New Jersey Flows

New Jersey Water Resources Research Institute

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Monitoring: Use & Coordination in NJ Water Resource Management

Introduction by Leslie McGeorge,
Water Monitoring and Standards, NJDEP

Monitoring is a key component of effective water resource management. Monitoring results inform decision-makers as to whether the state's waters are meeting applicable water quality criteria and designated uses. If water quality standards are not met, sampling results can provide information on the significant sources of stressors or pollutants, as well as the relative effectiveness of restoration measures for those waters deemed impaired. In New Jersey, uses of monitoring data for results-based management include:

- Identifying impaired waters
- Determining causes & sources of impairment
- Identifying waters needing special protections (e.g., Category 1)
- Establishing water quality standards and classifying waters
- Determining water quality status & trends
- Evaluating effectiveness of water quality management programs
- Responding to environmental spills

To receive federal grant funding under the Clean Water Act, states are required to monitor and assess their navigable waters, and to the extent practicable, their groundwaters. EPA guidance to states has further defined the testing requirements to involve all waterbody types, including streams, rivers, lakes, reservoirs, estuaries, ocean, wetlands, and groundwater. Monitoring should include physical, chemical, and biological indicators. States are also asked to use all available monitoring data in development of their water quality information, particularly their 303(d) list of impaired waters. In New Jersey, as well as many other states, this information is now reported to EPA in one comprehensive document, the *Integrated Water Quality Monitoring and Assessment Report*.

Limited resources hinder the ability of most state agencies to adequately monitor and assess 100 percent of their waters. Significant ambient water quality data gaps remain that limit the establishment of the necessary information foundation for effective water resource management. To gauge progress toward meeting this goal of assessing 100 percent of their waters, EPA has asked states to prepare long-term (10 year) water monitoring and assessment strategies which describe their current monitoring and assessment status, as well as identify needed enhancements. New Jersey has systematically evaluated its monitoring and assessment programs and identified the most critical data gaps to be filled to achieve the 100% assessed waters goal.

As one way of coming closer to this goal, the State has significantly enhanced its assessment methodology and spatial extent analyses for the waterbody listings in the 2006 *Integrated Water Quality Monitoring and Assessment Report*. The listings will be based on subwatersheds (HUC14s) rather than river miles associated with a specific monitoring location. Assessments will be based on designated uses such as aquatic life, trout, water supply including drinking water, agriculture, and industrial uses, and recreation.

To realistically make progress in testing all of New Jersey's waters, it is incumbent upon members of the state's ambient water monitoring community to explore ways in which to pool resources and exchange monitoring data to fill water quality information gaps. In order to strengthen the integration of ambient water monitoring activities in New Jersey, the NJ Water Monitoring Coordinating Council (NJWMCC) was formed in October 2003. The NJWMCC, which is co-chaired by NJDEP and the US Geological Survey (USGS), now consists of 30 members rep-

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The Director's Chair

by Joan G. Ehrenfeld, Ph.D., Director, New Jersey Water Resources Research Institute
Rutgers, The State University of New Jersey

This issue of New Jersey Flows is highlighting a selection of presentations that were made at the New Jersey Water Monitoring & Assessment Technical Workshop held on April 20th 2006. We chose articles to span the breadth of topics discussed. For a complete list of all presenters and to view their presentations visit the NJ Water Monitoring Coordinating Council website at http://www.state.nj.us/dep/wmm/wmcchome.html

For the latest in water research, funding announcements, events, and more visit the New Jersey Water Resources Research Institute at http://njwrri.rutgers.edu. We invite you to share your comments, opinions, and future NJ Flows articles by emailing njwrri@aesop.rutgers.edu. ♠

Water Monitoring Coordinating Council

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resenting 14 different water monitoring agencies/organizations throughout the state. It is modeled after the National Water Quality Monitoring Council and joins approximately a dozen other state and regional councils.

The Council's vision and mission are *"to provide a water information foundation for enhanced management and protection of New Jersey's aquatic environment"* and "*to serve as a statewide body to promote and facilitate the coordination, collaboration and communication of scientifically sound, ambient water quality and quantity data to support effective environmental management."* Goals of the NJWMCC include promoting efficient use of monitoring resources, effectively disseminating water monitoring information, facilitating water monitoring-related technology transfer, identifying information/research needs and/or emerging problems, as well as facilitating interaction with the National Water Quality Monitoring Council and other state/regional councils. To further these Council goals this year, the members are sponsoring this technical monitoring workshop and assisting NJDEP in the development of a web-based Water Monitoring Inventory for the State.

NJ's Integrated Report can be found at:
www.nj.gov/dep/wmm/sgwqt/wat/integratedlist/ integratedlist2004.html
NJ's strategy document, *New Jersey Water Monitoring and Assessment Strategy (2005-2014)*, can be found at:
www.nj.gov/dep/wmm/longtermstrategyreport.pdf
Additional information at:
http://www.state.nj.us/dep/wmm/wmcchome.html
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Water Monitoring Lexicon — Learn the Lingo

The scientific community is rife with acronyms that may deter the outside community and confuse scientists working in different areas the same field. Whether you are a scientist, educator, academic, or a member of a non-profit, refresh your memory and learn the meanings behind the letters.

IBI: An Index of Biotic Integrity is a metric developed to describe how well a component of the biota reflect undisturbed, unpolluted conditions. For example, a fish IBI expresses the relative abundance of fish found in polluted waters to fish only found in unpolluted waters.
http://www.state.nj.us/dep/wmm/bfbm/fishibi.html

TMDL: A Total Maximum Daily Load is a maximum quantity of pollutant that a water body can contain without exceeding water quality standards developed by state law. Total Maximum Daily Loads are developed for established contaminants only, and have not been developed for emerging contaminants (such as pharmaceuticals and personal care products and their degradants).

MST: Microbial Source Tracking is a technique that is used to determine a biological pathogen source by determining the likely place the specific pathogen in question would come from. Most microbial pathogens have a favorite host organism or have adapted to living in a specific host organism (cow, human, wildlife). Microbial Source Tracking is used to identify the pathogen and determine the likely source of contamination (animal waste, wastewater treatment plant, etc).
http://www.state.nj.us/dep/dsr/research/technology-critique-dec.pdf

HUC14s: Hydrologic Unit Codes are a way of organizing data about regional areas of river basins and watersheds. The divisions are drawn up by the United States Geological Survey, and are then used by a variety of organizations to define watershed management areas. The term HUC14 specifically delineates a 'subwatershed' category.
Geographical Information Systems data is available at the EPA's Region 2 (New Jersey) HUC website:
http://www.epa.gov/region02/gis/atlas/hucs.htm

BMP: Best Management Practices refers to effective ways to treat non-point source pollution.

WQC: Water Quality Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, fish production, or industrial processes.

WQS: Water Quality Standards are state-adopted EPA values which are used to designate a water body for specific human activities such as fishing or swimming.

Impact: An impacted water body has experienced a change in the chemical, physical, or biological quality which is caused by an external source.

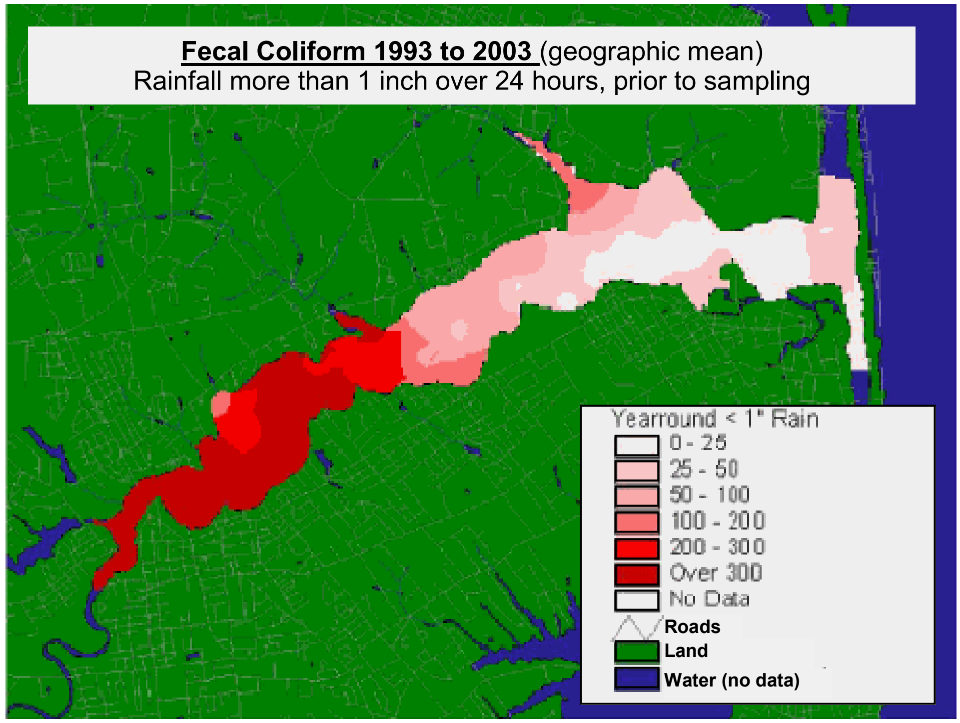
Impaired: Impaired water bodies do not meet Surface Water Quality Standards, and are prevented from their designated use (shellfish consumption, swimming, recreation). These water bodies will remain on the Impaired List, known as the "303d List", until the standards are met. Pollutant standards (TMDLs) are in place for total phosphorus, fecal coliform, nickel, copper, mercury, arsenic, chlorinated hydrocarbons (tetrachloroethylene, 1,2-dichloroethane), polychlorinated biphenyls (PCBs), temperature, and macrophytes (aquatic plants).
View the 303d list for New Jersey at: http://www.state.nj.us/dep/wmm/sgwqt/wat/integratedlist/integratedlist2004.html

Restoration of Shellfish Waters - Bacterial Source Tracking Monitoring Projects

By Eric Feerst
NJDEP Bureau of Marine Water Monitoring

The DEP Water Monitoring and Standards program has several on-going monitoring projects designed to track down sources of water quality impairments that are affecting shellfish areas. The identification of sources in an impaired area will greatly improve remediation efforts. Remediation projects include; correcting malfunctioning septic systems, repairing cross-connected stormwater/sanitary lines, and non-point runoff control measures to reduce domestic and wildlife fecal contamination. These remediation efforts can reduce or eliminate sources and improve water quality to allow harvesting of shellfish again in previously off-limit areas. On-going monitoring projects include the Upper Navesink River, Seaside Heights, and Maurice River Cove studies.

These studies are designed based on the Department's "Non-Point Monitoring Strategy". This approach includes the following objectives;



- Evaluate long-term bacteria monitoring data to identify impacted areas
- Perform stormwater monitoring to delineate major sources
- In addition to conventional microbial indicators, use specialized tests such as coliphage enumeration and Multiple Antibiotic Resistance (MAR) to identify sources as human, animal or wildlife.

Navesink River Study
Approximately 150 acres of shellfish waters were downgraded to prohibited status in the 2005 shellfish waters regulations. There are 25 sites in the upper portion of the Navesink River (Red Bank upstream to Swimming River Reservoir) which will be sampled under dry and rainfall conditions over a one-year period. Samples will be analyzed for conventional microbial indicators, i.e. coliforms and *E. coli,* to delineate the major areas of bacterial loading, typically adjacent to stormdrains in areas such as this. Microbial Source Tracking (MST) methods will be performed to identify the sources. Potential sources in this area could include non-point runoff from domestic animals and wildlife and the infiltration of sanitary wastes into stormwater drains.

Seaside Heights Project
This is an on-going monitoring project initiated in 1997 in the Seaside Heights area of Barnegat Bay. This area's impairments include shellfish harvesting and recreational bathing. Through our Non-Point Strategy, the Department was able to identify one stormdrain from approximately 12 stormdrains in the study area that was responsible for the majority of bacterial contamination. Using coliphage typing, the source was identified as human fecal contamination. This study is an excellent example of prioritizing areas, (or stormdrains) for remediation and identifying the source as either human or animal. Remediation measures are on-going and follow-up sampling will be performed to evaluate the effectiveness of these measures.

Maurice River Cove
Approximately 224 acres of shellfish growing waters in Maurice River Cove, Delaware Bay were downgraded from Seasonally Approved to Special Restricted in 2005. We have initiated ebbing tide sampling (every 2 hrs for a 6-hr. period) at 22 sites. Samples are analyzed for *E. coli* and the specialized source tracking techniques. As in the other studies discussed, this approach will supply the scientific data to delineate the highest sections of contamination and identify the source of bacterial contamination. Potential sources in this area could include malfunctioning septic systems, and wildlife fecal contamination.

Conference Calls

Stream Restoration and Protection in the Mid-Atlantic Region in Branchville, New Jersey June 14th-16th 2006. For more information email Kirk Barrett at kirk.barrett@montclair.edu or visit: http://awra.org/state/new_jersey/mac2006/
Second Passaic River Symposium at Montclair State University, October 13th 2006. Email kirk.barrett@montclair.edu for updates.

Stormwater Best Management Practice Monitoring

By Scott D. Struck, Ph.D., US EPA
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Implementation of an effective Best Management Practice monitoring program is not a straight-forward task. BMPs by definition are devices, practices, or methods used to manage stormwater runoff. This umbrella term lumps widely varying techniques into a single category. Also, with the existence of such a wide variety of underlying oftentimes site-specific conditions, a one-size-fits-all approach to Best Management Practice monitoring is infeasible. This article will introduce the difficulties of BMP monitoring, give current monitoring approaches, discuss how and what to monitor in structural and nonstructural Best Management Practices, and lastly, how to develop an effective monitoring program.

Great variability in stormwater properties and the associated runoff complicates Best Management Practices monitoring further. Precipitation varies in time, space, and intensity. Stormwater pollutants can be carried into the receiving water system by the precipitation itself (wet deposition) and/or picked up as it flows across surfaces with or without conveyance by man-made or natural drainage channels. Air quality, land use, drainage systems, and geology characteristics are all non-uniform, again leading to temporal and spatial variation concerning stormwater pollutant loads. An effective BMP monitoring program must incorporate this variability to produce reliable data.

Downloading data from continuous monitoring devices.

From a water quality and regulatory perspective, nonpoint sources are recognized as the major contributor to the uncontrolled pollution of the nation's waters. BMPs are the primary tools used to mitigate the deleterious effects of nonpoint sources on receiving waters, yet there is little evidence that Best Management Practices are meeting their projected goals. Therefore, high quality BMP monitoring programs are an important piece in completing the current picture of the nation's water quality and making steps towards improvements.

There are four main monitoring approaches employed to assess BMP effectiveness . The most popular approach is input/output sampling that is used with new, existing, or retrofitted structural BMPs. A second Best Management Practice monitoring approach is before/after sampling. This approach can be used in new or retrofit BMP situations, but is most often used with nonstructural or other BMPs that lack an inflow/outflow. Upstream/downstream monitoring can be used to assess the impact of a single Best Managemnt Practice effluent or an untreated stormwater input on its receiving stream . The final BMP monitoring approach is control watershed comparison. Although sometimes useful for evaluating nonstructural Best Management Practices where before data was not collected or structural BMPs without defined inlets (e.g., vegetative filter strips), the control watershed comparison approach is rarely used due to the difficulty in finding a watershed with similar contributing factors to serve as the control.

The number of possible parameters that may be measured in a Best Management Practice monitoring program is extensive. It is often impractical to measure all the physical, chemical, and biological parameters. Likewise there is no "one-size-fits-all" set of parameters that will satisfy the objectives of every monitoring program. The planning phase of a BMP monitoring program must include the selection of appropriate parameters.

Five major categories of Best Management Practice monitoring parameters have been identified: (1) chemical; (2) physical; (3) biological; (4) hydrological and (5) additional contributing factors. Traditional BMP monitoring programs have focused mainly on water quality and physical parameters. However, a robust monitoring program will incorporate some measures from most or all five of the major categories.

The effectiveness of nonstructural BMPs in improving the quantity and quality of stormwater has certainly been called into question. The lack of monitoring of nonstructural Best Management Practices has been cited on more than one occasion as a major impediment to their adoption. Monitoring of nonstructural BMPs is inherently difficult for many reasons. The most significant hindrance to monitoring the social aspects of nonstructural Best Management Practices is that many of them rely on behavioral change. From an engineering perspective, the most significant hindrance is the difficulty in monitoring undefined inflows and outflows.

Developing a BMP monitoring program that produces useful results takes a great deal of effort before any samples are taken. The Federal Highway Administration (FHWA) produced a well presented guide to the development of a BMP monitoring program. The agency organized a BMP effectiveness monitoring program into four phases: (1) planning, (2) design, (3) implementation, and (4) evaluation. Each phase is supported with useful examples to help conceptualize how the guidelines are put into practice.

With the information provided below one should have the foundation for developing an effective stormwater Best Managent Practice monitoring program for the improvement of water quantity and quality.

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United States Environmental Protection Agency (U.S. EPA). (2001). Techniques for tracking, evaluating, and reporting the implementation of nonpoint source control measures - urban. EPA 841/B-00/007. Office of Water, Washington, DC. January 2001.

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New Technologies for Measuring Stream Flow

By Timothy Reed, USGS

Streamflow and water elevations have been measured via mechanical means for many years. However, these mechanical methods can be hazardous in certain situations such as measuring flood waters containing heavy debris by lowering equipment beneath the water surface. The acoustic measuring devices available today allow for more accurate velocity measurements at very low velocities (less than 0.1ft/s). Other benefits include refined abilities to detect the direction of flow and stratified layers.

Acoustic sensors have been designed to mount on boats (remote controlled or manned) or fixed structures in the water. The Doppler Effect is the basis for the calculation of underwater sound to accurately measure water movement. The acoustic equipment sends a sound wave into the water at a known frequency. The sound wave bounces off of suspended particles in the water. These particles are assumed to be traveling at the same speed and direction of the water being measured. The change in frequency of the reflected (returning) sound wave is measured by the acoustic equipment and used to determine the velocity, depth, and direction of the water.

For more information please read:
"Hydroacoustic Current Meters for the Measurement of Discharge in Shallow Rivers and Streams" available online at http://www.comm-tec.com/Library/Technical_Papers/USGS/SEMpaper.pdf
"Field Evaluation of Boat-Mounted Acoustic Doppler Instruments used to Measure Streamflow" available on-line http://www.comm-tec.com/Library/Technical_Papers/USGS/CMTC_Paper_David_S_Mueller.pdf

Sources of Mercury to New Jersey's Environment and Total Maximum Daily Load Development

By Michael Aucott, PhD, NJDEP, Division of Science, Research & Technology

Development of an effective Total Maximum Daily Load requires a sound understanding of the sources of a pollutant to a water body, and of the behavior of that pollutant in the water body.

Mercury sources and impacts in New Jersey were described in the Final Report of the New Jersey Mercury Task Force *(1)* which was released in January 2002. Since that time, additional data have become available, including that acquired through the New Jersey Atmospheric Deposition Network *(2)*. Other research and modeling efforts completed and in progress have provided further knowledge. These include additional mercury we deposition data collected in Warren County 2002 through 2005, and extensive ambient concentration data of elemental, reactive gaseous, and particle-bound mercury collected by NJDEP in 2004 and 2005. New data on mercury concentrations in sediments, biota, water bodies, stormwater, and wastewater have also been obtained. More quantitative knowledge of specific sources and source types has also been obtained since 2002. Advanced modeling efforts have provided new insights into the fate, transport, and environmental behavior of mercury.

New findings on mercury levels in fish and other biota have provided more evidence that localized regions of high mercury concentration, or hot spots, exist. There is also increasing evidence that reductions in local mercury sources can lead relatively quickly to reductions in biota in nearby water bodies.

More has been learned about specific source categories. It is increasingly clear that dental offices contribute on the order of half of the total mercury in wastewater. It is also now clear that broken fluorescent bulbs contribute in the range of 250 pounds of mercury emissions to the air in New Jersey.
New data on concentrations of mercury in sediments reveal that some New Jersey water bodies have historically received much more deposition than others, and also that more deposition has occurred than can be accounted for by present measurements of mercury concentrations in precipitation. It appears likely that historical emissions and deposition were in fact higher than today. However, it also is likely that dry deposition, not captured in precipitation measurements, contributes a significant portion of overall deposition. New speciated mercury data collected by NJDEP include not only ambient concentrations of elemental mercury, but also ambient concentrations of particle-bound mercury and reactive gaseous mercury. Preliminary analysis of these data suggests that dry deposition, which is heavily influenced by particle-bound and reactive gaseous mercury, may account for one-third or more of total mercury deposition.

This Tekran sampling unit in Elizabeth measures elemental, reactive gaseous, and particle-bound mercury. Units are also installed in Camden, New Brunswick, and Chester.

The linkage of these data with wind direction by NJDEP staff and others also offers the hope of better characterizing and quantifying air emission source categories that are now only approximately estimated, which could prove helpful in TMDL development. These data are also providing new insights into the role of climatological factors in mercury deposition.

References
(1) http://www.state.nj.us/dep/dsr/mercury_task_force.htm
(2) http://www.state.nj.us/dep/dsr/njadn

Monmouth University's Microbial Source Tracking

By John Tiedeman, Associate Dean of the School of Science, Technology, and Engineering at Monmouth University

Fecal contamination in New Jersey's coastal watersheds continues to result in harvest restrictions or closure of shellfish beds. This is particularly true for coastal watersheds in Monmouth and northern Ocean Counties, where sanitary quality necessitates the classification of most waters as "Prohibited" or "Special Restricted". In addition to shellfish harvest restrictions, the presence of fecal bacteria in some areas result in beach closures because of the possible risks contamination poses to humans who utilize these waters for various forms of contact recreation.

The presence of *E. coli*—an indicator organism of fecal pollution—can indicate potential contamination of a waterbody with disease-causing strains of bacteria. Traditional tests for analyzing sources of *E. coli* waterways most often involves total coliform and fecal coliform counts. These assays are valuable for determining if a waterway contains fecal pollution, but they cannot be used to identify specific sources of bacterial pollution. Another method must be used to determine the source as human or non-human bacteria.

Over the last decade, several new methodologies in microbiology and molecular biology have been described which have demonstrated value for discriminating sources of fecal bacteria in surface waters. These Microbial Source Tracking (MST) methods are a variety of techniques that identify non-point sources responsible for fecal pollution in the waterways. These Microbial Source Tracking methods are being applied in the development of Total Maximum Daily Loads (TMDL) as part of Clean Water Act requirements and in the evaluation of the effectiveness of better management practices.

In New Jersey, Monmouth University has been applying MST techniques to identify sources of bacterial loadings in the coastal watersheds of the Manasquan River Estuary, Shark River Estuary, Deal Lake and Wreck pond watersheds. To date the MST work done in these highly urbanized watersheds identify or confirm the relative contribution from sources such as humans, livestock, wildlife, and domestic pets.

These Microbial Source Tracking studies have generated a tremendous amount of interest in applying source tracking techniques in other watersheds around the state. Monmouth University and Rutgers Cooperative Research and Extension Center have established a MST working group whose objective is to develop a coordinated approach to using these techniques in watershed assessment throughout the state. Other participants in the Working Group include representatives from the NJDEP Bureau of Marine Water Monitoring and Division of Watershed Management, the NJ Department of Agriculture, county planning and health agencies, private consulting firms, and citizen groups including a number of regional watershed associations. At the present time the NJ Microbial Source Tracking Working Group is developing a tiered MST strategy as a comprehensive approach for identifying bacterial sources in New Jersey coastal watersheds. This approach incorporates more than one MST technique to identify the pollution sources.

The tiered Microbial Source Tracking strategy consists of:

1. GIS Analysis to identify potential sources of contamination—available, documented potential inputs of bacterial contamination will be identified and places in to a project Geographic Information System database. GIS layers will include active and inactive landfills, farms, parklands, stables, impoundments suitable for waterfowl, industrial and commercial facilities, golf courses, Superfund sites, RCRA sites, stormwater outfalls, and point sources such as sewage treatment plants and industrial discharges. This information will guide the selection and establishment of a suitable number of sampling sites in each of the study areas and also be used in the final analysis of the data generated.

2. Coliphage Typing—F+RNA coliphages can be used to distinguish human and animal waste contamination by typing isolates into one of four subgroups. Ecological studies have demonstrated that groups I and IV are generally associated with animal feces whereas groups II and III are more sewage specific.

3. Antibiotic Resistance Analysis – Antibiotic resistance was developed as a method for source tracking based on the demonstrated phenomenon that bacteria from hosts exposed to antibiotics will develop resistance to those antibiotics, and on the hypothesis that this selective pressure would be a mechanism for discriminating among fecal bacteria from various hosts. Among the different antibiotic resistance approaches available, Anitbiotic Resistance Analysis (ARA) is

the most common method used in MST studies.

4. Other techniques, as deemed appropriate.

The NJ MST Working Group envisions that development of the tiered MST approach will provide NJ with a tool that can be applied statewide in the development of Total Maximum Daily Loads and regional storm water management plans. ♦

Helicopter Monitoring: New Jersey Beaches & Offshore Research

By Helen Grebe

The US EPA collects water quality monitoring data and conducts surveillance activities of the New Jersey and New York offshore waters each summer using a network of stations. This information is compiled and analyzed to assess the health of the coastal waters of New Jersey and New York.

The beach station network is used to gather bacteriological water quality information for public health protection of swimming beaches. Samples are collected on a weekly basis from a network of twenty-six stations on the Long Island Coast and forty-four New Jersey coastal stations in place from Sandy Hook to Cape May. Samples from the beach network are taken as close to the surf zone as possible, at a depth of one meter. Fecal coliform and *E. coli* are used as indicator organisms to evaluate the suitability for swimming in recreational waters. Guidelines for beach closures are laid out by federal and state laws; data that exceeds state or federal critera is reported to authorities for necessary beach closure. The research from the summer of 2005 showed the bathing waters of Long Island and New Jersey to be well below the threshold of health hazard.

The perpendicular station network monitors the dissolved oxygen concentrations and temperature at sampling depths of 1 meter above the ocean floor. These samples are collected 8 to 10 times during the summer months at distances of 1 to 9 nautical miles off shore. Sufficient dissolved oxygen levels are necessary for survival and reproduction of aquatic life, although each species and developmental stage has a different threshold for dissolved oxygen. The EPA adopted blanket guideline to determine healthy, stressed, and lethal levels of dissolved oxygen. Analysis of the data shows that on average, the quantity of dissolved oxygen is lower at a distance of 1 mile from shore, and higher at stations further offshore. This is explained by the demand for oxygen created by river discharges, effluent, stormwater runoff, and the plume from the Hudson-Raritan River Estuary. Re-aration of ocean water occurs through storm events, substantial winds, and strong thermocline (abrupt changes in the temperature gradient of the ocean water).

The floatable surveillance network was developed to address the problem with garbage wash-up and beach closures due to floating debris. The targeted area includes the Arthur Kill, Newark Bay, the Kill Van Kull, the Upper New York Harbor, and the Lower New York Harbor. This overall area is known as the New York / New Jersey Harbor complex, and is demonstrated in *figure 1*. The helicopter flights took place six days a week searching for evidence of a “slick” (aggregation of floating debris about 400 meters in length). During the surveillance period of in the summer of 2005, eight of the observed twenty-five slicks were placed in the largest size category, being an aggregation greater than 1600 meters in length. The overall frequency of debris slicks is decreasing, mostly due to clean-up programs. During the summer surveillance season, Long Island and New Jersey did not have any beach closures due to floatable debris.

The full analysis of data from 2005 and comparative data from previous years of helicopter monitoring is available in the “Helicopter Monitoring Report: A Report of the New York Bight Water Quality, Summer 2005”. This report, and its predecessors are available at this EPA link for region 2: http://www.epa.gov/Region2/monitor/nybight/index.html

Features

New Jersey Flows

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