REGIONAL MUNICIPALITY OF OTTAWA CARLETON | MEMORANDUM

MUNICIPALITÉ RÉGIONALE D'OTTAWA CARLETON | NOTE DE SERVICE

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TO/DEST. The Chair and Members of Regional Council

FROM/EXP. Director, Finance and Administration
Environment and Transportation Department

SUBJECT/OBJET **SURFACE WATER QUALITY PROGRAM**

PURPOSE

This information report introduces and briefs members of Council on the different initiatives within the Region's Surface Water Quality (SWQ) Programme. The intent is to give a general overview of the Region's water environment projects. The detailed technical and policy related reports will be tabled under separate cover with Planning and Environment Committee and Council.

HISTORY OF THE PROGRAMME

In the fall of 1990, Regional Council affirmed the Region's role in the protection of the water environment by endorsing and funding the surface water quality programme (Executive Report 127). By 1991, the Surface Water Quality Programme was operational, with field activities initiated that summer.

The key objectives established for the surface water quality program were the following:

- To monitor the health of the Region's surface waters, collect baseline information and to determine any long term changes in water quality.
- To monitor discharges to the rivers and assess their impacts on surface water quality.
- To co-ordinate efforts to reduce water pollution within the Region.
- To co-ordinate surface water quality initiatives with local municipalities, conservation authorities, Provincial and Federal agencies to protect the water environment.

In keeping with its co-ordination role, between 1990 and 1992 the Region managed the Rideau River Stormwater Management Study (RRSWMS) on behalf of the Cities of Gloucester, Ottawa,

Nepean, and the MOEE. During that period, other components of the surface water quality program developed and matured. Programme experience and public response during the RRSWMS led to recommendations approved by Council in October 1992 that re-directed the Surface Water Quality Programme as follows:

- To develop a municipal action plan for the co-ordinated funding and scheduling of surface water initiatives in the Region, through participation on the Water Quality Committee
- To re-evaluate the Regional Surface Water Quality Programme in consultation with the Water Quality Committee, and to review current and future funding to establish the following:

a) a biological monitoring and assessment strategy to report on the general health of the ecosystem.
b) a public information and education programme in line with the ecosystem approach.
c) a programme for evaluating the operation and performance of municipal stormwater management facilities.

The increased emphasis on ecosystem monitoring, assessment and evaluation necessitated the reallocation of budgets, as well as the development of RMOC resources and expertise. Today, a comprehensive monitoring and assessment strategy is in place, a number of public education activities have been undertaken, and the Region is actively involved in the evaluation of stormwater management infrastructure throughout Ottawa-Carleton. Much of the success of the programme relies on the co-operation and co-ordination with other agencies.

CURRENT PROGRAMME INITIATIVES

Current programme initiatives can be categorized as follows: ecosystem monitoring and assessment; co-ordination of technical planning, reviews and approvals; and education and advisory services.

Ecosystem Monitoring & Assessment

The purpose of ecosystem monitoring and assessment is to identify linkages and inter-relationships within and between natural and human environments. Once understood, this information allows for informed decision making regarding the management of resources and environment protection. For instance, assessment results are used to identify areas sensitive to particular kinds of development; impact on recreational and economic uses; the assimilative capacity of surface waters; pollution sources and potential remedial measures; and the cumulative impact of human activities.

Monitoring and assessment involves a number of activities including the following:

- **water quality sampling** to identify levels of nutrients, metals, and the presence of micro-organisms;
- **review of natural physical features** to determine the impacts of wind, rainfall and temperatures on system processes;
- **fish counts** to identify changes in fish populations, range and diversity;
- **shoreline evaluations** to identify areas of degradation and remediation measures; and

- **other biological assessments**, such as algae and invertebrate analysis, important indicator species which can be used to assess a variety of parameters and project future changes in the system.

Each of these activities helps the Region to develop a clear understanding of how surface water ecosystems are functioning and, therefore, how they could be managed. All of the parameters inter-relate and are studied in conjunction with one another. For example, pollutant levels from some storm outfalls may not be high enough to directly affect fish populations, but could lead to a reduction in the zooplankton upon which they feed. Examination or consideration of only a portion of the results can be misleading. For many years high phosphorus levels in water samples taken at Mooney's Bay were thought to be the result of stormwater runoff. However, recent biological assessments indicate that at least some of the phosphorus can be attributed to a type of algae that is displaced into the water column during rainfall events and from a release of phosphorus from sediment into the water during summer stratification.

The current baseline monitoring programme involves 150 sites across Ottawa-Carleton. Sites were selected to enable characterization of key waterbodies, as well as comparative analysis between similar ecosystems. Long-term monitoring at these sites will allow the Region to assess and compare the impact of human activities on waterways and prioritize programme activities and initiatives within the region.

A significant amount of work is being undertaken in Mooney's Bay. The purpose of the project is to understand the processes occurring in the Bay and determine how best to manage and protect this resource. Advances in technologies have and continue to produce an impressive array of new tools used by many disciplines to understand and solve environmental problems. An integrated generic framework for environmental data management and decision support is currently under development by Environment Canada and the National Research Council Canada. One of the applications that it will be configured to support is Urban River Management for which Mooney's Bay provides the necessary data inputs. Eventually, this system is to be implemented throughout the Region, which will allow for similar analysis of all key waterbodies in Ottawa-Carleton.

Technical Planning, Review & Approvals

Agencies without a direct mandate to manage water resources make critical decisions which affect water quality in Ottawa-Carleton. Therefore, the co-ordinated management of activities and impacts is critical to the success of achieving the Region's overall objective of protecting the water environment. To accomplish this the Region determines and defines the state of the water environment, identifies key environmental issues, establishes specific goals and objectives, and designs methods for predicting and assessing impacts on that environment. This allows for the development of policy, and the allocation of funds and resources towards environmental issues of highest value to the ecosystem.

The Region co-ordinates and provides technical support for a number of initiatives (attachment A) including: planning studies; implementation plans; and technical guidelines and standards such as the Evaluation Guidelines for Environmental Assessments of Surface Water Quality Projects. As well, the Region reviews surface water management plans for all proposed draft plans of subdivision.

Given the various jurisdictions and interests in water environment protection, the Surface Water Quality Branch has sought out and developed partnerships with various agencies and organizations thus ensuring a high calibre of expertise and resources being available to the RMOC. This includes the aforementioned partnerships with federal agencies and local universities and the Water Quality Committee.

Every year the Region provides technical support to numerous surface water projects undertaken by local municipalities and developers. Monitoring and assessment services are provided on a cost recovery basis, and advisory services on an as-required basis. Technical support is also provided to and compliments the Region's plan review process. Thus, through these varied activities the Region is able to monitor and assess progress towards achievement of its goals and bridge information between the different Water Quality Partners.

Education Services

Public awareness is a key component of the solution to maintaining and improving the quality of the Region's water environment. This involves a number of activities including the dissemination of information regarding the state of the Region's water environment; Fact Sheets outlining actions that individuals and businesses can take to reduce pollution of the environment; support for community based initiatives to improve local water quality; and working with Regional staff to ensure that the Region demonstrates leadership in the area of water quality protection and management.

The Region, through the Water Quality Committee, coordinates various public awareness initiatives undertaken by its member organizations.

Some of the services provided by the Region include support for South Carleton High School student activities on Poole Creek, information services through Window on the Region, and technical services to MOEE for the latest edition of "Guide to Eating Ontario Sports Fish." Water quality information is also made available to the public through internet services.

Through its partnerships the SWQB has benefited from technology development and transfer. This increased experience and knowledge is now being transferred back to our partners to improve management of local resources as well as the management of sensitive environments in the St. Laurent River and Sao Paulo, Brazil.

THE REGION'S WATER ENVIRONMENT PROJECTS

A lot has been learned about the Region's water environment since 1991. The following are examples of the projects that have been designed to provide an integral component to the ecosystem approach being applied. Some of these projects only began in 1995 and shall continue into 1996.

The Mooney's Bay project is representative of the Regions' approach to water environment protection as it integrates all the S.W.Q. Programme initiatives. The high priority placed on this section of the river by the public compliments the Programmes' emphasis. The development of

generic technologies and interpretative tools for the Mooney's Bay area is occurring with a view of transferring this experience to other areas within the region.

Mooney's Bay, An Integrated Approach

Prior to 1993, data acquisition in the Mooney's Bay area had concentrated on providing bacteriological and chemical information on the water quality. This included data from time-series as well as discrete samples. However, data describing the hydrodynamics of the Bay were insufficient to determine the source, transport and fate of contaminants within the Bay to any degree of confidence. It became apparent that due to the complexity of the system a much broader study was required to properly formulate management decisions and justify any large remedial expenditures.

The ecosystem approach to monitoring in Mooney's Bay led to a unique partnership between Environment Canada and the Regional Municipality of Ottawa-Carleton in 1993. The partnership has involved a unique co-operation and technological exchange with respect to ecosystem monitoring. Terms of the partnership involved developing and implementing an integrated environmental monitoring programme along with a decision support system to assess the management options for a portion of the Rideau River watershed, principally the Mooney's Bay Area.

Physical and Hydrodynamic

The key physical element is the bathymetry (shape) of the Bay which affects flow velocities and circulation patterns. This information is useful for the selection of sampling sites and understanding pollutant transport.

The water temperature indicates that a stratification typically develops by mid - summer. This means that deeper colder water remains relatively undisturbed and does not readily mix with the warmer water above. This affects the water quality and biological processes in the Bay.

Flow rates, wind speed and wind direction, in addition to the physical setting all play an important role in establishing the overall circulation patterns in the Bay. Flow meters installed at four locations within the Bay provide time series measurements that are used to determine when significant hydrologic events are occurring and to streamline the sampling.

Water Quality

An oxygen content of greater than 5 mg/L is required to support aquatic life. Over the summer, oxygen depletion (less than 1mg/L) takes place in the deeper water. By late June this area can expand to cover one third of the Bay area at a depth of greater than 5.5m. In the fall with the onset of cooler temperatures the anoxic zone is dispersed by an increase in river flow. Regulating river flow may be able to control the oxygen depletion zones making it a key management option.

The phosphorus measurements in the Bay typically exceed the Provincial Water Quality Objective of 0.03 mg/L. The highest phosphorous levels are found in the oxygen depletion zones. Under these conditions, internal phosphorus loading may be contributing to the high phosphorous levels in the Bay. This is a concern since elevated phosphorus levels promote algae blooms and reduced water clarity which can further degrade water quality and impair aesthetics and recreational use.

Data animation tools developed with *Environment Canada* have proven useful for the integration and interpretation of the data as well as an effective tool to communicate information. Through the use of this animation it became apparent that the E. coli threshold of 100 counts per decilitre was rarely exceeded. A closer evaluation of the data concluded the following:

- Conditions at Mooney's Bay Beach, within the Bay, and upstream to Manotick are acceptable, based on current frequency with which 100 *E.coli* per 100mL is exceeded.

- Between Hog's Back and Manotick, under existing land use, the river is capable of assimilating loads associated with storm runoff for small and medium rainfall events.

Biology

Algae (phytoplankton)
In partnership with the *University of Ottawa* and *the Museum of Nature* the evaluation of the algal communities showed a high diversity of species within Mooney's Bay. This is good because the river communities can respond to variable conditions without any one species dominating and becoming a problem. In the Bay many of the algae species were typical of lakes or slow moving waters and the algae was more abundant. In areas of the river where the flow is faster a reduction in the algae was observed.

During rain events the bottom (benthic) algae are disrupted and displaced into the water column. Their removal appears to range from 3-11 days depending on the severity of the storm. This is an important observation due to the increase in total phosphorus levels associated with the algae in the water column. To date increases in phosphorous during rain events have only been attributed to the various inputs to the river.

The visual impact of algae, specifically algal mats along the shoreline created an interest in the nearshore algal growth. The major floating mat problems were represented by three species. Knowledge of the algal species now allows for development of cost-effective control strategies to be considered.

Microscopic Aquatic Animals(Zooplankton)
Zooplankton samples were collected at each of the algae sites. Zooplankton feed on algae, thus providing some algal control, as well as they are food for fish. Their critical role in the ecosystem may be threatened by stormwater inputs, increased river flows or by the filter feeding of zebra mussels. Initial results show that there is a natural variation over time throughout the Bay. A change in this pattern is a warning that something in the system has changed.

Fish Populations
Parts of the Rideau River have been recognised for their high recreational fishing value. However, very little information was documented on the fish communities in the Mooney's Bay reach. Thus, in 1995 the SWQB in conjunction with the *Ontario Ministry of Natural Resources* initiated an assessment of this part of the river. The results indicated that there are substantial sport fish, sucker and forage fish communities present in this stretch of river. Large numbers of smallmouth bass, spanning all developmental stages, were recorded throughout the Bay. A smaller yet healthy population of walleye was also found. Mature northern pike and muskellunge were recorded over the course of the summer. Local areas of significance for young of the year

refuge and spawning have also been identified. This information has altered one of the preliminary proposed stormwater options for the Bay. If this information had been available prior to the option evaluation a more cost effective analysis of the potential options could have been done. In 1996 this evaluation will continue along the Rideau past Manotick as well as for a few key creek areas. This increased knowledge will allow cost effective recommendations to be made as to possible management practices to protect or enhance this resource.

Zebra mussels

The SWQB, in conjunction with the *Museum of Nature* has developed a monitoring programme to estimate the colonization and growth of zebra mussel in the Rideau River. Since 1994 their population has more than doubled on the Rideau. Since zebra mussels are very effective filter feeders they can rapidly remove particulate matter (including phytoplankton and zooplankton) from the water column. Thus changes in the biological community structure and several water quality parameters will occur. It is critical to understand whether changes to land use, stormwater management practices or the zebra mussels are affecting the changes we observe. Zebra mussels will also affect how infrastructure and stormwater facilities will have to be designed and operated. The rate of their growth and spread will determine how quickly we have to respond. The 1996 the monitoring programme was expanded to include sites upstream of Kars as well as along the Ottawa River to assist in the analysis of the zebra mussel problem, measure possible impacts on RMOC water filtration plants and evaluate the implications on surface water management in the Region.

Water Level

The most significant physical factor impacting on the lower Rideau River is the 3m lowering of the water level every fall and fill-up every spring. This has an engineering function of reducing the potential impact of ice damage on some of the locks. Biologically, the drawdown has disrupted the littoral vegetation and increases the shoreline instability. Increased sedimentation has a negative impact on the benthic organisms and native clams. Rapid draw-down traps many young of the year fish along the shoreline where they die. One positive impact of draw-down is the possible impact on the zebra mussel populations left exposed during the winter. Over the next few years the question of draw-down should receive more attention with ecosystem stability as the primary concern.

Water Quality Predictions

The source, fate and effect of various contaminants is another key aspect of this project. The importance of the storm sewer inputs into the Bay relative to the upstream river input is critical when considering remedial action. The 1994 and 1995 field programs focused on monitoring a number of significant storm events, mapping stormwater fate and determining its impact on the Bay. In 1996 a hydrodynamic model for the Bay is being developed in partnership with the *National Research Council (NRC), Environment Canada, and the Danish Hydraulic Institute (DHI) and Baird & Associates.* Once in place, it will be used to predict and evaluate future river management scenarios under various infrastructure conditions.

Management Concerns

The complexity of processes affecting this aquatic ecosystem provides a range of problems to be addressed and many possible management options to be evaluated. These options need to be practical, supportable, and provide an economic benefit. Large capital expenditures should not be undertaken to provide partial solutions. However, consideration must be given to the extensive effort that has been spent to date in developing pollution control options balanced with the expanding public, political, environmental and infrastructure pressures.

In the case of the Rideau River, a remedial action strategy was developed that solely responded to bacterial contamination . In 1995 dollars this singular remedial strategy is estimated to cost $60M. The question is do we modify the existing strategy to respect the various concerns, or evaluate a new matrix of options with an understanding of the true problems?

A reliable decision support system allows decision makers to evaluate the cost/benefit of alternate strategies and effectively communicate these results to the public. In any case, with a functional monitoring network and decision support system, informed decisions can be made and their effects monitored.

The Region also has ongoing projects in other areas. The following is a brief project outline:

Britannia Beach

Britannia Beach has experienced problems with elevated bacterial levels for a number of years. Despite implementation of various solutions, bacteria levels remain high. Recent studies have now shown that may be due to the complex circulation patterns which prevent the dilution and dispersal of flow in the beach area. Thus, a report has been commissioned for 1996 to further assess this problem, and develop and evaluate various alternatives for improving water quality at the beach.

Jock River

The SWQB provided monitoring and technical support to the Jock River Watershed Study, co-ordinated by the Rideau Valley Conservation Authority. This is an example of the interdependency and reliance on co-ordinating efforts to accomplishing a more cost effective study.

The SWQB in co-ordination with the *MNR,* designed and carried out the fish population surveys for the river. The reach of Jock River downstream of Richmond is a class 1 fishery due to the various types of sports fish found there, however, it has generally been considered poor fish habitat for a number of species. Fish counts completed by the Region have yielded two interesting findings. First, large numbers of toxic-sensitive redhorse fish were found downstream of Richmond indicating a relatively toxic-free environment. Second, populations of muskellunge and pike were found upstream of Richmond indicating that this area may also be worthy of a class 1 designation.

Aquatic Macroinvertebrates as Bioindicators of Water Quality

The SWQB in conjunction with the *University of Ottawa*, Department of Biology has initiated work on the development of water quality bioindicators for the Rideau, Ottawa and Jock Rivers. It is often difficult to monitor the impacts of degraded water quality with the collection of grab water samples since water quality impacts are often episodic and their effect on aquatic life (eg. fish) are often noticed after the damage has occurred. The impacts of water quality integrated over time along with an early warning system can be obtained by monitoring aquatic organisms that are more sensitive, less mobile, and more practically sampled. Aquatic benthic (bottom dwelling) invertebrates and algae have been recognized as suitable bioindicators of water quality. Their application as bioindicators have focused mainly on small streams and their validity in larger Eastern Ontario Rivers remains to be demonstrated. The main objective of this work is to develop a cost effective bioindicator to improve our ability to monitor water quality in large rivers and identify areas for remedial action. The results will also allow us to focus our efforts on a narrower scope of the datasets for future analysis and enable appropriate modifications and reallocations to sampling programmes.

The Sawmill Creek Flow Diversion

The Sawmill Creek Watershed Study was completed in 1994. The Recommended Water Management Strategy included the construction of a creek re-alignment which will address stormwater management issues within Sawmill Creek. The facility will incorporate wetland and pool features intended to improve the creek water quality. As well, the facility will be designed to alleviate flood problems within the South Keys area while providing sufficient storage volume to control downstream erosion. The constructed wetland will also provide the opportunity to create a continuous corridor between Hunt Club Road and Walkley Road.

In keeping with it's co-ordinating role, in 1996 the Region will co-ordinate the pre-design and class environmental assessment (EA) for a proposed flow diversion and constructed wetland along Sawmill Creek in the City of Ottawa. The proposed project will be located between Cahill Drive and Walkley Road in the vicinity of the South Keys Shopping Centre (Hunt Club Road and Bank Street).

Alternative Funding Options For Stormwater Management

As stormwater management costs increase, concern about the fairness of charges also increases. It becomes particularly important that charges against property or activities be based on related contributions to stormwater management costs. As concern grows over the problems of runoff pollution and the large projected costs of abatement, the examination of economic instruments to fund stormwater management is particularly relevant. Existing funding mechanisms have become either ineffective or too narrow in their application. User-pay approaches not only hold the potential for raising needed revenue in an equitable manner, they may also represent an incentive for landowners to apply better on-site controls, thereby reducing demand on stormwater systems.

The main objective of the project is to determine the feasibility and develop design details for the potential institution of funding mechanisms to support stormwater quantity and quality management, with a focus on a user-pay system.

Evaluation Guidelines (Completed in 1995, to be evaluated in 1996)

Since the Class EA document was released in 1993, many stormwater projects in the Ottawa-Carleton region have been carried out following the described process. While the requirements of the process have been observed by the consultants preparing these studies, the manner in which the various stormwater management alternatives have been evaluated has been highly variable. The purpose of the Evaluation Guidelines is to provide consultants with further guidance in terms of evaluating the alternatives. The result should include improvements in terms of traceability and accountability, region wide consistency, public consultation, and a more efficient approvals process.

Regional Stormwater Management Operational, Maintenance and Monitoring Guidelines

One of the main reasons for failure or poor performance of stormwater "best management practice" (BMP) systems is a lack of proper operation and maintenance (MOEE, 1994). These guidelines are being developed to provide information to owners of these systems in Ottawa-Carleton on appropriate O&M activities. The guidelines apply to all stormwater BMPs, including conventional quantity control systems.

FUTURE ACTIVITIES

The central theme of the Region's surface water quality program remains the collection and interpretation of water quality data such that present and future impacts can be evaluated. This information is key to making future cost effective decisions on infrastructure management.

The continued focus of the branch will be the following:

- To identify and understand trends in the Region's water environment.
- To develop cost-effective management solutions to adapt to or alter those trends.
- To further the Region's water quality objectives through co-ordinating investigations and surface water initiatives, and facilitating the exchange of knowledge and expertise.
- To provide educational services and raise awareness of surface water quality issue in the Region.

It is recognized that the on-going success of the Surface Water Quality Programme will rely increasingly on continued and as well as new partnerships. Integration of all aspects of water resource management will remain a necessary programme element.

If you require any additional information, please do not hesitate to contact Nancy Schepers, Director, Water Environment Protection Division at ext. 2579, or myself at ext. 2611.

Approved by
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