

Oxygenation and Circulation Techniques to Improve Water Quality

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This workshop is designed to train water resource managers, scientists, engineers, and any interested stakeholder in oxygenation and circulation techniques. This two-part workshop will provide a comprehensive review of both theory and practice of oxygenation and circulation techniques. Participants will be provided the tools and training to be able to properly select and design a oxygenation and/or circulation system to address a particular water quality issue(s).

Part 1:

This first half will focus on fundamentals and will be a series of PowerPoint presentations and excel exercises covering a range of topics, including:

- Reasons for oxygenation and circulation
- Types and proper selection of oxygenation and circulation techniques
- Caveats and lessons learned from oxygenation and circulation techniques
 - Sediment features
 - External nutrient loading
- Life cycle costs
- Methods for calculating oxygen demands
 - Incoming oxygen demands
 - Biological oxygen demands
 - Chemical oxygen demands
 - In-lake oxygen demands
 - Sediment oxygen demands
 - Dissolve oxygen and temperature profile data
- Oxygenation and circulation system sizing
 - Freshwater Vs. brackish/saltwater Vs. wastewater
 - Models (“rule of thumb”) Vs. site specific data
 - Sizing for manganese
 - Sizing for hydrogen sulfide
 - Sizing for ammonia/ammonium
 - Sizing for algal control
- Quantifying thermal structure and determining target waters
- Calculating theoretical Vs. actual oxygen transfer rates
- Calculating water movement from air
- Remote monitoring and system calibration

Part 2:

This second half will focus purely on practice and will include a field demonstration of a side-stream saturation system (shallow water hypolimnetic oxygenation system), sediment oxygen demand chambers, telemetry set-up and install, and measuring actual oxygen transfer using high range dissolved oxygen probes.



Paul Gantzer Ph.D., P.E., Gantzer Water, LLC

Dr. Paul Gantzer, Owner of Gantzer Water, LLC (Gantzer Water), is a world-renowned limnologist. Dr. Gantzer is especially recognized for his work with oxygenation techniques to restore lake water quality and ameliorate harmful algal blooms. Gantzer Water provides expertise in the review and design of oxygenation and circulation systems used to enhance or improve water quality through in-lake management strategies. Services provided by Gantzer Water include comprehensive analysis of baseline oxygen demand data used to size oxygenation systems and identify the preferred approach. Gantzer Water works closely with their clients to identify oxygenation needs and goals and to provide the most robust long-term management strategy within budget constraints. Representative projects include C.W. Bill Young Reservoir (air-lift aerator and destratification), Bear Lake (direct oxygenation), and Sarah's Pond (Side-stream saturation). Dr. Gantzer has published numerous peer-reviewed papers on aeration and oxygenation, including articles that were featured in the September 2019 NALMS Journal of Lake and Reservoir Management, which highlighted the use of oxygenation in the restoration of large lakes and reservoirs.



Patrick Goodwin, M.S., CLM Vertex Aquatic Solutions

Patrick Goodwin is an applied water resource manager who serves as Vertex Aquatic Solutions Inc. lead water quality analysts. Since 1992, Vertex Aquatic Solutions has been manufacturing and designing bottom diffused aeration systems to improve lake water quality. Since their inception, over 14,000 bottom diffused aeration systems have been installed worldwide in varying sizes of waterbodies, including a number of large recreational lakes and reservoirs, making Vertex an industry leader in bottom diffused aeration. Vertex's core belief is to provide well-engineered water quality solutions that are backed by science. Vertex is one of the only companies in the market that has independently tested and verified water movement and oxygen transfer from bottom diffused aeration at varying flow rates and depth. This information is vital to designing bottom diffused aeration systems and meeting oxygen and mixing requirements. Vertex has always welcomed scientific evaluation and has been transparent with case studies and industry know-how such that water resource managers can make the most informed and best decisions for lake stakeholders. Vertex has contributed to many publications and white papers over the years, along with presentations at water resource conferences to further their understanding of bottom diffused aeration. More recently, Vertex contributed to the Water Resource Foundations publication titled: Oxygenation and Circulation to Aid Water Supply Reservoir Management.