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The role of municipal government agencies concerning ambient monitoring and overall management of aquatic resources

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ABSTRACT

The need for quality scientific information to help managers make wise natural resource decisions is well accepted. However, the means to secure that information has historically been elusive as resources for “routine” monitoring programs are often lacking. Going forward these efforts may be more successful by identification of a consortium of area stakeholders to work together to design, implement and fund a comprehensive ambient monitoring program. This program will provide the regulatory authorities with scientifically defensible information that ensures that appropriate and realistic decisions can be made. Such programs offer many benefits (making a positive contribution to sound management of local aquatic resources, improved credibility with government agencies, demonstrating community leadership) but also come with associated costs. Balance must be achieved. An example of the NEW Water (the brand of the Green Bay Metropolitan Sewerage District) Aquatic Monitoring Program is presented. Demonstrated success for this 30+ year program might be used as a model for others. Discussion includes identification of the planning steps which are necessary to evaluate the efficacy related to development of an in-house ambient monitoring program, and a potential list of stakeholders who may be appropriate to participate in the consortium.

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Introduction

Natural resource protection and management cannot occur effectively without adequate environmental data. Few would argue with this assertion. Yet we see that, more often than not, decisions which affect our freshwater aquatic systems are made with minimal reliable information about the past or current physical, chemical or biological condition of the resource in question.

We have seen an increased rate of water quality related problems in recent years – invasive species, harmful algal blooms, recurring hypoxia (Klump et al., in press) among others. Resolving these problems can only be achieved by a concerted effort of resource managers who have access to adequate information. A recent editorial in *Nature Ecology and Evolution* (Vol 1, September 2017, pp. 1209–1210) highlights the value and importance of long-term monitoring datasets, stating:

Ecological processes rarely respect the time frames imposed by short-term projects and grants. In a period of unparalleled human-induced global change, the rapid alterations we currently see to natural communities and ecosystems may not be indicative of change in the medium-to-long term. Without high-quality baseline data from the recent past, predicting future responses is like betting on a horse race without first examining the form guide.

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Historically, conventional wisdom pointed to federal or state natural resource agencies to carry the responsibility of ambient (in this discussion meaning “natural system”) water quality monitoring, along with some degree of help from area academic institutions. The Clean Water Act requires the EPA to develop Ambient Water Quality Standards, which simply could not be developed without reliable ambient water quality data. However, budget realities at all levels of government have led to significant reductions in resources allotted to long term monitoring efforts. Sadly, routine monitoring is often the first “sacrificial lamb” in the process of trimming a budget for any natural resource program.

A more modern paradigm for this essential activity suggests that a collaborative effort from numerous entities may be more successful. This would include significant involvement by appropriate state and federal agencies, but would also include participation by regional local government agencies, universities, industries and non-governmental organizations (NGOs). Collaboration of this type inherently brings varied expertise as well as advantages to the process of developing and implementing long-term ambient monitoring programs. Such collaboration can also help establish and maintain consistent budgets that are generally easier to contribute financially to as a team effort, as opposed to going solo. Although more project participants will require firmly established communication links to keep everyone on the same page, the benefits of having group members of varied backgrounds with differing philosophical viewpoints outweigh this challenge.

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Overview of the NEW Water Aquatic Monitoring Program

NEW Water, the brand of the Green Bay Metropolitan Sewerage District, initiated an aquatic monitoring program (AMP) in 1986. Its Commission (the governing body of a Wisconsin authorized Metropolitan Sewerage District) had discussed the utility of developing such a program in-house for several years prior. During the 1970's and early 1980's, a number of regulatory pressures (e.g. development of wasteload allocation for control of biochemical oxygen demand discharges and other water quality standards) required NEW Water to hire consultants to collect and analyze water quality data from the Fox River and Lower Green Bay. By 1985 the Commission determined that it would be more cost-effective to establish in-house capabilities to collect and maintain this information, in an effort to ensure sustained continuity. NEW Water staff designed and implemented an aquatic monitoring program that would provide the Commission and NEW Water management with data necessary to evaluate the potential impact of the wastewater treatment plant's outfall on the receiving waters. These data would also provide high quality baseline information to aid NEW Water staff and others better understand the existing condition of those local waters. Of note is that this monitoring program was not required by the State or the EPA. In fact a number of NEW Water customers have historically questioned the need to operate the program along with its inherent expense. Fortunately, history has shown that the program has served both NEW Water and the community well by providing critical water quality information not available elsewhere.

The NEW Water Aquatic Monitoring Program (AMP) was not the first program of this type to be implemented in Wisconsin. Both the Milwaukee and Madison Metropolitan Sewerage Districts had ongoing ambient monitoring programs of their receiving waters prior to the initiation of the NEW Water program. Each of these programs has been designed to collect information deemed important to their particular facilities and local concerns.

The program initiated in 1986 is still in operation. Program updates have occurred as technology and information needs dictate. The acquisition of the *Bay Guardian* work boat in 2011 allowed NEW Water to expand its sampling range. This expansion allowed additional collaboration with other agencies conducting research on Green Bay, and enabled supplemental program funding through associated grants.

The data generated under this program have been utilized in a number of ways, and by a wide variety of end users. NEW Water is known as a resource for local water quality information, and has many times responded to inquiries from the WDNR and others in the community when unusual events have been observed (such as significant fish kills along the east shore of Green Bay in 2005 and 2011). The NEW Water AMP database has figured prominently in several major environmental initiatives, such as the [International Joint Commission designation of the Lower Green Bay and Fox River Area of Concern \(1988\)](#) and the development of the [Total Maximum Daily Load and Watershed Management Plan for Total Phosphorus and Total Suspended Solids in the Lower Fox River Basin and Lower Green Bay \(2012\)](#). NEW Water has been an active participant in the Remedial Action Plan process that began in 1986, both on various committees and by providing water quality data from the NEW Water AMP. These data provided the bulk of information used in the "State of the Bay" reports ([UW Sea Grant, 2013](#)).

NEW Water has conducted one of the longest running monitoring programs in existence for the waters of the lower Fox River and Green Bay. During each field season the following activities are typically conducted under the program, though some annual variability has occurred:

- Continuous operation of a weather station located on the roof of the NEW Water Administration Building.
- Weekly routine water quality surveys during the open water season are performed on the lower Green Bay, Fox River, and East River

(see [Fig. 1](#)). Stations are sampled at two depths – 1 m below the surface and 1 m above the bottom if station depth exceeds three meters; otherwise one mid depth sample is collected. Samples collected during these surveys are analyzed for chloride, chlorophyll *a*, solids (total, suspended, volatile and volatile suspended), turbidity, ammonia-nitrogen, nitrate-nitrogen, nitrite nitrogen, total phosphorus, orthophosphorus, turbidity, temperature, dissolved oxygen, specific conductivity and pH utilizing in-house state certified laboratory analyses.

- In-situ vertical profile water quality measurements for temperature, dissolved oxygen, specific conductance, pH, depth of light penetration and Secchi depth are collected weekly at each station.
- Analysis for heavy metals and organics are performed from two routine water surveys each year.
- Two in-situ continuous water quality monitoring stations at the Fox River mouth and at Entrance Light (sites 16 and 51, respectively, in [Fig. 1](#)) are deployed annually May–October. These monitors collect temperature and dissolved oxygen at 15 min intervals.

All data from the annual program are subjected to full Quality Control/Quality Assurance review associated with the NEW Water Laboratory methodology. Approved data are entered into a database maintained by NEW Water personnel. Annual reports for select years are available on the NEW Water website (see below). The annual reports have been produced to provide an overview of the work accomplished and information generated in a summative document that is readily digestible by a broad audience. More specific information may be requested from NEW Water.

For additional information about the NEW Water AMP, including program metadata, historical annual reports and contact information please visit: <http://www.newwater.us/programs-initiatives/aquatic-monitoring-program/>.

Aquatic monitoring program benefits

The primary motivation for any entity to conduct ambient monitoring is to demonstrate their commitment to the environmental component of their mission. This commitment demonstrates their concern, understanding, and protection of the water quality in the region in which they do business. For any large quantity water user, this means a responsibility, beyond simply agreeing to comply with a discharge permit, to contribute to the health of their local waters.

A partial list of realized benefits to be gained by such an endeavor would include:

- Demonstrate the importance of environmental stewardship to its customers and the greater community. Will be viewed as a regional source of scientifically defensible environmental data.
- Provide data which can identify changes taking place within the aquatic system resulting from land use, regulatory changes or resource management improvements and climate change.
- Demonstrate community service to a broader audience outside the regulatory area.
- Help develop sound working relationships with local and regional environmental regulatory agencies.
- Help improve credibility of a permit holder during permit negotiations through the use of scientifically defensible data during the permit renewal process to help generate the most realistic permit limits, reducing the use of safety factors which are often applied when there are insufficient ambient data. This in turn may reduce the likelihood of unnecessary treatment plant upgrades.
- Help to guarantee a "seat at the table" when regulations are being developed or modified.
- Development of in-house expertise, in conjunction with strong working relationships with government agencies and universities, allows

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