New Jersey Department of Environmental Protection
Water Monitoring and Standards
Bureau of Water Quality Standards and Assessment

2012 Integrated Water Quality Assessment for New Jersey

Overview of Water Quality Conditions

Introduction

This document presents an overview of the water quality conditions in New Jersey to assist the public with their review of the draft 2012 List of Water Quality Limited Waters ("303(d) List") and two-year schedule for development of total maximum daily loads (TMDLs) for high priority waters and to facilitate public participation in the 2012 integrated water quality assessment process. Components of this overview will be included in the 2012 Integrated Water Quality Monitoring and Assessment Report once the public participation process has concluded. The statistics presented in this summary are subject to change based upon comments received on the draft 303(d) List.

Introduction: What is an "Integrated Assessment"?

The federal Clean Water Act mandates that states submit biennial reports to the U.S. Environmental Protection Agency (USEPA) describing the quality of their waters. The biennial "305(b) Report" must include the status of principal waters in terms of overall water quality and support of designated uses, as well as strategies to maintain and improve water quality. The 305(b) reports are used by Congress and USEPA to establish program priorities and funding for federal and state water resource management programs. The biennial List of Water Quality Limited Waters or "303(d) List" identifies waters that are not supporting designated uses because they do not meet surface water quality standards despite the implementation of technology-based effluent limits. States must prioritize waters on the 303(d) List for Total Maximum Daily Load (TMDL) analyses and identify those high priority waters for which they anticipate establishing TMDLs in the next two years. These separate requirements were integrated into one statewide water quality monitoring and assessment process, the Integrated Assessment, in 2002. The results of the Integrated Assessment are presented and explained in the biennial Integrated Water Quality Monitoring and Assessment Report (Integrated Report).

The Integrated Assessment commences with the compilation and analysis of all readily available water quality monitoring data, which is then assessed for compliance with New Jersey's water quality standards using sound and vetted scientific methods. Water quality standards, monitoring, and assessment provide the scientific foundation for the protection of New Jersey's water resources and implementation of the federal Clean Water Act and the state Water Pollution Control Act. Monitoring and assessment of water quality data directs and supports the New

Jersey Department of Environmental Protection's (Department) efforts to develop and refine water quality standards that provide measurable targets for identifying and protecting high quality waters, identifying and restoring impaired waters, issuing and enforcing discharge permits, managing nonpoint sources of pollution, setting priorities for water resources management, and evaluating the effectiveness of restoration and protection actions.

Assessing the Health of Our Waters: Water Quality Goals and Measures

The surface water quality standards (SWQS) establish stream classifications and antidegradation designations for all surface waters of the State. The stream classifications reflect the designated uses assigned to individual surface waters. Designated uses include aquatic life support (maintenance, migration, and propagation), recreation, fish consumption, shellfish harvest for consumption, drinking water supply, industrial water supply, and agricultural water supply. The SWQS also specify the water quality criteria that correspond with the waterbody classifications, which are necessary to achieve the designated uses.

Water quality monitoring data supports the Department's efforts in developing and refining water quality standards, reporting on water quality conditions, listing impaired waters, issuing and enforcing discharge permits, managing nonpoint sources, protecting good quality waters, setting priorities for water quality management, tracking changes in water quality over time, and evaluating the effectiveness of restoration and protection actions in achieving Clean Water Act goals to "restore and maintain the chemical, physical and biological integrity of the Nation's waters". The Department oversees the operation of the primary water quality monitoring networks for the State of New Jersey. Monitoring strategies employed by the Department are comprised of multiple water quality assessment techniques including: habitat assessments, in-stream biological monitoring such as fish population surveys, collection of physical/chemical data on a variety of matrices (surface water, ground water, sediment), identifying pollution sources in the coastal and freshwater environment (discharges, stormwater, marinas), and sediment toxicity testing. However, monitoring conducted by other entities, such as federal and county government agencies, regional commissions (e.g., Pinelands Commission) watershed associations (including voluntary citizen monitoring) and discharger associations, is also used to supplement these networks and expand the range and scope of information available for water quality assessment. New Jersey's water monitoring programs are described in *New Jersey's Water Monitoring and Assessment Strategy (2005-2014)*, available on the Department's Web site at http://www.state.nj.us/dep/wms/longtermstrategyreport.pdf.

Water quality monitoring data used for the 2012 Integrated Assessment was generally collected between January 1, 2006 and December 31, 2010, and was used to identify high quality waters that are fully supporting applicable designated uses, lower quality waters that are not supporting designated uses, and waters for which insufficient information is available to assess water quality. The Integrated Assessment also identifies causes and sources of water quality problems so that appropriate strategies may be implemented by the State to maintain high quality waters, improve lower water quality waters, and gather sufficient information to assess all waters of the State. The information provided in the Integrated Assessment is used by Congress, USEPA, and the State of New Jersey to establish program priorities and funding for federal and State water resource management programs for maintaining and restoring water quality, including the

development of Total Maximum Daily Loads (TMDLs) for waters that do not meet surface water quality standards despite the implementation of technology-based effluent limits, as identified on the List of Water Quality Limited Waters (303(d) List).

The Integrated Assessment process was refined in 2012 using improved computer technology to focus on subwatersheds where water quality conditions had changed since the prior assessment cycle. All new water quality data was required to be submitted to the Department via the New Jersey Water Quality Data Exchange System (WQDE), which is available on the Department's Web site at http://www.state.nj.us/dep/wms/wqde/. WQDE already contained data covering the 2004-2008 reporting period, so the Department conducted a preliminary assessment (or "screening") of water quality data collected by the Department between 2009 and 2010 (and 2011 data collected in the Barnegat Bay) and any new data submitted by other entities in response to the April 2011 data solicitation public notice. This data was run through a computer database that identified all monitoring stations where the assessment outcome for the new data was different from the 2010 assessment outcome, i.e., stations where unimpaired waters now exceed water quality for one or more parameters and stations where impaired waters now meet water quality standards. These stations were then compiled into their corresponding assessment units for a comprehensive assessment that evaluated water quality data along with historical data and other factors such as hydrology, underlying geology, land use, biological habitat conditions and other scientific considerations, to determine if the overall water quality in the subwatershed supported a new listing or delisting on/from the 2012 303(d) List.

This "comprehensive assessment" included confirmation of data quality, station location, use designation, stream classification, and water quality criteria through the application of Geographic Information Systems (GIS) tools and spatial information overlays, aerial and satellite-based photography, meteorological and hydrologic data (weather and flow conditions), field observations and visual assessments. This additional step allowed the Department to address multiple water resource concerns concurrently and enhance "best professional judgment" decisions through a more robust assessment of environmental conditions affecting the entire subwatershed. Through this process, the Department was able to:

- Evaluate multiple stations, as well as neighboring subwatersheds, through a weight of evidence approach;
- Consider if outliers were due to data entry, analytical, or collection errors;
- Identify transient events such as snow storms that caused temporary excursions of the criteria;
- Verify biological indexes.
- Confirm water quality improvement resulting from restoration projects and identify targets for potential new projects.
- Validate the application of existing TMDLs on newly monitored locations.
- Consider newer data to confirm marginal listing/delisting decisions.
- Identify potential priority sources for permit review/enforcement.
- Justify natural conditions for DO, Temperature and pH based upon biological monitoring.
- Provide justification for station relocation.

As a result of this assessment process, 295 pollutant/AU combinations were delisted for the following reasons:

- Applicable Water Quality Standards (WQS) Attained; Due To Restoration Activities (13);
- Applicable WQS Attained; According To New Method (39);
- Applicable WQS Attained; Reason For Recovery Unspecified (89);
- Total Maximum Daily Load (TMDL) Approved Or Established By USEPA (61);
- WQS Attained; Original Basis For Listing Was Incorrect (87);
- Data And/Or Information Lacking To Determine Water Quality Status; Original Basis For Listing Was Incorrect (6).

A detailed justification of each delisting for good cause was prepared and posted on the Department's Web site along with the 2012 draft Delisted Waters and draft 303(d) List.

The Results: What Does The Data Tell Us?

Monitoring of chemical constituents in the water column provides a "snapshot" of conditions at the time of sampling but may fail to detect acute pollution events, such as runoff from heavy rain; non-chemical pollution, such as habitat alteration; and nonpoint source pollution. Because of the limitations of chemical monitoring, the Department supplements it with biological monitoring and evaluates data generated by both monitoring networks over a long period of time to detect water quality trends that may not be apparent by evaluating only chemical data over five-year periods.

Chemical and biological monitoring data collected between 2006 through 2010 were used to generate the Draft 2012 Assessment Unit Summary List (Integrated List)[1] and the Draft 2012 303(d) List of Water Quality Limited Waters (303(d) List). The Integrated List contains the use assessment results for all waters of the State, grouped into 952 assessment units[2]. When assessing each designated use, the Department determines whether the use is fully supported, not supported, or not assessed due to insufficient information. Figure 1 shows the overall use assessment results for 2012. Details regarding use assessment results are as follows:

- **Drinking Water Supply:** Forty-one percent of waters designated for the Drinking Water Supply Use fully support the use; a 7% decrease from 2010. Thirty-two percent did not support the use. Most of this change is attributable to improved detection of arsenic at very low levels. Twenty-seven percent of waters designated for the drinking water supply use were not assessed due to insufficient information. It should be noted that all New Jersey freshwater streams and lakes are designated for Drinking Water Supply Use as potential

[1] Formerly referred to as the "Status of Designated Uses by Subwatershed Report", "Statewide Water Quality Inventory Report" or "305(b) Report"

[2] New Jersey's waters are grouped for assessment purposes into hydrologically connected assessment units, which are based on United States Geological Survey (USGS) 14-digit Hydrologic Unit Code (HUC) boundaries. HUCs are geographic areas representing part or all of a surface drainage basin or distinct hydrologic feature as delineated by USGS in cooperation with the National Resources Conservation Service (NRCS). Shared waters of the Delaware River mainstem, Estuary, and Bay are assessed by the Delaware River Basin Commission (DRBC). Impaired Delaware River waters are shown in a sub-table of the New Jersey 2012 303(d) List but are not addressed in this report.

potable water supplies; however, most of the waters that do not support this use do not contain potable water intakes and are not used for drinking water purposes.

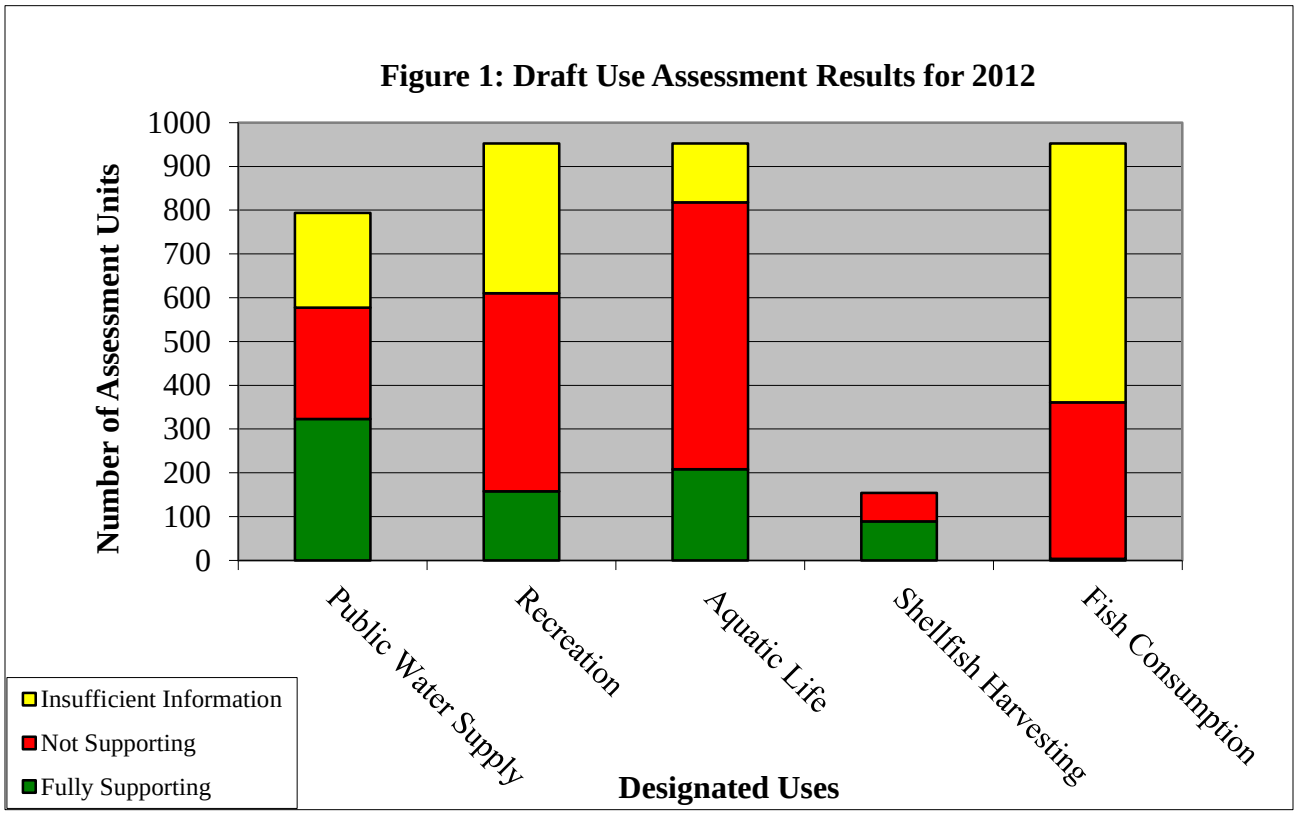
- **Recreation:** All waters of the State are designated for Recreational Uses and 17% fully support that use, a slight (1%) increase over 2010. Forty-seven percent did not support the use and 36% were not assessed due to insufficient information. TMDLs have been completed for most (81%) of the waters that did not support recreational uses because of pathogens (fecal coliform/*E. coli/Enterococcus*). It should be noted that the recreational use applies to all waters throughout the State (including lakes). Assessment of ocean bathing beaches, where most recreation occurs, shows that these waters are fully swimmable.

- **Aquatic Life:** All waters of the State are designated for the General Aquatic Life Use and 22% fully support that use; no change from 2010. Sixty-four percent did not support the use and 14% were not assessed due to insufficient information.

- **Shellfish Harvest for Consumption:** Currently, 58% of waters designated for Shellfish Harvest for Consumption fully support the use, a slight (2%) decrease from 2010 due to the 2011 reclassification of shellfish waters. Forty-two percent of designated waters did not support this use; however, approximately 90% of shellfish waters are classified as harvestable. This is because federal requirements for shellfish classification provide three categories of harvestable shellfish: "approved" (with no restrictions), "seasonal harvest", and "special restrictions". All three of these categories are considered "harvestable" but under federal water quality assessment guidelines, only shellfish waters approved without restriction ("approved") may be assessed as fully supporting the use. Approved waters comprise 80% of classified shellfish waters. TMDLs have been developed for almost all (95%) of the waters assessed as not supporting the shellfish harvest for consumption use.

- **Fish Consumption:** All State waters are designated for the Fish Consumption Use. Three out of 952 subwatersheds (0.4%) fully support the use, the same as in 2010. Thirty-eight percent of waters designated for this use did not support the use and 62% were not assessed due to insufficient information. While the Department used fish tissue data where available, most of the State's waters were assessed based on fish consumption advisories. Consumption advisories may restrict the amount and/or the type of fish consumed and there may be different advisories for high-risk populations and the general public. The Department issues both statewide and waterbody-specific advisories for the general population and for high-risk groups including infants, children, pregnant or nursing mothers, and women of childbearing age.

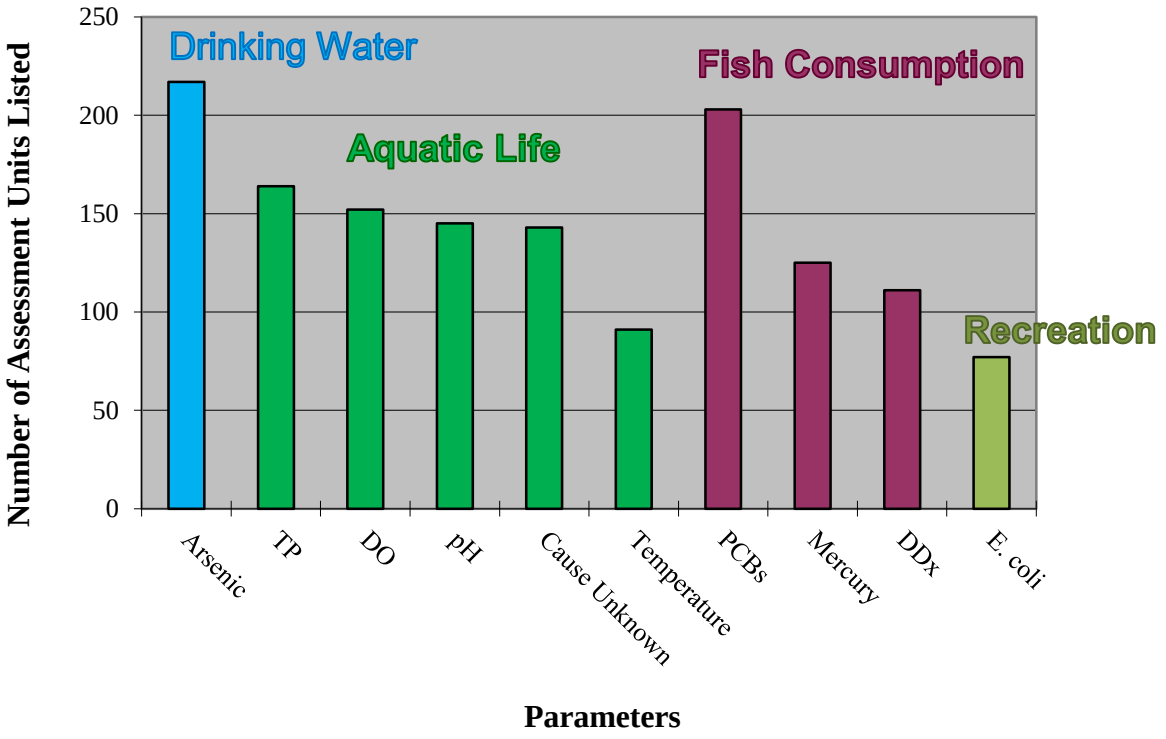
An increase in the number of AUs not supporting a designated use generally coincided with a corresponding decrease in the number of AUs not assessed for that use - which indicates that the change in use assessment is likely a result of additional water quality data rather than an actual decline in water quality.



Waters that do not fully support a designated use are placed on the 303(d) List of Water Quality Limited Waters (303(d) List) along with the pollutant(s) causing water quality impairment (i.e., not supporting the use). A "pollutant" is a chemical constituent that causes water quality impairment. If chemical data are unavailable or show no exceedance of applicable criteria, but other data (i.e., biological) indicate that the designated use (i.e., aquatic life) is not supported, "cause unknown" is identified on the 303(d) List as the pollutant causing non-support until a chemical pollutant cause is identified.

The draft 2012 303(d) List identifies 34 pollutants causing water quality impairment in one or more assessment units, for a total of 1,783 listings, of which 143 are attributed to "cause unknown". The 2010 303(d) List identified 38 pollutants and 1,831 listings, of which 140 were attributed to "cause unknown". Two hundred and sixty AU/pollutant combinations were removed from the 303(d) List becauseFigure 2 shows the top ten most frequent pollutants on the draft 2012 303(d) List, grouped and color-coded by associated use.

Figure 2: Top Ten Pollutants on the Draft 2012 303(d) List

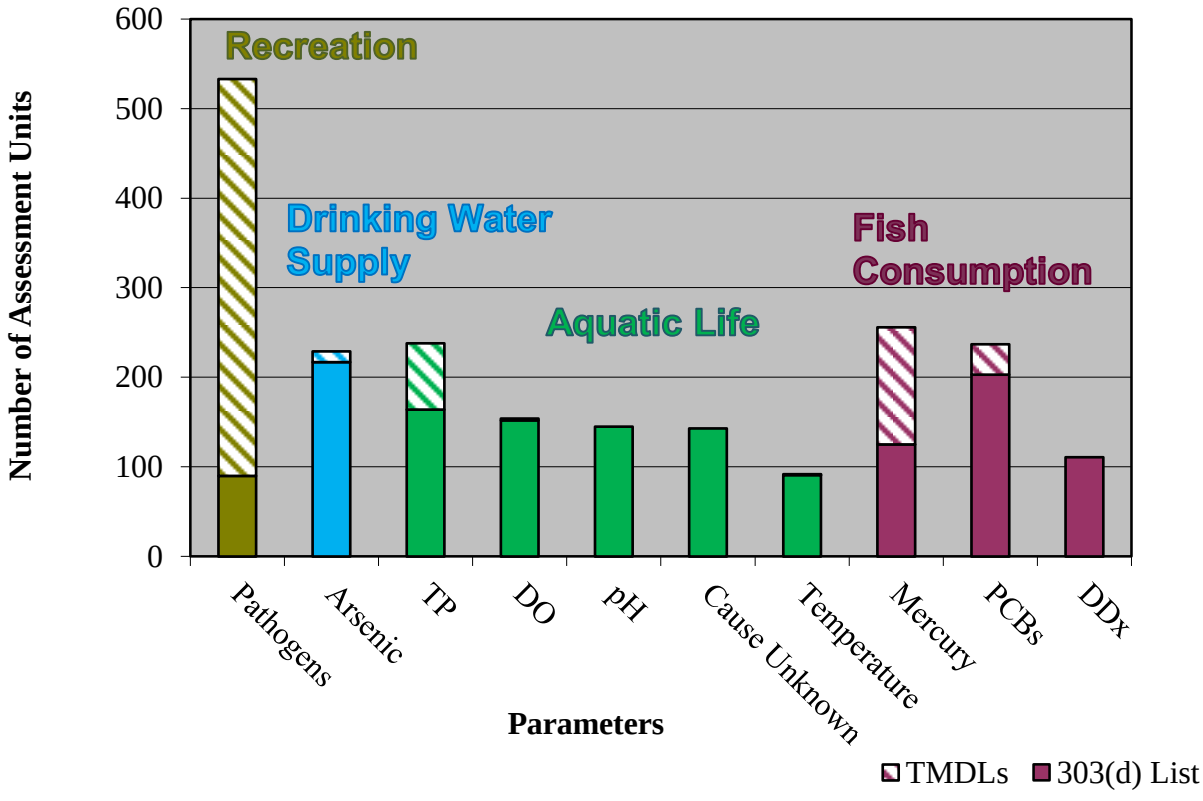


The top ten pollutants are responsible for 80% of the total listings identified on the draft 2012 303(d) List. Three of the top ten pollutants (PCBs, mercury, DDT and metabolites) are associated with the fish consumption use. PCBs in fish tissue is no longer the most frequent cause on the 303(d) List because 34 AUs were delisted based on the EPA-approved PCB TMDL for the Delaware River and Bay. Arsenic, which is associated with the Drinking Water Supply Use, is now the most frequent pollutant on the draft 2012 303(d) List, based on improved analytic methods (as explained earlier). The Department has been working with USGS to identify naturally-occurring regional concentrations of arsenic based on the underlying geography. Fifteen AUs were delisted for arsenic in 2012 based on naturally-occurring arsenic concentrations in the Inner and Outer Coastal Plain of New Jersey. Additional arsenic delistings are expected in the future as water quality studies are expanded to other physiogeographic provinces. Mercury remained in the top ten even though 98 AUs on the 2008 303(d) were delisted in 2010 under the EPA-approved Statewide Mercury TMDL. An additional 13 AUs were delisted for mercury in 2012 under the same TMDL.

Most of the other top ten pollutants ("total phosphorus, dissolved oxygen, pH, cause unknown," and temperature) are associated with aquatic life uses. Figure 3 shows the top ten causes of impairment, including those that are covered by a TMDL. Pathogens causing recreational use non-support are actually the most frequent cause of water quality impairment in New Jersey; however, most of these impairments are already being addressed through implementation of

TMDLs. When water quality is eventually restored and the Recreational Uses are fully supporting, pathogens will no longer be the predominant cause of water quality impairment in New Jersey.

Figure 3: Top Ten Causes of Impairment



Water Quality Trends

As stated earlier, water quality monitoring data collected over a five-year period provides a "snapshot" of conditions at the time of sampling but may fail to detect acute pollution events. Evaluating data over longer periods of time allows us to identify water quality trends that would otherwise not be apparent.

An analysis of water quality trends was conducted in 2010 for the Department by the U.S. Geological Survey (USGS) by evaluating key indicator parameters, including: dissolved oxygen (DO), pH, total dissolved solids (TDS), total phosphorus (TP), total organic nitrogen plus ammonia, and dissolved nitrate plus nitrite (nitrate), collected at 70 sampling stations located in various physiographic regions and land use types throughout the State between 1998 and 2007. These chemical constituents were selected for trends analysis because of their role in eutrophication as well as overall water quality. Water bodies affected by eutrophication (i.e., excessive primary production) are characterized by significant algae and weed growth and episodes of low dissolved oxygen. Nitrate is a readily available form of nitrogen taken up by

organisms and plants as a nutrient. Phosphorus is also readily used by aquatic plants as a nutrient. Together, these nutrients are principally responsible for the growth rate of aquatic algae and vegetation. Low dissolved oxygen episodes occur when algae die off, and bacteria consume the dissolved oxygen in the process of decomposition. Dissolved oxygen (DO) is necessary for almost all aquatic life; consequently, concentrations of DO in water provide a good indicator of the health of aquatic ecosystems. Under low DO conditions, fish are more susceptible to other pollutants, such as metals and toxics; at very low DO levels, trace metals from sediments are released into the water column. USGS coupled the results of the 1998-2007 trend analysis with results from the 1984-2004 trend analysis to produce a long- term perspective of water quality constituents from the 1980's to the present. The full report is available on the USGS Web site at http://pubs.usgs.gov/sir/2010/5088/.

The 1998 to 2007 trend analysis results show that water quality conditions remained relatively stable (i.e., no trend observed) for all constituents except TDS, nitrate, and TP. TDS and nitrate results over this time period indicate declining conditions, while TP results indicate overall improving conditions - even though TP is still one of the top ten most frequent pollutants on the 2012 303(d) List. If we look at only the aquatic life use, TDS would be in the top ten as well.

TDS is comprised of minerals and other substances dissolved in water. Changes in TDS can affect organisms by altering the flow of water through cell membranes, which can retard growth or even cause death. These changes can make water less fit for other uses. TDS exceedances have been associated with runoff from urban and agricultural areas, including runoff of salt used to control ice on roadways. Discharges from wastewater treatment facilities, including septic systems, can also contribute to increased TDS loadings. These TDS trends represent all types of land uses (urban, agricultural, mixed, and undeveloped) and physiographic regions. Although dissolved solids come from both point and nonpoint sources, road salting and improper salt storage are major contributors of this constituent.

There has been an effort to reduce the levels of the toxic form of ammonia from wastewater. In doing so, nitrate levels were correspondingly increased as ammonia levels declined (nitrate is a byproduct of ammonia oxidation). The resulting higher instream nitrate concentrations may contribute to eutrophication, along with phosphorus. (It should be noted that the few nitrate listings on the draft 2012 303(d) List are associated with the drinking water use, not aquatic life.)

Phosphorus is often considered the "limiting nutrient" in freshwater, governing the rate of growth of aquatic plants and algae. While both phosphorus and nitrogen are considered "nutrients" that contribute to eutrophication, historically the focus for controlling eutrophication has been on reducing total phosphorus (TP) concentrations rather than nitrogen. Studies demonstrate that the impact of nutrients on water quality is strongly influenced by other environmental factors such as sunlight availability, stream velocity and water clarity, meaning that the same amount of TP can have varying impacts in different waters.[3] Thus, while improving trends in phosphorus conditions may indicate improving water quality over time,

[3] NJDEP. 2009. *Nutrient Criteria Enhancement Plan*. April 2009. Available at http://www.state.nj.us/dep/wms/bwqsa/nutrient_criteria.htm.

some waters remain susceptible to the adverse affects of eutrophication despite decreasing TP concentrations.

Overall, the water quality trend results indicate that, since the 1980's, nutrient levels and DO conditions have significantly improved over time - most likely due to the upgrade and regionalization of wastewater treatment plants that occurred throughout the State in the late 1980's through the early 1990's. More current trend assessments show some stabilizing of conditions throughout the State with some improvements (e.g., TP) and some declines in water quality (e.g., TDS and nitrates).