Amendment to the Northeast Water Quality Management Plan

Total Maximum Daily Load Report to Address Phosphorus Impairment in Pompton Lake and Ramapo River in the Northeast Water Region

Watershed Management Area 3

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1.0 Executive Summary

This Total Maximum Daily Load (TMDL) document addresses phosphorus impairments in the Pompton Lake drainage area and is based on two supporting documents: "Pompton Lake and Ramapo River TMDL Support Study" (QEA, 2004), and "Development of a TMDL for the Wanaque Reservoir and Cumulative WLAs/LAs for the Passaic River Watershed" (Najarian, 2005). This TMDL is a companion document to the comprehensive TMDL document addressing the remainder of the non-tidal Passaic River basin entitled "Total Maximum Daily Load Report For the Non-Tidal Passaic River Basin Addressing Phosphorus Impairments" (2008).

On July 5, 2005 the Department of Environmental Protection (Department) proposed TMDLs in two reports addressing phosphorus in portions of the Passaic River basin. One document addressed the Wanaque Reservoir and the Passaic River and tributaries upstream of the confluence of the Pompton and Passaic Rivers. Because of the diversion of water from the Passaic and Pompton Rivers to the Wanaque Reservoir, the Wanaque Reservoir TMDL resulted in phosphorus load and wasteload allocations in the Passaic River basin upstream of the confluence of Passaic and Pompton Rivers. The other July 5, 2005 proposal addressed Pompton Lake and its drainage area and provided inputs to the Wanaque Reservoir TMDL. At that time, the Department believed that proceeding with these TMDLs would expedite attainment of water quality improvement in the Passaic River basin, in which phosphorus reductions had been stayed as a result of a settlement agreement between the Department and various wastewater treatment facilities in the basin. The Department received comments on these proposals, primarily with regard to the water quality endpoint in the Wanaque Reservoir, the mass balance model used to estimate phosphorus loadings to the reservoir, the cost to achieve the effluent improvements, and the feasibility of achieving the nonpoint source load reductions specified in the TMDLs. As noted in the July 5, 2005 proposal of the Wanaque Reservoir TMDL, the Department was engaged in a basin-wide study that included extensive water quality monitoring and development of dynamic flow and water quality models. The intent of the basin-wide study was to identify in-stream critical locations, in addition to the Wanaque Reservoir, that would call for phosphorus load reductions. It was recognized that an outcome of the basin-wide study could be a refinement of the load and wasteload allocations identified in the July 5, 2005 proposals. In light of delays in establishing the July 5, 2005 proposals, completion of the basin-wide study and in consideration of the comments received, the Department has determined that integration of the basin-wide study with relevant findings of the July 5, 2005 proposals is the most efficient means to achieve water quality objectives in the Passaic River basin. Therefore, the July 5, 2005 proposals will not be established. This Total Maximum Daily Load (TMDL) document addresses phosphorus impairments in the Pompton Lake drainage area and is a companion document to the comprehensive TMDL document addressing the remainder of the non-tidal Passaic River basin, providing boundary condition inputs to that study.

In accordance with Section 305(b) and 303(d) of the Federal Clean Water Act (CWA), the State of New Jersey, Department of Environmental Protection (Department) is required to assess the overall water quality of the State's waters and identify those waterbodies with a water quality impairment for which TMDLs may be necessary. A TMDL is developed to identify all the contributors of a pollutant of concern and the load reductions necessary to meet the Surface Water Quality Standards (SWQS) relative to that pollutant. The Department fulfills its assessment obligation under the CWA through the Integrated List of Waterbodies, issued biennially. The *2004 Integrated List of Waterbodies* was adopted by the Department on October 4, 2004 (36 NJR 4543(a)) as an amendment to the Statewide Water Quality Management Plan, as part of the Department's continuing planning process pursuant to the Water Quality Planning Act at N.J.S.A.58:11A-7 and the Statewide Water Quality Management

Planning rules at N.J.A.C. 7:15-6.4(a). The *2004 Integrated List of Waterbodies* Sublist 5 identifies the Ramapo River near Mahwah and Ramapo River at Dawes Highway on Sublist 5 as being impaired for phosphorus, as indicated by elevated total phosphorus (TP) levels in the stream segments. Pompton Lake was not listed on the *2004 Integrated List of Waterbodies* as being impaired for phosphorus; however, data evaluated in the development of this TMDL report indicate the lake is impaired, as indicated by exceedances of the Surface Water Quality Standard (SWQS) of 0.05 mg/l of total phosphorus (TP) in lake water samples. The Department had proposed and subsequently has adopted the *2006 Integrated List of Waterbodies*, which identifies impairments based on HUC 14 Assessment Units rather than stream segments associated with discrete monitoring locations. This change in assessment methodology allows establishment of a stable base of assessment units for which the attainment or non-attainment status of all designated uses within each subwatershed or assessment unit will be identified.

A TMDL is required to be developed for each of the impairments listed on Sublist 5. A TMDL is developed to identify all the contributors of a pollutant of concern and the load reductions necessary to meet the Surface Water Quality Standards (SWQS) relative to that pollutant. TMDLs are proposed to address the phosphorus impairment in the waterbodies identified in Table 1 and 2.

Table 1 Stream segments identified on Sublists 5 of the *2004 Integrated List* assessed for phosphorus impairment.

WMA	Site Id #	Station Name/Waterbody	2004 list TP status	Priority Ranking*
3	01387500	Ramapo River near Mahwah	Sublist 5	Medium
3	01388100	Ramapo River at Dawes Highway	Sublist 5	Medium

Table 2 Assessment Units Addressed from the *2006 Integrated List of Waterbodies*

Assessment Unit ID	Assessment Unit Name	2006 TP Status	Priority Ranking	Proposed Action	Acres	Stream Mile
02030103100040	Ramapo R (Bear Swamp Bk thru Fyke Bk)	Sublist 3	NA	Establish WLAs and LAs	3,018	9.5
02030103100030	Ramapo R (above Fyke Bk to 74d 11m 00s)	Sublist 3	NA	Establish WLAs and LAs	4,305	17.9
02030103100020	Masonicus Brook	Sublist 3	NA	Establish WLAs and LAs	2,783	7.3
02030103100050	Ramapo R (Crystal Lk br to BearSwamp Bk)	Sublist 4A*	NA	Establish WLAs and LAs	4,041	16.8
02030103100070	Ramapo R (below Crystal Lake bridge)**	Sublist 5	NA	Establish TMDL	7,224	7224
02030103100060	Crystal Lake/Pond	Sublist 3	NA	Establish	5,509	16.6

	Brook			WLAs and LAs		
02030103100010	Ramapo R (above 74d11m005)**	Sublist 5	NA	Establish TMDL	3,720	7.7
Pompton Lake-03	Pompton Lake	Sublist 3	NA	Establish TMDL	N/A	N/A

* The above Sublist 4A listings on the 2006 *Integrated List of Waterbodies* were classified based on a proposed TMDL that was not established.
** The above noted HUC 14 assessment units include the impaired stream segments identified in the *2004 Integrated List*.

This TMDL is based on a boundary condition in which the inflow from New York State, as calculated at the Mahwah station, attains the State SWQS for TP of 0.1 mg/l. This will require a 76 percent TP reduction from the combined sources upstream of Mahwah station. In addition, an overall TP load reduction of 68 percent is required within New Jersey. Wastewater treatment facilities are assigned a wasteload allocation consistent with a long term average effluent concentration of 0.4 mg/l. The Department intends to establish monthly average, concentration-only effluent limits that will apply year round for the wastewater dischargers using the methodology in the USEPA's *Technical Support Document for Water Quality-Based Toxics Control* (USEPA, 1991), assuming a 4 times per month sampling frequency and a coefficient of variation of 0.6. With these inputs, this methodology produces a monthly average effluent limit of 0.76 mg/l. Subject to the constraints of achieving the specified load reductions, attaining the watershed criteria in the Wanaque Reservoir and Dundee Lake, and accomplishing needed upgrades within the compliance schedule established in the discharge permits, modification of wasteload allocations and load allocations may be accomplished through water quality trading. EPA has awarded a Targeted Watershed Grant to Rutgers University to facilitate water quality trading in the Passaic River basin. This study is expected to identify suitable trading ratios and rules for trading within and between management zones within the Passaic River basin. In addition, loads from land uses generating stormwater point sources and nonpoint sources are assigned wasteload and load allocations consistent with an 80 percent reduction, applied to land uses where load reductions are practicable. To achieve this ambitious objective, the measures required under the Municipal Stormwater Regulation Program, an additional measure restricting application of phosphorus fertilizer, and other measures, such as riparian restoration will be needed.

The required load reductions were determined after evaluating two approaches, a Reckhow modeling of Pompton Lakes and a mass-balance model developed in previous studies of the Passaic River Basin (NJDEP, 1997) and further refined by Najarian in 2005. The loading analyses from both studies called for similar load reduction outcomes. To provide a consistent loading analysis for Approach Area 2, as described in the companion TMDL study for the non-tidal Passaic River basin, the mass-balance approach was selected in order to generate daily loading at the outlet of Pompton Lake, which serves as an input to the companion study.

The TMDLs in this report have been adopted by the Department as amendments to the appropriate area-wide water quality management plan in accordance with N.J.A.C. 7:15-3.4(g). This TMDL report was developed consistent with the United States Environmental Protection Agency's (USEPA's) May 20, 2002 guidance document entitled: "Guidelines for Reviewing TMDLs under Existing Regulations issued in 1992," (Sutfin, 2002) which describes the statutory and regulatory requirements for approvable TMDLs.

2.0 Introduction

In accordance with Section 303(d) of the Federal Clean Water Act (CWA) (33 U.S.C. 1315(B)), the State of New Jersey is required biennially to prepare and submit to the USEPA a report that identifies waters that do not meet or are not expected to meet SWQS after implementation of technology-based effluent limitations or other required controls. This report is commonly referred to as the 303(d) List. In accordance with Section 305(b) of the CWA, the State of New Jersey is also required biennially to prepare and submit to the USEPA a report addressing the overall water quality of the State's waters. This report is commonly referred to as the 305(b) Report or the Water Quality Inventory Report. The Integrated Water Quality Monitoring and Assessment Report combines these two assessments and assigns waterbodies to one of five sublists on the Integrated List of Waterbodies. Sublists 1 through 4 include waterbodies that are generally unimpaired (Sublist 1 and 2), have limited assessment or data availability (Sublist 3), are impaired due to pollution rather than pollutants or have had a TMDL or other enforceable management measure approved by EPA (Sublist 4). Sublist 5 constitutes the traditional 303(d) list for waters impaired or threatened by one or more pollutants, for which a TMDL may be required.

Sublist 5 of the State of New Jersey's *2004 Integrated List of Waterbodies* identified Ramapo River near Mahwah and Ramapo River at Dawes Highway as being impaired for phosphorus, as evidenced by elevated total phosphorus (TP). Pompton Lake was not listed as phosphorus-impaired, but the TP concentration in over 70 percent of lake water samples collected near the dam in a later study exceeded the surface water quality standard (QEA, 2004). Therefore, the Department determined that the lake is phosphorus-impaired and requires the development of a phosphorus TMDL to address this impairment.

The *New Jersey 2006 Integrated Water Quality Monitoring and Assessment Report* identifies impairments based on designated use attainment and then lists the parameters responsible for the non-attainment of the designated use. The assessments are conducted for each of the seven categories of designated use, which include aquatic life, recreational use (primary and secondary contact), drinking water, fish consumption, shellfish harvesting (if applicable), agricultural water supply use and industrial water supply use. The *2006 Integrated Water Quality Monitoring and Assessment Report* assessment units addressed in this TMDL report with respect to phosphorus are identified in Table 2. Two of the assessment units include the stream segments that were listed as impaired on the *2004 Integrated List*. While all of the assessment units are identified as having had a TMDL established, the Pompton Lake TMDL proposed in 2005 was not established. Instead, the assessment units listed as impaired are addressed through this TMDL study. Attainment status with respect to designated uses and the parameters identified as responsible for the non-attainment for the assessment units in Table 2 are identified in Appendix B.

A TMDL represents the assimilative or carrying capacity of a waterbody, taking into consideration point and nonpoint source of pollutants of concern, natural background and surface water withdrawals. A TMDL quantifies the amount of a pollutant a water body can assimilate without violating a state's water quality standards and allocates that load capacity to known point sources in the form of wasteload allocations (WLAs), nonpoint sources in the form of load allocations (LAs), and a margin of safety (MOS). A TMDL is developed to identify all the contributors to surface water quality impacts and set load reductions for pollutants of concern needed to meet SWQS.

Recent EPA guidance (Sutfin, 2002) describes the statutory and regulatory requirements for approvable TMDLs as well as additional information generally needed for USEPA to determine if a submitted TMDL fulfills the legal requirements for approval under Section 303(d) and EPA

regulations. The Department believes that this TMDL report addresses the following items in the May 20, 2002 guideline document:

1. Identification of waterbody, pollutant of concern, pollutant sources and priority ranking.
2. Description of applicable water quality standards and numeric water quality target(s).
3. Loading capacity – linking water quality and pollutant sources.
4. Load allocations.
5. Wasteload allocations.
6. Margin of safety.
7. Seasonal variation.
8. Reasonable assurances.
9. Monitoring plan to track TMDL effectiveness.
10. Implementation (USEPA is not required to and does not approve TMDL implementation plans).
11. Public Participation.

This report establishes TMDLs for portions of the Ramapo River and Pompton Lake and proposes management measures in an implementation plan to attain applicable surface water quality standards and designated uses in the river and lake.

3.0 Pollutant of Concern and Area of Interest

Pollutant of Concern

The pollutant of concern for this TMDL report is phosphorus. When present in excessive amounts, this nutrient can lead to excessive primary productivity in the form of algal and/or macrophyte overgrowth. The presence of excessive plant biomass can, in itself, interfere with designated uses, such as swimming or boating. In addition, the respiration cycle of excessive plant material can cause significant swings in pH and dissolved oxygen, which can result in violation of criteria for these parameters and can adversely affect the remainder of the aquatic community. Algal blooms can also affect taste and odor, an issue of importance with respect to drinking water standards.

As stated in N.J.A.C. 7:9B-1.14(c) of the SWQS for Fresh Water 2 (FW2) waters:

<u>Phosphorus, Total (mg/l):</u>

> i. Lakes: Phosphorus as total P shall not exceed 0.05 in any lake, pond or reservoir, or in a tributary at the point where it enters such bodies of water, except where watershed or site-specific criteria are developed pursuant to N.J.A.C. 7:9B-1.5(g)3.
>
> ii. Streams: Except as necessary to satisfy the more stringent criteria in paragraph i. above or where watershed or site-specific criteria are developed pursuant to N.J.A.C. 7:9B1.5(g)3, phosphorus as total P shall not exceed 0.1 in any stream, unless it can be demonstrated that total P is not a limiting nutrient and will not otherwise render the waters unsuitable for the designated uses.

Regarding site specific criteria, N.J.A.C. 7:9B-1.5(g)3 states:

> 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.

Elaborating on "…render waters unsuitable…" N.J.A.C. 7:9B-1.5(g)2 states:

> Except as due to natural conditions, nutrients shall not be allowed in concentrations that cause objectionable algal densities, nuisance aquatic vegetation, abnormal diurnal fluctuations in dissolved oxygen or pH, changes to the composition of aquatic ecosystems, or otherwise render the waters unsuitable for the designated uses.

The waterbodies listed in Tables 1 and 2 have a FW2 classification. The designated uses, both existing and potential, that have been established by the Department for waters of the State classified as such are as stated below:

In all FW2 waters, the designated uses are (N.J.A.C. 7:9B-1.12):

1. Maintenance, migration and propagation of the natural and established aquatic biota;
2. Primary and secondary contact recreation;
3. Industrial and agricultural water supply;
4. Public potable water supply after conventional filtration treatment (a series of processes including filtration, flocculation, coagulation and sedimentation, resulting in substantial particulate removal but no consistent removal of chemical constituents) and disinfection; and
5. Any other reasonable uses.

Area of Interest

Figure 1 shows the spatial extent of the entire Pompton Lake watershed. The New Jersey portion of the watershed is shown in Figure 2. The Mahwah station (USGS 01387500) is located on the Ramapo River near Mahwah, Bergen County, approximately 1.3 miles downstream of the NY/NJ borderline and 8 miles upstream of Pompton Lake. Pompton Lake is a 71-hectare artificial impoundment on the Ramapo River formed by the Pompton Lake Dam. The lake is located in Passaic County between Wayne Township and the Borough of Pompton Lakes. The dam is owned by the North Jersey District Water Supply Commission (NJDWSC), which uses the lake water as a supplemental drinking water source for the Wanaque Reservoir. The Ramapo Pump Station, located just below the lake outlet, is one of the three intakes feeding the Wanaque Reservoir and has a capacity of delivering up to 150 million gallon per day (MGD), on an "as needed basis," to the Wanaque Reservoir. As a result, the phosphorus loads from the Pompton Lake drainage area serve as an input to both endpoints of the non-tidal Passaic River basin TMDL, which is a companion study. Pompton Lake is mainly fed by the Ramapo River. It also receives some ungaged inflow from Acid Brook and smaller tributaries. The Ramapo River continues downstream of Pompton Lake Dam, draining into the Pompton River, a tributary of the Passaic River. The Ramapo River at Dawes Highway (USGS 01388100) station is located approximately 0.5 miles downstream of the outlet of Pompton Lake and is included in the spatial extent of this study because it reflects the quality of water leaving the lake.

The Pompton Lake watershed covers about 160 mi^2 (41,440 ha) of which 29 percent (47 mi^2) falls within New Jersey's Watershed Management Area (WMA) 3 and 71 percent (113 mi^2) within New York State. Some of the Pompton Lake's characteristics are summarized in Table 3. Figure 3 shows the land use coverage within the watershed and Table 4 summarized the distribution of land use by acreage.

Table 3 Characteristics of Pompton Lake

Lake Area (acre)	Lakeshed Area (acre)	Inflow (m^3/yr)	Avg. Diversion flow (m^3/yr)	Ave. Outflow (m^3/yr)	Areal Water load (m/yr)
175	102,400	2.6E+08	1.0E+07	2.5E+08	375

Except lakeshed area, all the data are obtained from QEA's study on Pompton Lake (QEA, 2004).

Figure 1 Location of the Pompton Lake Watershed

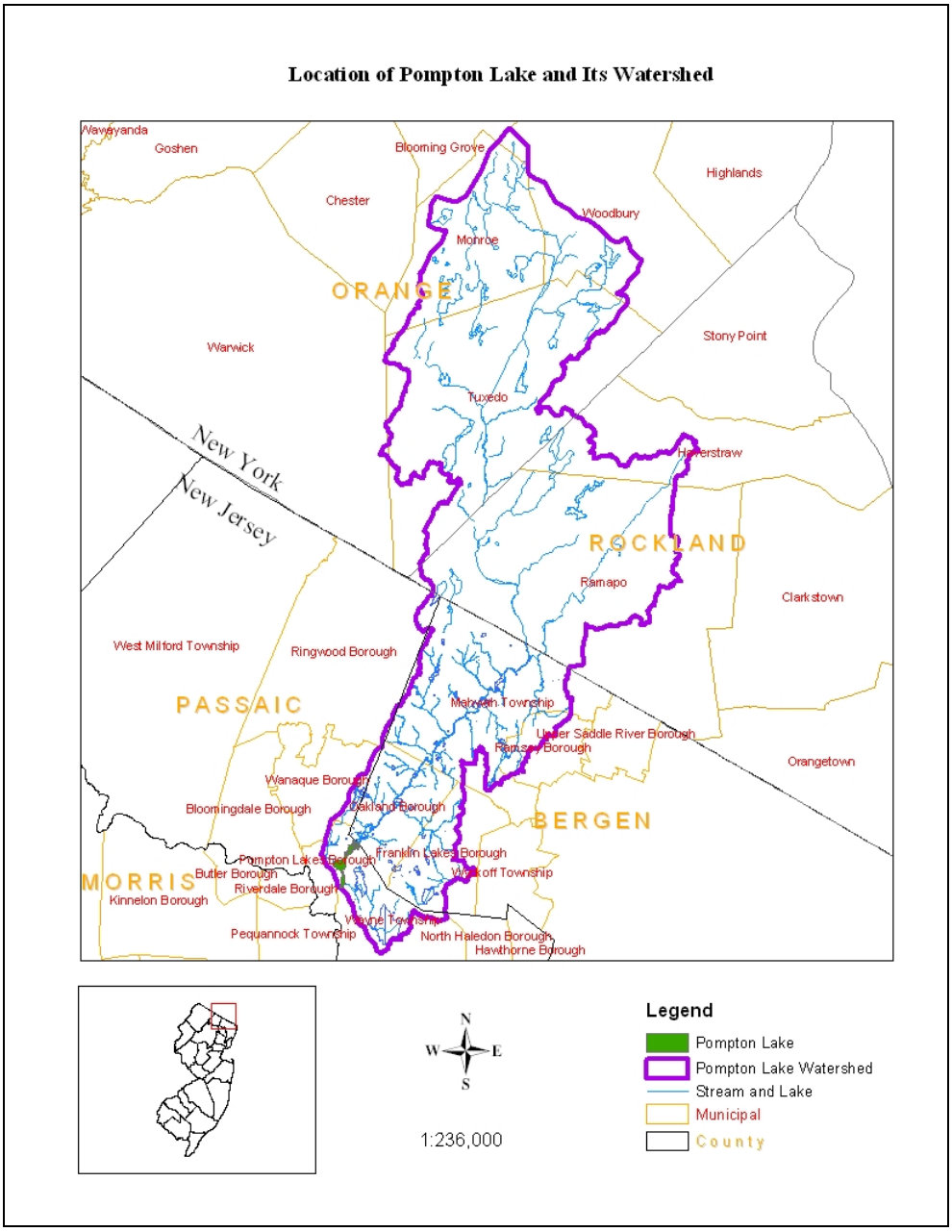


Figure 2 New Jersey Portion of Pompton Lake Watershed

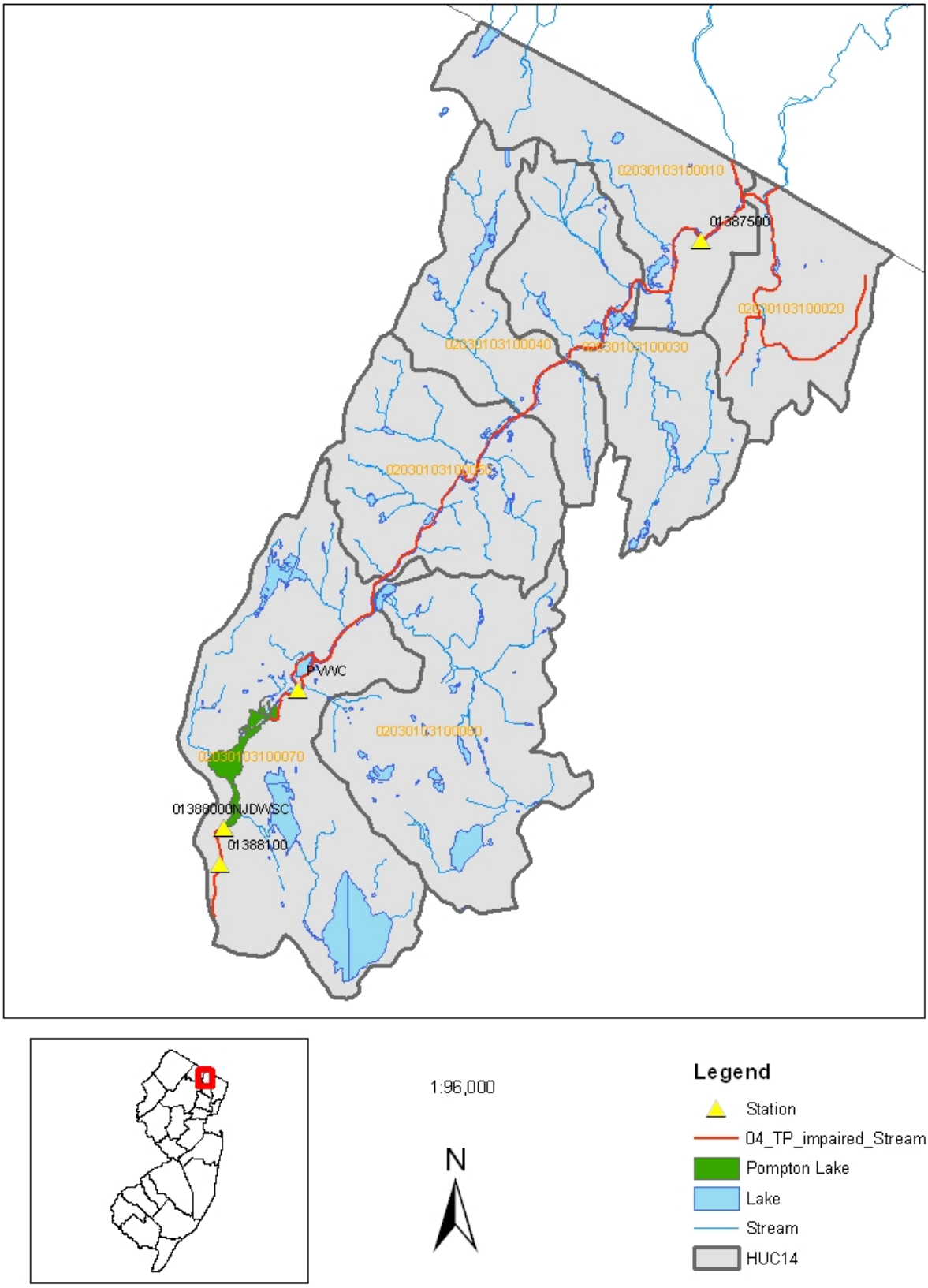


Figure 3 Pompton Lake Watershed land use GIS coverage

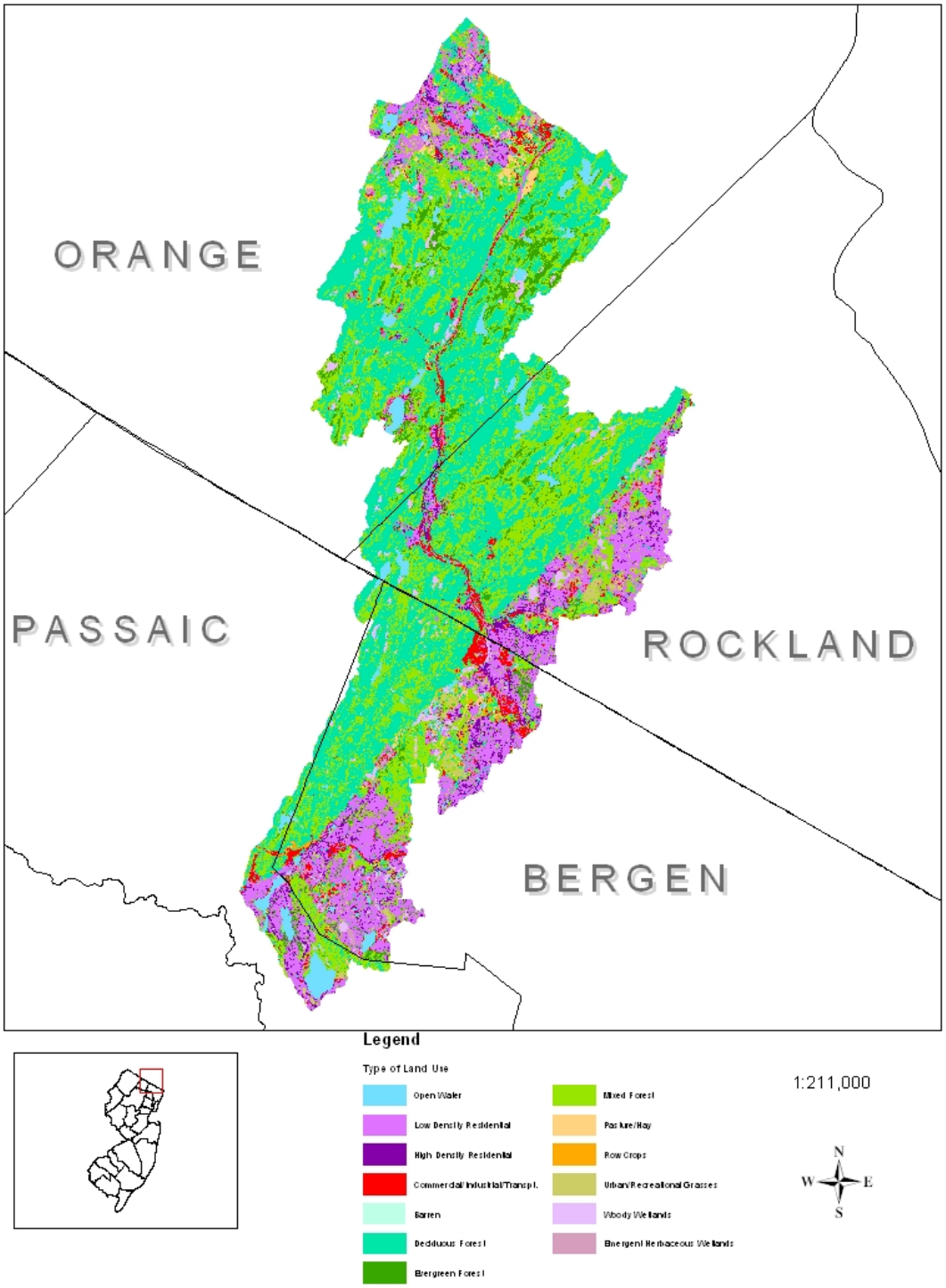


Table 4 Land Use Types in the Pompton Lake Watershed

Land Use	Area (ha)
Agriculture	440
Barren Land	110
Forest	31,755
Water	1,813
Wetlands	1,368
Recreational	290
Residential-High, Medium	2,058
Residential-Low, Rural	5,694
Other Urban	412
Commercial	1,280
Industrial	371

Table 4-2 of Pompton Lake and Ramapo River TMDL Support Study, QEA 2004

Geographic Information System (GIS) Coverage

Geographic Information System (GIS) data from the Department and for New York was used extensively to describe the lake and its watershed, specifically the following data:

- 1995/97 Land use/Land cover Update, published 12/01/2000 by NJDEP Bureau of Geographic Information and Analysis, delineated by watershed management area.
- NJDEP Countywide Lakes and Streams (Shapefile) with Name Attributes for Passaic and Bergen Counties to describe the lakes and streams located within the watershed. http://www.nj.gov/dep/gis/lakesshp.html and http://www.nj.gov/dep/gis/strmshp.html
- Lakeshed and subbasins were delineated based on NJDEP 10-meter Digital Elevation Grid for WMA 3. (http://www.nj.gov/dep/gis/wmalattice.html) The manual QC check was conducted on the boundaries automatically generated by NJBASIN and necessary modifications were made to appropriately delineate the lakeshed and subbasins.
- NJDEP's 2000 Census Block Shapefile http://www.nj.gov/dep/gis/stateshp.html#CENBLK
- NJDEP's 2002 Orthophotography Image for Passaic and Bergen Counties. http://njgin.nj.gov/OIT_IW/index.jsp
- National Land Cover Data (NLCD) for New York, last updated in July 2000. The data was produced under the direction of the USGS as part of the Multi-Resolution Land Characterization (MRLC) Regional Land Cover Characterization Project. The data used the NLCD Land Cover Classification Systems to categorize land use. http://edcsgs9.cr.usgs.gov/pub/data/landcover/states/
- Ramapo River and Pompton Lake Hydrology coverage (7.5 minute Quad Sheet) downloaded from Cornell University Geospatial Data Information Repository (CUGIR) was used to derive the entire lake boundary coverage. Hydrography (Census 2000) shapefiles were downloaded from CUGIR to describe the streams and lakes located in NY-side. http://cugir.mannlib.cornell.edu/browse_map/browse_map.html

4.0 Source Assessment

For the purposes of TMDL development, point sources include domestic and industrial wastewater treatment plants that discharge to surface water, combined sewer overflows, as well as stormwater discharges subject to regulation under the National Pollutant Discharge Elimination System (NPDES). This includes facilities with individual or general industrial stormwater permits and Tier A municipalities and state and county facilities regulated under the New Jersey Pollutant Discharge Elimination System (NJPDES) municipal stormwater permitting program. Point sources contributing phosphorus loads within the affected drainage area include the wastewater treatment facilities listed in Table 6, as well as stormwater point sources, including the Tier A municipalities listed in Appendix A. Stormwater point sources, like nonpoint sources, derive their pollutant load from runoff from land surfaces and load reduction is accomplished through BMPs. The distinction is that stormwater point sources are regulated under the Clean Water Act.

For the purpose of TMDL development, potential nonpoint sources include stormwater discharges that are not subject to regulation under NPDES, including Tier B municipalities, which are regulated under the NJPDES municipal stormwater permitting program, and direct stormwater runoff from land surfaces, as well as failing or inappropriately located septic systems, and direct contributions from wildlife, livestock and pets. These sources are not assigned separate loads. They are adequately captured by the nonpoint source loading method. There are no Tier B municipalities within the spatial extent of the study.

Based on the TMDL support documents: "Pompton Lake and Ramapo River TMDL Support Study" (QEA, 2004), and "Development of a TMDL for the Wanaque Reservoir and Cumulative WLAs/LAs for the Passaic River Watershed" (Najarian, 2005) potential sources of phosphorus to the river and lake were evaluated and the annual loading of phosphorus from different sources was quantified using different approaches.

In the QEA study, phosphorus loadings from New York State were estimated based on the relationship between flow and phosphorus concentrations at the Ramapo River near Mahwah station (01387500), and therefore, phosphorus loading at Mahwah represents both point and nonpoint sources combined. Phosphorus loadings from New Jersey, on the other hand, were calculated based on a separate assessment of point and nonpoint source loadings. The nonpoint source loads for total phosphorus were estimated using the Unit Areal Load (UAL) methodology, which applies pollutant export coefficients obtained from literature sources to the land use patterns within the watershed, as described in USEPA's Clean Lakes Program guidance manual (Reckhow, 1979b). As part of TMDL development, the Department reviewed phosphorus export coefficients from an extensive database (Appendix C). The selected values for the land use categories existing in Pompton Lake watershed are summarized in Table 5.

Phosphorus loads were characterized on an annual scale (kg TP/yr) or (lbs TP/yr). Long-term pollutant loads are typically more critical to overall lake water quality than the load at any particular short-term time period (e.g. day). Storage and recycling mechanisms in the lake, such as luxury uptake and sediments dynamics, allow phosphorus to be used as needed regardless of the rate of delivery to the system. Also empirical lake models use annual loads rather than daily or monthly loads to estimate in-lake concentrations.

Table 5 Phosphorus Export Coefficients (Unit Areal Loads)

Land use/Land Cover	LU/LC Codes*	UAL (kg TP/ha/yr)
medium / high density residential	1120	1.6
low density / rural residential	1130, 1140	0.7
Commercial	1200	2.0
Mixed urban/other urban	1400, 1700, 1800	1.0
Agricultural	2000	1.5
Forest, wetland, water	1750, 2140, 2150, 4000, 6000, 5000, 7430	0.1
Barren land	7000	0.5

* Based on the description of code found in LAND USE LAND COVER CLASSIFICATION SYSTEM, which is available at http://www.nj.gov/dep/gis/digidownload/metadata/lulc95/anderson.html.

Units: 1 hectare (ha) = 2.47 acres
1 kilogram (kg) = 2.2 pounds (lbs)
1 kg/ha/yr = 0.89 lbs/acre/yr

A UAL of 0.07 kg TP/ha/yr was used to estimate air deposition of phosphorus directly onto the lake surface. This value was developed from statewide mean concentrations of total phosphorus from the New Jersey Air Deposition Network (Eisenreich and Reinfelder, 2001).

Loads from point sources, other than stormwater point sources, that are a significant source of phosphorus within New Jersey were calculated based on the Department's DMRs (Daily Monitoring Reports) as an average load for the period 1997- 2000 for each New Jersey facility. Table 6 lists the dischargers of interest within the Pompton Lake watershed and their current loads.

Table 6 Point source discharges, other than stormwater point sources, that are a source of phosphorus into the Pompton Lake watershed- NJ

NJPDES #	Facility Name	Current Flow (mgd)[2]	Current Load (kg/d)
NJ0029858	OAKLAND CARE CENTER	0.0239	0.012
NJ0053112	OAKLAND-CHAPEL HILL ESTATES STP	0.0069	0.001
NJ0080811	RAMAPO RIVER CLUB STP	0.0696	0.018
NJ0027774	OAKLAND-OAKWOOD KNOLLS WWTP	0.0177	0.003
NJ0021253	RAMAPO-INDIAN HILLS H.S. WTP	0.0068	0.009
NJ0021342	OAKLAND-SKYVIEW-HIGH BROOK STP	0.0130	0.003

In the Najarian approach, a mass-balance model developed in a previous study of the Passaic River was refined to simulate the impact of point sources and nonpoint source load on the concentration in the river. The approach was based on a GIS analysis of the watershed's land uses and gauged USGS flow data, which was separated into baseflow and stormwater runoff components. Event mean

concentrations (EMCs) were developed as part of a multi-year analysis using the unit area load (UAL) methodology which provided EMCs on a composite basis for each subwatershed. Baseflow was assigned a constant concentration of 0.01 mg/l TP, which was found to be representative of base flow from a relatively pristine location in the watershed.

5.0 Water Quality Analysis

The United States Geological Survey (USGS) in collaboration with the Department has collected monitoring data at two stations:

- Station 01387500, located on the Ramapo River near Mahwah, 8 miles upstream of Pompton Lake. During a period 1970-2003, 146 sets of TP and flow results were obtained. From this number, 96 TP results (66%) exceeded SWQS of 0.1 mg/l TP. This station was used to assess the Ramapo River between the New York border and Pompton Lake.
- Station 01388000, located in Pompton Lake, less than 10 meters upstream of the dam. Vertically-integrated composite samples were collected from 1987 through 1996 water year. During this time, 137 total phosphorus results were obtained, 96 TP results (70%) exceeded SWQS for lakes (0.05 mg/l).
- Station 01388100, located approximately 0.5 miles downstream of the outlet of Pompton Lake, was sampled during the period 2000-2002 and 8 TP results were obtained. There was one exceedance (12.5%). Instantaneous dissolved oxygen results were also obtained and 2 of 8 samples violated the standard (25%).

In addition to these stations, water quality data were collected by:

- The Passaic Valley Water Commission (PVWC) sampled Ramapo River at Pleasure Land, Oakland. This station is located just upstream of the lake. Collection of water quality data was ceased in 2001.
- The North Jersey District Water Supply Commission (NJDWSC) collects surface water samples on the lakeside of the diversion channel for the Ramapo River 700 Pump Station, less than 10 meters upstream of the dam.
- The Department and QEA conducted a one-day sampling event to provide a snapshot assessment of in-lake water quality and to collect bathymetric data of the lake. Results from this sampling event are described in detail in the QEA study (QEA, 2004).

The observation of frequency exceedances above the standard is presented in Table 7.

Table 7 Frequency of violations of selected water quality standards from long-term monitoring stations

Substance	SWQS*	Percent Violations (%)				
		USGS 0137500	USGS 01388100	PVWC Oakland	NJWSC Pompton Lake	USGS 01388000 Pompton Lake
Total phosphorus (stream)	<0.1 mg/l	66	12.5	17	Na	Na
Total phosphorus (lake)	< 0.05 mg/l	N/a			71	70
Chlorophyll-a	seasonal mean <24μg/L	17		-	22	-
	Summer	33		-	40	-
	Autumn	-		-	20	-
	Spring	0		-	33	-
	Winter	-		-	0	-
Dissolved oxygen	>5 mg/l (24-hour average)	1.6		6.4	1.3	2.2
Dissolved oxygen	>4 mg/l (instantaneous)	1.1	25	6.4	0.7	2.2

Adapted from Table 3-2 of Pompton Lake and Ramapo River TMDL Support Study, QEA 2004

Na -not applicable

* Based on FW2-NT SWQS and the Department's Technical Manual for Phosphorus Evaluation (NJDEP, 2003a), applicable to streams only.

Analysis of the data available for the Ramapo River indicates that the river is a "losing" stream. The water quality in the downstream reach is substantially (approximately 30%) better than the quality at Mahwah station. A losing stream is one in which stream flow is lost to ground water at a greater rate than groundwater enters the stream. In the relevant portion of the Ramapo River, a well field is located which draws water at a rate so as to induce the "losing" stream condition. The stream flows, which contain higher concentrations of phosphorus, are drawn into the ground water and are replaced with ground water, which contains lower concentrations of phosphorus.

6.0 Technical Approach

The TMDL equation is as follows:

TMDL = loading capacity

= Sum of the wasteload allocations (WLAs) + sum of load allocations (LAs) + margin of safety (MOS) + reserve capacity (RC).

Two approaches for determining existing loads and the loading capacity, which would then be allocated among the TMDL component parts, were considered and are described below.

6.1 Using Reckhow Model

The first approach uses the Reckhow model to determine the loading capacity of Pompton Lake. To estimate the annual load currently entering into the Pompton Lake, some assumptions were made (QEA, 2004):

- Phosphorus loads from significant point sources, other than stormwater point sources, were derived from DMR data for the permitted wastewater treatment facilities in the watershed within New Jersey. Loadings from point sources within New York were not distinguished from nonpoint sources; the state boundary was taken as a boundary condition.
- Nonpoint source loads were estimated using land use coverage distribution in categories, as presented in Table 4, and the phosphorus export coefficients (Unit Areal Loads presented in Table 5. Land uses were estimated separately for the part of watershed north from the Mahwah station (01387500), the part of watershed entering the lake, and the part of the watershed draining directly to the lake, excluding Ramapo River watershed.
- The loads estimated directly from the water quality data and flow data at the Mahwah station were compared to the loads estimated using land use coverage and UAL. It was assumed that the loads estimated directly from monitoring data are likely to be more accurate because of the large amount of TP/flow data, and the quality of the regression of TP versus flow. The phosphorus load calculated using monitoring results was used for the further calculations of total TP load to Pompton Lake.

The Department evaluated empirical models to relate annual phosphorus load and steady-state in-lake concentration of total phosphorus. The Department surveyed the commonly used models in Table 9. These empirical models consist of equations derived from simplified mass balances that have been fitted to large datasets of actual lake measurements. The resulting regressions can be applied to lakes that fit within the range of hydrology, morphology and loading of the lakes in the model database. The Reckhow (1979a) model was selected because the hydrologic, morphological and loading characteristics of Pompton Lake fit well within the assumptions of the model and because it appeared to give the best predictive results for phosphorus concentration. These characteristics are summarized in Table 10. Although the areal water load for Pompton Lake is outside the calibration range (375 m/year), the model still remains a good choice since it has the broadest range of lake characteristics in its database. While the target concentration for the lake is well within the range, the areal phosphorus load provides a better representation of a lake's intrinsic loading characteristics. Also, it is the model's prediction of target condition that would be used to calculate the TMDL. If current loads are higher than the range that can produce reliable model results, this has no affect on the model's reliability to predict the target condition under reduced loads.

Table 8 Empirical models considered by the Department

Reference	Steady-state TP concentration in lake (mg/l)	Secondary term	Application
Rast, Jones and Lee, 1983	$1.81 \times NPL^{0.81}$	$NPL = \left(\frac{P_a \times DT / D_m}{1 + \sqrt{DT}} \right)$	expanded database of mostly large lakes
Vollenweider and Kerekes, 1982	$1.22 \times NPL^{0.87}$	$NPL = \left(\frac{P_a \times DT / D_m}{1 + \sqrt{DT}} \right)$	mostly large natural lakes
Reckhow, 1980	$\frac{P_a}{13.2}$	none	Upper bound for closed lake
Reckhow, 1979a	$\frac{P_a}{(11.6 + 1.2 \times Q_a)}$	$Q_a = \frac{Q_i}{A_l}$	General north temperate lakes, wide range of loading concentration, areal loading, and water load
Walker, 1977	$\frac{P_a \times DT / D_m}{(1 + 0.824 \times DT^{0.454})}$	none	oxic lakes with $D_m / DT < 50$ m/yr
Jones and Bachmann, 1976	$\frac{0.84 \times P_a}{(D_m \times (0.65 + DT^{-1}))}$	none	may overestimate P in shallow lakes with high D_m / DT
Vollenweider, 1975	$\frac{P_a}{(D_m \times (DT^{-1} + S))}$	$S = 10 / D_m$	Overestimate P lakes with high D_m / DT
Dillon-Kirchner, 1975	$\frac{P_a}{\left(13.2 + D_m / DT\right)}$	none	low loading concentration range
Dillon-Rigler, 1974	$P_a \times DT / D_m \times (1 - R)$	R = phosphorus retention coefficient	general form
Ostrofksy, 1978	Dillon-Rigler, 1974	$R = 0.201 \times e^{(-0.0425 \times Q_a)} + 0.5743 \times e^{-0.00949 * Q_a}$	lakes that flush infrequently
Kirchner-Dillon, 1975	Dillon-Rigler, 1974	$R = 0.426 \times e^{\left(-0.271 \times D_m / DT\right)} + 0.5743 \times e^{-0.00949 * D_m / DT}$	general application
Larsen-Mercier, 1975	Dillon-Rigler, 1974	$R = \frac{1}{1 + \sqrt{1 / DT}}$	Unparameterized form

where:

NPL = normalized phosphorus loading
P_a = areal phosphorus loading (g/m²/yr)
DT = detention time (yr)
D_m = mean depth (m)
Q_a = areal water load (m/yr)
Q_i = total inflow (m³/yr)
A_l = area of lake (m²)

S = settling rate (per year)

The Reckhow (1979a) model is described in USEPA Clean Lakes guidance documents: "Quantitative Techniques for the Assessment of Lake Quality" (Reckhow, 1979b) and "Modeling Phosphorus Loading and Lake Response Under Uncertainty" (Reckhow *et al*, 1980). The derivation of the model is summarized in Appendix D. The model relates TP load to steady state TP concentration, and is generally applicable to north temperate lakes.

Table 9 Hydrologic and loading characteristics of Pompton Lake

Parameters	Ranges of Characteristics Reckhow Model can fit		Pompton Lake	
	Min	Max	Current condition	Target Condition[3]
TP Conc. (mg/l)	0.004	0.135	0.063	0.02
Avg. Influent TP Conc. (mg/l)[2]	-	0.298	0.08	
Q_a, Areal Water Load (m/yr)	1.2	190	375	N/A
P_a, Areal TP Load (g/m^2/yr)	0.07	31.4	28.8	

Note:
1. Predicted in-lake annual average concentration using Reckhow model (see section below).
2. Calculated using Pa*DT/Dm.
3. As explained below, the target concentration is 0.02 mg/l after considering the seasonal variability. The other parameters under target condition were all calculated based on the target concentration.

Current Condition

Using lake physical parameters and estimated TP external loads, the predicted steady-state in-lake phosphorus concentration calculated using the Reckhow (1979a) model predicts an in-lake TP concentration of 0.063 mg/l (QEA, 2004). The predicted in-lake concentration compares well with observed in-lake mean phosphorus concentrations—at the USGS station located about 35 ft. upstream of the lake outlet, the mean phosphorus concentration for the period of record 1987 through 1996 is 0.08 mg/l. In 2003, several locations within the lake were sampled, and results show that the mean phosphorus concentration was 0.06 mg/l, with data ranging between 0.05 and 0.07 mg/l. Data from NJDWSC/Pompton Lake Station from 1993 to 2001 were also investigated; this data revealed an average TP concentration of 0.11 mg/l, nearly twice the average concentration computed using the Reckhow model. However, it is important to point out that these data are not representative of the in-lake concentration, since they are lake surface water samples, taken one foot from the lake surface. In contrast, both the USGS and the one day sampling event were taken as depth integrated samples. The predicted TP concentration is representative of the depth-integrated concentration.

Reference Condition

A reference condition for Pompton Lake was estimated by calculating external loads as if the land use throughout the lakeshed were completely forest and wetlands and the loads from septic tank systems and internal recycling were assumed to be zero. Estimates of air deposition loads were included to calculate the reference condition. Using the same physical parameters and external loads from forest,

wetlands and air deposition, a reference steady-state phosphorus concentration was calculated for Pompton Lake using the Reckhow (1979a) formulation as listed in Table 8. The reference condition was developed to estimate what the TP concentration would be under pristine conditions and assure that the target concentration based on the SWQS are achievable. For Pompton Lake, the target steady state concentration is 0.03 mg/l while the steady state concentration under the reference condition is only 0.014 mg/l. Therefore, the target concentration is achievable and is used for the TMDL calculations.

Seasonal Variation/Critical Conditions

The peak (based on the 90th percentile) to mean ratio was examined for the in-lake phosphorus concentration sampled by USGS at Pompton lake, station # 01388000 for period of record 1983 through 1996, the peak-to-mean ratio was estimated to be 1.62, this site-specific peak-to-mean ratio would result in target phosphorus concentrations of 0.031 mg/l. which compares well to previous target phosphorus concentrations set for other lakes in NJ. For example, a critical condition of 0.03 mg/l was chosen based on the peak-to-mean ratios of 1.56 and 1.48 observed from Strawbridge Lake and Sylvan Lake, respectively ((Strawbridge Lake, NJDEP 2000a; Sylvan Lake, NJDEP 2000b). Therefore, the Department determined that a target phosphorus concentration of 0.03 mg TP/l is appropriate for use in this TMDL. Since it is the annual pollutant load rather than the load at any particular time that determines overall lake water quality, the target phosphorus concentration of 0.03 mg TP/l accounts for critical conditions.

Margin of Safety

A Margin of Safety (MOS) is provided to account for "lack of knowledge concerning the relationship between effluent limitations and water quality." (40 CFR 130.7(c)). A MOS is required in order to account for uncertainty in the loading estimates, physical parameters and the model itself. The margin of safety, as described in USEPA guidance (Sutfin, 2002), can be either explicit or implicit (i.e., addressed through conservative assumptions used in establishing the TMDL). When using the Reckhow model to calculate the TMDL, both an implicit and an explicit MOS are provided.

An explicit MOS has been included to account for the uncertainty and is built into the model itself. As described in Reckhow *et al* (1980), the Reckhow (1979a) model has an associated standard error of 0.128, calculated on log-transformed predictions of phosphorus concentrations. Transforming the terms in the model error analysis from Reckhow *et al* (1980) yields the following (Appendix D):

$$MoS_p = \sqrt{1 \big/ \left((1-\rho) * 4.5\right)} \times \left(10^{0.128} - 1\right),$$

where: MoS_p = margin of safety as a percentage over the predicted phosphorus concentration;

ρ = the probability that the real phosphorus concentration is less than or equal to the predicted phosphorus concentration plus the margin of safety as a concentration.

Setting the probability to 90% yields a MOS of 51% when expressed as a percentage over predicted phosphorus concentration or estimated external load. The external load for each lake was therefore multiplied by 1.51 to calculate an "upper bound" estimate of steady-state phosphorus concentration. An

additional explicit MOS was included in the analyses by setting the upper bound calculations equal to the target phosphorus concentration of 0.03 mg TP/l, as described in the next section and shown in Table 10. Note that the explicit MOS is equal to 51% when expressed as a percentage over the predicted phosphorus concentration; when expressed as a percentage of total loading capacity, the MOS is equal to 33.3%:

$$\left(MoS_{lc} = \frac{MoS_p \times P}{P + \left(MoS_p \times P\right)} = \frac{MoS_p}{1 + MoS_p} = \frac{0.51}{1.51} = 0.333 \right),$$

where: MoS_p = margin of safety expressed as a percentage over the predicted phosphorus concentration or external load;
MoS_{lc} = margin of safety as a percentage of total loading capacity;
P = predicted phosphorus concentration (or external load).

Target Condition

As discussed above, when considering the seasonal variation, the steady state concentration of phosphorus in the lake must be equal to or less than 0.03 mg/l to avoid exceeding the 0.05 mg/l phosphorus criterion. Using Reckhow (1979a), any predicted concentration has a MOS of 51% when expressed as a percentage over the predicted phosphorus concentration. To assure compliance with the 0.03 mg/l target, the predicted concentration can not be higher than 0.02 mg/l (0.02 + 0.02*51% = 0.03 mg/l) considering the effect of the MOS. Therefore, 0.02 mg/l is chosen as the target concentration to attain the standard while 0.03 mg/l is defined as the upper boundary target condition. The load corresponding to a 0.03 mg/l in-lake concentration is defined as the allowable loading capacity of the lake. The overall reduction to attain the standard level in Pompton Lake was calculated by comparing the current concentration (calculated using Reckhow Model) to 0.02 mg/l, the target concentration (Table 11). For Pompton Lake, the load corresponding to 0.02 mg/l is 17.9 kg/day following the relationship given by Reckhow model.

Table 10 Current condition, reference condition, target condition and load- based on QEA TMDL study

Current condition [TP] (mg/l)	Reference Condition [TP] (mg/l)	Upper Bound Target Condition [TP] (mg/l)	Target Condition [TP] (mg/l)	Overall Load Corresponding to target 0.02 (kg/d)
0.063	0.014	0.03	0.02	17.9

6.2 Using Mass-balance Model

The second approach uses a mass-balance model to project long-term phosphorus concentration at the river intake sites under alternate point source and nonpoint source reduction scenarios. The result was checked for in-lake response using the Reckhow model when determining the final loading capacity for this TMDL.

Under this approach, it is initially assumed that the boundary condition at the New York State line (Ramapo River near Mahwah) reflects full compliance with the stream standard for TP of 0.1 mg/l, which requires a 76% reduction of the current loading from New York. Then it was determined that the

a scenario of a long-term-average (LTA) effluent concentration of 0.4 mg/l from wastewater discharges and an 80% reduction of adjustable nonpoint and stormwater point sources would produce a loading of 17.3 kg/day to Pompton Lake. This load when input into the Reckow model, produces a corresponding concentration of 0.019 mg/l, which is consistent with the target concentration of 0.02 mg/l determined through application of the Reckhow model. Since the results of two studies are comparable, the loading analysis based on the mass balance method was used in order to use a consistent basis within Approach Area 2, as described in the companion TMDL study for the non-tidal Passaic River basin, and to provide loadings on a daily basis, which is a necessary input to the Passaic River basin TMDL. The loadings were calculated as follows.

To determine the daily loadings, an 11-year time series (from 1992 through 2002) of in-stream concentrations were generated using an input of observed USGS flow data, reported DMR data and GIS-based land-use statistics. Comparing the simulated results with observed in-stream concentration at each control site, the mass-balance model simulates the overall magnitude, variability and trend of the observed data over the long-term (10-year) simulation period. Two stations within the Pompton Lake watershed were selected as the critical locations, Ramapo River at Pompton Lake (later replaced by station known as Ramapo River at Dawes Highway) and Ramapo River near Mahwah. The governing equation is:

$$C_{Riv}Q_{Riv} = \sum C_{Dis}Q_{Dis} + C_{NP}(Q_{Riv} - Q_{Dis})$$

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 the above equation represents the constituent mass flux at an in-stream site; the right side represents the cumulative upstream discharge load plus the total nonpoint source load.

The point source 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).

In order to provide an estimate of stormwater runoff load, the nonpoint source was set equal to the sum of the daily runoff and base loads, as described in Source Assessment, as follows:

$$L_{NP} = C_{NP}(Q_{Riv} - Q_{Dis}) = C_{Run}Q_{Run} + C_{BF}(Q_{BF} - Q_{Dis})$$

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.

6.3 Conclusions

As described above, the identified loading of 17.9 kg/d (using Reckhow only) or 17.4 kg/d (using the mass-balance approach) will achieve the target concentration in Pompton Lakes. Given the required boundary condition of water quality meeting the standard of 0.1 mg/l at the state border/Mahwah station, which requires a 76 percent reduction in load in the New York portion of the drainage area, and the fact that the Ramapo River is a "losing" stream, the in-stream standard of 0.1 mg/l will be met in the Ramapo R (above 74d11m005) Assessment Unit (02030103100010), without further demonstration. Because of the close proximity of the Dawes Highway station to the outlet of Pompton Lake, that station reflects lake water quality and so, if the target condition for the lake is achieved, the in-stream SWQS of 0.1 mg/l will be achieved in the Ramapo R (below Crystal Lake bridge) Assessment Unit (02030103100070) with the loading reductions identified for the Pompton Lake drainage area.

Reserve Capacity

Reserve capacity is an optional means of reserving a portion of the loading capacity to allow for future growth. The primary means by which future growth could increase phosphorus load is through the development of forest land within the lakeshed. Phosphorus contributions from future development are expected to be controlled through implementation of the Stormwater Management Rules, which establish quality standards for TSS and nutrients. The follow up monitoring and implementation plan will require the collection of more detailed information about the lakeshed, which may result in revisions to the loading capacity and/or allocations. With regard to nonpoint sources, the loading capacities and accompanying load allocations must be attained in consideration of any new sources that may accompany future development. A reserve capacity of 0.2 kg TP/day has been specified for point sources to allow for future growth.

7.0 Allocations

WLAs are established for all point sources, while LAs are established for nonpoint sources, as these terms are defined in "Source Assessment." Individual WLAs are assigned to wastewater treatment facilities. Stormwater discharges can be a point source or a nonpoint source, depending on NPDES regulatory jurisdiction, yet the suite of measures to achieve reduction of loads from stormwater discharges is the same, regardless of this distinction. Stormwater point sources receiving a WLA are distinguished from stormwater generating areas receiving a LA on the basis of land use, but both are expressed as a percent reduction. This distribution of loading capacity between WLAs and LAs is consistent with recent EPA guidance that clarifies existing regulatory requirements for establishing WLAs for stormwater discharges (Wayland, November 2002). Stormwater discharges are captured within the runoff sources quantified according to land use, as described previously. Distinguishing between regulated and unregulated stormwater is necessary in order to express WLAs and LAs numerically; however, "EPA recognizes that these allocations might be fairly rudimentary because of

data limitations and variability within the system" (Wayland, November 2002, p.1). Therefore allocations are established according to source categories as shown in Table 12. This demarcation between WLAs and LAs based on land use source categories is not perfect, but it represents the best estimate defined as narrowly as data allow. The Department acknowledges that there may be stormwater sources in the residential, commercial, industrial and mixed urban runoff source categories that are not NJPDES-regulated. Nothing in these TMDLs shall be construed to require the Department to regulate a stormwater source under NJPDES that would not already be regulated as such, nor shall anything in these TMDLs be construed to prevent the Department from regulating a stormwater source under NJPDES.

Table 11 Distribution of WLAs and LAs among nonpoint and stormwater point sources

Source Category	**TMDL Allocation Type**
Low Intensity Residential	WLA
High Intensity Residential	WLA
Commercial/Industrial/Transportation	WLA
Mixed Urban/Recreational	WLA
Crops/Pasture/Hay	LA
Deciduous Forest	LA
Evergreen Forest	LA
Mixed Forest	LA
Shrubland	LA
Woody Wetlands	LA
Herbaceous Wetlands	LA
Open Water	LA
Disturbed Areas	LA

Individual WLAs are identified in Table 13. The assignment of WLAs to point sources, other than stormwater point sources, is based on each source discharging at the permitted capacity at the same long term average effluent concentration. WLAs must be expressed as a daily load in accordance and with EPA requirements. However, effluent concentrations can and do vary on a daily basis. This variation can occur and still achieve the water quality objective provided that, on balance, reductions in point and nonpoint source loads on a long term basis conform to those needed to attain SWQS. The Department intends to establish concentration-only effluent limits determined by applying EPA's Technical Support Document for Water Quality-Based Toxics Control (USEPA, 1991) methodology to the LTA of 0.4 mg/l, assuming a 4 times per month sampling frequency and a coefficient of variation equal to the default value of 0.6. The resulting monthly average effluent limit would be 0.76 mg/l.

Dischargers will be allowed to engage in water quality trading negotiations to effect a change in effluent limits, with Department approval. It should be noted that, in June 2005 EPA awarded a Targeted Watershed grant in the amount of $900,000 to Rutgers University for the purpose of developing a water quality trading pilot with respect to the phosphorus impairment in the Passaic River basin. This project has been investigating the options for and overall viability of a trading approach in the Passaic River basin. This project will produce a set of tools and rules that will govern allowable trades within the study area. These are expected to include trading ratios and management zones

within which trades can occur and still achieve the TMDL outcomes at the critical locations. Once the proposed tools and rules are developed, they will be subject to public comment. Following this process, as well as Department and EPA approval of the protocols, interested permittees can proceed to negotiate trades that achieve the desired result in a more cost effective way. For example, it may be more cost effective for a few larger facilities to upgrade to a higher level than for all treatment facilities to upgrade to the same level. The Department anticipates allowing 1 year from the date of permit issuance to negotiate trades so that treatment plant upgrades consistent with permit limits are implemented within the compliance schedules that will be set forth in the permits.

The allocation of loading capacity is reflected in Tables 13 and 14. Because some land use loads are not readily adjustable (forest, wetland, water, barren), the overall land use based-reductions must be achieved from land uses that can be more readily affected by management measures. Therefore, an 80 percent reduction will be required for the remaining more readily adjustable nonpoint sources. An additional 6% MOS is stipulated to account for uncertainty in the land use load estimation. This MOS was believed to be adequate because of the significant MOS already incorporated through the Reckhow model. Although there are no known plans for new or expanded wastewater treatment facilities, an additional 1% is allocated for Reserve Capacity. The distribution of loading capacity is shown in Figure 4.

Table 12 WLAs for Treatment Facilities in the NJ Portion of the Pompton Lake Watershed

NJPDES #	Facility Name	Current Flow (mgd)[1]	Current TP Load (kg/d)[2]	Permitted Flow (mgd)	TP WLA (kg/d)[3]
NJ0029858	OAKLAND CARE CENTER	0.0239	0.012	0.0300	0.05
NJ0053112	OAKLAND-CHAPEL HILL ESTATES STP	0.0069	0.001	0.0100	0.02
NJ0080811	RAMAPO RIVER CLUB STP	0.0696	0.018	0.1137	0.17
NJ0027774	OAKLAND-OAKWOOD KNOLLS WWTP	0.0177	0.003	0.0350	0.05
NJ0021253	RAMAPO-INDIAN HILLS H.S. WTP	0.0068	0.009	0.0336	0.05
NJ0021342	OAKLAND-SKYVIEW-HIGH BROOK STP	0.0130	0.003	0.0230	0.03

[1] current flows are based on NJDEP's Municipal STP Flow Database for 2002
[2] current total phosphorus loads are based on facility's reported 1997-2000 discharge load
[3] based on a LTA effluent concentration of 0.40 mg/l total phosphorus

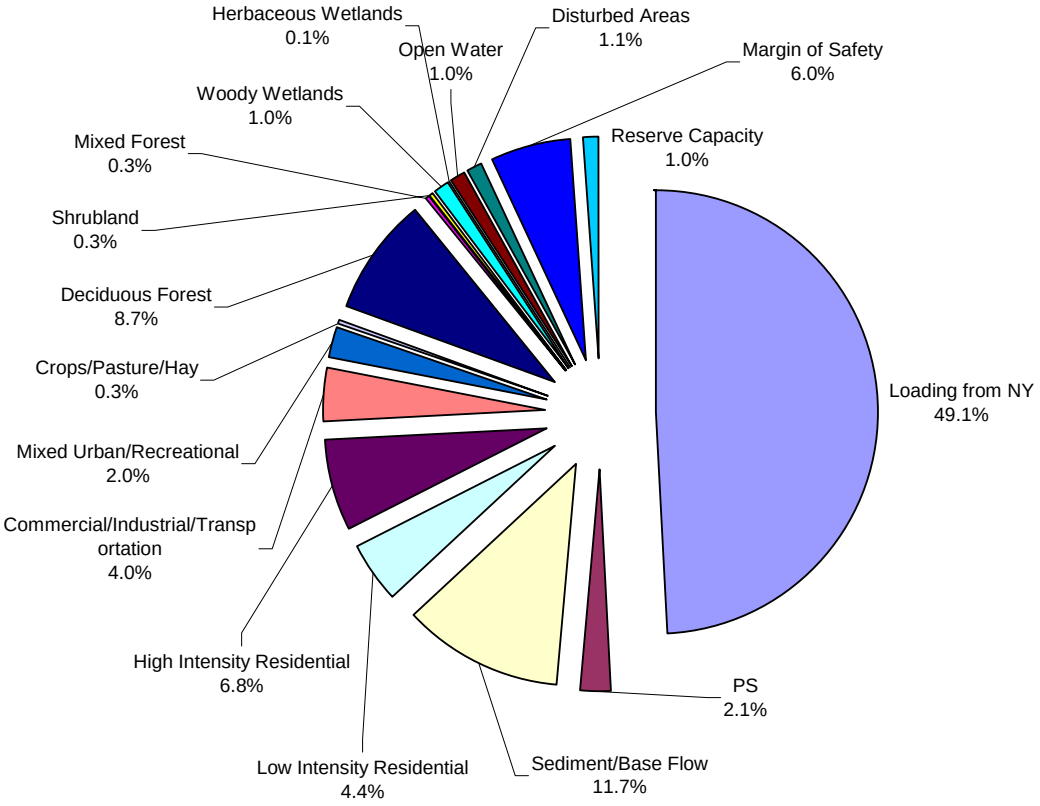
Table 13 TMDL components for Pompton Lake and for Ramapo River watershed including WLAs and LAs for New Jersey sources

Adapted fromTable 6-2 "Development of a TMDL for the Wanaque Reservoir and Cumulative WLAs/LAs for the Passaic River Watershed" (Najarian, 2005)

	TMDL Allocation Type	Existing Conditions[1]		TMDL Specification		Percent
		kg TP/day	% of LC	kg TP/day	% of LC	Reduction[2]
Cumulative Watershed Load (CWL)		54.6	100%	17.4	100%	68%
Point Sources other than Stormwater						
NJPDES Dischargers[3]	WLA	0.05	0.1%	0.37 (0.4)[5]	2.1%	0%
Internal Loading						
Sediment/Base Flow	n/a	2.0	3.7%	2.0	11.7%	0%
Boundary Inputs						
New York[4]	n/a	35.2	64.5%	8.5	49.1%	76%
Land Use Surface Runoff						
Low Intensity Residential	WLA	3.9	7.0%	0.8	4.4%	80%
High Intensity Residential	WLA	5.9	10.8%	1.2	6.8%	80%
Commercial/Industrial/Transportation	WLA	3.5	6.3%	0.7	4.0%	80%
Mixed Urban/Recreational	WLA	1.8	3.2%	0.4	2.0%	80%
Crops/Pasture/Hay	LA	0.2	0.4%	0.04	0.3%	80%
Deciduous Forest	LA	1.5	2.7%	1.5	8.7%	0%
Evergreen Forest	LA	0.01	0.0%	0.01	0.0%	0%
Mixed Forest	LA	0.05	0.1%	0.05	0.3%	0%
Shrubland	LA	0.05	0.1%	0.05	0.3%	0%
Woody Wetlands	LA	0.2	0.3%	0.2	1.0%	0%
Herbaceous Wetlands	LA	0.01	0.0%	0.01	0.1%	0%
Open Water	LA	0.2	0.3%	0.2	1.0%	0%
Disturbed Areas	LA	0.2	0.3%	0.2	1.1%	0%
Other Allocations						
Margin of Safety	n/a	n/a	n/a	1.0	6.0%	n/a
Reserve Capacity	n/a	n/a	n/a	0.2	1.0%	n/a

1 average annual loads for existing conditions based on 1993-2002 model simulation
2 = 1 - (TMDL load /Existing load)*100
3 a detailed listing of individual discharge facilities is provided in Table 12
4 includes PS and NPS discharges to the Ramapo River within New York State
5 Rounded value used in Cumulative Watershed Load summation.

Figure 4 Loading Capacity Distribution at Pompton Lake



8.0 Follow-up Monitoring and Lake Characterization Plan

The Water Resources Division of the U.S. Geological Survey and the Department have cooperatively operated the Ambient Stream Monitoring Network (ASMN) in New Jersey since the 1970s. The ASMN currently includes approximately 115 stations that are routinely monitored on a quarterly basis. A second ambient monitoring network, the Department's Supplemental Ambient Surface Water Network (100 stations), has improved spatial coverage for water quality monitoring in New Jersey. The data from these networks have been used to assess the quality of freshwater streams and percent load reductions. The ambient networks will be the means to determine the effectiveness of TMDL implementation and the need for additional management strategies.

In addition, a supplemental characterization and assessment study will be completed for Pompton Lake. This study should include sediment sampling, at a minimum. This will assist in refining implementation options for nonpoint sources and developing a more detailed restoration plan. Implementation measures currently envisioned are described below.

9.0 Implementation

Management measures are "economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint and stormwater sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of

the best available nonpoint and stormwater source pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives" (USEPA, 1993).

The Department recognizes that TMDLs alone are not sufficient to restore impaired stream segments. The TMDL establishes the required pollutant reduction targets while the implementation plan identifies some of the regulatory and non-regulatory tools to achieve the reductions, matches management measures with sources, and suggests responsible entities for non-regulatory tools. This provides a basis for aligning available resources to assist with implementation activities. Wastewater treatment facilities will receive NJPDES permits with effluent limitations consistent with the WLAs. Projects proposed by the State, local government units and other stakeholders that would implement the measures identified within the impaired watershed are a priority for available State (for example, CBT) and federal (for example, 319(h)) funds. In addition, the Department's ongoing watershed management initiative will develop detailed watershed restoration plans for impaired stream segments in a priority order that will identify more specific measures to achieve the identified load reductions.

In these impaired watersheds wetlands and forest represent a significant portion of the land use. As discussed under source assessment, loads from these land uses are not readily adjustable. Urban and agricultural land use sources must be the focus for implementation. Urban land use will be addressed primarily by stormwater regulation, including requiring adoption of fertilizer management ordinances, as described below. Agricultural land uses represent a very minor component of the existing land use, but can be addressed by implementation of conservation management practices tailored to each farm. Other measures are discussed further below. To achieve the ambitious nonpoint source reduction objective for this drainage area, emphasis will also be placed on riparian restoration, already envisioned in the Pequannock River watershed in response to the temperature TMDL established for that watershed.

Stormwater measures

The stormwater facilities subject to regulation under NPDES in this watershed must be assigned WLAs. The WLAs for these point sources are expressed in terms of the required percent reduction for nonpoint sources and are applied to the land use categories that correspond to the areas regulated under industrial and municipal stormwater programs. The BMPs required through stormwater permits, including the additional measure discussed below, are generally expected to achieve the required load reductions. The success of these measures will be assessed through follow up monitoring. As needed through adaptive management, other additional measures may need to be identified and included in stormwater permits. Follow up monitoring or watershed restoration plans may determine that other additional measures are required, which would then be incorporated into municipal stormwater permits. Additional measures that may be considered include, for example, more frequent street sweeping and inlet cleaning, or retrofit of stormwater management facilities to include nutrient removal. A more detailed discussion of stormwater source control measures follows.

The NJPDES rules for the Municipal Stormwater Regulation Program require municipalities, highway agencies, and regulated "public complexes" to develop stormwater management programs consistent with the NJPDES permit requirements. The stormwater discharged through "municipal separate storm sewer systems" (MS4s) also regulated under the Department's stormwater rules. Under these rules and associated general permits, Tier A municipalities are required to implement various control measures that should substantially reduce phosphorus loadings in the impaired watersheds. These control measures include adoption and enforcement of a pet waste disposal ordinance, prohibiting the feeding of unconfined wildlife on public property, street sweeping, cleaning catch basins, performing good

housekeeping at maintenance yards, and providing related public education and employee training. These basic requirements will provide for a measure of load reduction from existing development. For example, the US Department of Transportation Federal Highway Administration cites a state of California study on vacuum sweeper efficiency in which a total phosphorus removal rate of 74% was achieved, compared to mechanical sweeper efficiency rate of 40% (www.fhwa.dot.gov/environment).

Because most of the land use based phosphorus load reductions must be obtained from urban land uses, an additional measure to reduce the phosphorus load from landscape maintenance is needed in order to effectively reduce the phosphorus load originating from the urban land uses.

The literature supports that a significant overall phosphorus reduction can be expected from this measure alone. The USGS documented the effects of lawn fertilizer on nutrient concentrations from runoff for a study in Wisconsin and found that total phosphorus concentration in lawn runoff was directly related to phosphorus concentration in lawn soils. Further, runoff from lawn sites with phosphorus-free fertilizer application had a median total phosphorus concentration similar to that of unfertilized sites, an indication that phosphorus-free fertilizer use is an effective, low-cost practice for reducing phosphorus in runoff. A growing body of research from Wisconsin, Michigan, Minnesota and Maine concludes that phosphorus from fertilizer applied to lawns enters surface waterbodies through runoff. In fact, after 8 years of voluntary use of phosphorus-free lawn fertilizer starting in 2008, Maine is banning the sale of phosphorus fertilizer unless certain conditions are met because they found that most soils had enough phosphorus to keep a lawn healthy. Research conducted in Maine showed that in watersheds that are converted from their natural, forested condition to residential, commercial and agricultural uses, the amount of phosphorus runoff increases by a magnitude of 5 to 10 times. Minnesota has also restricted phosphorus in lawns fertilizers to protect the quality of their lakes and streams. In 2003, EPA reported that the City of Plymouth, Minnesota enacted a phosphorus fertilizer ban in 1996 and observed a 23% reduction in phosphorus inputs to their lake as compared to phosphorus loading from neighboring community. See http://www.lakeaccess.org/lakedata/lawnfertilizer/recentresults.htm

Therefore, all municipalities within the spatial extent of this TMDL study will be required to adopt an ordinance, consistent with a model ordinance provided by the Department, as an additional measure of the Municipal Stormwater Permit. This model ordinance has been posted on www.state.nj.us/dep/watershedmgt//rules.htm under the section heading Water Quality Management Planning Rules. The additional measure is as follows:

Fertilizer Management Ordinance

Minimum Standard – Municipalities identified in Appendix A shall adopt and enforce a fertilizer management ordinance, consistent with a model ordinance provided by the Department, that conforms with the Department's ordinance provided by the Department.

Measurable Goal - Municipalities identified in Appendix A shall certify annually that they have met the Fertilizer Management Ordinance minimum standard.

Implementation - Within 6 months from adoption of the TMDL, municipalities identified in Appendix A shall have fully implemented the Fertilizer Management Ordinance minimum standard.

Agricultural and other measures

Generic management strategies for nonpoint source categories, beyond those that will be implemented under the Municipal Stormwater Regulation program, and responses are summarized below.

Table 14 Nonpoint source management measures

Source Category	Responses	Potential Responsible Entity	Possible Funding options
Human Sources	Septic system management programs	Municipalities, residents, watershed stewards, property owner	319(h), State sources
Non-Human Sources	Goose management programs, riparian buffer restoration	Municipalities, residents, watershed stewards, property owner	319(h), State sources
Agricultural practices	Develop and implement conservation plans or resource management plans	Property owner	EQIP, CRP, CREP

Human and Non-Human measures

Where septic system service areas are located in close proximity to impaired waterbodies, septic surveys should be undertaken to determine if there are improper effluent disposal practices that need to be corrected. Septic system management programs should be implemented in municipalities with septic system service areas to ensure proper design, installation and maintenance of septic systems. Where resident goose populations are excessive, community based goose management programs should be supported. Through stewardship programs, areas such as commercial/corporate lawns should be converted to alternative landscaping that minimizes goose habitat and areas requiring intensive landscape maintenance. Where existing developed areas have encroached on riparian buffers, riparian buffer restoration projects should be undertaken where feasible. In the Pompton Lake drainage area an ambitious reduction of nonpoint source loads is called for. In this drainage area restoration of riparian buffers will be particularly important and already is a focus for implementation of the Pequannock River temperature TMDLs (NJDEP, 2004). This measure is expected to provide the additional load reductions needed to achieve the reduction objective in this TMDL.

Agricultural measures

Several programs are available to assist farmers in the development and implementation of conservation management plans and resource management plans. The Natural Resource Conservation Service is the primary source of assistance for landowners in the development of resource management pertaining to soil conservation, water quality improvement, wildlife habitat enhancement, and irrigation water management. The USDA Farm Services Agency performs most of the funding assistance. All agricultural technical assistance is coordinated through the locally led Soil Conservation Districts. The funding programs include:

The Environmental Quality Incentive Program (EQIP*)* is designed to provide technical, financial, and educational assistance to farmers/producers for conservation practices that address natural resource concerns, such as water quality. Practices under this program include integrated crop management, grazing land management, well sealing, erosion control systems, agri-chemical handling facilities, vegetative filter strips/riparian buffers, animal waste management facilities and irrigation systems.

The Conservation Reserve Program (CRP) is designed to provide technical and financial assistance to farmers/producers to address the agricultural impacts on water quality and to maintain and improve wildlife habitat. CRP practices include the establishment of filter strips, riparian buffers and permanent wildlife habitats. This program provides the basis for the Conservation Reserve Enhancement Program (CREP).

Conservation Reserve Enhancement Program (CREP) The New Jersey Departments of Environmental Protection and Agriculture, in partnership with the Farm Service Agency and Natural Resources Conservation Service, signed a $100 million CREP agreement earlier this year. This program matches $23 million of State money with $77 million from the Commodity Credit Corp. within USDA. Through CREP, financial incentives are offered for agricultural landowners to voluntarily implement conservation practices on agricultural lands. NJ CREP is part of the USDA's Conservation Reserve Program (CRP). There is a ten-year enrollment period, with CREP leases ranging between 10-15 years. The State intends to augment this program to make these leases permanent easements. The enrollment of farmland into CREP in New Jersey is expected to improve stream health through the installation of water quality conservation practices on New Jersey farmland.

Current Implementation Projects Update

The following projects are either ongoing or are anticipated to be implemented in the TMDL study area. These projects were funded using 319(h) grants and are expected to have an immediate and positive effect on water quality.

- Ramapo Reservation Lake: Installation of 1000 feet of riparian buffer restoration. (Completed)
- Visual Assessment of Streams in WMA 3 and ranking for stream restoration including restoration of Sheffield Brook in Wayne (Completed) One of the highest ranked projects proposed for when additional funding is available was: Acid Brook/Pompton Lake NPS Mitigation and Riparian Enhancement Project This project would stabilize approximately 1,000 linear feet of eroding shoreline along the northern end of Pompton Lake and 300 linear feet of streambank along Acid Brook at its mouth where it empties into Pompton Lake. The proposed restoration would re-establish a naturalized, native vegetated buffer, which would stabilize soils and mitigate the impacts of harmful waterfowl populations. The buffer would be of varying widths, totaling approximately 20,000 square feet. The project will reduce sediment and pollutant loading in the lake by retrofitting existing stormwater outfalls utilizing Best Management Practices, (BMPs) to treat nonpoint source (NPS) pollutants prior to entering the lake. Currently, the existing outfalls capture runoff from nearby roadways and residential areas and discharge directly into Pompton Lake. This is a priority project due to available public space, volumes of stormwater currently untreated prior to release, and volunteer and local support.

- Pequannock River Thermal Mitigation, Monitoring and Assessment: This project addressed two nonpoint source areas that are contributing to the increased temperature due to loss or riparian canopy. Riparian restoration was undertaken at Bailey Brook in Bloomingdale and the Pequannock River in Riverdale. Another components of this project were the documentation of areas in the Pequannock River headwaters that are impacted by current or past beaver activity and the collection of flow and temperature data for all significant tributaries in the Lower Pequannock drainage. Identification and mapping of stormwater outfalls in the lower and central Pequannock drainages were also undertaken. The majority of this project is complete, the monitoring is still underway as part of this contract, to ensure a longer term database for temperature in this watershed.
- A *WMA 3 Restoration Master Plan* was conducted over two years using a visual assessment protocol modified from the USDA methodology. This project was also funded with 319h funding. The project included four sub-watersheds, one of which was the Pequannock. Forty-five sites in the Pequannock Basin were identified for restoration projects. The average score based on the visual assessment for the overall basin was 7.8 SVAP (STREAM VISUAL ASSESSMENT PROTOCOL). Of the 45 sites, 24 scored below the basin average scores. Several of the Pequannock sites were rated as high priority and these sites would be priority sites for future restoration projects. Streambank restoration with replacement canopy would have a mitigating effect on temperature exceedances and limit expose of waterbody to sunlight; thus minimizing the potential for algal growth. An addendum of the final report included a Management Strategy Table with a Habitat Enhancement category. For this category several sites on the Pequannock River and Kanouse Brook have been identified as candidates for habitat restoration and enhancement. As part of the WMA 3 Restoration Master Plan the following sites were identified as containing deficient riparian buffers and these sites can provide a starting point for addressing riparian corridor restoration on both the mainstem Pequannock and significant tributaries feeding the river:
- Site 142- Pequannock River northwest of Route 23 between old Route 23 and Route 23 Railroad
- Site 143- Pequannock River southwest tributary of Pequannock headwaters at Rt. 23 bridge crossing
- Site 153- Clinton Brook 0.25 miles above Clinton Reservoir
- Site 155- Kanouse Brook, 0.65 miles north of confluence with Pequannock River
- Site 156- Kanouse Brook, 2.2 miles north of confluence with Pequannock River
- Site 158- Clinton Brook, 1.1 miles south of Clinton Reservoir adjacent to LaRue Road
- Site 168- Stone House Brook at confluence with Pequannock River
- Site 172- Pequannock River, 0.8 miles north of confluence with Wanaque
- Site 174- Matthew Brook
- Site 176- Van Dam Brook, Riverdale Town Park
- Site 177- Pequannock River, 0.15 miles north of confluence of Beaver Brook

This list should not be considered inclusive as it was part of a larger project for WMA 3 of which thermal mitigation was not the primary focus; therefore the list should be considered a starting point. The study also looked at ownership of land, and had public lands as a criterion for evaluation. As redevelopment occurs, inclusion of a riparian corridor to provide canopy should be implemented where feasible.

Priority Stream Segment Initiative

In addition to the generic and specific, current and future implementation measures identified above, the Department, through its watershed management program, has undertaken the development of watershed restoration plans for priority stream segments. Each area identifies specific measures and the means to accomplish them for specific impaired pollutant. Priority was based on the following criteria:

- Headwater area;
- Proximity to drinking water supply;
- Proximity to recreation area;
- Possibility of adverse human health conditions;
- Proximity to a lake intake;
- Existence of eutrophication;
- Phosphorus is identified as the limiting nutrient;
- Existence of use impairments;
- Ability to create a measurable change;
- Probability of human source;
- Stream Classifications;
- High success level.

Listed below is the priority stream segment project located in WMA 3within the TMDL Study Area, in which activities are occurring to support the development of watershed restoration plans.

NPS Grant: Demonstration Project to Support TMDL Implementation for the Pequannock River

As identified in the Pequannock River TMDL and the Pequannock River Temperature Impairment Characterization, Assessment and Management Plan discharges into river tributaries from smaller lakes and ponds can contribute to thermal elevation in the Pequannock River and its tributaries. This occurs because impoundments slow flows, expose waters to increased sunlight and release heated surface water from impoundments over spillway outlets. Preliminary sampling by the Pequannock River Coalition has shown that small impoundments do offer a level of temperature stratification within these impoundments that may be utilized to achieve downstream temperature reductions of 3-4 F. This project is a demonstration project and will actually occur on the West Brook in the Township of West Milford. The West Brook is impaired for temperature. The demonstration project will provide siphon piping from bottom water to provide a temperature reduction in the West Brook. This system will be monitored and documented for replication on other waterways.

10.0 Reasonable Assurance

Reasonable assurance that the TMDL will result in attainment of the SWQS requires both a reduction of the current phosphorus loading and protection against increased phosphorus loading from future development. The above implementation plan describes various management measures, both regulatory and nonregulatory, that will result in the needed reduction in phosphorus loads.

Additionally, NJDEP adopted the Stormwater Management Rules N.J.A.C 7:8, which minimizes the impact of stormwater run-off from new development. The Stormwater Management Rules, N.J.A.C. 7:8, establish statewide minimum standards for stormwater management in new development, and the

ability to analyze and establish region-specific performance standards targeted to the impairments and other stormwater runoff related issues within a particular drainage basin through regional stormwater management plans. The Stormwater Management Rules are currently implemented through the Residential Site Improvement Standards (RSIS) and the Department's Land Use Regulation Program (LURP) in the review of permits such as freshwater wetlands, stream encroachment, CAFRA, and Waterfront Development

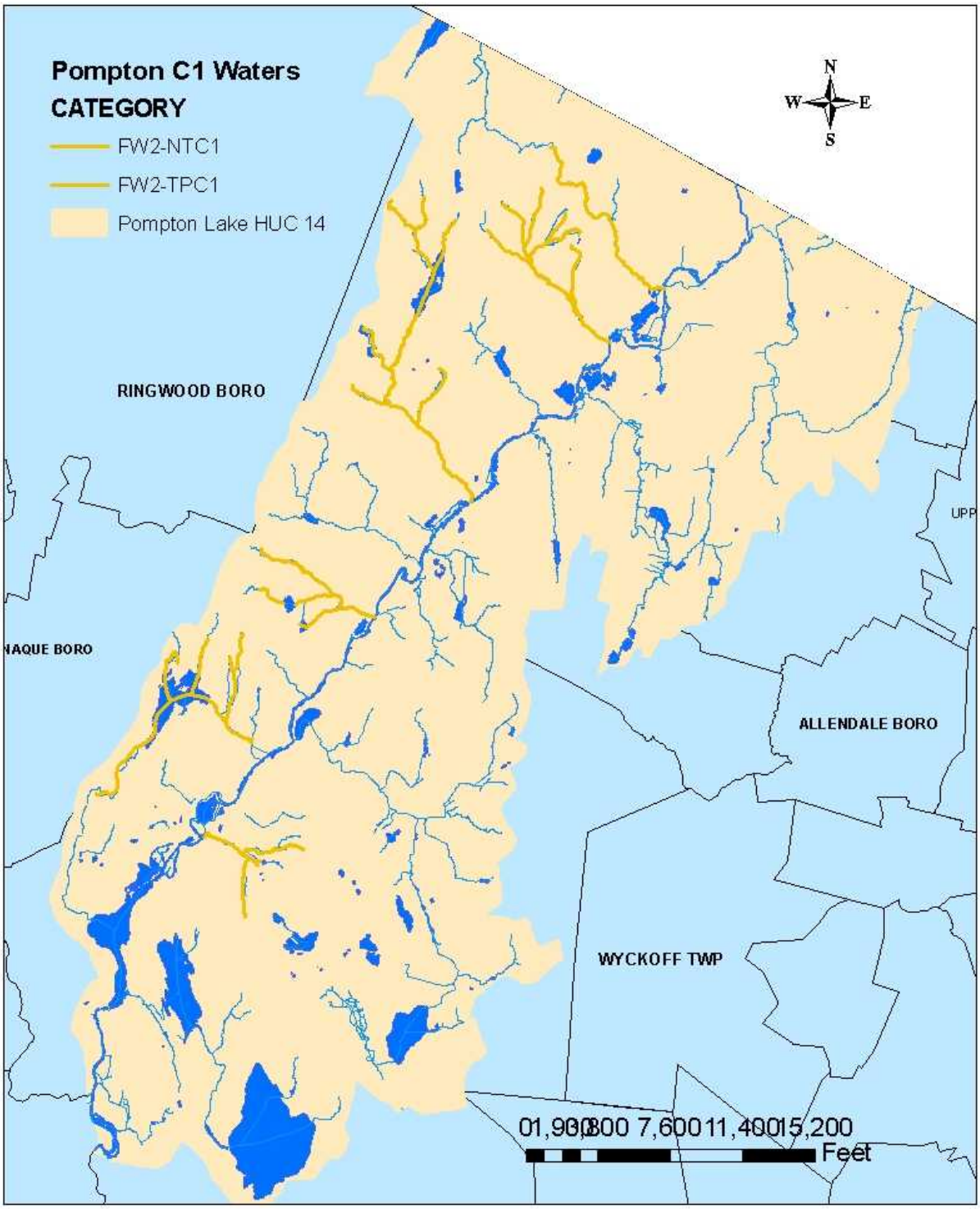
The Stormwater Management Rules focus on the prevention and minimization of stormwater runoff and pollutants in the management of stormwater. The rules require every project to evaluate methods to prevent pollutants from becoming available to stormwater runoff and to design the project to minimize runoff impacts from new development through better site design, also known as low impact development. Some of the issues that are required to be assessed for the site are the maintenance of existing vegetation, minimizing and disconnecting impervious surfaces, and pollution prevention techniques. In addition, performance standards are established to address existing groundwater that contributes to baseflow and aquifers, to prevent increases to flooding and erosion, and to provide water quality treatment through stormwater management measures for TSS and nutrients

As part of the requirements under the municipal stormwater permitting program, municipalities are required to adopt and implement municipal stormwater management plans and stormwater control ordinances consistent with the requirements of the stormwater management rules. As such, in addition to changes in the design of projects regulated through the RSIS and LURP, municipalities are updating their regulatory requirements to provide the additional protections in the Stormwater Management Rules.

Furthermore, the New Jersey Stormwater Management Rules establish a 300-foot special water resource protection area (SWRPA) around Category One (C1) waterbodies and their intermittent and perennial tributaries, within the HUC 14 subwatershed. In the SWRPA, new development is typically limited to existing disturbed areas to maintain the integrity of the C1 waterbody. C1 waters receive the highest form of water quality protection in the state, which prohibits any measurable deterioration in the existing water quality. Definitions for surface water classifications, detailed segment description, and designated uses may be found in various amendments to the Surface Water Quality Standards at www.state.nj.us/dep/wmm/sgwqt/sgwqt.html.

C1 designations within the pertinent portion of the Passaic River watershed are depicted on Figure 5

Figure 5: **C1 Waterbodies**



Commitment to carry out the activities described in the implementation plan to reduce phosphorus loads and the requirements of the Stormwater Management Rules and the Municipal Stormwater Regulation Program provide reasonable assurance that the SWQS will be attained for phosphorus in the spatial extent of the TMDL study. Follow up monitoring will identify if the strategies implemented are completely, or only partially successful. It will then be determined if other management measures can be implemented to fully attain the SWQS or if it is necessary to consider other approaches, such as use attainability.

11.0 Public Participation

In accordance with the Water Quality Management Planning Rules each TMDL shall be proposed by the Department as an amendment to the appropriate areawide water quality management plan(s) in accordance with N.J.A.C. 7:15-3.4(g). N.J.A.C. 7:15-3.4(g)5 states that when the Department proposes to amend an areawide water quality plan on its own initiative, the Department shall give public notice by publication in a newspaper of general circulation in the planning area, shall send copies of the public notice to the applicable designated planning agency, if any, and may hold a public hearing or request written statements of consent as if the Department were an applicant.

The Department has maintained a long term commitment to the stakeholder process and public participation in the development of this TMDL for the Passaic River Basin. The TMDL was developed with assistance and direct input from stakeholders in Watershed Management Areas 3, 4 and 6.

The stakeholder process in the Passaic River Basin has been continuous for over 13 years. The resulting collaborative restoration process arose out of a 1993 pilot watershed initiative in the Whippany River Watershed (1993 – 2000) and litigation over permit requirements. The Department's early meetings with dischargers in 1996 in response to a settlement agreement over proposed phosphorus permit limits coupled with the Whippany River Watershed Pilot project evolved into a comprehensive watershed management process. This model for watershed management was later refined and replicated throughout the state in twenty watershed management areas (WMAs).

The Department initiated a pilot watershed project in 1993 in the Whippany River Watershed to aid the Department in developing a comprehensive watershed process that could be replicated throughout the state. The 70 square mile Whippany River Watershed lies in the heart of the larger Passaic River Basin and was instrumental in pulling stakeholders with varied interests and backgrounds together to discuss and address issues germane to the Watershed. Stakeholders included: active watershed groups, academics, business, industry, consultants, interested public, purveyors as well as dischargers. The watershed management process has afforded New Jersey a unique opportunity to openly discuss and vet projects that need to be undertaken to ensure New Jersey achieves its statewide "clean and plentiful" water goal.

The Public Advisory Group (PAG), Technical Advisory Committee (TAC) and several subcommittees met for 6 years in an effort to achieve the goal to restore and preserve the value of the Whippany River as a vital natural resource. A main reason that the Whippany River Watershed was selected as the state's pilot watershed project was because of the number of dischargers located in the watershed. The Department recognized a unique opportunity in having dischargers, purveyors, environmental interest groups, local and state governments come together to vet and resolve issues unique to a specific geographic location. In addition to a replicable format for watershed management, one of several significant outcomes of the pilot watershed process included: the *Total Maximum Daily Load for Fecal Coliform and an Interim Reduction Plan for the Whippany River Watershed* adopted in December

1999 and its companion document Appendix G *Whippany River Watershed NPS Pollution Control Guidance Manual for Municipal Officials, Engineers and Department of Public Works, May 2000*. A workshop was held to acquaint municipalities with the best management practices recommended by the Technical Advisory Committee's NPS Workgroup.

During this time, the Department had also been meeting with the dischargers and purveyors in the Passaic River Basin on a regular basis through The Passaic River Task Group (1996 – 1998). The first priority of the Group was common concerns on phosphorus and eutrophication. Originally, the Whippany TMDL was proposed in 1999 to address both fecal coliform and phosphorus. Subsequently, only the fecal TMDL was established, since it was determined that, in the Whippany River, phosphorus was not rendering the waters unsuitable for the designated uses and so no phosphorus impairment was present. The Department did not pursue delisting because the Whippany River is a tributary to the Passaic River Basin wherein total phosphorus had not been assessed with respect to phosphorus rendering waters unsuitable for designated uses and, at a minimum, the Wanaque Reservoir was known to be a critical location of concern with respect to phosphorus loading. Thus, study of the larger area could result in the finding that phosphorus reductions on the Whippany would be needed to achieve water quality objectives in downstream locations.

The Group met through 1998, at which time the Department began a statewide watershed process within each of 20 watershed management areas that had been delineated for this purpose. Consequently, a Public Advisory Committee (PAC) and TAC were initiated for WMA 6. After the completion of the Whippany Fecal TMDL the Department-led Whippany River Watershed PAG and its TAC evolved into the WMA 6 PAC and TAC respectively which, met regularly from 1998-2003. The WMA 6 TAC assumed the mandate to discuss water quality related issues such as TMDL requirements.

In the Fall of 2000, the Department awarded two years worth of grant funding to 16 lead entities to serve as an extension of the Department to facilitate the watershed process for all 20 watershed management areas throughout the state. Deliverables from this statewide process varied; but resulted in the creation of PACs and TACs for WMAs 3 and 4; development of an extensive watershed characterization and assessment for WMAs 3, 4, and 6; creation of water resource based open space plans; and the implementation of numerous streambank restoration projects. At the same time, in order to successfully develop a comprehensive Passaic River Basin TMDL study, a separate committee was charged to focus on nutrient impairments in the Basin. With the Department, the Workgroup prepared the *Technical Approaches to Restore Impaired Waterbodies within the Non-tidal Passaic River Basin,* October 2001. The primary purpose of the report was to memorialize the outcome of the discussions to develop TMDLs and other management responses. The Workgroup continued to meet monthly through 2003.

In 2004, monitoring and initial modeling results from the TMDL work conducted by Quantitative Environmental Analysis, LLC (QEA), Najarian Associates and Omni Environmental, acting under contract to the Department, were shared and made available to the Passaic River Basin stakeholders through several informational sessions. On March 23, 2004, QEA presented their findings from the Ramapo River and Pompton Lakes Study to the WMA 3 PAC. Data exchange meetings based on the information collected by Omni Environmental were held on April 15, 2004, April 27, 2004, and September 28, 2004 and all stakeholders were invited to attend. On November 18, 2004, Najarian Associates presented preliminary findings on the Wanaque TMDL to the Passaic River Basin stakeholders. The Department conducted informal meetings with stakeholders on April 27 and September 28, 2004 to present model calibration and verification. The Department then conducted a

meeting on June 23, 2005 with the affected dischargers in the Basin to present the findings from the work completed by Najarian Associates for the Wanaque Reservoir and that portion of the Basin above the confluence of the Pompton and Passaic Rivers.

On July 5, 2005 the Department proposed a Phase 1 Passaic River Study TMDL for phosphorus in the Wanaque Reservoir and a TMDL for Total Phosphorus to Address Pompton Lake and Ramapo River. A public hearing on these TMDLs was held on August 4, 2005 at the Cultural Center at the Lewis Morris County Park in Morristown. Nearly 100 people attended the hearing, some of the specific issues/comments raised are discussed below. After the public meeting at the request of the commenters the Department extended the public comment period until November 21, 2005.

- Applicability of the phosphorus standard as a not to exceed value in the Wanaque Reservoir is inappropriate.

  Based on the thorough monitoring of the Passaic River basin and identification of critical locations through dynamic modeling, watershed criteria for Wanaque Reservoir and Dundee Lake were developed as part of the current TMDL work. These criteria are expressed in terms of a seasonal average chlorophyll–a concentration specific to each location. The existing numeric criteria in the SWQS remain applicable in the scope of the Pompton Lake TMDL because no basis to establish a watershed criterion there has been identified.

- Costs associated with treatment for phosphorus removal and longer term implementation consequences such as increase in sludge production and associated cost for removal, chemical usage, and total dissolved solids increases in effluent being discharged to the receiving waters;

  The goal of a TMDL is to identify the load reductions necessary to achieve the SWQS and the designated use of the waterbody. The point source dischargers in the Pompton Lake drainage are currently achieving excellent effluent quality and the proposed LTA will not be a burden. Further, trading is an option to achieve the needed load reductions in the most cost effective manner.

- The LA-WATERS model and water quality data inputs should be made available to the public for use to fully evaluate the TMDL results.

  The LA-WATERS model is a proprietary model and has not been released by the owners, NJDWSC and Najarian Associates. The proprietary nature of the model was known when the TMDL study for the Passaic River basin was initiated. This fact notwithstanding, the Passaic TMDL workgroup endorsed the use of this model, as documented in the public participation process. The LA-WATERS has been peer reviewed and accepted as a valid predictive tool for the Wanaque Reservoir. The simulation outputs compared to actual data have been presented graphically in support documentation for this TMDL, which is sufficient for evaluating the scientific validity of the tool. The Pompton Lake/Ramapo River TMDLs provides inputs to LA-WATERS, but does not use this model in determining load reductions needed within the study area.

- Applicability of Phase I study to headwater dischargers given the in-progress comprehensive Phase II study.

The Department proposed the Phase I TMDL with initial hopes to jumpstart water quality improvement. However, given delays experienced in finalizing Phase I, the Phase II study has since been completed. The Department has determined that the most efficient means to achieve water quality improvement is to incorporate the relevant portions of the Phase I study into this TMDL document.

- Water supply diversions should be treated as point sources, and the North Jersey District Water Supply Authority should receive a NJPDES permit for adding phosphorus load to the Wanaque Reservoir.

  It has been determined that diversions are not point sources subject to permitting under the National Pollutant Discharge Elimination System permit, as discussed in the August 5, 2005 EPA memorandum, *Agency Interpretation on Applicability of Section 402 of the Clean Water Act to Water Transfers*. Nevertheless, the Department agrees conceptually that a water supply diversion responsible for delivering pollutant loads to a water body should be considered in assigning responsibility for pollutant load reductions necessitated by the act of diverting water. In this case, the load reductions required to achieve the water quality target for the in-stream critical location is the same as that needed to achieve the water quality target in the Wanaque Reservoir. Water quality trading is an option through which NJDWSC can play a role in protecting the water quality of the Wanaque Reservoir, which is affected by the diversion of Pompton and Passaic River water into the reservoir. This issue is not relevant within the Pompton Lake/Ramapo River TMDLs.

- Achieving the 80 percent reduction in NPS called for is unrealistic.

  In the Pompton Lake drainage area, an 80 percent reduction is still required to achieve SWQS. While ambitious, the Department believes the identified measures will attain the required nonpoint source load reductions. Follow up monitoring will identify if the strategies implemented through this TMDL are completely, or only partially successful. It will then be determined if other nonpoint source management measures must be implemented to fully attain water quality objectives or if it is necessary to consider other approaches, such as use attainability.

- What are the assurances that New York will attain New Jersey's SWQS at the border, a boundary assumption for the TMDL.

  NJDEP has been in communication with both New York State and US EPA regarding this TMDL and the need for New York to achieve New Jersey's SWQS at the border. Progress has been made with the application of a 0.2 mg/l effluent limit on the Western Ramapo Wastewater treatment facility. It is expected, however, that NPS load reductions also will be needed in order to fully achieve the boundary objective.

- Basin dischargers are receiving special treatment since other dischargers are already receiving permits with 0.1 mg/l phosphorus requirement.

  In March 2003 the Department issued a *Technical Manual for Phosphorus Evaluations for NJPDES Discharge to Surface Water Permits* that provides the necessary guidance to determine if the numeric criterion for phosphorus applies. The "exit ramp protocol" is available

to all dischargers who receive a water quality based effluent limit for phosphorus based on the numeric criterion. However, in the Passaic River basin, in response to permit appeals when phosphorus limits were initially imposed there, the Department entered into settlement agreements with Passaic River basin dischargers establishing that the Department will not impose a phosphorus effluent limit until the appropriate limit has been determined through a TMDL. The settlement agreements predate and obviate the application of WQBELs pending the outcome of this TMDL.

For the Phase II study, the Department conducted additional outreach on May 19, 2006 and a presentation was made on behalf of the Department at the October 13, 2006 2nd Passaic River Symposium held at Montclair State University. The Department met with the dischargers and purveyors on September 11, 2006 to seek input on chlorophyll-a target endpoints for the Wanaque Reservoir and Dundee Lake Dam and to share preliminary findings on load reductions and how these should be translated into effluent limits.

Throughout the development of the TMDLs for the Passaic River Basin input was received through Rutgers New Jersey EcoComplex (NJEC). The Department contracted with the NJEC in August 2001. The NJEC consists of a review panel of New Jersey university professors whose role is to provide comments on the Department's technical approaches for the development of TMDLs and other management strategies. Their comments have resulted in refinement to model calibration resulting in this TMDL document.

Notice proposing the Passaic River basin phosphorus TMDL was published on May 7, 2007 in the New Jersey Register and in a newspaper of general circulation in the affected area in order to provide the public an opportunity to review the TMDL and submit comments. In addition, a public hearing was held June 7, 2007 at the Cultural Center at Lewis Morris County Park, 300 Mendham Road, Morristown, NJ 07962-1295. Notice of the proposal and hearing was provided to affected municipalities, dischargers, and purveyors in the watershed.

All comments received during the public notice period for this TMDL study and at the public hearing are part of the record for this TMDL and have been considered in finalizing this TMDL study. This TMDL has been adopted as an amendment to the Northeast WQMP. The full summary of comments and responses can be found in Appendix F.

Appendix A Municipalities Located in the Pompton Lake and Ramapo River and their MS4 Designation

Municipality	County	WMA(s)	Tier A or B	NJPDES Permit No.	Fertilizer ordinance required
Franklin Lakes Borough	Bergen	3,4	A	NJG0154121	Yes
Mahwah Township	Bergen	3,4	A	NJG0151211	Yes
Ramsey Borough	Bergen	3,4	A	NJG0151491	Yes
Oakland Borough	Bergen	3	A	NJG0148521	Yes
Pompton Lakes Borough	Passaic	3	A	NJG0152145	Yes
Ringwood Borough	Passaic	3	A	NJG0152749	Yes
Wanaque Borough	Passaic	3	A	NJG0149306	Yes
Wayne Township	Passaic	3, 4	A	NJG0150436	Yes

Appendix B Additional Impairments within TMDL Area

The two tables below identify the assessment units within the TMDL area of interest that have additional impairments not being addressed in the scope of this TMDL.

HUC 14 Assessment Units based on the proposed *2006 Integrated Water Quality Monitoring and Assessment Report*

WMA	Assessment Unit ID	Assessment Unit Name	Parameter	Designated Use Impairment
03	02030103100070-01	Ramapo R (below Crystal Lake bridge)	Dissolved Oxygen, pH	Aquatic Life (General & Trout)

Lake Impairments based on the proposed *2006 Integrated Water Quality Monitoring and Assessment Report*

WMA	Assessment Unit ID	Assessment Unit Name	Parameter	Designated Use Impairment
03	Pompton Lake-03	Pompton Lake-03	Mercury	Fish Consumption
03	Pompton Lake-03	Pompton Lake-03	PCBs	Fish Consumption
03	Pompton Lake-03	Pompton Lake-03	Dioxin	Fish Consumption
03	Pompton Lake-03	Pompton Lake-03	DDX	Fish Consumption
03	Pompton Lake-03	Pompton Lake-03	Chlordane	Fish Consumption
03	Ramapo Lake-03	Ramapo Lake-03	Mercury	Fish Consumption

Appendix C Database of Phosphorus Export Coefficients

In December 2001, the Department concluded a contract with the USEPA, Region 2, and a contracting entity, TetraTech, Inc., the purpose of which was to identify export coefficients applicable to New Jersey. As part of that contract, a database of literature values was assembled that includes approximately four-thousand values accompanied by site-specific characteristics such as location, soil type, mean annual rainfall, and site percent-impervious. In conjunction with the database, the contractor reported on recommendations for selecting values for use in New Jersey. Analysis of mean annual rainfall data revealed noticeable trends, and, of the categories analyzed, was shown to have the most influence on the reported export coefficients. Incorporating this and other contractor recommendations, the Department took steps to identify appropriate export values for these TMDLs by first filtering the database to include only those studies whose reported mean annual rainfall was between 40 and 51 inches per year. From the remaining studies, total phosphorus values were selected based on best professional judgment for eight land uses categories.

The sources incorporated in the database include a variety of governmental and non-governmental documents. All values used to develop the database and the total phosphorus values in this document are included in the below reference list.

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Appendix D: Summary of Reckhow (1979a) model derivation

The following general expression for phosphorus mass balance in lake assumes the removal of phosphorus from a lake occurs through two pathways, the outlet (M_o) and the sediments (ϕ):

$$V \cdot \frac{dP}{dt} = M_i - M_o - \phi$$ **Equation 1**

where:

V = lake volume (10^3 m³)
P = lake phosphorus concentration (mg/l)
M_i = annual mass influx of phosphorus (kg/yr)
M_o = annual mass efflux of phosphorus (kg/yr)
ϕ = annual net flux of phosphorus to the sediments (kg/yr).

The sediment removal term is a multidimensional variable (dependent on a number of variables) that has been expressed as a phosphorus retention coefficient, a sedimentation coefficient, or an effective settling velocity. All three have been shown to yield similar results; Reckhow's formulation assumes a constant effective settling velocity, which treats sedimentation as an areal sink.

Assuming the lake is completely mixed such that the outflow concentration is the same as the lake concentration, the phosphorus mass balance can be expressed as:

$$V \cdot \frac{dP}{dt} = M_i - v_s \cdot P \cdot A - P \cdot Q$$ **Equation 2**

where:

v_s = effective settling velocity (m/yr)
A = area of lake (10^3 m²)
Q = annual outflow (10^3 m³/yr).

The steady-state solution of Equation 2 can be expressed as:

$$P = \frac{P_a}{v_s + z/T} = \frac{P_a}{v_s + Q_a}$$ **Equation 3**

where:

P_a = areal phosphorus loading rate (g/m²/yr)
z = mean depth (m)
T = hydraulic detention time (yr)
Q_a = Q/A = areal water load (m/yr).

Using least squares regression on a database of 47 north temperate lakes, Reckhow fit the effective settling velocity using a function of areal water load: $P = \frac{P_a}{11.6 + 1.2 \cdot Q_a}$. **Equation 4**

Derivation of Margin of Safety from Reckhow *et al* (1980)

As described in Reckhow *et al* (1980), the Reckhow (1979a) model has an associated standard error of 0.128, calculated on log-transformed predictions of phosphorus concentrations. The model error analysis from Reckhow *et al* (1980) defined the following confidence limits:

$$P_L = P - h \cdot \left(10^{(\log P - 0.128)} - P\right)$$
$$P_U = P + h \cdot \left(10^{(\log P + 0.128)} - P\right)$$
$$\rho \geq 1 - \frac{1}{2.25 \cdot h^2}$$

where:

P_L = lower bound phosphorus concentration (mg/l);
P_U = upper bound phosphorus concentration (mg/l);
P = predicted phosphorus concentration (mg/l);
h = prediction error multiple
ρ = the probability that the real phosphorus concentration lies within the lower and upper bound phosphorus concentrations, inclusively.

Assuming an even-tailed probability distribution, the probability (ρ_u) that the real phosphorus concentration is less than or equal to the upper bound phosphorus concentration is:

$$\rho_u = \rho + \frac{1-\rho}{2} = \rho + \frac{1}{2} - \frac{\rho}{2} = \rho \cdot \left(1 - \frac{1}{2}\right) + \frac{1}{2} = \frac{1}{2} \cdot \rho + \frac{1}{2}$$

Substituting for ρ as a function of h:

$$\rho_u = \frac{1}{2} \cdot \left(1 - \frac{1}{2.25 \cdot h^2}\right) + \frac{1}{2} = \frac{1}{2} - \frac{1}{4.5 \cdot h^2} + \frac{1}{2} = 1 - \frac{1}{4.5 \cdot h^2}$$

Solving for h as a function of the probability that the real phosphorus concentration is less than or equal to the upper bound phosphorus concentration:

$$\frac{1}{4.5 \cdot h^2} = 1 - \rho_u$$
$$h^2 = \frac{1}{4.5(1 - \rho_u)}$$
$$h = \sqrt{\frac{1}{4.5(1 - \rho_u)}}$$

Expressing Margin of Safety (MoS_p) as a percentage over the predicted phosphorus concentration yields:

$$MoS_p = \frac{P_U}{P} - 1 = \frac{P_U - P}{P}$$

Substituting the equation for P_U:

$$MoS_p = \frac{P + h \cdot \left(10^{(\log P + 0.128)} - P\right) - P}{P} = \frac{h \cdot \left(10^{(\log P + 0.128)} - P\right)}{P}$$

$$P \cdot MoS_p = h \cdot \left(10^{(\log P + 0.128)} - P\right)$$

$$\frac{P \cdot MoS_p}{h} = 10^{(\log P + 0.128)} - P$$

$$\frac{P \cdot MoS_p}{h} + P = 10^{(\log P + 0.128)}$$

Taking the log of both sides and solving for margin of safety:

$$\log\left(\frac{P \cdot MoS_p}{h} + P\right) = \log P + 0.128$$

$$\log\left(\frac{P \cdot MoS_p}{h} + P\right) - \log P = 0.128$$

$$\log\left(P\left(\frac{MoS_p}{h} + 1\right)\right) - \log P = 0.128$$

$$\log P + \log\left(\frac{MoS_p}{h} + 1\right) - \log P = 0.128$$

$$\log\left(\frac{MoS_p}{h} + 1\right) = 0.128$$

$$\frac{MoS_p}{h} + 1 = 10^{0.128}$$

$$\frac{MoS_p}{h} = 10^{0.128} - 1$$

$$MoS_p = h\left(10^{0.128} - 1\right)$$

Finally, substituting for *h* yields Margin of Safety (MoS_p) as a percentage over the predicted phosphorus concentration, expressed as a function of the probability (ρ_u) that the real phosphorus concentration is less than or equal to the upper bound phosphorus concentration:

$$MoS_p = \sqrt{1 \big/ \left((1 - \rho_u) * 4.5\right)} \times \left(10^{0.128} - 1\right)$$

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Appendix F: Response to Comments: Non-tidal Passaic River Basin and Pompton Lake/Ramapo River Phosphorus TMDLs

Summary of Public Comments and Responses
The following people (listed alphabetically) submitted written and/or oral comments on one or both of the proposed TMDLs:

1. Alexander, Diane of Maraziti, Falcon, & Healey LLP for Rockaway Valley Regional Sewerage Authority, Letter and fax (same) dated July 6, 2007
2. Bongiovanni, Robert - Executive Director of Two Bridges Sewerage Authority. Letter dated July 3, 2007 (submitted with 16. below)
3. Covelli, Frank - Vice-Chairman of Wanaque Valley Regional Sewerage Authority, Letter dated November 8, 2006
4. Curran, Kelley of Great Swamp Watershed Association, Letter dated August 9, 2007
5. Decker, George - Chairman of Pompton Lakes Borough Municipal Utilities Authority, Letter dated November 7, 2006
6. Duch, Thomas - City of Garfield, Letter dated May 22, 2007
7. Filippone, Ella - Executive Director of Passaic River Coalition Watershed Association, Public Hearing, June 7, 2007
8. Filippone, Ella and Anne Kruger, Passaic River Coalition, Letter dated June 25, 2007
9. Filippone, Ella and Anne Kruger, Passaic River Coalition, Letter dated June 7, 2007
10. Goodsell, Robert of Post, Polak, Goodsell, MacNeill & Strauchler for Warren Township Sewerage Authority, Letter and fax (same) dated July 6, 2007
11. Kehrberger, Patricia of Hydroqual, Inc. for Township of Wayne, Letter and fax (same) dated July 6, 2007
12. Kehrberger, Patricia of Hydroqual, Inc. for Warren Township Sewerage Authority, Letter and fax (same) dated July 6, 2007

13. Kehrberger, Patricia of Hydroqual, Inc. for Warren Township Sewerage Authority, Letter and fax (same) dated September 19, 2007
14. Matarazzo, Pat - Chairman of Passaic River Basin Alliance, Public Hearing June 7, 2007
15. Meyers, Mark of Quantitative Environmental Analysis, LLC for Two Bridges Sewerage Authority, Technical memorandum dated July 2, 2007
16. Plambeck, Richard - Mayor of Chatham Borough, Public Hearing June 7, 2007
17. Platt, Fletcher of Hatch Mott MacDonald and Technical Advisory Committee Member, Public Hearing, June 7, 2007
18. Singer, Steven - Counselor-at-Law for Township of Wayne, Letter and fax (same) dated July 6, 2007 (submitted with 11. below)
19. Thompson, B. - Email of July 6, 2007 with forwarded July 6, 2007 letter from N. Bardach of Virotech USA, Inc.
20. Tittel, Jeff - Director of Sierra Club, Public Hearing June 7, 2007
21. United States Environmental Protection Agency – Region 2, Letter dated July 9, 2007
22. Wolfe, Bill - Director of New Jersey Chapter of Public Employee for Environmental Responsibility (PEER), Public Hearing, June 7, 2007
23. Wynne, Michael - Executive Director of Hanover Sewerage Authority, Letter and fax (same) dated July 6, 2007

A summary of comments on the proposals and the Department's responses to those comments follows. The numbers(s) in brackets at the end of each comment corresponds to the commenters(s) listed above.

Extend Comment Period:

1. Comment: The Department should extend the comment period an additional 60 days to allow sufficient time to evaluate various aspects of the Phase 2 Watershed Model. (10)

Response: The entire TMDL development process included significant information sharing with the public and multiple opportunities for public comment. For the formal proposal, the Department advertised the public hearing 30 days prior to the date of the hearing and allowed a 30 day comment period following the hearing. In addition, due to unexpected difficulties in making the model available on the web, an additional 30 days was allowed to comment on the proposed TMDLs. The Department believes that a further extension of the comment period would not be likely to raise issues or provide new information, data or findings that were not previously raised or provided during the development of the amendment or during the comment period outlined above. The Department believes that adequate opportunity for comment was provided to all commenters on this amendment without the necessity of a further extension of the comment period.

End Point:

2. Comment: Use of site-specific criteria is supported. Based upon review of the proposed criteria and supporting documentation, commenter agrees that chlorophyll-*a* represents an optimum endpoint for the Wanaque Reservoir and Dundee Lake TMDLs. In addition, based upon the modeling results presented in the proposed report and supporting technical reports, it appears that the proposed chlorophyll-*a* values of 10 ug/L for the Wanaque Reservoir and 20 ug/L for Dundee Lake are adequately protective of the applicable designated uses. Specifically, the modeling results, as presented in the various figures, indicate that compliance with the chlorophyll-*a* proposed values will

minimize the current nutrient-based impairments to these two waters: excessive diurnal dissolved oxygen swings, and elevated chlorophyll-*a* levels. The referenced literature and State examples serve to further justify the selection of these values. (21)

Response: The Department acknowledges the support of the watershed criteria developed for the two critical endpoints in the Passaic River Basin. With adoption of these TMDLs as amendments to the applicable Water Quality Management Plans, these criteria are adopted watershed criteria in accordance with the New Jersey Surface Water Quality Standards, *N.J.A.C.* 7:9B-1.5(g)3. The Department plans to post watershed criteria established as part of an adopted Water Quality Management Plan on its Water Quality Standards page.

3. Comment: Commenter believes that the discussion of the criteria could be reorganized to strengthen and clarify the justification as follows: a) the detailed information in Appendix E that taken together leads to the conclusion that designated uses are protected should be summarized there and added to the main document on page 18; b) the experience of other states could be relegated to supporting information rather than included as part of the justification. (21)

Response: The Department believes that the body of the TMDL document should summarize information that is set forth in greater detail in Appendices and/or the supporting documents that accompany the TMDL. Repeating the detailed information contained in Appendix E in the body of the TMDL does not add to the strength of the argument. The detailed information on the experiences of other states has been moved to Appendix E. In addition, the Department has revised Section 3 and Appendix E to more clearly state that designated uses will be supported with attainment of the watershed criteria.

4. Comment: On page 17 there is a reference to a New York State guidance value of 20 ug/L of chlorophyll-*a* and a New York City value of 15 ug/L chlorophyll-*a* for the New York City water supply reservoirs. Please note that both the 20 ug/L and 15 ug/L values are for total phosphorus, not chlorophyll-*a*. In addition, it should be noted that the total phosphorus value 15 ug/L relates to a chlorophyll-*a* concentration of 7.0 ug/L, and is only applied to a subset of the New York City water supply reservoirs. (21)

Response: The error noted by the commenter was based on the commenter's review of a pre-release draft. The errors referenced by the commenter were corrected prior to release of the final May 7, 2007 proposal.

5. Comment: 40 C.F.R. 131.6(a)-(f) specify the minimum requirements for a water quality standards submission to EPA. With regard to the State's submission of the site specific chlorophyll-*a* criteria for the Wanaque Reservoir and Dundee Lake, elements (b), (c) and (e) apply. Based upon the commenter's review of the applicable sections of the proposed TMDL Report, elements (b) and (c) are included in the proposal. The Department must also include the requisite Attorney General certification as part of the final submission in order to address the requirements of 40 C.F.R. 131.6(e). (21)

6. Comment: 40 C.F.R. 131.20(a)-(c) specify the Federal requirements for State review and revision of water quality standards. With regard to the State's submission of the site-specific chlorophyll-*a* criteria for the Wanaque Reservoir and Dundee Lake, the applicable 40 C.F.R. 131.20 elements that apply are (b) and (c). The Department has fulfilled the requirements of 40 C.F.R. 131.20(b) through its public participation process. The Department's submission of the final chlorophyll-*a* criteria for the

Wanaque Reservoir and Dundee Lake, along with the final methodologies used for site-specific criteria development, as well as the above-referenced Attorney General certification will satisfy the requirements of 40 C.F.R. 131.20(c). (21)

Response to Comments 5 and 6: The TMDL documents, revised for adoption in accordance with the response to comments, include the final documentation of the watershed criteria (not site specific) relative to the phosphorus standard within the non-tidal Passaic River basin. The Department notes that the referenced DAG certification is required under Federal regulations to stipulate that the water quality standards have been duly adopted pursuant to State law. This certification was provided to EPA as part of the submission of the current Surface Water Quality Standards, which were approved by EPA's letter dated August 16, 2002. That letter specifically approved the revision to the "phosphorus criteria to acknowledge that criteria may be developed through the watershed process (N.J.A.C. 7:9B-1.14(c)5." The Department believes this obviates the need for the DAG certification specified at 40 C.F.R. 131.6(e). The Department will provide any documentation determined to be necessary to establish that the watershed criteria are the applicable surface water quality criteria relative to the phosphorus standard in the specified portion of the non-tidal Passaic River basin.

7. Comment: The Department needs to show that the existing standard is inappropriate or under-protective before an alternate watershed-specific criterion is developed. Further, establishing the criterion as part of the TMDL does not appear to be procedurally correct. The target for the Phase 1 TMDL was not to exceed 0.05 mg/L. The seasonal average approach appears to be a back door ruse to weaken the compliance condition. The most stringent policy should be in place to protect the public water supply. (22)

Response: Site-specific or watershed criteria can be either the same, more, or less stringent than the existing/default criteria, as stated in the adoption of amendments to the Surface Water Quality Standards proposed on December 18, 2000, see 34 N.J.R. 537(a), January 22, 2002; specifically responses to comments 247, 248 and 343-351. Establishing the criteria in terms of the response indicator, chlorophyll-*a*, is not a weakening of the criteria. Instead, development of a dynamic model that simulates the effect of nutrients, productivity and water quality effects of productivity based on the characteristics of the specific watershed has allowed the Department to set criteria that provide protection of designated uses without requiring nutrient reductions aimed at achieving a default criterion. The SWQS state that watershed criteria shall be established through the watershed process, which includes through adopting a TMDL, which establishes said criteria.

8. Comment: Selection of chlorophyll-*a* as the endpoint parameter and as a seasonal average to measure compliance for Dundee Lake and Wanaque Reservoir is appropriate. Chlorophyll-*a* as a measure of algae related to taste and odor problems in water supplies (drinking water use), algae interference in the normal operation of a water treatment plant (drinking water use), recreation use (aesthetics) and the resultant dissolved oxygen (aquatic life use) are a direct measure of meeting designated uses. (11), (12)

9. Comment: The use of chlorophyll-*a*, a response indicator of the effect of phosphorus on algal growth, as the endpoint for the TMDL is applauded. The use of chlorophyll-*a* is supported over the former approach, which applied the numerical phosphorus limit without any consideration of the effect. (23)

10. Comment: The use of summer average phytoplankton chlorophyll-*a* as a measure of whether or not nutrient concentrations are excessive is appropriate and the critical locations for this measure are the

confluence of the Passaic and Pompton Rivers and in the Passaic upstream of Dundee Dam. The Department is commended for including Dundee Dam as an endpoint because it should be cleaned up so as to be suitable as a drinking water source. (7), (8), (9)

Response to Comments 8-10: The Department acknowledges these comments in support of use of chlorophyll-*a*. The Department selected chlorophyll-*a* as the appropriate response indicator for the Passaic River watershed criteria. Based on the development of a dynamic model for the Passaic River Basin that simulates the relationship between nutrients, productivity and water quality and allows identification of levels of chlorophyll-*a* that support designated uses in the critical locations.

11. Comment: While the use of chlorophyll-*a* as the response indicator for the TMDL is applauded, the selection of a summer average 10 ug/L target is very conservative and was made in the absence of any site specific data. A review of Florida lakes shows that 20 ug/L is exceeded only 2% of the time when the warm season average is 10 ug/L. This illustrates the conservative nature of the target. The selection of 10 ug/L is explained only in terms of reservoir characteristics: it is deep, and serves as a trout fishery and a drinking water supply. (15)

12. Comment: Moving from phosphorus to chlorophyll-*a* is a concern. We know phosphorus is a limiting factor. Chlorophyll-*a* is a biochemical byproduct. We all know what the standard is and that is what we should strive for. (20)

13. Comment: The seasonal average chlorophyll-*a* of 10 ug/L for the Wanaque Reservoir has not been documented as the appropriate end point and appears arbitrary. NJDEP lists the five factors taken into consideration in the selection of the chlorophyll-*a* value and cites a range of values adopted elsewhere, concluding that a conservative target is warranted for the Wanaque Reservoir. Was North Jersey District Waster Supply Commission (NJDWSC) input on the selection of the chlorophyll-*a* standard used or requested? An analysis and/or data from NJDWSC documenting the relationship of algae levels to treatment problems and/or taste and odor complaints from customers is necessary for the establishment of a protective chlorophyll-*a* standard for the reservoir. Although samples are collected monthly, values exceeding 10 ug/L are measured for most years. 15 ug/L appears to be normal for the Reservoir. NJDWSC should be an active participant in the establishment of the chlorophyll-*a* standard at their reservoir. (12)

14. Comment: The selection of 20 ug/l chlorophyll-*a* is arbitrary and not supported in the TMDL analyses. The Department's phosphorus technical guidance sets a threshold for chlorophyll-*a* of 24 ug/l as a seasonal average with a two-week mean of 32 ug/l. These values have been used for several years as a conservative threshold to determine when phosphorus is rendering waters unsuitable for designated uses. The endpoint should be the level at which Dundee Lake is not meeting designated uses. The 20 ug/L value was chosen to be conservative, an MOS was added, and the TMDL is based on an "extreme drought" year. The high sustained chlorophyll-*a* levels and extreme supersaturation of dissolved oxygen are not predicted in the Baseline Future Conditions. Absent measured impairments, the Dundee Lake endpoint should be 30 ug/l seasonal average. (11)

Response to Comments 11-14: The selected watershed criteria are appropriate and protective and were established taking into account site-specific data. The Department's Surface Water Quality Standards (SWQS) for phosphorus include narrative statements regarding allowable levels of nutrients based on the effect they have on primary productivity and water quality. These provisions recognize that phosphorus is a potential causal factor that may result in excessive primary productivity and associated water quality impacts, particularly with respect to dissolved oxygen and pH, but that it does not

necessarily do so in every location. The SWQS also include a provision at N.J.A.C. 7:9B-1.5(g)3 for establishing site specific or watershed criteria with regard to phosphorus recognizing the scientific reality that the nutrient dynamics in a given setting may warrant a different numeric value for phosphorus or a different basis to assess attainment of designated uses. It is generally held that measurement of acceptable levels of nutrients is ideally done in terms of response indicators of excessive productivity, such as chlorophyll-*a* (*Protocols for Developing Nutrient TMDLs*, First Edition, November 1999; *Nutrient Criteria Technical Guidance Manual Lakes and Reservoirs*, First Edition, April 2000, EPA). Based on the cited EPA guidance and experiences of other states as discussed in Appendix E of the TMDL, the selected chlorophyll-*a* value varied and reflected a best professional judgment guided by factors such as climate, physical lake characteristics and designated uses. As set forth in Appendix E of the TMDL, the Department evaluated model simulations of water quality response in the critical locations, the particular characteristics of the critical locations and their uses, as well as literature values and EPA guidance documents to guide selection of the watershed criteria. The Passaic River Basin Nutrient TMDL Study report (Omni 2007, pp. 167-169) provides some discussion of the basis for the watershed criterion established for Dundee Lake based on a water quality target of 20 µg/l chlorophyll-*a* as a summer average. Appendix L of *The Passaic River Basin Nutrient TMDL Study report* (Omni 2007) also includes simulations of water quality response at Dundee Lake as well as throughout the river basin, given attainment of the 20 µg/l endpoint. Furthermore, the Wanaque Reservoir Supplemental report (Najarian, 2007) provides graphical outputs for total phosphorus, chlorophyll-*a*, organic phosphorus, dissolved inorganic phosphorus, water temperature and dissolved oxygen that illustrate the water quality associated with the endpoint of 10 ug/L chlorophyll-*a*. Based on this information, the selected watershed criteria are protective of designated uses.

The statement that "The high sustained chlorophyll-*a* levels and extreme supersaturation of dissolved oxygen are not predicted in the Baseline Future Conditions" is inaccurate. Extreme dissolved oxygen saturations and high chlorophyll-*a* were predicted under the Baseline Future Conditions at the critical locations, see Figures 36 and 37 on page 142 (Omni, 2007). Furthermore, actual measurements of chlorophyll-*a* and diurnal dissolved oxygen in the lower reaches of the Passaic River confirm high chlorophyll-*a* levels (97 µg/l at Market Street on August 14, 2002) and extreme supersaturation of dissolved oxygen (over 16 mg/l in August 2003). The suggested endpoint of 30 ug/l at Dundee Lake represents the Baseline Future Conditions, see graph 57 page 173. As stated above, this would result in extreme supersaturation of dissolved oxygen at the critical locations and would not be an acceptable endpoint. The use of the phosphorus protocol criteria at Dundee Lake is also not appropriate because the phosphorus protocol criteria were developed for flowing streams and this location is an impoundment. The *Technical Manual for Phosphorus Evaluations for NPDES Discharge to Surface Water Permits*, NJDEP, March 2003, which defines the criteria for determining is phosphorus is rendering waters unsuitable for the designated uses, specifically states that the "phosphorus protocol study, including application of the thresholds, is not applicable where there is a downstream impoundment. At the selected watershed criteria, the levels of biomass and associated water quality response parameters, dissolved oxygen and pH, are compatible with the actual and designated uses.

The proposed watershed criteria were presented to the regulated community and NJDWSC at the September 11, 2006 meeting. At that time, the NJDWSC indicated that this level of chlorophyll-*a* will provide suitable protection for use of the Wanaque Reservoir for public potable water supply after conventional filtration treatment, as provided in the SWQS designated uses for FW-2 waters.

15. Comment: It was understood that the Phase 1 TMDL would be superseded by the Phase 2 TMDL, but it was expected that the Phase 1 TMDL would jumpstart water quality improvement and the Phase 2 TMDL would ratchet down on limits to be fully protective. The Phase 1 TMDL had an endpoint of not to exceed 0.05 mg/L of total phosphorus while the Phase 2 TMDL establishes a watershed criteria in terms of chlorophyll-*a*. Which is more protective of the drinking water use? The Department should provide a side by side comparison of the two TMDL documents. (22)

Response: The commenter is correct in stating that the purpose of the Phase 1 TMDL, which addressed phosphorus impairment in the Wanaque Reservoir, was to accelerate water quality improvement by determining and directing the phosphorus reductions needed to attain SWQS in the reservoir. However, there was no preconceived notion of what the final outcome of the overall TMDL for the Passaic River basin would be. The outcome was to be and is driven by the science of the model results. The development and application of a dynamic, basin-wide model that is capable of simulating the effects of nutrients on productivity and the associated water quality effects has enabled the Department to provide a carefully balanced implementation approach using response indicators as the water quality endpoints. Tying phosphorus reduction to attainment of levels of chlorophyll-*a* that are protective of the designated uses achieves the water quality objective without incurring unnecessary treatment expense.

The commenter is directed to Figure 5.7 in (Najarian, 2005), and Figure 1 in the supplemental report entitled *Phosphorus Chlorophyll a Relationship Wanaque Reservoir Addendum to Najarian 2005* (Najarian, 2007) for a comparison of the in-lake phosphorus concentrations as the result of the two approaches. Beyond this, given the myriad differences in the two TMDL documents (spatial extent, modeling approach, critical locations, endpoints, etc.) a side by side comparison of the documents is not appropriate. Instead, the Department has explained in the current TMDL documents that the Phase 1 TMDL has been withdrawn, provided a response to the key comments on the Phase 1 proposal, and has reiterated any relevant information from Phase 1 in the current TMDL documents.

16. Comment: The Passaic TMDL was developed for an overly conservative drought condition. NJDEP establishes wastewater treatment plant discharge effluent limits for phosphorus based a 7Q10 receiving water flow, a flow condition with a return period of 10 years. Najarian 2005 states that this time period was the third lowest in the 48 years of record, a return frequency of 16 years. Flow rates were also low; February 2002 had the lowest monthly flow in 50 years of record at Chatham and in 24 years of record at Pine Brook. The year 2002 represents a severe condition when NJDEP declared drought warning status for northeast New Jersey. From the "Wanaque Reservoir TMDL Development New Model Scenario" prepared by Najarian & Assoc. in 2007, the volume of diversion to the reservoir exceeded the reservoir during the "sustained drought" period of WY2002 (October 1, 2001 through September 30 2002) . In addition, the TMDL calculation was performed with pumping at the ultimate safe yield as provided by NJDWSC. Any carryover of phosphorus to the next year is minimal. The 2002 drought year upon which the Passaic TMDL is based is "conservative" and the developed chlorophyll-*a* standard should not apply. (12)

17. Comment: The Passaic TMDL for Dundee Lake was developed for an overly conservative drought condition, a point noted by the New Jersey EcoComplex (NJEC). Najarian 2005 states that the rainfall in this time period was the third lowest in the 48 years of record, a return frequency of 16 years. Flow rates were also low; February 2002 had the lowest monthly flow in 50 years of record at Chatham and in 24 years of record at Pine Brook. Effluent limits are based on a 7Q10 receiving water flow, a return period of 10 years. Flow is an important driver for productivity, illustrated by the reduction in chlorophyll-*a* in Baseline Future Conditions, when plants are at full permitted flow, compared to

Existing Conditions. It is recommended that the NJDEP use Water Year 2001 instead of the extreme drought year as the basis for the TMDL. (11)

Response to Comments 16 and 17: The TMDL was not developed for an overly conservative drought condition. The Passaic River Basin has experienced several drought periods in the last 15 years, notably 1994-1995, 1998-1999, and 2001-2002. From a water supply perspective, 2002 was notable but not unique. Reservoir capacity has dipped below 10 billion gallons three times since the beginning of 1993 – extensive pumpage from river intakes was needed to refill the reservoir after each event. Thus, given that this is a managed system, conditions that could produce the adverse water quality effects in the reservoir can occur more frequently (and more severely) than do purely meteorological droughts. Further, in terms of the prevalence of low-flow warm-weather conditions conducive to algal growth, 2002 was not significantly different than other recent drought periods. For instance, the average flow at the Little Falls gage (01389500) from June through September was 230 cfs in 2002, compared with 168 cfs in 1995. Similarly, 81% of the daily summer flows in 2002 were below the published 70th percentile flow of 295 cfs at that same gage, compared to 84% during the summer of 1995. The commenter states that phosphorus does not accumulate in the reservoir, presumably because water pumped in does, on occasion, exceed that which is pumped out. This situation does not occur every year and even when pumping does exceed outflow, phosphorus can settle below the level of pumpage and be available for algal growth following turnover events. Finally, even if 2002 were not utilized for the TMDL calculations, simulated algal concentrations at Dundee Lake were similar in 2001 and 2002.

18. Comment: The measurement of success of the TMDL must be based on attainment of the chlorophyll-*a* targets that will be assessed through a sufficient monitoring program. (15)

19. Comment: Confirmation is requested that the objective of the TMDL is the achievement of the designated chlorophyll-*a* level, not whether an in-stream phosphorus level of 0.4 ppm LTA has been met. (2)

Response to Comments 18 and 19: The attainment of the established watershed criteria at the critical locations is the objective of the TMDL. While the watershed criteria are established in terms of chlorophyll-*a*, attainment will depend on reducing phosphorus loads in accordance with the TMDL, which includes wasteload allocations and load allocations to point and nonpoint sources, respectively. An in-stream phosphorus level has not been specified. The TMDL is based on long term average effluent concentrations that will be applied to wastewater treatment facilities through NJPDES permitting following adoption of the TMDL. The long term average concentrations will be reflected as monthly average effluent limits in the applicable NJPDES permits, subject to water quality trading. As indicated in Table 14, most facilities will be receiving an effluent limit based on a long term average concentration of 0.4 mg/L. The Department concurs that assessment of successful implementation of the TMDL will require an adequate follow-up monitoring program, as described in the TMDL under "Follow-up Monitoring".

Models:

20. Comment: It is stated that phosphorus concentrations in baseflow (page 58 of technical document) ranged from 0.02 to 0.09 mg/l in pristine locations, and from 0.02 to 0.13 mg/l in areas affected only by nonpoint sources; one would expect there to be a greater difference. There should be discussion of the reason(s) why these two concentrations are similar. (21)

Response: The referenced document does offer an explanation that the amount of forest and wetlands in a drainage area appeared to be the most significant influence on tributary concentration. To elaborate, the Passaic River headwaters are strongly influenced by major wetland complexes, namely the Great Swamp and Great Piece Meadows. An analysis of the export of phosphorus from the Great Swamp to the Passaic River is provided in Appendix D of the Passaic River Basin Nutrient TMDL Study report (Omni 2007). In addition, data at reference locations in the Passaic River basin demonstrate that tributaries in relatively pristine areas frequently have higher phosphorus concentrations than might otherwise be expected. The Passaic River TMDL study accounted for these background phosphorus sources using the best available data.

21. Comment: Using global parameters implies that the aquatic ecosystem has similar characteristics in all of the segments (pages 98-99 of technical document). What assumptions are used to make the determination as to which parameters should be calibrated globally or locally? (21)

Response: Most parameters are applied throughout the model domain (global). The EPA Water Quality Analysis Program 7.0 (WASP7) model allows that certain parameters can be assigned localized values. In this modeling approach, local parameter values are only assigned when necessary to obtain an acceptable calibration, unless localized information is available (such as location-specific light attenuation coefficients). It is possible to divide the study area into separate models that are then linked externally and this may be necessary to achieve an acceptable calibration in some waterbodies. In the Passaic River TMDL model, calibration was successful using a single model throughout the study area.

22. Comment: In the Light Extinction Coefficients (pages 68-69 of the technical document), "The surface light energy and the light energy at the deepest measurement were used to derive the value of K." Why was it estimated this way rather than taking the average over depth? (21)

Response: As described in the Passaic River Basin Nutrient TMDL Study report (Omni 2007, p. 68), the Beer-Lambert law was used to calculate light extinction coefficient as a function of light energy at the surface and light energy at a particular depth. The light energy at the deepest measurement was used in order to obtain an estimate over the largest depth of the photic zone. This procedure is commonly used to estimate light extinction coefficients when light energy measurements are available (Wool, T.A., R.B. Ambrose, J.L. Martin, E.A. Comer, WASP Version 6.0 Draft User's Manual, pp. 11-38).

23. Comment: Regarding Table 13: specify the dates of the July and August events; more than two events should be considered if K1 will be used throughout the year; estimates for light extinction coefficients should cover more than only the summer period and during storm events; and there is no description why the K1 values vary so much between the July and August event for some of the stations and the implications of this variability. (21)

Response: Light extinction measurements were generally taken during the July and August 2003 diurnal events, which occurred July 15, 16, and 18 of 2003 and August 24, 25 and 26 of 2003. The July and August light extinction coefficients are consistent for most locations, with only two of 23 showing variability. The extent and quality of light extinction data for the Passaic River TMDL study was appropriate given the state-of-the-art for these types of modeling studies. Light extinction data was sufficient and appropriate to inform a model concerned with productivity during critical periods. Light extinction is important during low-flow summer periods when periphyton and macrophyte productivity is highest. Light extinction can vary spatially in WASP, but not temporally. The Passaic River Basin

TMDL study benefited from multiple localized light extinction measurements, providing a basis to assign spatially variable values.

24. Comment: The observed Hydroqual and the observed Omni SOD data are significantly different. Do they represent one value or an averaged value? The observed values are very different than the calibrated SOD values. (page 111, Table 24 of the technical document). (21)

Response: Field measurements of SOD and sediment deposits are typically highly variable spatially and temporally due to varying flow regimes affecting deposition and scour (Rates, Constants, and Kinetics Formulations in Surface Water Quality Modeling, G. L. Bowie et. al., 1985). For the model, SOD values for large areas were needed. Taking into consideration the variability of individual site measurements, the issue of precision of SOD measurements in general, and the extensive amount of SOD data needed to characterize the SOD profile in the Passaic Basin based on data alone, SOD values were assigned by model calibration rather than assign one value or an average value. A limited number of SOD measurements at sampling stations in the Passaic River were conducted in order to perform a reality check on the calibration SOD values. It should be noted that average dissolved oxygen levels are largely influenced by hydraulics through reaeration, and by stream temperature due to solubility differences. SOD primarily influences the average DO and causes only a minor impact on the DO diurnal variation.

25. Comments: In many of the figures of the report, it is difficult to determine the importance of the difference between simulated and observed data. The differences are provided as total difference rather than percentage difference (i.e. Table 8). For other tables, the units are not provided. (i.e. Table 25). There is at times limited or no discussion of the implication of differences between simulated and observed data. Based on the figures provided how accurate is the model? (i.e. Table 22). Whenever observed mean data is presented the number of data points used should be included (i.e. Table 26). (21)

Response: The perceived difficulty in determining the importance of differences between simulated and observed data is a result of the large-scale watershed modeling study that was conducted. The graphical presentation in Appendices E and F of the Passaic River Basin Nutrient TMDL Study report (Omni 2007) was deemed the best way to convey the overall results.

As noted, even a well-calibrated model may at times show a poor comparison between simulated and observed data; for example, a poorly characterized boundary condition may cause a poor fit, even though the model is well-calibrated and perfectly suitable to evaluate future conditions based on an assumed boundary condition. On the other hand, a poorly calibrated model can show a very good fit between simulated and observed data, perhaps due to an over-reliance on localized parameters to force a good fit, or due to a limited set of observation data under a variety of conditions. It is appropriate to provide absolute differences rather than percent differences between simulated and observed data, because the absolute magnitude provides a better sense of the importance of the difference. For instance, the percent differences for ammonia might be high simply because the ammonia levels are low. Units for the calibration statistics are concentrations (e.g. mg/l), and are provided in the example calibration graphs. For Omni sampling stations, generally 12 or 20 observations were available for the 2003 calibration period. Statistics were only derived when enough observed data were available. The model clearly captures the salient features of the system within a unified framework and with an acceptable degree of accuracy, and can be utilized to relate point and nonpoint sources of phosphorus to water quality impacts at critical locations under a variety of conditions.

26. Comment: When providing coefficients of correlation (page 93), the document should state whether the comparison between data sets is for a monthly, daily or hourly time period. The squared correlation coefficient, R^2, could be significantly different between monthly and daily datasets, and this could also give valuable insight on model performance. Are there other statistical measures that could provide insight on model accuracy and performance? (21)

Response: Descriptions of calibration statistics are provided in the Passaic River Basin Nutrient TMDL Study report (Omni 2007, p. 98). Statistics were calculated automatically within the WASP post-processor by comparing intra-day simulation values with observed values. This method is the only one available within the WASP post-processor, and is considered the preferred method when evaluating the goodness of fit for a dynamic water quality model. The use of intraday comparisons tends to exaggerate the differences between observed and predicted values.

The most relevant statistics available within the WASP post-processor were selected. "Mean Error" provides a key absolute measure of the average difference between predicted and observed concentrations. A Mean Error of zero indicates that overpredictions and underpredictions were exactly balanced. The average predicted value is provided along with the average among the observed values. These means are important because they provide a context to understand the importance of the Mean Error. The predicted and observed standard deviations provide an indication of how well the model captured the variability about the mean. Finally, the squared correlation coefficient, R^2, is provided as a measure of the degree to which model predictions and observations vary together linearly. Appendix G includes graphical representations of predicted versus measured total phosphorus concentrations for stations throughout the model domain, providing another measure of model performance. The calibration procedure consisted primarily of plotting the discrete observed data and the continuous simulated data together, and comparing them. Limited statistics were considered to provide some guidance during calibration. Based on the many representations of model performance, and thorough evaluation by the Department and the New Jersey EcoComplex, the model clearly captures the salient features of the system within a unified framework and with an acceptable degree of accuracy, and can be utilized to relate point and nonpoint sources of phosphorus to water quality impacts at critical locations under a variety of conditions.

27. Comment: What is limiting biological productivity in the different stream segments? (Page 149 of the technical document) For example, if in certain locations DO is not very sensitive to phosphorus reductions, but these areas are very sensitive to changes in velocity and light, couldn't this be evaluated in the model analysis? (21)

Response: Biological productivity is influenced dynamically by a number of factors, including nutrient availability, flow, velocity, light penetration, temperature, and substrate. Some of these factors can be evaluated independently through model sensitivity. The purpose of this study was to determine the extent to which phosphorus was affecting biological productivity. Where phosphorus was found to be causing excessive productivity and related water quality impacts, the purpose was to determine the amount of phosphorus reduction that would achieve water quality objectives, expressed in terms of the watershed criteria as chlorophyll-*a* criteria at the critical locations. The study did conclude that other factors were responsible for water quality effects in the portions of the basin. For example, lack of light penetration due to naturally occurring dark water was the reason for low observed productivity in upper reaches of the basin, even when phosphorus was present in sufficient quantities to support high productivity; and low dissolved oxygen was found to be a naturally occurring condition in some locations either because source waters were naturally low in dissolved oxygen or because of high natural SOD from large wetlands complexes.

28. Comment: Why not incorporate shading in the TMDL analysis? (21)

Response: Generally, the modeled streams in this study are higher order streams for which shading would not be expected to be as significant a factor as in smaller streams. For this reason, data on percent canopy cover were not collected during the data collection phase. As expected, it was not necessary to incorporate shading to obtain a meaningful calibration. Few, if any, large watershed studies of this magnitude incorporate shading into the water quality analyses. In terms of using shading as a management response, this may be effective for a limited spatial extent in smaller tributaries, but productivity was not found to be an issue in these smaller order stream areas.

29. Comment: Does the reduction in phosphorus loads have an effect on biological productivity throughout at different stations in the watershed? Chlorophyll-*a* graphs could accompany phosphorus graphs for each location in Figures 26-48 of the technical document. (21)

Response: The overall conclusion of the study was that phosphorus was responsible for causing excessive primary productivity in the identified critical locations, but not elsewhere in the basin. Therefore, focus was on simulated outcomes of reductions at the critical locations. Chlorophyll-*a* graphs showing the impact of phosphorus reductions in the body of the Passaic River Basin Nutrient TMDL Study report (Omni 2007) are provided for locations where phytoplankton is important. Appendix J provides a more complete set of graphs showing the impact of extreme phosphorus reductions on chlorophyll-*a* and dissolved oxygen throughout the basin.

30. Comment: A major assumption in the TMDL model is "that phosphorus is a conservative constituent and the dominant factor in determining in-stream concentrations of phosphorus in the Passaic system is the relative dilution, depending on available streamflow, of a significant and relatively constant wastewater discharge load." This seems to hold true at current phosphorus loadings in the Passaic and Pompton Rivers, which exceed surface water quality standards several-fold. However, there is inadequate narrative detail describing the range of in-stream phosphorus concentrations for which the conservative mass-balance assumption is valid. Please explain in greater detail why the assumptions made at current loadings will remain valid when TMDLs are implemented and dischargers reduce their loadings. (21)

Response: This assumption is only used in a limited way for estimating loadings to the Wanaque Reservoir from direct drainage to the reservoir outside the domain of the dynamic model and for loadings to Pompton Lake. Loading reductions from dischargers are not significant in these drainage areas and exceedances of existing numeric criteria are not significant. Therefore, the loading assumptions from the limited drainage areas where this approach was used are believed to remain valid in the future scenario.

31. Comment: In Table 3-1, the R^2 for the mass balance model for the Ramapo River at Pompton Lakes is 0.244. According to the analysis, the reason for low correlations seems to be partially due to greater uncertainty in measuring phosphorus samples with concentrations below 0.10 mg/l. Please identify background literature that supports this claim. What is the correlation between observed and simulated phosphorus concentrations for all data above 0.10 mg/l? (21)

Response: Background literature supporting the statement made regarding the greater uncertainty in measuring phosphorus samples with concentrations below 0.10 mg/l can be found in numerous references; the report provides two: USEPA, (1993) "Guidance on Evaluation, Resolution, and

Documentation of Analytical Problems Associated with Compliance Monitoring: Washington, D.C., U.S. Government Printing Office, USEPA 821-B-93-001, June 1993; and, USEPA, (1985) "U.S. Code of Federal Regulations, Title 50," Washington, D.C., U.S. Government Printing Office, November 13, 1985, 46906. Statistical analysis, including correlation between observed and simulated phosphorus concentrations for data above 0.10 mg/l, would be of limited usefulness and not technically supported because of the small number of observations- only 10 data points exceeded the 0.10mg/L TP concentration.

32. Comment: On page 3-3 of the technical document for the Pompton Lake TMDL, please identify either the literature sources or the monitoring data on which the estimated baseflow concentration of 0.01 mg/l is founded. Please explain whether the baseflow concentration could vary based on the specific soils and bedrock present in the watershed? (21)

Response: It is important to note that the base flow component referred to in Pompton Lake TMDL document should not be confused with the tributary baseflow component used in the dynamic modeling for the overall Passaic River Basin TMDL document. Tributary baseflow in the latter document is the in-stream total phosphorus concentrations taken under 70th percentile low flow and includes both groundwater and residual from surface runoff/interflow. In the Pompton Lake document, the base flow concentration consists of ground water only. A base flow separation method was used with areal runoff loading coefficients to derive nonpoint source loadings in the Pompton Lake document. While ground water phosphorus concentration may vary based on local conditions, but in this region, based on the USGS ground water data for Passaic County, the 90th percentile dissolved phosphorus is 0.01 mg/L and the mode of the data is also 0.01 mg/L. This substantiates the use of this value for the base flow/ground water component in the Pompton Lake TMDL.

33. Comment: An explanation is needed as to how septic systems are incorporated into the TMDL analysis. The Wanaque Reservoir watershed seems to be impacted by septic system runoff since relatively high nitrate concentrations are found in West Brook, Cupsaw Brook and Erskine Brook, while the total phosphorus concentrations are similar for all tributaries. (See Table 2-6 on Page 2-4 of the technical document). Although one can surmise that these subwatersheds do not have sewer service, there could be an alternative explanation. The documents provide no information regarding the location of non-sewered areas or the failure rates of septic tanks in both the Wanaque Reservoir watershed and the greater Passaic-Pompton-Ramapo watershed. Furthermore, do areal phosphorus loadings for urban areas differ if they are served by separate storm water and sanitary sewer systems, combined sewer systems, or septic systems? This could be useful in determining the reduction in non-point source pollution that could be reasonably expected and also in providing more details on BMP implementation. (21)

Response: The majority of TMDL Approach Areas 1 and 3 are covered by centralized sewer systems. The majority of TMDL Approach Area 2 and 4 is serviced by individual septic systems and is taken as a headwater boundary condition to the TMDL model. Areas served by septic systems can be expected to contribute higher concentrations of nitrate either overland from failing systems or through groundwater entering the streams, because this compound is soluble and very mobile. However, the same is not true of phosphorus. The TMDLs and the technical documents address phosphorus loading from all nonpoint sources by hydrograph separation and assigning EMCs for each land use category. EMCs are derived through monitoring or Unit Areal Loads, and the non-storm load is estimated using the tributary baseflow monitoring results or groundwater data, depending on the approach applied (see discussion of Approach Areas in the TMDL document). Phosphorus is generally immobilized in the soil matrix, which is borne out by data on ground water concentrations of phosphorus in the basin (see

response to Comment 32). Absent information about a particular septic system problem, the approaches used for nonpoint sources are believed to adequately account for septic system loading. Nevertheless, malfunctioning septic systems (e.g., those that result in a discharge directly to a water body) are identified as potential sources in Section 4.0 Source Assessment (page 34) and in Section 7.0 Implementation Plan (page 48), but the Department is not aware of any actual malfunctions. This potential would be as the result of a malfunction, not by design. The Department investigates reports of noncompliance with NJPDES permits, illegal point and nonpoint discharges, and accidental discharges. These discharges are not considered ongoing point sources that warrant a WLA; rather, they are ephemeral events that are addressed through compliance and enforcement measures as they occur. Regarding different loadings delivered by separate storm sewer areas compared to combined sewer areas, the loading coefficient method is not used in the very limited spatial extent of the study area in which combined sewers are used. In any case, phosphorus loadings from combined sewers were calculated separately from other stormwater loadings, as shown in Table 14 of the Passaic TMDL.

34. Comment: The Wanaque Reservoir model appears to over-estimate algal biomass during the 2002 drought period and the Wanaque Reservoir TMDL scenario results were incorrectly compared with the seasonal average target. (15)

Response: The observation that algal biomass is over-estimated during the 2002 drought is true in some locations and is believed to be the result of operational practices to prevent algal blooms during this period (e.g., application of alum, ultrasound treatment, aeration, etc.) Note that the model tracked the observed data during year 2002 at the Erskine station (Figure 4.15), where no alum was applied. Also, the available database indicates a relatively high nitrate concentration response to diversion loading at Raymond Dam during this period – concentrations that are largely unaffected by such practices. Since the model generally tracked the chlorophyll-*a* concentration data during other drought years (e.g., 1995, 1998), it is not overly conservative in predicting reservoir chlorophyll-*a* concentrations, absent taking extraordinary measures to suppress expression of algae.

35. Comment: The areas in the Wanaque Reservoir where characterizations are performed are not appropriate to determine the real background from undeveloped portions of the contributing drainage areas or to reveal how funky the reservoir gets when the pumps are turned on. (20)

Response: The TMDL modeling approach addressed the entire Wanaque Reservoir, and both graphic and/or tabular outputs for several stations within the reservoir representing both background (Erskine) and “hot spots” (Raymond Dam and West Brook) within the reservoir were presented in the supporting documentation (Najarian, 2005). The critical locations reflective of the most severe effects from diversion pumping were specifically modeled, ensuring that the critical location is accounted for when specifying load reductions.

36. Comment: The reservoir model does not accurately represent non-diversion and diversion loads to the reservoir; the dynamics of diversion events are not modeled accurately. (15)

37. Comment: The Department needs to explain the rationale for the parameters used in the reservoir water quality. (15)

38. Comment: Cycling of phosphorus in the Wanaque Reservoir is an important component of the model simulations that form the basis of the TMDL calculation. Insufficient data is provided to confirm that the Reservoir model accurately describes phosphorus dynamics. The Department has

access to a numerical simulation model, in-reservoir monitoring data, and well-defined reservoir hydraulics to defensibly support its TMDL. Data on Reservoir-wide chlorophyll-*a* concentrations, as well as water treatments that NJDWSC implements, should be made available so as to confirm the effectiveness of the TMDL in protecting the designated use of public water supply. (15)

Response to Comments 36-38: These comments were made on the Phase 1 TMDL and were repeated for the Phase 2 TMDL. The reservoir model is a hydrothermal/water quality model that was designed and is appropriate for evaluating the effect of diversion scenarios on water quality and trophic state in the reservoir. The reservoir model, Laterally Averaged - Wind and Temperature Enhanced Reservoir Simulation (LA-WATERS) simulates laterally averaged velocities, water temperature and constituent concentrations at all grid locations for a selected period. Simulated constituents include organic phosphorus, dissolved inorganic phosphorus, particulate inorganic phosphorus, dissolved oxygen, carbonaceous biological oxygen demand, nitrogenous biological oxygen demand and temperature. In addition, a relationship was derived between phosphorus and chlorophyll-*a*. The model simulates responses in these parameters, given specified loading inputs from diversion and natural drainage sources and the hydraulic dynamics of inflow/outflow volumes in this managed reservoir system. The Najarian 2005 TMDL study report provides sufficient data for the evaluation of model performance and results. Data is provided in the form of graphic outputs, summary loading budgets, and error analysis. For the Phase 2 TMDL, which targets a watershed criteria expressed as chlorophyll-*a*, additional information regarding the simulation of chlorophyll-*a* response, as well as tabular chlorophyll-*a* data for the Wanaque Reservoir at Raymond Dam, were provided in a supplemental report (Najarian, 2007). While the actual model code was developed under funding of the NJDWSC and remains proprietary to that agency, the reservoir model has been extensively documented in two prior reports ("Influence of Wanaque South Diversion on the Trophic Level of Wanaque Reservoir and its Water Quality Management Program", Najarian 1988 and "A preliminary assessment of water quality status of the upper Passaic River and re-verification of the Wanaque Reservoir model", Najarian 2000). Further, the model's hydrothermal and water quality algorithms have been published in peer-reviewed journals ("Mixed-Layer Hydrothermal Reservoir Model," M. ASCE. Journal Hydraulic Engineering. 120 (7), 846-862 and "A Multicomponent Model of Phosphorus Dynamics in Reservoirs," Water Resources Bulletin, 20, No. 5:777-788).

39. Comment: Key aspects of the Passaic TMDL are supported as technically defensible; however, it is also technically flawed in several key aspects that need to be addressed before adoption. The Wanaque Reservoir TMDL is flawed since only one alternative was evaluated. The seasonal average chlorophyll-*a* in Tables 1 and 2 of Najarian 2007 shows the summer average chlorophyll-*a* is 9.2 mg/L. It appears that the TMDL for Wanaque Reservoir including the MOS was the product of a guess that the TMDL LTA for Dundee Lake would "work" for the reservoir. More interchange between the river and reservoir modeling should be performed. The integrated model framework of DAFLOW plus the dynamic Passaic River Model plus the Wanaque Reservoir Model (the product of years of development and considerable public and discharger monies) has not been fully utilized to arrive at a TP load scenario for the reservoir. Model runs for existing conditions, Baseline Future Conditions, Most Extreme Reduction of Phosphorus (MERP) and TMDL scenarios with alternate LTAs and seasonal phosphorus reduction are needed. These analyses would provide an understanding of how the reservoir chlorophyll-*a* is influenced by management of the Passaic River phosphorus. (12)

40. Comment: The final Wanaque Reservoir TMDL was determined with a single reservoir model projection. It was not used to determine load reductions, including diversion loads, required to meet the new chlorophyll-*a* standard; a TMDL has not been established. (13)

41. Comment: Only one run of LA-WATERS was done to confirm that the chlorophyll-*a* in the reservoir would not exceed 10 ug/L with the LTA of 0.4 mg/L and 60% NPS reduction. This does not establish that the criterion could not be met by less stringent LTAs. (10)

Response to Comments 39-41: More than one TMDL scenario was evaluated to arrive at the TMDL for Wanaque Reservoir. As stated in Omni 2007, p. 172, "Time series of phosphorus concentration predictions were provided to NJDEP and their technical consultant for the Wanaque Reservoir TMDL Study (Najarian and Associates) in order to predict the summer average phytoplankton in the Wanaque Reservoir associated with each phosphorus reduction scenario. Several combinations of point source effluent concentrations and nonpoint source phosphorus reductions were tested. Through an iterative process, it was determined that a point source long-term average (LTA) effluent concentration of 0.4 mg/l TP and a 60% reduction of phosphorus loads from runoff associated with urban and agricultural land uses will satisfy the water quality end point in the Wanaque Reservoir." According to the iterative simulations performed by Najarian and Associates based on Wanaque South intake concentration boundaries provided by Omni Environmental, the wasteload allocations and load allocations established by the TMDL were the highest allowable while still satisfying the water quality target, with a margin of safety and an allowance for reserve capacity, in the Wanaque Reservoir.

42. Comment: LA-WATERS does not directly model chlorophyll-*a*, unlike current state of practice using mathematical models to predict the impacts of nutrient dynamics. The model was calibrated to total phosphorus data with chlorophyll-*a* based on organic phosphorus. It is therefore not an appropriate tool to determine the chlorophyll-*a* levels under alternative loading conditions. (13)

Response: The reservoir model does not directly model chlorophyll-*a*, however, the model does adequately predict observed chlorophyll-*a* concentrations by using the observed relationship between the simulated organic phosphorus and observed chlorophyll-*a* concentrations. A full discussion of the phosphorus-chlorophyll-*a* relationship was provided in the supplemental report for the Wanaque Reservoir modeling (Najarian, 2007). Because the model prediction of observed chlorophyll-*a* concentrations is based on nutrient loading, which is directly modeled, the model is an appropriate tool for use in developing the TMDL.

43. Comment: The basis of Najarian Wanaque Reservoir Model is flawed by incorrect loading assumptions for its calibration. The calibration/validation of the Wanaque Reservoir Model was presented in Najarian 2000 and Najarian 2005 as based on the assumption that total phosphorus is conservative in the Passaic River and that point source phosphorus is not attenuated. Reservoir loads used for the calibration and validation were calculated based on the assumption of phosphorus as conservative. Najarian 2000 and Najarian 2005 acknowledge the shortcoming of the load development methodology. Therefore, in the Phase 2 TMDL, the Wanaque Reservoir Model calibration and validation should have been checked using Passaic Model total phosphorus and ortho-P results at Two Bridges for all model years. Since this was not done, the model may not be properly calibrated. Use of the Reservoir Model is questionable when calibration and validation may be in doubt. Additional Wanaque Reservoir Model runs should be performed to address this concern. (12)

Response: The prediction of phosphorus concentration at the Wanaque South intake used to provide a boundary condition for the Wanaque Reservoir model in the Phase 1 TMDL, while based on a simplified dilution model, is consistent with the prediction generated by the Passaic River model (Omni 2007) for the existing condition in the Phase 2 TMDL. The Passaic River TMDL model, which accounts for attenuation and other kinetics throughout the system, was used to generate the future condition phosphorus concentrations at the Wanaque South intake for the Wanaque Reservoir

simulations. Both models compare favorably with one another and with the observed data. This is expected, since both models are calibrated to match the observed conditions. The reservoir model calibration/validation was based on actual data. The calibrated model is then used to simulate what would happen in the reservoir if inputs are altered. How future loads are estimated does not affect the calibration; the reservoir model simulates the effect of phosphorus loads once delivered into the reservoir.

44. Comment: The LA-WATERS model was developed to determine the impact of diversion waters on the water quality it the reservoir. The same model determined that diversions to the reservoir would not cause an excessive detriment to water quality (Najarian 1988). The current results contradict the previous results. (13)

Response: It is not correct to assume that the Najarian 2005 TMDL study using LA-WATERS represents a direct continuation of the methodologies of previous relevant studies using LA-WATERS, such as the study of the impact of diversion waters on the water quality of the reservoir in 1988. The Najarian 2005 TMDL study and refinement of LA-WATERS represents the culmination of a series of studies dating back to 1987 regarding water quality issues in the Wanaque Reservoir and its intake site. In each successive study, improvements were made to address limitations of the previous studies. Thus, comments regarding previous study limitations and inconsistencies are irrelevant. The primary intent of the Najarian (2000) Report (entitled "A preliminary assessment of water quality status of the upper Passaic River and re-verification of the Wanaque Reservoir model") was to assess the water quality status of the River. Thus, its analysis of the Passaic River dealt with a statistical assessment of water quality data. While this approach successfully addressed water quality status issues, it was of limited use in addressing the long-term loading regime of the river. Difficulties included the limited availability of data for selected analysis periods and uncertainties in the calculation of monthly average loads based on a limited number of observations. For such reasons, the Najarian 2000 Report did not form the basis for the 2005 Najarian TMDL study. Rather, a new model-based approach was developed during the 2002 Watershed Characterization studies for WMA 3, 4 and 6. This mass-balance approach was then refined and enhanced as part of the Najarian 2005 TMDL study. This method provides a simulation of daily in-stream total phosphorus concentrations and diversion loads. The approach was then verified using the entire set of available data – a procedure that sidestepped the limitations of the 2000 report. As such, the Najarian 2005 TMDL study does not represent an outgrowth of the 2000 study but, rather, a totally different approach developed to reduce the limitations of the 2000 study. Thus, as the result of subsequent model validation studies, the accuracy and reliability of the model was improved as new information became available. As the improved simulation of the river-loading regime allowed for a more accurate simulation of Reservoir inputs, the Najarian 2005 TMDL and the supplemental report to the Wanaque TMDL, (Najarian, 2007), supersede the relevant findings of the earlier reports.

45. Comment: A number of model constants and coefficients have large variations over the model domain or are unusual, as follows:

-The settling applied to particulate inorganic phosphorus ranges from 0-40% depending on location. Although the model report states that the fraction available for settling is 60%, the model inputs have a fraction dissolved of 0.6 and therefore a fraction particulate of 0.4. This would only be calculated with partition coefficient values on the high end of the range combined with the 97th percentile of the solids measurements made for the TMDL study.

-Organic phosphorus is subject to settling in the same reaches, but only at a rate of 10%. The fraction particulate for BOD, algae and organic nitrogen is zero and they are not subject to settling. These inconsistencies have not been explained.

-The rates at which phosphorus variables settle changes dramatically from segment to segment. Settling is entered as flows, which can be considered settling velocity multiplied by the surface area of the segment. The model has some large sections of the river with constant settling flows, which results in variations in settling velocity from segment to segment. Other sections of the river have velocities that may change by a couple of orders of magnitude and back over only a few segments as well as many areas with zero settling flows.

-The SOD values and ammonia fluxes also vary greatly on a spatial basis. These values are model inputs and do not respond to changes in loads, although the WASP model is capable of calculating nutrient and SOD fluxes. By specifying fluxes as model inputs, the TMDL analysis cannot track mass rigorously.

-There are a number of model parameters that the Wanaque Reservoir and Passaic River models have in common. Some values are consistent, but others are not: The growth rate used in the WASP model is nearly half the value used in LA-WATERS. Respiration and death are lumped in LA-WATERS and considered separately in the river model; the combined values from the river model are 2.5 times greater at 20 degrees Celsius and show much greater temperature dependence. The phosphorus half saturation values are inconsistent; the value used in the Wanaque Reservoir would require ten times the phosphorus to reach half of the maximum growth rate, thereby inducing a phosphorus growth limitation at a much higher concentration. The river model considers the impact of nitrogen concentration on algal growth, which the reservoir model cannot account for. Both models settle organic phosphorus, but in the reservoir model, organic phosphorus represents algal biomass, which does not settle in the river model. (13)

Response: The Passaic River WASP model was a complex undertaking that involved combining multiple processes and datasets within a single modeling framework. The model choice, calibration and validation were performed using the most appropriate scientific tools available. The modeling framework developed exclusively for the Passaic River Basin is described in detail in the Passaic River Basin Nutrient TMDL Study report (Omni 2007). Assumptions used in a river model may reasonably differ in a model designed to simulate a reservoir, given the significant differences in hydrology. Regarding phosphorus settling and SOD in the river model:

Phosphorus Settling

Inorganic phosphorus settling in the Passaic River comprises more than physical settling of particulate material. It also incorporates processes occurring in the river that are not explicitly simulated by WASP7. "Settling rates were used to represent the physical settling of organic and inorganic particulate phosphorus, adsorption of orthophosphate to the sediment bed and extra phosphorus uptake by macrophytes in certain areas of the Passaic River and its tributaries due to influence of wetland meadows." (Omni 2007, p. 102)

The settling of inorganic phosphorus involves two parameters: the fraction of particulate inorganic phosphorus available for settling and settling velocities. Figure 1 of the supplemental comments by HydroQual relates water column TSS with particulate inorganic phosphorus, which is not applicable to the context of inorganic phosphorus settling adopted in the model. Since the phosphorus settling component lumps multiple wetland meadow processes involving inorganic phosphorus uptake which are not explicitly represented in WASP7, settling rates used for inorganic phosphorus can not be used as a basis for the particulate settling of other water quality constituents. Applying similar settling rates to particulate BOD, organic nitrogen and organic phosphorus would be incorrect.

Natural processes such as the excess phosphorus uptake by algae and the adsorption of inorganic phosphorus to the bottom sediment vary spatially in large and diverse systems such as the Passaic

River Basin. The different settling rates were applied to the Passaic River Basin in order to capture the spatial variability of natural processes represented in the settling component.

The usage of the settling component to address processes that are not explicitly simulated in WASP7 does not jeopardize the model performance for establishing the TMDL. The calibration of inorganic and organic phosphorus is excellent for the great majority of sampling stations. This is evidence that all sources, sinks and processes affecting the phosphorus transformations in the system are being accounted for adequately in the model.

Sediment Oxygen Demand

Sediment Oxygen Demand (SOD) and Ammonia fluxes were assumed as steady state and spatially variable parameters in the Passaic River model. Previous versions of the WASP model were able to simulate the diagenesis of organic matter in the sediment. However, WASP7 does not have this capability. WASP7 was the most recent version of the model when the Passaic River modeling was initiated. WASP7 included several improvements from its previous versions, most importantly the inclusion of benthic algae as a state variable. The simulation of benthic algae was a key factor for the Passaic River modeling. Most of the primary productivity in the Passaic River and its tributaries is due to the presence of benthic algae and macrophytes. Phytoplankton is of significance only in the lower sections of the Passaic River near Dundee Lake. The previous versions of the WASP model were not able to simulate the effect of attached algae and plants. Given the importance of primary productivity for the TMDL, the WASP7 framework was the appropriate choice for the Passaic River modeling.

In addition, the dynamic simulation of SOD is not justified for the Passaic River Basin. Simulating SOD response based on measurements introduces substantial uncertainty into the modeling framework. A meaningful calibration requires several SOD measurements over time and in multiple locations. In the case of the Passaic River, SOD results from the decomposition of macrophytes and residual organic matter that are accumulated in the sediment bed. Major floods could cause significant re-suspension of this particulate material. A sediment transport model would be necessary to account for these losses. Settling of organic matter discharged by treatment facilities is significant when BOD concentrations are high. Presently, the discharge of organic material by treatment facilities is not significant and BOD concentrations are very low throughout the Passaic River Basin.

Decomposition of particulate organic material from phytoplankton is clearly not impacting SOD in the lower Passaic River. Phytoplankton is of significance only at the most downstream sections of the Passaic River where SOD is low. Relatively low SOD levels measured by HydroQual in 2003 at sampling station PA11 (1.4 and 0.4 g/m2/day) support the assumption that phytoplankton settling and decomposition is not affecting SOD in the downstream branches of the Passaic River.

There are no short-term processes affecting SOD in the Passaic River Basin. Organic material from attached algae and plant decomposition is not significantly mobile, BOD levels are very low, and phytoplankton decomposition is believed to be of importance in the lower sections of the Passaic River. In addition, there are not enough data to support a formal calibration of the dynamics of SOD in the Passaic River Basin. Therefore, it is very reasonable to assume SOD and ammonia fluxes as spatially variable and steady state parameters.

46. Comment: The Dundee Lake portion of the Passaic TMDL model was not well-calibrated for chlorophyll-*a*, tending to over-predict by a factor of 2. (11)

Response: As explained in detail in the Passaic River Basin Nutrient TMDL Study report (Omni 2007, pp. 116-118), the Passaic TMDL model is well-calibrated for chlorophyll-*a* particularly in the most downstream branch of the Passaic River, in which Dundee Lake is located. It does not over-predict chlorophyll-*a* by a factor of two. Several factors influencing phytoplankton growth are not subject to calibration, namely stream water temperatures and solar radiation inputs. Similarly, transport-related inputs, which are defined by the flow model and were previously calibrated, also influence phytoplankton growth. Phytoplankton growth rate is the most important chlorophyll-*a* calibration parameter; a value of 1.25/day was chosen as the final calibrated parameter, which is within the range suggested by the literature for phytoplankton growth rate. Two PVSC stations with a significant number of chlorophyll-*a* data throughout the simulation period were chosen for calibration: PVSC1 (Passaic at Totowa Avenue) and PVSC4 (Passaic at Market St.). Omni chlorophyll-*a* data, which consisted of three low flow events sampled in 2003, were used for validation purposes. A good fit of chlorophyll-*a* was obtained for the entire basin. The peak measured chlorophyll-*a* concentration of 97 µg/l at PVSC4 on 8/14/2002 was captured perfectly. Furthermore, the mean errors were -3.3 and 4.7 µg/l at PVSC1 and PVSC4, respectively.

47. Comment: The Passaic River TMDL model does not include any settling for algae. The settling of algae can be an important component of algal loss, especially in shallow waterbodies and/or water bodies with a long detention time (low flow). A run of the model introducing a modest settling rate dramatically reduces the chlorophyll-*a* concentration in the lake. If an important process such as algal settling that is normally included in eutrophication modeling is absent, an explanation is needed. (11)

Response: Most of the primary productivity in the Passaic River and its tributaries is due to the presence of benthic algae and macrophytes. Phytoplankton is of significance only in the lower sections of the Passaic River near Dundee Lake. Phytoplankton settling could potentially increase seasonal sediment oxygen demand (SOD) at shallow and slow moving water bodies. However, the decomposition of particulate organic material from phytoplankton clearly does not impact SOD in the Passaic River, since measured SOD is low at the sections of the Passaic River where phytoplankton growth is significant. Model calibration demonstrates that settling of phytoplankton in the relatively limited branch of the Passaic where significant phytoplankton growth occurs is not important to capture observed phytoplankton growth patterns.

Attenuation:

48. Comment: The TMDL does not take location and/or size of point sources into account. The TMDL assigned the same wasteload allocation to all dischargers based on an LTA of 0.4 mg/L of total phosphorus. There is no attempt to take into account attenuation of phosphorus loads in the Passaic River. Total phosphorus (TP) is not conservative in the Passaic, especially at low-flow conditions. Using the watershed model, the effect of the WTSA plants at the point of discharge and at the identified endpoints was calculated. At current concentrations, the WTSA contribution to Wanaque South load is less than 5 percent and at the 0.4 LTA less than 1 percent. The graphs submitted show the negligible impact of WTSA facilities. The phosphorus discharged by WTSA, whose three plants are located a significant distance from both endpoints, attenuates before it reaches the endpoints. A properly formulated Passaic TMDL must account for the attenuation associated with these long distances in determining the LTAs for the various dischargers. The TMDL should be less stringent than the LTA of 0.4 mg/L proposed basin-wide. (12)

49. Comment: The commenter expressed appreciations for the efforts made by the NJDEP and Omni Environmental that resulted in the 2007 TMDL, but believes that it is still seriously flawed and does not represent the sound science needed to justify imposing limits. Specifically, the 2007 TMDL fails to account for attenuation, instead imposing a "uniform" effluent limit on all STPs. For treatment plants, which are 35, 39 and 41.5 miles upstream of the Wanaque Reservoir end point and 50, 54, and 57 miles upstream of the Dundee Lake endpoint, HydroQual's utilization of the model establishes that essentially only 1% of the phosphorus in the effluent from these three plants reaches either of the two endpoints. The 2007 TMDL improperly assumes that *all* of the phosphorus from the WTSA sewage treatment plants, located 35, 39 and 41.5 miles upstream from the confluence of the Pompton and Passaic River, and 50, 54 and 57 miles upstream of Dundee Lake, reaches these TMDL endpoints. A 0.4 mg/l LTA for *all* dischargers is inappropriate, inequitable and not supported by the very science on which the TMDL purports to be based. Individualized LTAs can and should be calculated, reflecting each sewage treatment plant's effective phosphorus load contribution to the endpoints. The WTSA plants' contribution is *de minimus* and they should only be required to continue to meet their EEQ-calculated limits. It would be arbitrary, capricious and unreasonable for the Department to adopt a TMDL that would require the expenditure of significant public funds and production of adverse environmental impacts from the addition of chemicals and the increased generation of sludge to remove phosphorus given attenuation that established in the model. (10)

Response to Comments 48 and 49: The Passaic River Basin model does not assume phosphorus is conservative and does account for attenuation. As described in detail in the Passaic River Basin Nutrient TMDL Study report (Omni 2007), the dynamics of nutrient cycling as well as loss mechanisms for water column phosphorus-attenuation mechanisms were simulated using the Water Quality Analysis Program 7.0 (WASP7). Model results show that the degree of attenuation depends greatly on the flow and diversion conditions, and most of the phosphorus load that originates in the Dead River persists to both of the end points. For example, approximately 70-80% of the phosphorus load from point sources that discharge to the Dead River reaches Two Bridges. In 2001, over 60% of the phosphorus load from point sources that discharge to the Dead River reached Dundee Lake; in 2002, just under 40% of the phosphorus load reached Dundee Lake. The difference between the two years is primarily due to increased water supply diversions from the Passaic River in 2002.

Therefore, attenuation does not render phosphorus originating in the Dead River watershed irrelevant to the end points in Wanaque reservoir and Dundee Lake. The commenter's analysis of the influence of WTSA phosphorus load on phosphorus concentration at the endpoints is inappropriate, since it uses the annual maximum total phosphorus concentration as the basis of comparison. However, the commenter's analysis does demonstrate the importance of WTSA phosphorus load to the phytoplankton concentration at Dundee Lake: Figure 3 in the July 6, 2007 comment letter provided by HydroQual on behalf of Warren Township SA depicts chlorophyll-*a* concentrations with different contributions from Warren Township's treatment facilities. This figure shows that, even if all other point sources in the entire basin were reduced to an LTA of 0.4 mg/l total phosphorus, allowing WTSA to discharge at its permitted maximum concentration would increase the growing season average phytoplankton concentration at Dundee Lake by about 25%.

In accordance with USEPA's Protocol for Developing Nutrient TMDLs (1999), "the administering agency must find an acceptable combination of allocations that adequately protects water quality standards (p. 7-1)." There are many factors that might affect the allocation decisions, including economics, equitability, and implementation. Alternatives in terms of assigning wasteload allocations among multiple dischargers include: equal percentage treatment; equal effluent concentration, and various allocation schemes that result in variable wasteload allocations. In the case of the Passaic

River TMDL, an equal effluent concentration was assigned to all wastewater dischargers as the most equitable alternative for the wasteload allocation scheme.

Notwithstanding the above, given the large number of dischargers in the basin, the affected dischargers are best equipped to evaluate the capabilities of the individual facilities and determine if there are ways to maximize efficiency and cost effectiveness in achieving the water quality objectives through water quality trading. This was a key reason that this basin was selected for award of a Targeted Watershed Grant from EPA to develop such a program. Dischargers will have one year from the date of NJPDES permit issuance to negotiate trades, which, upon approval, would be incorporated into NJPDES permits.

Alternatives:

50. Comment: The Passaic TMDL was developed without consideration of alternatives. The impacts of phosphorus within the Passaic River Basin can be addressed in a more cost-effective manner. No other reservoir management alternatives beyond the historic pumping and diversions that took place during the 1993-2002 time period were considered. Alternate management scenarios could include reduced pumping during severe drought conditions, examination of the use of the Monksville Reservoir stored water instead of diversions, and/or direct routing of the diversion to the NJDWSC water treatment plant during severe or critical situations where diverted water never enters the reservoir while delivering the same amount of pumped water for raw water supply. Due to the enormous cost of implementing the proposed Passaic TMDL, the NJDEP must explore these cost-effective alternatives to satisfy the TMDL goals. The Passaic TMDL was developed for reduction of Wanaque South phosphorus load without consideration of the relocation of the Two Bridges Wastewater Treatment Facility outfall downstream of the intake. A preliminary analysis indicates this action could result in a 20% reduction in phosphorus load to the reservoir, and could well result in significantly less stringent, less costly LTAs. In light of the costs associated with implementing this TMDL, it is in the best interest of all affected parties to address the impacts of phosphorus in the most cost effective manner. (12)

51. Comment: The TMDL should include a thorough analysis of alternatives for achieving the chlorophyll-*a* criteria at both endpoints that reduce the phosphorus removal requirements for the STPs and for the nonpoint sources. *N.J.A.C.* 7:15-7.2(h) requires that, where feasible, "the TMDL proposal shall include the various management options and alternatives which will ensure that the surface water quality standards will be attained." Thus, the Department is obligated to provide such option and alternatives, or demonstrate why doing so is not feasible. The TMDL must address: NJDWSC operational modifications, water treatment by NJDWSC prior to diversion or release into the Wanaque Reservoir, relocation of the Two Bridges STP outfall and aeration at Dundee Lake. Aeration could be put in place on a trial basis to ascertain its viability and impact on chlorophyll-*a* levels, which could reduce the TP reduction needed at the STPs. The burden of establishing the viability of more cost-effective alternatives should not be on the dischargers or members of the public. The objective should be to properly identify the problem created by phosphorus loads within the river system and determine the most cost-effective manner to address that problem. The Department needs to devote the time and resources to evaluate the viability of aeration at Dundee Lake. (10)

52. Comment: The Department failed to consider the use of in-stream aeration as a cost effective alternative technology. Citing *N.J.A.C.* 7:15-7.6(d)4, *N.J.A.C.* 7:9B-1.5(e)1, and *N.J.A.C.* 7:15-7.2(h)1, the Department did not select the most cost effective and environmentally sound means of

addressing water quality concern in Dundee Lake. The TMDL report contains no study of the costs of achieving those goals, nor of any alternatives, and does not address the negative environmental consequences of imposing more stringent limits on all wastewater facilities. In accordance with its regulations, the Department should have considered the allocation of an equal effluent concentration to each source, the allocation of an equal percent removal to each source, the allocation of an equal effluent mass loading to each source and the minimization of the total treatment expenditure for the entire waterbody segment. Surface Water Quality Standards state that water-quality based effluent limitations should be established in a cost effective manner "so as to minimize total expenditures." Regulations require that TMDLs should take into consideration all management options and alternatives for ensuring that the water quality standards will be attained and that "[m]inimization of the total treatment expenditure for the entire waterbody segment" is one of the approaches to be considered in the development of allocation options. *N.J.S.A.* 58:10A-8 states that prior to establishing more stringent effluent limits the DEP must "determine if there is a reasonable relationship between the economic and social costs of achieving such limitation,…and the social and environmental benefits to be obtained…" The Department requested that dischargers report on costs to achieve potential effluent limits. A review of the reports reveals the costs are staggering. In-stream aeration, by contrast, would meet water quality objectives at a fraction of the cost. The TMDL report should be withdrawn and a roundtable of interested parties (should be) convened to explore the use of innovative solutions to meet the identified water quality objectives. (18)

53. Comment: The Passaic TMDL for the Dundee Lake endpoint was developed without consideration of any other alternatives beyond phosphorus removal. One such alternative is in-stream aeration. Reducing supersaturation of dissolved oxygen through mechanical means may disrupt algal productions as well. Manufacturers of aeration equipment were contacted and costs associated with installation and O&M are significantly less than those for phosphorus removal. Further, aeration equipment could be installed and begin achieving water quality improvement much more quickly. The next step would be to determine specifications for installation in Dundee Lake and possibly piloting the operation. (11)

54. Comment: The Department did not address other alternatives to achieve appropriate controls to achieve the Wanaque Reservoir endpoint, such as altering the withdrawal and and pumping scenarios used by NJDWSC, as recommended in the New Jersey EcoComplex July 30, 2002 Interim Report. (1), (2), (15), (23)

Response to Comments: 50-54: *N.J.A.C.* 7:9B-1.5(e)1 states policies for applying water quality-based effluent limitations and does not apply to TMDL development. This provision allows for assignment of different WQBELs to different dischargers, provided the overall water quality objectives are met, to achieve a more beneficial solution on a study area basis. The Department is providing an opportunity, through water quality trading, to achieve the TMDL objective in a more cost effective way. *N.J.A.C.* 7:15-7.2(h) refers to the Department's commitment to identify the management measures that are expected to attain the load reductions called for through the TMDL study, not a requirement for a cost effectiveness analysis of alternative means to attain the load reductions. The Department sets forth these measures in the implementation plan section of the TMDL. Within the implementation plan, the Department identifies regulatory and non-regulatory tools to achieve the reductions, matches management measures with actual or potential implementing entities, and identifies possible funding sources for non-regulatory measures.

Regarding the cost for phosphorus removal at wastewater treatment facilities, a recent report, "Advanced Wastewater Treatment to Achieve Low Concentrations of Phosphorus" (EPA 910 R 07

002, April 2007), contains findings indicating phosphorus removal at the levels called for in these TMDLs is feasible, low cost on a per user basis and provides ancillary benefits by enhancing removal of other pollutants, such as pharmaceuticals. Specifically, phosphorus removal to 0.3 mg/L was achievable using enhanced biological nutrient removal and the monthly residential sewer rates charged ranged from $18 to $46. Several treatment authorities did respond to the Department's request to provide cost estimates for achieving phosphorus reductions. While the total cost for upgrading all of the facilities was stated to be in the millions of dollars, the number of people and businesses served by the collected facilities is very large and the costs spread out over a number of years, so that the impact to an individual user is not expected to be significant.

Several alternative approaches were suggested by commenters in lieu of requiring reductions from the point source discharges. Under the Clean Water Act, the expectation is that, where a TMDL identifies that pollutant loading is causing exceedance of water quality standards, attainment of the standards will be achieved by reductions of the pollutant load. Further, the pollutant load reduction is expected to come primarily from regulated sources. Where non-regulated sources contribute to the load and load reductions from these sources are identified in lieu of obtaining all needed reductions from regulated sources, there must be reasonable assurance that reductions from non-regulated sources will be achieved. Other outcomes are possible where exceedances are due to natural conditions (standards are adjusted), technology does not exist to attain the water quality standards (variance option), or there is no reasonable way to attain the standards and support the designated use (use attainability option). Here, point sources are responsible for a substantial amount of the phosphorus loading to the system and the load reductions required are clearly achievable.

With regard to the specific alternatives suggested: In-stream aeration might mask a portion of the problem by ameliorating some of the adverse water quality effects, such as attenuating dissolved oxygen swing, but there is no evidence that it would reduce excessive primary productivity sufficiently to achieve the water quality objectives. In addition, there would be implementation issues with such an approach: installing infrastructure within a riverine system subject to flooding would be problematic; and there is no regulatory or institutional framework to cause such a system to be built, maintained and compliance assured. Therefore, options that do not address the root cause of the water quality problem or use the stream for treatment, such as in-stream aeration or addition of alum directly to the waterbodies, cannot be entertained. Relocation of the TBSA outfall, if proposed, would be considered. However, if proposed, the model would have to be rerun with new assumptions since loading to the Dundee Lake endpoint would increase if TBSA effluent is no longer diverted into Wanaque Reservoir. Regarding the role of NJDWSC operations, there are two factors to be considered. NJDWSC supplies drinking water to more than 3 million of New Jersey's residents. Management of the system needs to be flexible enough to allow the maximum safe yield without deleterious water quality impacts. While safe yield and allocation decisions do consider water quality implications, directing NJDWSC to change operations for the primary purpose of minimizing the requirement for dischargers to reduce the introduction of a pollutant into the river system is not appropriate. FW2 waters are to be suitable for drinking water use with conventional treatment. Therefore, the quality of the water at the Wanaque South intake point must support the drinking water use, with or without diversion activities.

55. Comment: The endpoint in Dundee Lake is to be measured between June 15 and September 1, but the effluent limit is intended to apply from May through October. Based on an independent run of the model, the target condition was met with effluent limits at 0.4 mg/L only in June, July and August. To meet the Passaic TMDL for Dundee Lake, phosphorus removal at the Lower Passaic treatment plants is only necessary from June through August. (11)

Response: It is true that during the critical simulation year of 2002, conditions favorable to produce high phytoplankton concentrations were limited to July and August. However, the TMDL is intended to be protective during future summer conditions. While summer algal blooms are most common during July and August, periods conducive to high algal production can occur anytime from May through October. For instance, the most critical months for algal growth during 2001 were September and early October. In 2004, late June through the first week of July was the most critical periods. While the model demonstrates the fact that seasonal phosphorus reductions provide the same level of protection at Dundee Lake as year-round reductions, it would be short-sighted and incorrect to apply the seasonal limits only to the months that happened to be critical during the 2002 simulation year.

56. Comment: Was the potential for the permanent lowering of Dundee Dam, which was as possible outcome of a study conducted by the Federal Energy Regulatory Commission (FERC), considered as part of the TMDL process? (18)

Response: The Federal Energy Regulation Commission (FERC) and the Department have not received an application for a permanent lowering of the Dundee Lake dam. Although the dam owner has removed the hydroelectric operation, the owner has maintained the FERC license. The dam was recently repaired and the Department has determined that it is in safe condition. Therefore, the lowering of Dundee Dam is not an imminent physical change to the system that should be considered in the TMDL.

57. Comment: Efforts should be concentrated on protecting and restoring the "Green Infrastructure" in the Passaic River Basin, especially in the Highlands, as it has been shown that water treatment costs increase as forest cover in the watershed decreases. (9)

Response: The Department concurs that maintaining and replacing areas of natural vegetation ("green infrastructure") have a positive impact on water quality. While preserving land with natural land cover can help with minimizing future degradation, it will not address existing water quality concerns. The Department recognizes this in the discussion of Category One waters and the associated Special Water Resource Protection Areas in Section 8, Reasonable Assurance. Restoring riparian vegetation can help improve existing water quality and is included as one of the measures identified in Section 7, Implementation Measures. This section has been enhanced to identify the known stream bank restoration and similar management measures that have been completed within the basin.

NJDWSC Responsibility:

58. Comment: The Department should require that the North Jersey District Water Supply Commission (NJDWSC) also assume appropriate responsibility for the level of phosphorus that enters the Wanaque Reservoir. The NJDWSC plays a central role in the phosphorus issue as it relates to the Wanaque Reservoir endpoint, yet the Department does not require that NJDWSC take any responsibility for reducing the phosphorus load it diverts into the Reservoir. NJDWSC must participate in the solution to its phosphorus problem. The TMDL suggests that NJDWSC might be a trading partner, yet provides no description of how that might occur. Potentially, NJDWSC can undertake treatment or some other measures that will significantly reduce the TP reaching this endpoint (or which will ensure that the 10 ug/L chlorophyll-*a* seasonal average criterion is met) that are less costly than requiring the STPs to reduce phosphorus to a year-round LTA of 0.4 mg/l. Unless the Department imposes obligations on NJDWSC to take actions to reduce the TP load, NJDWSC will have no incentive to do

so, and no incentive to "trade" with the STPs. As part of or in conjunction with this TMDL, the Department should exercise the authority it has over NJDWSC to address phosphorus. There are at least two sources of such authority. The first is found in the statutory and regulatory provisions that govern NJDWSC's water diversion permit. The second is found in the federal Clean Water Act's pollutant discharge elimination system permit requirements, when those requirements are properly applied in a manner consistent with the recent United States Supreme Court holdings and those of the federal Court of Appeals. (10)

59. Comment: The North Jersey District Water Supply Commission should be required to secure a NJPDES permit for diversion of Passaic River waters into the Wanaque Reservoir. WTSA respectfully submits that the Department must impose responsibility on NJDWSC by requiring NJDWSC to obtain a NJPDES permit for its addition of a phosphorus load to the Wanaque Reservoir. In light of judicial interpretations of the CWA, including South Florida Water Mgt. Dist. v. Miccosukee Tribe of Indians, 541 U.S. 93, 124 S.Ct. 1537 (2004) ("Miccosukee"), (also cited were *National Wildlife Federation v. Gorsuch*, 693 F.2d 156, 165 (D.C.Cir. 1982), *Catskill Mountains Ch. Of Trout Unltd, Inc. v. City of New York*, 273 F3d 481 (2d Cir. 2001), *Catskill Mountains Ch. Of Trout Unltd, Inc. v. City of New York*, 451 F.3d 77 (2d Cir. 2006) and *Friends of the Everglades, Inc. v. South Florida Water Management District*, 2006 WL 3635465 (S.D.Fl. 2006)), the need to address phosphorus in the Wanaque Reservoir, and the critical role NJDWSC plays in introducing the phosphorus load into the reservoir, the Department should not "defer" to the 2005 EPA Memorandum. Instead, the Department should require that NJDWSC obtain a NJPDES permit. The diversion of water from the Passaic River by pumping it some 17 miles north into the Wanaque Reservoir is a transfer into a distinct water body. Water from the Passaic is only diverted when NJDWSC elects to draw off water at a rate that exceeds the Pompton River flow, causing an uptake of Passaic River water into the Pompton River, and, hence, into the intake. Therefore, the NJDWSC operates a "point source" that "discharges pollutants," in that phosphorus is "added" to the Reservoir as a result of the transfer of waters from the Passaic to the Reservoir. This being the case, the Department should require that NJDWSC obtain a NJPDES permit. Such a permit would not necessarily mean that NJDWSC would be solely responsible for reducing the phosphorus load into the Reservoir so as to achieve the 10 ug/l chlorophyll-*a* seasonal average, but it would require that NJDWSC meaningfully participate in achieving the required reduction. (10)

60. Comment: Even if it were determined that a NJPDES permit is not required, under its water diversion permit, North Jersey District Water Supply Commission should be required to reduce the amount of phosphorous coming into the Wanaque Reservoir from the Passaic River so as to mitigate any adverse impacts that such phosphorus has on water quality in the Reservoir. The Department's current regulations expressly state that the party transferring water from one body to another "is responsible for mitigating adverse impacts…caused as a result of the diversion." *N.J.A.C.* 7:19-2.14. Nothing in the 2005 Najarian TMDL Report, the 2005 TMDL, or the proposed 2007 TMDL addresses that NJDWSC's diversion practices have caused the alleged impairment of the Reservoir. The 2007 TMDL was developed without consideration of any other Reservoir management alternatives, instead accepting as a "given" the historic pumping and diversions that took place during the 1993-2002 time period. No attempt was made to investigate other possibilities, either in the pumping protocol or in direct treatment of the diverted water. The 1988 Najarian Report concluded that, provided that NJDWSC implemented appropriate management and diversion practices, there would be no cause for concern with impacts of the diversion on water quality within the Reservoir. If the 2005 Najarian TMDL Report is correct in its conclusion that the diversion of water from the Passaic has adversely impacted the water quality within the Reservoir, the obvious and critical questions are why haven't NJDWSC's diversion practices achieved the result predicted in the 1988 Najarian Report and can

NJDWSC better monitor those practices so as to mitigate adverse impacts, as required by the Department and regulation? The conclusions in the 2005 Najarian TMDL Report are inexplicably at odds with the conclusion reached in the 1998 Najarian Report. No explanation has been given for abandoning the conclusions in the 1988 Najarian Report that, when properly managed, diversion of water from the Pompton and Passaic Rivers, even "under the severest of operating conditions," and "at times of unusual flow periods" and "[d]uring unusual hydrologic events associated with prolonged dry years," will not have any long term impact on water quality in the Wanaque Reservoir. If the answer is that Dr. Najarian's 1988 conclusions, based on the simulations conducted at that time, have proven to be incorrect, then surely the Department is justified in now requiring NJDWSC to take some direct responsibility for addressing the impacts of the diversion of water from the Passaic. Had the 1988 simulations demonstrated such adverse impacts, either the Department would not have approved the diversions, or it would have conditioned such approval on specific, affirmative actions to address those impacts. In addition to more responsible management of its diversion practices, NJDWSC should be the party responsible for ensuring the quality of the water it discharges into the Reservoir by its diversion of water or certainly participate in that responsibility. (10)

61. Comment: Commenter believes the Supreme Court decision in Miccosukee (*South Florida Water Management District v. Miccosukee Tribe of Indians*, 541 U.S. 93, 124 S.Ct. 1537 (2004)), requires a NPDES permit be issued to NJDWSC because they divert river water to the Wanaque Reservoir. The Department must justify why it believes this is not required and has failed to modify its position to meet the US Supreme Court decision. NJDWSC should be required to mitigate any effects of their discharge on the reservoir. Further, NJDWSC should have a NPDES permit to discharge reservoir water to the river, based on a recent Federal Court decision (cited were *National Wildlife Federation v. Gorsuch*, 693 F.2d 156, 165 (D.C.Cir. 1982), *South Florida Water Management District v. Miccosukee Tribe of Indians*, 541 U.S. 93, 124 S.Ct. 1537 (2004), *Catskill Mountains Ch. Of Trout Unltd, Inc. v. City of New York*, 273 F3d 481 (2d Cir. 2001), *Catskill Mountains Ch. Of Trout Unltd, Inc. v. City of New York*, 451 F.3d 77 (2d Cir. 2006) and *Friends of the Everglades, Inc. v. South Florida Water Management District*, 2006 WL 3635465 (S.D.Fl. 2006)). After applying permit requirements to NJDWSC, the Department should recalculate the TMDL based upon the limitations that would be imposed on other dischargers. (10)

Response to Comments 58-61: The Department does not interpret the Supreme Court decision in Miccosukee as requiring the State of New Jersey to issue discharge permits to regulate purveyors under NJPDES, the State NPDES program. The Department's interpretation is consistent with EPA's determination that water diversions are not point sources requiring a NPDES permit under the Clean Water Act. See, USEPA, Agency Interpretation on Application of 401 of the Clean Water Act to Water Transfers. EPA has proposed its interpretation as a rule. 71 Fed. Reg. 32887. In support of their position that EPA's interpretation of the Clean Water Act and the Miccosukee decision are incorrect, the commenters refer to other federal court decisions, such as Catskill Mountains Ch. Of Trout Unlimited, Inc. v. City of New York, 451 F. 3d 77 (2d Cir. 2006) and Friends of the Everglades, Inc. v. South Florida Water Mgt Dist. 2006 WL 3635465 (S.D.Fl. 2006). They contend that, based on these decisions, the Department is obligated to issue a NJPDES permit to the NJDWSC for its water diversion permit. However, the federal court decisions the commenters cite involve different facts, and these decisions are not from the Third Circuit. Therefore, the decisions do not create controlling precedent.

The Department believes that the most appropriate way to address water quality effects of water supply diversion activities is through State authorities related to safe yield and allocation decision making. The role of NJDWSC operations is discussed above in response to comments 49-53. To reiterate,

NJDWSC supplies drinking water to more than 3 million of New Jersey's residents. Management of the system needs to be flexible enough to allow the maximum safe yield without deleterious water quality impacts. While safe yield and allocation decisions do consider water quality implications, directing NJDWSC to change operations for the primary purpose of minimizing the requirement for dischargers to reduce the introduction of a pollutant into the river system is not appropriate. FW2 waters are to be suitable for drinking water use with conventional treatment. Therefore, the quality of the water at the Wanaque South intake point must be consistent with support of the drinking water use, with or without diversion activities. Water quality trading is an option, but not a requirement, through which NJDWSC can play a role in protecting the water quality of the Wanaque Reservoir as affected by the diversion of Pompton and Passaic River water into the reservoir.

The load reduction required to achieve the water quality target for the in-stream critical location is the same as that needed to achieve the water quality target in the Wanaque Reservoir. The difference is the applicability of seasonal effluent limits. Commenters suggest that some or all of the burden of achieving the phosphorus load reductions outside the May through October season should be borne by NJDWSC because it is the act of diverting water into the Wanaque Reservoir that dictates year round reductions from dischargers in the portion of the river basin affected by the diversion. With reference to the decision on the Wanaque South Diversion, background on this permit decision is in order. The grant application for the Wanaque South project diversions was approved by the New Jersey Water Supply Council on September 25, 1978. The initial evaluation of water quality impacts due to the Wanaque South Project was presented as an appendix within the "Wanaque South Project Economic Feasibility Study" (1981). This assessment indicated that there may be impacts to temperature and dissolved oxygen in the Passaic River due to diversions at the Two Bridges site. As the Department's total phosphorus (TP) standard was not established until 1980 (after the initiation of the Feasibility Study), impacts due to TP were not assessed at that time. In 1981, the Department did conduct an in-house screening-level (Vollenweider) assessment of TP impacts that suggested that the reservoir could be in a mesotrophic state and that expanded diversions could result in possible degradation of the reservoir's trophic state. Thus, the Department included a provision for a "reservoir phosphorus management study" within the Wanaque South water diversion permits (No. 1651 and 1685), which were issued on April 30, 1982. The 1988 Najarian report was developed in response to this permit condition. The 1988 study concluded that "…the proposed Wanaque South diversion would not have a lasting impact on the water quality of the Wanaque Reservoir." The study also found no long-term impairment with respect to the trophic state of the Reservoir. This predicted result was attributed in part to the reservoir's relatively short residence time (approximately 6-8 months). However, while the residence time is short based on a mathematical comparison of volume in and volume out, in practice, the reservoir is not pumped dry. There is always a residual pool and settled phosphorus can accumulate and be available for biological activity as the result of turnover events. Measured and predicted levels of chlorophyll-*a* are in excess of those associated with maintenance of a mesotrophic condition. This is likely due to the fact that the NJDWSC has needed to divert river water at frequencies and rates that were not anticipated in 1988 -- due to extended dry-weather (drought) conditions over much of the past decade. In response, over the past decade, NJDWSC has implemented various management strategies to reduce transient water quality impacts to the reservoir from river diversions. These strategies have been helpful in the control of peak phosphorus concentrations and nuisance algal blooms within the Reservoir. However, such management programs can, at best, only partially mitigate worst-case conditions. Further, the addition of chemicals (alum) on an ongoing basis is not an appropriate approach for reservoir management. Additional means are needed to protect reservoir water quality.

Impacts from TP Removal:

62. Comment: The TMDL fails to consider the following negative impacts associated with pretreatment for phosphorus: increase in sludge production; increase in total dissolved solids; negative impacts on incinerator operation; an increase in aluminum in plant effluent as a result of chemical addition. Public policy is not well served where a water quality enhancement is attained at the expense of a diminution of other water quality criteria or other negative environmental impacts. There are alternatives to imposing phosphorus limits that would achieve the desired environmental benefit without the negative consequences. (18)

63. Comment: There are several negative impacts that would result from phosphorus removal, as follows:

-As a result of chemical treatment to meet the phosphorus LTA of 0.4 mg/l, STPs will have significant increased sludge disposal costs from increase sludge production, estimated to increase from 19% (with biological removal) to 37% (chemical removal only).

-Total Dissolved Solids (TDS) will increase in the effluent when meeting phosphorus LTA of 0.4 mg/l. TDS will negatively impact water quality, which will impact drinking water supplies and drinking water quality through potential additional treatment requirements.

-Chemical sludge from the phosphorus removal process will impact incinerators. It will increase ash production and possibly produce "clinkers" which plug drop holes of multiple hearth incinerators and may require certain incinerator improvements.

-Chemical treatment for phosphorus removal will increase aluminum (or iron) in effluent. (11)

Response to Comments 62 and 63: The TMDL specifies WLAs in terms of total phosphorus to achieve the water quality goals for the Wanaque Reservoir and Dundee Lake. The comments presume that the only available treatment technology is chemical addition. However, the Department believes that the WLAs can be achieved through a variety of treatment options. The Department encourages permittees to utilize biological nutrient removal (BNR) wherever feasible based on site and process constraints. The use of BNR has the benefit of reducing nitrates while avoiding increases in the levels of TDS and affecting sludge treatment and disposal options. The Department is working with New York DEC and the EPA to develop a TMDL to address dissolved oxygen issues in the New York/New Jersey Harbor, which may require the NJPDES facilities in the Passaic River Basin to implement nitrogen removal. This is a further incentive to use BNR wherever feasible to achieve the required phosphorus reductions. Further, by developing and applying a dynamic model within the Passaic basin, the Department has taken care to require only the level of phosphorus load reductions needed in order to achieve water quality objectives. By carefully evaluating the model simulations, the Department was able to determine the critical locations where primary productivity is causing water quality problems and develop criteria in terms of the response indicator, chlorophyll-*a*, that equate to protection of the designated uses. Seasonal limits are also offered where appropriate.

64. Comment: The Department should consider a particular trademarked commercial product identified by the commenter which the commenter indicates has proven to be extremely effective and economical at controlling phosphate levels in contaminated water and contaminated soil, in the plans to establish phosphate contamination limits for the Passaic River Watershed. (19)

Response: The Department appreciates that information provided by the commenter, but can not endorse any proprietary water quality device or material. The New Jersey Corporation for Advanced

Technology (NJCAT) has a procedure by which developers of new technology can demonstrate performance claims. Additional information is available at www.njcat.org.

65. Comment: Achieving the significant phosphorus reductions called for in the TMDL may not be technologically, ecologically, economically or socially achievable. Therefore, commenter suggests dischargers evaluate their systems and determine the retrofits that will reduce phosphorus and nitrogen loadings to the extent feasible, given these considerations, similar to the improvements made at RVRSA. (9)

66. Comment: Biological technologies should be selected over "chemical" technologies for nutrient removal. (9)

67. Comment: The Department should investigate innovative technology that will reduce phosphorus loadings with fewer undesirable side effects and at reduced cost, like RVRSA did. (7)

Response to Comments 65-67: The Department believes the phosphorus reductions called for in the TMDL are fully achievable and at reasonable cost. The Department supports biological nutrient removal because it is a more cost effective removal technology that produces fewer harmful by-products than chemical treatment. The Department recognizes the innovative work of RVRSA and Wayne Township in incorporating such approaches for nutrient removal and will continue to rely on the regulated community to determine the best means to achieve permit limits, given site and process constraints that apply to each one, as well as outcomes that may come from water quality trading.

Permit Requirements:

68. Comment: Five of the sewage treatment plants listed in the proposed TMDL are located in West Milford and are regulated under the Greenwood Lake TMDL for Phosphorus. These facilities should also be required to meet whatever standards are set for total phosphorus, nitrate and ammonia in the Passaic TMDL. Further, the WMP for this area has not been done in 20 years. The Department needs to do its part in getting the load reductions by enforcing the requirement to do a WMP. (7), (9)

Response: The allocation of loading capacity for Greenwood Lake was addressed in the September 2004 TMDL and included WLAs for the associated NJPDES discharges. The allocation of loading capacity established in the Greenwood Lake TMDL is protective of the SWQS and did not need to be reassessed by the Passaic TMDL. Rather, the loadings that would result from successful implementation of the TMDL in this watershed were taken as a boundary condition input to the Passaic River basin TMDL. Requirements for load reductions are required whether or not there is a current WMP.

69. Comment: Monthly average permit limits based on a long term average in the stream should be used. No limitation based on a shorter time period is necessary or warranted. (23)

Response: The long term average used in the modeling study is that required in wastewater treatment effluent in order to achieve the watershed criteria, expressed as seasonal average concentrations of chlorophyll-*a* at the two critical locations. There is no long term average stream concentration objective expressed in this study. As indicated in the TMDL, the Department intends to express the WLAs set forth in the TMDL in terms of monthly average effluent limits.

70. Comment: A TMDL must be expressed in terms of daily limit. How can a long term average be compliant with CWA requirements? The proposed 0.76 mg/L limit is 7 times less stringent than the criterion. The Department should enforce the 0.1 mg/L that is required unless the phosphorus protocol demonstrations are made, which has not occurred. (22)

71. Comment: The 0.4 mg/L limit is too liberal and should be 0.1 mg/L, as is recommended for impaired waters. Commenter is disturbed about the concept of averaging and believes it doesn't really work. (20)

Response to Comments 70 and 71: According to an USEPA memorandum issued November 15, 2006, all TMDLs and associated load allocations and wasteload allocations should be expressed in terms of daily time increments, which these TMDLs do. The November 15, 2006 memorandum further states that TMDL submissions may include alternative, non-daily pollutant load expressions in order to facilitate implementation of the applicable water quality standards. It should be noted that the November 15, 2006 memorandum makes clear that although TMDLs are to be expressed in terms of a daily load, this does not affect a NPDES permitting authority ability to establish permit effluent limits, which "… may be written in a form that derives from, and complies with, applicable water quality standards…". Additionally, The National Pollutant Discharge Elimination System (NPDES) regulations at 40 CFR 122.45(d) allow numerical NPDES effluent limitations for continuous discharges to be expressed, unless impracticable, as average weekly and average monthly discharge limitations for publicly owned treatment works (POTWs) and as daily maximums and monthly averages for other dischargers. The EPA Protocol for Developing Nutrient TMDLs, EPA 841-B-91-007 (pg. 7-3) also describes these acceptable practices. The current TMDL and proposed approach for applying effluent limits comply with USEPA guidance and the requirements of the Clean Water Act.

As the result of the Passaic River basin TMDL, the 0.1 mg/l total phosphorus SWQS has been superseded within the modeled domain by watershed criteria expressed in terms of chlorophyll-*a* at the identified critical locations. Commenters appear to refer to the practice of applying the SWQS as an end-of-pipe effluent limit where the discharge of a pollutant from a facility is in quantifiable amounts and is to a waterbody identified as impaired with respect to that pollutant. Because of the narrative criteria that accompany the in-stream numeric criterion for phosphorus, a phosphorus evaluation protocol was developed to determine when the numeric criterion does not apply in light of the narrative criteria, which is commonly known as the phosphorus protocol. As a result of the Phosphorus Settlement Agreement, WQBELs for phosphorus are not to be applied except through a TMDL study with respect to most significant dischargers in the Passaic River basin. Therefore, the end-of-pipe limit approach and phosphorus protocol do not apply. In any case, NJPDES effluent limits must conform with a WLA from an adopted TMDL, in lieu of a WQBEL established any other way. The TMDL establishes WLAs based on a total phosphorus long-term average (LTA) effluent concentration of 0.4 mg/L for most dischargers, to achieve the watershed criteria set in order to be protective of the designated uses of the affected waterbodies. The Department has also stated the intent to express this LTA as a monthly average of 0.76 mg/L in the NJPDES permits for the identified facilities, subject to water quality trading.

Seasonal Limits:

72. Comment: Seasonal limits have been found to be sufficiently protective of the river, yet phosphorus removal on a year-round basis has been imposed on dischargers upstream of the reservoir intake. Seasonal limits, either tied to the use of the Wanaque South Pumping Station, or a reservoir

level, would be sufficiently protective of the environment and would result in a significant cost savings to the public and decreased pollutant load to the environment. The Department has imposed additional requirements upon dischargers without regard to whether the discharge is being pumped into the reservoir. The determination to treat effluent when water is not transferred to the reservoir must be revisited. Treating effluent to meet a limitation that is not appropriate is a waste of public funds and results in the use of chemicals that increases sludge production and Total Dissolved Solid discharges. The Department should have reviewed and offered for public comment its consideration of the option of seasonal phosphorus control during periods when NJDWSC is not pumping water from the Passaic River Basin into the Wanaque Reservoir. Seasonal effluent limits should be applied to dischargers upstream of the Wanaque South Pump Station because of the intermittent but predictable diversion of water to the Wanaque Reservoir. The application of effluent limits should be related to water supply needs, as indicated by the pumping schedule or reservoir water level. (2) (15)

73. Comment: The Department has failed to provide relief from stringent limits during periods when phosphorus control cannot provide a benefit to the Wanaque Reservoir. Strict adherence to year round phosphorus removal does not bear any relationship to goal of protecting the Reservoir. Treating effluent to meet a limitation that is not appropriate is a waste of public funds and results in the use of chemicals that are not warranted. Chemical precipitation and additional TDS and sludge production can be avoided through judicious establishment of compliance levels, tied to the use of the Wanaque South pump station or a reservoir level, to achieve benefit at cost savings to the public. The Department should have reviewed and offered for public comment its consideration of the option of seasonal phosphorus control during periods when NJDWSC is not pumping water from the Passaic River Basin into the Wanaque Reservoir. (1)

74. Comment: The limit of 0.76 mg/L, which is applied seasonally to protect the River, should be applicable to all dischargers, not just those downstream of the Reservoir intake. The Department has proposed limitations to protect the Wanaque Reservoir from diversions from the river system. It is believed that such diversions have not occurred in approximately four years. It does not seem appropriate to protect this use on a continuous basis when diversion does not occur at any reasonable frequency. (23)

Response to Comments 72-74: As discussed in the response to Comment 55, the Department believes seasonal limits are only appropriate for discharges below the confluence of the Pompton and Passaic River. Tying effluent limits to an unpredictable pumping regimen outside the control of the regulated entity is institutionally impracticable. Regarding the opportunity to provide input on the concept of seasonal limits, multiple opportunities were provided. In addition to the opportunity for formal public comment provided with the formal notice and public hearing for the proposed watershed criteria, TMDL and anticipated effluent limits that will emanate from the TMDL, prior to the proposal, there were at least two opportunities for public comment on these issues. At the May 19, 2006 Data Exchange Meeting on the Passaic River Basin TMDL, the Department requested input on the watershed criteria. At the June 4, 2007 meeting between the Department and the affected dischargers, a presentation was made on the Non-tidal Passaic and Pompton Lake TMDLs in which the Department presented information regarding the intent to apply seasonal limits for some discharges as well as the basis for seasonal limits. Some of these points were raised and responded to at those events.

Margin of Safety:

75. Comment: Confirmation is requested that the issue of margin of safety will be revisited once the TMDL is implemented and that antibacksliding and antidegradation policies will not preclude the Department from undertaking appropriate remedies and revisions at that time if deemed warranted. (1), (2)

Response: Antidegradation policies are required to be implemented should a permittee request to expand its discharge beyond the levels currently authorized. As the TMDL has allocated the total the phosphorus loading for the Passaic River Basin, a request for a new or expanded treatment plant would need to: maintain the phosphorus loading authorized in its NJPDES permit, obtain an allocation of the loading contained in the reserve capacity or obtain a reallocation of load from another NJPDES facility. With regard to antibacksliding, under Section 402(o) of the Federal Act (33 U.S.C. §1342(o)), "A permit may not be renewed, reissued, or modified… to contain effluent limitations which are less stringent than the comparable effluent limitations in the previous permit." However, as described by the regulation and the USEPA Technical Support Document for Water Quality-based Toxics Control (EPA/505/2-90-001), establishing less stringent limits based on water quality is allowed where: material or substantial facility changes justify relaxation, events beyond control can not be remediated, the permittee has installed and properly operated the facility and is still unable to meet the limit, or new information (such as a revised TMDL) justifies relaxation of water quality-based permit limitation. In either situation, it is not expected that the loading capacity contained in the MOS for these TMDLs would be further reallocated as WLAs and LAs. If the water quality response based on follow-up monitoring warrants and a subsequent TMDL study that includes improved predictive capabilities is developed, it is possible that revised WLAs and LAs could result.

76. Comment: The TMDL's numerous conservative assumptions, including inclusion of the 2002 drought conditions, comprise a sufficient Margin of Safety, so as to meet the definition of an "implicit" Margin of Safety and are thus sufficient to meet EPA's requirements for a TMDL calculation. The addition of an "explicit" Margin of Safety is unnecessary. The MOS is used to assign load allocations that are protective of a water quality endpoint, based upon uncertainty in the TMDL calculation, and should not be embodied additionally in the site-specific criterion itself. (15)

Response: In this study, the MOS and reserve capacity are provided for by setting a target lower than the established watershed criteria, not in addition to a specified additional allocation of the loading capacity as suggested by the commenter. EPA guidance does allow an MOS to be implicit, explicit or a combination of both. An 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)). EPA directs that it may "prove feasible to include margins of safety in more than one TMDL analytical step. For example, relatively conservative numeric targets and source estimates could be developed that, in combination, create an overall margin of safety adequate to account for the uncertainty of the analysis" (Protocol for Developing Nutrient TMDLs, EPA). EPA requirements for an approvable TMDL also require consideration of critical conditions and seasonal variation when setting the TMDL and associated WLAs and LAs, neither of which is allowed to serve as the MOS. The fact that the TMDL study complies with requirements for critical conditions and seasonal variations does not constitute an implicit MOS.

Water Quality Trading:

77. Comment: Water quality trading is opposed and this provision should be eliminated from the proposed TMDL for the following reasons:

- Discharges cause the greatest degradation of water and biota in the water in the immediate vicinity of the discharge, not miles away where another discharge occurs.
- Changes in the composition of a discharge will change the ecology of the receiving water. This is especially true if there are changes in nutrient loadings. In a trading situation, evaluating the benefits and damages to the ecology at two different locations will be impossible.
- If some dischargers can buy credits, then the overall reductions in loadings will be less, and the water will be less clean than if all dischargers meet the same requirements.
- Marketing credits will result in inequities that will probably be controlled by political and economic forces.
- Everyone needs clean water to drink, but who will bear the costs of cleaning up the water from dischargers who buy credits?
- Enforcement of trading agreements has been poor in other parts of the United States.
- No environmental organizations were invited to be part of the review team established by Rutgers on the trading project; thus the study completed by Rutgers did not have the oversight of a critical stakeholder for the Passaic River, and has a tendency to represent only sewerage authority interests and not those of the general public.

(7), (9)

Response: In the case of nutrient impacts on dissolved oxygen and phytoplankton, it is not true that "discharges cause the greatest degradation of water and biota in the water in the immediate vicinity of the discharge." In fact, it is far more common for dissolved oxygen and productivity impacts to occur substantially downstream from nutrient point sources. Phosphorus is considered a pollutant because it can stimulate excessive productivity. The TMDL analysis demonstrated the two locations where phosphorus is responsible for excessive primary productivity. Water quality targets were developed for these two discrete locations. The trading program will consist of a trading currency among point sources that will result in a condition the same as or better than the TMDL premise, as demonstrated by modeling runs of trading scenarios. Under the trading program, if some dischargers buy credits, then by definition there must be a discharger or dischargers that are selling credits in order to maintain the TMDL outcome at the critical locations.

With respect to creating untenable economic circumstances for some users, the Department believes that the responsible entities for each discharge will only seek trades that are consistent with discharge of their fiscal responsibility, which includes managing the system so that user costs are set only as high as necessary to satisfy water quality as well as public health and safety obligations.

The scientific, economic, and legal feasibility of water quality trading in the non-tidal Passaic River basin is under study. With finalization of the TMDL specification, the research on trading can be finalized. The final trading proposal, including trading ratios and rules, will be presented to the public for comment and must be approved by both the Department and EPA prior to implementation through NJPDES permits.

78. Comment: The trading concept is opposed. It doesn't belong in New Jersey. We should be cleaning up the sources. (20)

Response: The Department believes that water quality trading represents a viable means to determine if more efficient and cost effective means are feasible to attain water quality objectives and to implement them. The Department anticipates providing a 1 year period from the date of permit issuance to negotiate trades, provided the trading tool and rules have been approved by the Department

and EPA. To be approvable, a viable trading option would have to ensure that the TMDL condition in the Wanaque Reservoir and Dundee Lake are met and that there is full enforceable accountability for required load reductions.

79. Comment: If available, the trading ratios developed under the trading program should be included in the TMDL report. If these ratios are not yet available, then the trading ratios will need to be separately public noticed and sent for EPA approval. (21)

Response: Rutgers Cooperative Research and Extension received an EPA Targeted Watershed Grant in 2005 to develop, evaluate and implement a water quality trading program for the non-tidal Passaic River Basin. Upon completion of the trading study, there will be an opportunity for public comment on the study, and both the Department and EPA will need to approve the trading tools and rules prior to their use in formulating a trade. In addition to the public comment on and agency approval of the tools and rules, the public will have the opportunity to comment on specific trades as they are reflected in NJPDES permits.

80. Comment: The voluntary "Water Quality Trading Program" suggested in the TMDL cannot be substituted for properly addressing the attenuation of phosphorus, particularly when the preliminary indications are that the Department has or will impose artificial constraints and requirements on key components of such a trading program. Given its failure to properly allocate loading as part of the TMDL, the Department must entertain comments on the trading project and address such comments in formulating the eventual TMDL that will be submitted to EPA for approval. The Department cannot relegate to a potential, voluntary trading program the scientifically sound allocation of initial responsibility for phosphorus reductions. Once the proper initial responsibility for phosphorus removal is established, water quality trading may be appropriate. The unsoundness of relying on trading is compounded by the uncertainty of whether the trading project will be implemented and whether there will be sufficient parties reducing phosphorus in effluent enough to trade with potential credit "purchasers" is unknown. (10)

81. Comment: The Department is considering imposing unsound, artificial, and unfair conditions or restrictions on trading. First it proposed that there would be a maximum trading ratio of 1.0, which is not supported mathematically and will discourage STPs that are further from the model endpoints to trade with closer STPs to have the closer STPs remove additional phosphorus. The Department is also considering that credits be accumulated and recalculated annually, based not on actual flow but on permitted flow. For an STP that is operating close to its permitted flow, this calculation of credits may not be particularly troublesome. However, for an STP whose actual flow is far below its permitted flow, this formula will significantly discourage trading from the buyer's perspective. Where, as under the proposed trading project, such credits are calculated annually, this trading disincentive does not serve any rational purpose. The effect on effluent limits that would follow from attenuation cannot be relegated to a voluntary trading program and must be addressed in the phosphorus effluent limit for each STP. If trading is to occur, the "trading ratios" will then be incorporated within each STP's limit, which actually simplifies the trading calculations. The disincentives to trading reverse the Department's concept of "cost efficiency," which the trading project would try to promote. (10)

82. Comment: Unless the Department <u>requires</u> that NJDWSC take responsibility, it will not do so and it will have no incentive to "trade" with other dischargers. The entity that should pay for such treatment of the diverted river water is NJDWSC, the party diverting it. Only by providing NJDWSC with its own financial incentive to reduce the phosphorus load coming into the Wanaque Reservoir will this critical party have an interest in participating in any trading program. WTSA agrees that a

properly formulated trading program can help achieve the most cost-effective approach to reducing phosphorus loads at the critical endpoints. To be effective and fair, all potential trading partners must have appropriately determined financial incentives to participate. (10)

83. Comment: NJDEP has indicated that trading ratios will be capped at 1.0. That clearly is not appropriate for WTSA in view of the significant attenuation of WTSA loads. If trading ratios are indeed capped at 1.0, there will be no reason for WTSA to participate. If the Department were to insist on "capping" the trading ratios at 1.0, the result would be ignore the significant attenuation that occurs, and would be unfair to WTSA, as it would improperly assign a much greater contribution of TP than WTSA's facilities in fact contribute. (12)

Response to Comments 80-83: No final determinations on the trading program have been made. When the trading study is complete, it will be subject to public comment as well as Department and EPA approval. Issues related to attenuation and alternatives to phosphorus reduction are addressed in responses to Comments 48-54.

Nonpoint Source Load Reduction:

84. Comment: The Department should support and help implement programs which will provide a reduction of phosphorus and nitrogen. An open and forthright planning process is needed to attain meaningful reductions. (9)

85. Comment: A real commitment from the State of New Jersey, both regulatory and financially, would be needed to deal with point and nonpoint problems in this reservoir. A 60% reduction cannot be assured when septic management systems are not mandated; when goose management and riparian buffer restoration efforts are voluntary and underfunded, with inputs from these sources uncontrollable and unmanageable; and when conservation plans and resource management plans on farmland to reduce agricultural inputs are not mandatory. Given the lack of confidence in achieving the NPS load reduction, more must be required of point sources. (22)

86. Comment: Commenter is concerned about how reductions will be achieved. Parking lots will not be ripped up. Money is running out to buy up stream corridors. We don't require retrofitting of stormwater when we do redevelopment. A regulatory and financial commitment is needed from the Department to get the NPS reductions. Goose management and fertilizer ordinances are not going to do it. (20)

87. Comment: There is concern about achieving NPS reductions; commenter is relying on Department's assertion that these reductions are feasible. (14)

Response to 84-87: The Department has been and continues to be committed to reducing phosphorus sources derived from stormwater point sources as well as nonpoint sources through best management practices. Stormwater sources regulated as NJPDES point sources are subject to several measures that are expected to significantly reduce phosphorus loads from urban areas. Through their NJPDES permit, Tier A communities are required to implement street sweeping and outlet cleaning, as well as to adopt ordinances regarding proper yard and pet waste management, and limiting wildlife feeding. In addition, municipalities within the spatial extent of the model will be required to adopt the fertilizer management ordinance limiting the application of phosphorus through lawn fertilization. Based on studies in other areas, implementation of a fertilizer ordinance alone is expected to achieve a 20%

reduction in phosphorus inputs to the Passaic River and its lakes and tributaries. Additionally, each year the Department funds NPS reduction projects through the federally funded 319(h) program. These funds are to be used to implement programs and projects designed to reduce nonpoint source pollution. Projects include, but are not limited to, riparian buffer restoration and stormwater retrofits. Relevant projects in the drainage area have been cited in the TMDL document. Although agriculture is not a significant land use in the drainage area, the Department regularly coordinates with the Department of Agriculture to address water quality issues related to agricultural land uses and there are a number of cited funding programs available to accomplish agricultural BMPs. Finally, the Department recognizes the importance of continued public education as key to the overall abatement of NPS pollution. To aid in the public education, the Department continues to support the New Jersey Watershed Ambassadors program. The NJWA program is a community-oriented AmeriCorps environmental program designed to raise awareness about water issues, including nonpoint source pollution in New Jersey.

88. Comment: What assurance is there that New York will address the need to reduce phosphorus load entering New Jersey, without which the TMDL objectives cannot be met. (7), (20)

Response: New York has already applied a phosphorus limit on the Western Ramapo treatment facility that will begin the process of reducing phosphorus loads entering New Jersey. New Jersey believes this permit action signifies a willingness to cooperate and expects to continue to work with New York to assess the loading reduction accomplished and the extent to which additional load reductions are needed.

89. Comment: Commenter recognizes that the cost for achieving required point source controls is not insignificant and wants to be sure that it is well spent, since ratepayers and taxpayers would need to pay for it. Regarding nonpoint source control, while the commenter is willing to pass the proposed fertilizer ordinance, there is concern that in some affected municipalities, much of the fertilizer application occurs by way of landscapers. Landscapers apply fertilizer from tanks and there is no way to know what is in them, which will make enforcement challenging. Limiting the application of phosphorus from fertilizer is better accomplished regionally or statewide and though legislation or rules, even if new legislation or rules are needed to address this issue. (16)

90. Comment: The Department should regulate landscapers to get reductions from the fertilizer source. (14)

91. Comment: The Department should urge the State Senate and Assembly that a more productive tactic would be to introduce and pass legislation controlling non-point source phosphorus contribution via banning the sale and use of phosphorus laden fertilizers and detergents in New Jersey. (3)

Response to comments 89-91: As a requirement of the TMDL, municipalities listed in Appendix B of the TMDL documents must adopt and enforce a fertilizer application ordinance. The fertilizer ordinance applies to all persons, defined as any individual, corporation, company, partnership, firm, association, or political subdivision of this State subject to municipal jurisdiction. The landscaping industry falls under this definition and is required to comply with the conditions of the ordinance. The purpose of the fertilizer ordinance is to regulate the outdoor application of fertilizer so as to reduce the overall amount of excess nutrients entering waterways, thereby helping to protect and improve surface water quality. The Department agrees that a regional or statewide plan may be a more effective means to manage the fertilizers source of phosphorus. An initial step towards this approach is the Memorandum of Understanding (MOU) between the Department and members of the lawn care

industry to reduce phosphorus by 50 percent the pounds of phosphorus applied in lawn care products in New Jersey Watersheds by 2010 as compared to a 2006 base year.

92. Comment: The City of Garfield has adopted a Fertilizer Management Ordinance and will provide a certified copy when passed by the Mayor and Council. (6)

Response: The Department appreciates the initiative demonstrated by the City of Garfield to reduce phosphorus loads in advance of adoption of the TMDL.

93. Comment: The proposed TMDL requires a basin-wide uniform reduction in non-point source phosphorus of 60%. Municipalities identified in Appendix B will be required to adopt a Fertilizer Management Ordinance and to undertake other phosphorus reducing measures. The uniform NPS reduction ignores phosphorus attenuation that occurs in the river system. Given the 99% attenuation and greater settling of organic phosphorus which makes up most of NPS phosphorus, it is likely that none of the NPS phosphorus from Warren arrives at Two Bridges, which is some 35 miles away, or at Dundee Lake which is 50 miles distant. There is no reason to require that Warren Township to adopt a Fertilizer Management Ordinance or undertake other NPS phosphorus reducing measures. (10)

Response: The commenter is incorrect to assume that none of the stormwater phosphorus load from Warren arrives at Two Bridges. In fact, attenuation of wet-weather phosphorus loads is much less than dry-weather, so nearly all of the wet-weather load from Warren will reach Two Bridges. Attenuation, while not as significant for stormwater loads, is fully accounted for by the Passaic River TMDL model.

95. Comment: There is substantial uncertainty as to whether the nonpoint and stormwater point source load reduction targets can be achieved. Therefore, Wayne requests confirmation that those phosphorus effluent limits applicable to the point source dischargers, which derive from the TMDL process, will not be amended in the future in the event that the nonpoint and stormwater point source load reduction targets are not met. (18)

96. Comment: The NPS load reduction for Township of Wayne may not be achievable. Wayne already has a fertilizer ordinance in place. If the nonpoint source reduction is not achieved, there is concern that the impacts of the lack of water quality improvements will be placed on the STPs by additionally lowering their loadings. (11)

Response to 95 and 96: The Department fully expects through the various management measures outlined in Section 7 Implementation Plan of the TMDL report that nonpoint and stormwater point source target reductions will be met comprehensively throughout the basin. The Department is committed to assisting with achieving these reductions through enforcing the municipal stormwater permit requirements, requiring the fertilizer management ordinance, the fertilizer MOU, and funding projects. The Department does not anticipate that the STPs will have to additionally lower their loadings in the future to meet the TMDL requirements. However, there can be no guarantee regarding future permit limits that may be imposed given the many physical variables, as well as potential for changes in regulatory requirements that may occur. Water quality response to implementation of the load reductions in the TMDL will be assessed and the need for adaptive management will be determined over time.

Data Availability:

97. Comment: Because the supporting documentation for the Wanaque Reservoir Model is not sufficient to facilitate a detailed technical review, the proposed TMDL should not be adopted. The model contains uncertainty in the loading to the Wanaque Reservoir from diversions and in how well the model responds to the diversion loads discharged to the reservoir. Although this particular model is proprietary to Najarian and Associates, input and output files for the 1/1/93 to 12/31/02 calibration can be provided. This includes daily 1993-2002 diversion inputs used for the baseline model case (date, location, flow, phosphorus concentration), the monthly diversion data. In addition, an integral component of the Passaic TMDL modeling analysis, the USGS DAFLOW Model and report has yet to be released. (12)

98. Comment: The Department has continued to withhold information critical to a thorough evaluation of the TMDL, which is necessary to enable the submission of all relevant comments. The Department continues to refuse to make available the LA-WATERS Wanaque Reservoir Model. Given the significant expenditure of public funds that the proposed TMDL is likely to require of the dischargers, it would be in the public's interest to make the model and the water quality inputs available. Based on the meaningful input provided given availability of the Phase 2 model, allowing public access to models is the only way to ensure that the Department will have the benefit of an open and transparent TMDL process. (10)

99. Comment: It is not possible to perform a complete technical and scientific evaluation of the TMDL due to lack of access or delayed access to data and model inputs. Insufficient information is provided about observed algal concentrations, their relationship to diversion inputs in the Wanaque Reservoir, and the reservoir concentration of phosphorus that would maintain acceptable algal concentrations for the protection of drinking water. Insufficient data is provided to confirm that the Reservoir model accurately describes phosphorus dynamics. Data provided in figures in insufficient. The Omni modeled was not made available until late in the public comment period. (15)

100. Comment: The Department has failed to provide the data that supports key determinations made with respect to the Wanaque Reservoir. This information must be provided in accordance with OPRA. Lack of access to requested information is particularly egregious because RVRSA paid its fair share toward development of the TMDL. (1), (2)

Response to Comments 97-100: The Department has addressed all OPRA requests that were made with respect to the Phase 1 TMDL and provided all information in its possession in response to these requests. Certain information is not available in the form requested; however, the Department believes that the available information is sufficient to allow an assessment that the studies provide a sound basis for the TMDL and the WLAs and LAs established as an outcome. As stated previously, the Najarian 2005 TMDL study report provides sufficient data for the evaluation of model results. Data is provided in the form of graphical outputs, summary loading budgets, and error analysis. Tabular chlorophyll-*a* data for the Wanaque Reservoir at Raymond Dam were also provided in the supplemental report for the Wanaque Reservoir modeling, (Najarian, 2007). While the actual model code was developed under funding of the NJDWSC and remains proprietary to that agency, the reservoir model has been extensively documented in two prior reports ("Influence of Wanaque South Diversion on the Trophic Level of Wanaque Reservoir and its Water Quality Management Program", Najarian 1988 and "A preliminary assessment of water quality status of the upper Passaic River and re-verification of the Wanaque Reservoir model", Najarian 2000). Further, the model's hydrothermal and water quality algorithms have been published in peer-reviewed journals ("Mixed-Layer Hydrothermal Reservoir Model," M. ASCE. Journal Hydraulic Engineering. 120 (7), 846-862 and "A Multicomponent Model of Phosphorus Dynamics in Reservoirs," Water Resources Bulletin, 20, No. 5:777-788). With regard

to the Passaic River basin model, the comment period was extended to allow additional time to evaluate to that model. The flow Model Diffusion Analogy Surface-Water Flow Model, published by USGS in 2007, entitled, "Simulation of Surface-Water Conditions in the Non-Tidal Passaic River Basin, New Jersey Scientific Investigations Report 2007-5052" was used to simulate flow in the non-tidal Passaic River and its major tributaries.

In addition, this TMDL has been the subject of more public involvement than any other in the State, as described in the TMDL document and reiterated in response to Comments 101-102. The Department has conducted stakeholder discussions on phosphorus TMDLs for the Passaic River Basin as far back as 1996. One outcome of that extensive process was selection of LA-WATERS as the appropriate tool to assess nutrient and productivity in the Wanaque Reservoir under current conditions and to determine phosphorus loading reductions needed to achieve water quality objectives. This determination was made with full knowledge that this model was proprietary. Specifically, the October 2001 "Technical Approaches to Restore Impaired Waterbodies within the Non-tidal Passaic River Basin", memorialized the outcome of the discussions with stakeholders and the work of the Passaic River Basin TMDL Work Group regarding the plan to develop the TMDL. Included was the recommendation to use LA-WATERS to develop a water quality objective for the Wanaque Reservoir to protect designated uses.

Public Participation:

101. Comment: Public participation has been severely restricted in the process of developing this proposal. Before further action is taken the Department should undertake the following activities:

- Convene a Technical Advisory Committee to peer review the scientific investigations and the conclusions that have been reached in this process;
- Convene a Public Advisory Group to study and evaluate the economic and ecologic costs and benefits to be derived from the implementation of this proposed TMDL;
- Ask for public comment on the outputs from these groups.

(8)

Response: The Department does not agree that public participation has been severely restricted in this TMDL development process. In fact no other TMDL has had the degree of participation and discussion that is the hallmark of the Passaic River Basin TMDL. Section 9 Public Participation in both TMDL documents chronicle the various workgroups and key meetings that the Department has convened and had with all stakeholders groups (including the commenter) throughout the past 14 years. The Passaic TMDL Work Group, which met monthly from 2001-2003, was a technical advisory committee that led to the development of the proposed Passaic TMDLs as articulated in the *Passaic Technical Approaches to Restore Impaired Waterbodies within the Non-tidal Passaic River Basin* document. From 2004 to 2007 the Department convened stakeholder meetings to present and discuss key findings and to seek input from the public on the TMDL. Information obtained from this process informed the development of the Passaic TMDLs. Components of the TMDL were also reviewed by the NJ EcoComplex academic panel and presented at conferences and in peer reviewed journals.

A cost benefit analysis is not a requirement of the State's TMDL process. Nevertheless, the Department did request cost estimates from dischargers in September 2007. Responses were received from some dischargers, which indicate that phosphorus removal costs will be significant, but the needed phosphorus reductions are both achievable and reasonable. Use of BNR technology at plants where this technology is feasible can accomplish needed reductions that will require an initial capital cost and low operation and maintenance costs and will have minimal adverse side effects associated

with chemical removal. , The TMDL provides that, upon approval of a trading tool, the Department will make water quality trading an option for specified treatment plants within the Passaic River Basin, which may identify viable cost effective options beyond a uniform reduction of phosphorus at each facility.

102. Comment: The Department violated the premise of the Clean Water Act by not publicizing the development of the TMDL for the fresh water Passaic and the Ramapo. There should have been briefings during development. The TMDL would have benefited from broader public participation. (7)

Response: In addition to the Clean Water Act's public process requirement, the Department's Water Quality Management Planning rules at *N.J.A.C.* 7:15-7.2(f) require the Department to informally initiate a public process prior to the development of each TMDL including informational sessions as needed. The Department has fully complied with both the spirit and intent of the requirement to provide opportunities for public comment. As set forth in the response to Comment 101, the Department has gone to extraordinary lengths to maintain an open public process in the development of these TMDLs. The Department publicized the development of the Passaic River Basin TMDLs by including stakeholders in the TMDL development process throughout the past 14 years through various workgroups and milestone informational sessions as set forth in Section 9 of both TMDL documents. In preparation of the TMDL proposal, the public was formally noticed: through direct correspondence by the Department, by public notice as published in the May 7, 2007 New Jersey Register; and through newspapers of general circulation in the affected area. In addition, a public hearing was held on June 7, 2007 at the Cultural Center at Lewis Morris County Park, 300 Mendham Road, Morristown, NJ. Notice of the proposal and hearing was provided to affected Designated Planning Agencies, municipalities, dischargers, and purveyors in the watershed.

TMDL Administrative Comments:

103. Comment: There are data and information required for defining the Passaic River Basin TMDL equations that are missing from the TMDL report. While this data and information may be found in the supporting documents, the TMDL report should provide this information in order to present and support these TMDL equations. (21)

Response: Highly complex TMDL studies that cover large areas, such as the subject TMDL studies, preclude inclusion of the supporting data and other information within the TMDL document itself. As noted by the commenter, the data and information upon which the TMDLs are based are found in the cited support documents, which were made available along with and are part of the TMDL reports. The commenter is referred to other complex studies, such as the Delaware Estuary PCB TMDLs established as a collaborative effort among EPA, the affected states and DRBC, wherein the TMDL document summarizes the findings and the detailed information is found in several volumes of supporting information.

104. Comment: For the Passaic River basin TMDL, the entire TMDL equation must be presented by assigning numeric values to the wasteload allocation (WLA), load allocation (LA), explicit margin of safety, and reserve capacity. Some of this essential information is missing from the TMDL report, most notably in Table 12, which provides the TMDL for the area between the Wanaque Reservoir and Dundee Dam, and Table 13, which provides the TMDL for the Wanaque Reservoir. Table 12 currently provides allocations of TP per day in the following broad categories: headwaters, NPS

runoff, NPS baseflow, CSO discharges and STP discharges. These allocations are divided between three geographic areas: Pompton, Upper/Mid Passaic and Lower Passaic. These categories must be broken down further to include: the names of the affected tributary waters along with the individual LA for each tributary, the identification of the different New Jersey land use categories by size with their current loads, percent reductions, and TMDL allocations, the method for identifying MS4 areas and identification of their loads in the WLA by MS4 name and permit number, and the names, permit numbers, and individual WLAs of the other permitted discharges in the contributing watershed. (21)

Response: Tables 12 and 13 have been modified to clarify the TMDL and WLAs and LAs for each endpoint and to correct minor errors. It should be noted that the MOS and reserve capacity have been factored into the Passaic River basin TMDL by targeting a level of chlorophyll-*a* that is below the criterion. Therefore, there is no quantified amount of the loading capacity attributed to these components. This means of providing a MOS and reserve capacity is allowed according to EPA guidance (May 20, 2002 Sutfin Memorandum). A more detailed areal breakdown is not appropriate or necessary because a key finding of this TMDL study is that the in-stream numeric criterion does not apply within the modeled domain. Watershed criteria have been established at the two critical locations, the Wanaque Reservoir and Dundee Dam Lake. A tributary by tributary breakdown of loading allocation would only be appropriate to demonstrate attainment of the in-stream criterion, which clearly does not apply here. Regarding specific requested additions, the Department notes the following points. Permitted point sources, other than stormwater point sources, were identified by permit number in Tables 7 and 14. The location of dischargers was provided in Figure 4 and footnotes to Table 14 provide information relevant to the established WLA (e.g., location in outside boundary of modeled domain, location below confluence of Pompton and Passaic Rivers thereby warranting seasonal limits). For additional clarity, Table 14 has been modified to indicate within which TMDL Approach Area each discharge is located, and to correct minor errors. Tables 12 and 13 have been revised to identify the assignment of WLAs and LAs to distinguish stormwater point sources from nonpoint sources by land use type, as described in the text, including existing loads and loads under the TMDL specification. Permit numbers have been added for stormwater point source permittees in Appendix B. Land use information was provided in Table 6 and Figure 3 for the overall Passaic River drainage area. A land use breakdown for the Pompton Lake drainage area is provided in Table 6.9 of Najarian 2005. Note that the method for Approach Areas 1, 3 and 4 is described in Section 4, Source Assessment, and explained in greater detail in Omni 2007. For Approach Area 2, the UAL coefficients were used to derive an EMC for storm-driven loads and applied in combination with an estimate of groundwater concentration, using a base flow separation method to obtain nonpoint source loads.

105. Comment: In the Passaic River Basin TMDL, Table 13 is missing the following from the TMDL equation: explicit margin of safety, reserve capacity (if any), the identification of the specific permitted discharges located in this TMDL's contributing watershed, a table assigning the different land uses to either the WLA or the LA portion of the equation, and the distribution and size of the different land uses in this contributing watershed. (21)

Response: Table 13, which provides information for the Wanaque endpoint, has been revised to distinguish between WLAs and LAs for stormwater point sources and nonpoint sources, respectively. The MOS and reserve capacity have been factored into the Passaic River basin TMDL by targeting a level of chlorophyll-*a* that is below the established watershed criteria. Therefore, there is no quantified amount of the loading capacity attributed to these components. This means of providing a MOS and reserve capacity is allowed according to EPA guidance Sutfin 2002. Regarding land use information, the land use areas are found in Najarian 2005, Table 6.9, as indicated in footnote 7 of Table 13. As described in response to Comment 104, for Approach Area 2, UAL coefficients were used to derive an

EMC for storm-driven loads and applied in combination with an estimate of groundwater concentration, using a base flow separation method, to obtain nonpoint source loads. Existing and TMDL loadings derived from these methods are provided in Table 13. Point sources, other than stormwater point sources, were identified in Table 14 by permit number. This table has been modified as described in response to Comment 104 for additional clarity. Stormwater point sources are identified by permit number in Appendix B.

106. Comment: In the Passaic River Basin TMDL, the data used to develop the TMDLs must be identified in a general way in the TMDL report. A summary of the major observations, such as dissolved oxygen and chlorophyll-*a* levels in the Passaic River at Dundee Dam and the Passaic River at Two Bridges, should also be provided. (21)

Response: Detailed observations and data are included in the supporting documents. The TMDL does provide a summary of key water quality findings in Section 3. The findings identify locations where phosphorus is causing excessive primary productivity and where it does not and why, and where observed low dissolved oxygen is the result of naturally occurring conditions. A summary statement about chlorophyll-*a* levels in Wanaque Reservoir has been added for completeness.

107. Comment: In the Passaic River Basin TMDL, a summary of boundary conditions should be provided in the TMDL report. (21)

Response: The boundaries are identified in Figure 2 entitled "Spatial extent of non-tidal Passaic River basin study and related studies with modeling approach applied" (page 23). A discussion of the TMDL approaches is found in section "Area of Interest" (page 18-19). Boundary conditions are summarized on page 11 and then discussed in greater detail on page 123-124 of the Omni Environmental Final Report. Boundary conditions are also addressed in section 5.4 Conditions for TMDL Development in the Najarian Report (page 5-3).

108. Comment: In the Passaic River Basin TMDL, other information and data which support the TMDL analysis and delisting conclusions must be identified in the TMDL report by providing adequate references, including document name and relevant page number(s), to the supporting documents. For instance, when the TMDL report states that 2004 Sublist 5 listings were shown to not be impaired by TP, the reference to the data or information supporting this claim must be provided in the body of the TMDL report. (21)

Response: Section III, Watershed Modeling Analysis, of the Passaic River Basin TMDL document (Omni, 2007) provides adequate discussion and relevant graphs for the interpretation of the narrative criteria for phosphorus for all of the five sub-watersheds studied that leads to the conclusion that phosphorus is only "rendering unsuitable" in the identified critical locations. In addition, comprehensive graphical model simulation outputs in terms of the response indicators, dissolved oxygen and chlorophyll-*a* concentration under different model conditions, are provided in Appendix J in the Passaic River Basin TMDL Appendices (Omni, 2007). References to these sections will be included in the TMDL document.

109. Comment: In the Passaic River Basin TMDL, for reasonable assurance, please provide as much detail as possible regarding the reductions in phosphorus loading expected from the implementation actions identified in the TMDL report. (21)

Response: The Department expects to achieve the needed levels of nonpoint source reduction through a suite of management measures, as described in the implementation section. Significant reductions in phosphorus load are expected from implementation of the measures required under the municipal stormwater regulation program. These include street sweeping, yard and pet waste management, and limitations on wildlife feeding. For example, the US Department of Transportation Federal Highway Administration cites a State of California study on vacuum sweeper efficiency where 74% TP was removed, with an efficiency rate of 40% attributed to mechanical sweepers– see www.fhwa.dot.gov/environment. In addition, adoption of the fertilizer management ordinance will be required of those municipalities that are within the model domain. The literature supports that a significant (20%) overall phosphorus reduction can be expected from this measure alone. The USGS documented the effects of lawn fertilizer on nutrient concentrations from runoff for a study in Wisconsin and found that total phosphorus concentration in lawn runoff was directly related to phosphorus concentration in lawn soils. Further, runoff from lawn sites with phosphorus-free fertilizer application had a median total phosphorus concentration similar to that of unfertilized sites, an indication that phosphorus-free fertilizer use is an effective, low-cost practice for reducing phosphorus in runoff. A growing body of research from Wisconsin, Michigan, Minnesota and Maine concludes that phosphorus from fertilizer applied to lawns enters surface waterbodies through runoff. After 8 years of voluntary use of phosphorus-free lawn fertilizer starting in 2008, Maine is banning the sale of phosphorus fertilizer unless certain conditions are met because of the finding that most soils had enough phosphorus to keep a lawn healthy. This mirrors information available about soils in New Jersey as well. Research conducted in Maine showed that in watersheds that are converted from their natural, forested condition to residential, commercial and agricultural uses, the amount of phosphorus runoff increases by a magnitude of 5 to 10 times. Minnesota has also restricted phosphorus in lawns fertilizers to protect the quality of their lakes and streams. In 2003, EPA reported that the City of Plymouth, Minnesota enacted a phosphorus fertilizer ban in 1996 and observed a 23% reduction in phosphorus inputs to their lake as compared to phosphorus loading from neighboring community. See http://www.lakeaccess.org/lakedata/lawnfertilizer/recentresults.htm

In addition to measures to be implemented through the Municipal Stormwater Regulation Program, the implementation section describes numerous restoration projects funded with 319(h) funds that are located within the study drainage area. The National Grants Reporting Tracking database provides a tool for estimating load reductions from measures, including those that achieve phosphorus reduction. For example, a 1998 319(h) funded detention basin retrofit project in Mendham Township estimated using the "Spreadsheet Tool for Estimating Pollutant Load" or "STEPL" model that a 160 pound per year reduction in phosphorus may be expected as a result of the completion of the project. The cumulative effect of these projects will enhance the phosphorus reduction achieved through regulated stormwater and contribute to the overall reduction required. The Department remains committed to targeting future 319(h) funds, as well as available State funds, for example, Corporate Business Tax, to achieve water quality objectives.

110. Comment: In the Passaic River Basin TMDL, please explain the difference between the Ortho-P values in Tables 9 and 10 when both tables have the heading “Tributary Baseflow Concentrations for Contributing Watersheds.” (21)

Response: Table 9 was intended to provide tributary baseflow values for parameters other than phosphorus, while Table 10 was intended to provide tributary baseflow values for phosphorus species, which vary by watershed. The titles of the tables will be revised to be more clear and the phosphorus value will be omitted in Table 9, as this was an error.

111. Comment: In the Passaic River Basin TMDL, why is there no decrease in P loading from CSO discharges? (21)

Response: As background, the Department regulates all portions of combined sewer systems by general permit. The permit relies upon the development and implementation of best management practices, technology-based control measures, self-monitoring, and permit compliance certification to comply with the requirements of the Federal Clean Water Act (CWA) as defined by the National CSO Control Policy. The TMDL addressed CSO discharges in section 4.0 Source Assessment (page 29) under the discussion on Point Sources. It was determined that the CSO load was insignificant in that elimination of this load would result in no significant difference in the outcome of the TMDL. Therefore, because the means for achieving load reductions would entail costly measures such as eliminating CSOs or providing end of pipe treatment, such reductions were deemed an inefficient means of achieving the objective and were not required or factored into the TMDL. Nevertheless, some reductions are expected to be achieved through the Long Term Control Plans for the affected CSOs, which will provide a conservative assumption within the TMDL.

112. Comment: In the Passaic River Basin TMDL, "Baseline Future Condition" is better described as "Upper Bound Condition" on phosphorus loading since it assumes that every NJDPES is discharging at their permitted limit to the watershed (p. 120 of technical document). (21)

Response: Both expressions, baseline future conditions and upper bound conditions, were used interchangeably throughout the study. The descriptor suggested by the commenter for the table would be accurate; however, no change has been made because the descriptor in the TMDL is fully explained as to meaning and is used extensively in the TMDL and supporting documentation. There would be no value added from the effort to change the descriptor throughout the documents.

113. Comment: In the Pompton Lake/Ramapo TMDL document, there should be explanatory text to describe how both the Reckhow model and the mass balance model are used in order to determine the final loading capacity, WLAs, LAs, and margin of safety. How was one modeling approach selected over the other for the TMDL values? If the mass balance model alone was used to determine these, then the discussion must be based on the use of the mass balance model and calculation of implicit margin of safety, the 6% explicit margin of safety, and the 1% reserve capacity. (21)

Response: Section 6 of the TMDL document provides an explanation of the two technical approaches considered as well as an explanation for selection of the mass balance approach over the Reckhow approach. The two approaches gave similar outcomes. However use of the mass balance approach for the Pompton Lake/Ramapo River TMDL would allow the use of a consistent approach throughout Approach Area 2, the remainder of which is addressed in the Passaic River basin TMDL. In addition, the mass balance approach was able to provide daily loadings as a boundary condition input to the Passaic River basin TMDL, while the Reckhow approach does not. Section 6.2 will be revised to provide greater clarity on the integration of the approaches as well as this additional elaboration on the selection of the mass balance approach. With regard to the MOS and the Reserve Capacity, a significant MOS is integral to the Reckhow model and an additional 6% MOS was stipulated values with respect to loadings under the mass balance approach. The mass balance MOS value was deemed sufficient, given the significant MOS already incorporated in the Reckhow model. The 1% Reserve Capacity was provided to allow for the possibility that there may be a new or expanded wastewater treatment facility in the future, although there are no planned new or expanded facilities at this time.

114. Comment: Pertinent information currently in the Wanaque TMDL needs to be presented in the Ramapo River-Pompton Lake TMDL document and this document should be able to "stand alone." These items are currently described with regard to the Reckhow model alone. (21)

Response: The information in the Wanaque TMDL, or Passaic River basin TMDL, is not pertinent to the Ramapo River-Pompton Lake TMDL calculations. The latter study addresses a distinct drainage area that contributes, in terms of a boundary condition, to the Passaic River basin TMDL study, but the converse is not true. Therefore, the Pompton Lake/Ramapo River TMDL is a stand-alone document. Because the Pompton Lake/Ramapo River document has not yet been approved and contains information relevant to the Passaic River basin TMDL, the pertinent information from the Pompton Lake/Ramapo TMDL document is included in the Passaic River basin TMDL so that it is also a stand alone document.

115. Comment: In the Pompton Lake/Ramapo TMDL, on page 15-16, the Najarian Mass Balance Model is described in the Source Assessment Section. This should be located in Section 6.0, Technical Approach. Furthermore, the results of the model, including graphs of observed versus simulated loadings and coefficient of correlation, should be included. (21)

Response: The Department agrees that some of the discussion under Source Assessment is more appropriate in Technical Approach and will modify the document accordingly. However, the Department believes that the supporting details are more appropriately provided in the support document, Najarian 2005, which is part of the TMDL.

116. Comment: In the Pompton Lake/Ramapo TMDL, NJDEP states the following regarding phosphorus concentrations for the Ramapo River between Mahwah and Pompton Lake (see Page 23): "Given the required boundary condition of water quality meeting the standard of 0.1 mg/L at the state border/Mahwah station and the fact that the Ramapo River is a "losing" stream, the in-stream standard of 0.1 mg/L will be met in the Ramapo River, without further demonstration." The term "losing stream" is unclear. This concept could be demonstrated by including graphs comparing the phosphorus concentrations in the Ramapo River at Mahwah versus downstream at Oakland. In general, meeting a stricter WQS in a downstream lake doesn't necessarily mean that a higher WQS in an upstream segment will be met due to greater variability and higher peak to average P ratios in river phosphorus concentrations. In addition, Ramapo River is a "losing stream" given current phosphorus loads, but will it remain a "losing stream" once the TMDL is implemented? Please explain this linkage and identify mechanisms by which the Pompton River's phosphorus concentration decreases further downstream from Mahwah. (21)

Response: A losing stream is one in which stream flow is lost to ground water at a greater rate than groundwater enters the stream. In the relevant portion of the Ramapo River, a well field is located which draws water at a rate so as to induce the losing stream condition. The stream flows, which contain higher concentrations of phosphorus, are drawn into the ground water and are replaced with ground water, which contains lower concentrations of phosphorus. This hydrologic condition is not expected to change as the result of implementing the TMDL. The supporting document, Najarian, 2005, pages 3-4,3-5, and Figures 3.6a, 3.6b, 3.7a and 3.7b, provide a detailed explanation and justification for the conclusion drawn that the Ramapo River is a losing stream. In addition, water quality sampling conducted for the Passaic River TMDL study demonstrates the same result. Commenter is referred to the synoptic sampling done at the two locations, as illustrated in the graph provided in the Passaic River Basin TMDL- Phase I data summary and analysis (Omni, 2004) page 7 slide 6. It should be noted that the called for reduction from New York is of primary importance in

meeting the in-stream criterion at the Mahwah station, as it is very close to the border. The reductions called for in New Jersey are to attain the more stringent lake criteria in Pompton Lake. Comparison of the observed TP concentrations between Ramapo River and Mahwah and Ramapo River at Pompton Lake show a clearly significant decrease in TP concentrations.

117. Comment: For Pompton Lake, the Qa, Areal Water Load (m/yr), is 375 m/yr, which exceeds the recommended range for the Reckhow model of 1.2-190 m/yr. Please discuss using the Reckhow approach when this discrepancy exists. (21)

Response: Although the areal water load for Pompton Lake is outside the calibration range (375 m/year), the model still remains a good choice since it has the broadest range of lake characteristics in its database. While the target concentration for the lake is well within the range, the areal phosphorus load provides a better representation of a lake's intrinsic loading characteristics. Also, it is the model's prediction of target condition that would be used to calculate the TMDL. If current loads are higher than the range that can produce reliable model results, this has no affect on the model's reliability to predict the target condition under reduced loads.

118. Comment: In the Pompton Lake/Ramapo TMDL, the current title of Table 13 does not make sense. The title should explain that this is the loading capacity or TMDL for total phosphorus including WLAs, LAs, explicit margin of safety and reserve capacity for the <u>New Jersey portion only</u> of the Pompton Lake watershed. (21)

Response: The referenced table includes information regarding both New Jersey and New York sources, providing a summary of all source loads, as reflected in the title. The title will be modified to indicate that the table provides the TMDL components for the Pompton Lake endpoint and WLAs and LAs that apply to sources originating in New Jersey.

119. Comment: In the Pompton Lake/Ramapo TMDL, the allocations in the column labeled “TMDL Specification” add up to 17.4, not 17.3 kg TP/day which has been identified as the loading capacity. Please reconcile these two numbers. (21)

120. Comment: The “TMDL Specification” for “Point Sources other than Stormwater NJPDES Dischargers” is given as 0.4 kg TP/day yet the summation of these individual WLAs in Table 12 is 0.37 kg TP/day. Please reconcile these two numbers so that the same number is used in both tables for this category of sources. (21)

Response to Comments 119 and 120: The difference between the values in Table 12 and Table 13 is negligible. However, the Department has resolved the imprecision caused by conventional rounding as requested by the commenter.

121. Comment: In the Pompton Lake/Ramapo TMDL, there are certain allocations under the “Land Use Surface Runoff” section which appear to conflict or are not identified. Clarify how “low intensity residential” and “high intensity residential” do not overlap with the category called “mixed urban/recreational.” Please provide some description in the document of the source category “disturbed areas.” Please explain why it is reasonable to assign a load of 0 kg TP/day to the category “Crops/Pasture/Hay.” Finally, please explain the Sediment/Base Flow load and how is it estimated. In the Source Assessment Section whether this load is a sediment flux load, a groundwater inflow load, or a combination thereof could be provided. (21)

Response: Table 5 provides the Anderson Land Use/Land Cover codes that were grouped into each land use category descriptor used in the document. The descriptions of what is covered under each code can be found in LAND USE LAND COVER CLASSIFICATION SYSTEM, (Derived from: A Land Use and Land Cover Classification, System for Use with Remote Sensor Data, U. S. Geological Survey Professional Paper 964, 1976; edited by NJDEP, which is available at http://www.nj.gov/dep/gis/digidownload/metadata/lulc95/anderson.html. A footnote will be added to Table 5 referring to this source, which will be added to the References Section. For convenience, the Department had grouped several code types under an unofficial descriptor, "mixed urban/recreational". There is no overlap with the residential land uses, as the codes included in "mixed urban/recreational" include "transportation, communication and utilities", "other urban or built-up" and "recreational land." "Disturbed areas" are the same as "barren land" commonly used in other TMDLs. The "crops/pasture/hay" category appears to have a zero value in the future because, after the 80% reduction, the value is less than 0.05 and is lost due to rounding to maintain significant figures. The table will be revised to clarify this. The term "sediment/base flow" refers to the portion of the mass balance equation that represents ground water base flow and storm water flows, derived as described in the TMDL document.

122. Comment: In the Pompton Lake/Ramapo TMDL, the names of the land use categories which have been assigned daily loads do not match the names of the categories which were divided into WLAs and LAs. Please make clear, for the categories actually used, which are in the WLA and which are in the LA. (21)

Response: The Department has revised the table to clarify WLA and LA by category.

123. Comment: In the Pompton Lake/Ramapo TMDL, Table 12 (page 25) does not identify that the units represent total phosphorus. (21)

Response: The Department has revised the table to clarify that the units represent total phosphorus.

124. Comment: In the Pompton Lake/Ramapo TMDL, Table 4 (page 13) provides the size of each land use area in the entire Pompton Lake watershed. There must be a table which provides these sizes for the focus of the TMDL which is only the New Jersey portion (47 mi^2) of the total watershed (160 mi^2). Also, the 1995/97 land use coverage should be replaced with the 2002 land use coverage. (21)

Response: The values shown in the TMDL for land uses used in the Reckhow approach are from the Pompton Lake and Ramapo River TMDL Study, QEA 2004. The consultant combined the 1995/1997 land use/land cover for New Jersey and the 2000 New York land use information to develop nonpoint source loading. Comparison of the 1995/1997 and 2002 coverage showed no significant change in the New Jersey land use assessment by category. In any case, the Reckhow approach was not ultimately used to calculate the TMDL. In the mass balance approach, land use from New Jersey only was used to estimate the baseflow versus groundwater values for phosphorus, as described in the TMDL.

125. Comment: In the Pompton Lake/Ramapo TMDL, Figure 2 (page 11), the map of the New Jersey portion of the watershed, does not identify the approximate location for the collection of monitoring data from the Passaic Valley Water Commission and from the North Jersey District Water Supply Commission. Also, there is a monitoring location labeled "AN0267" on the map that is not discussed. Is this possibly the location for collection of benthic macroinvertebrate (AMNET) data? What were the results? (21)

Response: In the Pompton Lake/Ramapo TMDL, the sample locations used for the TMDL have been included. The benthic macroinvertebrate (AMNET) site labeled "AN0267" is irrelevant to the TMDL and has been removed from Figure 2. The PVWC (at Pompton Lake inlet) and NJDWSC (same as 1388000 – additional label) sample locations will be added.

126. Comment: In the Pompton Lake/Ramapo TMDL, on page 7, the last sentence of the third paragraph states "Attainment status with respect to designated uses and the parameters identified as responsible for the non-attainment for the assessment units in Table 2 are identified in Appendix B." The designated use impairments do not appear in Appendix B. (21)

Response: This information will be added to Appendix B.

127. Comment: In the Pompton Lake/Ramapo TMDL, at the top of page 16, is the statement "Two stations within the Pompton Lake watershed were selected as the critical locations, Ramapo River at Pompton Lake and Ramapo River at Mahwah." The two monitoring stations used as the critical locations were called "Ramapo River at Dawes Highway" and "Ramapo River near Mahwah" in the 2004 303(d) list. Should these names be used? (21)

Response: The "Ramapo River at Pompton Lake" is a station that is no longer sampled, replaced by one nearby entitled "Ramapo River at Dawes Highway", which is the name used in the 2004 listing. "Ramapo River at Mahwah" was inadvertently used and should be "Ramapo River near Mahwah". This will be changed in the document.

128. Comment: In the Pompton Lake/Ramapo TMDL, the opening description of reasonable assurance, provided in this section on page 33, does not accurately describe the EPA definition or use of reasonable assurance. Since this information is identified on page 8 as "an EPA requirement for approval which will be addressed in the TMDL document," a more accurate definition should be provided. EPA uses reasonable assurance to determine that TMDL reductions in nonpoint sources are reasonable when they are offsetting required reductions from point sources. Please provide as much detail as possible in terms of the reductions expected from the implementation actions identified in the TMDL report. (21)

Response: The opening of the Reasonable Assurance Section was not intended as a restatement of the EPA definition. The Department understands the purpose of reasonable assurance and sees no conflict between that requirement and the statement in the TMDL document. Regarding the means to achieve the identified nonpoint source and stormwater point source reductions, please refer to the response to Comment 109. In this drainage area, an even more ambitious reduction is called for and is expected to be achieved by, in addition to the measures described, an emphasis on funding riparian restoration projects, which is consistent with measures identified to be needed to address temperature impairments in the Pequannock River temperature TMDLs approved by EPA in 2004.

129. Comment: In the Pompton Lake/Ramapo TMDL, on page 21, the discussion of the explicit margin of safety focuses on the Reckhow model's 33.3% MOS yet the final TMDL is based on a 6% MOS using the mass balance approach. The document does not provide discussion of the 6% MOS which was used. Please provide this information. (21)

Response: The 6% MOS was chosen to reflect the degree of confidence in the data and model used and is comparable to the explicit MOS used in other TMDLs.

130. Comment: In the Pompton Lake/Ramapo TMDL, the fourth paragraph on page 21 begins "An implicit margin of safety is provided by using conservative critical conditions…" This section needs discussion of the conservative assumptions that may have been employed to determine the critical condition(s). The discussion of providing an implicit margin of safety by targeting total phosphorus instead of dissolved phosphorus is correct. The implicit margin of safety is not associated with the selection of critical conditions or the use of total phosphorus as the target pollutant versus dissolved or particulate phosphorus (since water quality standards have taken this into account already), but with conservative modeling assumptions. (21)

Response: The comment appears to be internally inconsistent. It is assumed the commenter intended to state that "The discussion of providing an implicit margin of safety by targeting total phosphorus instead of dissolved phosphorus is *not* correct." The implicit MOS section will be revised to eliminate the discussion of total versus dissolved phosphorus.

131. Comment: In the Pompton Lake/Ramapo TMDL, The discussion of reserve capacity on page 23 should also state the number, that is, 0.2 kg TP/day (1% of the TMDL) that has been chosen for reserve capacity. (21)

Response: This information is provided in Table 13, but will be added to the Reserve Capacity Section for completeness.

132. Comment: In Figure 1 of the Pompton Lake/Ramapo TMDL document (page 10), the map should include Wanaque Reservoir and the diversion pipe since it is a part of the hydrological system. (21)

Response: The Wanaque diversion location is not within the spatial extent of the Pompton Lake/Ramapo River TMDL study and therefore it is not necessary to add this information to the cited map.

TMDL Should Address Nitrogen:

133. Comment: The TMDL does not deal with all the issues. In 1999, the nitrogen got so high that it nearly shut down PVWC. (20)

134. Comment: Given the long standing objective of the Public Advisory Committee for WMA 6 to set appropriate target levels for nitrogen, as well as phosphorus, through scientific investigation, the commenter believes that the studies upon which this TMDL proposal is based should have evaluated the impacts of nitrogen concentrations with respect to dissolved oxygen and chlorophyll-*a*. Both nitrogen and phosphorus are nutrients that contribute to algal growth and affect suitability of waterbodies for use as water supplies, which is the highest use and must be protected. Phosphorus was found not to be limiting productivity in a number of locations. In these locations, reducing both nitrogen and phosphorus should reduce algal growth. Consequently, the Department should address nitrogen in the Passaic TMDL. The goals of chlorophyll-*a* for the Wanaque Reservoir and Dundee Lake will not be achieved unless loadings of both phosphorus and nitrogen are reduced. The Highlands Draft Regional Master Plan and the NY/NJ Harbor TMDL are targeting nitrate as a parameter that must be limited or reduced. It is bothersome that the Highlands do not have a database that could inform the TMDL plan to make it more comprehensive; instead the TMDL proposal is piecemeal and has inaccuracies. Nitrogen and ammonia reductions are needed to assist the Lower

Passaic River Restoration project because, in that part of the river, nitrogen is the nutrient of concern to control algal growth. (7), (8), (9)

Response to Comments 133 and 134: The modeling study for this TMDL did include nitrogen species. However, a TMDL for nitrogen species in the Passaic River itself is not warranted at this time because the waters are not listed as impaired with respect to nitrogen species. It is important to note that ammonia is currently very low throughout the Passaic River basin due to existing point source requirements. As noted in *The Technical Approaches to Restore Impaired Waterbodies within the Non-tidal Passaic River Basin*, October 2001, vetted and approved by the Passaic TMDL Workgroup Workgroup, October 31, 2001, and still true today, there are no documented exceedances of the 10 mg/l SWQS for nitrate. However, nitrate is identified as an emerging issue with a critical location at Little Falls where water is withdrawn directly into a drinking water facility. Currently, purveyors are required to perform additional monitoring if nitrate levels above 5 mg/l are found. Furthermore, the Department has begun to implement water quality based effluent limitations (WQBELs) for nitrate upon renewal of NJPDES permits based on compliance with the 10 mg/l nitrate criterion under low design flow conditions (7Q10). The Department is assessing what additional measures may be appropriate to address the issue statewide.

The focus of this TMDL is the phosphorus impairment as it relates to excessive primary productivity and related water quality effects. While it is true that both nitrogen and phosphorus are necessary to support plant and algal growth, it is not true that nitrogen reductions are necessary to achieve the phytoplankton chlorophyll-*a* goals for the Wanaque Reservoir and Dundee Lake. Since both nitrogen and phosphorus are necessary to support plant and algal growth, reducing either or both nutrients to low levels could theoretically limit plant and algal growth. In practice, however, phosphorus is generally targeted to constrain productivity in freshwater systems. Natural and nonpoint sources of nitrate in freshwater systems are generally sufficient to support high levels of productivity, and are more difficult to control than phosphorus. In addition, it would not be desirable to induce nitrogen limitation, which tends to promote nuisance algae in freshwater systems. While neither nitrogen nor phosphorus is low enough currently to limit primary productivity, by establishing watershed criteria in terms of the response indicator chlorophyll-*a* in the two critical locations, Dundee Lake and Wanaque Reservoir, and requiring phosphorus reductions that will attain these criteria as demonstrated by the models, the water quality objectives for this study will be met.

While watershed-wide nitrogen reductions are not necessary to achieve water quality objectives in the non-tidal Passaic River system, they may be necessary to achieve water quality objectives in the NY/NJ Harbor. The model developed for the Non-Tidal Passaic River Basin Nutrient TMDL Study is calibrated for ammonia, nitrate, and organic nitrogen, and can therefore be used to translate a load allocation for the Passaic River at Dundee into wasteload and load allocations throughout the system. Upon completion of the New York/New Jersey Harbor Estuary TMDL, carbon and/or nitrogen reductions may be called for to achieve dissolved oxygen standards in the harbor. If so, the non-tidal Passaic River basin model can be used to allocate loads among sources in the non-tidal Passaic River basin.

135. Comment: The commenter asks what the maximum long-term average concentration of total nitrogen would be to keep summer averages of chlorophyll-*a* below 10µg/L or 20 µg/L. (9)

Response: It was determined in this TMDL study that phosphorus is causing excessive primary productivity in two locations in the Passaic River Basin, the Wanaque Reservoir and Dundee Lake. In these locations, the Department has established watershed criteria in the form of chlorophyll-*a* as well

as the phosphorus reductions needed to attain these criteria. As discussed in the response to Comments 133-134, nitrogen reductions are not needed in order to attain the water quality objectives in the non-tidal Passaic River with respect to eutrophication. However, nitrogen reductions may be required in the future, in response to the NY/NJ Harbor TMDL or as determined necessary to ensure the drinking water use is protected.

General Comments:

136. Comment: The existence of a phosphorus problem in the Wanaque Reservoir has not been supported. No limitation based upon discharge to the Reservoir should be imposed until it is demonstrated that phosphorus is causing the impairments. (23)

Response: Water quality data clearly identifies violations of water quality criteria for phosphorus.

137. Comment: The Great Swamp Watershed Association and Ten Towns Great Swamp Watershed Management Committee (TTC) collaborated on the collection of water quality sampling for the Omni Environmental February 2007 Report (Appendix D, Page D-2 of the Omni Report). Specifically, sample collection at certain sites that was conducted by TTC are improperly attributed to GSWA at sites PRin, PB1, LB1, GB1, BB1 and PRout. (4)

Response: The Department has posted a revised Appendix D of the 2007 Omni Report in order to make it clear that the data used for the analysis were provided through collaboration between the Ten Towns Great Swamp Watershed Management Committee and the Great Swamp Watershed Association.

138. Comment: A State mandated program requires water purveyors to add polyphosphate to potable water for corrosion control. This practice increases total phosphorus in STP influent. (11)

Response: Currently there is no mandated State program for the addition of polyphosphate to drinking water. The commenter may be referring to the National Primary Drinking Water Regulations for Lead and Copper (40 C.F.R. 9, 141 and 142), which, since the early 1990's have required all public community water systems serving populations greater that 50,000 to do a corrosion optimization study and then after state approval implement the recommendations of the study. In many cases the study outcome was the addition of polyphosphate, sometimes with pH adjustment. However, other outcomes also included increasing existing pH levels with lime or soda ash, adding silicates, or no action at all. Additionally, for systems serving less that 50,000, if more than 10 % of sampling results exceeded established action levels during semiannual testing for lead and copper, those systems also were required to consider treatment to reduce corrosion with the distribution system.

For the systems that opted to use polyphosphates, the amount of polyphosphate dosed to the system would be that needed to achieve the goal of minimizing the levels of lead and copper in the water system. This amount can vary significantly depending on the quality of the raw water, but is not known to be a significant source of phosphorus in sewage influent.

139. Comment: The TMDL is contrary to the settlement agreements reached with various Passaic River Basin dischargers, including WTSA. The spirit of those agreements has been disregarded and sound science and economic responsibility has been ignored. (10)

Response: The Department believes that both the intent and specific requirements of the Phosphorus Settlement Agreements have been met. Per their individual Stipulation of Settlement, each of the permittees agreed to participate in the watershed planning process, including the TMDL development process. All dischargers, as well as other affected parties, were invited to participate in this process. As a component of this process, the Department developed *The Technical Approaches to Restore Impaired Waterbodies within the Non-tidal Passaic River Basin*, October 2001, with the Passaic River TMDL Work Group to identify the technical approaches to address impairments as identified in the 303(d) list in the non-tidal Passaic River Basin. The Passaic Technical Approach was vetted at several workgroup meetings and consensus was reached at the October 31, 2001 Passaic River TMDL Workgroup on its content. It was agreed that a watershed modeling effort was needed in order to determine where within the Passaic River basin phosphorus was causing excessive primary productivity and what level of phosphorus reduction would be needed to address this response where it was determined to be occurring. Dischargers who were a party to the settlement agreed to participate in the cost of developing a workplan for the study and for carrying out the study itself as well as identifying and implementing low cost phosphorus reductions measures until the TMDL study was completed. The Department agreed to establish phosphorus effluent limits only as determined needed as a result of the TMDL. These steps have been accomplished. The resultant Passaic River basin TMDL is the outcome of the application of sound science to study the problem, with ample opportunities for review and input from affected parties. By establishing watershed criteria that in terms of the response variable chlorophyll-*a*, at levels that will support the designated uses, and providing for seasonal limits where appropriate, the Department has fine tuned the pollutant reductions to require only that expenditure needed to attain water quality standards. After the required reductions are incorporated in revised NJPDES permits and upon approval of an acceptable trading tool, the Department will provide an opportunity for dischargers to determine if a more cost effective means to attain the pollutant load reductions is feasible through water quality trading.

140. Comment: Please consider issues of concern to Pompton Lakes Borough MUA as you move forward with the TMDL implementation process: The plant continues to operate within its current permit limits; our customer base is limited to the residents—11,000; a more stringent phosphorus limit will place an enormous burden on our customers; there is no room at the plant site to construct and operate additional treatment units. (5)

141. Comment: Please consider issues of concern to Wanaque Valley Regional Sewerage Authority as you move forward with the TMDL implementation process: The plant continues to operate within its current permit limits; our customer base is limited to the residents—10,616; a more stringent phosphorus limit will place an enormous burden on our customers. (3)

142. Comment: TBSA supports and applauds NJDEP's efforts to develop a scientifically defensible solution to water quality issues in the Passaic River Basin. Significant amount of time, money and effort have been expended to determine the appropriate regulatory response to nutrient enrichment in the Passaic and TBSA is anxious to commence implementation of the TMDL and to continue to work in partnership with the NJDEP to achieve water quality improvements in the Passaic, provided identified issues are addressed re: data availability, alternative approaches and seasonal limits. (2)

Response to Comments 141 and 142: The Department has made every effort to ensure that the pollutant load reductions called for are needed to attain surface water quality standards. Further, by establishing watershed criteria in terms of the response variable chlorophyll-*a* at levels needed to support designated uses and providing for seasonal limits where appropriate, the Department has fine-tuned the pollutant reductions to require only that expenditure needed to attain water quality standards.

After the required reductions are incorporated in revised NJPDES permits and upon approval of an acceptable trading tool, the Department will also provide an opportunity for dischargers to determine if a more cost effective means to attain the pollutant load reductions is feasible through water quality trading.

143. Comment: Commenter is happy to see progress in achieving a proposal with a scientific basis. (16)

144. Comment: The Department is commended for its efforts to resolve the issue of Phosphorus regulation in a scientifically defensible manner and for moving forward with the Phase 2 TMDL study. RVRSA is fully committed to making the investment necessary to discharge its obligation to protect the environment and reaffirms its desire to work cooperatively with the NJDEP to achieve improvements in water quality. (1)

145. Comment: Although it comes after years of attempting to implement phosphorus control without a study, the Department is commended for moving forward with the current study. (23)

146. Comment: Commenter thanks the Department for going the extra measure to complete the Phase 2 TMDL. Some areas can be criticized, but this is a good starting point and we should move forward. (17)

147. Comment: While there are some missing data and issues to address, we have enough here, grounded in science, that we can move forward. (14)

Response to Comments 142-147: The Department acknowedges the commenters' support for the comprehensive modeling of the Passaic River Basin which has produced a science-based solution that will address water quality impairments in the basin.

148. Comment: Phosphorus removed from effluent should be reused as fertilizer. (9)

Response: Residuals are generated by domestic and industrial wastewater treatment plants. Residuals are managed in variety of ways, including the development of marketable residuals products (also called biosolids) that are used to fertilize or condition the soil. Examples include pellets, compost, and alkaline materials. Beneficial use of residuals as a fertilizer or soil conditioner is regulated under the New Jersey Pollutant Discharge Elimination System regulation at *N.J.A.C.* 7:14A-20. Subchapter 20 of the NJPDES rules defines the standards for the use or disposal of residual. The Department encourages beneficial reuse of sludge. However, as described in these TMDLs, application of phosphorus fertilizer is intended to be limited as one of the management measures needed to achieve pollutant load reductions. Therefore, extensive use of phosphorus containing biosolids would be counterproductive in the basin.

149. Comment: Phosphorus may be coming from leaking sewer pipes; this source may be reducible. (9)

Response: While the potential that leaking sewers exist in the study area cannot be discounted, the model is adequately calibrated without considering this source. In general, sewerage treatment facilities are responsible for the proper collection, treatment, analysis, and discharge of wastewater received from separate sanitary or combined sewer systems. To assure compliance, the Department imposes significant penalties and/or requires remediation for unpermitted discharges to the waters of

the State. Responsible entities must undertake an active monitoring and preventive maintenance program to identify problems, install new sewer lines, clean blocked lines, repair lines that are subject to leaks and infiltration, and conduct all maintenance activities to assure maximum system capacity and to prevent sanitary sewer leaks and overflows. Treatment facilities are required to report all overflows and flooding, whether from sanitary or combined sewage systems, so that repairs and preventive action can be taken to minimize the extent of environmental and human health impacts.

Phase 1 TMDL

150. Comment: The Proposed TMDL continues to ignore key criticisms made by Rutgers New Jersey EcoComplex TMDL Advisory Committee ("NJEC"). A review of the New Jersey EcoComplex interim reports, which were issued in conjunction with the 2005 TMDL, continues to raise serious questions with the newly proposed 2007 TMDL. An examination of the proposed 2007 TMDL reveals that the Department, without explanation, has elected to continue to ignore key questions and criticisms raised by NJEC in 2005. Two examples stand out:

1. In NJEC's Interim Report to the Department, dated November 13, 2003, NJEC recognized that the year 2002 (when a severe drought occurred), could have been an anomaly and questioned whether it should be included or rejected as an outlier. The NJEC later estimated that the 2002 rainfall did correspond to the lowest 10th percentile of precipitation over 100 years and thus represented an anomaly that would result in too stringent a condition. Also, the 9-year simulation (omitting 2002) was not provided as requested by NJEC.
2. In its July 30, 2002 Interim Report, NJEC identified one task of the Department as being the analysis of the relationship between phosphorous concentrations and indicators of primary productivity, as a way to better establish quantifiable endpoints. In doing so, NJEC recommended use of the LA-WATERS model in order to study management strategies and specifically alternative pumping scenarios for NJDWSC. (10)

Response: The comments made by the NJEC were assessed and modifications made, as appropriate, to the TMDL study. With regard to the specific issues identified, the Department believes inclusion of 2002 in the simulation is appropriate, as addressed more fully in the response to Comments 16 and 17. The appropriateness of alternative management measures to achieve the watershed criteria in Wanaque Reservoir is addressed more specifically in response to Comments 58-61.

151. Comment: Commenter includes by reference comments made on the proposed July 5, 2005 *Phase 1 Passaic River Study TMDL for Phosphorus in the Wanaque Reservoir and the TMDL for Total Phosphorus to Address Pompton Lake and Ramapo River* contained in letters dated September 6, 2005 and November 21, 2005 as comments on the current TMDL proposal. The Department agreed not to adopt the Phase 1 TMDL under a Superior Court Order and should not use Phase 1 TMDL information until comments on that document are addressed and information requested through OPRA is provided. Issues include:

a) Evidence of a phosphorus impairment in the Passaic River basin has not been provided

b) The purpose of the Passaic phosphorus studies was to determine the level of phosphorus that causes impairment; attainment of 0.05mg/L numeric criterion was never envisioned. The Phase 1 TMDL eliminated the option to demonstrate that phosphorus was not causing an observed impairment.

c) The Phase 1 TMDL was not identified by the Department as a tool intended to address phosphorus impairment in the Passaic River; as provided for in the Phosphorus Settlement Agreement, the workplan to do so was to be provided for review by the affected parties.

d) It is noted that the Department used the LA-WATERS model for the Reservoir, the NJDEP mass balance model from 1987 and water characteristic studies done by NJDWSC. In response to questions at the DEP's presentation on June 23, 2005, representatives of Najarian Associates indicated that the LA-WATERS model incorrectly predicted the effects of adding Passaic River water to the Reservoir. This being the case, why continue to use the model? The 1987 model did not include a study of phosphorus and has been considered unsuitable for the purpose until the present time. The NJDEP study that resulted from the 1987 model specifically indicates that a comprehensive model of the river is needed. Why is this model now suitable?

e) The TMDL requires an 80% reduction in nonpoint sources. This does not appear to be achievable. The Department sent a misleading letter to municipalities telling them their only obligation was to adopt a fertilizer ordinance.

f) The diversion of water into the Wanaque Reservoir by North Jersey District Water Supply Commission is responsible for any impairment that exists there. They should be the entity responsible for load reductions and receive a NJPDES permit for the diversion, in accordance with the recent Supreme Court ruling.

g) Throughout the Phase 1 process, the Department has indicated that the Phase 2 TMDL could result in less stringent limits, but was unable to explain how at the August 4, 2005 public hearing. The Department then stated that, when the study of the lower section of the river is completed, a 0.1 mg/l limit will be established. It appears that the Department again intends to impose more stringent limits without any scientific study or basis.

h) The Department has not responded to the OPRA requests filed in order to be able to review data and documents related to the study; the comment period should continue to be extended for at least 30 days from the time that the information is provided for review.

i) NJ Ecocomplex comments on the studies that provided the basis for the Phase 1 TMDL were not addressed. There was no final NJEC report provided on the Phase 1 TMDL.

j) As it appears the work for the Phase 2 TMDL is nearing completion, the Phase 1 TMDL should not be adopted. The Phase 2 TMDL results should be presented to the public. (23)

Response: As stated in the TMDL, the July 5, 2005 proposals entitled *Phase 1 Passaic River Study TMDL for Phosphorus in the Wanaque Reservoir and the TMDL for Total Phosphorus to Address Pompton Lake and Ramapo River* were withdrawn and pertinent information from those proposals incorporated into the current TMDLs. Many of the comments made on the Phase 1 TMDL had as their resolution proceeding with the Phase 2 TMDL in lieu of the Phase 1 TMDL. Proposal of the current TMDLs along with the withdrawal of the Phase 1 TMDL renders moot most of the issues identified in the previous comment letters. Responses to specific points in the cited letters are as follows:

a) The purpose of the Phase 1 TMDL was to address phosphorus impairment in the Wanaque Reservoir, not the entire Passaic River basin. The Wanaque Reservoir was identified as an expected critical location early in the larger Passaic River basin TMDL planning process and, in the course of TMDL development, it was determined that water quality in the Wanaque Reservoir, in addition to several locations in the river system, exceeded the Surface Water Quality Standards in terms of the numeric criteria and data was provided in the Phase 1 TMDL support documents. This constitutes impairment, absent establishment of a watershed or site specific criterion. As a result, a TMDL was required to be and was developed for the reservoir.

b) The Passaic phosphorus studies were to determine what action was needed to address phosphorus impairment in the Passaic River, which means to attain the SWQS. In accordance with the SWQS, the Phase 1 and Pompton Lake TMDLs used the numeric criterion as a target, absent documentation that a watershed specific criterion was appropriate. The Phase 1 TMDL necessarily required load reductions from discharges to the Passaic River system, but did not attempt to reach

conclusions about attainment of the in-stream numeric criterion of 0.1 mg/L. The option to conduct a study under the *Technical Manual for Phosphorus Evaluations for NJPDES Discharge to Surface Water Permits* is provided in the SWQS only with respect to the in-stream numeric criterion, not for the lake/reservoir numeric criterion. Therefore, the Phase 1 TMDL neither created nor eliminated an opportunity with respect to the phosphorus protocol. In any case, in accordance with the findings of the current proposal, watershed specific criteria have been developed in place of the numeric criterion for the Wanaque Reservoir and Dundee Lake critical locations and the watershed criteria have been used as the endpoints in these locations.

c) The intention to use the LA-WATERS model to determine the loading capacity of the Wanaque Reservoir had been established in the *Technical Approaches to Restore Impaired Waterbodies within the Non-tidal Passaic River Basin*, which was shared through extensive public participation that included the regulated parties. The Phase 1 TMDL accomplished that objective of the Technical Approach and did not address the reductions needed to address phosphorus impairment in the river itself. As was always intended, the Phase 2 TMDL is the tool that addresses the listing of the river as impaired for phosphorus.

d) This comment is moot in that the model used to simulate river loadings in the Phase 2 TMDL was developed as an outcome of the workplan designed to address the in-stream phosphorus impairments and the Phase 1 TMDL has been withdrawn. Nevertheless, as regards the Phase 1 TMDL, representatives of Najarian Associates never stated that the Reservoir TMDL model incorrectly predicted the effects of adding Passaic River water to the Reservoir. NJDEP's 1987 model addressed all relevant water quality constituents, including phosphorus. However, the NJDEP study was not part of the Najarian 2005 TMDL study. An independently developed mass-balance model for the watershed was used to simulated relevant river conditions for the Phase 1 TMDL.

e) The TMDLs within the spatial extent call for a range of nonpoint source and stormwater point source reductions that range from 0 to 85. The Department identifies the suite of measures that are expected to achieve those reductions. Some measures are non-regulatory while other are regulatory in nature, such as the phosphorus ordinance. Both the Phase 1 and current TMDL clearly state that the measures required under the Municipal Stormwater Regulation permit are the primary means expected to result in the necessary phosphorus reductions from urban areas. The letter sent to municipalities for both the Phase 1 and the Phase 2 TMDL was the required notification that an additional requirement would be added to their Municipal Stormwater Permit, upon adoption of the TMDL. Through adaptive management, in response to follow-up monitoring, it may be necessary to institute other nonpoint source or stormwater point source control measures, but this is not currently proposed. The commenter's suggestion that the Department misled municipalities as to their obligations as a result of the TMDL is incorrect.

f) As stated in the response to Comments 58-61, the load reduction required to achieve the water quality target for the in-stream critical location is the same as that needed to achieve the water quality target in the Wanaque Reservoir. The difference is the applicability of seasonal effluent limits. With regard to NJDWSC responsibility to remove phosphorus prior to diverting it to the Wanaque in order to achieve water quality requirements, the Department does not interpret the Supreme Court decision in Miccosukee as requiring the State of New Jersey to issue discharge permits to regulate purveyors under NJPDES, the State NPDES program. The Department believes that the most appropriate way to address water quality effects of water supply diversion activities is through State authorities related to safe yield and allocation decision making. NJDWSC supplies drinking water to more than 3 million of New Jersey's residents. Management of the system needs to be flexible enough to allow the maximum safe yield without deleterious water quality impacts. While safe yield and allocation decisions do consider water quality implications, directing NJDWSC to change operations for the primary purpose of minimizing the requirement for dischargers to reduce the introduction of a pollutant into the river system is not appropriate. FW2 waters are to be suitable for drinking water use

with conventional treatment. Therefore, the quality of the water at the Wanaque South intake point must be consistent with support of the drinking water use, with or without diversion activities. Water quality trading is an option, but not a requirement, through which NJDWSC can play a role in protecting the water quality of the Wanaque Reservoir as affected by the diversion of Pompton and Passaic River water into the reservoir.

g) The basis of the commenter's assertion is unclear. At the time the Phase 1 TMDL was proposed, the outcome of the Phase 2 work was not known and could not be predicted with accuracy. This necessarily would mean that the WLAs and associated effluent limits resulting from the Phase 2 work could be more or less stringent than identified in the Phase 1 TMDL. Again, the Phase 1 TMDL has been withdrawn and is superseded by the currently proposed TMDL.

h) The Department has fully responded to the OPRA request. Because the Phase 1 TMDL has been withdrawn, extension of the comment period for that TMDL is moot. The currently proposed TMDL was presented prior to the public hearing and a 30 day comment period was provided. The comment period was further extended by 30 days to provide additional time for commenters to assess the Passaic River basin model.

i) The NJEC comments on the Phase 1 TMDL that remain relevant with respect to the Phase 2 TMDL have been addressed within the Phase 2 TMDL document.

j) Again, the Phase 1 TMDL has been withdrawn and the currently proposed TMDL supersedes it.