

## Appendix A-4

### Progress toward water quality improvement: Dissolved Oxygen. AMP 2013 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 cool water 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"><li>Interim effluent limits for BOD met consistently since 2004</li></ul>																								
Improvements at Metro and nonpoint sources reduce the volume-days of anoxia and hypoxia.	<ul style="list-style-type: none"><li>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).</li></ul>																								
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"><li>Since 2003, NYS AWQS (daily average DO &gt;5 mg/l) has been met in upper waters (0-3m) during fall turnover, based on field profiles.</li></ul>																								
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)																								
Average of the minimum concentration in the upper waters (0-4m average) during October for the time period noted <i>(standard deviation between the years for each time period noted)</i>	<table><tr><th>Time Period</th><th>South Deep, 0-4 meters (mg/l)</th></tr><tr><td>1990-1997:</td><td>4.4 (1.6)</td></tr><tr><td>1998-2004:</td><td>5.8 (1.5)</td></tr><tr><td>2005-2009:</td><td>7.6 (0.1)</td></tr><tr><td>2010:</td><td>7.5</td></tr><tr><td>2011:</td><td>7.8</td></tr><tr><td>2012:</td><td>7.8</td></tr><tr><td>2013:</td><td>8.5</td></tr></table> <p><i>(Source: calculated from field profile data collected during the month of Oct)</i></p>	Time Period	South Deep, 0-4 meters (mg/l)	1990-1997:	4.4 (1.6)	1998-2004:	5.8 (1.5)	2005-2009:	7.6 (0.1)	2010:	7.5	2011:	7.8	2012:	7.8	2013:	8.5								
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Volume-days of anoxia <i>(Annual Average (standard deviation))</i>	<table><tr><th>Time Period</th><th>Anoxia (&lt;1 mg/l)</th><th>Hypoxia (&lt; 4 mg/l)</th></tr><tr><td>1992-1997:</td><td>6748 (1141)</td><td>9564 (2197)</td></tr><tr><td>1998-2004:</td><td>6339 (449)</td><td>8088 (487)</td></tr><tr><td>2005-2009:</td><td>5629 (911)</td><td>7438 (1119)</td></tr><tr><td>2010:</td><td>4546</td><td>6387</td></tr><tr><td>2011:</td><td>4139</td><td>7164</td></tr><tr><td>2012:</td><td>4668</td><td>6945</td></tr><tr><td>2013:</td><td>5563</td><td>7829</td></tr></table> <p><i>(Source: calculated from field profile data)</i></p>	Time Period	Anoxia (<1 mg/l)	Hypoxia (< 4 mg/l)	1992-1997:	6748 (1141)	9564 (2197)	1998-2004:	6339 (449)	8088 (487)	2005-2009:	5629 (911)	7438 (1119)	2010:	4546	6387	2011:	4139	7164	2012:	4668	6945	2013:	5563	7829
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Compliance with NYS AWQS in Upper Waters <i>(“For non-trout 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>	<p>In Onondaga Lake upper waters in 2013 the minimum daily average<sup>1</sup> was 7.23 mg/l (10/07/13), and the minimum instantaneous reading was 6.98 mg/l (10/07/13, 9:48); readings were never measured below 4 mg/l in the upper waters).</p> <p><i>(Source: Honeywell-UFI in-situ Buoy (2-meter depth)</i> <sup>1</sup> “daily average” based on available data (between 1 and 4 measurements per day).</p>																								
Factors Affecting Compliance	Algal abundance (related to phosphorus load), ammonia N concentration and dynamics, meteorology																								

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(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 <i>Annual County monitoring program</i>	<ul style="list-style-type: none"><li>• 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.</li><li>• Storm event monitoring in tributaries</li><li>• Daily measurements of Metro effluent</li></ul>
Lake Monitoring <i>Annual County monitoring program</i>	<ul style="list-style-type: none"><li>• Biweekly DO profiles in Lake, Apr to Nov, 0.5-meter intervals</li><li>• Intensive sampling during fall, including tributary mouths</li><li>• Monitoring buoy installed at South Deep for near-continuous measurements and transmittal of water quality data including DO</li><li>• Winter sampling as weather allows</li></ul>
Related Biological Monitoring	<ul style="list-style-type: none"><li>• Annual phytoplankton monitoring</li><li>• Annual zooplankton monitoring</li><li>• Macroinvertebrate monitoring</li><li>• Assessment of fish community</li></ul>
Tools for Decision Making	
Models	<ul style="list-style-type: none"><li>• Onondaga Lake Water Quality Model (Anchor QEA, LLC)</li><li>• Mass balance TP framework and linked empirical eutrophication model (William Walker)</li></ul>
TMDL Allocations	<ul style="list-style-type: none"><li>• NYSDEC Phase I TMDL for phosphorus 8/27/97</li><li>• Phase II TMDL under development</li></ul>