St. Clair River

REMEDIAL ACTION PLAN

The St. Clair River Area of Concern

IMPLEMENTATION ANNEX 1997

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EXECUTIVE SUMMARY

The St. Clair River Stage 1 Remedial Action Plan (RAP) was released in 1991. This document served to define the environmental status of the St. Clair River Area of Concern (AOC) by means of summarizing the results of monitoring carried out by government, corporate, academic, and private agencies and stakeholders. The resulting information provided a "snapshot" of environmental conditions which were assessed against benchmarks defined by the Great Lakes Water Quality Agreement .

The second "stage" of the RAP process defined water use goals, remedial measures and an implementation strategy for addressing problems identified in the Stage 1 RAP. The *Stage 2--Recommended Plan* document for the St. Clair River RAP was released in 1995, and included the definition of and a schedule for specific remedial goals and actions, the identification of agencies/organizations responsible for specific actions, and the definition of processes for evaluating the effectiveness of remedial measures and monitoring programs.

The implementation phase of the RAP remains ongoing, with the multi-agency RAP Implementation Committee (RIC) and St. Clair River Binational Public Advisory Council (BPAC) working to ensure that remediation efforts continue to move forward.

Significant progress has been made in the implementation of the St. Clair River RAP. Readers of the *Stage 1 1997 Update* document released concurrently to this annex will note that 2 of the 9 impairments of beneficial uses identified as impaired in the *Stage 2--Recommended Plan* document have changed status to "not impaired", based solely on improving conditions; a third impairment has been reclassified and is no longer considered impaired but requires further site-specific assessment. In addition, the issue of "tainting of fish and wildlife flavour", which had been classed as "requiring further assessment on a site-specific basis", has been reassessed as "not impaired" based on the results of additional study.

These significant improvements are the direct consequence of the reduction in frequency and size of spills from industrial facilities in Ontario and Michigan and have resulted in the achievement of a critical delisting criteria necessary for the removal of the St. Clair River from the list of Great Lakes Areas of Concern.

Readers of the *Stage 1 1997 Update* document will also note marked progress towards achievement of the remaining delisting criteria and the restoration of other impairments of beneficial uses.

The implementation measures and commitments to future improvements reported on in this annex document represent tens of millions of dollars of environmental remediation expenditures and significant effort on the part of the industrial sector, municipal, state, provincial, and federal government agencies, and numerous non-governmental agencies and individual stakeholders. These efforts also include pollution prevention, control, and education measures not specifically called for in the RAP.

The intent of this document, entitled *Implementation Annex 1997 (*which is a companion document to the *Stage 2--Recommended Plan*--together they constitute a complete Stage 2), is to:

- provide an update on the implementation measures carried out to date
- measure progress on the actions recommended in the Stage 2 document
- summarize the commitments to future actions made by involved agencies/organizations

This document outlines the implementation strategy for the St. Clair River RAP, describes the specific implementation actions recommended, and summarizes the formal government and local implementor's responses to the recommended actions.

This document further summarizes all of the RAP implementation measures carried out to date, as communicated to the RAP Coordinator by the responsible agency/organization and presents commitments to future activities. Finally, also summarized herein is the progress made to date towards achieving the delisting criteria and the restoration of impairments of beneficial use**s.**

St. Clair River Area of Concern
Remedial Action Plan--Implementation Annex--1997

1.0 INTRODUCTION

1.1 IMPLEMENTATION STRATEGY

In March 1995, the *Stage 2--Recommended Plan* for the St. Clair River Area of Concern (AOC) was released. This plan identified the water use goals, remedial measures and an implementation strategy to restore the Impairments to Beneficial Uses identified by Great Lakes Water Quality Agreement (GLWQA) for the St. Clair River AOC. It presented a framework for restoring the environmental integrity of the river and recommended preventative actions to reach these goals.

Following the release of the document, and as part of the implementation phase, subsequent steps were identified as:

- prioritizing actions that will clearly lead to removal of impairments
- obtaining commitments (including funding) from those responsible and proceeding with carrying out the priority actions listed in the *Stage 2-- Recommended Plan* document
- further refining plans for those areas where the remedial actions have not yet been fully developed

This Implementation Annex is intended to take stock of remedial measures implemented to date (Fall 1997) and measure progress according to the actions recommended in the *Stage 2-- Recommended Plan* document, based on comments and data received by the RAP Coordinator at the time of reporting. It is a companion document to the *Stage 1 1997 Update* document released concurrently, which summarizes all data and information on water, sediment, and biota quality released since the *St. Clair Remedial Action Plan Addendum* (to the Stage 1 Problem Definition document) was released in 1993. The *Stage 1 1997 Update* summarizes ambient and point source data, indicates overall trends, and re-evaluates each of the 14 impairments to beneficial uses.

The *Stage 2--Recommended Plan* identified 9 impairments to beneficial uses that required remedial actions to ensure their delisting as impairments and eventual removal of the AOC designation to the St. Clair River. The impairments included:

1. Restrictions on fish consumption.
2. Bird or animal deformities or reproductive problems.
3. Dynamics of benthic populations/communities.
4. Restrictions on dredging activities.
5. Restrictions on drinking water consumption, or taste and odour problems.
6. Beach closings.

7. Degradation of aesthetics.
8. Added cost to agriculture or industry.
9. Loss of fish and wildlife habitat.

The results of the summary and evaluation of environmental conditions presented in the *Stage 1 1997 Update* document indicate that real progress is being made towards delisting of impairments of beneficial uses in the St. Clair River AOC. This progress is the result of improving conditions, which in turn can be attributed to the implementation of remedial actions and activities recommended by the RAP, compliance with relevant state, provincial, and federal pollution regulations and guidelines, as well as to general voluntary pollution abatement initiatives.

Actions implemented within the AOC have resulted in the delisting of 2 out of 9 impairments of beneficial uses:

- Restrictions on drinking water consumption, or taste and odour problems
- Added cost to agriculture or industry.

The rationale and explanation for these changes are discussed fully in the companion 1997 update report. In addition, the impairment relating to bird and animal deformities or reproductive problems has been reclassified from “impaired” to “requires further study on a site-specific basis”, based on the reassignment of the original evidence used to identify this impairment (chironomid mouth part deformities) to “dynamics of benthic populations/communities”. In addition, the impairment relating to tainting of fish and wildlife flavour, which had been classed as “requiring further assessment on a site-specific basis”, has been reassessed as “not impaired” based on the results of additional study.

1.2 RECOMMENDED ACTIONS

The *Stage 2-- Recommended Plan* document listed a total of 46 Issues/Actions requiring implementation for purposes of ensuring the delisting of all Impairments to Beneficial Uses and the eventual removal of the AOC designation. These actions were grouped according to point source (16), non-point source (12), sediment (3), habitat (7), public education and outreach (2), monitoring and research (4), and RAP implementation (2). Specific actions, responsible agencies or industrial/municipal facilities, and targeted completion dates are shown in Table 1. This table is taken directly from the *Stage 2-- Recommended Plan* document.

Many of the actions recommended in the *Stage 2--Recommended Plan* have been acted on since the release of that document in 1995. Of the point-source actions, 13 of 16 have been acted on; of non-point source actions, 7 of 12; and of actions pertaining to sediment, habitat, public education

and outreach, monitoring and research, and RAP implementation, all have been acted on to varying degrees. These actions have been summarized by agency/facility in Section 2 and Table 2 of this document.

Table 1. Summary of significant actions, responsible agencies or facilities, and completion date (by task) for implementation of the St. Clair RAP. Agencies/facilities noted are those with primary responsibility and are not meant to be all-inclusive with regard to funding sources. Shaded areas identify priority action items.

ISSUE/ACTION	AGENCY/FACILITY	COMPLETION DATE FOR SPECIFIC ACTIONS (*)
POINT SOURCE		
Persistent and bioaccumulative substances	Cole Drain; Dow; Corunna WPCP; Ethyl; Port Huron WWTP; Sarnia WPCP; St. Clair WWTP	1995 -determine whether levels fall above or below yardstick
		2000 -meet yardstick 2004 -virtually eliminate from discharge
Persistent (potentially bioaccumulative) substances	Dow; Ethyl; Corunna WPCP; Esso Petroleum; Novacor Petroleum; Sarnia WPCP; Shell Canada; Suncor	1995 -determine whether levels fall above or below yardstick
		2000 -meet yardstick at end of pipe
Persistent parameters (not bioaccumulative)	Sarnia WPCP	2000 -meet yardstick at edge of mixing zone
Non-persistent, non-bioaccumulative substances	Ethyl; Esso Petroleum; Marysville WWTP; Polysar; Port Huron WWTP; Sarnia WPCP	2000 -meet yardstick at edge of mixing zone
Source discharges of coliform bacteria	MDEQ (CSOs); all WPCPs and WWTPs; municipalities	2000 -50% reduction from Sarnia WPCP 2000 -all WPCP/WWTP effluents disinfected
		2005 -completely eliminate from Sarnia WPCP
CSO elimination	Port Huron WWTP; Marysville WWTP; Sarnia WPCP	2001 -Marysville 2005 -Port Huron and Sarnia
Point source discharges to air	RIC; all sources; EPA	1994/95 -inventory of atmospheric releases for all yardstick substances 1996 -develop means to define impacts
Eliminate spills	all point sources	2000
Pollution prevention/toxics release plan	all point sources not meeting yardsticks	December 1995

ISSUE/ACTION	AGENCY/FACILITY	COMPLETION DATE FOR SPECIFIC ACTIONS (*)
Setting new yardsticks and adjusting existing (as required)	MDEQ; OMOE	ongoing
Develop discharge permits on the basis of discharges already approved or under application and assess total mass loadings to the river	MDEQ; OMOE	ongoing
Develop whole plant permitting system	MDEQ; OMOE	1994 and ongoing
Elimination of all discharges/leachate to Cole Drain	all relevant point sources	2004
Small business toxic reduction education	OMOE; MDEQ; Environment Canada	1993 and ongoing
Assess storm water impacts	all facilities; MDEQ; EPA	1997/99 -Ontario 1995/96 -Michigan
Zero discharge	all point sources	To be determined - ongoing
NON-POINT SOURCE		
Watershed/subwatershed management plans	MDEQ; OMOE; OMNR; EPA; Environment Canada; USDA/SCS	1997 -draft Ontario and Michigan watershed plans
Urban runoff for new developments	municipalities; developers	1994 -enforce bylaws re on-site pollution control 1995 -maintain natural areas 2000 -maintain pre-development hydrography
Urban runoff for existing developments	municipalities; developers	2000 -construct on-site controls to remove pollutants
Link urban/rural stormwater control through subwatershed plans	municipalities; Conservation Authorities	1994 and ongoing

ISSUE/ACTION	AGENCY/FACILITY	COMPLETION DATE FOR SPECIFIC ACTIONS (*)
Reduce use of road salt and seek alternatives	transport agencies in Ontario and Michigan; MDEQ; OMOE; municipalities/local gov'ts	1994 and ongoing
Reduce use of lawn fertilizers and pesticides	residents; municipalities	1994 and ongoing
Promote agricultural programs and technology to reduce contamination to rural runoff	OMAF; MDEQ; Agriculture Canada; MDA; USDA/SCS	ongoing since 1993
Protect existing natural areas and undertake remedial measures	OMOE; OMNR; MDEQ; local gov'ts; conservation authorities	1993 and ongoing
Improved waste site planning and management	OMOE; MDEQ; municipalities	5 year phase in -incentives for disposal of wastes; implement pollution prevention measures 1993 and ongoing -sites only accept waste they are designed to handle; secure monies to avoid abandonments; ensure proper closing of all bore holes and wells 1994 -BAT for new waste sites; up-to-date inventory of sites and site condition; licensed/insured/bonded haulers 1995 and ongoing -improved accountability of waste disposal practices; properly cap closed sites; determine extent of contamination of existing sites; monitor site conditions and shallow groundwater 2000 and ongoing -mitigate and remediate contaminated groundwater
Identify problems relating to domestic sanitary sources and ensure proper maintenance/repair	municipalities; residents; public health authorities	1993 and ongoing

ISSUE/ACTION	AGENCY/FACILITY	COMPLETION DATE FOR SPECIFIC ACTIONS (*)
Correct direct discharges of untreated grey water	municipalities; OMOE; MDEQ; U.S. and Canadian coast guards	1994 and ongoing
Proper use and disposal of household hazardous wastes and product substitution / education	municipalities; residents	1994 and ongoing

ISSUE/ACTION	AGENCY/FACILITY	COMPLETION DATE FOR SPECIFIC ACTIONS (*)
SEDIMENT		
Complete sediment characterization studies	OMOE; LIS; Environment Canada; Geological Survey of Canada; EPA; SEMI; MDEQ; USACOE	1994/95 -OMOE/LIS sediment characterization study 1995 -Priority 1 Zones follow-on sediment characterization studies 1995 -review study of sediment transport mechanisms
Undertake in-situ pilot scale remediation	OMOE; LIS; Environment Canada; USACOE	1996 -begin pilot studies
Develop final remedial strategy	OMOE; LIS; Environment Canada; USACOE	1998
HABITAT		
Develop and implement communications/education program and appropriate landowner guidelines	RIC; BPAC; EPA; MDEQ; Environment Canada; OMNR	1995 and ongoing
Strengthen wetland protection measures	Ontario and Michigan legislatures; Environment Canada; EPA	1995 and ongoing
Reduce ship wakes and surges and minimize impacts from winter shipping	U.S. and Canadian coast guards; MDEQ; USACOE; USFWS	1994 and ongoing
Ensure protection of shorelines from erosion and protect/enhance/restore other natural habitats in watershed	MDEQ Surface Water Quality Division--Non-Point Source Program; USDA Natural Resource Conservation Service (Soil Conservation Service); OMNR; landowners; conservation agencies	1994 and ongoing
Control/eradicate exotic species	OMNR; MDEQ	1994 and ongoing
Undertake habitat restoration and enhancement measures	OMNR; OMOE; MDEQ; RIC; conservation agencies; Environment Canada; EPA	1994 and ongoing -maximize fish use of delta habitats; encourage maintenance/enhancement of riparian vegetation; implement candidate sites projects; expand candidate sites in Ontario and Michigan

ISSUE/ACTION	AGENCY/FACILITY	COMPLETION DATE FOR SPECIFIC ACTIONS (*)
		1994 - Stag Island restoration; develop combatable mapping for Ontario and Michigan; acquire Harsens Island property; improve co-ordination among conservation & protection agencies; expand list of special status species
Develop long-term habitat management plan	OMNR; MDEQ; EPA; Environment Canada; all conservation agencies	2000 - develop a long-term habitat management plan for both Ontario and Michigan; plan will include a GAP analysis that assess needs related to maintain wildlife diversity and integrity
PUBLIC EDUCATION AND OUTREACH		
Develop and implement public involvement program	RIC; BPAC	1994 and ongoing
Develop and implement public outreach and education programs	RIC; BPAC	1994 and ongoing
MONITORING AND RESEARCH		
Develop detailed monitoring workplans	RIC; BPAC	1995
Complete GIS analytical spatial database	RIC	1994
Implement monitoring programs and update GIS database	RIC; LIS; all agencies	1994 and ongoing
Acquire additional information to improve modelling accuracy	OMOE; MDEQ	1994 and ongoing

(*) Contingent on emerging information and RAP priorities.

1.3 FORMAL RESPONSES TO RECOMMENDED ACTIONS

1.3.1 Provincial Government

The formal response on behalf of the provincial government regarding the St. Clair River RAP *Stage 2-- Recommended Plan* document was provided in June 1997 by way of a letter from the Minister of Environment and Energy (the Honourable Mr. Norman W. Sterling) to the Canadian Co-Chair of BPAC (Mr. Bob Lalonde) (OMOE 1997a). In the letter, the Minister noted that:

> *The Province of Ontario recognizes and supports the goals and desired beneficial uses of the St. Clair River Remedial Action Plan (RAP) as stated in the Stage 2 Recommended Plan, Water Use Goals, Remedial Measures and Implementation Strategy. The Province agrees that the strategy detailed in the report is sound and will result in the attainment of the environmental goals and the eventual delisting of the St. Clair River as an Area of Concern.*

However, the Minister also noted that the Province did not concur with 3 of the recommendations as stated: 1) additional treatment of segregated storm sewers should their effluent exceed 200 counts of *E. coli*/100 ml; 2) not permitting any increases in total loadings of substances of concern to the river or its tributaries; and 3) the continuation and enhancement of public outreach projects already initiated. Each of these were specifically addressed and alternative actions were highlighted for the first 2. The province concurred, in principal, with all other recommendations.

The response noted that over $18 million had already been contributed by the Province for the implementation of actions in the St. Clair River AOC. Each of the point source and non-point source recommendations were addressed in a tabular format with specific comments principally expanding on the recommendations and providing information on existing provincial requirements.

1.3.2 Federal Government

In July 1997, the Government of Canada released its formal response to the St. Clair River RAP *Stage 2--Recommended Plan* document (Government of Canada 1997). This response compiled responses from each of the affected departments: Environment Canada, Health Canada, Department of Fisheries and Oceans, Agriculture and Agri-Food Canada, Transport Canada, and Industry Canada.

The federal response also included a statement supporting the overall goals and objectives outlined in the *Stage 2--Recommended Plan.* Specifically, the government's response was as follows:

> *The federal government supports the goals and objectives set forth in the St. Clair River Stage 2 Recommended Plan. It is also of the view that the recommendations contained in the plan accurately identify the remedial actions necessary for restoring the impaired*

beneficial uses, and that appropriate criteria have been set forth for determining when delisting should occur.

The federal document also provided detailed responses to each of the recommended actions for which the federal government was either identified as an implementing agency, or to which federal monies had been provided to support other agencies, organizations, or industries in acting on the recommendation. Each specific response is summarized in Section 2 of this report.

2.0 SUMMARY OF RAP IMPLEMENTATION MEASURES TO 1997

This section reviews information provided from companies, agencies, and municipalities which were identified in Table 1 as responsible for the implementation of defined actions. The information is presented according to point source (2.1), non-point source (2.2), sediment (2.3) and habitat (2.4) actions, with Ontario facilities, agencies, and municipalities listed first followed by those from Michigan.

All actions undertaken, ongoing, or identified as a future commitment are summarized for each facility, agency, or municipality that provided information to the RAP Coordinator. Each summary is supported by a reference to the source memorandum, report, or document from which the information was derived; these are listed in Section 5 (References).

Following the descriptions for each facility, a table is presented (Table 2) which summarizes the ongoing and completed actions by recommended action (similar in format to Table 1). A qualitative assessment regarding the implementation status of each action (by facility or agency) is indicated in Table 2.

2.1 POINT SOURCE

2.1.1 Ontario

Amoco Canada Petroleum Company Ltd., Sarnia, Ontario
(Amoco Canada Petroleum Company Ltd. 1997)
<u>elimination of all discharges/leachate to Cole Drain</u>

- currently engaged in a $4.5 million project to increase the holding capacity for stormwater runoff from the process area by a factor of ten, including the installation of filters to remove solids from discharges to the Drain; scheduled completion January, 1998
- 50% reduction of contaminant loadings to Drain through 1) improved operating procedures, 2) installation of oil/water separation system in oil heater area to separate oil from water before discharge, 3) installation of oil/water separation system in product storage area, 4) removal of molybdenum from chemicals used to treat cooling water

<u>point source discharges to air</u>

- in 1995, a flare gas recovery system was installed resulting in a reduction in CO_2 emissions of 20,000 tons/year

Bayer Inc. (formerly Polysar Rubber Corporation), Rubber Division, Sarnia, Ontario
(Bayer Inc. 1997a, 1997b; LIS 1997; *The Observer* 1997)
<u>nonpersistent, nonbioaccumulative substances</u>

- all process waters containing benzene have been rerouted to biological oxidation (BIOX) plant; monitoring shows that effluent benzene levels are consistently below the method detection limit of 0.5 ppb

- company currently assessing alternative solvents in oil and grease monitoring methodology; until resolved no information available on reduction of this parameter; the OMOE is

resolving alternate methods of oil and grease monitoring and there is no currently acceptable analytical method that does not dissolve a small portion of rubber

- phosphorus loadings have been reduced from 53.4 kg/day in the Municipal-Industrial Strategy for Abatement (MISA) monitoring year to 9.7 kg/day in the first 3 months of 1997; no further improvements are anticipated as this parameter is essential to the functioning of the BIOX plant

point source discharges to air

- air releases of benzene have been reduced from 327 t/year in 1991 to current levels of 72 t/year; Bayer's goal is zero airborne emissions of benzene by 1998
- a leak detection/repair program has been implemented which together with operational improvements have resulted in significant reductions of air emissions from 1991 levels: 48% for methyl chloride, 66% for 1-3-butadiene, and 74% for ethylene

spill elimination

- 17 out of 27 points of a spill prevention plan developed with public consultation have been completed, with 9 points transferred to a Spills Prevention Initiative (SPI); $10 million has been spent on the installation of a cooling loop and diversion tank under the plan
- 8 of the 32 SPI projects have been completed, 11 are under construction, and the remainder are in an engineering phase; total cost to date: $6.5 million
- 1986--39 incidents
  1994--0
  1995--0
  1996--3

pollution prevention

- all process water treated via BIOX plant
- all discharges monitored for a number of parameters to ensure contaminants are within MISA limits
- implementation of waste reduction/recycling programs at all operational units
- in 1996, received a Certificate of Pollution Prevention from the Ontario Minister of Environment and Energy for its benzene emissions reduction

elimination of all discharges/leachate to Cole Drain

- 2 plants currently discharge organic contaminants to the Drain; one has already been equipped with a total carbon analyzer and the other will be shortly in order to monitor contaminant levels
- a third plant is scheduled to come on-line in July 1997, but its discharge will only contain inorganic contaminants; discharges will be monitored via grab samples but as this plant uses BAT it is anticipated that contaminant levels will be well below current guidelines
- installation of a leachate collection system at the Scott Road landfill currently underway

zero discharge

- benzene use reduction program is continuing, with zero air discharge as objective

Cabot Canada Ltd., Sarnia, Ontario
(LIS 1997)

zero discharge

- Zero Discharge Team has reduced outfalls to the river by 40%; with additional evaluations of

plant water reuse underway

Chinook Group, Sombra Plant, Ontario
(Chinook Group 1997a, 1997b)

persistent, potentially or non-bioaccumulative substances

- combined loadings of methylamines, methanol, dimethylformamide, and monomethylformamide have been reduced by 93% from 1994 to 1996

spill elimination

- containments have been installed around all raw material and product storage tanks, and loading/off-loading areas
- no spills in last 2 years (1995-1997) that would have caused any impacts on river water quality

pollution prevention

- spills prevention and employee education plans implemented
- all plant process, cooling, and boiler waters, all stormwaters are collected in a 1 million gallon lined pond with strictly monitored discharge to the St. Clair River; spray irrigation takes place in summer months
- discharge is continuously monitored for organics and only discharged if effluent criteria are met
- a new WWTP based on bioremediation is scheduled for completion by the end of 1997, and will satisfy MISA discharge regulations

zero discharge

- goal: to achieve zero discharge in 3 to 4 years (2001)

Dow Chemical Canada Inc., Sarnia, Ontario
(Dow Chemical Canada Inc. 1997a, 1997b; LIS 1997; *The Observer* 1997)

persistent, bioaccumulative and potentially bioaccumulative substances

- organic contaminants have been reduced by 96% since 1990
- discharge levels of As, Cd, Cr, Cu, Pb, Ni, chloride, benzene, carbon tetrachoride, chlorophenols, 1,1-dichloroethane, 1,2-dichloroethane, hexachlorobenzene, hexachlorobutadiene, hexachloroethane, PCBs, pentachlorobenzene, tetrachloroethylene, 1,1,2-trichloroethane, trichloroethylene, toluene, and xylene-m are all below or near the yardstick levels intended for ambient conditions (1996)

point source discharges to air

- program implemented to estimate atmospheric emissions; resulting information used to prioritize abatement projects
- initiatives recently completed that resulted in a 50% reduction in hydrocarbon and NOx emissions
- emissions of ethylene oxide reduced 95%, from 4.6 t/year in 1994 to 0.24 t/year in 1996

spill elimination

- 1990--11 water incidents
  1991--5
  1992--1
  1993--3
  1994--7

1995--8
1996--2
1997--1 (to date)

pollution prevention

- in 1996, reduced the amount of non-hazardous solid waste requiring landfill by 27%, non-hazardous solid waste by 6%, and sent 7 t of paper, 32 t of cardboard, 777 t of metal, 45 t of lumber, and 5 t of plastics to recyclers

elimination all discharges/leachate to the Cole Drain

- remedial program initiated at Scott Rd. site to stop chlorinated contaminants from entering Drain; program reviewed by both OMOE and local property owners; scheduled completion 1998

zero discharge

- company is publicly committed to eliminate spills and harmful discharges to the St. Clair River by the year 2000, via their River Separation Program
- $24 million spent on program to date
- program has 3 components:
  1) to meet RAP yardstick criteria associated with DOW's environmental performance in the *Stage 2--Recommended Plan* document; instances where the criteria were not being met are attributed to the incoming river water quality and, in the instance of carbon tetrachloride, to a known source. These problems will be solved as part of the River Separation Program.
  2) stormwater management
  3) spill risk identification and assessment to attain a spill-free performance
- site is now 60% contained/separated
- overall chemical discharges to river have been reduced 93%, from an average of 8 kg/day in 1989 to an average of 0.6 kg/day in 1996

in-situ pilot-scale remediation

- the perchloroethylene and carbon tetrachloride "chemical pool" discovered on the river bottom sediments offshore of the Dow First St. site in 1985 has been the focus of monitoring and remediation efforts since its discovery:

1985-86	initial removal of chemicals via divers and vacuum trucks; monitoring indicates substances not present in plant sewer discharges
1986	one sewer removed from service; groundwater barrier installed isolating Dow site from shoreline
1990	trench and sump system excavated to divert material to enclosed system for removal
1990-95	small puddles of substance reoccur; removed by divers/vacuums
1993	all sewers sealed from river
1995	quantity of substances increases; sediment cores taken at 230 locations
1996	study indicates that entrenchment system inadequately designed and situated; system redesigned and subsequently implemented; as of Dec. 1996 no puddles observed on sediment for first time since monitoring began in 1986

Dupont Canada Inc., Sarnia, Ontario
(LIS 1997)

pollution prevention

- plant has reduced solid waste volumes sent to landfill by 64% from 1991 to 1996

Esso Imperial Oil, Refinery and Chemical Plants, Sarnia Site, Sarnia, Ontario (Esso Imperial Oil 1997a, 1997b, 1997c; LIS 1997)

persistent (potentially bioaccumulative) substances

- the company recommends the reclassification of arsenic from a "persistent (potentially bioaccumulative) substance" to a "persistent parameter (not bioaccumulative)"; the basis for this recommendation is the draft OMOE document prepared in support of the Provincial Water Quality Objectives (PWQO), which states there is "...no indication that arsenic biomagnifies in fresh water food chains."
- the net arsenic levels in the company effluent (6 ppb) will be well below the 1 ppb RAP yardstick for "persistent parameters (not bioaccumulative)" at the edge of the discharge mixing zone
- the company also recommends that the RAP yardstick for arsenic be revised to be more consistent with the new PWQO and drinking water objectives currently being developed by the OMOE

non-persistent, non-bioaccumulative substances

- the *Stage 2--Recommended Plan* document called for Esso Imperial to reduce its total phosphorus concentrations to 20 ppb at the edge of its effluent mixing zone in the St. Clair River; in response, the company commissioned a consultant to model the dispersal plume of its BIOX outfall; 3 different methodologies were used and produced essentially the same results--that the dilution of the plume was sufficient to meet the RAP yardstick of 20 ppb for this parameter approximately 30 m from the outfall, thereby addressing the Stage 2 concern
- the company points out that the current levels of phosphorus in their BIOX effluent are a minimum beyond which further reductions are impossible, due to the use of this parameter as a nutrient essential to the effective functioning of the BIOX unit; any further reductions in phosphorus levels would entail a worsening of overall effluent quality

point source discharges to air--refinery

- in 1994, experimental recovery equipment installed to extract benzene from refinery process streams
- from 1994 to 1996, $13 million has been spent on improving the operation of the carbon monoxide boiler to reduce the number of "opacity" air incidents (due to particulate matter in stack emissions)

point source discharges to air--chemical plant

- chemical plant is voluntary participant in Responsible Care Reducing Emissions initiative of the Canadian Chemical Producers Association

- from 1994 to 1995, air emissions of the following parameters decreased at the chemical plant:
  benzene--23.4%
  ethylene--17.4%
  vinyl chloride--42.8%
  napthalenes--43.3%
  124TM benzene--47.7%
  ethylbenzene--11.1%
  1,3 butadiene--89.4%

toluene--72.9%
cyclohexane--42.8%
xylene (mixture)--78.3%

- from 1994 to 1995, air emissions of propylene increased by 45.7%
- the increase in propylene levels is expected to be addressed via the leak detection and repair (LDAR) program
- company plans to reduce benzene emissions at the chemical plant by 64% over the period 1995 to 1998

point source discharges to air--Sarnia site

- over the period 1988 to 1995, $40 million has been spent on reducing air emissions
- LDAR program initiated in 1995, which includes ongoing monitoring of over 30,000 potential leak sources and immediate on-the-spot repair; 1993 to 1995 reductions of emissions attributed in part to this program
- from 1993 to 1995, air emissions have decreased from a total of 1182 t (all parameters) to 921 t
- improvements to dryers at lube-oil processing units is expected to reduce emissions of methyl ethyl ketone and methyl isobutyl ketone

spill elimination

- both the refinery and chemical plants maintained a zero spill record in the 20 month period prior to March 1997
- company has committed to a “Zero-Spill” strategy, summarized by the following:
  1) to design and operate facilities in a manner that minimizes spills
  2) to ensure the early detection of potential problems
  3) to provide in-plant treatment/containment/response systems
  4) to provide off-plant response resources
- in 1995, the highest monthly averages of total suspended solids and oil and grease loadings at both the refinery and the chemical plant were less than OMOE's 1998 effluent quality limits

pollution prevention

- $12 million has been spent in the last 3 years on environmental projects relating directly to water quality
- current treatment facilities represent best available technology
- in 1996, implemented a management system that eliminated alkaline batteries from its landfill waste

assess stormwater impacts

- 1995 OMOE exemption to the MISA-regulated stormwater control study based on the fact that the company collects all stormwater runoff from its site and treats it via their BIOX facility prior to release into the river
- in 1996, a $6 million state-of-the-art monitoring and pumping system was installed in its water treatment facilities, intended to reduce overflows to the St. Clair river during heavy rainstorms
- additional improvements included the addition of gravel to tank lots to filter solids from rainwater before it is sent to the BIOX plant

zero discharge

- the Sarnia site has met the IJC and OMOE zero discharge goal of the virtual elimination of

persistent, bioaccumulative toxic substances
- Esso-Imperial is committed to monitoring its environmental performance and lowering its discharges through continuous improvement

Ethyl Canada Inc., Corunna, Ontario
(Ethyl Canada Inc. 1997)

persistent, bioaccumulative substances
- contaminant levels cited in *Stage 2--Recommended Plan* document no longer above yardstick values

persistent (potentially bioaccumulative) substances
- contaminant levels cited in *Stage 2--Recommended Plan* document no longer above yardstick level, with the exception of lead, but this should cease once onsite cleaning of lead-contaminated portable tanks, refinery weigh tanks, and tankcars completed, scheduled for 1999-2000

spill elimination
- implementation of spill prevention program, including installation of level gauges and alarms on all active storage tanks, and plugs on sample lines and pipes ending in valves

pollution prevention
- stormwater not meeting MISA limits continues to be treated at a best-available technology WWTP
- continuing to work towards meeting 1998 MISA limits
- planning to eliminate 0200 production waste stream

Fibrex Insulations Inc., Sarnia, Ontario
(Fibrex Insulations Inc. 1997)

point source discharges to air
- in 1994, redirected the oven exhaust to filter house to reduce fibres from air discharge
- in 1995, cooling systems were redirected to filter house to eliminate fibre discharge

assess stormwater impacts
- implemented policy of better pond management to reduce high levels of contaminated water in pond; no water has had to be trucked from site since 1994
- in 1994, installed pond heaters to allow year-round use eliminating spring high-level problems

spill elimination
- in 1994, installed containment system around diesel fuel tank and eliminated elevated fuel tank
- in 1995, installed piping from resin tank containment to interior storage tank increasing potential spill containment capacity
- in 1995, installed concrete containment system around ammonia tank

pollution prevention
- eliminated the once-through cooling water circuit from the pipe machines (cooling water cited in 1993 RAP update)
- eliminated practice of piling scrap materials on ground
- in 1995, installed permanent equipment to facilitate stack cleaning, reducing potential oily residue buildup

ICI Canada Inc. (formerly C-I-L), Courtright, Ontario (river-facing portion of site sold to Terra International in 1993; remainder still operated by ICI)
(ICI Canada Inc. 1997)

spill elimination

- spill potential addressed through:
  1) maintaining pond water levels at a minimum of 3 feet below the top of the containment dykes
  2) dyke maintenance work completed in 1997 and a dyke inspection program established with a certified geotechnical engineer
  3) containment systems in place around all chemical storage tanks
  4) grading of entire site to drainage trenches/sumps and/or catchment ponds with trenches/sumps pumped back to the treated pond water system

assess stormwater impacts

- stormwater is collected in catchment ponds and discharged to the St. Clair River via surface drain in compliance with Certificate of Approval (CofA) criteria

zero discharge

- ICI's activities are consistent with the IJC's and Ontario government's objectives regarding zero discharge; it is not anticipated that the treated pond water discharges will contain any compounds which are persistent, toxic, and bioaccumulative

Laidlaw Environmental Services, Corunna, Ontario
(LIS 1997)

point source discharges to air

- completion of a $500,000 upgrade to incineration system; continuous monitoring of hydrochloric acid air emissions now implemented

Lambton Generating Station, Ontario Hydro, Courtright, Ontario
(Ontario Hydro 1997a-d)

point source discharges to air

- completed major rehabilitation and upgrade initiatives begun in 1993

- installed flue gas desulphurization "scrubbers" on 2 of 4 generating units, resulting in an SO_2 emission reduction of over 90%
- installed new burners, which control the mix of air and coal, resulting in improved combustion efficiency and lower NOx emissions (30% reduction in unit 4)
- improved flue gas monitoring system (SO_2 and NOx) to ensure quality of monitoring data; complete inventory of through-stack emissions now available for 1995 and 1996
- as documented in their Air Quality Compliance Report for 1996, there were no EPA Ambient Air Quality Criteria Regulation exceedences, in either hourly or daily SO_2 concentrations, in 1996

spill elimination

- $30 million has been spent on numerous initiatives over the last 4 years on spill elimination and pollution control
- installed oil/water separators to collect cooling water and floor drain discharges
- improved containment dykes around outdoor chemical and oil storage containers
- relocated underground fuel oil piping above ground

- removed 41,000 kg of PCB contaminated oil and 77,000 kg of PCB-contaminated equipment from site
- constructed a containment area for the storage and handling of waste oil
- implementation of an Emergency Response Team, onsite at all times

pollution prevention

- of the 150,000 t of bottom and fly ash produced annually, all the bottom and a portion of the fly ash is used in road aggregate and in the cement industry instead of disposed of via landfill
- installed floating oil booms at the 2 river outfalls
- improved the coal pile drainage system and coal dock hopper to prevent runoff
- constructed a contained runoff area for the handling of limestone, gypsum, and the flue gas wastewater stream facility; collected runoff is used in the flue gas scrubbing process

assess stormwater impacts

- recently completed a Storm Water Control Study according to OMOE protocols; results found that stormwater quality is good, and no further action is planned

zero discharge

- $2.1 million spent on installation of wastewater treatment systems: a segregated diversion drainage system and 2 oil/water separators to remove oil prior to river discharge
- $10 million will be spent on a boiler quench/seal overflow wastewater treatment facility to remove ash discharges, and online oil detection equipment, with both scheduled for completion in 1998
- a MISA effluent treatment facility designed to collect and treat process effluents prior to discharge will be in service in 1998

Montell Canada Inc. (formerly Shell Canada Chemical Plant), Corunna, Ontario
(Montell Canada Inc. 1997)

CSO elimination

- all stormwater from process units is contained and treated before discharge; company does not discharge any contaminated or potentially contaminated stormwater streams to the St. Clair River
- in 1996, the following initiatives were instituted to prevent abnormal, non-process storm discharges from reaching Baby Cr.: 1) screens were installed at outfalls to retain solids, 2) isolation valves were installed to retain liquids, and 3) diversion boxes were constructed to redirect flows to onsite containment

point source discharges to air

- an inventory of emissions has been developed in conjunction with the National Pollutant Release Inventory (NPRI) and National Emissions Reduction Masterplan (NERM) programs
- dispersion modelling was carried out to calculate offsite levels with respect to ambient air quality guidelines, resulting in an assessment of environmental impacts
- a Leak Detection and Repair Program was initiated in 1995, with one unit completed by 1996 and the remainder by 1997, with the result of reducing emissions

pollution control

- elimination of zinc chromate from cooling treatment (quoted by Shell Canada Products Ltd.)

NOVA Chemicals Ltd., Sarnia, Ontario
(LIS 1997)

persistent, bioaccumulative substances

- in 1996, all stored PCB containing and contaminated equipment was sent to an Alberta disposal facility rated at 99.9999% efficiency; all 3 NOVA sites now considered PCB-free

Shell Canada Products Limited, Corunna, Ontario
(Shell Canada Products Limited 1997a-c; LIS 1997)

nonpersistent and nonbioaccumulative substances

- based on self-monitoring results for 1988-1996, effluent levels of oil and grease, suspended solids, and sulphide show a marked decrease since 1990-1991; levels of dissolved organic carbon have decreased since 1993; and phosphorus has decreased since 1995; levels of phenols remain predominantly in the range 3 to 15 ppb; and NH_3 levels are inconsistent
- one MISA exceedance in suspended solids in 1996
- zero exceedances to date in 1997

point source discharges to air

- recently completed $17 million upgrade to No.1 Crude Unit, intended to address efforts at reducing water use, has also resulted in significant decreases in NO_x and VOC emissions
- voluntary replacement of all chlorofluorocarbon-based refrigerants in its process chillers, at a cost of $250,000

spill elimination

- process and clean water sewer diversions constructed, allowing storm pond containment and reprocessing through biotreater; all stormwaters are contained, diverted and processed through biotreater as standard procedure; excesses are discharged to Talfourd Cr. in full accordance with CofA
- 1986--23 spills
  1987--31
  1988--17
  1989--22
  1990--11
  1991--5
  1992--4
  1993--3
  1994--2
  1995--3
  1996--3
  1997--0
- in the period 1994-1996, the cumulative quantity of spilled material was less than 5 litres annually

pollution prevention

- Shell Canada has spent more than $10 million on discharge quality and spills prevention since 1985
- work has involved modification of operational procedures, increased inspection frequency, and retiring heat exchangers in cooling system identified as having leak potential
- Sour Water Stripper improved to improve control of NH_3 levels to sewer
- Poly plant (principal source of phosphorus to wastewater stream) shut down permanently in 1995
- completion of WWTP biotreater advanced process control and control centre building

- installation of various analyzers/detectors, linked to alarms, targeting total organic carbon, turbidity, and pH in the clean, oily, biotreater feed and effluent water systems

miscellaneous

- upgrade to No.1 Crude Unit has also resulted in significant reductions in water use

Suncor Inc. Refinery, Sarnia, Ontario
(Sunoco Inc. 1997)

pollution prevention

- $6 million spent in 1991-1996 program to redesign waste water treatment system, with measures taken to segregate clean/contaminated waters, institute upstream controls, and provide of oil/water separation facilities to reduce air emissions/odours
- in 1994 an online mass spectrometer was installed in the cooling water circuit capable of detecting hydrocarbons in the ppb range every 3 minutes and setting alarms in the control room--allowing leaks to be addressed before contaminants reach the river
- more than $8 million in capital expenditures has been spent in the period 1992-1997 for the protection of the St. Clair River

monitoring

- over $300,000 per year is expended on water analysis and related issues

CSO elimination

- in 1994, a stormwater storage tank was installed to impound stormwaters to reduce loadings to the treatment system

spill elimination

- 1990--5 spills
  1991--3
  1992--2
  1993--1
  1994--0
  1995--0
  1996--1
- since 1992, all spills were detected only at the ppb range, and none have resulted in shutdowns at downstream communities
- Suncor is committed to continual improvement of effluent water quality, and the goal of zero spills

persistent (potentially bioaccumulative) substances

- in 1994, Suncor protested the inclusion of the Sarnia refinery in the RAP *Stage 2*--*Recommended Plan* document as a high priority source of arsenic, and even as a point source of arsenic; basis:
  1) arsenic occurs naturally in crude oil
  2) levels in effluent are only slightly above detection levels with recent effluent levels remaining consistent at 3 to 5 ppb (MDL = 2 ppb)
  3) the *1994-1995 Lambton Industrial Society St. Clair River Sediment Report* quotes sediment arsenic levels downstream of the Suncor outfall at below the Ontario Provincial Lower Effect Levels
  4) there is no known, economically feasible technology that can remove 3 ppb arsenic from 8 million litres of effluent (containing levels of 3 to 5 ppb) daily

Terra Nitrogen, Courtright, Ontario
(LIS 1997)

spill elimination

- in 1996, began phase 2 of a water separation project, consisting of the construction of a retention pond to divert process water upsets for possible plant recycling; to be completed in late 1997

Government of Canada's response to the RAP *Stage 2--Recommended Plan*
(Government of Canada 1997)

source discharges of coliform bacteria

- contributed funds toward WPCP upgrade report for Sarnia
- contributed funds for optimization of Courtright WPCP
- contributed funds for optimization of Polysar's biological treatment plant

eliminate CSOs

- contributed funds in support of CSO tank on Devine St., Sarnia
- contributed funds for new sewer installations in Sarnia and Sombra Township

eliminate spills

- organized and partly funded local industry pollution prevention workshops
- developed and formalized series of area specific Environmental Emergency Teams for on-scene advice during spill events

City of Sarnia WPCP, Ontario
(City of Sarnia 1997a, 1997b)

CSO elimination

- Devine CSO storage tank completed
- Wellington CSO storage tank scheduled for completion in 1997
- Cromwell, Exmouth CSO storage tanks on hold pending flooding report findings

pollution prevention

- completion of "year 3" of city's Pollution Control Plan currently on hold pending funding outcomes
- Sarnia WPCP upgrade not complete; currently in detailed design phase
- no work other than ongoing sewer system improvements
- sewer use, water conservation, roof leaders bylaw enforcement programs underway; accompanied by public awareness programs
- sewer flushing and catchbasin cleaning programs implemented

Sombra Township, Ontario
(Randell 1997)

source discharges of coliform bacteria

- the sanitary sewage system was upgraded with a chemical feed facility and expanded significantly to service 3 built-up areas on the river; these have been tested and meet OMOE standards

pollution prevention

- the township has a new Official Plan with pollution and erosion control measures that developers must meet

2.1.2 Michigan

Crown Vantage, Port Huron Mill, Michigan
(Crown Vantage 1997)

point source discharges to air

- in 1996, the mill shut down its gas turbine plant and now purchases power from a local utility; steam is produced by natural gas boiler power; together these measures have reduced NO_X emissions by approx. 90%

spill elimination

- major spill containment program underway since 1990: $125,000 has been spent on containment structures for all chemical storage areas and tanks; chemical feeding stations have been consolidated to reduce spill points; employee training has been improved; a pollution control plan incorporating federal requirements has been developed and implemented
- river turbidity events (from paper coating pigments) caused by product/equipment changeovers have been reduced

- containment structures have been built and the waste collection system upgraded at coatings operations, including the installation of overflow alarms, diversion tanks to store waste streams for later treatment, and $300,000 has been spent on a new settler to treat these wastes

discharge permits

- the mill has been granted a General Stormwater Discharge Permit, and no significant sources of contaminants have been identified in associated monitoring

zero discharge

- "zero" discharge is not economically feasible with available technology, and is not a goal for the foreseeable future

Detroit Edison, Marysville, St. Clair, and Belle River power plants, Michigan
(Detroit Edison 1997)

point source discharges to air

- no current inventory of atmospheric releases of yardstick substances currently available
- implementation of system to obtain information pertaining to yardstick substance emission scheduled for completion in 1999, with information to be made available as a part of Toxic Release Inventory reporting

spill elimination

- number of spills (all types) reduced by one third in last ten years
- ongoing employee training program in spill prevention/remediation in place
- all facilities in compliance with US and Michigan regulations governing spill prevention, reporting, and clean-up

assess stormwater impacts

- Stormwater Pollution Prevention plans in place at all 3 facilities; these include management practices, provision of structural controls, periodic inspections of stormwater control facilities and outfalls, annual plan reviews, and staff training
- all discharges in full compliance with Michigan General Permit for the Discharge of Stormwater Associated with Industrial Activity, under the NPDES program

zero discharge

- Detroit Edison believes that the goal of zero discharge is laudable but unachievable; however, progress towards goal can be made

pollution prevention

- programs in place for product substitution and resource recovery to reduce pollutants
- estimate of amount of material recycled by company annually:
  - plastic--2.5 tons
  - drycell batteries--5.0 tons
  - corrugated cardboard--180 tons
  - paper--420 tons
  - non-ferrous metal--2420 tons
  - flyash--240,000 tons
  - woodchips--100,000 $yards^3$
  - used oil--450,000 gallons
  - large truck tires--1000
  - wooden poles--2000
  - wooden crossarms--6025
  - street light lamps--100,000
  - fluorescent bulbs--150,000
- company is in second year of program to reduce inventories of mercury, resulting in a reduction of 1500 pounds in inventory by the end of 1998

E. B. Eddy Paper, Inc., Port Huron, Michigan
(E.B. Eddy Forest Products Ltd. 1997a, 1997b; MPPEC-MDEQ 1997)

point source discharges to air

- 7 yardstick substances monitored
- reduced volatile organic compound emissions by 30% in 1997
- eliminated SO_2 and Cl_2 storage and use in 1997
- $5.3 million budgeted for NO_X and SO_X reduction in 5 year capital business plan

eliminate spills

- average capital spending has been over $6 million each year for the past 4 years; all new equipment installed with secondary containment facilities
- $200,000 identified in 1998 business plan for separation of “low-impact” storm sewers

pollution prevention

- company has pledged its commitment to the Pulp and Paper Pollution Prevention Project (P5) developed by the MDEQ and Michigan Pulp and Paper Environmental Council; this voluntary pollution prevention partnership is intended to identify substance of concern and establish priorities/goals for their use, generation, discharge and emission
- implemented a biannual audit of environmental systems
- an environmental incident related to start-up of the Blue Water Fiber effluent treatment system resulted in the issue of a non-compliance notice from the MDEQ in 1995--all issues were resolved and the matter is closed

assess stormwater impacts

- implemented a storm water pollution prevention plan; includes a review of potential discharges from site, training and inspections
- documented semi-annual inspections by internal audit team

- budgeted $100,000 for the installation of unloading pads in 1997
- installed roadways with curbing to allow for proper stormwater drainage

zero discharge

- water usage has been reduced 50% over past 10 years; further possible reductions have been identified
- Blue Water Fiber reuses company process water

City of Marysville, Michigan
(City of Marysville 1997)

CSO elimination

- Phase II of the city's CSO elimination program is scheduled for completion in October, 1997

City of St. Clair WWTP, Michigan
(City of St. Clair 1997)

persistent and bioaccumulative substances

- in 1995, the WWTP submitted a Mercury Minimization Program and Cadmium Compliance Plan to MDEQ; key elements of these involve an increase to biweekly testing for these contaminants, testing throughout system to identify the possible point sources for these, and random checks of precipitation/snowmelt samples
- no point sources identified at this time
- current levels of cadmium are now below effluent guidelines
- current levels of mercury are below detection limit 85% of the time; the number of detects and the concentrations are decreasing over time, with a possible correlation with atmospheric deposition due to coal burning in region

persistent (potentially bioaccumulative) substances

- current levels of zinc and copper are now below effluent guidelines
- "Whole Effluent Toxicity Tests" carried out periodically, with result of zero mortality of test organisms at all effluent concentrations

source discharges of coliform bacteria

- effluent concentrations continue to meet the guidelines of 200 organisms/100 ml (note: RAP yardstick is 33/100 ml)
- conversion from chlorine to sodium hypochlorite disinfection currently under consideration

CSO elimination

- separation of storm and sanitary sewers now 95% complete, with completion by end of 1997; note that with separation storm flows will now be directed directly into the river
- program implemented to disconnect down spouts from the sanitary system
- system flow/capacity study underway to determine if capability exists for removal of final CSOs

Port Huron WWTP, Michigan
(City of Port Huron 1997)

persistent and bioaccumulative substances

- documentation available to show that original listing in table 4.2 of the *Stage 2*--*Recommended Plan* document was based on a single datum and in error--levels of cadmium

have never been in excess of EPA and local limits at this plant
- major industrial process discharges have been separated from combined system, virtually eliminating possibility of persistent bioaccumulative substances released in CSOs

urban runoff for existing developments
- 50% of city now served by separated system
- only separated sewers have been built since the 1960s
- $4.5 million has been spent in 1995-1997 alone on downtown and industrial part sewer separation
- $4 million in separation work has been undertaken in the Indian Creek sewer district

urban runoff for new developments
- all new housing developments have eliminated combined systems or installed separate systems, and all new roadwork has included sewer separation

CSO elimination
- 24 hr monitoring of city collection systems has been instituted
- 4 sewer discharge points have been eliminated since 1991
- catch basin restrictors have been installed in areas served by combined sewers
- CSO discharges have been reduced by 40% over 1980s levels
- plan prepared to eliminate CSOs over a 30-year timeframe; including 42% reduction in CSOs by 2005

2.2 NON-POINT SOURCE

Government of Canada's response to the RAP *Stage 2--Recommended Plan*
(Government of Canada 1997)

reduction of contamination from rural runoff
- funding support of project to demonstrate new planter/drill combinations to local farmers and soil and crop experts
- funding support to the Environmental Farm Plan Program which has put on workshops in Lambton County resulting in 184 environmental projects
- funding support to South Lambton Conservation Tillage Club which undertook project on conservation tillage

Lambton County, Ontario
(Lambton County 1997)

pollution prevention
- local plans are to identify all known abandoned, inactive, and active waste disposal sites and provide policies for development in proximity to sites
- any development proposals located within 500 m of any such sites are to be accompanied by impact/mitigation feasibility studies subject to approval by both the municipality and the Ontario Ministry of the Environment

urban runoff for new developments
- current sewage treatment facilities have sufficient reserve capacity to accommodate existing planned development
- approvals of new urban developments will not be made unless existing municipal/communal sewage treatment facilities have sufficient reserves to serve the new development

- the county will ensure that development proposals include regard for onsite stormwater drainage and surface water infiltration
- encouragement of management policies that include use of infiltration to minimize offsite flooding/erosion
- onsite erosion and sedimentation controls will be a requirement at construction sites

Sombra Township, Ontario
(Randell 1994)

<u>reduce use of road salt and seek alternatives</u>

- the alternative de-icing products investigated were too expensive for implementation

<u>reduce use of lawn fertilizers and pesticides</u>

- the township does not use any fertilizers and pesticide use is minimal

RIC Non-Point Source Steering Committee, St. Clair River RAP, Michigan and Ontario
(RIC NPS Steering Committee 1997a, 1997b; GLNPO 1997)

<u>watershed/subwatershed management plans</u>

- development of 3 year Watershed Improvement Program, with primary goal of assisting private landowners and farmers to alleviate erosion and other non-point source pollution that contribute to impairment/loss of fish and wildlife habitat
- program objectives: improving water quality, non-point source pollution remediation, habitat protection, and enhancement of streams, wetlands, forests, and prairies
- other key elements of program:
  1) cooperation by 14 different U.S. and Canadian agencies and organizations, including First Nations
  2) identification and mapping of priority sites for rehabilitation
  3) development of landowner contact program to identify natural features and vegetation types in non-farmed areas and farm types with reference to habitat impairments/loss; program to include mechanism for regular landowner contacts
  4) biological monitoring programs for birds, amphibians, benthic invertebrates (scheduled for 1998)
  5) Michigan data gathering for coastal planning accomplished through Coastal Zone Management Program
  6) watershed management plan for St. Clair County scheduled for completion in 1998 through 1999
  7) binational fish and wildlife habitat managment plan scheduled for completion by 1998; funded by Environment Canada

<u>urban runoff for new developments</u>

- recommendation of specific actions to control contamination from this source, determination of implementation status, and ensuring that remaining/ongoing actions continue

<u>promote agricultural programs ...to reduce contamination to rural runoff</u>

- recommendation of specific actions to control contamination from rural runoff; determination of implementation status, and ensuring that remaining/ongoing actions continue
- specific remediation actions identified by Watershed Improvement Program include: controlling soil loss, encouraging proper storage/handling of manure, reduction and encouragement of proper use of pesticides, promotion of land stewardship and new

technology/management practices, promotion of maintenance of existing wetlands and forest cover

protect existing natural areas and undertake remedial measures

- landowner interaction, education, and voluntary pollution reduction and natural area enhancement measures, in context of Watershed Improvement Program

improved waste site planning and management

- recommendation of specific actions to control contamination from waste sites without leachate and runoff collection systems; determination of implementation status, and ensuring that remaining/ongoing actions continue

identify problems relating to domestic sanitary sources and ensure proper maintenance/repair

- recommendation of specific actions to control contamination from malfuntioning septic systems and other domestic sanitary sources; determination of implementation status, and ensuring that remaining/ongoing actions continue
- correction of faulty septic systems and discharges of untreated sewage identified as action items in Watershed Improvement Program

proper use and disposal of household hazardous wastes and product substitution/education

- recommendation of specific actions to control household hazardous waste, determination of implementation status, and ensuring that remaining/ongoing actions continue

2.3 SEDIMENT

Lambton Industrial Society (LIS)/OMOE Sediment Characterization Studies (details provided in 2.2.2.1, 2.2.2.3 and 2.2.2.4 of *1997 Stage 1 Update* report)

complete sediment characterization studies

- studies commissioned by LIS (Pollutech Enviroquatics Limited 1997) and by OMOE (Beak International Incorporated 1994 and OMOE 1996) and undertaken in 1994 and 1995 covering the 3 priority zones defined as "priority 1" areas in the Stage 1 RAP document
- studies resulted in further characterization of sediments including chemistry, benthic species and communities, and benthic community health determinations
- a total of 83 samples were collected including some repeat samples

Government of Canada's response to the RAP *Stage 2--Recommended Plan* (Government of Canada 1997)

completion of sediment characterization studies in Priority Zone 1

- provided funding and participated in 1994 and 1995 studies (see companion *Stage 1 1997 Update*) including upper "priority 1" area and GIS mapping of sediment contamination levels
- providing funding support to predictive model development describing sediment transport mechanisms and effects based on various clean-up options

Sediment Subcommittee, St. Clair River RAP, Michigan and Ontario (McCorquodale and Tomczak 1997)

develop final remedial strategy

- commissioned a multicomponent study testing the application of computer modelling and biomonitoring tools to sediment remediation strategy development; components include:
  1) development of predictive model to evaluate long-term impacts of remedial scenarios

2) field/laboratory verification of sediment transport/transformation processes
3) biohazard identification, sediment-bound contaminants
4) definition of Study Area #1 priority areas
5) development of a GIS for the St. Clair River AOC

2.4 HABITAT

2.4.1 Ontario

Esso Imperial Oil, Sarnia Site, Sarnia, Ontario
(Esso Imperial Oil 1997c)
undertake habitat restoration and enhancement measures
- contributed funding to the McKeough Floodway Reforestation Project through the Tree Canada organization

ICI Canada Inc. (formerly C-I-L), Courtright, Ontario (river-facing portion of site sold to Terra International in 1993; remainder still operated by ICI)
(ICI Canada Inc. 1997)
ensure protection of shorelines from erosion...
- stormwater discharges are via a surface ditch to the river

undertake habitat restoration and enhancement measures
- in 1992, site designated as a certified wildlife habitat by the Wildlife Habitat Council
- company is evaluating the establishment of a wildlife refuge and wetland at the site

Lambton Generating Station, Ontario Hydro, Courtright, Ontario
(Ontario Hydro 1997a-d)
undertake habitat restoration and enhancement measures
- in 1995, a study of the site's natural habitats was completed
- in 1996, under the Biodiversity Program Plan, an inventory of plant and animal species native to the site was carried out
- in 1997, 11,000 trees were planted to link 2 existing woodlots on the site, providing a wildlife habitat link; the future project within the Plan, to plant an area of prairie tallgrass, is scheduled for spring 1998
- in 1997, certification with the Wildlife Habitat Council was received

ensure protection of shorelines from erosion...
- riprap was placed in some areas in the early 1990s for shoreline erosion protection

Shell Canada Products Limited, Corunna, Ontario
(Shell Canada Products Limited 1997a, 1997b)
undertake habitat restoration and enhancement measures
The following local programs have been funded by Shell.
- Centre by the Bay/Bay Point Development--establishment of 1 acre of tallgrass prairie
- Hill Street School--2 year program to plant trees and develop a park

Government of Canada's response to the RAP *Stage 2--Recommended Plan*
(Government of Canada 1997)

control/eradicate exotic species

- undertook research and development demonstration project on ballast water control technology and carried out study in Welland Canal to sample ballast tanks of upbound vessels
- undertook study of various organic acids for use to sterilize ballast tanks

undertake identified habitat restoration and enhancement projects

- contributed funding to Centre by the Bay wetland creation demonstration and interpretive project in Sarnia area
- contributed funding to McKeough Floodway Reforestation/Wildlife Habitat Project and Stag Island Habitat Rehabilitation Project
- contributed funding to Ontario Native Tallgrass Prairie Nursery Project which is designed to supply indigenous seeds and plants for restoration projects in southern Ontario including AOCs

develop long-term habitat management plan

- contributed funding to St. Clair River Habitat Target Testing Program to establish baseline of existing and historic upland forest, wetland and riparian habitat through the development of a Natural Heritage System
- contributed funding to support St. Clair/Sydenham River Regional Habitat Management Plan which is a multi-year fish and wildlife habitat rehabilitation strategy

reduce ship wakes and surges...

- participated in bilateral studies on commercial ship wakes in affected areas - determined present speed limits are appropriate to mitigate wake damage at current water levels

Corporation of the Township of Dover (St. Clair River Delta--Mitchell's Bay), Ontario
(OMOE 1997a; Township of Dover 1996)

pollution prevention

- review of future municipal sewer system alternatives underway; includes development of interior wetland for use in municipal wastewater treatment and disposal for sanitary sources from Paincourt to Mitchell's Bay

strengthen wetland protection measures

- over past 15 years, many of the existing wetlands along the shoreline have been or are being restored by the public and private agencies
- the township's drainage network provides water to wetland areas during extended dry seasons

ensure protection of shorelines...

- shoreline of township currently protected by breakwalls
- plan developed for a breakwater/public swim area in Mitchell's Bay, at site of old WWTP

Lambton County, Ontario
(Lambton County 1997)

develop long-term habitat management plan

- county official plan incorporates water quality, forest cover, natural heritage systems, and waste management issues
- new development is to be directed away from significant natural areas or areas with environmental constraints; prohibited in provincially significant wetlands, defined portions of dynamic beaches, defined portions of the 100 year flood level, floodways
- land use planning is to be consistent with the protection of significant woodlots and designated Natural Heritage corridors

Rural Lambton Stewardship Network, Lambton County, Ontario (unidentified 1996)

<u>undertake habitat restoration and enhancement measures</u>

- project list as of 1996:
- Sydenham Nursery
  -- This 12 ha nursery is located on Crown Land and property belonging to the St. Clair Region Conservation Authority (SCRCA) in Lambton County. Tallgrass plugs of 25 species were planted during the summers of 1995 and 1996 to generate the large quantities of tallgrass seeds that will be used for prairie-related projects throughout the province.
- Dealtown Nursery
  -- Nursery is located on 12 ha of Crown land in Kent County. Plugs of 32 species of prairie grasses were planted during the summer of 1996.
- Henderson Pit
  -- A trial rehabilitation project at Henderson Pit was implemented to determine the methods of establishing prairie on the depleted soils of abandoned pits and quarry sites. Thirty block planting, testing, seeding, and plugging techniques are being monitored by the Rural Lambton Stewardship Network and the OMNR. Information gathered will promote sound management decisions on future pit rehabilitation projects.
- Borrow-Pit Prairie Demonstration
  -- A borrow pit in Lambton County was restored by grading the extraction area into a 2 ha pond with gently sloping banks, with the 1.5 ha surrounding the pond plug planted with 19 tallgrass prairie species (July 1996). The pond edge is now connected to the drier upland areas which were reforested by the SCRCA.
- MacDonald Park
  -- Located on the St. Clair River, this highly visible public park was well suited to demonstrate small-scale rehabilitation techniques. An excavation was completed to create a fish habitat. Excess soil from the excavation was used to create a raised walkway through the 1.5 ha of surrounding upland, which was then planted with 23 tallgrass prairie species. This well publicized undertaking was one of the delisting criteria for the St. Clair River RAP.
- Stag Island
  -- The southern part of the island was built up from dredged material, and approximately 20 acres were planted with over 20 tallgrass prairie species, which will be monitored to determine species mixes for future planting.
- Pain Court High School Demonstration Prairie
  -- This school acquired additional land and restored 0.5 ha to tallgrass prairie. Students successfully collected over 20 species of seeds under the supervision of the MNR and

RLSN. The seeding was completed in 1994 and supplementary planting was done in 1995 and 1996.

- Moore Wildlife Habitat Management Area
  -- This WMA is managed by the SCRCA. The area is heavily overgrown with hawthorn but some prairie species have been identified in the existing open areas. The RLSN plans to enhance the existing prairie species as well as create new openings in the hawthorn cover. An initial planting was completed in the summer of 1996 and a prescribed burn was implemented in late 1996.
- New Highway 40 Prairie Demonstration
  -- The RLSN and MTO have agreed to a project consisting of 5 sites along the new Highway 40 to demonstrate the effectiveness of prairie wildflowers on road sides. One site was planted in the summer of 1996.
- Highway 401/21 Prairie Demonstration
  - A prescribed burn was carried out on this 400 series highway in early 1996, which was a first for Ontario.
- Highway 401/59 Prairie Demonstration
  -- A 1 ha site was prepared in late 1995 and early 1996, seeded in mid-1996, and is intended to demonstrate the effectiveness of prairie as a roadside vegetation management mechanism.

Sombra Township, Ontario
(Randell 1997)

undertake habitat restoration and enhancement measures

- the area around the Sombra lagoon will be planted with 3500 young trees on 12.4 acres in spring 1997

St. Clair Region Conservation Authority, Strathroy, Ontario
(SCRCA 1997)

undertake habitat restoration and enhancement measures

- McKeough Floodway Channel
  -- This project involved reforestation and naturalization of channel berms with 34 ha planted to 1997 and an additional 12 ha proposed for 1997 to 1999. A 4 ha tallgrass prairie habitat is also proposed for the berms, in the same timeframe.

develop and implement public outreach and education programs

- Conservation Education programs:
  -- River Bottom Critters: in 1997, 3000 grades 1 to 8 students enrolled in this program to study healthy, live benthic organisms
  -- Lambton County Woodlot Owners Association: program organizes meetings, field trips, and information sharing between members

Walpole Island First Nation Heritage Centre, Walpole Island, Ontario
(Walpole Island First Nation 1996)

undertake habitat restoration and enhancement measures

- Fish Habitat Improvement Plan, Seaway Island
  -- In 1994, Public Works and Government Services Canada (PWGSC) and the Canadian Coast Guard (CCG) sponsored the construction of a fish-habitat area on Seaway Island. This project was required by the federal Fisheries Act in order to compensate for fish habitat which was lost and/or altered because of nearby dredging activities.

2.4.2 Michigan

Crown Vantage, Port Huron Mill, Michigan
(Crown Vantage 1997)

ensure protection of shorelines from erosion...

- majority of mill shoreline protected by a concrete or steel seawall--erosion minimal

Detroit Edison, Marysville, St. Clair, and Belle River power plants, Michigan
(Detroit Edison 1997)

ensure protection of shorelines from erosion...

- shorelines at all 3 facilities protected by sheet pile; all low-traffic unpaved areas are vegetated

undertake habitat restoration and enhancement measures

- Detroit Edison is lead organization of the St. Clair Waterways for Wildlife Project coordinated by the Wildlife Habitat Council (WHC)
- in 1996, the Belle River Power Plant was certified as a wildlife site by the WHC; projects at this site include:
  1) organization of "Green Team" (consisting of employee and retiree volunteers) to conduct habitat projects on plant property
  2) installation of nest boxes and institution of a nest monitoring program for cavity nesting birds
  3) release of 50 pheasants on company property (that had been raised at another plant)
  4) tree planting along the berms surrounding this and the St. Clair Power Plant to transform area from monoculture to diverse wooded area; in 1996 and 1997 over 30,000 trees of a variety of species were planted at this and the St. Clair plant
  5) 3 acres per year at the ash disposal site are filled, clay-capped, disced, and seeded with a new mix of native/forage vegetation species (replacing old grass mixture)
  6) the company stipulates that 15 to 20 foot strips of crop be left standing at the margins of its agricultural fields where they border natural areas
  7) in June 1997, a garden was planted on plant property to attract butterflies and hummingbirds
- Detroit Edison is funding a lake sturgeon study being conducted by the MDEQ and the University of Michigan to assess population, spawning habits, and habitat areas for this species

E. B. Eddy Paper, Inc., Port Huron Michigan
(E.B. Eddy Forest Products Ltd. 1997a, 1997b; MPPEC-MDEQ 1997)

ensure protection of shorelines from erosion...

- best management practices were used on the shoreline during BWF construction

- installed “No Wake Zone” sign on riverbank
- hands-off policy on riverbank other than routine trash pick-up
- performed a toxic reduction initiative/toxicity identification evaluation to determine any toxic sources

City of Marysville, Michigan
(City of Marysville 1997)
ensure protection of shorelines from erosion...
- rip-rap barrier is being constructed along the riverfront walkway currently under construction

Michigan Habitat Restoration Projects (Michigan Department of Natural Resources), Michigan
(MDNR 1997)
undertake habitat restoration and enhancement measures
- Harsens Island
  -- aquisition of 800 acres will not proceed due to purchase of 2 land parcels of interest by private parties
  -- Land Trust funds that were to be used are still available for use elsewhere in St. Clair County
  -- several other purchases of parcels less than 50 acres in size have been made between 1995-1997
- Algonac State Park
  -- the restoration of approx. 200 acres of prairie/savannah is underway, funded by stewardship grant money
- St. John's Marsh
  -- wetland enhancement of some 300 acres is underway and scheduled for completion by 2000
- St. Clair Flats Wildlife Area
  -- legislation in development to impose stricter regulations pertaining to watercraft use, to help protect wetlands

Table 2. RAP implementation actions and status to September 1997.

The following provides a key to "implementation status" codes listed in the second column of this table. The terms "complete" or "partial" refer to the recommended action at the facility or with the agency listed. The entire action is considered to be completely fulfilled (completed) only when all facilities/agencies/municipalities indicated in the *Stage 2--Recommended Plan* document (Table 1, this report) have completed implementation for that action. Future commitments provided in writing to the RIC are summarized in Section 3. The overall progress of implementation since the Stage 2 document was released is discussed in Section 4. Shaded areas identify priority action items.

Partial	partial implementation of remedial/corrective measures and/or Stage 2 "Issues/Actions" to attain RAP-identified goals towards AOC delisting
Complete	full implementation of measures and attainment of RAP-identified goals
AA	measures carried out as part of another issue/action, as part of overall pollution reduction strategy, or outside scope of RAP *Stage 2--Recommended Plan* document
D	status as stated in RAP *Stage 2--Recommended Plan* document questioned
NF	attainment of RAP-identified goals not feasible due to incorrect classification, insufficiently developed technology, excessive cost, or other mitigating factor
NA	not applicable
INA	information not available to update status
NIL	no action
*	indicates that the facility/agency is determining RAP implementation progress with reference to state, provincial, and/or federal regulations/guidelines, rather than RAP yardstick levels

ISSUE/ACTION	IMPLEMENTATION STATUS	FACILITY/AGENCY AND PARAMETER (IF APPLICABLE)
POINT SOURCE		
Persistent and bioaccumulative substances	D	City of Port Huron WWTP * Cd
	Complete	City of St. Clair Cd
	Partial	City of St. Clair Hg
	Complete	NOVA Chemicals Ltd. PCBs
	Partial	Dow Chemical Canada Inc. Cd, Cr, chlorophenols, hexachlorobenzene, hexachlorobutadiene, hexachloroethane, PCBs, pentachlorobenzene, xylene
	Complete	Ethyl Canada Inc. Hg, PAHs
Persistent (potentially bioaccumulative) substances	Complete	City of St. Clair Cu, Zn
	INA	Shell Canada Products Limited Zn
	D, NF	Suncor Inc. As
	NF	Esso Imperial Oil As
	Partial	Dow Chemical Canada Inc. As, Cu, Pb
	Complete	Ethyl Canada Inc. carbon tetrachloride
Persistent, non-bioaccumulative parameters	Partial	Dow Chemical Canada Inc. Ni
Non-persistent, non-bioaccumulative substances	Complete	Shell Canada Products Limited
	Complete	Esso Imperial Oil P
	Complete	Chinook Group methanol, methylamines, dimethylformamide, monomethylformamide
	Partial	Dow Chemical Canada Inc benzene 1,1- 1,2-dicholoroethanes, tetracholorethylene, 1,1,2 trichloroethane, tricholoroethylene, toluene
	Complete	Ethyl Canada Inc. 1,2-dicholoroethanes, 1,1,2-trichloroethane, tetrachloroethylene, trichloroethylene, toluene
	Complete	Bayer Inc. benzene
	NF	Bayer Inc. P
Source discharges of coliform bacteria	Partial	City of St. Clair *
	Partial	Sombra Township
	AA	Government of Canada

ISSUE/ACTION	IMPLEMENTATION STATUS	FACILITY/AGENCY AND PARAMETER (IF APPLICABLE)
CSO elimination	Partial	City of Sarnia WPCP
	Partial	City of Port Huron WWTP
	Partial	City of St. Clair
	AA	Suncor Inc.
	Complete	Montell Canada Inc.
	Partial	Fibrex Insulations Inc.
	Partial	City of Marysville
	AA	Government of Canada
Point source discharges to air	Complete	Esso Imperial Oil emissions inventorying: benzene, ethylene, vinyl chloride, napthalenes, 124TM benzene, ethylbenzene, 1,3 butadiene, toluene, particulate matter
	Complete	Montell Canada Inc. emissions inventorying, assessment of environmental impacts
	Partial	Detroit Edison (Marysville, St. Clair, Belle River plants) emissions inventorying
	Complete	Lambton Generating Station emissions inventorying: SO_2, NO_x
	AA	Crown Vantage Mill NO_x
	AA	Shell Canada Products Limited NO_x, VOC
	AA	Amoco Canada Petroleum Limited CO_2
	AA	Suncor Inc. benzene
	AA	Laidlaw Environmental Services
	AA	Dow Chemical Canada Inc hydrocarbons, NO_x, ethylene oxide
	AA	Bayer Inc. benzene, methyl chloride, 1,3-butadiene, ethylene
	AA	Fibrex Insulations Inc. fibres
	AA	E.B. Eddy Paper Inc. volatile organic compounds, NO_x, SO_x
Eliminate spills	Complete-- Delisting Criteria Met	all facilities
	AA	Government of Canada

ISSUE/ACTION	IMPLEMENTATION STATUS	FACILITY/AGENCY AND PARAMETER (IF APPLICABLE)
Pollution prevention/toxics release plan	Partial Complete	City of Sarnia WPCP Esso Imperial Oil
Other pollution abatement measures undertaken by facilities over and above the scope of the RAP		*Shell Canada Products Limited — pH, turbidity, water use* *Suncor Inc.* *Chinook Group* *Dupont Canada Inc.* *Montell Canada Inc.* *Dow Chemical Canada Inc. — hazardous and non-hazardous landfill wastes* *Ethyl Canada Inc.* *Bayer Inc. — benzene, solid wastes* *Fibrex Insulations Inc.* *E.B. Eddy Paper Inc.* *Lambton Generating Station* *Detroit Edison (Marysville, St. Clair, hazardous and non-hazardous* *Belle River plants) landfill wastes* *Township of Dover* *Sombra Township* *Lambton County*
Setting new yardsticks and adjusting existing (as required)	NIL	
Develop discharge permits on the basis of discharges already approved or under application and assess total mass loadings to the river	Complete	Crown Vantage Mill
Develop whole plant permitting system	NIL	
Elimination of all discharges/leachate to Cole Drain	Partial Partial Partial Partial	Amoco Canada Petroleum Limited Dow Chemical Canada Inc. Fiberglas Canada Bayer Inc.
Small business toxic reduction education	NIL	

ISSUE/ACTION	IMPLEMENTATIO N STATUS	FACILITY/AGENCY AND PARAMETER (IF APPLICABLE)
Assess storm water impacts	NIL AA AA AA Complete Complete	City of Sarnia WPCP Esso Imperial Oil ICI Canada Inc. E.B. Eddy Paper Inc. Lambton Generating Station Detroit Edison (Marysville, St. Clair, Belle River plants) *
Zero discharge	NF Complete Partial Complete NF Partial NF	Crown Vantage Mill Esso Imperial Oil P Cabot Canada Inc. ICI Canada Inc. E.B. Eddy Paper Inc. Lambton Generating Station Detroit Edison (Marysville, St. Clair, Belle River plants)
NON-POINT SOURCE		
Watershed/subwatershed management plans	Partial	RIC Non-Point Source Steering Committee Watershed Improvement Program
Urban runoff for new developments	Complete Partial Partial	City of Port Huron Lambton County RIC Non-Point Source Steering Committee
Urban runoff for existing developments	Partial	City of Port Huron
Link Urban/Rural stormwater control through subwatershed plans	NIL	Kent County
Reduce use of road salt and seek alternatives	NIL NF	Kent County Sombra Township
Reduce use of lawn fertilizers and pesticides	NIL NA	Kent County Sombra Township
Promote agricultural programs and technology to reduce contamination to rural runoff	Partial Partial	Government of Canada RIC Non-Point Source Steering Committee Watershed Improvement Program
Protect existing natural areas and undertake remedial measures	Partial	RIC Non-Point Source Steering Committee Watershed Improvement Program

ISSUE/ACTION	IMPLEMENTATION STATUS	FACILITY/AGENCY AND PARAMETER (IF APPLICABLE)
Improved waste site planning and management	Partial	RIC Non-Point Source Steering Committee
Identify problems relating to domestic sanitary sources and ensure proper maintenance/repair	Partial Partial Partial	Moore Township Sombra Township RIC Non-Point Source Steering Committee Watershed Improvement Program
Correct direct discharges of untreated grey water	NIL	
Proper use and disposal of household hazardous wastes and product substitution / education	NIL	Kent County
SEDIMENT		
Complete sediment characterization studies	Partial AA	LIS/OMOE and RIC Sediment Subcommittee sediment characterization studies undertaken in 1994 and 1995 (83 samples) Government of Canada
Undertake in-situ pilot scale remediation	Complete	Dow Chemical Canada Inc. Contaminant Removal Project
Develop final remedial strategy	Partial	RIC Sediment Subcommitee modelling/biomonitoring studies completed strategy development
HABITAT		
Develop and implement communications/education program and appropriate landowner guidelines	Partial	OMNR, Lambton Stewardship Network, publication/distribution of RIC Habitat Subcommittee, BPAC 2 brochures
Strengthen wetland protection measures	AA	Township of Dover
Reduce ship wakes and surges and minimize impacts from winter shipping	NF	Coast Guard (Government of Canada) undertook studies and concluded that more stringent regulations were not required

ISSUE/ACTION	IMPLEMENTATION STATUS	FACILITY/AGENCY AND PARAMETER (IF APPLICABLE)
Ensure protection of shorelines from erosion and protect/enhance/restore other natural habitats in watershed	AA AA AA AA AA NIL AA Partial	Crown Vantage Mill ICI Canada Inc. E.B. Eddy Paper Inc. Lambton Generating Station Detroit Edison (Marysville, St. Clair, Belle River plants) Kent County Township of Dover City of Marysville
Control/eradicate exotic species	Partial Partial	Government of Canada voluntary ballast exchange program U.S. Federal Government enactment of ballast exchange regulations (Non-Indigenous Aquatic Nuisance Act)
Undertake habitat restoration and enhancement measures	AA AA AA AA AA AA AA AA AA	ICI Canada Inc. Lambton Generating Station Detroit Edison (Marysville, St. Clair, Belle River plants) Sombra Township MDEQ Rural Lambton Stewardship Network St. Clair Region Conservation Authority Walpole Island First Nation Heritage Centre Government of Canada
Develop long-term habitat management plan	AA AA	Lambton County Government of Canada

3.0 IMPLEMENTATION COMMITMENTS

Table 3 summarizes all commitments for future implementation of the recommended actions from the *Stage 2--Recommended Plan* document. These commitments are identified according to facility and type of action proposed or planned. It does not include ongoing actions which are addressed above in Section 2. Commitments identified in Table 3 were taken from the various documents provided to the RIC and summarized in Section 2. To be included in Table 3, the facility, agency or municipality has provided a formal written commitment towards implementation of remedial/corrective measures and/or Stage 2 recommended actions.

Other than those actions which are ongoing, very few firm commitments for further implementation efforts relating to the recommended actions have been provided to the RIC. Generally, most of those actions assigned a status of "partial" in Table 2 include ongoing actions.

To date, the following future actions have been identified from the information provided.

- achievement of yardstick for lead at the end of the pipe at Ethyl Canada Inc.
- further reductions of several volatile organics in point source discharges to air at Esso Imperial Oil
- further spill reduction or complete elimination of spills by Esso Imperial Oil, Sunoco Inc., and E.B. Eddy Paper Inc.
- Dow Chemical Canada's commitment to eliminate all chlorinated contaminant discharges/leachate to the Cole Drain
- elimination of all air emissions of benzene by 1998, at Bayer Inc.'s facility
- commitments to achieve zero discharge at Chinook Group, Dow Chemical Canada, Ontario Hydro's Lambton Generating Station
- through the official planning process, the County of Lambton is currently developing a plan to implement a Natural Heritage System
- the RIC Non-Point Source Steering Committee, through the Watershed Improvement Program, will undertake a voluntary incentive program of landowner education and involvement in both rural runoff pollution abatement and natural area/habitat enhancement; the program will include biomonitoring components, and through Michigan's Coastal Zone Management Program, coastal data gathering will be undertaken with the intent of developing a watershed management plan
- completion of a final sediment remediation plan by the RIC Sediment Subcommittee

Table 3. Commitments for future implementation.

ISSUE/ACTION	FACILITY OR PROGRAM AND ACTION PROPOSED
POINT SOURCE	
Persistent and bioaccumulative substances	
Persistent (potentially bioaccumulative) substances	Ethyl Canada Inc. Pb
Persistent parameters (not bioaccumulative)	
Non-persistent, non-bioaccumulative substances	
Source discharges of coliform bacteria	
CSO elimination	City of Port Huron committed to elimination; currently negotiating timeframe with MDEQ (currently plan calls for 42% reduction after 10 years of program)
Point source discharges to air	Bayer Inc. elimination of air emissions of benzene in 1998 Detroit Edison establishment of emissions monitoring/inventorying system in 2 years
Eliminate spills	Suncor Inc. E.B. Eddy Paper Inc.
Pollution prevention/toxics release plan	
Setting new yardsticks and adjusting existing	
Develop discharge permits on the basis of discharges already approved or under application and assess total mass loadings to the river	
Develop whole plant permitting system	
Elimination of all discharges/leachate to Cole Drain	Dow Chemical Canada Inc.
Small business toxic reduction education	
Assess storm water impacts	
Zero discharge	Chinook Group Dow Chemical Canada Inc. Bayer Inc. Lambton Generating Station
NON-POINT SOURCE	
Watershed/subwatershed management plans	RIC Non-Point Source Watershed Improvement Steering Committee Program
Urban runoff for new developments	
Urban runoff for existing developments	
Link urban/rural stormwater control through subwatershed plans	

ISSUE/ACTION	FACILITY OR PROGRAM AND ACTION PROPOSED
Reduce use of road salt and seek alternatives	
Reduce use of lawn fertilizers and pesticides	
Promote agricultural programs and technology to reduce contamination to rural runoff	RIC Non-Point Source Steering Committee; Watershed Improvement Program
Protect existing natural areas and undertake remedial measures	RIC Non-Point Source Steering Committee; Watershed Improvement Program
Improved waste site planning and management	
Identify problems relating to domestic sanitary sources and ensure proper maintenance/repair	RIC Non-Point Source Steering Committee; Watershed Improvement Program
Correct direct discharges of untreated grey water	
Proper use and disposal of household hazardous wastes and product substitution / education	
SEDIMENT	
Complete sediment characterization studies	LIS; Toxicity Identification and Evaluation (TIE) studies of "priority" zones
Undertake in-situ pilot scale remediation	
Develop final remedial strategy	RIC Sediment Subcommittee; strategy development to be based on overview of modelling/ biomonitoring studies
HABITAT	
Develop and implement communications/education program and appropriate landowner guidelines	
Strengthen wetland protection measures	
Reduce ship wakes & surges/minimize impacts from winter shipping	
Ensure protection of shorelines from erosion and protect/enhance/restore other natural habitats in watershed	
Control/eradicate exotic species	
Undertake habitat restoration and enhancement measures	
Develop long-term habitat management plan	Lambton County Natural Heritage System

4.0 SUMMARY OF IMPLEMENTATION PROGRESS

4.1 PROGRESS TO DATE

Implementation actions completed to date have directly resulted in the delisting of 2 impairments of beneficial uses. In addition, other improvements in environmental conditions are indicated by decreasing ambient levels in some contaminants and in the reduced loadings of contaminants to the St. Clair River (as reported in the *Stage 1 1997 Update* document, as well as documentation provided by various agencies for this report).

Actions undertaken since 1993 in support of the 38 recommended actions relating to point sources, non-point sources, sediment and habitat were evaluated according to current status of implementation in Table 2. From Table 2, it is clear that there have been many actions implemented, ongoing, and planned by facilities, agencies, and municipalities in the St. Clair River AOC since 1993, including activities not directly related to the RAP.

4.1.1 Point Source

All of the point source recommended actions were at least partially implemented with the exception of 3: 1) recommendations for provincial and state agencies to develop whole plant permitting systems, 2) recommendations to develop a small business toxic reduction education program, and 3) the setting of new yardsticks or the adjustment of existing yardsticks.

Generally, numerous actions have been undertaken relating to the control and reduction of chemical and bacterial contaminants from point sources in the AOC. Virtually all of the major industrial and municipal facilities in both Michigan and Ontario have shown significant progress in implementing these actions. The most notable of these is the dramatic reduction of spills to the St. Clair River. Not only has the frequency of spills been reduced, but the large-volume spills that have in the past resulted in water treatment plant shutdowns have not occurred for more than 2 years. Although a great deal of success has been achieved, facilities need to continue to implement actions which totally eliminates accidental spills of all types.

Other actions have resulted in significant control of persistent and bioaccumulative substances, particularly cadmium, chromium, mercury, PAHs, PCBs and several chlorinated organics (HCB, HCBD, QCB). Persistent, potentially bioaccumulative substances including copper, zinc, arsenic, lead, and carbon tetrachloride have also been addressed at key facilities. Concentrations of nickel, a persistent non-bioaccumulative substance, have been reduced to the yardstick value or less at the edge of the mixing zone at Dow Chemical. Yardstick values or better have also been achieved for several non-persistent, non-bioaccumulative substances at Shell Canada, Esso Imperial Oil, Chinook Group, Dow Chemical, Ethyl Canada and Bayer (Table 2).

Priority sources and associated contaminants identified for action in the *Stage 2--Recommended Plan* document but which have not yet been fully implemented include the following:

Cole Drain	- hexachlorobenzene, hexachlorobutadiene, pentachlorobenzene, octachlorostyrene
Corunna WPCP	- cadmium, lead, hexachlorobenzene
Sarnia WPCP	- mercury, cadmium, zinc, lead, copper, nickel, iron, phosphorus
Port Huron WWTP	- cadmium, phosphorus
Marysville WWTP	- phosphorus
Dow	- mercury, hexachlorobenzene, zinc, copper
Imperial Oil Refinery	- arsenic[1]
Novacor Petroleum	- arsenic
Polysar	- benzene[2], oil & grease, phosphorus
Suncor	- arsenic
Shell Canada	- zinc

[1] *RAP requirements are met if arsenic is reclassified as a "persistent parameter (not bioaccumulative)".*

[2] *Benzene implementation was completed at Bayer.*

Pollution prevention strategies were identified as being required for all facilities not capable of achieving their yardstick requirements. The plans were to be completed by December 1995 and include timetables for reduction. Although 17 industrial or municipal facilities addressed this action in their documentation, reporting involved ongoing measures and did not specifically address timetables for reduction of specific yardstick parameters.

The RAP Team recognizes the obligation to strive for the virtual elimination of all contaminant loadings, within a philosophy of zero discharge of persistent toxic contaminants. Actions leading toward zero discharge were described by 10 industrial facilities of which 4 were indicated as future commitments. Three facility operators indicated that this requirement was not attainable for their operations, although they had undertaken actions towards reducing discharges as far as feasible: Crown Vantage Mill (no specific parameters), E.B. Eddy Paper (no specific parameters), and Detroit Edison (3 plant facilities--no specific parameters). Cabot Canada indicated it had undertaken some actions toward a goal of zero discharge. Esso Imperial Oil indicated that it has met the IJC/OMOE zero discharge goal for the virtual elimination of persistent and bioaccumulative substances, as well as attained the RAP yardstick goal for phosphorus.

CSO control programs have been undertaken at a number of municipal and industrial facilities. None of these programs are yet complete but significant reductions in bacterial contamination and other contaminants found in urban runoff should be achieved by the completion of ongoing activities in Sarnia, Port Huron and the City of St. Clair. The *Stage 2--Recommended Plan* had also recommended that all sewage treatment plant effluents be disinfected or comparably treated to reach the yardstick value for *E. coli* (33 counts per 100 ml). No actions in this regard have occurred and the provincial response to the Stage 2 document indicated that the province did not support actions related to the disinfection of effluents.

The specific recommendations relating to point source discharges to air within the *Stage 2*--

Recommended Plan were focused on 2 key requirements:

- having all facilities provide inventories of amounts discharged/emitted of all substances currently on the yardstick list

- identifying and determining the nature and degree of impacts to the AOC as a result of air emissions from local sources

A total of 13 industrial facilities provided information relating to their point source discharges to air, which is summarized in section 2 of this document. The majority of this information pertained to voluntary reductions of discharges/emissions not directly related to the specific recommended actions noted above. However, 3 facility operators, Esso Imperial Oil, Montell Canada Inc., and Ontario Hydro (Lambton Generating Station) stated that monitoring/emissions inventorying systems had been established and were in operation; with Esso's and Montell's programs operating within the context of the federal National Pollutant Release Inventory (NPRI) and National Emissions Reduction Masterplan (NERM) programs. Montell also stated that they had completed pollutant dispersal studies and assessments of environmental impacts of their emissions, although specific information on the results of these were not available for incorporation into this document. Detroit Edison stated that an emissions inventorying system was currently in development at their facilities.

The information provided by the facilities is useful in terms of their programs and actions relating to regulated emissions. However, substances on the yardstick list have not been specifically addressed, other than benzene and toluene, and significant additional work remains to specifically address the issue of water, sediment, and biotic impacts from local sources of emissions to air in the AOC.

4.1.2 Non-Point Source

Of the 12 non-point source recommendations contained in the *Stage 2--Recommended Plan* document, 7 have been acted upon. Some of the actions implemented are at the level of policy definition, such as those included in the *Lambton County Official Plan* relating to urban runoff for new developments. Sombra Township has a new *Official Plan* requiring erosion control measures at new developments.

Other actions are currently at the planning/recommendation stage, such as the activities contained in the RIC Non-Point Source Steering Committee's Watershed Improvement Program, relating to watershed management plans, the promotion of agricultural landowner programs to reduce contaminant loadings to rural runoff and ensure the maintenance of domestic (rural) sanitary sources, and the identification, protection, and enhancement of natural areas. The Steering Committee has also refined its recommendations relating to improving waste site planning and management.

The City of Port Huron has implemented a program to control urban runoff from existing and new developments. Sombra Township indicated a series of domestic sanitary system upgrades

and expansions to complete and expand its services to ratepayers and also to meet OMOE requirements.

The recommended actions relating to the linkage of urban and rural stormwater control, the reduction in the use of road salt, the reduction in the use of lawn fertilizers and pesticides, not been acted on; the only consideration of these actions was acknowledged by Kent County and Sombra Township as either not being feasible for reasons of cost, or inapplicable due to responsibility for implementation resting with other levels of government. The additional recommended actions relating to the use of untreated grey water, and the proper use and disposal of household hazardous waste have not been addressed in the AOC.

4.1.3 Sediment

All 3 of the sediment recommended actions have been implemented to some degree. The further characterization of contaminated sediments was undertaken in 1994 and 1995 by the Lambton Industrial Society and OMOE, and additional Toxicity Identification and Evaluation (TIE) studies are currently underway.

In addition, the RIC Sediment Subcommittee has commissioned a multicomponent study on the application of computer modelling and biomonitoring tools that includes as integral components: 1) the field and laboratory verification of the major sediment transport and transformation processes operating in the St. Clair, 2) the identification of biohazards associated with sediment-bound contaminants, and 3) the definition of priority areas for remediation within “priority” zone 1. Anticipated in early 1998, the results of this study will be used in the development of a final sediment remedial strategy. The final remedial strategy for sediments of the AOC was originally scheduled to be in place by 1998. Based on the recent completion of the overview portion of this study, which will provide much of the framework for the final strategy, this action can be considered to be on schedule.

In 1996, Dow Chemical Canada completed the in-situ pilot scale sediment remediation program (Contaminant Removal Project) for the area south of the old Cole Drain discharge. Dow also undertook remediation work at the “chemical pool” offshore of the Dow First Street site, and has reported that as of December 1996, no chemical puddles were observed on bottom sediments since monitoring of this site began in 1986. The Cole Drain site was the impetus for the recommended action, so this action can be considered complete.

4.1.4 Habitat

All of the habitat recommended actions have been addressed in some manner, ranging from the publication of educational brochures, to site-specific shore enhancement measures, through to the development of a landowner habitat enhancement program in the context of the binational Watershed Improvement Program established by the RIC Non-Point Source Steering Committee (see Section 2.2).

With regard to shoreline habitat measures, the Canadian and U.S. coast guards undertook surveys of ship speeds and resulting wakes and concluded that current wakes were not damaging and there was no requirement for further speed reductions. Notwithstanding, habitat protection has been undertaken with regard to shoreline protection measures at a number of municipalities and at several industrial facilities, as well as to wetland protection measures in the Township of Dover. In addition, the, RIC has undertaken the development of framework for an AOC Natural Heritage System which addresses issues related to the identification of existing habitat required for protection as well as additional areas for enhancement and rehabilitation.

With regard to habitat restoration and enhancement, several programs have been instituted which are or will have a significant impact. Specific restoration projects have been undertaken on the Ontario side at candidate sites on Stag Island, at MacDonald Park, and along the Darcy McKeough Floodway. Several facilities (ICI Canada Inc., Lambton Generating Station, Detroit Edison) and agencies/organizations (Sombra Township, Rural Lambton Stewardship Network, St. Clair Region Conservation Authority and Walpole Island First Nation Heritage Center) have undertaken habitat restoration activities or programs within the AOC. Lambton County is currently revising their Official Plan with the inclusion of a Natural Heritage System. To be effective, this will require the restoration of forested areas and the establishment of natural riparian buffers. The RIC Non-Point Source Steering Committee has initiated a 3 year Watershed Improvement Program with the goal of educating landowners and encouraging voluntary pollution reduction and natural area/habitat enhancement.

Overall, habitat protection measures have been *ad hoc* with no coordinated regulatory or policy framework in either Ontario or Michigan. Overall, more work is required in AOC-specific activities related to the identification of existing natural habitats for protection, shoreline and wetland protection, greater enforcement of existing regulations, development of regulations relating to the use of small watercraft in shallow marshes, the education of landowners, and the control and eradication of exotic species. In the latter case, recent activity has included work relevant to the Great Lakes Basin as a whole, including 3 studies completed by the Government of Canada in the areas of ship ballast water control technology, ballast water sampling, and ballast tank sterilization methods; the U.S. Federal Government has also enacted ballast exchange regulations (cf., Non-Indigenous Aquatic Nuisance Act, 1990).

Although there has been some success at habitat restoration and enhancement since 1993, major weakness exists in the total amount of habitat restored and the identification of habitats and measures for additional rehabilitation. Some progress is being made by the RIC in the development of the GIS database nearing completion and in the development of an AOC-wide Natural Heritage System framework. These will assist greatly in the identification of additional areas and types of habitat requiring protection.

The timeframes for implementation of habitat protection and restoration measures are long-term (mostly defined as “ongoing” in the *Stage 2--Recommended Plan*), and involve many steps including identification, ownership or conservation easement designation, and ecological planning prior to implementation. However, to date protection and restoration activities can be considered to be well behind schedule with more coordinated AOC-wide planning and actions required.

4.1.5 Summary

Overall, recommended actions implemented since 1993 have focussed principally on the elimination of spills and the design and/or construction of upgraded waste treatment facilities. This has resulted in immediate benefits related to reductions of some key contaminants and the elimination of the need to close water treatment plant intakes.

Key recommended actions which are falling behind schedule with regard to implementation include eliminating or reducing the Cole Drain as a source, meeting specified requirements for yardstick parameters (especially at priority sources), and reducing non-point source contributions of contaminants.

4.2 DELISTING CRITERIA AND IMPAIRMENTS OF BENEFICIAL USES

The relationship between the implementation of recommended actions and improvements in the status of identified impairments to beneficial uses, including their eventual delisting, cannot be determined quantitatively. However, the actions recommended in the *Stage 2--Recommended Plan* document were defined on the basis of improving overall water, sediment, and biota quality in the AOC. As such, they were specifically targeted to parameters and sources known to be causing impairments to beneficial uses. For example, parameters targeted included those known to fall above yardstick values (e.g., zinc in sediments) or contribute to an action which resulted in an impairment (e.g., CSOs → coliform bacteria → beach closings).

Specifically, the *Stage 2--Recommended Plan* identified the following 9 impairments to beneficial uses and associated contaminants or problems.

1. Restrictions on fish consumption	• Hg, PCB, PCOD/PCDF
2. Bird or animal deformities or reproductive failures	• chironomid mouth-part deformities
3. Dynamics of benthic populations/communities	• degraded community health along 6 km of AOC
4. Restrictions on dredging activities	• As, Cu, Cd, Fe, Pb, Hg, Ni, Zn, Mn, total PCBs, total PAHs, HCB, TOC, TKN, TP, oil and grease
5. Restrictions on drinking water consumption or taste and odour problems	• periodic closures of water treatment plants
6. Beach closings	• Ontario and Michigan beaches periodically closed and discharges inadequately treated

		sewage
7.	Degradation of aesthetics	• periodic floating scums, oil slicks, spills and odours
8.	Added cost to agriculture and industry	• periodic closures of intakes to food processing plants
9.	Loss of fish and wildlife habitat	• filling, draining, dredging, bulkheading, wetland loss

Implementation of most of the actions recommended in the *Stage 2--Recommended Plan* document is critical to resolving many of the impairments to beneficial uses identified for the AOC. The implementation that has occurred to date, in particular the reduction or elimination of contaminants from point and non-point sources and spills, has resulted in improvement in those impairments indicated for drinking water consumption and taste/odour, beach closings, degradation of aesthetics, and added costs to agriculture and industry.

Based on a thorough evaluation of 1997 conditions (see *Stage 1 1997 Update*) against the delisting criteria reported in the *Stage 2--Recommended Plan,* 2 of the 9 impairments were delisted. A status of "not impaired" was assigned to restrictions on drinking water consumption or taste and odour problems, and added costs to agriculture and industry.

One impairment--bird and animal deformities--was re-classed as "requires further site-specific assessment" because of the reassignment of chironomid mouthpart deformities as evidence to the impairment of the dynamics of benthic populations. In addition, the issue of "tainting of fish and wildlife flavour", which had been classed as "requiring further assessment on a site-specific basis", has been reassessed as "not impaired" based on the results of additional study.

Table 4. Achievement of delisting criteria and changes to status of impairments of beneficial uses, St. Clair River RAP, 1997. Shaded areas highlight those impairments that have changed status since the release of the 1995 *Stage 2--Recommended Plan* document.

GLWQA IMPAIRMENT OF BENEFICIAL USE	STATUS
Restrictions on Fish and Wildlife Consumption Restrictions on Fish Consumption	*impaired*
Bird or Animal Deformities or Reproductive Problems	requires site-specific assessment
Degradation of Benthos Dynamics of Benthic Populations/Communities	*impaired*
Restrictions on Dredging Activities	*impaired*
Restrictions on Drinking Water Consumption or Taste and Odour Problems Consumption Taste and Odour Problems	not impaired not impaired
Beach Closings	*impaired*
Degradation of Aesthetics	*impaired*
Added Cost to Agriculture or Industry	**not impaired**
Loss of Fish and Wildlife Habitat	*impaired*

The *Stage 2--Recommended Plan* had assigned a status of "Requiring Site-Specific Studies" to the impairment on tainting of fish and wildlife flavour. The 1997 Update report reassessed this impairment as "Not Impaired" based on the results of a fish tasting test panel study.

The 6 remaining impairments to beneficial uses were not reclassified, and remain "impaired" following the recent re-assessment (see Table 4). Further, based on the number and type of contaminants and the lack of statistically significant trends, the 1997 Update Report concluded that these 6 impairments have shown little or no improvement.

Implementing non-point source actions will have a direct bearing on beach closings. The impairments pertaining to fish and wildlife consumption, degradation of benthos, and restrictions on dredging activities are affected by both current point and non-point sources of contamination, as well as by in-situ sediment conditions. The loss of fish and wildlife habitat impairment will be addressed by means of habitat protection, restoration, and enhancement implementation actions.

The degree to which one can correlate specific implementation actions to improvements in impairments is quite variable. One problem is related to the intensity and extent of sampling--as sampling becomes more site-targeted both to address gaps in coverage and to focus on priority areas, sampling locations will change between reporting periods. Thus, it is not possible to directly correlate the number and magnitude of contaminant occurrences above yardstick values from one period to the next. In addition, ongoing contributions from non-point sources and from

in-situ sediments may mask improvements due to point source reductions in the short term. Through time, however, the number and magnitude of parameters above yardstick levels, or the frequency and duration of beach closings should be reduced.

The most dramatic improvement within the AOC is clearly the reduction in the size and frequency of chemical spills. This has led directly to the de-listing of 3 impairments based on the absence of water treatment plant closures over a 2 year period. The change in status of tainting of fish flavour was based on the results of a key study along with the lack of anecdotal reports, and is likely the result of improvements in point source effluent quality following the implementation of recommended actions, particularly those relating to phenols. This is also consistent with studies of fish tainting, using a community taste and odour panel, conducted by the Lambton Industrial Society through the 1980s, which were discontinued when panellists could no longer distinguish among sites.

The implementation of recommended actions has clearly had a significant impact on impairments caused by chemical spills. However, more statistically significant trend data will be required from the implementation of recommended actions.

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