

Library Reference 2.7.5

Progress towards water quality improvement: Dissolved Oxygen. AMP 2009 Annual Report.
(Water Quality Standard)

AMENDED CONSENT JUDGMENT GOAL

Achieve compliance with the applicable ambient water quality standard in the upper waters, and removal of oxygen depletion as impairment to designated best use for survival and propagation of a coolwater fish community such as walleye. Eliminate dissolved oxygen as impairment to desired uses of the lake for aquatic life protection and fish reproduction.

Hypotheses to be tested:	Status:
Improvements at Metro enable the County to meet interim effluent limits for BOD	<ul style="list-style-type: none"> Since 2004, interim effluent limits for BOD have been met.
Improvements at Metro and nonpoint sources reduce the volume-days of anoxia and hypoxia.	<ul style="list-style-type: none"> Volume days of anoxia and hypoxia have decreased since the 2004-2005 improvements at Metro to treat ammonia and phosphorus were implemented (BAF and HRFS, respectively).
Improvements at Metro and related nonpoint source phosphorus load reductions bring the lake into compliance with NYS AWQS for DO during fall mixing.	<ul style="list-style-type: none"> Since 2003, NYS AWQS (daily average DO >5 mg/l) has been met in upper waters (0-3m) during fall turnover, based on field profiles data.
Improvements at Metro and nonpoint sources reduce the areal hypolimnetic oxygen depletion rate.	<ul style="list-style-type: none"> The average oxygen depletion rate for the period 2001-2005 was 998 mg/m²-day, and was 987 mg/m²-day for the period 2003-2007. <p><i>The rate reflects oxygen consumption below the thermocline between the first sampling date with thermal stratification and the last date prior to development of anoxic conditions (hypolimnetic mean < 2 ppm). The areal rate is computed as the product of the mean hypolimnetic depth and the decrease in volume-averaged concentration divided by the number of days between sampling events.</i></p>

Current Conditions with Historical Comparison

Major Sources	Oxygen depletion in the LWL is primarily due to decomposing algal biomass (excess algae is caused by phosphorus load). Other sources include ultimate oxygen demand from organic material in watershed and reduced nitrogen species (including ammonia from Metro)		
Upper Waters Concentration during fall mixing <i>(Annual Average of minimum daily averages (standard deviation))</i>	<u>Time Period</u>	<u>South Deep, 0-3 meters (mg/l)</u>	
	1990-1997:	4.2 (1.6)	
	1998-2004:	5.2 (0.9)	
	2005-2008:	7.4 (0.1)	
	2009:	7.5	
	<i>(Source: calculated from field profile data collected 1 week before and 1 week after measured DO minimum for each year)</i>		
Volume-days of anoxia <i>(Annual Average (standard deviation))</i>	<u>Time Period</u>	<u>Anoxia (<0.5 mg/l)</u>	<u>Hypoxia (< 2 mg/l)</u>
	1992-1997:	6055 (811)	7008 (1397)
	1998-2004:	4003 (1202)	5209 (555)
	2005-2008:	2862 (1068)	4410 (508)
	2009:	2155	3855
	<i>(Source: calculated from field profile data)</i>		
Compliance with NYS AWQS in Upper Waters <i>("For nontrout waters, the minimum daily average shall not be less than 5.0 mg/L, and at no time shall the DO concentration be less than 4.0 mg/L")</i>	In Onondaga Lake upper waters in 2009, the minimum daily average was 7.15 mg/l (10/02), and the minimum instantaneous reading was 6.38 mg/l (08/20 at 4:33 p.m.). <i>(Source: 2-meter depth in-situ buoy).</i>		
Factors Affecting Compliance	Algal abundance (related to phosphorus load), ammonia N concentration and dynamics, meteorology		

Library Reference 2.7.5

Progress towards water quality improvement: Dissolved Oxygen. AMP 2009 Annual Report. (Water Quality Standard) – (continued).

Planned Load Reductions (1998 – 2012)

Metro SPDES Permit Requirement

See staged effluent limits for total phosphorus
Interim BOD limit: 21 mg/l (30-day average)

Monitoring and Assessment Program

Loading Estimates

Annual County monitoring program

- Biweekly tributary monitoring, supplemented with samples collected during high flow conditions to estimate TP, N and BOD inputs, which influence DO concentrations in the lake.
- Storm event monitoring in tributaries
- Daily measurements of Metro effluent

Lake Monitoring

Annual County monitoring program

- Biweekly DO profiles in Lake, Apr to Nov, 0.5-meter intervals
- Intensive sampling during fall, including tributary mouths
- Monitoring buoy installed at South Deep for near-continuous measurements and transmittal of water quality data including DO
- Winter sampling as weather allows

Related Biological Monitoring

- Annual phytoplankton monitoring
 - Annual zooplankton monitoring
 - Macroinvertebrate monitoring
 - Assessment of fish community
-

Tools for Decision Making

Models

- Onondaga Lake Water Quality Model (under development by QEA, LLC)
- Mass balance TP framework and linked empirical eutrophication model (developed by William Walker)

TMDL Allocations

- NYSDEC Phase I TMDL for phosphorus 8/27/97
 - Phase II TMDL for phosphorus by December 2011
-