

# **BAY OF QUINTE RAP MONITORING STRATEGY 2002-2005**

**Part A - Review of Existing Government  
Programs, Research, Surveillance and Monitoring Activities,**

**and**

**Part B - Monitoring Strategy toward delisting  
the Bay of Quinte RAP Area of Concern**

prepared for:  
Bay of Quinte RAP Restoration Council



Fred Stride Consulting

September 2002



## **Fred Stride Consulting**

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Facilitating Innovative Environmental Solutions and Support

12 September 2002

Barry Jones  
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Dear Mr. Jones

Fred Stride Consulting is pleased to submit the report (one paper copy and one electronic copy in Word format) *Bay of Quinte RAP Monitoring Strategy 2002-2005: Part A - Review of Existing Government Programs, Research, Surveillance and Monitoring Activities, and Part B - Monitoring Strategy toward delisting the Bay of Quinte RAP Area of Concern* to the Bay of Quinte RAP Restoration Council.

I wish you and your group the best with your continuing efforts to delist the Bay of Quinte RAP Area of Concern.

Yours truly

Fred Stride

# **Bay of Quinte RAP Monitoring Strategy 2002-2005**

## **Part A - Review of Existing Government Programs, Research, Surveillance and Monitoring Activities, and Part B - Monitoring Strategy toward delisting the Bay of Quinte RAP Area of Concern**

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Bay of Quinte RAP Restoration Council

## **Bay of Quinte RAP Monitoring Strategy 2002-2005**

### **Part A - Review of Existing Government Programs, Research, Surveillance and Monitoring Activities, and Part B - Monitoring Strategy toward delisting the Bay of Quinte RAP Area of Concern**

#### **Introduction**

Since 1985, a Remedial Action Plan (RAP) program has been underway to restore water quality and environmental health in the Bay of Quinte. Cleanup work has progressed steadily, and plans to review environmental changes and seek a delisted status for the area have been discussed. The report *Bay of Quinte RAP Monitoring Strategy 2002-2005* is the third in a series of reports produced by the Bay of Quinte RAP Restoration Council between 2000 and 2002 to advance cleanup activities to the delisting review stage. The report

- reviews existing government monitoring programs in the Bay of Quinte area,
- outlines the monitoring activities that may be needed to assess environmental changes and undertake the delisting review,
- provides links to other Bay of Quinte RAP Restoration Council reports,
- lists options for completing monitoring activities, and
- offers a possible Bay of Quinte RAP Restoration Council strategy (e.g., monitoring actions, tentative schedule and preliminary cost estimates for some projects).

#### **Background**

The Bay of Quinte was identified by the International Joint Commission (IJC) in 1985 as a Great Lakes Area of Concern (AOC) due to 11 Impaired Beneficial Uses (IBU) giving rise to very poor local water quality conditions. In non-scientific terms, the IBUs can be summarized as loss of fish and wildlife habitats, too much algae, unsafe levels of bacteria at beaches, and high levels of persistent toxic substances in fish and sediments (e.g., mercury, arsenic, lead, PCB, dioxin). A complete list of the Bay of Quinte IBUs is provided in Table 1.

Table 1. Bay of Quinte RAP Impaired Beneficial Uses (as noted in the 2001 report *Bay of Quinte RAP Restoration Council Five-Year Work Plan 2001–2005*)

<b>#</b>	<b>Impaired Beneficial Use</b>	<b>Designation</b>
1	Restriction on fish and wildlife consumption	Impaired
2	Tainting of fish and wildlife flavour	Not impaired
3	Degradation of fish and wildlife populations	Impaired
4	Fish tumours and other deformities	Impaired

Table 1. Continued

#	Impaired Beneficial Use	Designation
5	Bird or animal deformities or reproduction problems	Not impaired
6	Degradation of benthos	Impaired
7	Restrictions on dredging activities	Impaired
8	Eutrophication or undesirable algae	Impaired
9	Restrictions on drinking water or taste and odour problems	Impaired
10	Beach closures	Impaired
11	Degradation of aesthetics	Impaired
12	Added costs to agriculture or industry	Needs assessment
13	Degradation of phytoplankton and zooplankton populations	Impaired
14	Loss of fish and wildlife habitats	Impaired

To offer solutions, a RAP process was introduced in 1986. As outlined in Annex 2 of the Great Lakes Water Quality Agreement (GLWQA), a RAP has three distinct stages: (1) Stage 1 - problem definition and planning, (2) Stage 2 - remedial options and implementation, and (3) Stage 3 – monitoring, review and delisting.

A Public Advisory Committee (PAC) was established in 1988. The PAC, now locally called and incorporated as Quinte Watershed Cleanup (QWC), provided public comment and community liaison to RAP development, planning and programs. More recently, QWC undertook management and funding raising activities to oversee community-based environmental restoration projects.

RAP Stage 1 was completed in 1990, and the report *Time to Decide* was submitted to the IJC to fulfil Annex 2 requirements. The Stage 2 was completed in 1993 with the release of the report *Time to Act* with 80 environmental restoration activities. The Governments of Canada and Ontario endorsed the Stage 2 report in 1995, and in 1996, the report was submitted to the IJC for final review. IJC endorsement was received February 2002.

In 1997, the Bay of Quinte RAP was reorganized. A new locally-managed implementation organization was formed called the Bay of Quinte RAP Restoration Council. This group was charged with completing the Bay of Quinte RAP cleanup work.

About 60% of the Stage 2 cleanup recommendations had been implemented by the end of 1999 (Bay of Quinte RAP Restoration Council, 2000). Some evidence, empirical and scientific, was gathered to suggest water quality changes were occurring (see Bay of Quinte RAP Monitoring Report #7). It also appeared that some of the Bay of Quinte RAP delisting targets were being approached (e.g., Lake Ontario LaMP reported that "...habitat gains are being realized and there are now a greater diversity of top order predators in the fishery" (*Clearwaters* (Fall 2000, Volume 30(3))).

To focus cleanup efforts, the Bay of Quinte RAP Restoration Council with partnership support of QWC undertook a review of the Bay of Quinte RAP Stage 2 Report. The 2000 review had six parts.

- The status of the 80 Stage 2 Report cleanup recommendations was documented (i.e., actions completed, underway or outstanding).
- The monetary investment was determined for cleanup actions implemented between 1993 and 2000. The assessment included a summary of direct expenditures on cleanup work plus predictions of the economic spin-offs resulting from the cleanup (e.g., number of jobs created, potential new economic opportunities generated, secondary and tertiary spending, changes in tax revenues). Complete information is listed in the Environment Canada 2000 report *Economic Impacts of the Bay of Quinte Remedial Action Plan Restoration Activities 1990-1999*.
- Stage 2 Report delisting targets were reviewed and updated. The review included an assessment of the relevancy of the 1993 targets (e.g., Was the target numeric or non-numeric? Could the numeric target be accurately measured? Was the 1993 target relevant given the increased scientific understanding of the Bay of Quinte ecosystem in 2000? Could a different target be used?). The revised delisting targets were presented in Report #1 of the series: *Bay of Quinte RAP Restoration Council Delisting Targets 2000-2005 – A Discussion Document*.
- Cleanup actions deemed to be underway and outstanding were reevaluated (e.g., planned schedule for completion, potential for action to be initiated, relevancy to Bay of Quinte RAP delisting requirements). Actions considered unachievable or impractical were further reviewed. In some cases, projects were deleted or modified, and a new comprehensive list of 24 cleanup projects was developed. The new list emphasized achievable actions with measurable outcomes. The cleanup projects were presented in Report #2 of the series: *Bay of Quinte RAP Restoration Council Five-Year Work Plan 2001 – 2005*.
- Report #1 and Report #2 were reviewed by many external organizations. The reviewers included government representatives (e.g., Environment Canada, DFO, MOE, OMNR, Hastings Prince Edward Health Unit), municipal officials and staff, possible local implementation partners (e.g., Public Utilities, industry), other members of the Bay of Quinte community (e.g., QWC, Fish and Game Clubs, Quinte Field Naturalists) and the public-at-large. A public meeting was held in September 2001 to receive input and comment.
- A two-part monitoring strategy was developed to reflect the updated cleanup plan and the modified delisting targets. The work is described below.

### **Bay of Quinte RAP Data Requirements for Delisting**

The Bay of Quinte has 11 IBUs with varying degrees of impairment (see Table 1). The range of IBUs includes:

- restricted consumption of fish due to level of contaminants in fish flesh exceeding safe consumption guidelines,

- frequent and nuisance blooms of undesirable blue-green algae,
- closed beaches with associated loss of water-based recreational opportunities,
- poor tasting drinking water,
- a few species dominating the phytoplankton, zooplankton and benthic organism communities (i.e., poor community diversity), and
- destruction of wetlands with loss of fish and wildlife habitat.

A broad set of delisting targets is required to address the different Bay of Quinte RAP IBUs. As noted, the Bay of Quinte RAP delisting targets were updated in 2000. The revised targets include water chemistry, water clarity, sediment quality, toxic contaminants, bacteriological water quality, community structures, fish and wildlife, event frequencies, exceedences of guidelines, area, protective planning and treatment processes. A full description of the revised targets is provided in the report *Bay of Quinte RAP Restoration Council Work Plan 2000-2005*. A summary of the monitoring information needed to undertake a delisting review is noted in Table 2.

Table 2. Monitoring Information needed to Assess the Delisting Targets for the Bay of Quinte RAP

Type of Information	Parameters to be Measured and Contrasted	Relevant IBU
Water chemistry	• average concentration of total phosphorus (summer and annual)	8
	• algae density	8, 11
	• <i>chlorophyll a</i> concentrations	8
	• general water chemistry	8
Water clarity	• seasonal mean and summer secchi disk levels	8, 11
Sediment quality	• reduced occurrence of Provincial Sediment Quality Guideline Lowest Effect Level (LEL) exceedences	7
	• presence of pollution sensitive benthic macroinvertebrate species	6, 7
Toxic contaminants	• no increase in trihalomethane levels in Bay of Quinte drinking water	9
	• type, frequency and occurrence of tumours in Bay of Quinte walleye does not exceed significantly comparable walleye (e.g., similar age) from a control site	4
	• number of fish consumption restrictions reduced	1, 3
	• contaminant levels in young-of-the-year perch and spottail shiners does not exceed background levels	1, 3
Bacteriological water quality	• improved quality at targeted beach areas	10

Table 2. Continued

Type of Information	Parameters to be Measured and Contrasted	Relevant IBU
Community structure	<ul style="list-style-type: none"> <li>diversity of benthic macroinvertebrate community to include pollution sensitive species</li> </ul>	6
	<ul style="list-style-type: none"> <li>diversity of benthic macroinvertebrate community as determined by Index of Biotic Integrity</li> </ul>	6
	<ul style="list-style-type: none"> <li>distribution, species composition, stem density, stem frequency and biomass of submerged aquatic macrophytes</li> </ul>	8, 11, 14
	<ul style="list-style-type: none"> <li>phytoplankton species composition</li> </ul>	8
	<ul style="list-style-type: none"> <li>ratio of calanoids to cladoceran and cyclopod</li> </ul>	13
	<ul style="list-style-type: none"> <li>mean individual sizes of zooplankton</li> </ul>	13
	<ul style="list-style-type: none"> <li>zebra mussels</li> </ul>	13
Event frequencies	<ul style="list-style-type: none"> <li>frequency, duration and severity of algae blooms</li> </ul>	8
	<ul style="list-style-type: none"> <li>beach closures</li> </ul>	10
	<ul style="list-style-type: none"> <li>taste and odour complaints in drinking water</li> </ul>	9
Guideline exceedences	<ul style="list-style-type: none"> <li>no Ontario Drinking Water Surveillance Program Maximum Allowable Concentration (ODWSP MAC) exceedences</li> </ul>	9
	<ul style="list-style-type: none"> <li>zero exceedences of Provincial Dredge Spoil Disposal Guidelines caused by local input sources</li> </ul>	7
Area	<ul style="list-style-type: none"> <li>areal coverage of submerged aquatic macrophytes</li> </ul>	7, 14
	<ul style="list-style-type: none"> <li>hectares of wetland bordering the Bay of Quinte</li> </ul>	14
Protective planning	<ul style="list-style-type: none"> <li>Natural Heritage Strategies</li> </ul>	14
	<ul style="list-style-type: none"> <li>Official Plan statements</li> </ul>	14
	<ul style="list-style-type: none"> <li>classification of wetlands, Area of Natural and Scientific Interest (ANSI), etc.</li> </ul>	14
	<ul style="list-style-type: none"> <li>Fishery Habitat Management Strategy</li> </ul>	14
	<ul style="list-style-type: none"> <li><i>Framework for Guiding Habitat Rehabilitation in Great Lakes Areas of Concern</i> guideline</li> </ul>	14
Treatment processes	<ul style="list-style-type: none"> <li>reduced chemical use for drinking water treatment</li> </ul>	9, 11
Fish and wildlife	<ul style="list-style-type: none"> <li>targeted fish and wildlife species present</li> </ul>	3
	<ul style="list-style-type: none"> <li>self-reproducing populations of walleye, bass and pike</li> </ul>	3
	<ul style="list-style-type: none"> <li>self-sustaining populations of targeted coastal, upland wetland and forest bird and mammal species</li> </ul>	3

## Bay of Quinte RAP Monitoring Strategy 2002-2005

A scientific review is needed to evaluate environmental and water quality improvements, as well as delist the Bay of Quinte as a Great Lakes AOC. The review would offer the following information:

- the extent to which the 2001 Bay of Quinte RAP delisting targets can be measured,
- the extent to which the 2001 Bay of Quinte RAP delisting targets and the Annex 2 of the Great Lakes Water Quality Agreement requirements have been met,
- additional cleanup activities that may be required to provide enhanced water quality conditions in the Bay of Quinte,
- a list of other possible Bay of Quinte RAP monitoring needs, and
- a strong and defensible rationale for seeking a delisting status for the Bay of Quinte AOC.

To provide the required review information, the *Bay of Quinte RAP Monitoring Strategy 2002-2005* has been prepared with two parts.

Part A – Existing Government Programs, Research, Surveillance and Monitoring Activities is a review of 20 Government of Canada and Province of Ontario Great Lakes environmental monitoring programs. The work was completed to provide direction in four key areas:

- relevancy of existing monitoring to Bay of Quinte RAP delisting targets,
- status and format of existing monitoring information,
- identification of key Great Lakes monitoring partners, and
- allocation of future monitoring resources to ensure new monitoring actions did not duplicate existing actions.

Part B - Outline of Bay of Quinte RAP Monitoring Needs highlights the actions needed to collect Bay of Quinte water quality and environmental information for a RAP delisting review. Seven distinct monitoring categories are described. The categories include collating and reformatting existing Great Lakes monitoring information, expanding actions or introducing new monitoring programs to provide additional information, and communicating findings to stakeholders, Great Lakes RAP reviewers and the Bay of Quinte public. A proposed schedule of actions and estimated preliminary costs are also noted.

### Part A - Existing Government Programs, Research, Surveillance and Monitoring Activities

Part A summarizes information for 20 Government of Canada and Province of Ontario environmental research, surveillance and monitoring programs to determine their relevance to the Bay of Quinte RAP delisting requirements. The programs included:

- Lake Ontario Lakewide Management Plan (LaMP)
- Binational Toxics Strategy (BNS)
- IJC Great Lakes Ecosystem Health Indicators
- State of the Lakes Environment Conference (SOLEC) 80 indicators of Great Lakes Basin Ecosystem Health and the Biodiversity Investment Area (BIA) project

- Pulp and Paper Regulations of the Canadian Environmental Protection Act (CEPA)
- Environment Canada Federal Programs – Conservation and Protection
- Ecological Monitoring and Assessment Network (EMAN)
- Bird Studies Canada's Wildlife Watchers
- Project Quinte
- Fisheries and Oceans Canada (DFO) Bay of Quinte Ecopath project
- Ontario Ministry of Natural Resources (OMNR) Lake Ontario Management Unit (LOMU) studies
- MOE-OMNR Sport Fish Contaminant Monitoring Program and Guide to Eating Ontario Sport Fish
- Ontario Ministry of the Environment (MOE) Municipal - Industrial Strategy of Abatement (MISA) program
- MOE Municipal Utilities Monitoring Program (MUMP)
- MOE Great Lakes Surveillance Program
- MOE Provincial Water Quality Monitoring Network (PWQMN)
- MOE Drinking Water Surveillance Program (DWSP)
- MOE Project Trackdown
- MOE Deloro mine site rehabilitation project
- Hastings-Prince Edward Health Unit beach monitoring information.

Program information was gathered from a number of sources including government web sites, publications, government reports and newsletters, interviews and e-mail inquiries with key government personnel and researchers, and Bay of Quinte RAP reports.

The following information was requested for each activity.

- Activity Title
- Lead Agency
- Contact Information
- Purpose of the Activity
- Activity Relevancy to Bay of Quinte RAP Delisting Needs (e.g., data collected to support delisting review, Bay of Quinte sampling stations)
- Timeframe for Activity (e.g., when initiated, frequency of work in the Bay of Quinte)
- Type of Data Collected and Sampling Methodologies
- Format of Database (e.g., paper copy records, electronic spreadsheet)
- Availability of Database (e.g., confidentiality, download electronically)
- Recent Results and Interpretation
- Date of Last Update
- Future Plans.

Summary information is provided for each activity in the following chapters. The information is presented in four easy-to-read tables.

Table 3 outlines the activity relevancy with respect to four categories:

- providing direct information to a delisting review,
- providing indirect information for a delisting review (e.g., background monitoring station),
- providing information for a delisting review from event specific actions (e.g.,

- monitoring a site cleanup action, undertaking time-specific research), and providing no information.

Table 4 provides lead agency and contact information.

Table 5 lists other information such as type of data collected, sampling methods and results.

Table 6 reformats the activity information so that linkages to Bay of Quinte RAP delisting targets are highlighted.

Observations and suggestions are also provided about the data to provide direction to the Bay of Quinte RAP Restoration Council.

## **A.1 Government of Canada and Province of Ontario Great Lakes Environmental Programs, Research, Surveillance and Monitoring Activities – Descriptions**

### **A.1.1 Lake Ontario Lakewide Management Plan**

As part of the GLWQA to restore and protect the uses of the Great Lakes, the Governments of Canada and the United States made a commitment in 1987 to develop Lakewide Management Plan (LaMPs) for the Great Lakes. The Lake Ontario LaMP was introduced in 1996 as a cooperative United States Environmental Protection Agency (USEPA), Environment Canada, New York State Department of Environmental Conservation and MOE action to restore and protect Lake Ontario open water uses. It is noted that “uses” were adopted from the 14 indicators of impairment, or Impaired Beneficial Uses, outlined by the RAP process (see GLWQA Annex 2 and Table 1 of this report).

The Lake Ontario LaMP embraced the 1987 *Lake Ontario Toxics Management Plan* (LOTMP) as a cornerstone for action. LOTMP identified eleven priority toxic chemicals affecting the Lake Ontario ecosystem and provided a plan to reduce inputs of these chemicals through government actions. The 1996 Lake Ontario LaMP incorporated the relevant goals and objectives of the LOTMP (from Environment Canada at [www.on.ec.gc.ca/glimr/lakes/ontario/introduction.html](http://www.on.ec.gc.ca/glimr/lakes/ontario/introduction.html)).

The Lake Ontario LaMP also adopted an ecosystem approach that recognizes all components of the environment interact and activities affecting one component impact the others. As part of its ecosystem approach strategy, the Lake Ontario LaMP established three goals:

- The Lake Ontario ecosystem should be maintained and as necessary restored or enhanced to support self-reproducing diverse biological communities.
- The presence of contaminants shall not limit the uses of fish, wildlife, and waters of the Lake Ontario basin by humans and shall not cause adverse health effects in plants, fish, animals and humans.
- We as a society shall recognize our capacity to cause great changes in the ecosystem and we shall conduct our activities in such a way as to protect the Lake Ontario basin (from Environment Canada (1999) at [www.on.ec.gc.ca/glimr/lakes/ontario/introduction.html](http://www.on.ec.gc.ca/glimr/lakes/ontario/introduction.html)).

To enhance efforts, Lake Ontario LaMP was linked to local Lake Ontario environmental actions such as the Bay of Quinte RAP and natural resource management activities such as the development of Lake Ontario fish community objectives by the Great Lakes Fishery Commission, the Lake Ontario Committee of Fisheries Managers and OMNR. Similar to RAPs, Lake Ontario LaMP used four distinct stages:

- Stage 1 - Problem definition
- Stage 2 - Schedule for load reduction activities
- Stage 3 - Selection of remediation measures
- Stage 4 - Implementation and monitoring for successful results.

As the Lake Ontario process evolved, Lake Ontario stakeholders were asked for guidance. As a result, the agencies implemented a Lakewide Advisory Network.

The Lake Ontario LaMP Stage 1 Report was released in 1998. Four lakewide beneficial use impairments were identified:

- Restrictions on fish and wildlife consumption
- Degradation of wildlife populations
- Bird or animal deformities or reproductive problems
- Loss of fish and wildlife habitat.

Lake Ontario LaMP updates were issued in 1999 and 2000. The publications provided summary information was about a range of topics plan development, research activities and ecosystem health indicators.

Specific to Bay of Quinte RAP, Lake Ontario LaMP completed a study of select Lake Ontario tributaries in 1999 to measure the range of contaminants entering Lake Ontario under dry and wet flow conditions. The study, undertaken by Boyd and Biberhofer, was called *Large Volume Sampling of Six Lake Ontario Tributaries During 1997 and 1998: Project Synopsis and Summary of Selected Results* and included a Trent River sampling location. Loading data were provided for a wide range of substances and compared to Ontario's Provincial Water Quality Objectives (PWQO). The substances tested included:

- nutrients such as phosphorus
- suspended solids
- metals such as cadmium, copper, lead, nickel and zinc
- PCBs
- toxic substances such as aldrin/dieldrin, benzo(a)pyrene, hexachlorobenzene and lindane.

Overall, Lake Ontario LaMP provides information about loadings of priority pollutants to Lake Ontario. The program also offers links to other actions examining priority pollutants such as the Lake Ontario Toxic Modeling Project which employs the LOTOX2 mass balance and bioaccumulation modeling process to assess the effectiveness of load reduction strategies. The information from these programs may provide vital background reference data for a Bay of Quinte RAP delisting evaluation.

### **A.1.2 Great Lakes Binational Toxics Strategy (BNS)**

Introduced in 1997, BNS is joint program of Environment Canada and the U.S. Environmental Protection Agency. BNS establishes a collaborative, four-step process by which Canada and the United States will work to virtually eliminate persistent, bioaccumulative toxic substances from the Great Lakes (Environment Canada at

[www.ec.gc.ca/press/usa1\\_b\\_e.htm](http://www.ec.gc.ca/press/usa1_b_e.htm)). Other BNS features include:

- establishing a process to work closely with provincial/state governments and other partners in this regard
- meeting the GLWQA Article II obligations to control and prevent toxic substances from entering the Great Lakes
- meeting the IJC's recommendation for a cooperative binational strategy regarding toxic substances
- building on the ongoing processes in LaMPs and RAPs to reduce "within basin" sources of toxic substances
- specific to Canada, supporting the efforts of the Government of Canada and Province of Ontario to reduce toxics in the Great Lakes under the 1994 Canada-Ontario Agreement respecting the Great Lakes Basin Ecosystem.

BNS focuses on twelve Level 1 substances for virtual elimination and fifteen Level 2 substances for reduction through pollution prevention. The substances have been "...associated with widespread, long-term adverse effects on wildlife in the Great Lakes, and, through their bioaccumulation, cause concern for human health" (USEPA at [www.epa.gov/glnpo/p2/bnsintro.html](http://www.epa.gov/glnpo/p2/bnsintro.html)). The Level 1 substances include:

- aldrin/dieldrin
- benzo(a)pyrene
- chlordane
- DDT (DDD and DDE)
- dioxins and furans
- hexachlorobenzene
- alkyl-lead
- mercury
- mirex
- octachlorostyrene
- PCB
- toxaphene.

The four-steps of BNS are (1) gathering information, (2) analysing current regulations and programs that manage the substances, (3) identifying cost-effective options to achieve further reductions, and (4) taking action toward the goal of virtual elimination. The timeframe to achieve quantifiable reduction "challenges" is 1997 to 2006.

Within the context of the Bay of Quinte RAP delisting needs, BNS does not provide new monitoring or surveillance data for the area. Rather, BNS provides summarized information about total toxic substance inputs to Lake Ontario (e.g., total loads, total percent reductions in inputs). At the same time, Government of Canada and the Province of Ontario may introduce specific actions to meet BNS obligations that could possibly support Bay of Quinte RAP requirements (e.g., Project Trackdown – see Section A.1.16).

### **A.1.3 IJC Great Lakes Ecosystem Health Indicators**

IJC introduced the Great Lakes Ecosystem Health Indicators project in 1997. The project was established to investigate the feasibility of using indicators to monitor progress with respect to GLWQA recommendations and requirements. As a starting point, the project adopted as a framework the ideas outlined in the 1996 IJC publication *Indicators to Evaluate Progress under the Great Lakes Water Quality Agreement*.

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The 1996 report set forth a listing of “desired outcomes” or indicators for the Great Lakes ecosystem. Indicators were defined as:

- providing a clue to a matter of larger significance
- making perceptible a trend or phenomenon that is not immediately detectable
- making something known with a reasonable degree of certainty
- revealing, giving evidence, and signifying beyond what is actually measured to a larger phenomenon of interest.

To provide consistent direction, IJC also suggested three guidelines for selecting indicators.

- All parties define indicators in the same manner. That is, the indicators should be standardized, use accepted terminology easily understood by the public.
- Indicators include metrics that are measurable using accepted scientific techniques consistent and reasonable with the practices currently being carried out by those in natural resources fields.
- Indicators be selected with the assumption that there are hundreds of potential indicators that would be equally plausible. The selection of specific indicators represents a best attempt to select those that will adequately measure environmental health and the progress of programs toward this goal.

A full listing of the indicators is provided on the IJC web site at [www.ijc.org/boards/iitf/pr9799/](http://www.ijc.org/boards/iitf/pr9799/). The indicator categories included:

- fishability
- swimmability
- drinkability
- healthy human populations
- economic viability
- biological community integrity and diversity
- virtual elimination of inputs of persistent toxic substances
- absence of excess phosphorus
- physical environment integrity.

The project also compared the proposed suite of indicators with SOLEC measurements of ecosystem health (see Section A.1.4). For example, the IJC indicator for fishability is “...no restrictions on the human consumption of fish in the waters of the Great Lakes basin ecosystem as a result of anthropogenic (human) inputs of persistent toxic substances.” The measure of success is fish consumption advisories (e.g., number of advisories added, altered or lifted). SOLEC’s ecosystem measure is “...fish should be safe to eat...” with the elimination of fish consumption advisories in the Great Lakes as the endpoint. In either case, the development of the fishability indicator is confounded by a number of elements including:

- definitions for fish advisories vary between areas
- sampling protocols to collect data are not consistent
- a limited number of chemicals are routinely measured
- a limited number of fish species are monitored
- human exposure and risk varies (i.e. women of child-bearing age, children and high consumers of Great Lakes fish are more susceptible to health threats caused by eating contaminated Great Lakes fish)

Relevant to the Bay of Quinte RAP, the IJC Ecosystem Health Indicators may provide a consistent "set of yard-sticks" to compare Bay of Quinte RAP progress with other Great Lakes AOCs. Moreover, the indicators can be used to

- provide direction during a delisting review
- contrast local delisting requirements with IJC expectations
- help identify key actions needed to meet local and IJC delisting expectations.

#### **A.1.4 State of the Lakes Environment Conference – Indicators of Great Lakes Basin Ecosystem Health and Biodiversity Investment Areas**

The State of the Lakes Ecosystem Conference (SOLEC) is a biannual conference hosted by USEPA and Environment Canada in response to the GLWQA. Started in 1994, SOLEC provides a forum for government staff (managers and scientists), industry representatives and invited non-government groups to exchange information on the ecological condition of the Great Lakes. The objectives of SOLEC include:

- examining the state of the Great Lakes ecosystem
- studying major factors impacting the ecosystem
- providing scientific information to support the evaluation and redirection of restoration programs.

SOLEC has three focuses:

- the health of the ecosystem with emphasis on ecosystem health indicators
- the impact of human activities (i.e., habitat loss, pollution, and introduction of exotic species)
- starting in 1996, Biodiversity Investment Areas (BIA) or ecological areas that hold unusual concentrations of biodiversity.

Since 1994, SOLEC has been preparing Indicators of Great Lakes Basin Ecosystem Health. Version 4 was released at SOLEC 2000 (for a full description see SOLEC web site at [www.on.ec.gc.ca/solec/indicators2000-e.html](http://www.on.ec.gc.ca/solec/indicators2000-e.html)). The goal is "...to assemble a basin-wide suite of scientifically valid indicators that will be most useful and understandable in determining and reporting the health of the Great Lakes ecosystem to the interested public" (SOLEC 2000 Selection of Indicators for Great Lakes Basin Ecosystem Health – Version 4).

The SOLEC indicator work calls attention to seven areas:

- open waters
- nearshore waters
- coastal wetlands
- nearshore terrestrial (land by the Great Lakes)
- human health
- socio-economics and land use
- stewardship.

As suggested in Section A.1.3, SOLEC's Indicators of Great Lakes Basin Ecosystem Health and BIA could be used to contrast local Bay of Quinte RAP delisting needs with broader Great Lakes restoration expectations to assess progress and identify next steps. As well, a BIA designations for the Bay of Quinte could provide additional support for the protection of natural areas, and enhanced direction for initiatives such as the OMNR

Lake Ontario Fish Community Objectives exercise and the Bay of Quinte RAP Fish Habitat Management Strategy project.

### **A.1.5 Pulp and Paper Regulations of the Canadian Environmental Protection Act**

Federal regulations pertaining to pulp and paper operations were originally enacted in 1971 under Section 36(3) of the Fisheries Act which prohibits the direct or indirect deposit of substances harmful to fish into water frequented by fish. The 1971 regulation was intended to limit the quantities of certain substances -- specifically, total suspended solids and biochemical oxygen demand (BOD) matter-- discharged into watercourses. As well, the regulation prohibited the discharge of acutely lethal effluent (i.e., effluent that kills fish under specified laboratory test conditions).

Under the revised 1998 Canadian Environmental Protection Act (CEPA), the federal Ministers of Health and Environment established a list of priority substances harmful to human health and the environment. The work declared dioxins and furans toxic, and further, recommended that regulations be enacted regarding the release of dioxins and furans from pulp and paper mills.

Under Section 34 of CEPA, the government promulgated the Pulp and Paper Mill Effluent Chlorinated Dioxins and Furans Regulations in 1992 for pulp and paper mills that use the chlorine bleaching process. There are 75 dioxin compounds and 135 furans. Section 34 was designed to protect the environment and humans from dioxin and furan releases by:

- preventing the formation of dioxins and furans, and
- prohibiting the discharge of measurable amounts of the most toxic forms of dioxins and furans (2,3,7,8-TCDD and 2,3,7,8-TCDF, respectively).

Since pulp and paper manufacturing uses a variety processes and the mills discharge effluent to widely varying receiving environments, the 1992 regulations required that aquatic Environmental Effects Monitoring (EEM) studies be completed at each mill to:

- determine site specific environmental impacts, and
- establish site-specific control measures.

The 1992 regulation also required each mill to:

- sample effluent on a regular predetermined basis
- report results
- ensure effluent monitoring equipment is operational and accurate
- establish and update Emergency Response and Remedial Plans to deal with accidental discharges
- report accidental discharges to Environment Canada immediately.

Since testing for dioxins and furans is complex and costly, the regulations allowed for a graduated testing schedule. For example, sampling requirements were reduced at a mill from monthly to quarterly sampling if sampling during 1995 at that mill showed no measurable concentrations of 2,3,7,8-TCDD or 2,3,7,8-TCDF in the last three monthly samples. If sampling found no measurable concentrations of dioxin and furan in the last three samples after conducting four quarterly samples, sampling was allowed on an annual basis. However, if any quarterly or annual sample contains any measurable concentration, sampling must revert to a monthly basis.

It is also noted that mills can choose which technology to install to meet federal requirements. Consequently, the regulations have encouraged the development and use of new technologies, products and services.

The Pulp and Paper Mill Effluent Chlorinated Dioxins and Furans Regulations became a federal law in 1995.

Since 1996, Environment Canada – Ontario Region has posted a compliance summary report for Ontario pulp and paper mills on its web site ([www.on.ec.gc.ca/doc/compliance-report/](http://www.on.ec.gc.ca/doc/compliance-report/)). The report does not provide information pertaining to specific mills. Rather, data for all Ontario pulp and paper mills for a range of substances are presented as total amounts discharged. As well, the total number of non-compliant mills is noted but the non-compliant mills are not identified.

The data from the Pulp and Paper Mill Effluent Chlorinated Dioxins and Furans Regulations for Bay of Quinte pulp and paper mills **may be available** from the Environment Canada's Enforcement and Compliance Branch, if requested. The data could complement the effluent quality information collected and reported by MOE (see Section A.1.13).

In addition, the federal information is posted and downloaded (Dbase format) from Environment Canada's National Pollutant Release Inventory (NPRI) web site ([www.ec.gc.ca/pdb/npri/](http://www.ec.gc.ca/pdb/npri/)). NPRI is a mandatory reporting system under CEPA whereby operations subject to CEPA regulations must report annually on discharges and transfers (e.g., transfer from water to air) of specific substances. NPRI data have been compiled since 1994 and an annual report has been prepared summarizing discharge information. Data are maintained on the NPRI web site for Bay of Quinte pulp and paper mills and reported as annual summaries.

#### **A.1.6 Environment Canada Environmental Protection Branch - Federal Programs**

Environment Canada's Environmental Protection Branch (EPB) is responsible for environmental regulations, guidelines and other matters pertaining to federal properties. There are numerous federal properties within the Bay of Quinte AOC including 8 Wing Trenton, Warkworth Institution, Trent-Severn Waterway and, bordering the edge of the AOC, Prince Edward Point National Wildlife Area. Under its Federal Program responsibilities, EPB monitors federal operations, collects environmental information (e.g., storage of materials, burning of fuels, waste disposal, discharges) and undertakes special research projects pertaining to federal responsibilities. A recent research example is the 1994 report *Environmental Inventory of Federal Facilities in the Drainage Basin of the Bay of Quinte*. This report and other information pertaining to federal operations within the Bay of Quinte AOC **may be available** in paper copy (see Table 4 for contact information), if requested.

#### **A.1.7 Ecological Monitoring and Assessment Network – Frog Watch**

The Ecological Monitoring and Assessment Network (EMAN) is not a stand-alone monitoring program. Rather, EMAN is a system to link a wide variety of existing monitoring programs to encourage interdisciplinary approaches to ecological problems, as well as provide a mechanism to integrate and synthesis results.

Started in 1994 by Environment Canada, EMAN is intended to:

- establish a national network of ecologically representative sites for monitoring ecological functions over long periods of time
- provide a forum for academic, governmental and private sector scientists to address the cumulative effects of major environmental stresses
- encourage a multi-disciplinary approach to define the ecosystem effects of environmental stresses affecting Canadian ecosystems
- provide a mechanism to exchange and synthesize ecological information
- promote the use of environmental indicators
- establish strong scientific rationales for measures to control and prevent pollution including the development of adaptation measures
- define and interpret the response of ecosystems to programs implemented to control or prevent stresses
- provide an early warning of significant new stresses
- offer an overall assessment of results, and from that work, provide input to Canada-wide environmental policy.

Located on the Internet at [www.eman-rese.ca/eman/](http://www.eman-rese.ca/eman/), EMAN consolidates and profiles monitoring data to show national trends with respect to eighteen environmental measures such as weather, forestry, hydrology and agriculture. EMAN employs the aggregated data to provide:

- a national perspective the health of Canada's ecosystems (e.g., trends and shifts in environmental quality)
- scientifically defensible rationales for control and management activities
- a general evaluation of the effectiveness of control programs
- a means to identify new and emerging issues.

EMAN's database incorporates scientific research and volunteer information (Ontario Breeding Bird Survey). EMAN also provide direct linkages to other North American and global monitoring and research networks.

EMAN's research information includes site specific studies including information pertinent to the Bay of Quinte. For example, the findings the report *Biodiversity of Freshwater Mussels in the Lower Great Lakes Drainage Basin* (J.L. Metcalfe-Smith, S.K. Staton, G.L. Mackie and N.M. Lane, 1997) are listed. In this study, over 4000 records spanning a 140-year period from 1860 to 1996 were compiled and examined to determine if mussel diversity was declining in the lower Great Lakes. Relative to the Bay of Quinte, the study concluded:

- mussel diversity is somewhat limited relative to other areas, especially Lake Erie – the maximum number of species found in the Moira River was eight
- the mussel community in the Moira River was dominated by three or four species (about 60%)
- *P. grandis* became more common after 1960 suggesting an increase in siltation in the system
- no losses of mussel diversity occurred in the Moira and Trent-Severn Rivers for the period of record.

EMAN's database also includes Frogwatch Ontario (see web site [www.eman-rese.ca/emanops/frogwatch/ontario/](http://www.eman-rese.ca/emanops/frogwatch/ontario/)). Frogwatch Ontario is a volunteer-based program

monitoring amphibian populations. Amphibians are vulnerable to changes in the environment (on land or in the water), and as such, they are effective "barometers" of environment health. The program also establishes a long-term database to study the distribution of 24 frog and toad species in Ontario and Canada. The Frogwatch Ontario database, including Bay of Quinte sites, is maintained at OMNR's Natural Heritage Information Centre in Peterborough. Maps and population information can be generated on the web sites for specific sites and species.

The information compiled by EMAN may provide the Bay of Quinte RAP Restoration Council with another measurement of progress relative to wildlife delisting targets.

### **A.1.8 Wildlife Watchers**

Wildlife Watchers is a large, volunteer-based program managed by Environment Canada's Canadian Wildlife Service and Bird Studies Canada. Program partners include the Federation of Ontario Naturalists, OMNR, the Royal Ontario Museum, Bird Survey Canada, the Ontario Field Ornithologists, other organizations and individuals.

The objectives of most Wildlife Watchers Projects include:

- monitoring more common species of birds and amphibians to ensure they do not become endangered
- providing current information on the status of many species
- contributing to the knowledge for vulnerable, threatened or endangered (VTE) species (e.g., existing and new breeding sites for rare species)
- tracking the progress of VTE Recovery Plans.

The full suite of Wildlife Watchers activities was introduced in 1994, although many aspects of the program such as the Forest Bird Monitoring Program were started during the 1980s. The present Wildlife Watchers includes a variety of activities such as:

- Christmas Bird Count
- Project Feeder Watch
- Canadian Lakes Loon Survey
- Owl Monitoring
- Amphibians Road Call Count
- Amphibians Backyard Survey
- Ontario Nest Records
- Marsh Monitoring Program
- Ontario Birds at Risk
- Ontario Shorebird Survey
- Forest Bird Monitoring Program
- Breeding Bird Survey

Within the Bay of Quinte AOC, one of the Wildlife Watchers actions is a Marsh Monitoring Program (MMP). Started in 1995, MMP provides information on the population trends and habitat associations of marsh-dependent amphibians and birds. In this area, MMP volunteers survey seven Bay of Quinte wetlands for marsh birds, and calling frogs and toads.

Wildlife Watchers produces an annual monitoring report and the MMP information was compiled in two reports: (1) 1997 "State of Their Environment" report and (2) a 2000 five-year summary report. The reports present summaries of the habitat, bird and

amphibian data in each marsh, a preliminary assessment of the quality of the marshes in the AOC, a description of the existing MMP routes, a volunteer listing, as well as identification of potential future routes and volunteer recruitment needs. Copies of the reports can be obtained from MMP or the Canadian Wildlife Service (see Table 4 for contact information).

The data are available electronically on request for the MMP Bay of Quinte sites (see Table 4). The data can be transmitted by e-mail as a comma-delimited file. The data include location information as latitude and longitude.

MMP has established a “use policy” for the database (e.g., data must be used only for the purpose(s) specified in the request). The data is stored in a Paradox format.

As suggested in Section A.1.7, information compiled by Wildlife Watchers may provide the Bay of Quinte RAP Restoration Council with another measurement of progress relative to wildlife delisting targets.

### **A.1.9 Project Quinte**

Project Quinte was established in 1972 by scientists of OMNR, MOE and DFO as a research project comparing the limnological features of the Bay of Quinte before and after the implementation of phosphorus controls in 1978 at municipal sewage treatment plants bordering the Bay of Quinte. Features assessed include chemical and physical limnology, phytoplankton, macrophytes, zooplankton, benthos and fish. Data have been collected between 1972 and 2001, and as a result, a longer-term monitoring database has been established for the limnological characteristics of the area.

Data from the research activities are printed yearly in the Project Quinte Annual Report. The information is also available in the Monitoring Reports produced by the Bay of Quinte RAP Restoration Council. Peer reviewed publications appear in many scientific journals including the *Journal of Great Lakes Research* and the *Journal of Fisheries and Aquatic Sciences*. A special publication was published in 1986 entitled *Project Quinte: Point-source Phosphorus Control and Ecosystem Response in the Bay of Quinte, Lake Ontario*. It is noted that much of the fisheries information is reproduced and summarized with consent of the authors from the information published by LOMU (see Section A.1.11).

The Project Quinte data are key indicators for a delisting review.

### **A.1.10 DFO Bay of Quinte Ecopath Project**

Ecopath is an ecosystem modelling project. It was introduced in 2000 by DFO's Great Lakes Laboratory of Fisheries and Aquatic Sciences as a method to assess the response of the Bay of Quinte food web (e.g., changes in total ecosystem biomass, changes in production of algae and fish) to fisheries and other ecosystem management activities. Once completed, the Bay of Quinte Ecopath model will provide mean seasonal estimates of biomass and composition of several trophic levels in the food web for three habitats representing conditions in the Bay of Quinte.

In 2001, efforts were expanded. A field program was added for one year to provide additional seasonal data. The data were subsequently used to compare biomass and ecosystem components across trophic levels in offshore and representative Bay of

Quinte onshore sites (e.g., highly vegetated and less vegetated sites covering the spectrum of current conditions in the upper Bay of Quinte).

The 2001 field work collected the following types of data:

- biomass and composition of phytoplankton, zooplankton, macrobenthos and fish
- water quality
- vegetation cover
- water and air temperatures.

Sampling stations are concentrated in Big Bay. Each station is a cluster of three or four sites. The stations are (1) offshore mid-bay, (2) inshore on the exposed north side of Big Island (lower vegetation levels), and (3) inshore on the sheltered southeast side of Big Island (higher vegetation levels).

A variety of sampling methods were noted. The methods included water bottles, pumps, dredges, electrofishing and trawling. Sites were sampled at least three times per season to ensure more accurate assessment of seasonal means.

The new field data provide additional information about the status of fish populations and aquatic habitat conditions in the Bay of Quinte. The information can be used to enhance the OMNR Lake Ontario Management Unit (LOMU) and Project Quinte databases during a Bay of Quinte delisting evaluation.

The Ecopath model and other research information can be downloaded from the Ecopath web site at [www.ecopath.org/](http://www.ecopath.org/)

### **A.1.11 Ontario Ministry of Natural Resources - Lake Ontario Management Unit**

LOMU is OMNR's lead administration unit for fisheries management in Lake Ontario and the St. Lawrence River. As part of its work, LOMU produces a yearly report entitled *Lake Ontario Fish Communities and Fisheries: Annual Report of the Lake Ontario Management Unit*. Information is presented in a peer-review, journal-ready format. Extensive scientific information is provided about sampling methods, information sources, temporal trends (e.g., changes in fish populations, biomass, catch and harvest efforts) and fisheries management implications. In all cases, longer-term information has been maintained with some studies offering data from the early 1970s.

For the Bay of Quinte, detailed information is presented regarding:

- fish communities in Lake Ontario (as a comparison)
- fish communities within the Bay of Quinte
- commercial fishing in Lake Ontario and the Bay of Quinte
- recreational fishing within the Bay of Quinte
- fishing by Tyendinaga Mohawks of the Bay of Quinte.

Hoyle (2001) provided a detailed examination of the Bay of Quinte fish community, while Waring and Mathers (2001) summarized information about the status of Bay of Quinte walleye. Fish sampling was completed at six locations within the Bay of Quinte and five other nearby eastern Lake Ontario sites. Longer-term information was furnished regarding abundance and year-class strength of many species including lake whitefish, smallmouth bass, walleye and yellow perch. More recent data were also provided about

lake sturgeon. It is noted that precise information is not provided for sampling locations (i.e., geographic latitudinal and longitudinal coordinates), format of database and availability of database; this information is likely available from OMNR, if requested.

In its 1999 report, LOMU also presented a special study called *Status and Prognosis for Bay of Quinte Walleye*. The study, contrasted with other Bay of Quinte fisheries information in the report, provides vital information and scientific interpretation of the health of the Bay of Quinte fish community.

#### **A.1.12 MOE-OMNR Sport Fish Contaminant Monitoring Program and Guide to Eating Ontario Sport Fish**

The Sport Fish Contaminant Monitoring Program and its report Guide to Eating Ontario Sport Fish is a joint OMNR and MOE program. Started in 1977, the program provides advice on consuming sport fish from Ontario waters. The guide is published in paper copy every two years. As well, the guide is available electronically at [www.ene.gov.on.ca](http://www.ene.gov.on.ca) (MOE web site).

The fish consumption advisories employed in the guide are based on Health Canada guidelines. The guidelines identify a “safe dose” or “tolerable daily intake” for a range of contaminants. The contaminants are partitioned into exposure pathways (e.g., air, other foods, water, sport fish consumption) and, from this information, MOE determines the consumption suitability of fish from the different rivers and lakes in Ontario.

The program analyses fish for a wide range of contaminants including:

- mercury
- polychlorinated biphenyls (PCB)
- mirex and photomirex
- pesticides including aldrin, chlordane, DDT, heptachlor, lindane and toxaphene,
- dioxins and furans
- metals such as arsenic, cadmium, chromium, copper, lead, nickel, selenium and zinc
- chlorinated phenols
- chlorinated benzenes
- polynuclear aromatic hydrocarbons (PAH).

Sampling methods are not identified. Sampling includes “...ten or more fish of each species with lengths and weights representative of the size range of that species in the locations being tested...” (Ontario Ministry of Environment and Ontario Ministry of Natural Resources, 2001). A boneless, skinless fillet of dorsal muscle flesh is removed for MOE analyses. Analytical methods are not noted in the 2001 guide.

Program data are maintained by the MOE Sport Fish Contaminant Monitoring Program (see Table 4 for contact information).

The program has a number of Bay of Quinte sampling stations. Within the Bay of Quinte, the three stations are the upper bay between Quinte West (Trenton) and Deseronto, the middle bay between Deseronto and Glenora, and the lower bay including Long Reach and eastern Lake Ontario. Within the Bay of Quinte watershed, there are numerous sampling sites. The sites include the Trent River drainage basin (e.g., four stations in the Trent River, three Otonabee River stations, Rice Lake and Balsam Lake) and the

Moira River drainage basin (e.g., two Moira River stations, Moira Lake and two stations in Stoco Lake). The watershed sites can be used as background or reference sites, while other Lake Ontario sites can be used to compare quality between areas.

In the 2001 guide, information was provided for 15 different species of fish in the upper and middle Bay of Quinte. The fish species included American eel, brown bullhead, channel catfish, chinook, freshwater drum, gizzard chad, largemouth bass, northern pike, pumpkinseed, smallmouth bass, walleye, whitefish, white perch, white sucker and yellow perch. Fewer fish species (between two and ten) were analysed from watershed sampling sites, while the same number (15) but some different species were tested in Lake Ontario.

Year 2001 consumption advisories were established in the upper Bay of Quinte for the larger sizes of four fish: American eel, chinook, walleye and whitefish. In the middle bay, three additional advisories were added for larger sized channel catfish, freshwater drum and gizzard chad. Fewer advisories were listed for Trent River sampling sites (possible background reference site). At the same time, Lake Ontario had consumption advisories for 11 different species of fish.

#### **A.1.13 MOE Municipal Industrial Strategy for Abatement**

MOE introduced the Municipal – Industrial Strategy for Abatement (MISA) program in the early 1990s. MISA was intended to reduce the discharge of toxic substances to Ontario waterways by implementing new effluent regulations. The regulations established more intensive effluent monitoring requirements and more stringent, legal effluent limits for municipalities and eight industrial sectors of Ontario including:

- electric power generation
- industrial minerals
- inorganic chemical
- iron and steel manufacturing
- metal mining
- organic chemical manufacturing
- petroleum
- pulp and paper.

Regulations were promulgated for the sectors between 1990 and 1995. Industries provide annual reports to MOE on a range of substances set out in the regulations. The data are typically yearly mean values.

Industries bordering the Bay of Quinte and subject to MISA requirements include:

- Norampac
- Sonoco
- Strathcona Papers
- Essroc Cement.

The reports include effluent discharge data for a range of substances and parameters including:

- BOD<sub>5</sub>
- Total Suspended Solids (TSS)
- Total Phosphorus
- Dissolved Organic Carbon (TOC)

- Phenols
- Toluene
- Chloroform
- 2,3,7,8 – T4CDD
- 2,3,7,8 – T4CDF
- Acute Lethality – Daphnia
- Acute Lethality – Trout
- Flow.

Depending on the reporting requirements and schedules defined in the MISA regulations, raw data (typically aggregated as monthly means or monthly averages) are submitted to the MOE Eastern Region District Office for a compliance review. An internal report is prepared for the MOE District Office files, a MOE plan of action is developed (if needed), and the data reformatted for storage.

The MISA data are maintained in a centralized, internal data storage system at MOE Environmental Monitoring and Reporting Branch (EMRB). The system is called Sample Results Data Storage (SRDS). Since 1998, MOE has provided descriptive summary SRDS information in Environmental Compliance Reports (.pdf format) at the MOE web site ([www.ene.on.gc.ca/envision/](http://www.ene.on.gc.ca/envision/)). The web site lists industrial operations not in-compliance with MISA regulations. Given the uniqueness of the SRDS data formatting system, the data are not readily accessible. Rather, an information retrieval request is needed. The request can be generated via the MOE Eastern Region contact (see Table 4). The requested detailed data can be provided in a Quattro Pro or other software-based spreadsheet format. The detailed information can include sampling frequency, sampling locations, sampling methods and laboratory procedures for each Bay of Quinte direct discharging industry.

The MISA data could be used as input data to the Bay of Quinte RAP Toxics Fate Model (Diamond, et. al. – reported as Bay of Quinte RAP Technical Report #13) to update predictions about environmental impacts to the Bay of Quinte ecosystem.

#### **A.1.14 MOE Municipal Utilities Monitoring Program**

The MOE Municipal Utilities Monitoring Program (MUMP) replaced the former MOE Utilities Monitoring Information System (UMIS), although data and information from UMIS was carried forward to MUMP. MUMP monitors sewage treatment plant (STP) operations to ensure compliance:

- MOE regulations and guidelines
- STP Certificate of Approval (C of A) requirements.

Under the MUMP process, STP operating authorities (municipalities or private operators) prepared monthly operating reports (electronic or paper copy). The reports are standardized forms for monthly average information such as:

- flows (average daily, maximum or peak)
- influent quality
- chemical usage
- effluent quality (BOD<sub>5</sub>, Total Suspended Solids, Total Phosphorus).

The number of monthly sampling events is defined in the C of A for each STP. Typically, one sample is collected each week, and the weekly data are aggregated into a monthly

mean. If outlined in the STP C of A, more frequent sampling may be required (e.g., daily, hourly). For non-mechanical STPs (i.e., lagoons), sampling requirements may be less rigorous.

The data (raw and aggregated) are submitted to the MOE Eastern Region District Office every three months. An Environmental Officer reviews the information for C of A and MOE STP operating guideline compliance. Events of non-compliance are reported, and the STP operator is required to develop and implement a corrective plan. The data are compiled and maintained in a data storage system at MOE EMRB, and reformatted to develop annual compliance summary information for the MOE web site.

Since 1998, MOE has reported MUMP in Environmental Compliance Reports in .pdf format at the MOE web site ([www.ene.on.gc.ca/envision/](http://www.ene.on.gc.ca/envision/)). The web site lists STP operating authorities not in-compliance with Government of Ontario water quality and environmental regulations in a descriptive summary format.

As noted, the raw MUMP data are maintained in a centralized, internal data storage system at MOE EMRB. Given the uniqueness of the UNIX-based data formatting system, the data are not readily accessible. Rather, an information retrieval request is needed. The request can be generated via the MOE Eastern Region contact (see Table 4). The requested detailed data can be provided in a Quattro Pro or other software-based spreadsheet format.

It is noted that Ontario's regulations may not be as stringent as the voluntary Bay of Quinte RAP requirements for Total Phosphorus and other parameters. As such, the MOE Environmental Compliance Reports may not identify Bay of Quinte municipal STPs that fail to meet the Bay of Quinte RAP target.

### **A.1.15 Great Lakes Surveillance Program**

#### MOE

MOE has operated a Great Lakes Surveillance Program for many years. Within the context of the Great Lakes, the program strives to:

- provide good water quality information about the Great Lakes
- establish index stations and, from those stations, provide reference information on local background environmental quality
- determine general trends and changes in water quality
- identify emerging issues
- support site-specific actions by providing comparative reference information from the index stations.

Starting in 1990, a lake-by-lake rotational sampling schedule was introduced with Lake Ontario sampled in 1990, 1994, 1997 and 2000. In 1996, the scope of the program was reduced to focus on key indicators of Great Lakes ambient water quality, and in 1997, the program was linked to Environment Canada's Great Lakes Surveillance Program work to minimize any duplication of effort. The program has four Bay of Quinte sampling stations

In a sampling year, MOE could collect a wide range of information such as:

- spring, summer and fall water samples of conventional parameters (i.e., nutrients, ions, chemistry and metals)

- summer sediment samples of conventional parameters (i.e., nutrients, ions, chemistry and some metals)
- benthic organisms for biomonitoring purposes
- juvenile fish (e.g., perch) for biomonitoring purposes.

MOE Great Lakes Surveillance Program does not collect data specific to RAP needs. Rather, the program undertakes specific RAP-related monitoring activities if requested. For example, the 1997 Lake Ontario monitoring included some water and sediment monitoring at Trenton and Belleville as part of a larger Lake Ontario program to update harbour and embayment quality information (the action was not related specifically to Bay of Quinte RAP needs). In 2000, Lake Ontario monitoring included a detailed Bay of Quinte sediment sampling program at the request of the Bay of Quinte RAP Restoration Council. The 2000 work was used to update information regarding sediment quality throughout the Bay of Quinte.

Data are maintained by MOE in a centralized, internal data storage system in a corporate MOE database and, to a lesser extent, at MOE EMRB in individual or project database storage systems. Given the uniqueness of the MOE data formatting system, the data are not readily accessible. Rather, an information retrieval request is needed. The request can be generated via the MOE Eastern Region or MOE EMRB contact (see Table 3). The requested data can be very detailed and large. Information can be obtained electronically in a spreadsheet format or a paper copy.

#### Environment Canada

Between 1974 and 2000, Environment Canada conducted 116 sampling cruises at 98 open waters of Lake Ontario. The work did not include any sites with the Bay of Quinte. Nutrient (e.g., phosphorus, nitrate-nitrite) and major ion (e.g., calcium, chloride, sulphate) samples were collected from the Upper Gap and Lower Gap near Amherst Island, while organic contaminants (e.g., organochlorines, chlorobenzenes), nutrients and major ions were measured in Prince Edward Bay along the southeast shoreline of Prince Edward County.

The objectives of the Environment Canada Great Lakes Surveillance Program were to ensure compliance with water quality objectives, evaluate trends and identify emerging issues.

Summary information is available including sample location (latitude and longitude coordinates), sample depth, parameters measured (chemical, physical, and biological) and sampling frequency at two Environment Canada's web sites: [www.on.ec.gc.ca/monitoring/water-quality/reports-e.html](http://www.on.ec.gc.ca/monitoring/water-quality/reports-e.html) and [www.on.ec.gc.ca/glimr/data/ehd/ontfin.pdf](http://www.on.ec.gc.ca/glimr/data/ehd/ontfin.pdf). Data are also stored at Canada Centre for Inland Waters (CCIW) in the STAR database and can be retrieved upon request.

#### Coordinated Program

Since 1997, the Great Lakes Surveillance Programs of Environment Canada and MOE have been jointly managed so resources can be shared and actions coordinated. The joint program uses the noted rotational lake-by-lake sampling schedule. Sampling occurred in Lake Ontario in 1997 and 2000. The joint Great Lakes Surveillance Program collected no Lake Ontario data in 1998 and 1999. Coordinated reports are typically not produced.

### **A.1.16 MOE Provincial Water Quality Monitoring Network**

The Provincial Water Quality Monitoring Network (PWQMN) was started in the early 1970s to provide water quality information about Ontario's rivers and streams. Although the number of sampling stations has been reduced in recent years, the PWQMN still provides a source of long-term water quality information for the Bay of Quinte AOC tributaries, and an extensive database for a wide range of conventional metals and water chemistry parameters.

Historically, over 100 stations were sampled within the Trent River watershed. Today, sampling stations include sites in and along the Moira, Napanee and Trent River systems, plus near the mouth of the Salmon River.

Event specific sampling is also conducted. In 2001, a monitoring project is underway in Wilton Creek to determine nutrient and bacteria levels related to farm inputs. Also in 2001, a more intensive monitoring program has been established for arsenic in the Moira River relative to the Deloro mine site cleanup work (see Section A.1.19).

The water chemistry parameters include:

- pH
- turbidity
- phosphorus
- nitrate, nitrite, ammonia and TKN
- water temperature
- suspended solids
- chloride
- BOD<sub>5</sub>
- colour.

PWQMN metal parameters include:

- cadmium
- lead
- manganese
- nickel
- zinc.

Samples are routinely collected monthly between April and October by the local Conservation Authorities, although in recent years, Lower Trent Conservation has not participated in the Trent River sampling work. Sample analyses are completed at the MOE Laboratory in Etobicoke. The data are maintained by MOE EMRB in an internal, centralized ORACLE-based data storage system. Given the uniqueness of the storage system, the data are not readily accessible. Rather, an information retrieval request is needed. Output is typically provided in a paper format.

Pre-1990, an annual report was prepared containing the aggregated information in that year for all PWQMN sampling stations. In 2000, a summary report was produced. The report is listed on the MOE web site under Publications. The report is also available on request (see Table 4 for contact information).

### **A.1.17 MOE Drinking Water Surveillance Program**

The Ontario Drinking Water Surveillance Program (DWSP) began in 1986 as a MOE monitoring program for 22 water supply systems. Now, the program oversees 162 municipal waterworks. DWSP provides reliable and current information on municipal drinking water. The data are used to:

- monitor levels of chemicals and establish trends
- define and track the occurrence of new chemicals
- provide data in support of drinking water standards setting
- assess treatment plant operations.

It is noted that DWSP is not a **compliance** monitoring program. The operating authority is responsible for compliance, while DWSP participation is voluntary. Standard DWSP practice in 1998 and 1999 was to inform the operating authority and the MOE when a health objective was exceeded. The operating authority has the option to then notify the local Medical Officer of Health.

Bay of Quinte water treatment facilities monitored by DWSP include Belleville, Deloro (groundwater supplies), Deseronto, Lindsay, Napanee, Peterborough, Picton and Trenton. Summary data available in .pdf format at Ministry of Environment web site [www.ene.gov.on.ca/envision/dwps9899](http://www.ene.gov.on.ca/envision/dwps9899).

DWSP monitors the following parameters.

- Fluoride -- a chemical substance that may be added to municipal water during the treatment process to promote strong teeth.
- Nitrates are present in source water as a result of run-off from fertilizer use, leaching from septic tanks, sewage and erosion from natural deposits.
- Turbidity -- presence of suspended matter such as clay, silt and microscopic organisms and is commonly present in the source water as a result of soil runoff.
- Metals -- naturally present in source water or the result of industrial activity.
- Lead -- erosion of natural deposits with the most common source corrosion of household plumbing.
- Selenium -- occurs naturally in waters at trace levels as a result of geochemical processes such as weathering of rocks and soil erosion.
- Mercury and cyanide
- Chloroaromatics -- by-products of certain processes of chlorination of hydrocarbons.
- Chlorophenols
- N-nitrosodimethylamine (NDMA) or its precursors -- result of industrial discharge or from sewage/animal waste effluents combined with nitrite from anaerobic decay of organic waste matter.
- Chloramines (Combined Chlorine) -- produced during the disinfection process when aqueous chlorine and ammonia are mixed.
- Trihalomethanes (THM) -- by-products of drinking water chlorination, occur during the treatment process.
- Haloacetic Acids (HAA) -- another category of disinfection by-products that will occur in chlorinated waters as a result of the water treatment process.
- Polycyclic aromatic hydrocarbons (PAH) -- associated with the combustion of organic matter.
- PCB -- used in the past for a wide variety of purposes but their use in Canada is currently being phased out.

- Volatile organics -- generally present as a result of recreational and industrial activity.
- Radionuclides -- more than 200 radionuclides, some of which occur naturally and others which originate from the activities of society.
- Taste and odour -- caused by the decomposition of blue-green algae and generally occur after the algae blooms in the late summer.

In light of the Walkerton tragedy, MOE introduced two significant changes to the drinking water program: (1) Operation Clean Water and (2) more frequent and rigorous water treatment plant inspections.

Operation Clean Water was introduced in 2000 to provide a more comprehensive safe drinking water strategy for Ontario. Operation Clean Water is intended to:

- establish tough and clear standards and requirements to improve and protect the quality of drinking water;
- provide effective inspection and enforcement to put a stop to activities that threaten water quality;
- implement tough penalties for non-compliance;
- make strategic investments and efficient, innovative delivery practices to ease potential burdens associated with complying with the necessary requirements (MOE 2001 at [www.ene.on.gc.ca/envision/news/](http://www.ene.on.gc.ca/envision/news/)).

As part of Operation Clean Water, MOE introduced its new and more stringent Drinking Water Protection Regulations (Ontario Regulation 459/00). The regulation establishes strict and mandatory requirements for large waterworks. Large waterworks are facilities that serve six or more private residences **or** supply more than 50,000 litres of water daily on any given day, and offer capacity to supply 250,000 or more litres of water per day. The regulation contains the following requirements.

- Regular and frequent testing for a wide range of parameters, including total coliforms, fecal coliforms or E. coli, chlorine residuals, lead and arsenic.
- Disinfection of all drinking water entering distribution systems to kill disease-bearing organisms (waterworks that use surface waters as their source must also use chemically-assisted filtration or other, equally effective technologies).
- Clear reporting requirements for situations when drinking water does not meet ministry standards and must be reported to the ministry and the Medical Officer of Health
- Owners of large waterworks to provide free quarterly reports on the state of their drinking water.
- Owner to place notices in clearly visible public locations if water does not meet standards.
- Water quality analysts to obtain a new, mandatory licence to perform a wide range of water tests.
- Laboratories that test drinking water to be accredited for the tests they are conducting.

Regulations were proposed in 2001 for other facilities not included in Ontario Regulation 459/00 (i.e., schools, day nurseries, nursing and retirement homes and social and health care facilities that have their own water supply system).

Regarding inspections, MOE now inspects all 645 Ontario municipal water treatment

systems annually and, where failures to meet standards exist, requires corrective actions to be implemented. For example, MOE found deficiencies at 357 plants in 2000 and ordered the owners of 311 plants to take corrective actions to meet Ontario Regulation 459/00 requirements.

Annual compliance information is available as a descriptive summary (.pdf format) at the MOE web site ([www.ene.gov.on.ca/envision/](http://www.ene.gov.on.ca/envision/)), while the raw DWSP data are maintained in a centralized, internal data storage system at MOE EMRB. Given the uniqueness of the data formatting, the data are not readily accessible. Rather, an information retrieval request is needed. The request can be generated via the MOE Eastern Region contact (see Table 4).

#### **4.1.18 MOE Project Trackdown**

MOE introduced Project Trackdown in 2001 as part of Ontario's support for the Lake Ontario LaMP and BNS initiatives. The goal of Project Trackdown is to locate sources of PCB inputs at three Great Lakes sites. At this time, there are no Bay of Quinte sites included in Project Trackdown.

#### **4.1.19 MOE Deloro mine site rehabilitation project**

Since 1979, MOE (more recently the Ontario Clean Water Agency (OCWA)) has operated a treatment facility at the former Deloro mine site to remove arsenic leaching from the mine site in groundwater discharges. The MOE actions have reduced the amount of arsenic exiting the site by more than 80 per cent (from 52.1 kilograms/day in 1979 to less than 10 kilograms/day in 1993).

The work includes a surface and ground water monitoring program. Surface water sampling stations are located on the Moira River and Young's Creek, while groundwater is sampled at monitoring wells on the property. Samples are taken hourly, daily, weekly, monthly or quarterly depending on the sample location. If requested, MOE **may** provide the information in a spreadsheet format including specific sampling site locations and parameters tested.

It is noted that a site-specific downstream Moira River surface water quality objective for arsenic of 0.2 mg/L has been established for the Deloro mine site (Highway 7 sampling station). The Deloro objective is twice the arsenic concentration recommended by the Ontario Provincial Water Quality Objectives (PWQO). Moreover, the objective is often exceeded in low flow conditions such as 2001 flow levels.

MOE has been developing a site cleanup strategy. The initial planning phase was prepared in 1992. It involved (1) finding a secure and registered hazardous waste facility for the ferric arsenate sludge from the treatment operation and (2) sealing mineshafts located throughout the site. The Phase 1 site restoration work was completed in 1997.

MOE is presently developing plans for a final cleanup project. The schedule for cleanup call for technical planning between 1997 and 2000, public consultation in 2001 and initiation of site cleanup work in 2002. The project will take between two and three years to complete at an estimated capital cost of \$18 million. Preliminary plans include:

- upgrading the arsenic treatment plant
- stabilizing the mine tailings

- removing old buildings
- constructing a on-site hazardous waste disposal facility
- capping areas of contamination with clean soil
- diverting surface and ground water flows away from areas of contamination
- reshaping the banks of the Moira River within the site to provide additional groundwater contaminant.

MOE also examined off-site contamination.

In 1999, MOE completed the *Deloro Village Environmental Health Risk Study*. Pathways of exposure (e.g., drinking water, food, soil, air) were examined, and the human health risk was assessed. A report produced by CanTox Environmental was released in 1999 concluding that risk was minimal to human health.

Golder and Associates and GlobalTox International Consultants (2001) measured the downstream environmental impacts in the Moira River (see MOE web site at [www.ene.on.gc.ca/envision/deloro/](http://www.ene.on.gc.ca/envision/deloro/)). Despite the presence of contaminants in the Moira River system, the authors found:

- no adverse effects on aquatic life
- minimal concern for downstream human users
- improvements in overall water quality since MOE provided enhanced treatment.

Relevant to the Bay of Quinte RAP, the Deloro mine site monitoring data and the two special studies provide important background reference information to estimate future Bay of Quinte water and sediment quality near the mouth of the Moira River.

#### **A.1.20 Health Unit beach monitoring information**

Bacteriological water quality at beaches in the western Bay of Quinte area (i.e., Frankford, Northport, Zwick's Island (Belleville), Bain Park (Trenton), and Riverside Beaches (Moira River – Belleville) and lower Trent River) is monitored by the Hastings and Prince Edward Health Unit. Beaches are monitored in the eastern Bay of Quinte area (i.e., Newburgh, Forest Mills and Kingsford) by the Kingston, Frontenac and Lennox-Addington Health Unit.

Sampling occurs in the summer swimming period (May to the start of September). Five samples are collected weekly from each beach and analyzed for *E. coli* as an indicator species. If *E. coli* levels are greater than 100 in 100 mL of water, the beach is posted (identified by signs as unsafe for swimming) until safer bacteria levels are measured.

The Health Units retain the data electronically in an internal database storage system. The data are difficult to access. Information includes bacteria levels, names of beaches posted, and annual number of beach posting days. If requested, the Health Units will provide a paper summary of the information.

In year years, sampling was reduced or eliminated at infrequently used beaches (e.g., Forest Mills). There was no sampling in 2000 at Riverside Beaches in Belleville because the beach was chronically contaminated (closed 100% of the swimming period for all records). Sampling was resumed in 2001 at Riverside Beaches by the Hastings and Prince Edward Health Unit. It was observed that Riverside Beaches were not posted until June 2001, and overall, bacteria levels were lowered than previous sampling years

between June and September (although the safe swimming guideline was still exceeded). It was suggested that the improved quality at Riverside Beaches was a result of the past Province of Ontario Clean Up Rural Beaches (CURB) program (Glen Hudgin, personal conversation).

## **A.2 Observations and Suggestions**

Twenty program, monitoring, surveillance and research activities of the Government of Canada and the Province of Ontario were reviewed. These activities provide a wide range of information and data about the Great Lakes and, in particular, the Bay of Quinte ecosystem collected at different times and locations.

Three types of activities were detected:

- long-term databases (e.g., Project Quinte, LOMU, Great Lakes Surveillance Program)
- event specific information (e.g., Deloro mine site rehabilitation, special studies of the Lake Ontario LaMP, Ecopath project)
- policy information providing overall direction and identifying targets (e.g., IJC's Great Lakes Ecosystem Health Indicators, Lake Ontario LaMP, BNS).

Much of the information is relevant to a delisting assessment by the Bay of Quinte RAP Restoration Council. In some cases, ample information has been collected to address most of the 2001 Bay of Quinte RAP delisting targets, while information may be lacking or insufficient in a few areas to adequately assess the status of the delisting target. The following observations and suggestions are provided concerning the information and Bay of Quinte RAP Restoration Council needs.

- A few Bay of Quinte RAP delisting targets are not addressed by the existing programs, surveillance, research and monitoring activities (e.g., fewer taste and odour complaints in drinking water supplies). Options are required to fill in the data gaps.
- In most cases, the data are related to water and sediment quality of the open water areas of the Bay of Quinte and Lake Ontario. The monitoring activities typically do not provide information about site specific cleanup work. Thus, it may be difficult to judge the effectiveness of each cleanup project from the perspective of water quality changes, ecosystem health impacts and delisting targets.
- The data are reported, most commonly, as a concentration amount (e.g., the effluent concentration of substance X was...; the phosphorus concentration in the upper Bay of Quinte was...). The fate of these substances (e.g., uptake and accumulation in fish, deposition in sediments, discharge to Lake Ontario) is not determined. Between 1990 and 1995, models were prepared to assess toxic substance fate specific to the Bay of Quinte (e.g., In-bay Phosphorus Model, Fate Model of Toxic Substances). A delisting review of the fate of the targeted substances may require (1) the Bay of Quinte models be reexamined and, where required, updated, and (2) a reassessment of substance fate be undertaken for the Bay of Quinte using the models and updated data.

- The temporal quality of the data must be considered. Data gaps may occur between sampling periods. The gaps may be in lengths of months, seasons or many years. In some cases, sampling may no longer occur for some sites or certain parameters. The gaps may impact a trend-over-time evaluation.
- As with any longer term data, the quality of the information may be impacted by changes such as sampling methodologies, detection limits, QA/QC requirements, laboratory procedures and reporting practices. The Bay of Quinte RAP Restoration Council should use care to ensure the data have been corrected for these factors.
- Geo-positioning information is not available for some sampling sites.
- Electronic data on the Environment Canada and other federal departmental web sites is often reported as (1) annual summaries or (2) national summaries. Environment Canada's support and guidance may be required to effectively query the Government of Canada systems for more detailed and site specific information.
- The MOE data have been retained in complex storage systems. These systems are difficult to access by the causal user. MOE support and guidance will be required to effectively query these systems for information.
- The Health Units data have been retained in complex storage systems. These systems are difficult to access by the causal user. Health Units' support and guidance will be required to effectively query these systems for information.
- Some activities are still underway such as the Ecopath and the fish community objectives project of OMNR. A degree of flexibility should be added to the Bay of Quinte RAP delisting review to incorporate the new information as it becomes available.
- Event or topic specific research has been completed in the Bay of Quinte, Some research has been noted (e.g., Lake Ontario LaMP large volume tributary water sampling, 1997 report *Biodiversity of Freshwater Mussels in the Lower Great Lakes Drainage Basin* reported in EMAN). Other event or topic specific studies have not been reported. The Bay of Quinte RAP Restoration Council may want to search the network information systems such as EMAN and SOLEC for other relevant Bay of Quinte research.
- No OMNR wildlife monitoring program was noted in this report. The federal Wildlife Watchers program provides some information. Comparable OMNR information may be needed to complete a delisting review with respect to wildlife populations and habitats.
- Some of the Great Lakes measures of good environmental quality may differ from the locally developed and endorsed Bay of Quinte RAP delisting targets (e.g., the Great Lakes measurements are more stringent than the Bay of Quinte RAP targets). For example, a broader Great Lakes' objective may be the elimination of fish consumption advisories throughout the Great Lakes. The Bay

- of Quinte RAP delisting target in this regard requires that toxic substance concentrations in Bay of Quinte fish not differ significantly from concentrations in fish in other areas of the Great Lakes. In these instances, the Bay of Quinte RAP Restoration Council needs to report carefully its conclusions and justify its cleanup projects in terms of its local delisting targets.
- The various data sources will have to be compiled, collated and evaluated in terms of relevancy to complete a Bay of Quinte RAP delisting review. The Bay of Quinte RAP Restoration Council may need to either (1) secure broad support and scientific input from its Government of Canada and Province of Ontario partners to complete an internal review, or (2) seek adequate resources hire short-term staff or contracted professionals to undertake an external, scientific review.

Table 3. Program, Research, Monitoring and Surveillance Activities of the Government of Canada and the Province of Ontario (Year 2001) in regards to the Delisting Targets for the Bay of Quinte RAP Area of Concern

#	Program Title	Lead Agency	Program Type (Research, Monitoring, Surveillance or Policy)	Purpose	Offers Direct Information to Delisting Targets	Offers Indirect Information to Delisting Targets (Comparative Sites)	Offers Limited or Event Specific Information relative to Delisting Targets	Provides No Relevant Information
1	Lake Ontario Lakewide Management Plan (LaMP)	Environment Canada	Policy	Develop strategies for source reduction and other actions to restore beneficial uses of Lake Ontario		Lake Ontario information for background reference sites	Boyd and Biberhofer 1997 and 1998 monitoring work to measure range of contaminants input from tributaries to Lake Ontario under wet and dry weather conditions (includes Trent River)	
2	Binational Toxics Strategy (BNS)	Environment Canada	Policy	Reduce and virtually eliminate, using a four-step strategy, the release of persistent toxic substances including mirex, toxaphene, PCBs, dioxins and furans.				No specific information; rather, estimates total reductions from all sources
3	IJC's Great Lakes Ecosystem Indicators	IJC	Policy	Assist IJC in fulfilling its responsibilities relative to RAPs called for in the Great Lakes Water Quality Agreement				Standards for delisting Impaired Beneficial Uses

Table 3. Continued

#	Program Title	Lead Agency	Program Type (Research, Monitoring, Surveillance or Policy)	Purpose	Offers Direct Information to Delisting Targets	Offers Indirect Information to Delisting Targets (Comparative Sites)	Offers Limited or Event Specific Information relative to Delisting Targets	Provides No Relevant Information
4	State of the Lakes Ecosystem Conference	Environment Canada	Policy / Research	Under the <i>Biodiversity Investment Area</i> (BIA) concept, determine Great Lakes areas of exceptional biodiversity value, and encourage new efforts to protect and restore these areas				No specific information
5	Pulp and Paper Regulations	Environment Canada	Surveillance	Regulate effluent discharges from pulp and paper operations (under Section 34 of Canadian Environmental Protection Act (CEPA))	Local pulp and paper Industries submit annual effluent quality data			
6	Federal Programs – Conservation and Protection	Environment Canada	Surveillance	Manage federal environmental regulations pertaining to federal activities, operation and properties			Information could include event specific surveillance of federal actions and operation such as 8 Wing Trenton	

Table 3. Continued

#	Program Title	Lead Agency	Program Type (Research, Monitoring, Surveillance or Policy)	Purpose	Offers Direct Information to Delisting Targets	Offers Indirect Information to Delisting Targets (Comparative Sites)	Offers Limited or Event Specific Information relative to Delisting Targets	Provides No Relevant Information
7	Ecological Monitoring and Assessment Network (EMAN) – Frog Watch	Environment Canada	Monitoring	Link ecological research activities to study trends and encourage multi-disciplinary solutions	Frogwatch Ontario includes Bay of Quinte information	Comparative information regionally, provincially and nationally	Research studies information available	
8	Wildlife Watchers (Marsh Monitoring Program)	Environment Canada	Monitoring	Compile statistics and population information for birds and amphibians	Data for some Bay of Quinte locations	Comparative information for other Great Lakes sites		
9	Project Quinte	Fisheries and Oceans Canada	Research	Research limnological features of the Bay of Quinte before and after reductions in phosphorus inputs	Annual report for Bay of Quinte sites on chemical and physical limnology, phytoplankton, macrophytes, zooplankton, benthos and fish			
10	Ecopath Project	Fisheries and Oceans Canada	Research	Using an Ecopath model, assess fisheries and other Bay of Quinte ecosystem management activities in relation to the dynamic response of the biomass-production foodweb	Includes biomass and composition of phytoplankton, zooplankton, macrobenthos and fish, plus key water quality, vegetation, cover and temperature data at three representative Bay of Quinte sites	The results will be incorporated into the next stage of Ecopath model to offer higher resolution estimates of biomass and productivity		

Table 3. Continued

#	Program Title	Lead Agency	Program Type (Research, Monitoring, Surveillance or Policy)	Purpose	Offers Direct Information to Delisting Targets	Offers Indirect Information to Delisting Targets (Comparative Sites)	Offers Limited or Event Specific Information relative to Delisting Targets	Provides No Relevant Information
11	Lake Ontario Management Unit (LOMU)	Ontario Ministry of Natural Resources	Research / Monitoring	Manage fisheries in Lakes Ontario and the St. Lawrence River	Annual LOMU assessment work report including status of Bay of Quinte fish communities and review of uses (commercial, sport and aboriginal fishery)		Recent zebra mussel monitoring information available.	
12	Fish Contaminant Monitoring Program	Ontario Ministry of Environment / Ontario Ministry of Natural Resources	Monitoring	Provide advice on contaminants in fish (e.g., DDT, PCB, mirex, mercury, heavy metals) and the consumption of sport fish in Ontario waters	Bi-annual <i>Guide to Eating Ontario Sport Fish</i> contains information for upstream sites, sites in Bay of Quinte and Lake Ontario sites			
13	Municipal - Industrial Strategy for Abatement (MISA)	Ontario Ministry of Environment	Surveillance	Virtual elimination of the discharge of toxic substances to Ontario waterways by regulation	Local direct discharging industries submit annual effluent quality data			

Table 3. Continued

#	Program Title	Lead Agency	Program Type (Research, Monitoring, Surveillance or Policy)	Purpose	Offers Direct Information to Delisting Targets	Offers Indirect Information to Delisting Targets (Comparative Sites)	Offers Limited or Event Specific Information relative to Delisting Targets	Provides No Relevant Information
14	UMIS	Ontario Ministry of Environment	Surveillance	Assess operations of sewage treatment plants in Ontario	<i>Annual Environmental Compliance Reports</i> provided for sewage treatment plants discharging contaminants that exceed legal allowable limits, and Ministry policies and guidelines	Comparative information with other Ontario sewage treatment plants		
15	Great Lakes Surveillance Program	Environment Canada / Ontario Ministry of Environment	Monitoring	Undertake lake-by-lake rotational monitoring of water quality, sediments and biota		Historic work includes Lake Ontario sites for comparative information (including sites in Upper Gap and Lower Gap)	If requested, monitoring will include specific Bay of Quinte needs...detailed sediment monitoring was completed in 2000	
16	Provincial Water Quality Monitoring Network (PWQMN)	Ontario Ministry of Environment	Monitoring	Monitor long-term water chemistry in tributaries to the Great Lakes	Annual summary of information for major Bay of Quinte tributaries (at point of input). As well, historic database may include input information for minor Bay of Quinte tributaries	Comparative information with other Ontario tributary inputs		

Table 3. Continued

#	Program Title	Lead Agency	Program Type (Research, Monitoring, Surveillance or Policy)	Purpose	Offers Direct Information to Delisting Targets	Offers Indirect Information to Delisting Targets (Comparative Sites)	Offers Limited or Event Specific Information relative to Delisting Targets	Provides No Relevant Information
17	Drinking Water Surveillance Program (DWSP)	Ontario Ministry of Environment	Monitoring	Provide reliable and current information on municipal drinking water to the operating authority and the Ministry of the Environment for (1) monitoring levels of chemical and establishing trends, (2) defining and tracking occurrence of new chemicals, (3) providing data to support setting of drinking water standards and (4) assessing water treatment plant operations	Summary information is provided for Bay of Quinte water treatment plants including <i>Adverse Water Quality Incident Reports</i> .	Comparative information with other Ontario water treatment plants		
18	Project Trackdown	Ontario Ministry of Environment	Surveillance	Identify sources of PCBs at three Great Lakes sites ... as support for Lake Ontario LaMP and BNS work				No immediate sampling Bay of Quinte sampling sites, but program could be expanded if a need is identified

Table 3. Continued

#	Program Title	Lead Agency	Program Type (Research, Monitoring, Surveillance or Policy)	Purpose	Offers Direct Information to Delisting Targets	Offers Indirect Information to Delisting Targets (Comparative Sites)	Offers Limited or Event Specific Information relative to Delisting Targets	Provides No Relevant Information
19	Deloro Mine Site Rehabilitation	Ontario Ministry of Environment	Monitoring	Prepared final site cleanup plan, and assess health risk of living next to former Deloro mine site and complete a two-part river study to (1) determine present contamination in the river and to what degree the environment is being affected; (2) determine if these contaminants pose any potential health implications to people living downstream of the site; and (3) predict environmental improvements in response to site remedial work, plus complete.			1999 Ministry of the Environment comprehensive <i>Deloro Village Environmental Health Risk Study</i> and the 1999 Ministry of the Environment study of the Moira River system	
20	Beach monitoring	Hastings and Prince Edward Health Unit	Surveillance	Assess and provide advice on bacteriological water quality at beaches	Information on water quality at Bay of Quinte beaches			

Table 4. Contact Information for the Program, Research, Monitoring and Surveillance Activities of the Government of Canada and the Province of Ontario (Year 2001) in regards to the Delisting Targets for the Bay of Quinte RAP Area of Concern

#	Program Title	Purpose	Lead Agency	Contact Information
1	Lake Ontario Lakewide Management Plan (LaMP)	Develop strategies for source reduction and other actions to restore beneficial uses of Lake Ontario	Environment Canada / Ontario Ministry of Environment	Jannette Anderson Environment Canada 867 Lakeshore Road P.O. Box 5050 Burlington, Ontario L7R 4A6 (905) 336-6277 jannette.anderson@ec.gc.ca  Jorgen Fleischer MOE Water Monitoring 125 Resources Road Etobicoke, Ontario M9P 3V6 (416) 235-6222 fleischfr@ene.gov.on.ca
2	Binational Toxics Strategy (BNS)	Reduce and virtually eliminate, using a four-step strategy, the release of persistent toxic substances including mirex, toxaphene, PCBs, dioxins and furans.	Environment Canada	Susan Humphrey Environment Canada 4905 Dufferin Street Downsview, Ontario M3H 5T4 (416) 739-4251 susan.humphrey@ec.gc.ca

Table 4 Continued

#	Program Title	Purpose	Lead Agency	Contact Information
3	IJC Great Lakes Ecosystem Indicators	Assist IJC in fulfilling its responsibilities relative to RAPs called for in the Great Lakes Water Quality Agreement	IJC	Jennifer Day IJC - Great Lakes Regional Office 100 Ouellette Avenue 8th Floor Windsor, Ontario N9A 6T3 (519) 257-6733 dayj@windsor.ijc.org
4	State of the Lakes Ecosystem Conference	Under the Biodiversity Investment Area (BIA) concept, determine Great Lakes areas of exceptional biodiversity value, and encourage new efforts to protect and restore these areas	Environment Canada	Harvey Shear Environment Canada 4905 Dufferin Street Downsview, Ontario M3H 5T4 (416) 739-4704  Nancy Stadler-Salt Environment Canada 4905 Dufferin Street Downsview, Ontario M3H 5T4 (905) 336-6271 nancy.stadler-salt@ec.gc.ca
5	Pulp and Paper Regulations	Regulate effluent discharges from pulp and paper operations (under Section 34 of Canadian Environmental Protection Act (CEPA))	Environment Canada	
6	Federal Programs – Conservation and Protection	Manage federal environmental regulations pertaining to federal activities, operation and properties	Environment Canada	Lawrence King Environment Canada Environmental Protection Branch 49 Camelot Drive Ottawa, Ontario K1A 0H3 (613) 952-8679

Table 4. Continued

#	Program Title	Purpose	Lead Agency	Contact Information
7	Ecological Monitoring and Assessment Network (EMAN)	Link ecological research activities to study trends and encourage multi-disciplinary solutions	Environment Canada	<p>EMAN Environment Canada 867 Lakeshore Road P.O. Box 5050 Burlington, Ontario L7R 4A6 (905) 336-4414 eman@cciw.ca</p> <p>Frogwatch Ontario Toronto Zoo 361A Old Finch Ave Scarborough, Ontario M1B 5K7 aap@zoo.metrotor. on.ca</p>
8	Wildlife Watchers	Compile statistics and population information for birds and amphibians	Environment Canada – Canadian Wildlife Service	<p>Valarie Wyatt Environment Canada Canadian Wildlife Service Wildlife Watchers 75 Farquhar Street Guelph, Ontario N1H 3N4. (519) 826-2092 Valerie.Wyatt@ec.gc.ca.</p> <p>Kathy Jones Marsh Monitoring Program Bird Studies Canada P.O. Box 160 Port Rowan, Ontario N0E 1M0 (519) 586-3531 aqsurvey@bsc-eoc.org</p>

Table 4. Continued

#	Program Title	Purpose	Lead Agency	Contact Information
9	Project Quinte	Research limnological features of the Bay of Quinte before and after reductions in phosphorus inputs	Fisheries and Oceans Canada	Scott Millard DFO - GLLFAS 867 Lakeshore Road P.O. Box 5050 Burlington, Ontario L7R 4A6 (905) 336-4702 MillardS@dfo-mpo.gc.ca
10	Ecopath Project	Using an Ecopath model, assess fisheries and other Bay of Quinte ecosystem management activities in relation to the dynamic response of the biomass-production foodweb	Fisheries and Oceans Canada	Scott Millard DFO – GLLFAS 867 Lakeshore Road P.O. Box 5050 Burlington, Ontario L7R 4A6 (905) 336-4702 MillardS@dfo-mpo.gc.ca
11	Lake Ontario Management Unit (LOMU)	Manage fisheries in Lakes Ontario and the St. Lawrence River	Ontario Ministry of Natural Resources	Tom Stewart OMNR - LOMU Glenora Fisheries Station R.R. #4 Picton, Ontario K0K 2T0 (613) 476-3147
12	Fish Contaminant Monitoring Program	Provide advice on contaminants in fish (e.g., DDT, PCB, mirex, mercury, heavy metals) and the consumption of sport fish in Ontario waters	Ontario Ministry of Environment / Ontario Ministry of Natural Resources	Al Hayton MOE – EMRB Sport Fish Contaminant Monitoring Program 125 Resource Road Etobicoke, Ontario (416) 327-7470 M9P 3V6 haytonal@ene.gov.on.ca

Table 4. Continued

#	Program Title	Purpose	Lead Agency	Contact Information
13	Municipal - Industrial Strategy for Abatement (MISA)	Virtual elimination of the discharge of toxic substances to Ontario waterways by regulation	Ontario Ministry of Environment	Dan White MOE Eastern Region Assistant Director's Office 133 Dalton Avenue P.O. Box 820 Kingston, Ontario K7L 4X6 (613) 549-4000 X 2740 whiteda@ene.gov. on.ca
14	Municipal Utilities Monitoring Program (MUMP)	Assess operations of sewage treatment plants (STP) in Ontario for compliance with Ontario STP operating guidelines	Ontario Ministry of Environment	Dan White MOE Eastern Region Assistant Director's Office 133 Dalton Avenue P.O. Box 820 Kingston, Ontario K7L 4X6 (613) 549-4000 X 2740 whiteda@ene.gov. on.ca  Koshy Mathew MOE – EMRB 125 Resources Road Etobicoke, Ontario M9P 3V6 (416) 235-6136 mathewko@ene.gov. on.ca

Table 4. Continued

#	Program Title	Purpose	Lead Agency	Contact Information
15	Great Lakes Surveillance Program	Undertake lake-by-lake rotational monitoring of water quality, sediments and biota	Environment Canada / Ontario Ministry of Environment	<p>Duncan Boyd MOE – EMRB Great Lakes Investigations – Water Monitoring 125 Resources Road Etobicoke, Ontario M9P 3V6 (416) 235-6221 boyddu@ene.gov.on.ca</p> <p>Serge L'Italien Environment Canada Environmental Conservation Branch 867 Lakeshore Road P.O. Box 5050 Burlington, Ontario L7R 4A6 (905) 336-4960 Serge.L'Italien@cciw.ca</p>
16	Provincial Water Quality Monitoring Network (PWQMN)	Monitor long-term water chemistry in tributaries to the Great Lakes	Ontario Ministry of Environment	<p>Aaron Todd MOE – EMRB Surface Water Group 125 Resources Road Etobicoke, Ontario M9P 3V6 (416) 235-6240 toddaa@ene.gov.on.ca</p>

Table 4. Continued

#	Program Title	Purpose	Lead Agency	Contact Information
17	Drinking Water Surveillance Program (DWSP)	Provide reliable and current information on municipal drinking water to the operating authority and the Ministry of the Environment for (1) monitoring levels of chemical and establishing trends, (2) defining and tracking occurrence of new chemicals, (3) providing data to support setting of drinking water standards and (4) assessing water treatment plant operations	Ontario Ministry of Environment	Dan White MOE Eastern Region Assistant Director's Office 133 Dalton Avenue P.O. Box 820 Kingston, Ontario K7L 4X6 (613) 549-4000 X 2740 whiteda@ene.gov.on.ca
18	Project Trackdown	Identify sources of PCBs at three Great Lakes sites ...as support for Lake Ontario LaMP and BNS work	Ontario Ministry of Environment	Wayne Herrick MOE Eastern Region Assistant Director's Office 133 Dalton Avenue P.O. Box 820 Kingston, Ontario K7L 4X6 (613) 549-4000 X 2678 herricwa@ene.gov.on.ca

#	Program Title	Purpose	Lead Agency	Contact Information
19	Deloro Mine Site Rehabilitation	<p>Develop site cleanup plans</p> <p>Assess human health risks of living next to former Deloro mine site</p> <p>Complete a two-part river study to (1) determine present contamination in the river and to what degree the environment is being affected, (2) determine if these contaminants pose any potential health implications to people living downstream of the site, and (3) predict environmental improvements in response to site remedial work, plus complete.</p>	Ontario Ministry of Environment	<p>Jim Ritter MOE Eastern Region Assistant Director's Office 133 Dalton Avenue P.O. Box 820 Kingston, Ontario K7L 4X6 (613) 549-4000 X 2720 ritterji@ene.gov.on.ca</p>
20	Beach monitoring	Assess and provide advice on bacteriological water quality at beaches	Hastings and Prince Edward Health Unit	<p>Glen Hudgin Hastings and Prince Edward Health Unit 179 North Park Street Belleville Ontario K8P 4P1 (613) 966-5500</p>

Table 5. Reference Information for the Program, Research, Monitoring and Surveillance Activities of the Government of Canada and the Province of Ontario (Year 2001)

#	Program Title	Type of Sampling	Frequency of Sampling	Sampling Location	General Findings
1	Lake Ontario Lakewide Management Plan (LaMP)	<ul style="list-style-type: none"> <li>Large volume water sampling in tributaries (wet and dry weather) to identify areas with large inputs of contaminants</li> <li>Harbour and embayment sediment studies to determine quality relative to Provincial Sediment Quality Guidelines (PSQG)</li> </ul>	Special study – one year of sampling only during wet and dry events	<p>The sample location for the special study was the Trent River 500 metres south of the 401 highway (shoreline east or west?). Latitude 44°07.476 Longitude 77°35.513</p> <p>Harbours in Belleville and Trent</p>	<ul style="list-style-type: none"> <li>PCB levels similar at all stations for all conditions... representative of background conditions</li> <li>Suspended solid loads increase in wet weather</li> <li>Sampled in 2000....results pending</li> </ul>
2	Binational Toxics Strategy (BNS)	No sampling in Bay of Quinte AOC			
3	IJC Great Lakes Ecosystem Indicators	No sampling in Bay of Quinte AOC			
4	State of the Lakes Ecosystem Conference	Literature review, modeling and habitat typing	Special studies to define Biodiversity Investment Areas (BIA) for land, shoreline and open water areas...started in 1996 with reports every two years		Draft definition and elements to define BIA established

Table 5. Continued

#	Program Title	Type of Sampling	Frequency of Sampling	Sampling Location	General Findings
5	Pulp and Paper Regulations	Effluent quality monitoring for chemistry, metals and priority toxic substances	Frequency of sampling defined by CEPA Section 34...if no priority pollutants measured reporting could be minimal annual summary	Effluent discharge points at Norampac (Trenton), Sonoco (Glen Miller) and Strathcona Papers (Newburgh)	TBD
6	Federal Programs – Conservation and Protection	Special studies only	Special event only	Federal properties in Bay of Quinte AOC	Summary of federal facilities in Bay of Quinte developed
7	Ecological Monitoring and Assessment Network (EMAN)	EMAN is not a sampling program. It is a network of information and data only, although the EMAN library includes studies not reported elsewhere			
8	Wildlife Watchers	Marsh Monitoring Program (MMP) reports volunteer collected information for seven Bay of Quinte wetlands	<ul style="list-style-type: none"> <li>• Since 1995, samples have been collected during spring and summer. The number of samples varies per year and per site.</li> <li>• Not all stations sampled every year</li> <li>• Note: not all seven sampling routes were active in 2000.</li> </ul>	TBD	<ul style="list-style-type: none"> <li>• Early suggestion that frog population was low</li> <li>• Special study of terns suggested ample habitat but few terns</li> </ul>

Table 5. Continued

#	Program Title	Type of Sampling	Frequency of Sampling	Sampling Location	General Findings
9	Project Quinte	<p>Samples include</p> <ul style="list-style-type: none"> <li>• clarity and light penetration</li> <li>• water temperature</li> <li>• phosphorus concentrations</li> <li>• phytoplankton and zooplankton biomass</li> <li>• aquatic plants (type, location and biomass)</li> <li>• benthic organisms</li> <li>• fish numbers</li> </ul> <p>Special survey for zebra mussels completed between 1997 and 2000</p>	<p>Bi-weekly samples collected at seven stations between 1972 and 1986.</p> <p>Number of stations reduced to three (upper, middle and lower bays) between 1986 and 1997.</p> <p>Additional upper bay station added in 1997.</p>	<p>Seven stations were Trenton, Belleville, Napanee, Hay Bay, Picton, Glenora and Conway. Specific sampling site locations available from contact.</p> <p>Three stations were Belleville (upper bay), Hay Bay (middle bay) and Conway (lower bay).</p> <p>Trenton and Napanee added</p>	<ul style="list-style-type: none"> <li>• Seasonal changes in quality documented</li> <li>• Reduced loadings of phosphorus with less than anticipated ecosystem impact</li> <li>• general improvements in water quality such as greater clarity</li> <li>• shift in algae communities</li> <li>• numerous factors influence fish community makeup</li> <li>• zebra mussels impacting Bay of Quinte ecosystem</li> </ul>
10	Ecopath Project	<p>Special sampling to provide data for model conducted in 2000 and 2001</p>	TBD	TBD	None to date

Table 5. Continued

#	Program Title	Type of Sampling	Frequency of Sampling	Sampling locations	General Findings
11	Lake Ontario Management Unit (LOMU)	<p>Monitoring includes gillnetting (various types and net sizes), and trawling to estimate fish populations and community structure.</p> <p>Recreational fishing is studied to determine catch/harvest rates and biological characteristics of walleye. Sampling method is creel sampling.</p>	<p>Samples collected on an ongoing basis and reported annually.</p> <p>Period of record depends on station and fish species. Hoyle (1999) states that "...a diverse assemblage of cold- and warm-water fish species...has been closely monitored by index gillnetting and trawling programs based out of the Glenora Fisheries Station for forty years."</p> <p>Sampling is during the "on-ice" (December to February) and "open water" (May to December).</p>	<p>Six trawling locations and three index gill netting stations are positioned throughout the Bay of Quinte. As well, there are stations for background reference information in Lake Ontario in the Outlet Basin area. Trawling sites are Trenton, Belleville, Big Bay, Deseronto (mouth of Napanee River), mouth of Hay Bay and Conway. Gillnetting sties are Big Bay, Hay Bay and Aldophus Reach.</p> <p>The Bay of Quinte is divided into 12 sampling zones between Trenton and Glenora.</p>	<ul style="list-style-type: none"> <li>• Highly diverse Bay of Quinte fish community</li> <li>• Some recent downward changes in populations of key species such as walleye and perch</li> <li>• Impacts from zebra mussel, water quality upgrades (e.g., greater water clarity) noted for impacts on fish populations</li> </ul> <p>Findings are provided annually in LOMU report. In 1999, the number of walleye harvested was lower in both sampling periods compared to average of previous years.</p>

Table 5. Continued

#	Program Title	Type of Sampling	Frequency of Sampling	Sampling locations	General Findings
12	Fish Contaminant Monitoring Program	Long-term monitoring of contaminant levels in sport fish.	Sampling zones are monitored about 35 times per year. Additional sampling can occur within a specific zone to provide enhances data.	There are 50 Great Lakes sampling zones with two sampling zones in the Bay of Quinte with a reference Lake Ontario zone in Outlet Basin. There are also many watershed sampling sites.	Restrictions persist for large sizes of seven species such as walleye, Chinook salmon and whitefish in the middle Bay of Quinte.
13	Municipal - Industrial Strategy for Abatement (MISA)	Effluent quality monitoring including parameters such as flow general chemistry (BOD <sub>5</sub> , pH, dissolved organic carbon (DOC), total suspended solids), nutrients (total phosphorus) organics (toluene, chloroform, dioxin and furans) and lethality ( <i>Daphnia</i> and trout)	Frequency depends on MISA regulation.  Mean monthly data are reported quarterly. The data are summarized and reported as annual mean concentrations.	Industries reporting are Norampac (Trenton), Sonoco (Glen Miller), Strathcona Papers (Newburgh) and Essroc Cement (Picton)	Local industries generally meet MISA requirements
14	Municipal Utilities Monitoring Program (MUMP)	Effluent quality sampling for BOD <sub>5</sub> , total suspended solids, total phosphorus, flow, and nitrogen (TKN, ammonia, etc.)	Frequency depends on Certificate of Approval requirements. Minimum sampling would be once per month. Typically sampling would be once per week.	Eighteen municipal STPs throughout Bay of Quinte watershed.	STPs are meeting PWQO requirement of 1.0 mg/L P, and most STPs meet the more Bay of Quinte total phosphorus targets on a consistent basis.

Table 5. Continued

#	Program Title	Type of Sampling	Frequency of Sampling	Sampling locations	General Findings
15	Great Lakes Surveillance Program	<ul style="list-style-type: none"> <li>• Open water sampling for conventional water quality parameters.</li> <li>• Sediment sampling for toxic contaminants</li> <li>• Benthic invertebrates are monitored as biological indicators of ecosystem health</li> <li>• Water intake biomonitoring using nutrient concentrations and phytoplankton biomass</li> <li>• Special studies can include monitoring toxic substances in juvenile fish and mussels</li> </ul>	Sampling for conventional parameters is conducted on Lake Ontario once every three years with samples collected in spring, summer and fall in the sampling year. Sediment and benthic invertebrate sampling is completed in the summer. Water intake biomonitoring is a year round, raw water collection program with a period of record over 20 years.	Four index stations in the Bay of Quinte are strategically located in upper, middle and lower bays. Background reference stations are also located in Lake Ontario in Outlet Basin and along the south shore of Prince Edward County. Water intake biomonitoring occurs at Belleville.	Background data for comparison with site specific cleanup actions
16	Provincial Water Quality Monitoring Network (PWQMN)	Sampling for water quality indicators such as temperature, pH, conductivity, turbidity, suspended solids, major ions, nutrients and metals. Sampling can include an Enhanced Tributary Monitoring Program for trace organics.	Samples are collected at monthly intervals between April and November. Enhanced monitoring emphasizes spring freshet (period accounts for significant proportion of annual contaminant loadings)	Sites along the Moira, Napanee and Trent Rivers as well as the mouth of the Salmon River. Geographic and site description identifiers – see Appendix A. Enhanced monitoring stations in Bay of Quinte are not noted.	Long-term monitoring and reference information to evaluate quality

Table 5. Continued

#	Program Title	Type of Sampling	Frequency of Sampling	Sampling Locations	General Findings
17	Drinking Water Surveillance Program (DWSP)	Monitoring of drinking water quality for wide range of parameters	Daily sampling. Reported monthly and summarized as annual mean concentrations.	Water treatment plants throughout the Bay of Quinte AOC	No problems noted, although trihalomethanes (THM) noted as ongoing issue
18	Project Trackdown	Special study collecting data on PCBs in sediments and water in three harbours. Note, there are presently no Bay of Quinte sampling stations			For Kingston Inner Harbour study, preliminary results show similar levels of PCBs in sediments as measured in earlier study occurring throughout the target area.
19	Deloro Mine Site Rehabilitation	<ul style="list-style-type: none"> <li>• Special study -- 1999 Human health risk assessment for Village of Deloro</li> <li>• Special study – 1999 downstream impacts of Deloro mine site</li> </ul>	Special one time sampling in 1999	<ul style="list-style-type: none"> <li>• Village of Deloro</li> <li>• Downstream sites included areas of potential deposition such as Big Bend, Moira Lake and Stoco Lake</li> </ul>	<ul style="list-style-type: none"> <li>• No increased human health risk in Village of Deloro</li> <li>• Downstream impacts on fish and aquatic organisms minimal for arsenic</li> </ul>

Table 5. Continued

#	Program Title	Type of Sampling	Frequency of Sampling	Sampling Locations	General Findings
20	Beach monitoring	Monitoring of bacteria concentrations	TBD – Typically weekly for high-use recreational areas.	Bathing beaches and points of recreation	Problem depends on site. Riverside Beach in Belleville has a chronic bacteria problem and the beach is frequently posted. Other beaches such as Forest Mills on the Salmon River have sporadic episodes of bacteriological contamination. Bacterial problems are also weather dependent with increased contamination occurring immediately after a storm event.

Table 6. Bay of Quinte RAP Impaired Beneficial Uses and the Program, Research, Monitoring and Surveillance Activities of the Government of Canada and the Province of Ontario (Year 2001) providing Information

#	Impaired Beneficial Use	Activity the can provide Direct Information and/or Data	Activity that may provide Information and/or Data	Activity that provides Policy Direction
1	Restrictions on fish and wildlife consumption	<ul style="list-style-type: none"> <li>• Fish Contaminant Monitoring Program</li> <li>• Great Lakes Surveillance Program</li> </ul>	<ul style="list-style-type: none"> <li>• Municipal - Industrial Strategy for Abatement</li> <li>• Deloro Mine Site Rehabilitation</li> </ul>	<ul style="list-style-type: none"> <li>• Lake Ontario LaMP</li> <li>• Binational Toxics Strategy</li> <li>• IJC Great Lakes Ecosystem Indicators</li> </ul>
2	Tainting of fish and wildlife populations <i>(Not Impaired)</i>			
3	Degradation of fish and wildlife populations	<ul style="list-style-type: none"> <li>• Ecological Monitoring and Assessment Network</li> <li>• Wildlife Watchers</li> <li>• Project Quinte</li> <li>• Ecopath Project</li> <li>• Lake Ontario Management Unit</li> <li>• Great Lakes Surveillance Program</li> </ul>	<ul style="list-style-type: none"> <li>• Deloro Mine Site Rehabilitation</li> </ul>	<ul style="list-style-type: none"> <li>• State of the Lakes Ecosystem Conference</li> </ul>
4	Fish tumours and other deformities	<ul style="list-style-type: none"> <li>• Ecological Monitoring and Assessment Network</li> <li>• Fish Contaminant Monitoring Program</li> <li>• Great Lakes Surveillance Program</li> </ul>	<ul style="list-style-type: none"> <li>• Pulp and Paper Regulations</li> <li>• Deloro Mine Site Rehabilitation</li> </ul>	<ul style="list-style-type: none"> <li>• Lake Ontario LaMP</li> <li>• Binational Toxics Strategy</li> <li>• IJC Great Lakes Ecosystem Indicators</li> </ul>

Table 6. Continued

#	Impaired Beneficial Use	Activity the can provide Direct Information and/or Data	Activity that may provide Information and/or Data	Activity that provides Policy Direction
5	Bird and animal deformities or reproduction problems <i>(Not Impaired)</i>			
6	Degradation of benthos	<ul style="list-style-type: none"> <li>• Ecological Monitoring and Assessment Network</li> <li>• Project Quinte</li> <li>• Great Lakes Surveillance Program</li> </ul>	<ul style="list-style-type: none"> <li>• Deloro Mine Site Rehabilitation</li> </ul>	<ul style="list-style-type: none"> <li>• Lake Ontario LaMP</li> <li>• Binational Toxics Strategy</li> <li>• IJC Great Lakes Ecosystem Indicators</li> <li>• State of the Lakes Ecosystem Conference</li> </ul>
7	Restrictions on dredging activities	<ul style="list-style-type: none"> <li>• Federal Programs</li> <li>• Ecological Monitoring and Assessment Network</li> <li>• Project Quinte</li> <li>• Municipal – Industrial Strategy for Abatement</li> <li>• Great Lakes Surveillance Program</li> <li>• Project Trackdown *</li> </ul>	<ul style="list-style-type: none"> <li>• Provincial Water Quality Monitoring Network</li> <li>• Deloro Mine Site Rehabilitation</li> </ul>	<ul style="list-style-type: none"> <li>• Lake Ontario LaMP</li> <li>• Binational Toxics Strategy</li> <li>• IJC Great Lakes Ecosystem Indicators</li> </ul>
8	Eutrophication or undesirable algae	<ul style="list-style-type: none"> <li>• Ecological Monitoring and Assessment Network</li> <li>• Project Quinte</li> <li>• Great Lakes Surveillance Program</li> </ul>		<ul style="list-style-type: none"> <li>• Lake Ontario LaMP</li> <li>• IJC Great Lakes Ecosystem Indicators</li> </ul>

Table 6. Continued

#	Impaired Beneficial Use	Activity the can provide Direct Information and/or Data	Activity that may provide Information and/or Data	Activity that provides Policy Direction
9	Restrictions on drinking water or taste and odour problems	<ul style="list-style-type: none"> <li>• Ecological Monitoring and Assessment Network</li> <li>• Project Quinte</li> <li>• Municipal Utilities Monitoring Program</li> <li>• Great Lakes Surveillance Program</li> <li>• Drinking Water Surveillance Program</li> </ul>		<ul style="list-style-type: none"> <li>• IJC Great Lakes Ecosystem Indicators</li> </ul>
10	Beach closures	<ul style="list-style-type: none"> <li>• Great Lakes Surveillance Program</li> <li>• Provincial Water Quality Monitoring Network</li> <li>• Beach monitoring</li> </ul>		<ul style="list-style-type: none"> <li>• Lake Ontario LaMP</li> <li>• IJC Great Lakes Ecosystem Indicators</li> </ul>
11	Degradation of aesthetics	<ul style="list-style-type: none"> <li>• Ecological Monitoring and Assessment Network</li> <li>• Project Quinte</li> <li>• Great Lakes Surveillance Program</li> <li>• Provincial Water Quality Monitoring Network</li> </ul>	<ul style="list-style-type: none"> <li>• Pulp and Paper Regulations</li> <li>• Ecopath Project</li> <li>• Municipal - Industrial Strategy for Abatement</li> <li>• Municipal Utilities Monitoring Program</li> <li>• Drinking Water Surveillance Program</li> <li>• Beach monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Lake Ontario LaMP</li> <li>• Binational Toxics Strategy</li> <li>• IJC Great Lakes Ecosystem Indicators</li> </ul>
12	Added cots to industry or agriculture <b>(Not Impaired)</b>			

Table 6. Continued

#	Impaired Beneficial Use	Activity the can provide Direct Information and/or Data	Activity that may provide Information and/or Data	Activity that provides Policy Direction
13	Degradation of phytoplankton and zooplankton populations	<ul style="list-style-type: none"> <li>• Ecological Monitoring and Assessment Network</li> <li>• Project Quinte</li> <li>• Ecopath Project</li> <li>• Great Lakes Surveillance Program</li> <li>• Provincial Water Quality Monitoring Network</li> <li>• Project Trackdown *</li> </ul>	<ul style="list-style-type: none"> <li>• Pulp and Paper Regulations</li> <li>• Municipal - Industrial Strategy for Abatement</li> <li>• Municipal Utilities Monitoring Program</li> <li>• Deloro Mine Site Rehabilitation</li> </ul>	<ul style="list-style-type: none"> <li>• Lake Ontario LaMP</li> <li>• Binational Toxics Strategy</li> <li>• IJC Great Lakes Ecosystem Indicators</li> <li>• State of the Lakes Ecosystem Conference</li> </ul>
14	Loss of fish and wildlife habitats	<ul style="list-style-type: none"> <li>• Ecological Monitoring and Assessment Network</li> <li>• Wildlife Watchers</li> <li>• Project Quinte</li> <li>• Ecopath Project</li> <li>• Lake Ontario Management Unit</li> </ul>	<ul style="list-style-type: none"> <li>• Lake Ontario LaMP</li> <li>• State of the Lakes Ecosystem Conference</li> <li>• Provincial Water Quality Monitoring Network</li> <li>• Deloro Mine Site Rehabilitation</li> </ul>	<ul style="list-style-type: none"> <li>• Lake Ontario LaMP</li> <li>• IJC Great Lakes Ecosystem Indicators</li> </ul>

\* Project Trackdown does not operate in the Bay of Quinte AOC at this time. The program would provide important contaminant information if expanded to the AOC.

## **Part B – Outline of Bay of Quinte RAP Monitoring Needs**

### **B.1 Monitoring Categories**

Part B highlights the monitoring needs of the Bay of Quinte RAP. As identified, a diverse range of information is required for a delisting review. To organize the information gathering requirements and maximize resource allocations, seven monitoring categories have been identified. The seven categories are listed in order of importance, volume of work involved and potential cost to the Bay of Quinte RAP Restoration Council. Additional descriptive information about each category is also provided (e.g., various options for undertaking the information gathering).

The categories are:

- Monitoring Category #1 – Incorporate Data from Major Government of Canada and Ontario Environmental Databases
- Monitoring Category #2 – No Data
- Monitoring Category #3 - Site-specific or Action-specific Monitoring Requirements
- Monitoring Category #4 – Expansion of Existing Monitoring Programs
- Monitoring Category #5 - Update Monitoring Information or Repeat Previous Studies
- Monitoring Category #6 – Incorporate Data from Less Relevant Government of Canada and Ontario Actions
- Monitoring Category #7 - Public Engagement and Results Communication.

#### **B.1.1 – Incorporating Data from Major Government of Canada and Ontario Environmental Databases**

Monitoring Category #1 builds on the observations in Part A that some Bay of Quinte RAP data requirements can be secured from existing Government of Canada and Ontario monitoring programs. Existing programs could include the Great Lakes Surveillance Program, Project Quinte, Sport Fish Contaminant Monitoring, LOMU efforts, wildlife monitoring actions such as Wildlife Watchers and the Ontario Breeding Bird Atlas, MISA, PWQMN, MUMP and the Hastings-Prince Edward Health Unit beach monitoring information. This work represents a major part of a Bay of Quinte RAP delisting review. As noted in Part A, the work in Monitoring Category #1 would require the allocation of human and financial resources, either Bay of Quinte RAP Restoration Council resources or Government of Canada and Ontario support, to query effectively the data management systems.

The consolidation of information is vital for assessing restoration progress and noting potential data gaps. For example, the delisting target for IBU #3 – Degradation of Fish and Wildlife Population is “demonstrate that targeted fish and wildlife species are healthy, abundant and self-sustaining in the Bay of Quinte area given the influence of key factors such as habitat availability, habitat features (e.g., impacts of eutrophication, impacts of zebra mussels), human interactions (e.g., fish harvesting) and other factors (e.g., toxic contaminants).” The Sport Fish Contaminant Monitoring program provides information related to toxic substances, but an interpretation and possible reformatting of the data may be required to match Bay of Quinte RAP delisting target needs. Likewise, a new Ontario Breeding Bird Atlas is being jointly developed by the Federation of Ontario Naturalists, Bird Studies of Canada, Canadian Wildlife Service, OMNR and Ontario Field Ornithologists to provide updated information on the status and distribution of birds in

Ontario. As suggested, data reformatting may be required to meet Bay of Quinte RAP delisting requirements.

Four possible options are presented for Monitoring Category #1.

- MC#1 – Option 1 -- The Bay of Quinte RAP Restoration Council members and staff complete the work as an internal action.

This option has four requirements. Bay of Quinte RAP Restoration Council human and financial resources would have to be directly allocated. Review roles would have to be assigned to different members of the Bay of Quinte RAP Restoration Council technical team, and input from the reviewers would have to be coordinated, managed and adjusted for a common format. Possible additional staff would have to be hired on a short-term, contractual basis to complete the tasks in a timely and efficient manner.

- MC#1 – Option 2 -- The Bay of Quinte RAP Restoration Council requests that the “owners” of the different databases undertake the data organization and interpretation, with Bay of Quinte RAP Restoration Council members and staff supporting the data consolidation effort.

This option has a number of requirements. The Bay of Quinte RAP Restoration Council would have to seek and secure commitments from the database owners. The step includes defining Bay of Quinte RAP Restoration Council information needs, establishing schedules and formats for data delivery, and outlining database owner roles such as data interpretation and ongoing provision of information. The Bay of Quinte RAP Implementation Manager or other staff member would be required to provide effective and ongoing process management to ensure Bay of Quinte RAP Restoration Council needs are met. The information would have to be assessed relative to the Bay of Quinte RAP delisting targets and presented in a common reporting format for external reviewers such as the IJC and QWC. Changes to monitoring programs by database owners would have to be communicated promptly to the Bay of Quinte RAP Restoration Council to ensure that alternative monitoring plans can be prepared.

- MC#1 – Option 3 -- The Bay of Quinte RAP Restoration Council allocates financial resources to contract an external contractor to complete the work.

This option's requirements could include defining expectations (e.g., schedule, number of draft reports, number of client-contractor meetings) and anticipated final products (e.g., reporting format), securing financial support, assigning Bay of Quinte RAP Restoration Council staff to manage the contract, forming a team of reviewers, and obtaining external access by the contractor to the monitoring databases. While this option may be the most financially costly, it may provide the desired products and information in a timely manner

- MC#1 – Option 4 -- The Bay of Quinte RAP Restoration Council uses a combination of Options 1–3.

Option 4 may offer the greatest degree of flexibility and require a medium allocation of Bay of Quinte RAP financial resources. For example, the database owners may be able to provide some human resource commitments augmented by research and data collection efforts of Bay of Quinte RAP Restoration Council staff or external contractors. Bay of Quinte RAP Restoration Council could work with local database owners to secure information (e.g., LOMU, Hastings Prince Edward Heath Unit, MISA) while an external contractor collects information from distant database owners (e.g., Sport Fish Contaminant Monitoring, Great Lakes Surveillance, Ontario Breeding Bird Atlas). An external contractor could design a common electronic reporting format to be used by database owners to reduce overall human resource commitments and provide information to the Bay of Quinte RAP Restoration Council on an ongoing and predetermined schedule.

### **B.1.2 – No Data**

In some cases, data have not been collected to support the Bay of Quinte RAP delisting targets. For example, Bay of Quinte RAP delisting requirements for IBU #9 – Restrictions on Drinking Water or Taste and Odour Problems include:

- A reduction in chemical usage levels from the base year levels as anticipated by reduced phosphorus concentrations in the upper Bay of Quinte at the Belleville, Deseronto and Bayside water treatment plants,
- Fewer taste and odour complaints compared to the base year in the Belleville, Deseronto and Bayside drinking water supplies, and
- No safe level exceedences of trihalomethane in Bay of Quinte drinking water at the noted DWSP sites.

At present, water treatment plant operators do not collect the information. In these cases, new information must be collected to meet Bay of Quinte RAP delisting requirements.

To address data gaps, six options are noted.

- MC#2 – Option 1 – To address IBU #7 – Restrictions on Dredging Activities, existing surveillance programs such as Great Lakes Surveillance and MOE Project Trackdown and could be expanded to include new actions for the Bay of Quinte.

Great Lakes Surveillance undertakes monitoring of the Great Lakes water quality on a rotational schedule (e.g., Lake Ontario once every four years). During the Lake Ontario monitoring year, a broader intensive program could be scheduled to target sediment contaminants specific to the Bay of Quinte or at suspected “hot spot” sites throughout the Bay of Quinte.

Project Trackdown is looking for areas of PCB contamination at three Great Lakes sites, including one in eastern Lake Ontario at Kingston. A similar action in the Bay of Quinte may provide information to support a delisting assessment for contaminated sediments and toxic contaminants.

- MC#2 – Option 2 – OMNR fish and wildlife monitoring programs (e.g., 2000 Natural Heritage Information Centre (NHIC) *Odonate* (dragonfly and damselfly)

and herpetofaunal (amphibian and reptile) surveys; OMNR Species at Risk) could be expanded within the Bay of Quinte region to offer new information.

While adequate information about fish in the Bay of Quinte may exist, information about wildlife species and habitats may be lacking. Data the NHIC in Peterborough needs to be examined, and where applicable, additional wildlife monitoring completed.

- MC#2 – Option 3 – Seek partnership support to introduce new monitoring actions

Option 3 requires input from Governments of Canada and Ontario to implement new, short-term monitoring actions specific to Bay of Quinte RAP delisting targets.

- MC#2 – Option 4 – Develop a common reporting form for ongoing and future Bay of Quinte monitoring.

A simple, standardized electronic reporting form may help ensure adequate data are provided. In particular, a standardized form may encourage collection of data relative to IBU #9 – Restrictions on Drinking Water or Taste and Odour Problems.

- MC#2 – Option 5 – Introduce new community-based wildlife monitoring programs.

As noted, wildlife information may be limited in the Bay of Quinte area. Some community-based monitoring programs have been used in the Bay of Quinte area (e.g., Marsh Monitoring, Frog Watch, Christmas Bird Counts, Lake Sturgeon). In 2001, the Bay of Quinte RAP Community Wildlife Monitoring Program was introduced with 150 local volunteer wildlife monitors. The program has established a local monitoring team of 150 volunteers while encouraging managers of federal programs to actively build on Quinte information and offer support to local monitoring efforts. Other areas, such as the St. Lawrence (Cornwall) RAP have successfully introduced a wider range of community-based wildlife monitoring (e.g., hawks and other birds of prey, endangered species of bird). New community-based wildlife monitoring could be introduced for the Bay of Quinte to provide information in areas not presently monitored.

- MC#2 – Option 6 – Design and implement new monitoring actions specific to Bay of Quinte RAP delisting requirements

The Bay of Quinte RAP Restoration Council may need to undertake its own monitoring to provide new data. For example, an intensive tributary monitoring program may be required to assess the impact of watershed-based restoration actions on water quality in the Bay of Quinte.

### **B.1.3 - Site-specific or Action-specific Monitoring Requirements**

Site-specific or action-specific monitoring has limited value for the Bay of Quinte RAP delisting review since most Bay of Quinte RAP delisting targets are related to water quality parameters measured as part of the larger Bay of Quinte ecosystem. As such,

monitoring information from specific restoration projects (e.g., rehabilitation of shoreline, industrial site restoration) may not provide data of sufficient resolution for delisting. At the same time, site-specific monitoring may be required to obtain information for efforts targeting certain subwatershed areas of the Bay of Quinte. For instance, IBU #7 requires “zero exceedences due to local input sources of Provincial Dredge Spoil Disposal Guidelines for the parameters listed in the Bay of Quinte RAP Stage 2 Report at depths for those area that are being dredged or may be considered for dredging.” A detailed assessment is needed for these restoration actions to determine whether the Bay of Quinte RAP delisting targets have been realized.

- MC#3 – Option #1 – Identify sites for monitoring and undertake site specific monitoring as needed.

Monitoring is needed in the targeted areas (e.g., areas of dredging, offshore of the Bakelite property). The Bay of Quinte RAP Restoration Council can either implement its own site monitoring (e.g., in-house staff, external professional contractor) or work with the site owner/operator to ensure Bay of Quinte RAP monitoring needs are realized. As its initial step, the Bay of Quinte RAP Restoration Council may wish to document and prioritize sites for detailed monitoring.

#### **B.1.4 – Expansion of Existing Monitoring Programs**

This category seeks to modify and enhance existing Government of Canada and Ontario monitoring programs to secure more precise information related to a Bay of Quinte RAP delisting review. From the programs reviewed in Part A, this category will likely represent a significant new investment of Bay of Quinte RAP Restoration Council human and financial resources. Monitoring Category #4 does not include collecting and reformatting information as noted in Monitoring Category #1. Rather, this category expands existing monitoring efforts to collect additional information to meet Bay of Quinte RAP delisting requirements.

Monitoring Category #4 pertains primarily to IBU #7 – Restrictions on Dredging Activities and IBU #14 - Loss of Fish and Wildlife Habitat. For IBU #7, the delisting target is “measure zero exceedences due to local input sources of Provincial Dredge Spoil Disposal Guidelines (PDS DG) for the parameters listed in the Bay of Quinte RAP Stage 2 Report at depth for those areas that are being dredged or may be considered for dredging.” An IBU #14 delisting target is “through wildlife monitoring programs, demonstrate that key indicator species for coastal and upland wetlands and existing forests are present and in significant numbers to be self-sustaining.” From the initial review in Part A, it appears additional and enhanced monitoring actions are needed.

The environmental monitoring programs in this category also include Sport Fish Contaminant Monitoring, Great Lakes Surveillance, Wildlife Watchers, PWQMN, DWSP, MUMP and Hastings-Prince Edward Health Unit beach monitoring. These programs provide some information, but they do not address the full suite of Bay of Quinte RAP delisting needs. The Great Lakes Surveillance Program, the four-year cycling period may not provide enough temporal data to define changes or trends for a short term delisting assessment. Wildlife Watchers information may be limited by the number of sampling transects and sites monitored. PWQMN may provide inadequate watershed coverage to address a broad range of Bay of Quinte RAP delisting requirements. The

Bay of Quinte RAP Restoration Council may require other targeted fish species to be analyzed by the Sport Fish Contaminant Monitoring program.

The supplementary actions by the Bay of Quinte RAP Restoration Council will likely depend on the program (e.g., scope, parameters tested, resources available to “lead” agency, Bay of Quinte RAP requirements). Six options are listed.

- MC#4 – Option 1 – Request expansion of monitoring programs on a needs basis

Programs such as Great Lakes Surveillance Program and PWQMN are equipped and available to undertake additional work upon request (e.g., PWQMN’s Enhanced Tributary Monitoring Program).

- MC#4 – Option 2 – Enhance existing community-based monitoring actions

Programs such as Wildlife Watchers rely heavily on volunteers to collect field information. To meet its needs, the Bay of Quinte RAP Restoration Council could encourage and support the expansion of existing community-based monitoring activities while employing the partnership support, data management techniques and professional expertise of groups such as Wildlife Watchers. An example in this regard is the Quinte Conservation Watershed Watch program.

- MC#4 – Option 3 – Provide technical support to local partners

Municipal operators oversee monitoring activities and collect quality information related to parameters of programs such as DWSP and MUMP. For some Bay of Quinte RAP delisting needs, additional monitoring efforts and new monitoring parameters may be required. Likewise, additional resources will be required to introduce new monitoring requirements to the Hastings-Prince Edward Health Unit beach monitoring activities. The Bay of Quinte RAP Restoration Council may wish to evaluate each program and devise a plan to secure the required information.

- MC#4 – Option 4 – Design and implement monitoring actions specific to Bay of Quinte RAP delisting requirements that enhance existing monitoring

The Bay of Quinte RAP Restoration Council may need to implement its own monitoring to supplement existing data collection programs and ensure its data needs are met. For example, the MOE tributary monitoring program may not provide data resolution at a level to meet Bay of Quinte RAP needs. In some cases, local action may expedite the collection of information.

- MC#4 – Option 5 – For data collected but not specific to Bay of Quinte RAP needs, the options are similar to Monitoring Category #1 (e.g., allocating Bay of Quinte RAP Restoration Council staff, securing information from owners and partners, contracting for external professional support).

Using IBU #9 – Restrictions on Drinking Water or Taste and Odour Problems as an example, drinking water quality information is collected routinely by the operators of water treatment facilities. In partnership with the operators, the Bay

of Quinte RAP Restoration Council could develop a common reporting format that effectively expands the existing monitoring efforts in a manner useful for Bay of Quinte RAP delisting needs. An external contractor could develop the report form, Bay of Quinte RAP Restoration Council could input historic data and provide training to operators for future reporting, MOE could offer data interpretation services, and water treatment operators could input future information on a predetermined reporting schedule

- MC#4 – Option 6 – Review relevancy of delisting target

It may be impractical to collect information. In such instances, The Bay of Quinte RAP Restoration Council may wish to readjust the delisting target, eliminate the target, or set a schedule and preferred methodology for collecting the relevant information.

### **B.1.5 – Update Monitoring Information / Repeat Previous Studies**

Work in Monitoring Category #5 falls under two groupings: (1) providing support to complement the monitoring and research activities of Project Quinte, and (2) repeating previous studies to provide updated information. Previous studies may include LaMP's large volume tributary water sampling, the tumours in fish assessment and sediment assessment work completed recently by the Bay of Quinte RAP Restoration Council and partners using a BEAST protocol.

- MC#5 – Option 1 – Support Project Quinte

For Group #1, Project Quinte provides an extensive range of vital ecological information about the Bay of Quinte ecosystem. Many of the Bay of Quinte RAP delisting targets have direct links to the Project Quinte long term monitoring information and databases. The Bay of Quinte RAP Restoration Council should recognize the substantial Project Quinte contribution and consider practical efforts to support relevant Project Quinte monitoring actions.

- MC#5 – Option 2 – Update previous research

As noted, Group #2 includes a number of different monitoring actions. Some actions have provided pre-restoration comparative data. For example, the LaMP tributary monitoring work in the Trent River provided information pertaining to contaminant loadings entering the Bay of Quinte from the Trent River watershed. (Boyd and Biberhofer, 2000). In other cases, results were inconclusive. For example, the 1995 fish tumour assessment work could not explain the rate of tumour occurrences in walleye in the Bay of Quinte (Environment Canada, unpublished). The information is needed to address IBU #4 – Fish Tumours and Other Deformities delisting criteria "...Type, frequency and occurrence of tumours in Bay of Quinte walleye does not exceed significantly the type, frequency and occurrence of tumours in walleye of similar age and comparable population in the selected control site...that is, the background and normal levels of type, frequency and occurrence of tumours in fish elsewhere." In a third area, new projects have been completed including the 2000 BEAST monitoring work. The BEAST work included a preliminary assessment of sediment quality in the Bay of Quinte in relation to benthic organisms. The information needs to be

evaluated in terms of Bay of Quinte RAP requirements and, if needed, repeated to provide updated information for delisting.

The Bay of Quinte RAP Restoration Council may need to review the past research actions and, if needed, repeat the action to address any outstanding concerns (e.g., contaminants in fish, changes in tributary loads of contaminants, new sediment quality information). Options for action include

- direct actions by the Bay of Quinte RAP Restoration Council,
- expanded monitoring work by partners such as Project Quinte,
- Bay of Quinte RAP Restoration Council partnership with original researchers such as LaMP and BEAST,
- external contractors to repeat the research activities, and
- a combination of these suggested options.

### **B.1.6 – Incorporate Data from Less Relevant Government of Canada and Ontario Actions**

Monitoring Category #6 represents the assessment and possible incorporation of relevant information from activities such as the Government of Canada Pulp and Paper Regulations, DFO's Ecopath project, the Deloro Mine Site Rehabilitation monitoring work, and possibly, EMAN. The relevance of these projects to the Bay of Quinte RAP delisting requirements should be determined.

As suggested in Monitoring Category #1, the Bay of Quinte RAP Restoration Council has four options to complete work in this category. The positive and negative aspects of these options are noted in the outline for Monitoring Category #1; the aspects also apply to this category.

- MC#6 – Option 1 -- Bay of Quinte RAP Restoration Council staff completes the work as an internal review action (e.g., assesses the relevancy of the data and, where required, collects and collates the information in a common reporting format).
- MC#6 – Option 2 -- Bay of Quinte RAP Restoration Council requests that the "owners" of the different databases assess the relevancy of the data to Bay of Quinte RAP delisting needs and, where relevant, organize and interpret the data. The Bay of Quinte RAP Restoration Council staff will support the work by providing direction, providing a common reporting format and consolidating the information.
- MC#6 – Option 3 -- The Bay of Quinte RAP Restoration Council uses financial resources to contract an external professional to assess the relevancy of the data and, where required, collects and collates the information in a common reporting format.
- MC#6 – Option 4 - The Bay of Quinte RAP Restoration Council employs a combination of Options 1–3.

### **B.1.7 – Public Engagement and Results Communication**

Monitoring Category #7 has two requirements: (1) providing opportunities for active public involvement and (2) addressing concerns if monitoring does not meet public expectations or fails to highlight ecosystem changes.

- MC#7 – Option 1 – Active public monitoring

A number of activities offer opportunities for public input. The activities include:

- wildlife monitoring by local groups as the Quinte Field Naturalists and “Friends of...”, and government sponsored groups such as Wildlife Watchers,
- tributary monitoring by landowner and property associations such as Cold Creek, Rawdon Creek, Palliser Creek and Wilton Creek, and
- fish monitoring such as OMNR’s Lake Sturgeon Watch effort
- the ongoing MOE Self-Help lake monitoring program.

- MC#7 – Option 2 – Public review of monitoring information

The Bay of Quinte RAP Restoration Council presently shares information with QWC to ensure public review of RAP plans and activities. This arrangement has been proven successful for past undertakings. As a minimum, the arrangement should be maintained and expanded to include QWC review and comment to Bay of Quinte RAP monitoring actions, preliminary findings and final results.

As an extended option, the Bay of Quinte RAP Restoration Council could seek other local groups to either (1) provide ongoing review similar to QWC or (2) offer input as a participating party or stakeholder to site and action specific monitoring.

Finally, public-at-large comments may be desired regarding a final delisting evaluation. At the appropriate time, the Bay of Quinte RAP Restoration Council may wish to consider a public comment session to run concurrent with the more technical delisting review.

- MC#7 – Option 3 – Communicating outcomes

To communicate outcomes, the Bay of Quinte RAP Restoration Council may wish to coordinate its annual monitoring plans and results with a short communication action. The communication work will describe the objectives, timing and limitations of the monitoring plans, plus highlight findings and offer explanations, where possible.

## **B.2 Short-term Bay of Quinte RAP Restoration Council Monitoring Actions**

This section identifies four monitoring activities that should be completed in the short-term (e.g., present fiscal year) to help determine needs and design appropriate monitoring actions. The suggested short-term activities are:

- collecting, reviewing, assessing and reformatting existing monitoring information,
- seeking to expand existing or alter monitoring efforts, where required,
- planning new monitoring efforts for lacking information, and

- communicating plans to partners, stakeholders, potential implementers and the public.

### **B.2.1 Assess and Reformat Existing Monitoring Information**

As noted, many of the parameters listed as Bay of Quinte RAP delisting targets are collected within other government and stakeholder monitoring programs. As its initial monitoring step, the Bay of Quinte RAP Restoration Council needs to evaluate this information relative to its delisting requirements. The work has been identified as Monitoring Category #1, and it represents the bulk of the Bay of Quinte RAP monitoring effort. To provide direction, Monitoring Category #1 work should commence as quickly as possible.

### **B.2.2 Design Actions to Expand Existing Monitoring**

Opportunities exist to expand existing Government of Canada and Ontario monitoring actions. Per Monitoring Category #4, examples include Ontario's PWQMN and the federally-provincially shared Great Lakes Surveillance Program. The Bay of Quinte RAP Restoration Council may wish to immediately pursue any opportunity to enhance environmental monitoring in the area. The action would ensure that information presently determined to be insufficient for a delisting review for some parameters is collected, and at the same time, highlight new monitoring actions that the Bay of Quinte RAP Restoration Council may wish to consider (e.g., information needed but no enhanced monitoring actions forthcoming).

In some instances, data have been collected for purposes other than the Bay of Quinte RAP. For example, information about drinking water quality is collected routinely by plant operators to safeguard drinking water supplies. However, the information may not be useful for a Bay of Quinte RAP delisting assessment. The Bay of Quinte RAP Restoration Council may wish to consider actions that alter monitoring methods (e.g., collection methodologies, reporting format) to ensure its needs are met by the existing sampling and monitoring work.

### **B.2.3 Identify Potential Data Gaps and Design Programs to Collect New Information**

If information has not been collected to meet delisting needs, new monitoring may be required. New monitoring needs should be identified and appropriate responses prepared from work completed as Monitoring Category #1.

### **B.2.4 Communicate Plans**

As part of the RAP process, monitoring plans and findings should be communicated to partners, stakeholders, implementers and the public. Communication of monitoring activities can be part of the larger, ongoing Bay of Quinte RAP communication and outreach initiatives.

## **B.3 Preliminary Cost Estimates for Some of the Short-term Monitoring Actions**

Preliminary cost estimates for some of the short-term monitoring actions have been provided. Costs were determined by:

- reviewing effort (e.g., time and human resources dedicated to a project) and total project cost from past Bay of Quinte RAP research and monitoring projects,

- estimating the effort required for completing the suggested monitoring actions,
- prorating the project costs from previous studies to the suggested actions, and
- adjusting the cost by adding an additional 15% to cover potential unknown and unexpected costs.

Four other assumptions were used.

- All or part of the tasks will be contracted to an external professional firm.
- Total cost of any work would be similar for in-house or external processes although actual financial savings would be realized by in-house actions (e.g., in-kind contributions of office space, telephone, computers, photocopying).
- Stakeholder and partner in-kind contributions (e.g., in-house human resources to support data collection, interpretation and reformatting), while significant, are not included in the cost estimates.
- Item B.2.4 – Communicate Plans is completed as an in-house exercise. The existing Bay of Quinte RAP communication staff would develop products. The information is also linked to ongoing communication actions. For example, general monitoring information could be presented electronically on the existing web pages of Quinte Conservation, Lower Trent Conservation and Great Lakes Information Management Resource (GLIMR). As well, yearly monitoring work and results could be summarized in Bay of Quinte RAP press releases and newsletters, presented at joint Bay of Quinte RAP – QWC workshops and public open houses, and printed in the Project Quinte Annual Report. In this way, resource costs are minimized.

The costs are preliminary estimates. Degree of effort and anticipated final product(s), as determined by the Bay of Quinte RAP Restoration Council, will impact and establish the final cost for each monitoring action.

The estimated total cost for Items B.2.1 to B.2.4 is \$26,000. The breakdown of cost per item and the approximated effort for item are outlined in Table 7.

Table 7. Preliminary Effort and Cost Estimates for Short-term Monitoring Actions

Item	Action Title	Approximated Effort (Days)	Estimated Cost (\$,000.)
B.2.1	Assess and Reformat Existing Monitoring Information	40	15
B.2.2	Design Actions to Expand Existing Monitoring	10	4
B.2.3	Identify Potential Data Gaps and Design Programs to Collect New Information	10	4
B.2.4	Communicate Plans	N/A	1
Total		60	26

## B.4 Schedule

A schedule for monitoring actions is provided. The schedule is presented in a practical and easy-to-read table format. It also offers achievable timelines.

The suggested schedule has seven initial priorities (including the four monitoring actions noted in Section B.2):

- reviewing existing data,
- identifying needs,
- building partnerships,
- providing direction and leadership,
- undertaking projects to supplement and enhance existing monitoring actions,
- designing new actions to provide missing information, and
- reporting results.

As listed, timing is suggested for each Bay of Quinte RAP Monitoring Category. The schedule for monitoring actions is provided in Table 8.

Table 8. Possible Schedule for Bay of Quinte RAP Monitoring Actions

<b>Monitoring Category</b>	<b>Type of Work Needed</b>	<b>Suggested Timing of Action</b>
#1 – Incorporate Date from Major Government of Canada and Ontario Environmental Databases	Undertaking an effective review of programs has five steps: <ul style="list-style-type: none"> <li>• Reviewing existing data</li> <li>• Consolidating relevant data</li> <li>• Interpreting information</li> <li>• Reporting on findings</li> <li>• Identifying additional requirements</li> </ul>	2002 2002 2003 2003 2003
#2 – No Data	Undertaking new actions includes: <ul style="list-style-type: none"> <li>• Working with water treatment plant operators to secure and assess data for a delisting review IBU #9</li> <li>• Working with municipalities to evaluate Official Plans relative to IBU's #3 and #14</li> <li>• Assessing key indicator species for Bay of Quinte RAP wildlife delisting needs</li> <li>• Expanding Project Trackdown to determine extent and, if any, sources of PCB contamination</li> </ul>	2003  2003 2004 2004
#3 – Site-specific or Action-specific Monitoring	<ul style="list-style-type: none"> <li>• Evaluating targets in other areas mapped by NHS work</li> </ul>	2004



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