

# IN-WATERBODY BEST MANAGEMENT PRACTICES



Department of  
Environmental  
Conservation

## To reduce phosphorus loading

Projects that reduce internal cycling of nutrients (primarily phosphorus) in waterbodies are eligible for non-agricultural nonpoint source abatement and control funding under DEC's Water Quality Implementation Project (WQIP) grant program. For waterbodies experiencing excessive algae and plant growth, low clarity, or other water quality impairments due to internal cycling of nutrients, in-waterbody best management practices (BMPs) may help to reduce nutrients and result in an improvement in water quality. External loading of nutrients must be controlled or eliminated prior to applying for funding to address internal loading. Destratification systems, dredging, hypolimnetic aeration and hypolimnetic withdrawal have been identified as priority BMPs to control in-lake nutrients. Applicants should refer to this document for general and technical resources that can assist with the WQIP application process.

### Technical Resources

An in-depth review of priority best management practices can be found in the follow technical documents:



#### Destratification Systems for Polymictic Lakes

- Marc W. Beutel & Alex J. Horne (1999) A Review of the Effects of Hypolimnetic Oxygenation on Lake and Reservoir Water Quality, *Lake and Reservoir Management*, 15:4, 285-297.
- Mobley, M.H., G.E. Hauser, D.F. McGinnis and R.J. Ruane. 2000. Diffuser system modeling and design for dissolved oxygen enhancement of reservoirs and releases. Presented at International Association of Hydraulic Research Symposium 2000, Charlotte, NC.
- North American Lake Management Society (NALMS). 2010. *Lake and Reservoir Manual*. Terrene Institute.

#### Dredging

- Cooke, G.D., Welch, E.B., Peterson, S.A. and Nichols, S.A. 2005. *Restoration and Management of Lakes and Reservoirs*. Third Edition, CRC Press.
- Lurling, M. and E. Faassen. 2012. Controlling toxic cyanobacteria: effects of dredging and phosphorus-binding clay on cyanobacteria and microcystins. *Water Research* 46: 1447-1459.

#### Hypolimnetic Aeration

- Brookes, J. D., Burch, M. D. and Tarrant, P. (2000). Artificial destratification: Evidence for improved water quality. *Water: Official Journal of the Australian Water and Wastewater Association*. 27 (3): 18-22.
- Cooke, G.D., Welch, E.B., Peterson, S.A. and Nichols, S.A. 2005. *Restoration and Management of Lakes and Reservoirs*. Third Edition, CRC Press.
- Visser, P., B. Ibelings, B. Van Der Veer, J. Koedoods. 1996. Artificial mixing prevents nuisance blooms of the cyanobacterium *Microcystis* in Lake Nieuwe Meer, the Netherlands. *Freshwater Biology* 36: 435-450

## Hypolimnetic Withdrawal

- Cooke, G.D., Welch, E.B., Peterson, S.A. and Nichols, S.A. 2005. Restoration and Management of Lakes and Reservoirs. Third Edition, CRC Press.
- Nürnberg, G. 2007. Lake responses to long-term hypolimnetic withdrawal treatments, Lake and Reservoir Management 23: 388-409.
- Dunalska, J., G. Wiśniewski & C. Mientki. 2007. Assessment of multi-year (1956–2003) hypolimnetic withdrawal from Lake Kortowskie, Poland, Lake and Reservoir Management, 23:4, 377-387

## Application Requirements

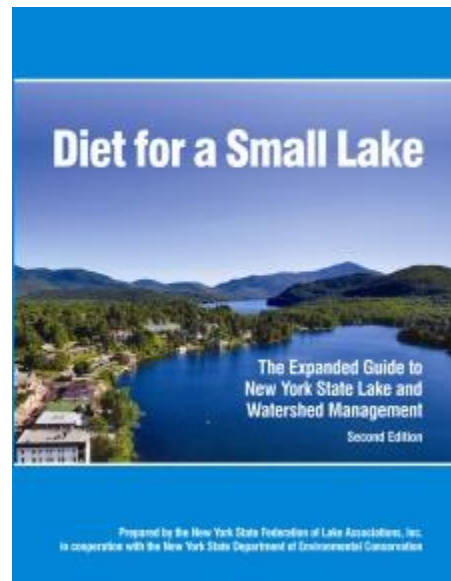
Applications for in-lake practices must include the following documentation and approvals:

- Completed plan for controlling external sources and documentation that the plan is being implemented;
- Study completed by a qualified professional (e.g. certified lake manager, professional engineer) that identifies significant internal lake loading and justification for the use of the BMP;
- Plan for long term operation and maintenance of the BMP (Destratification, Hypolimnetic Aeration and Withdrawal);
- Appropriate permits must be secured prior to submitting application

## General Resources

A general overview of lake management practices to reduce nutrients in lakes can be found in the following guidance documents:

- Diet for a Small Lake:  
<http://www.dec.ny.gov/chemical/82123.html>
- NEIWPCC Harmful Algal Bloom Control Methods Synopsis:  
<http://www.neiwpcc.org/harmfulalgalblooms.asp>
- The Practical Guide to Lake Management in Massachusetts: A Companion to the Final Generic Environmental Impact Report on Eutrophication and Aquatic Plant Management in Massachusetts:  
<https://www.mass.gov/doc/the-practical-guide-to-lake-management-in-massachusetts/download>



## Additional Online Resources

Water Quality Improvement Project Program: <http://www.dec.ny.gov/pubs/4774.html>

Nonpoint Source Guidance and Technical Assistance Catalogue: <http://www.dec.ny.gov/chemical/96777.html>

Water Quality Information: <http://www.dec.ny.gov/chemical/8459.html>

Harmful Algal Blooms: <http://www.dec.ny.gov/chemical/77118.html>

### CONTACT INFORMATION

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