC	02/02/88	PS01	Passaic R. at Two Bridges, Lincoln	0.500	0.560	0.030	2.180	3.250	3.23
NJDWSC	03/15/88	PS01	Passaic R. at Two Bridges, Lincoln	0.260	0.330	0.020	1.070	0.520	4.14
NJDWSC	04/19/88	PS01	Passaic R. at Two Bridges, Lincoln	0.700	0.830	0.090	3.020	0.730	6.9
NJDWSC	05/24/88	PS01	Passaic R. at Two Bridges, Lincoln	0.330	0.570	0.060	0.540	1.090	6.7
NJDWSC	06/28/88	PS01	Passaic R. at Two Bridges, Lincoln	0.720	0.920	0.300	4.390		33.9
NJDWSC	07/19/88	PS01	Passaic R. at Two Bridges, Lincoln	0.750	0.950	0.200	2.710	2.140	26.3
NJDWSC	08/10/88	PS01	Passaic R. at Two Bridges, Lincoln	0.530	0.540	0.220	2.430	1.470	25.4
NJDWSC	09/20/88	PS01	Passaic R. at Two Bridges, Lincoln	0.780	0.780	0.200	4.890	1.320	3.6
NJDWSC	10/18/88	PS01	Passaic R. at Two Bridges, Lincoln	1.400	1.400	0.350	5.400	1.470	40
NJDWSC	11/15/88	PS01	Passaic R. at Two Bridges, Lincoln	0.620	0.630	0.180	1.720	1.970	6.1
NJDWSC	12/13/88	PS01	Passaic R. at Two Bridges, Lincoln	0.400	0.530	0.070		1.350	0.6
NJDWSC	01/17/89	PS01	Passaic R. at Two Bridges, Lincoln	0.330	0.360	0.040	1.370	1.420	0.8
NJDWSC	02/07/89	PS01	Passaic R. at Two Bridges, Lincoln	0.660	0.790	0.030	2.310	1.040	6.6
NJDWSC	01/10/90	PS01	Passaic R. at Two Bridges, Lincoln	0.624	0.662	0.047	2.77	2.068	0.8
NJDWSC	02/06/90	PS01	Passaic R. at Two Bridges, Lincoln	0.077	0.093	< 0.025	1.05	0.225	2.1
NJDWSC	03/12/90	PS01	Passaic R. at Two Bridges, Lincoln	0.251	0.271	0.038	1.85	0.672	10.3
NJDWSC	04/03/90	PS01	Passaic R. at Two Bridges, Lincoln	0.219	0.247	< 0.025	1.33	0.438	1.7
NJDWSC	05/15/90	PS01	Passaic R. at Two Bridges, Lincoln	0.116	0.137	0.030	0.610	0.162	1.6
NJDWSC	06/27/90	PS01	Passaic R. at Two Bridges, Lincoln	0.3	0.303	0.141	1.83	0.576	14.9
NJDWSC	07/17/90	PS01	Passaic R. at Two Bridges, Lincoln	0.302	0.305	0.074	1.37	0.23	22.2
NJDWSC	08/07/90	PS01	Passaic R. at Two Bridges, Lincoln	0.291	0.31	0.078	1.52	0.394	5.4
NJDWSC	09/04/90	PS01	Passaic R. at Two Bridges, Lincoln	0.384	0.384	0.153	2.28	0.565	7.4
NJDWSC	10/16/90	PS01	Passaic R. at Two Bridges, Lincoln	0.273	0.285	< 0.025	0.263	0.107	1.5
NJDWSC	11/13/90	PS01	Passaic R. at Two Bridges, Lincoln	0.132	0.145	0.012	0.588	0.018	1.4
NJDWSC	12/04/90	PS01	Passaic R. at Two Bridges, Lincoln	0.449	0.539	0.042	1.85	0.843	5.3
NJDWSC	01/15/91	PS01	Passaic R. at Two Bridges, Lincoln	0.180	0.210	0.018	1.224	0.492	
NJDWSC	01/15/91	PS01	Passaic R. at Two Bridges, Lincoln	0.000	0.000	0.018	1.224	0.000	

Monitoring Data for Passaic River at Two Bridges

Agency	Sample Date	Station ID	Station Location	Total Phosphate	Ortho Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	01/15/91	PS01	Passaic R. at Two Bridges, Lincoln	0.000	0.000	0.018	1.224	0.000	
NJDWSC	02/05/91	PS01	Passaic R. at Two Bridges, Lincoln	0.076	0.120	0.015	1.365	0.101	
NJDWSC	03/06/91	PS01	Passaic R. at Two Bridges, Lincoln	0.086	0.088	0.022	0.771	0.092	
NJDWSC	04/03/91	PS01	Passaic R. at Two Bridges, Lincoln	0.310	0.320	0.027	1.933	0.252	
NJDWSC	04/03/91	PS01	Passaic R. at Two Bridges, Lincoln	0.000	0.000	0.000		0.000	
NJDWSC	04/08/91	PS01	Passaic R. at Two Bridges, Lincoln	0.310	0.360	0.077	2.722	0.526	
NJDWSC	04/08/91	PS01	Passaic R. at Two Bridges, Lincoln	0.000	0.000	0.000		0.000	
NJDWSC	05/21/91	PS01	Passaic R. at Two Bridges, Lincoln	0.290	0.410	0.130	2.744	0.583	
NJDWSC	06/25/91	PS01	Passaic R. at Two Bridges, Lincoln	0.520	0.600	0.130	3.678	0.194	
NJDWSC	07/30/91	PS01	Passaic R. at Two Bridges, Lincoln	0.500	0.590	0.094	2.961	0.215	
NJDWSC	08/27/91	PS01	Passaic R. at Two Bridges, Lincoln	0.540	0.640	0.100	3.725	0.109	
NJDWSC	08/27/91	PS01	Passaic R. at Two Bridges, Lincoln	0.000	0.640	0.000		0.000	
NJDWSC	09/24/91	PS01	Passaic R. at Two Bridges, Lincoln	0.740	0.800	0.130	5.758	0.291	
NJDWSC	09/24/91	PS01	Passaic R. at Two Bridges, Lincoln	0.000	0.000	0.000		0.000	
NJDWSC	10/22/91	PS01	Passaic R. at Two Bridges, Lincoln	< 0.006	0.068	0.008	0.912	0.002	
NJDWSC	11/19/91	PS01	Passaic R. at Two Bridges, Lincoln	1.100	1.100	0.051	5.759	0.435	
NJDWSC	12/10/91	PS01	Passaic R. at Two Bridges, Lincoln	0.280	0.310	0.020	1.717	0.164	
NJDWSC	01/08/92	PS01	Passaic R. at Two Bridges, Lincoln	0.025	0.033	0.018	0.398	0.076	
NJDWSC	02/04/92	PS01	Passaic R. at Two Bridges, Lincoln	0.600	0.640	0.024	3.796	0.506	
NJDWSC	03/10/92	PS01	Passaic R. at Two Bridges, Lincoln	< 0.006	< 0.013	< 0.002	0.365	0.064	
NJDWSC	04/14/92	PS01	Passaic R. at Two Bridges, Lincoln	0.230	0.320	0.017	1.550	0.007	
NJDWSC	05/12/92	PS01	Passaic R. at Two Bridges, Lincoln	0.023	0.480			0.001	
NJDWSC	05/12/92	PS01	Passaic R. at Two Bridges, Lincoln	0.000	0.330	0.000		0.001	
NJDWSC	06/15/92	PS01	Passaic R. at Two Bridges, Lincoln		0.160			0.000	
NJDWSC	06/15/92	PS01	Passaic R. at Two Bridges, Lincoln	0.000	0.000	0.000		0.000	
NJDWSC	07/14/92	PS01	Passaic R. at Two Bridges, Lincoln	0.440	0.470	0.045	3.302	0.225	
NJDWSC	07/14/92	PS01	Passaic R. at Two Bridges, Lincoln	0.000	0.470	0.000		0.000	
NJDWSC	08/04/92	PS01	Passaic R. at Two Bridges, Lincoln	0.180	0.270	< 0.002	0.036	0.128	
NJDWSC	09/08/92	PS01	Passaic R. at Two Bridges, Lincoln	0.380	0.490	0.036	0.027	0.134	
NJDWSC	10/07/92	PS01	Passaic R. at Two Bridges, Lincoln	1.000	1.200	0.030	7.470	0.091	
NJDWSC	10/07/92	PS01	Passaic R. at Two Bridges, Lincoln	0.000	0.000	0.030	7.462	0.000	
NJDWSC	11/23/92	PS01	Passaic R. at Two Bridges, Lincoln	0.330	0.360	0.021	2.465	0.081	
NJDWSC	12/07/92	PS01	Passaic R. at Two Bridges, Lincoln	0.310	0.310	0.013	2.390	0.092	
NJDWSC	12/07/92	PS01	Passaic R. at Two Bridges, Lincoln	0.000	0.000	0.000		0.000	
NJDWSC	01/11/93	PS01	Passaic R. at Two Bridges, Lincoln	0.180	0.240	0.012	1.553	0.068	
NJDWSC	01/11/93	PS01	Passaic R. at Two Bridges, Lincoln	0.000	0.000	0.000		0.000	
NJDWSC	01/11/93	PS01	Passaic R. at Two Bridges, Lincoln	0.000	0.000	0.000		0.000	
NJDWSC	02/01/93	PS01	Passaic R. at Two Bridges, Lincoln	0.160	0.180	0.010	2.073	0.086	
NJDWSC	03/01/93	PS01	Passaic R. at Two Bridges, Lincoln	0.250	0.340	0.019	3.247	0.080	

Monitoring Data for Passaic River at Two Bridges

Agency	Sample Date	Station ID	Station Location	Total Phosphate	Ortho Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	04/05/93	PS01	Passaic R. at Two Bridges, Lincoln	< 0.006	0.064	0.008	0.454	0.017	
NJDWSC	05/10/93	PS01	Passaic R. at Two Bridges, Lincoln	0.006	0.130	0.032	1.930	0.154	
NJDWSC	05/10/93	PS01	Passaic R. at Two Bridges, Lincoln	0.000	0.000	0.000		0.000	
NJDWSC	06/21/93	PS01	Passaic R. at Two Bridges, Lincoln	0.550	0.650	0.050	4.105	0.007	
NJDWSC	06/21/93	PS01	Passaic R. at Two Bridges, Lincoln	0.000	0.000	0.000		0.000	
NJDWSC	07/19/93	PS01	Passaic R. at Two Bridges, Lincoln	0.340	0.880	0.048	1.723	0.031	
NJDWSC	08/02/93	PS01	Passaic R. at Two Bridges, Lincoln	0.870	0.013	0.007	5.616	0.011	
NJDWSC	09/13/93	PS01	Passaic R. at Two Bridges, Lincoln	1.100	1.100	0.039	6.709	0.024	
NJDWSC	10/18/93	PS01	Passaic R. at Two Bridges, Lincoln	0.690	0.160	0.007	5.328	0.104	
NJDWSC	11/09/93	PS01	Passaic R. at Two Bridges, Lincoln	0.054	0.690	0.002	2.881	0.072	
NJDWSC	11/09/93	PS01	Passaic R. at Two Bridges, Lincoln	0.000	0.000	0.000		0.000	
NJDWSC	12/06/93	PS01	Passaic R. at Two Bridges, Lincoln	0.170	0.140	0.032	1.225	0.056	
NJDWSC	01/03/94	PS01	Passaic R. at Two Bridges, Lincoln	0.460	0.430	0.021	2.346	0.146	
NJDWSC	02/08/94	PS01	Passaic R. at Two Bridges, Lincoln	0.093	0.150	0.015	1.543	0.240	
NJDWSC	03/07/94	PS01	Passaic R. at Two Bridges, Lincoln	0.100	0.200	0.018	0.990	0.033	
NJDWSC	04/05/94	PS01	Passaic R. at Two Bridges, Lincoln	0.006	0.012	0.007	0.260	0.006	
NJDWSC	05/02/94	PS01	Passaic R. at Two Bridges, Lincoln	0.082	0.024	0.027	1.561	0.150	
NJDWSC	05/02/94	PS01	Passaic R. at Two Bridges, Lincoln	0.000	0.000	0.027	1.561	0.000	
NJDWSC	06/06/94	PS01	Passaic R. at Two Bridges, Lincoln	0.500	0.970	0.076	2.407	0.070	
NJDWSC	07/05/94	PS01	Passaic R. at Two Bridges, Lincoln	0.200	0.300	0.055	1.291	0.131	
NJDWSC	08/08/94	PS01	Passaic R. at Two Bridges, Lincoln	0.550	0.570	0.002	0.005	0.033	
NJDWSC	09/12/94	PS01	Passaic R. at Two Bridges, Lincoln	0.790	0.860	0.023	5.348	0.007	
NJDWSC	09/16/94	PS01	Passaic R. at Two Bridges, Lincoln					0.000	
NJDWSC	10/03/94	PS01	Passaic R. at Two Bridges, Lincoln	0.960	1.300	2.100	2.264	0.136	
NJDWSC	11/28/94	PS01	Passaic R. at Two Bridges, Lincoln	0.620	0.430	0.018	1.893	0.080	
NJDWSC	12/12/94	PS01	Passaic R. at Two Bridges, Lincoln	0.099	0.190	0.006	1.608	0.008	
NJDWSC	01/09/95	PS01	Passaic R. at Two Bridges, Lincoln	0.370	0.530	0.002	2.037	0.009	
NJDWSC	02/06/95	PS01	Passaic R. at Two Bridges, Lincoln	0.690	0.750	0.002	8.483	0.086	
NJDWSC	03/07/95	PS01	Passaic R. at Two Bridges, Lincoln	0.800	0.460	0.008	4.833	0.007	
NJDWSC	04/24/95	PS01	Passaic R. at Two Bridges, Lincoln	0.660	0.530	0.036	2.078	0.093	
NJDWSC	05/30/95	PS01	Passaic R. at Two Bridges, Lincoln	0.410	0.400	0.075	1.933	0.208	
NJDWSC	06/26/95	PS01	Passaic R. at Two Bridges, Lincoln	0.510	0.012	0.059	2.125	0.204	
NJDWSC	07/25/95	PS01	Passaic R. at Two Bridges, Lincoln	0.260	0.420	0.044	2.090	0.052	
NJDWSC	08/21/95	PS01	Passaic R. at Two Bridges, Lincoln	0.048	0.720	0.002	1.079	0.007	
NJDWSC	09/25/95	PS01	Passaic R. at Two Bridges, Lincoln	1.400	1.600	0.002	12.520	0.005	
NJDWSC	10/30/95	PS01	Passaic R. at Two Bridges, Lincoln	0.240	0.380	0.110	0.714	0.077	
NJDWSC	11/27/95	PS01	Passaic R. at Two Bridges, Lincoln	0.770	0.930	0.002	3.915	0.042	
NJDWSC	12/18/95	PS01	Passaic R. at Two Bridges, Lincoln	0.490	0.390	0.030	1.795	0.270	
NJDWSC	01/22/96	PS01	Passaic R. at Two Bridges, Lincoln	0.220	0.220	0.002	3.614	0.175	

Monitoring Data for Passaic River at Two Bridges

Agency	Sample Date	Station ID	Station Location	Total Phosphate	Ortho Phosphate	Nitrite	Nitrate	Ammonia	Chlorophyll-a
NJDWSC	01/22/96	PS01	Passaic R. at Two Bridges, Lincoln	0.220	0.220	0.002	3.614	0.175	
NJDWSC	02/05/96	PS01	Passaic R. at Two Bridges, Lincoln	0.079	0.190	0.002	0.884	0.084	
NJDWSC	02/05/96	PS01	Passaic R. at Two Bridges, Lincoln	0.079	0.190	0.002	0.884	0.084	
NJDWSC	03/04/96	PS01	Passaic R. at Two Bridges, Lincoln	0.120	0.120	0.002	1.266	0.067	
NJDWSC	03/04/96	PS01	Passaic R. at Two Bridges, Lincoln	0.120	0.120	0.002	1.266	0.067	
NJDWSC	04/08/96	PS01	Passaic R. at Two Bridges, Lincoln	0.150	0.220	0.002	3.390	0.007	
NJDWSC	04/08/96	PS01	Passaic R. at Two Bridges, Lincoln	0.150	0.220	0.002	3.390	0.007	
NJDWSC	05/13/96	PS01	Passaic R. at Two Bridges, Lincoln	0.430	0.530	0.002	5.008	0.105	
NJDWSC	05/13/96	PS01	Passaic R. at Two Bridges, Lincoln	0.430	0.530	0.002	5.008	0.105	
NJDWSC	06/10/96	PS01	Passaic R. at Two Bridges, Lincoln	0.300	0.380	0.035	1.495	0.169	
NJDWSC	06/10/96	PS01	Passaic R. at Two Bridges, Lincoln	0.300	0.380	0.035	1.495	0.169	
NJDWSC	07/08/96	PS01	Passaic R. at Two Bridges, Lincoln	0.410	0.530	0.007	3.368	0.007	
NJDWSC	07/08/96	PS01	Passaic R. at Two Bridges, Lincoln	0.410	0.530	0.007	3.368	0.007	
NJDWSC	08/26/96	PS01	Passaic R. at Two Bridges, Lincoln	0.700	0.820	0.002	5.158	0.007	
NJDWSC	08/26/96	PS01	Passaic R. at Two Bridges, Lincoln	0.700	0.820	0.002	5.158	0.007	
NJDWSC	09/24/96	PS01	Passaic R. at Two Bridges, Lincoln	0.360	0.420	0.012	2.169	0.033	
NJDWSC	09/24/96	PS01	Passaic R. at Two Bridges, Lincoln	0.360	0.420	0.012	2.169	0.033	
NJDWSC	10/08/96	PS01	Passaic R. at Two Bridges, Lincoln	0.720		0.002	6.885	0.008	
NJDWSC	10/08/96	PS01	Passaic R. at Two Bridges, Lincoln	0.720		0.002	6.885	0.008	
NJDWSC	11/12/96	PS01	Passaic R. at Two Bridges, Lincoln	0.220	0.520	0.002	1.451	0.054	
NJDWSC	12/16/96	PS01	Passaic R. at Two Bridges, Lincoln	0.006	0.012	0.110	0.657	0.007	
NJDWSC	01/06/97	PS01	Passaic R. at Two Bridges, Lincoln	0.150	0.160	0.060	1.566	0.033	
NJDWSC	02/03/97	PS01	Passaic R. at Two Bridges, Lincoln	0.110	0.180	0.002	1.300	0.056	
NJDWSC	02/03/97	PS01	Passaic R. at Two Bridges, Lincoln	0.000	0.000	0.000		0.056	
NJDWSC	03/03/97	PS01	Passaic R. at Two Bridges, Lincoln	0.070	0.100	< 0.002	0.784	0.104	
NJDWSC	04/07/97	PS01	Passaic R. at Two Bridges, Lincoln	0.023	0.110	< 0.002	0.115	0.007	
NJDWSC	05/05/97	PS01	Passaic R. at Two Bridges, Lincoln	0.047	0.180	0.031	0.664	0.112	
NJDWSC	06/03/97	PS01	Passaic R. at Two Bridges, Lincoln	0.096	0.460	0.054	5.031	0.199	
NJDWSC	07/08/97	PS01	Passaic R. at Two Bridges, Lincoln	0.180	0.830	0.021	0.702	0.012	
NJDWSC	08/11/97	PS01	Passaic R. at Two Bridges, Lincoln	0.390	0.500	< 0.002	4.213	0.035	
NJDWSC	09/15/97	PS01	Passaic R. at Two Bridges, Lincoln	0.250	0.400	0.059	1.517	0.051	
NJDWSC	10/14/97	PS01	Passaic R. at Two Bridges, Lincoln	1.100	1.500	< 0.002	6.992	0.102	
NJDWSC	11/12/97	PS01	Passaic R. at Two Bridges, Lincoln	0.420	0.590	0.010	2.604	0.059	
NJDWSC	12/16/97	PS01	Passaic R. at Two Bridges, Lincoln					0.000	
NJDWSC	02/09/98	PS01	Passaic R. at Two Bridges, Lincoln	0.218	0.391	< 0.002	1.347	< 0.007	13.430
NJDWSC	03/09/98	PS01	Passaic R. at Two Bridges, Lincoln	0.132	0.219	< 0.002	0.956	0.017	6.540
NJDWSC	04/06/98	PS01	Passaic R. at Two Bridges, Lincoln	0.133	0.239	< 0.002	0.537	0.044	3.170
NJDWSC	05/04/98	PS01	Passaic R. at Two Bridges, Lincoln	0.161	0.218	0.045	0.910	< 0.007	5.340
NJDWSC	06/02/98	PS01	Passaic R. at Two Bridges, Lincoln	0.280	0.391	0.081	1.882	0.085	13.990

Monitoring Data for Passaic River at Two Bridges

Agency	Sample Date	Station ID	Station Location	Total Phosphate	Ortho Phosphate		Nitrite	Nitrate		Ammonia	Chlorophyll-a
NJDWSC	07/06/98	PS01	Passaic R. at Two Bridges, Lincoln	0.414	0.436		0.072	3.279		0.010	8.010
NJDWSC	08/17/98	PS01	Passaic R. at Two Bridges, Lincoln	0.931	0.849		0.076	6.265		0.018	36.950
NJDWSC	09/28/98	PS01	Passaic R. at Two Bridges, Lincoln	1.090	1.098		0.080	7.912		0.064	4.060
NJDWSC	10/19/98	PS01	Passaic R. at Two Bridges, Lincoln	0.946	1.124		0.067	5.205		0.077	9.400
NJDWSC	11/05/98	PS01	Passaic R. at Two Bridges, Lincoln	1.413	1.474		0.103	7.782		0.009	0.000
NJDWSC	12/01/98	PS01	Passaic R. at Two Bridges, Lincoln	0.787	1.013		0.097	4.953		0.060	0.000
NJDWSC	01/04/99	PS01	Passaic R. at Two Bridges, Lincoln	0.261	0.461		0.080	1.928		0.179	9.830
NJDWSC	02/08/99	PS01	Passaic R. at Two Bridges, Lincoln	0.131	0.158		0.051	1.391		0.065	3.100
NJDWSC	03/01/99	PS01	Passaic R. at Two Bridges, Lincoln	0.291	0.400		0.070	2.876		0.108	16.660
NJDWSC	04/05/99	PS01	Passaic R. at Two Bridges, Lincoln	0.178	0.270		0.049	1.460		0.050	25.200
NJDWSC	05/04/99	PS01	Passaic R. at Two Bridges, Lincoln	0.437	0.451		0.084	3.014		0.086	14.630
NJDWSC	06/14/99	PS01	Passaic R. at Two Bridges, Lincoln	0.660	0.613		0.150	4.730		0.016	1.170
NJDWSC	07/12/99	PS01	Passaic R. at Two Bridges, Lincoln	0.930	1.027		0.170	3.930		0.018	83.940
NJDWSC	08/09/99	PS01	Passaic R. at Two Bridges, Lincoln	0.083	0.791		0.150	5.851		0.297	7.800
NJDWSC	09/13/99	PS01	Passaic R. at Two Bridges, Lincoln		0.514						81.170
NJDWSC	10/19/99	PS01	Passaic R. at Two Bridges, Lincoln	0.450	0.466		0.100	2.310		0.039	2.560
NJDWSC	11/22/99	PS01	Passaic R. at Two Bridges, Lincoln	0.583	0.593	<	0.002	4.274		0.127	
NJDWSC	01/11/00	PS01	Passaic R. at Two Bridges, Lincoln	0.363	0.412	<	0.002	2.267		0.129	3.740
NJDWSC	02/07/00	PS01	Passaic R. at Two Bridges, Lincoln	0.719	0.753	<	0.002	3.783		0.164	1.920
NJDWSC	03/06/00	PS01	Passaic R. at Two Bridges, Lincoln	0.215	0.234	<	0.002	1.371	<	0.007	6.620
NJDWSC	04/03/00	PS01	Passaic R. at Two Bridges, Lincoln	0.168	0.228	<	0.002	1.120		0.046	29.900
NJDWSC	05/01/00	PS01	Passaic R. at Two Bridges, Lincoln	0.146	0.174	<	0.002	1.074		0.015	10.570
NJDWSC	06/05/00	PS01	Passaic R. at Two Bridges, Lincoln	0.034	0.045		0.135	2.240		0.236	18.710
NJDWSC	07/10/00	PS01	Passaic R. at Two Bridges, Lincoln	0.585	0.609		0.148	4.305		0.107	50.410
NJDWSC	08/01/00	PS01	Passaic R. at Two Bridges, Lincoln	0.123	0.083	<	0.002	0.798		0.045	2.884
NJDWSC	09/11/00	PS01	Passaic R. at Two Bridges, Lincoln	0.420	0.273	<	0.002	3.433		0.131	8.758
NJDWSC	10/10/00	PS01	Passaic R. at Two Bridges, Lincoln	0.515	0.582	<	0.002	4.400		0.160	1.709
NJDWSC	11/27/00	PS01	Passaic R. at Two Bridges, Lincoln	0.216	0.142		0.073	1.540		0.099	4.272
NJDWSC	12/12/00	PS01	Passaic R. at Two Bridges, Lincoln	0.480	0.838		0.073	3.670		0.510	2.670
NJDWSC	01/08/01	PS01	Passaic R. at Two Bridges, Lincoln	0.640	1.095		0.114	4.120		0.660	1.495
NJDWSC	02/05/01	PS01	Passaic R. at Two Bridges, Lincoln	1.904	0.147		1.118	1.985		0.404	2.777
NJDWSC	03/12/01	PS01	Passaic R. at Two Bridges, Lincoln	0.082	0.402	<	0.002	1.097		0.095	9.932
NJDWSC	04/02/01	PS01	Passaic R. at Two Bridges, Lincoln	0.011	0.062	<	0.002	0.550		0.064	14.525
NJDWSC	05/01/01	PS01	Passaic R. at Two Bridges, Lincoln	0.265	0.363	<	0.002	2.036		0.085	33.749
NJDWSC	06/05/01	PS01	Passaic R. at Two Bridges, Lincoln	0.145			0.077	0.498		0.114	