PART II: ENVIRONMENTAL IMPERATIVES

The original mandate of the Royal Commission was to examine the shoreline: the Greater Toronto waterfront. But a growing understanding of ecological principles led inexorably to expanding the scope of the Commission's enquiry to encompass the watersheds, Lake Ontario, and the Great Lakes Basin. This section of the final report addresses certain key environmental imperatives of waterfront regeneration: water, shorelines, greenways, and the winter waterfront.

First, and on the broadest scale, are the waters of Lake Ontario and its watersheds, constantly moving and ever-changing; we depend on them for drinking, washing, cooling, industrial use, shipping, and recreation. The natural systems and wildlife of the bioregion are dependent on the cycling of water (groundwater recharge, springs, streamflow, etc.) and on aquatic habitats: ponds, creeks, rivers, wetlands, the lake.

Second is an examination of the interface between land and water, the Lake Ontario shoreline. Its shape once formed by the power of the lake, the shoreline is now radically altered by human activities.

Third, we explore the possibilities of renewing ecological and recreational links between the waterfront and its watersheds, through greenways from the shoreline up the river valleys and into the hinterland.

Fourth, we explore the potential to improve year-round use of the waterfront, by careful consideration of microclimates, access, safety, landscaping, urban design, programming, and facilities.

Regeneration of the waterfront depends on restoring the environmental health of Lake Ontario's waters, its shoreline, and the river valleys. Therefore, we take an ecosystem approach to examining current problems, and to recommendations for regeneration. Because of the interdependence of ecosystems, a comprehensive strategy for regeneration must combine many objectives, so that each action fills a variety of needs, and complements actions being taken elsewhere.

For example, we cannot expect to regenerate the shoreline without addressing the health of both the lake that laps at its shore and the rivers that feed it. Similarly, actions designed to enhance year-round recreational use of the waterfront, or to provide linked trails in the bioregion, will be more valuable if efforts are undertaken at the same time to restore ecological health.

CHAPTER 3: WATER

Early in its work, the Royal Commission realized that it could not consider the Greater Toronto waterfront in isolation from the area surrounding it. Ecological principles tell us that it will both affect areas outside itself and be affected by external influences. Moreover, the Greater Toronto waterfront is part of a much greater whole — in fact many greater "wholes". First (and closest to home), it is linked ecologically to the Greater Toronto bioregion by the river valleys and streams flowing south to the lake.

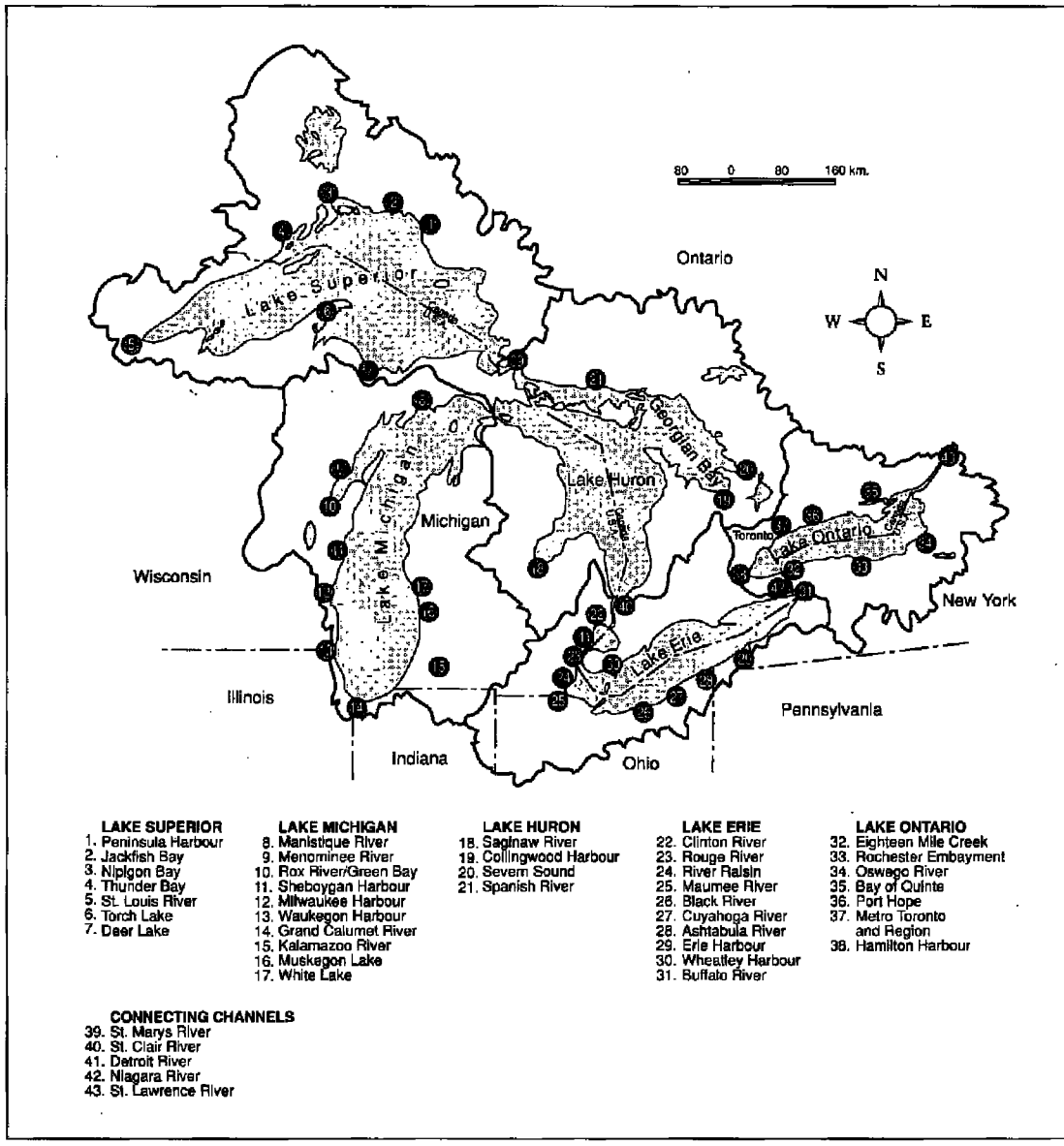
At the same time, as Map 3.1 makes clear, water quality along the Greater Toronto waterfront is tied to that of Lake Ontario, and the Lake Ontario Basin. The basin drains an area of about 64,000 square kilometres (24,710 square miles) in south-eastern Ontario and northern New York State.

But Lake Ontario does not sit in isolation. It is the fifth and most downstream in the chain of Great Lakes. About 80 per cent of the water entering it comes from upstream through the Niagara River. Although there is much that must and can be done in and around Metropolitan Toronto's waterfront, restoration of water quality is in part dependent on the health of the Great Lakes. For example, we can do little, acting independently, to tackle the problems of persistent toxic chemicals throughout the waters of the basin. That kind of problem requires a much broader perspective, one that can be gained only by examining the Great Lakes Basin ecosystem.

The Greater Toronto waterfront is but 250 kilometres (155 miles) of what has sometimes been called "North America's fifth coast" — 8,000 kilometres (5,000 miles) of continuous coastline bounding the Great Lakes and the St. Lawrence River. The earliest European explorers and settlers sailed up that coastline looking for a "land of plenty" and found almost unimaginable natural riches in an area sparsely settled by native people. The lakes provided a seemingly inexhaustible supply of fresh water for drinking. Stands of timber stretched as far as the eye could see. The rivers draining into the lakes could be used for transportation into the interior and floating timber out for powering grist and sawmills.

Wetlands, inland and at the mouths of rivers, supported thriving communities of fish, reptiles, and waterfowl. The forests

Map 3.1 The Great Lakes Basin, areas of concern



that touched the Great Lakes shores were home to fur-bearing mammals, which could be trapped, and to deer, which were hunted for food. The lakes supported an abundance of fish — lake trout and herring, whitefish and sturgeon, Atlantic salmon and American eel, and many others.

Small wonder people flocked here. Today, 10 per cent of the American population and almost a third of all Canadians live in the Great Lakes Basin, which is the economic heartland of Canada. It includes 28 cities with populations of more than 50,000 people, as well as 13,400 manufacturing and industrial plants. Those who live in the basin depend on the Great Lakes for water used for drinking, irrigation, industry, waste receiving, power generation,

transportation, and recreation, as well as for fisheries and wildlife habitat.

Now, almost two hundred years after European settlement began in earnest, the Great Lakes Basin has been dramatically transformed by human activities. Most of the great forests that once lined its shores were logged in a frenetic flurry of activity that lasted from 1850 to 1920. Development and the loss of habitat drove large mammals such as bear and deer inland. As the result of overfishing, dam construction, and habitat destruction, many once-abundant species of fish became rare or extinct. However unwittingly, the decision to build canals and the international movement of goods and people opened the door to the sea lamprey, purple loosestrife, and other exotic non-native species. In 1890 and 1891, one man's somewhat eccentric idea of importing into New York species of all birds mentioned by Shakespeare introduced the ubiquitous European starling to North America while, more recently, the release of bilge water from a foreign vessel brought us the zebra mussel. With few natural enemies, such opportunistic species have flourished in the basin and elsewhere, and have pushed out less hardy native species.

Natural areas — woodlands and wetlands — as well as valuable agricultural land have been gobbled up by indiscriminate development. Rivers have been befouled, and streams placed underground or paved over. One legacy of the intense resource extraction and manufacturing activities carried out in the basin is the presence of heavy metal and chemical pollutants; these can be found in the Great Lakes waters, in the sediments on the bottom of lakes and rivers, in landfill sites dotted across the landscape, and in soil and groundwater on industrial sites.

The landscape today is very different from the one that greeted European explorers. Natural resources, once so rich, are sadly diminished. This chapter briefly describes the state of the Great Lakes, particularly water quality and the health of humans and wildlife, and examines why there has been so little progress in restoring the Great Lakes ecosystem, which is crucial to the regeneration of the Greater Toronto waterfront.

THE STATE OF THE LAKES

An exhaustive review of the state of the Great Lakes is beyond the scope of this report; moreover, many excellent books have recently been published on the subject. This section focuses on three specific environmental problems in the Great Lakes

Beginning with the nineteenth-century cities and continuing through our post-war reshaping of cities, suburbs, and countryside, we have been making changes in the environment at an unprecedented rate. Today's world not only looks very different from the eighteenth-century world but also sounds very different and smells very different. Whatever else these changes have brought us in the way of human benefits or environmental degradation, they have offered us an unparalleled chance to look at how our health and well-being are affected by changing what we can experience in a place.

Hiss, T. 1990. *The experience of place*. New York: Alfred A. Knopf.

CHANGES TO THE GREAT LAKES FISH COMMUNITY

The first settlers on the shores of the Great Lakes were astounded by the bounty of fish. *The Jesuit Relations*, a journal published annually describing the experiences of Jesuit missionaries, reported that, "A single fisherman will catch in one night twenty large sturgeon, or a hundred and fifty whitefish, or eight hundred herring in one net" on the south shore of Lake Superior. It was reported that, at Sault Ste. Marie, whitefish in the St. Marys River ran so thick that, standing in the water, a person could reach out and easily grab a thousand. By the early 19th century, commercial fisheries had been established on the lakes, initially supplying mining and lumbering companies and, later, the booming cities of the U.S. midwest.

As early as 1879, more than a million pounds of lake trout and nearly two million pounds of whitefish were being harvested annually from Lake Ontario. By the beginning of the 20th century, commercial fishing was big business in the Great Lakes, involving 10,000 people — twice as many as 20 years earlier. "But as fishing intensity increased, and human-initiated changes to environment accelerated", the delicate web within which the fish community existed began to unravel.

Fish stocks declined, and some species disappeared forever, primarily as the result of overfishing. For example, the black-finned and short-nosed ciscoes were much sought after but, by 1900, these deep-water herring-like fish were commercially extinct. Other species were deliberately destroyed: the long-lived sturgeon (some live as much as 150 years) was hunted and destroyed because its external body armour easily tore nets set for smaller fish. Once they caught the sturgeon, fishers "piled them like cordwood, on the beaches, dousing them with oil and burning them."

Still other species were lost or declined as the result of a combination of factors. For example, overfishing, compounded by decreasing habitat, led to the demise of Lake Ontario Atlantic salmon. As settlers cleared the land, water flow in the summer decreased and siltation increased. Without trees to shade the rivers, temperatures rose, denying salmon the cool clear waters necessary for reproduction. Furthermore, saw mills blocked spawning routes and released saw dust that blanketed the river bottoms and marshes, suffocating fish eggs and larvae. The last Lake Ontario Atlantic salmon was seen in Wilmot Creek in 1896.

The final major blow to the Great Lakes fisheries came when, deliberately and accidentally, foreign fish species were introduced. Already vulnerable fish stocks could not compete with the new arrivals, changing forever the Great Lakes' ecosystem. Rainbow smelt, added to the Great Lakes as a food source for an unsuccessfully introduced salmonid, thrived and probably fed on the prey of whitefish and herring, thus bringing about the decline of these species. Carp, introduced as a food source for humans, destroyed aquatic vegetation, thereby affecting many fish species dependent on wetlands.

There are two fish species — lamprey and alewife — that have played a major role in degrading the Great Lakes fisheries; they are thought to have gained access via the

canals that were constructed to link the fresh-water seas with the Atlantic Ocean. Lampreys, parasites that suck fish dry of their vital juices, have decimated whitefish and lake trout populations. Alewives do damage by virtue of their sheer numbers: they consume prey species used by lake herring, chub, and whitefish.

We are left with a Great Lakes fishery that has been drastically altered. The foreign species have become the most abundant; now, our sport fisheries rely almost exclusively on coho and chinook salmon raised in hatcheries, because these types do not reproduce very successfully in the lakes.

Because of diminished stocks, and also because of the relatively new threat of toxic contamination, commercial fishery operations cannot be sustained in the Great Lakes. The chemical soup produced by the agricultural and urban communities that rim them makes many fish unfit for consumption by either humans or wildlife. Today, the blue pike and lake trout are gone from Lake Erie, while Lake Ontario has lost the lake herring. Furthermore, six of seven species of chub are now extinct in the Great Lakes. It took 10,000 years for the fish community to evolve in the Great Lakes, and only a few decades to change it forever.

Sources: Ashworthy, W. 1986. *The late, Great Lakes: an environmental history.* Toronto: Collins; Weller, P. 1990. *Fresh water seas: saving the Great Lakes.* Toronto: Between the Lines.

Basin: water quality (especially as it affects the health of humans and wildlife), wetlands and river systems, and water quantity.

WATER QUALITY

The degraded water quality in the Great Lakes Basin is not just a recent concern. In Toronto, for example, pollution of the harbour and Ashbridge's Bay was a civic preoccupation as early as the 1880s. Prior to that time, the waters of the harbour had been viewed, in the main, as a convenient (and inexhaustible) dumping ground for human and animal wastes, and any other unwanted garbage. But as the stench along the waterfront became unbearable and understanding of waterborne disease grew, attitudes began to change. In order to protect public health, by 1910 the City of Toronto had built its first plant to treat sewage.

Toronto, of course, was not alone and its problems were being duplicated around the lakes, in Buffalo, Chicago, Cleveland, and other rapidly growing urban centres. To remedy the situation, in 1912 the Canadian and American governments asked the fledgling International Joint Commission to study the matter — the first bilateral environmental initiative undertaken in the Great Lakes.

In retrospect, building sewage treatment facilities and implementing measures to control nutrient loadings in the lakes have been the highlights of pollution control in the Great Lakes Basin. Until quite recently, sewage treatment initiatives there were a patchwork but, by the late 1960s, it was becoming apparent to scientists, policy makers, and the general public that the lower lakes were suffering badly from nutrient pollution. High levels of nutrients such

Massey Creek, Toronto

as phosphorus and nitrogen were causing eutrophication of the lakes — uncontrolled growth of aquatic plants, lowered levels of oxygen, and an environment in which many fish could not survive. Lake Erie, in particular, was in severe trouble and, as the "dying lake", became a powerful symbol of what was wrong in the basin.

Of course, excess levels of nutrients were by no means the only pollution problem at the time: waterways were receiving huge amounts of what are called "conventional pollutants" — oils and greases, oxygen-depleting organic matter, and suspended solids — in addition to barely treated industrial effluents and spills. The conditions in the 1960s were captured graphically by Phil Weller (1990) in his book, *Fresh Water Seas: Saving the Great Lakes*:

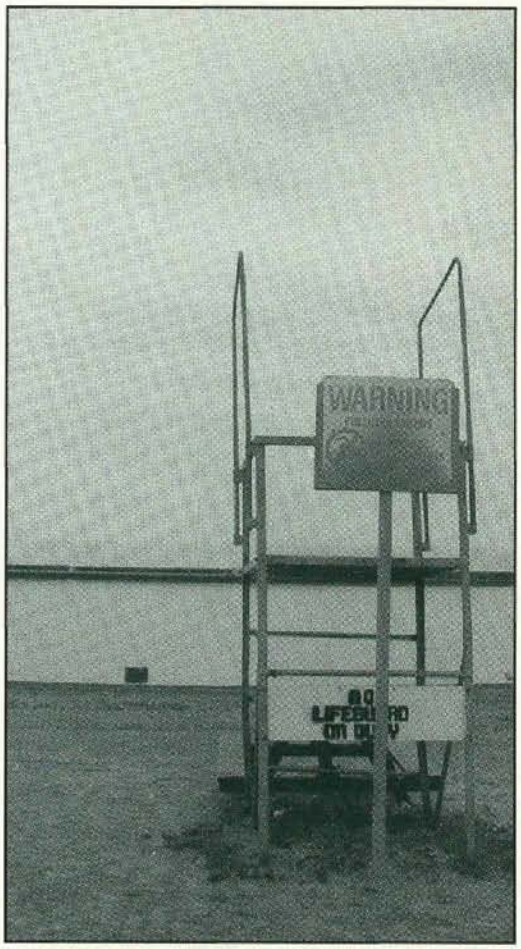
> The severity of the problems produced a catalogue of bizarre phenomena. The weeds in Rondeau Bay on the north shore of Lake Erie became so dense that they looked like a "field of wheat" and an aquatic weed cutter was purchased to fight back the growth. The Cuyahoga River running through Cleveland was so clogged with oils and greases that it caught fire in 1969. The city had to build a fire wall and declare the river a fire hazard. . . . In March 1967 a deadly combination of cold weather and industrial pollution killed five thousand ducks along the Detroit River. Wood fibres, chips, pulp-paper mats, and oil slicks clogged the St. Marys River. Oil slicks and discoloured water were common on the Niagara River. . . . In January 1967 a worker's acetylene torch accidentally ignited the oils on the Buffalo River, a tributary of the Niagara. Flames leaped high into the air, burning

pilings for a bridge and melting glass fixtures thirty feet above the surface of the water.

In 1964, in response to public demands for action, Canada and the U.S. asked the International Joint Commission to investigate and recommend remedial measures to stop the deterioration of the lakes. Following the IJC's report in 1970, concerted binational action was initiated. In 1972, the two governments signed the first Great Lakes Water Quality Agreement (GLWQA); it dealt specifically with eutrophication in lakes Ontario and Erie.

The agreement set the stage for co-ordinated prevention activities on both sides of the border; it set effluent targets for sewage treatment plants, and contained a schedule for reducing phosphorus loadings into the lakes. Canada's federal government took the lead by restricting phosphate concentrations in detergents and providing funds to upgrade sewage treatment plants. The Province of Ontario set tougher guidelines for effluents from treatment plants and also assisted municipalities to pay the costs of upgrading. The outcome was significant: the fishery in Lake Erie eventually recovered, and the thick green mats of algae, once so common, are now rarely seen.

This does not mean that conventional pollutants like phosphorus, suspended solids or bacteria have disappeared: site-specific problems still exist. In Toronto, for example, phosphorus levels across the waterfront are still too high, and some old combined sewers, which spew raw sewage into the nearshore of Lake Ontario in heavy rain storms, still exist. As a result, beaches have to be closed every summer because of high bacterial levels, and recreational opportunities



Sunnyside Beach

are reduced for swimmers, boardsailors, rowers, and others. In Toronto and 42 other places around the Great Lakes, these site-specific problems are being addressed within the framework of Remedial Action Plans to improve water quality.

However, the overall success of programs triggered by and agreed to under the 1972 GLWQA clearly demonstrates what can be achieved on the basis of co-ordinated action. Indeed, as pointed out in the report, *The Great Lakes in the 1990s*, "the rapid improvement in the condition of these lakes after 1972 encouraged Canada and the USA to sign a new agreement in 1978" (Jackson and Runnalls 1991).

The new agreement — the 1978 Great Lakes Water Quality Agreement — contains both an eloquent vision and a bold statement of purpose. While the 1972 document focused on eutrophication in two of the Great Lakes, the 1978 Agreement set out as its purpose nothing less than the restoration and maintenance of "the chemical, physical, and biological integrity of the Great Lakes Basin ecosystem" (International Joint Commission 1988). It bound both federal governments to consider the whole ecosystem in the basin, not just parts of it, and to examine the quality of the ecosystem (air, water, soil, humans, wildlife, and the connections among them).

The problems that had been addressed by the 1972 agreement were conventional pollutants — the so-called "lumps and solids" — the impact of which was visible in the form of scum, slicks, algae growth, and dead fish. The 1978 agreement tackled more complex problems — including one that was largely invisible: the myriad of synthetic toxic chemicals that could often be neither seen nor smelled. Therefore, the IJC's Water Quality Board (its principal advisory body) began compiling lists of synthetic toxic chemicals discovered in Great Lakes waters. Year by year, as detection methods improved, the list grew.

It now includes 362 compounds, of which 32 are metals, 68 are pesticides, and 262 are other organic chemicals. Of the total, at least 126 have been shown to be toxic to living beings, but there is little or no information about the toxicity of the remainder to humans or wildlife. Acceptable standards for the presence in water of many of these compounds do not exist: the IJC has set objective levels for 28 compounds in water, while the Province of Ontario has water quality objectives for 87 compounds.

By 1985, after 13 years of compiling data, the IJC was able to target a sub-set of pollutants of great concern. They include:

- three industrial chemicals (PCBs, mercury, and alkylated lead);
- five pesticides (DDT, dieldrin, toxaphene, mirex, and hexachlorobenzene); and
- three waste by-products (dioxins, furans, and benzo (a) pyrene).

These were singled out in the basin because of their persistence in the environment, and their toxicity to wildlife and possibly human health.

The Water Quality Board has recently subjected six of the 11 pollutants — PCBs, DDT, dieldrin, toxaphene, mirex, and hexachlorobenzene — to further scrutiny. The manufacture and use of these chemicals have been significantly restricted for years; for example, most uses of DDT were stopped in Canada in 1970. The use of toxaphene virtually ceased in the early 1980s. Dieldrin, once widely used, may no longer be utilized for termite control. Because of restrictions on their use and manufacture, these chemicals are found in much lower levels in the environment now than 20 years ago. In fact, the levels found in the water of the Great Lakes are lower than the objectives set under the GLWQA and (in respect of these six pollutants) is "safe". It would seem that the problem should be solved.

But it has not been solved. Despite the significantly lower levels in the environment that resulted from actions taken, the IJC Water Quality Board concluded in their

Table 3.1 Critical pollutants in the Great Lakes Basin ecosystem

Total polychlorinated biphenyls* (PCBs)
Insulating fluid in electrical transformers and in production of hydraulic fluids, lubricants and inks. Includes 209 related chemicals of varying toxicity. Enters from air or in sediments.

DDT and its components (including DDE)**
Insecticide. Still used heavily for mosquito control in tropical areas on other continents. Enters from air or in sediments.

Dieldrin**
Insecticide used on fruits. Enters from air or in sediments.

Toxaphene**
Insecticide developed as a substitute for DDT. Used on cotton. Enters from air or in sediments.

2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)
Chemicals in herbicides used in agriculture and for prairie and forest management (contaminant in Agent Orange herbicide used in Vietnam). Also a by-product of burning fossil fuels and wastes, and of pulp and paper production processes. This chemical is the most toxic of 75 forms of dioxin.

2,3,7,8-tetrachlorodibenzofuran (TCDF)
Chemicals in herbicides used in agriculture and for prairie and forest management. Also a by-product of burning fossil fuels and wastes, and pulp and paper production processes. This chemical is the most toxic of 135 types of furan.

Mirex***
Fire retardant and pesticide to control fire ants. Breaks down to more potent chemical, photomirex, in presence of sunlight. Enters from air or in sediments.

Mercury
Used in metallurgy, and a by-product of paint, chlor-alkali and electrical equipment production. Also occurs naturally in soils and sediments.

Alkylated-lead
Fuel additive and used in solder, pipes and paint. Also released when burning fuel, wastes, cigarettes and from pipes, cans and paint chips.

Benzo(a)pyrene
Produced when fossil fuels, wood, wastes and charcoal are burned and from automobile exhaust. One of many forms of polyaromatic hydrocarbons, or PAHs.

Hexachlorobenzene (HCB)
By-product of burning fossil fuels and wastes, and in manufacturing chlorine. A contaminant in chlorinated pesticides.

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* Manufacture and new uses prohibited in the United States and Canada

** Use restricted in the United States and Canada

*** Banned for use in United States and Canada

Source: International Joint Commission. Great Lakes Water Quality Board. 1991. *Cleaning up our Great Lakes: a report from the Water Quality Board to the International Joint Commission on toxic substances in the Great Lakes Basin ecosystem.* Windsor: International Joint Commission.

1991 report to the IJC, *Cleaning up Our Great Lakes*, that reductions of the 11 critical pollutants:

> . . . are not as comprehensive as we now think necessary. Studies suggest that these substances actually have or threaten to have continuing important, if very subtle effects on human health and wildlife, even in very low concentrations. (IJC Great Lakes Water Quality Board 1991).

Persistent Toxic Substances and the Health of Wildlife and Humans

How can "safe levels" of toxic chemicals in water cause problems in humans and in wildlife? The answer lies in the characteristics of the chemicals and how they move through the food chain. The 11 on the IJC's list (and many others found in the Great Lakes Basin) are persistent: they take a very long time to break down into less toxic forms. In the case of toxic metals such as mercury and lead, breakdown never occurs.

At least eight of the 11 share one other important characteristic: they have the potential to "biomagnify". In other words, the levels of dieldrin or mirex or PCBs found in animal tissues get progressively higher as one moves up the food chain. In order to understand the problems of toxics in the Great Lakes, it is important to know why this happens.

When a kilogram of a persistent toxic chemical is discharged into water, some will remain dissolved in the water, and some will become attached to particles and sink to the bottom sediment. In either case, the chemical is "available" to aquatic organisms. Bottom-dwelling invertebrates (such as clams or worms) will accumulate the toxin in tissues as they ingest sediment or water. If levels are high enough, toxic effects will be seen in the organisms. If levels are lower, the invertebrates themselves will be fine, but a problem can still appear farther up the food chain.

In the animal world, almost everything is a potential dinner for something else. The food web is illustrated in Figure 3.1. It shows that invertebrates are near the bottom of the food chain and get eaten by forage fish such as smelts or alewives which, in turn, are eaten by larger fish — pike or lake trout, for example — which are eaten by aquatic birds such as gulls or cormorants, or by humans.

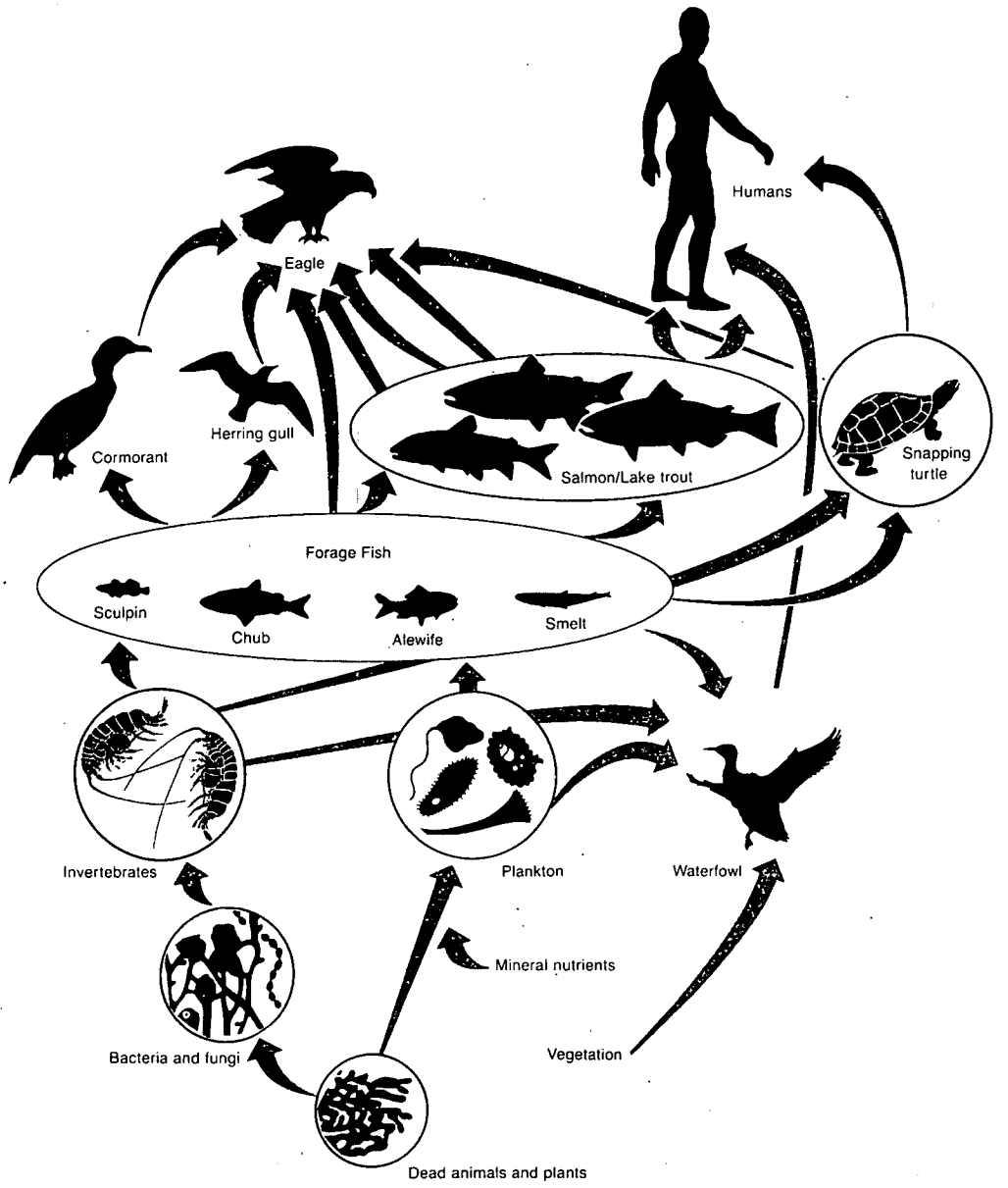
Although levels of persistent chemicals in water may be "safe" (because they meet the standards that have been set), as a consequence of biomagnification, levels are often too high in the fish to make them safe food for humans or wildlife. In the Metro Toronto area, because of chemical biomagnification, there are restrictions on eating some sizes of eight species of fish. Similar restrictions are found elsewhere around the lakes. Because of the biomagnification process, herring gull eggs may contain levels of PCBs 10 million times greater than those found in Great Lakes waters.

Biomagnification illustrates one of the weaknesses of the traditional approach to managing chemicals: water quality standards are set for the "most sensitive receptor", often to ensure the survival of sensitive species such as trout. But our water quality standards are *not* set to protect the gull that eats the smelt, or the human who eats the trout that ate the smelt.

The levels of persistent toxic chemicals found in the waters or tissues of animals in

the Great Lakes are generally not high enough to cause acute toxic effects, including immediate death. Rather, scientists worry about chronic effects, the more subtle effects that can occur in humans or wildlife after years of carrying a chemical burden of PCBs or dioxins or toxaphene in body tissues. These effects can manifest themselves as cancer or reproductive failures; recently, scientists have begun to examine

Figure 3.1 Simplified Great Lakes food web



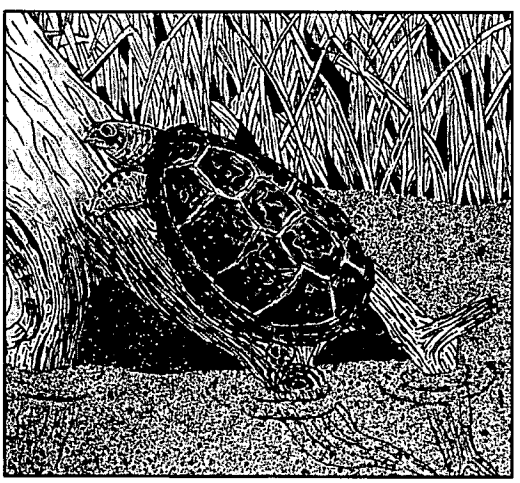
Note: This is a simplified representation of the Great Lakes food web showing the main pathways. Levels of toxic chemicals found in animal tissues get progressively higher as one moves up the food chain.

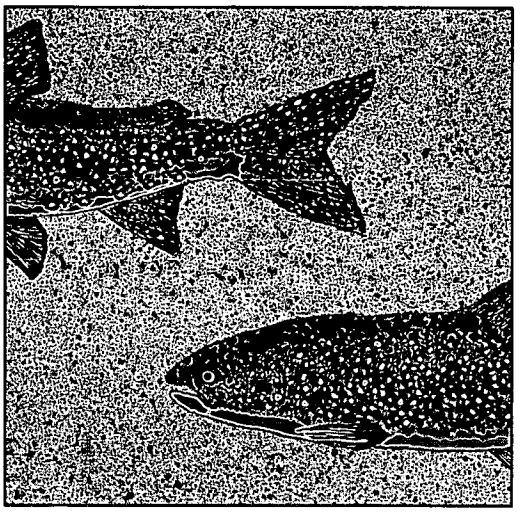
We've gone too far...we're going to wipe ourselves out. It will be like a frog in a pot of water. If you bring the temperature up slowly, it will stay there and paddle around until it dies in the hot water. But if you heat the water and throw the frog in, it will jump out. Well, the trouble is that the water around us is warming slowly and it's so comfortable and it feels so good and life is so great in Canada. . . . But what we have to do is look around and we'll realize that the water's getting hot.

Potter, P. August/September 1991. "Classrooms without walls". In *Canadian geographic.*

the possibility that there are other, more subtle effects, such as hormonal or behavioural changes.

Since the 1950s, persistent toxic chemicals have been implicated in problems suffered by some 14 species of wildlife near the top of the food chain in the Great Lakes Basin. (See Table 3.2). They include reproductive problems, deformities, and sometimes dramatic population declines. They have been noted in two species of mammals (otter and mink), reptiles (snapping turtles),





and in three species of fish (lake trout, brown bullhead, and white sucker).

Similar difficulties have been noted in eight species of fish-eating birds around the basin: caspian, common, and Forster's terns, ring-billed and herring gulls, double-crested cormorant, black-crowned night heron, and bald eagle. Because of levels of chlorinated organic chemicals such as DDT in the environment, the populations of all these birds declined sharply in the 1960s. In fact, some decreases were so great that, according to the IJC Water Quality Board in its 1991 report:

> . . . records show that there was no known successful breeding of double-crested cormorants on Lake Ontario between 1954 and 1977. By the early 1960s and 1970s, this breeding failure had spread to lakes Michigan and Superior. . . . By the late 1960s some fish-eating birds in lakes Ontario and Michigan were found to be among the most contaminated birds in the world.

After uses of chemicals such as DDT were restricted and environmental levels dropped, populations of most of these birds recovered. In Toronto, we have night

herons and cormorants nesting again. Even so, obstacles remain. Across the basin today cormorants are still being born with club feet and hideously crossed bills. Common and caspian terns still suffer from deformities and embryonic mortality. Bald eagles are unable to reproduce normally along the shores of the Great Lakes. Why is this happening?

Studies of animal tissues over time indicate that the levels of persistent chemicals such as DDT, dieldrin, and PCBs have stopped declining and are remaining at a stable level in the environment. Continued use and unseen sources — sediments, leaking landfill sites, deposition from the air — have resulted in a steady equilibrium in the environment and these residual levels in the environment are causing problems in wildlife. The evidence suggests that we will be living with these chemicals for a very long time.

Humans share the top rung on the food chain ladder with fish-eating birds and mammals: we breathe the same air and drink the same water. Some of us — especially hunters, anglers, and natives — eat fish and waterfowl from the basin. What about the effects on humans of exposure to these low levels of persistent toxic chemicals?

Table 3.2 Species of fish and wildlife known to be affected by contaminants in the Great Lakes

Species	Population decrease	Effects on reproduction	Eggshell thinning	Congenital malformations[1]	Behavioural changes	Biochemical changes	Mortality	Alterations in recruitment
Mink	X	X	NA	NE	NE	NE	X	?
Otter	X		NA	NE	NE	NE	?	?
Double-crested Cormorant	X	X	X	(X)		X	?	?
Black-crowned Night-Heron	X	X	X	X		X	?	?
Bald Eagle	X	X	X	NE		NE	NE	?
Herring Gull		X	X	X	X	X	X	
Ring-billed Gull				X		NE	X	
Caspian Tern		X		X	NE	NE		X
Common Tern		X	X	X		X		
Forster's Tern		X		X	X	X		
Snapping Turtle	NE	X	NA	X	NE	NE	NE	NE
Lake Trout		X	NA			X		
Brown Bullhead			NA			X		
White Sucker			NA	X		X		

X = effects documented NE = not examined NA = not applicable ? = suspected since population declined

[1]Unpublished records of congenital malformations (gross birth defects) exist for double-crested cormorant, great blue heron and the Virginia rail.

Source: Canada: Environment Canada, Canada. Dept. of Fisheries and Oceans, and Canada. Health and Welfare Canada. 1991. *Toxic chemicals in the Great Lakes and associated effects.* Toronto: Canada. Environment Canada, Canada. Dept. of Fisheries and Oceans, and Canada. Health and Welfare Canada.

Deformed bill on a double-crested cormorant

Historically, concerns about human health and persistent toxic chemicals in the Great Lakes Basin have centred around the risk of cancer. However, as our understanding of the effects of persistent toxic chemicals on wildlife has grown, researchers have begun to look for more subtle, less easily measured health effects. As the IJC Water Quality Board noted in its 1991 report:

> In news reports, the possibility of cancer is the risk most frequently associated with toxic chemicals. But there is growing evidence that some of the toxic chemicals identified in the Great Lakes ecosystem are likely to affect the nervous system, fertility, the development of young and immunity to disease.

Few detailed epidemiological studies have been carried out on the effects of persistent toxics in the Great Lakes on humans. One detailed survey did compare the health of children whose mothers regularly ate contaminated fish from Lake Michigan with a control group whose mothers did not. It found that the mothers who ate fish were carrying higher-than-average body burdens of PCBs and other chemicals.

Researchers also found significant differences in the children whose mothers ate an average of 6.7 kilograms (15 pounds) of Lake Michigan fish annually. They were born earlier in the pregnancy, weighed less, and had smaller heads than the control children. They startled more easily and had abnormally weak reflexes. On visual memory tests given when they were seven months old, the babies of fish-eating mothers scored lower than those in the control group. Tested again at four years, babies of mothers who had eaten Lake Michigan fish had poorer verbal skills and poorer short-term memory. Researchers in this ongoing project will continue to study the children as they grow.

The Lake Michigan story indicates two things: first, exposure to existing low levels of Great Lakes chemicals may be causing subtle neurological or other effects we just have not been looking for. As the IJC Great Lakes Science Advisory Board concluded in its report, *1991 Report to the International Joint Commission* :

> The traditional public health approach to monitoring for cancer and unusual birth outcomes is too blunt to capture the subtle reproductive effects of Great Lakes contaminants. Subtle health effects observed in wildlife provide clues for the design of experimental approaches for determining if the same or similar effects occur in human populations.

Second, it underlines how babies are exposed to chemicals and their effects, either in the placenta or in breast-feeding. A mother's blood, which circulates to a baby through the placenta, and mother's milk can contain high levels of fat-soluble

persistent toxic chemicals. The "acceptable intakes" of chemicals usually based on an adult diet do not address the exposure of children and breast-feeding infants whose immune systems are still developing. This shortcoming is described in *Toxic Chemicals in the Great Lakes and Associated Effects*, published in 1991 by the federal departments of the Environment, Fisheries and Oceans, and Health and Welfare:

> Several factors can increase the intake of contaminants by children and infants. Children usually consume more food per kilogram of body weight and have a higher absorption rate than adults. In addition, breast-fed infants are exposed to higher concentrations of fat-soluble contaminants than those found in adult foods. Although these exposures are for a relatively short period of time, they occur during a critical period of development.

The Lake Michigan study is worrisome because it indicates that children of high-risk mothers (those eating Great Lakes fish) may be at risk because of persistent toxic chemicals. Some observers suggest that children of women who are *not* high-risk — who do not eat Great Lakes fish — may also be at risk from persistent toxic chemicals. There is no doubt that people in areas around the Great Lakes (as in other highly industrialized areas of North America) are exposed to a complex mix of persistent chemicals. These chemicals are present not only in breast milk, but in food, air, soils, surface waters, and bottom sediments.

Wetlands and River Systems

An examination of the Great Lakes' condition would not be complete without describing the health of the tributaries that feed those lakes, and of nature's own filters, the wetlands. Both are critical to a healthy, integrated ecosystem.

The Great Lakes Basin is rich in surface waters. It encompasses more than 80,000 inland lakes and an estimated 750 kilometres (466 miles) of rivers and streams. No overall assessment of their health has been undertaken in Ontario.

In general, acidification can be said to be a pressing problem in the lakes located in the northern part of the basin, while the effects of agricultural run-off are of great concern to those in the southern parts. Near urbanized areas, inland lakes and rivers are subject to the stresses of populated areas: direct discharges of toxic and conventional pollutants; effluent from sewage treatment plants; run-off from streets, roofs, and parking lots.

Many rivers in the basin have been structurally altered. Toronto's Don River is a classic example: dammed, straightened, and, in its lower reaches, encased in a straitjacket of concrete. Many rivers that were bottom-scoured by logging in the last century are silted today from urban storm run-off or erosion of their banks. Many of these degraded rivers — the Black, the Cuyahoga, the Fox, the St. Clair, and the Don, among others — lie in areas in which Remedial Action Plans are being developed.

While there may be few truly pristine rivers and streams in the basin, there are still many of good quality — streams and rivers that provide good spawning areas for cold- and warm-water fish, and offer aesthetically beautiful, diverse habitats for aquatic life. On the Metro waterfront, the Rouge is one such river, still remarkably unscathed by the development that surrounds

it. Such rivers are a dwindling, invaluable resource, and should be protected.

It is also crucial to protect our remaining wetlands. At the water-land interface, they provide incredibly rich habitats for aquatic birds, mammals, reptiles, amphibians, and fish. Left undisturbed, wetlands filter and purify water, recharge groundwater, help to control erosion, and protect against floods. Sadly, however, as pointed out by the IJC Great Lakes Science Advisory Board in the *1991 Report to the International Joint Commission*:

> . . . despite their worth, the wetlands of the Great Lakes continue to experience irretrievable losses in both quantity and quality.

Even now, wetlands are still being filled for agricultural use, paved over as mall sites, and destroyed to make room for housing subdivisions, marinas or golf courses. Losses due to development have been staggering: in southern Ontario, an estimated 80 per cent of original wetland areas have been lost. In Michigan the figure is 71 per cent, and in Illinois it is 90 per cent!

Under the 1987 Great Lakes Water Quality Agreement, Canada and the U.S. agreed to establish a process to identify and preserve (and, where necessary, to rehabilitate) significant wetland areas in the Great Lakes Basin. The IJC is geared to research on wetlands, not on action. To date the parties have failed to develop a basin-wide inventory of wetlands and their health.

In the main, the Canadian government's Green Plan ignores wetland issues. The most recent version of the long-awaited provincial wetland policy under the Planning Act was released for review in September 1991. Many of those who worked on the issue for years were devastated by weaknesses in the proposed policy. As chapter two

Pumphouse Marsh, Oshawa: one of the few remaining natural wetlands in the Greater Toronto bioregion

described, it appears that the draft Wetland Policy Statement falls far short of providing the clear direction required to protect wetlands in Ontario.

In its report, *A Green Strategy for the Greater Toronto Waterfront* (1990), the Royal Commission made recommendations concerning the wetlands along the Greater Toronto waterfront, arguing that they are an immeasurable regional resource, and identifying critical habitat areas that require protection.

WATER QUANTITY

The Great Lakes are so large that explorer Samuel de Champlain called them "mers douces" — Sweetwater Seas. The largest, Superior, is 405 metres (1,325 feet) in depth and covers 82,000 square kilometres (32,000 square miles). In fact, it is so huge that it would take a molecule of water dropped in at Duluth 191 years to reach the Soo Locks and get into the St. Marys River. But it is one of the great ironies that the "Great" Lakes, despite their vastness — they hold one-fifth of the world's supply of fresh water — are a finite resource.

Nonetheless, we continue to use the waters in the Great Lakes Basin as if they were unlimited. People in Canada and the United States use more water per capita than those in any other of the world's countries — as they use more energy and many other natural resources. On average, an Ontario resident uses 360 litres (80 gallons) of water a day — water use has risen steadily over the past 20 years. It is estimated that, if trends continue, Ontario municipalities will double their per capita use of water by 2011.

There are Great Lakes Basin communities already experiencing water supply problems, some of which are related to upstream contamination by chemicals, which is what has happened at Walpole Island, in the St. Clair River. Niagara-on-the-Lake, which once drew its water from the highly polluted Niagara River, is now linked to Lake Erie by an umbilical cord of fresh-water pipes. It is likely that, in the future, more fresh water will be piped over long distances in the Great Lakes Basin.

Other areas such as Kitchener-Waterloo or parts of Halton, York, Peel, and Durham regions are experiencing water supply problems because groundwater resources are being depleted faster than natural processes can replace them. In the rapidly growing Region of York, limitations on water availability are constraining development. In the Oak Ridges Moraine, groundwater has lain in deep underground aquifers for thousands of years. This groundwater is important, not only for municipal, industrial, and agricultural use, but as a source of water for the streams feeding into the Great Lakes: 40 per cent of the water flowing in southern Ontario streams comes from groundwater and if supplies are exhausted, feeder streams will dry up, affecting fisheries, wildlife, and conservation.

Policy makers have recently begun to understand that our patterns of water use are not sustainable. In the Great Lakes Basin, we use more water than we return to the system. Some of the water removed from the Great Lakes is lost to evaporation or diversion and ends up outside the basin. Future pressures may come from the water-poor areas of the American sunbelt, which want to divert large quantities of water from the Great Lakes. Global warming will exacerbate the problem, as higher temperatures bring less rainfall, increased evaporation, and a greater demand for irrigation.

The quest for safe, clean water for drinking and household use, as well as commercial and industrial purposes, does not come cheaply. In *Water Conservation in Ontario: Implementing the User Pay System to Finance a Cleaner Environment*, a report prepared by the Municipal/Industrial Strategy for Abatement (MISA) Advisory Committee, it was concluded that in total, Ontario's municipalities have about $50 billion invested in water and sewage treatment infrastructure. The province contains about 37,000 kilometres (23,000 miles) of watermains and 30,000 kilometres (19,000 miles) of combined or sanitary sewers. In 1991, Ontario municipalities spent about $1.7 billion (more than one per cent of the Gross Provincial Domestic Product) on the infrastructure needed to treat and distribute drinking water and treat sewage. This was nearly triple the amount spent in 1980.

Not surprisingly, much of this investment is crumbling as it reaches the end of its useful life. On average, Ontario's sewers are about 50 years old, and some contain components that are older than Confederation! Leakage rates in these old sewer systems can range as high as 30 per cent.

More than 100 municipalities still have some old combined sewers, which contribute substantially to the bacterial and chemical loading of our waterways. Estimates of the current replacement value of municipal water supply systems are $30 billion, or about $3,750 per capita served. The costs of replacing sewage treatment systems have been estimated at $20 billion, or about $3,040 per capita served.

As discussed in Chapter 1, many Ontario residents are not paying the true costs of the water that they use. Of houses in Ontario that are supplied by municipal water systems, about 43 per cent pay a flat rate, regardless of the amount of water used. Another 30 per cent pay a declining block rate: as more water is used, the cost per unit drops. A mere 27 per cent of houses in the province are metered.

Wasteful water use, deteriorating infrastructure, and lack of full-cost pricing have serious economic and environmental consequences. Building ever-larger water and sewage treatment plants requires huge amounts of money, chemicals, and energy. Unless demand for water is reduced, and efficient use is made of water resources, municipalities will continue on this treadmill.

The alternative is to become more water-efficient: treatment plants would purify less water, operate more efficiently, and pollute less. Less water would be drawn from wells, protecting groundwater and Ontario's wetlands and streams. Processing smaller amounts of water would save energy and money, reduce chemical use, and defer the need for expensive new plants and equipment.

There are some hopeful signs that things are changing: in the summer of 1991, the Ontario Ministry of Natural Resources announced it would develop a provincial water efficiency strategy. Many municipalities, among them Metro Toronto, are establishing their own plans for becoming water-efficient.

WHY IS PROGRESS STALLED?

After hearing the litany of environmental problems in the Great Lakes Basin, it seems only logical to ask: why is the situation so grim? After all, we have had

environmental ministries and laws to protect the environment for 20 years. Millions of dollars of public and private money are spent every year on environmental regulation, enforcement, monitoring, and control. Why can't we eat the fish in the Great Lakes, or swim in their waters, or preserve wetlands from development? Why can't we protect the aquatic life living in the lakes? What is wrong?

JURISDICTIONAL FRAGMENTATION

One of the most obvious reasons for lack of progress is that jurisdictions are fragmented in the Great Lakes Basin: environmental responsibilities are shared among two federal governments, one province, and eight Great Lakes states. Within each state and province are dozens of regional governments, hundreds of municipal governments, and hundreds of special-purpose agencies (such as conservation authorities). Each has its own priorities and mandates. In *Environment in Transition: A Report on Phase I of an Environmental Audit of Toronto's East Bayfront and Port Industrial Area,* a 1990 report of a study carried out for the Royal Commission, the authors, speaking of the situation in Canada, noted that:

> The existing regulatory framework is characterized by overlap and duplication by different levels of government, by joint action on some issues, and by failure to exercise authority that is already in place. . . . The framework is fragmented, with different instruments governing separate aspects of the environment which makes it difficult to apply ecosystem goals and principles.

Citizens battling the regulatory dragon are frustrated by the fragmentation: with as many as five layers of government involved in the Great Lakes Basin, with more than a hundred agencies in the Greater Toronto bioregion alone, it is easy for any one group to say, "It isn't my fault." Pinpointing responsibility is difficult and, in some cases, futile. At a time when constitutional reform is being debated, it is useful to read the 1990 federal Auditor General's report, which asked: "Is Canada's Constitution environmentally friendly?" and concluded that:

> The consequence of these federal-provincial and interdepartmental divisions in responsibility for environmental matters is a patchwork that makes it almost impossible to assign public accountability for safeguarding Canada's environment. There is no focal point of responsibility or accountability to the Canadian people in respect of this crucial issue.

Resolving the complex environmental problems of the Great Lakes Basin will require dedicated, co-ordinated action. This is not occurring. Nor is there any one body taking responsibility for arranging the actions of the various agencies. As the IJC Great Lakes Science Advisory Board lamented in its 1991 report:

> Policies in each country are developed through a process of inter-agency negotiation within general parameters of fiscal and foreign policy laid down by the governments of the day. To the extent that Great Lakes issues are not first-order concerns of the political parties or chief executives, policy questions devolve among the bureaucratic agencies, each with its own limiting mandates and interests in the lakes. These interests may conflict and sometimes

affect agency personnel, programs and budgets.

And, the Board adds in what must surely be an understatement, ". . . this process is not necessarily conducive to setting a coherent policy for the lakes".

There is one body that could play a major role in ensuring the clean-up of the Great Lakes Basin — the International Joint Commission. The IJC was set up, by treaty, more than 80 years ago and, when asked by both the United States and Canada, is empowered to investigate and report on any matter along the common border. The IJC has the capacity to bring together officials and technical personnel from different levels of governments and other institutions in both countries. These individuals are invited to participate on IJC boards and committees in their "personal and professional" capacity, and to provide the Commission with knowledgeable expertise for analysing problems and considering possible solutions when framing recommendations to governments.

The IJC's powers are limited, for example, it only makes recommendations to governments. Nevertheless, over the years the IJC has ably completed many assignments primarily, but not exclusively, relating to the quality, quantity and uses of boundary waters. Perhaps its most important role in recent years has been to review government progress in achieving the goals of the Great Lakes Water Quality Agreement (GLWQA). Through its work, the IJC has developed a reputation as an unbiased watchdog over the environment in the basin.

However, many people and groups are concerned that the Commission's ability to function as an independent body, as required by the GLWQA, is being eroded. Attention is focused on the Water Quality Board described in GLWQA as "the principal adviser to the Commission . . . composed of an equal number of members from Canada and the United States, including representatives from the parties, and each of the State and Provincial governments".

Most observers agree that the Water Quality Board, once recognized as a key intergovernmental group dedicated to Great Lakes issues, is now generally considered an empty body. Many environmental groups, having seen the IJC's substantial committee structure being dissolved since 1987, believe the Water Quality Board has been gutted. They have made repeated calls for additional members on the Board, including aboriginal and environmental representatives, as one way of making it more accountable.

Some feel that the IJC approach of asking experts from federal, provincial and state agencies to wear two hats (one as an IJC committee member, the other as a government bureaucrat) hasn't been working. Since 1987, members of the Water Quality Board have made no pretense of serving two functions: they simply and unabashedly defend their government's interests.

The IJC has provided an important means for government officials in Canada and the United States to discover ways to resolve differences and achieve shared goals. The complexity of problems and the economic implications of possible solutions require imagination, co-operation, and competence. At its best, the Commission encouraged these qualities in the deliberations and findings of its boards and committees. Some observers feel that without effective mechanisms for inter-governmental co-operation, the objectives of the Great Lakes Water Quality Agreement will not be reached.

A FERRY TALE: AWASH IN JURISDICTIONS

Five years ago, the ferry *Prince Edward Island* motored into Whitby Harbour and started a chain of events that Franz Kafka would have found worthy of inclusion in his novels — just one local example of how jurisdictional fragmentation paralyses action.

The *PEI* was owned by a locally based numbered company and it carried an unusual cargo: two transformers filled with 2,275 litres (500 gallons) of PCBs. Originally meant to become a floating generating station in the Caribbean, the *PEI* found a temporary haven at the Whitby Harbour wharf when that deal fell through. The owner of the ferry soon found himself in a tangle of provincial and federal regulations governing PCB storage and export. He decided to do nothing for the time being.

In September 1986, worried about possible leaks of PCBs, the Town of Whitby made its first attempt to have the ferry and its cargo removed. Because the boat was in the harbour — which is under federal jurisdiction — neither the Town nor the Province had any power to intervene in the case. Ontario would have had authority to act if the transformers had been deemed to be PCB waste, but because they were deemed still "in use", the transformers were not covered by provincial regulations governing PCB wastes. A 1988 attempt to have the ferry removed was thwarted because, unbeknownst to the Town, one arm of the federal government (the Department of Transport) had been inadvertently collecting docking fees from the ferry's owner since 1986.

In February 1989, the owner of the *PEI* tried to move the ferry out of Canadian waters, but Environment Canada refused to allow him to do so — because there were PCBs on board! The owner then took the position that, while he would like to be able to comply with the Town's wishes and move his boat, he could not because he had no place to put the PCBs.

In early 1990, the Town was successful in having its harbour reclassified as a small craft harbour, which transferred jurisdiction from the federal Department of Transport to the federal Department of Fisheries and Oceans, and gave the Town of Whitby control of the wharf, pier area, and harbour waterlots. In May 1990, the Town gave the ferry's owner formal notice to remove the ferry from its property and move the PCBs to a location approved by the Ontario Ministry of the Environment.

While these jurisdictional battles were taking place, the very fear that had first triggered the Town's concern became reality: the ferry caught fire — not once, but twice, in July 1987 and October 1989. The vessel broke its moorings in January 1989; in December 1990, the vessel sank to the bottom of the harbour (although its deck remained above water). This sinking prompted a flurry of activity: Environment Canada issued a series of orders instructing the boat's owners to remove the transformers.

The orders were ignored and, after the boat was eventually refloated, the ferry's bilge water was found to be contaminated with PCBs. The slick was eventually skimmed off and stored on the deck of the vessel, alongside the transformers. At that time, Environment Canada issued two more orders, requiring the owner to store the contaminated bilge water properly. These, too, were ignored.

In summer 1991, a tentative agreement was reached to remove the PCBs. It involved the ferry's owner, the Town of Whitby, Whitby Hydro (which had agreed to store the PCBs temporarily, prior to their eventual destruction), and the Ontario Ministry of the Environment. The agreement fell through after the ferry owner refused to put up the agreed-on security for removing and destroying the PCBs.

In September 1991, the ill-fated ferry was still sitting docked at the wharf, leased from the federal government by the Town. An increasingly frustrated municipality had spent $12,000 to take the ferry's owner to court, where it successfully sued the owner in an action for trespass. He was fined $250, but he appealed. In October, the Town sought a mandatory injunction for the removal of the PCBs. The parties reached an agreement in court that, by 15 December 1991, the owners would remove the transformers from the boat and, by 31 December 1991, would remove the boat from the harbour. It remains to be seen whether this actually happens.

The last word belongs to David Sims, the Town of Whitby's frustrated lawyer, who lamented in provincial court that "the Second World War has been fought and won in less time than it will take to get the ship out of the harbour".

Lack of Ecosystem Thinking

Because restoration of the integrity of the Great Lakes ecosystem is the prime objective of the Great Lakes Water Quality Agreement, meeting it will require an ecosystem approach to managing, remediating, and rehabilitating. That approach demands comprehensive and systematic planning; management based on ecological units rather than political boundaries; an emphasis on long-term planning; and respect for the needs of future generations. It is obvious that an ecosystem approach has not been taken in the Great Lakes Basin, and it is equally obvious that this is a major reason for lack of progress in cleaning up the system.

There are no consistent rules across the Great Lakes Basin. Although the many governments involved have developed laws to protect air, water, sediments, soil, wildlife, and humans from pollution, standards set under these laws vary from jurisdiction to jurisdiction. For example, water quality standards for PCBs range from 14 parts per quadrillion in Minnesota to 1,000 parts per quadrillion in Ontario and New York.

An ecosystem approach requires management based on ecological units — bioregions or watersheds, for example. In general, however, policy-makers are still parochially confining their interest to what lies inside their boundaries, whether those are municipal, regional, provincial, state or federal. For example, there is no comprehensive management in the Don Watershed, or for the Rouge or Humber rivers. No one is taking responsibility for protecting the Greater Toronto bioregion, the Lake Ontario or the Great Lakes Basin.

There is little comprehensive ecosystem planning being carried out in the basin on a watershed or basin-wide scale. Environmental plans are not being integrated into other land-use planning initiatives. Remedial Action Plans are being developed to clean up

17 Canadian pollution "hot spots" in the basin but it isn't clear how these will relate to other initiatives, such as plans for fisheries and habitat management, land use, economic development, transportation, and housing.

One illustration of the piecemeal approach which has been taken in environmental planning is the PCB story. It illustrates how partial solutions have failed to address the very problem they were intended to deal with.

In the late 1970s, when PCBs were identified as an environmental contaminant, production was stopped. Nevertheless, PCBs are still in use in tens of thousands of pieces of electrical equipment around the Great Lakes. Most of the PCBs removed from service sit in storage in basements and out-buildings. In total, 52 per cent of the PCBs ever used in Canada are still in use; about 16 per cent remain in storage. Both types can leak and — as dramatically illustrated at St.-Basile-le-Grand in 1988 — can catch fire. Those not destroyed are potential new sources of environmental contamination.

Remedial Action Plans are being developed to clean up 17 Canadian pollution "hot spots" in the basin but it isn't clear how these will relate to other initiatives, such as plans for fisheries and habitat management, land use, economic development, transportation, and housing.

Despite the actions taken since the 1970s, PCBs remain an acute problem. IJC estimates indicate that seven tonnes (6.9 tons) of PCBs fall from the air into the Great Lakes every year, predominantly as the result of leaks, spills, and fires. PCB levels in lake trout throughout the Great Lakes still exceed IJC objectives, while herring gull eggs around the basin contain high levels of PCBs, highest in contaminated areas such as the Detroit River and Saginaw Bay.

Nonetheless — and despite the fact that substitutes exist — there is no deadline in Canada by which PCBs must be taken out of service and — while there are proven technologies for destroying PCBs in storage — there is no requirement that they be destroyed.

The PCB experience is echoed in other compounds. Of the 11 pollutants considered critical by the IJC, only one — mirex — has been totally banned by Canada and the U.S. The long-lived pesticides DDT, dieldrin, and toxaphene are still permitted for some purposes in the two countries and both mercury and alkylated lead are still widely used. There are no comprehensive strategies to reduce the presence of the critical pollutants (such as dioxins and furans) produced as by-products of industrial or combustion processes.

Some of the sources of these chemicals are far beyond the Great Lakes Basin: they are imported in food, or are carried long distances through the air to land in the basin. To protect ourselves from these persistent toxic chemicals, concerted action will be required worldwide.

Restoring the Great Lakes Basin ecosystem and preventing future problems means that our planning policies at all levels must look beyond the horizon of a single political term. But as the IJC Science Advisory Board points out in its 1991 report:

> Conventional political wisdom calls for visibly addressing the problems of the day, not the problems that may (or may not) become politically significant

tomorrow. There is little political payoff today for long-range anticipatory planning that will yield benefits only at some indefinite time in the future.

Lack of Accountability

An examination of events since 1978 highlights the remarkable failure of accountability mechanisms: too often, governments failed to meet their obligations under the Great Lakes Water Quality Agreement. In some cases, this has been in the form of unmet deadlines while, in others, programs have not been delivered as required under the agreement. The result is a string of broken promises that has contributed to the lack of progress in cleaning up the Great Lakes.

As signatories to the 1978 Great Lakes Water Quality Agreement, the governments of Canada and the U.S. pledged to:

> Make a maximum effort to develop programs, practices and technology necessary for a better understanding of the Great Lakes Basin ecosystem and to eliminate or reduce to the maximum extent practicable the discharge of pollutants into the Great Lakes System (International Joint Commission 1988).

The policy directive was clear and, by signing the GLWQA in 1978, both parties agreed that the overall objective should be that "the discharge of toxic substances in toxic amounts be prohibited and the discharge of any or all persistent toxic substances be virtually eliminated". Thirteen years later, and after weighing the evidence, it is difficult to avoid the conclusion that the two parties have not made a "maximum effort" and that the goal of virtual elimination of persistent toxic substances is as remote now as it was in 1978.

It is actually more instructive to look at what has not been achieved under the GLWQA than what has. To date, the Canadian and U.S. governments have failed to:

- develop a binational strategy for managing persistent toxic chemical use in the basin;
- set targets for interim goals;
- set up mechanisms for achieving short-term and long-term targets; and
- develop a comprehensive database to guide decision-making.

The need for an overall strategy was articulated in the IJC's 1982 report, *Biennial Report under the Great Lakes Water Quality Agreement of 1978*, which recommended that Canada and the U.S. develop an "overall management plan for directing and guiding the activities of the parties and the state and provincial governments in controlling pollution in the Great Lakes system." Nine years later, this has still not happened. Indeed, in the *Fifth Biennial Report*, in 1990 (as in every one in the eight intervening years), the IJC again recommends that Canada and the U.S. immediately set up a "bi-national toxic substances management strategy to provide a co-ordinated framework for accomplishing, as soon and as fully as possible, the Agreement philosophy of zero discharge." It is nowhere in sight.

No interim targets have been set for reducing loadings of persistent toxic chemicals in the basin. While the U.S. has recently released its much-vaunted "33/50" program (under which releases of toxic chemicals are to be reduced by 50 per cent by 1995), it is voluntary and applies to only 17 chemicals, which were chosen on a nation-wide basis. The list of targets does not include

many of the persistent bioaccumulative chemicals of most concern in the Great Lakes; indeed, only two of the IJC's critical 11 make the list. Neither the Government of Canada nor the Province of Ontario has set targets for reducing loadings of persistent toxic chemicals.

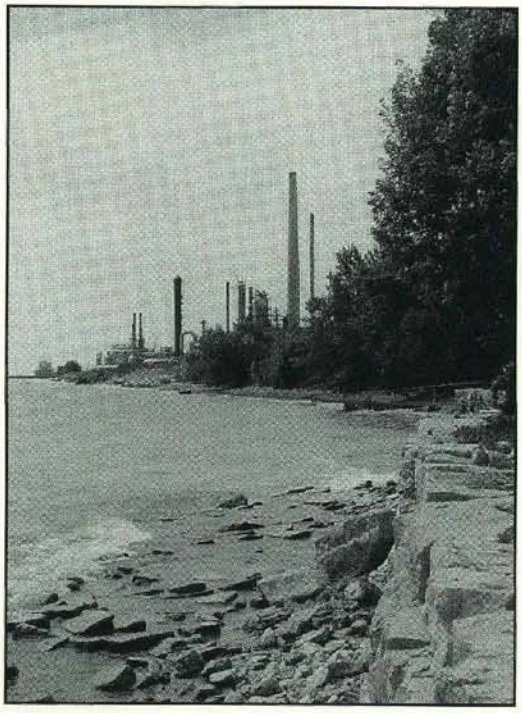
A number of commitments made by Canada and the U.S. under the GLWQA had timetables. Great Lakes United, a binational umbrella group of non-governmental organizations, recently analysed these commitments; of the 16 that had deadlines, eight (50 per cent) are three or more years behind schedule. One program — for joint disposal of hazardous wastes — is 11 years behind schedule! (Great Lakes United's list of commitments and notations on whether they were met can be found in Table 3.3.)

In their report, *The Great Lakes in the 1990s*, Ian Jackson and David Runnalls (1991) point out that:

> Whatever the original wording of agreements such as the Great Lakes Water Quality Agreement, as time passes they come to be defined in terms of what actually happens. Some elements are pursued, others are forgotten, or come to be regarded as not feasible, or even as window-dressing, whatever the original intent. Even in an ecosystem agreement such as the 1978 GLWQA, which rests on the principle that everything is connected to everything else, there is a clear danger that during the 1990s, ten to twenty years later, major items in the Agreement will be tacitly abandoned. If this happens, it is difficult to see how the ecosystem approach can be sustained.

The Province of Ontario's efforts at reducing the inputs of toxic chemicals into Ontario waterways are concentrated under the Municipal/Industrial Strategy for Abatement (MISA) program. It was launched by the previous government with great flourish in 1986, and was intended to move towards the goal of "virtual elimination of toxic chemicals" by setting tough new standards for eight industrial sectors and municipal sewage treatment plants. The Ministry of the Environment assured the public that the first of these rigorous new regulations would be in place by January 1988.

Almost six years after the program was launched, and four years after the first regulations were to be put in place, not a single abatement regulation has been promulgated under MISA. The program, first billed as the flagship of the Ministry of the Environment's pollution control initiatives, today looks more like a leaking dory. The overall MISA program has been mired in inaction and, under the most optimistic scenario,



Industry on the Mississauga waterfront

Table 3.3 Commitments made under GLWQA by Canada

Commitment	Completed	Date Commitment to be Achieved by	Time Lapsed beyond Commitment Deadline
Put programs in place to control pollution from industries	Partially	Dec. 31/83	9 years
Revise standards in Annex 1 of GLWQA	No	July 1/88	4 years
Agree to standard methods for assessing toxicity of substances	No	April 1988	3.5 years
Identify point source impact zones (mixing zones)	No	Sept. 30/89	2 years
Inventory raw materials, processes, by-products, waste sources and emissions of point sources	No	January 1982	9.5 years
Develop joint program for disposal of hazardous wastes	No	1980	11 years
Develop joint program for transportation of hazardous wastes	Yes	1980	6 years
Evaluate methods for quantifying transfer of contaminants from and to sediments	Partially	Dec. 31/1988	3 years
Agree to procedure for managing contaminated sediments	No	Dec. 31/1988	3 years
Develop joint demonstration program to manage contaminated sediments	No	June 30/1988	3 years
Complete three lists of toxic chemicals	Yes	Dec. 31/1988	11 months
Meet to review effectiveness of phosphorous load reduction plans	Yes	Dec. 31/1988	14 months
Confer on integrated atmospheric deposition network	Yes	Oct. 1/1988	17 months
Evaluate sediment management technologies	Yes	Oct. 31/1988	
Report to IJC progress under 11 Annexes to GLWQA (every two years)	Yes	Dec. 31/1988	2 months
		Dec. 31/1990	9 months

there will be no new standards in place for industrial sectors before 1995, at the earliest — fully ten years after the program was initially launched. Work on the municipal sector — sewage treatment plants — and industries discharging to sewers has barely begun. And as the days and months pass, the industries and municipalities around the basin continue the discharge of pollutants into Ontario lakes and rivers.

Failure to Adopt a Preventive Approach

For almost two decades, environmental groups and scientists have urged that society move to an "anticipate and prevent" approach for environmental problems, rather than the conventional "react and cure". "Anticipate and prevent" strategies include comprehensive ecosystem planning and environmental assessment of all projects, programs, and policies before they are implemented. It also includes avoiding or minimizing waste and pollution. This can be accomplished through the increased efficiency that results from changing or redesigning products, good management practices, the use of closed-loop systems, and substituting non-hazardous for hazardous raw materials. The "anticipate and prevent" approach also includes rigorously screening new chemicals for possible environmental and health effects, and banning chemicals found to cause undue environmental or health problems.

Society needs to move to an "anticipate and prevent" approach for environmental problems, rather than the conventional "react and cure".

The tendency in pollution control, too often, is still to treat at the "end of the pipe": build a bigger sewage treatment plant, tack on another piece of pollution control technology, or engineer a better garbage dump. Too often these kinds of solutions merely transfer persistent pollutants from one medium to another. The filter on the industrial discharge pipe may stop pollutants from entering the river, but the filter (and the pollutants it traps) must eventually be put in a landfill site where groundwater can become contaminated, or it must be incinerated, thus spewing pollutants into the air, from which they will fall out on water or land.

React and cure strategies date from that time before we understood that we live in an ecosystem where pollutants cycle endlessly from air to water to soil to tissues, before we acknowledged that such practices are not sustainable over the long term.

There is some indication that a shift in attitudes and behaviour is starting to occur. As noted above, there are moves to ban chemicals — which, in fact, may be the only way to achieve zero discharge of persistent toxic chemicals, the goal of the Great Lakes Water Quality Agreement.

In 1990, the United States Council on Environmental Quality reported to the president that:

> It appears that the only chemicals to have declined significantly in the Great Lakes ecosystem are those whose production and use have been prohibited outright or severely restricted.

In September 1991, Ontario Environment Minister Ruth Grier announced her intention to refocus the Municipal/Industrial Strategy for Abatement (MISA) program to emphasize prevention. She

said the new MISA program would move towards zero discharge by developing a list of specific persistent toxic chemicals that are to be banned from the discharges of all facilities regulated under MISA. While this initiative deals only with discharge into water (and does not consider discharge into air), it is the first move by a government in the Great Lakes Basin to develop a process for banning persistent toxic chemicals.

Mrs. Grier's announcement came hard on the heels of reports from the IJC's Water Quality and Science Advisory boards, and from its Virtual Elimination Task Force. All three recognized the need to ban some persistent toxic chemicals.

The Water Quality Board recommended targeting six of the IJC's list of 11 critical pollutants as a first step. In its opinion, traditional approaches to controlling pollution were clearly failing to protect the health of humans and wildlife. It found that Canada and the U.S. had not adequately dealt with the manufacture, import, use, storage, transportation, and disposal of persistent toxic chemicals. "Many of these persistent toxic chemicals," said the Board, "are so troublesome as to require clear and absolute bans" (Great Lakes Water Quality Board 1991). The Board went on to recommend that the GLWQA parties develop a process with a fixed timetable and schedule to identify other chemicals that should be added to the list.

In addition to the parties' failure to develop a binational toxic substances strategy, outlined earlier, is the failure of governments at all levels to legislate the anticipate and prevent approach to set enforceable targets with deadlines for reducing persistent toxic substances. Where they exist, pollution prevention initiatives around the basin are discretionary and voluntary. This is the case with Environment Canada's $25 million Great Lakes Pollution Prevention Initiative, announced in March 1991 as part of the Green Plan. It includes programs aimed at achieving voluntary reductions in discharges in three areas: the automobile industry; small-quantity waste generators; and residential communities through citizen action. Similar activities are being conducted in the U.S. under the Great Lakes Pollution Prevention Action Plan.

In its 1990 *Fifth Biennial Report*, the International Joint Commission recognized the need to change the voluntary approach and enunciated the following principle, which was "universally supported" in submissions made to it:

> That principle was that, with respect to both the enactment of preventive measures and the enforcement of penalties for infractions, there must be an end to the 'business as usual' attitude: there must be strict application and enforcement of zero discharge and other restrictions as appropriate, and meaningful penalties for violations. The theme that the time has come when the principle of the Agreement must be given the force of law, providing for prohibition of the creation and/or discharge of dangerous substances and for appropriate penalties for breach, and that attention to this requirement should be given top priority, was either specific or inherent in the great majority of submissions made at the meeting.

In its recommendations, the IJC went on to urge that all parties "co-operatively develop and implement appropriate legislation, standards and/or other regulatory measures that will give enforceable effect to

the principles and objectives of the Agreement on a Basin-wide basis."

Lack of Information

Good policy development requires good information. Developing a strategy to achieve virtual elimination of persistent toxic chemicals requires knowledge of who is discharging what into the Great Lakes. That is why the GLWQA parties agreed in 1978 to produce, by January 1982, a "complete inventory of raw materials, processes, products, by-products, waste sources and emissions involving persistent toxic substances" (International Joint Commission 1978). It is almost ten years after the target date, and no such inventory has been developed.

The interim report released by the IJC Virtual Elimination Task Force in 1991 concluded that information on sources of toxic chemicals is inadequate. It found that, while approximate loadings could be determined for lead and PCBs, "for most other persistent toxic substances, information about sources and quantities entering the ecosystem is fragmentary or non-existent".

It is known that tens of thousands of tonnes of toxic chemicals are dumped into the air and water of the Great Lakes Basin every day. Exactly how much, however, is not known. In 1988, in the American states around the Great Lakes, 2,041 tonnes (2,009 tons) of toxic chemicals were emitted into the environment or transferred off-site each day. According to the U.S. General Accounting Office, because of the exemptions allowed in the U.S. reporting system, this may account for as little as five per cent of the total releases.

From the Canadian side, loadings of pollutants to the Great Lakes cannot even be guessed at. A federal initiative asking industries to produce Toxic Release Inventories will not provide figures until 1994 at the earliest.

The irony of trying to assess the health of the Great Lakes ecosystem is that, despite all the gaps, there is a huge amount of data generated every year. But data are not information. The data collected are all too often inconsistent in methodology and therefore not useful for analysing spatial trends or trends over time. Data are often stored in a manner that makes retrieval by others difficult or impossible. Information is scattered among agencies. Sometimes, there is no synthesis and interpretation of information and, when it does occur, the results are often communicated to decision-makers in obscure language. The Royal Commission's *Pathways: Towards an Ecosystem Approach: A Report of Phases I and II of an Environmental Audit of Toronto's East Bayfront and Port Industrial Area* described the problem as:

> . . . a lack of comprehensive approaches to measuring the health of the ecosystem, or its component systems (air, water, soils). Like someone working on a jigsaw puzzle, there are many research programs under way in different departments at all levels of government, but not one of them is responsible for assembling the pieces into a whole picture, or for ensuring that no pieces are missing. Co-ordinated, comprehensive research, modelling, and monitoring programs would help to ensure that pathways in the ecosystem are explored, that cumulative effects are assessed, that remedial programs can be evaluated, and that indicators of ecosystem health can be developed and applied (Barrett and Kidd 1991).

Lack of Adequate Resources

Under the GLWQA, Canada and the U.S. have pledged to restore water quality in 43 toxic hot spots around the Great Lakes Basin, 17 of which are in Ontario. Since 1987, the federal government has spent $4.86 million on developing Remedial Action Plans (RAPs) for these areas. In the same period, the Ontario Ministry of the Environment has spent $7.58 million. Some participants in the RAP process argue that these expenditures are much too low, and that the lack of adequate funding has seriously hampered progress on the plans.

The IJC's *Review and Evaluation of Great Lakes RAP: Remedial Action Plan Program, 1991*, confirmed that one of the principal barriers to the implementation of RAPs is resource limitations, especially with regard to reducing the impact of agricultural pollution, combined sewer overflows, and contaminated sediments. Estimates are that it will cost as much as $19 billion to restore water quality in Canadian hot spots.

The Remedial Action Plans are site-specific, and are only part of an overall strategy for the Great Lakes Basin. Restoring ecosystem integrity will take basin-wide initiatives, as well as RAPs. The necessary actions and their costs have not yet been determined.

Perhaps the most basic need is to upgrade sewage treatment systems around the Great Lakes to meet the GLWQA's objectives. This is a commitment spelled out in Annex VI, in which Canada and the U.S. (in co-operation with state and provincial governments) agree to the "provision of financial resources to ensure prompt construction of needed facilities" (International

Metro Toronto's Main Sewage Treatment Plant

Joint Commission 1988). This commitment has not been fulfilled.

One untapped source of revenue for improving and upgrading sewage treatment systems is "full-cost pricing", under which municipalities charge users the full cost of water and wastewater services, on a metered basis. In addition to providing funds for upgrading infrastructure, that would reduce fiscal pressures on senior levels of government while reducing water use and associated pollution.

Canada's GLWQA commitments are funded under the Canada/Ontario Agreement (COA), which spells out federal and provincial governments' responsibilities in cleaning up the Great Lakes, and allocates funds for various activities. The last COA, signed in 1985, capped total spending at on average $3.7 million a year for six years. While that does not include all the money spent by either party, it is hardly sufficient, given the evidence that cleaning up the Great Lakes will require expenditures of a different order of magnitude.

Lack of Enforcement of Existing Laws

While restoring the Great Lakes Basin ecosystem will require new strategies, approaches, and laws, there is a question of what existing (albeit imperfect) laws and regulations are being fully used. Could we, at this moment, be cleaning up at least some of the problems, using existing technologies and regulations?

The U.S. score in this respect is impressive: only one of 37 direct industrial dischargers to Lake Ontario is *not* meeting Best Available Technology Economically Available (BATEA) limitations for toxic pollutants. (This is in contrast to the Canadian situation where, as already mentioned, we are at least three years away from setting BATEA regulations through the MISA program.) In the meantime, 25 of 44 industries (or 57 per cent) discharging into Lake Ontario are not in compliance with even the existing weak requirements.

The record for Ontario's municipal sewage treatment plants is almost as distressing. In 1989, 108 of 364 (or 30 per cent) of the province's sewage treatment plants did not meet provincial guidelines for discharges of conventional pollutants. (At present, there are no guidelines for metals or organic chemicals.) Fifty of these treatment plants have not complied for at least three years. Perhaps most distressing is the fact that 61 of the non-complying plants are owned and/or operated by the Ontario Ministry of the Environment!

Nor are these industries and sewage treatment plants being prosecuted for exceeding allowable effluent guidelines. Of the 93 industrial polluters who were not in compliance in Ontario in 1989, eight were investigated by the Ministry's Investigations and Enforcement Branch, and one was prosecuted and convicted. With regard to the 108 sewage treatment plants not in compliance in 1989, two municipalities were charged by the Ministry. One pleaded guilty; the other case was dismissed and is currently under appeal.

While the Province has jurisdiction in many environmental matters, the federal government has some responsibility for environmental protection. The aim of the federal Environmental Protection Act, for example, is to comprehensively manage chemicals "from cradle to grave". In fiscal 1989-90, Environment Canada carried out 3,412 inspections under the Canadian Environmental Protection Act. These led to

280 enforcement actions, which resulted in 266 warnings and eight "directions". In a mere three cases, prosecutions were undertaken and convictions were obtained.

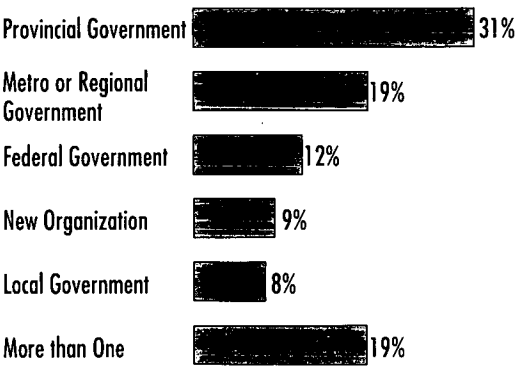
One of the federal government's potentially most powerful enforcement tools is the Fisheries Act, which is designed to protect fisheries and physical habitat. Under the pollution prohibition component of the Act, effluent limits have been set for seven industrial sectors, including pulp and paper. In addition, under its general prohibition section, the Act prohibits depositing of "deleterious substances" of any type in water frequented by fish. Despite these available powers, however, the Fisheries Act is rarely used. In 1988, for example, 21 charges were laid; there were 16 convictions, for which fines averaged $3,180. Considering that both the Fisheries Act and the Environmental Protection Act cover the entire country, these figures hardly reflect either the seriousness of the issue or the potential harm caused to the environment.

Lack of Responsibility

There is a fundamental conflict in carrying out Canada's responsibilities in the Great Lakes Basin. While the federal government has signed an international agreement to restore water quality in the Great Lakes, it is disinclined to pay the costs of clean-up. Environment Canada staunchly maintains that cleaning up the Great Lakes is the responsibility of Ontario and municipalities around the basin and says it will pay only for remediation related to federal lands or federal agencies.

But, as pointed out in *The Great Lakes in the 1990s* (Jackson and Runnalls 1991), when it comes to paying some of the costs of clean-up:

Responsibility for Water Problems



One-third of the respondents feel the provincial government should be most responsible for addressing water quality issues in the Toronto area.

Source: Environics Poll. 1991

> There are those who feel that a substantial federal commitment is unavoidable, both because of the large total sums that will be required, and because "it comes with the territory": if Canada commits to an international agreement to restore and maintain Great Lakes Water Quality, and if the federal government is to take credit for such an initiative, it cannot avoid paying its way.

Moreover, GLWQA's Article II states it is the policy of Canada and of the United States that "financial assistance to construct publicly owned waste treatment works be provided by a combination of local, state, provincial and federal participation" (International Joint Commission 1988).

In recent years governments have attempted to pass the buck for Great Lakes clean-up (and environmental protection in general): under the guise of "personal responsibility" there has been a tendency to finger the public (that is, everybody who is not government) as the major player in

environmental protection. Then, if nothing happens, the reason given is that "the public wasn't ready to move" or "the public refused to pay". Environment Canada's Pollution Prevention strategy, for example, is based on having industrial sectors and the public set their own targets for reducing pollution and reaching them voluntarily, rather than having enforceable limits set federally. In a similar vein, the IJC Water Quality Board stated in its 1991 report, *Cleaning Up Our Great Lakes*, that:

> Although governments must pass regulations, provide some funding and coordinate research, much of the work of cleaning up and protecting the lakes has to be done by businesses and citizens. This means that all of us have to understand the importance of pollution prevention and learn how to practice it in our daily lives.

There is no question that, by themselves, governments cannot restore the Great Lakes to health. Individuals, by changing their attitudes and personal actions, will play a vital role in clean-up. However, they will need guidance from governments, and assurance that governments are doing their part. Furthermore, individuals can do just so much. Only governments can upgrade sewage treatment plants or regulate industrial discharges into the lakes or regulate the use of chemicals.

The IJC's 1986 *Third Biennial Report Under the Great Lakes Water Quality Agreement of 1978 to the Governments of the United States and Canada and the States and Provinces of the Great Lakes Basin* states unequivocally that:

> . . . the primary responsibility for carrying out the programs needed for the success of the 1978 Agreement rests with governments. They also have the principal funding and enforcement capabilities.

SUMMARY

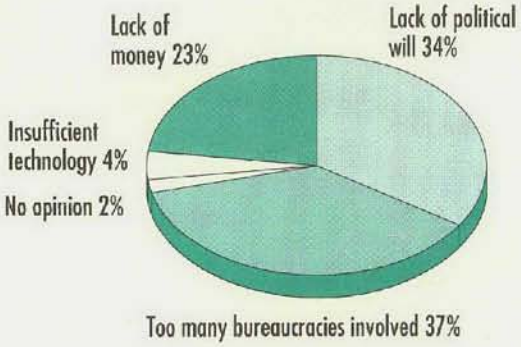
The lack of progress in cleaning up existing problem areas, and the lack of progress in developing strategies for preventing future problems, has led to a crisis of confidence in government. Informed observers and the general public have little confidence in the ability of governments and other institutions to restore the health of the Great Lakes Basin ecosystem, or even to prevent further deterioration. This institutional paralysis people perceive comes at a time when they believe action on the environment *must* take place.

Because Remedial Action Plans operate on a local basis, and involve so many members of the public, those closest to the RAPs are most cognizant of Great Lakes problems, and most frustrated by events. At the 1991 IJC biennial meeting, Great Lakes United member Sarah Miller asked the commissioners, "Are RAPs healing the Great Lakes?" and used the analogy that RAPs were intended to provide holistic treatments for sick Great Lakes. She concluded that:

> I am here today representing the exhausted and discouraged friends of the Great Lakes to communicate our fear that your experiment may be failing. There are grave signs that the patient is weakening while waiting for full treatment and for those in charge of this experimental treatment to agree to act. The original intent of the RAP cure was to fast-track the patient's recovery but the Great Lakes have been allowed to languish now for six years since your announcement of the RAP cure.

An Environics poll conducted in the Greater Toronto Area in June 1991 showed that only five per cent of those polled felt that water quality in the rivers and along the waterfront was good. There was universal support for cleaning them up so that people can safely swim and fish again. Eight of every ten respondents felt that cleaning up area waterways was an achievable goal which could be accomplished in a decade. A significant number of those polled expressed a willingness to pay for environmental clean-up and, significantly, they believe bureaucratic complexities and lack of political will — not money or technology — stand in the way of progress on environmental clean-up.

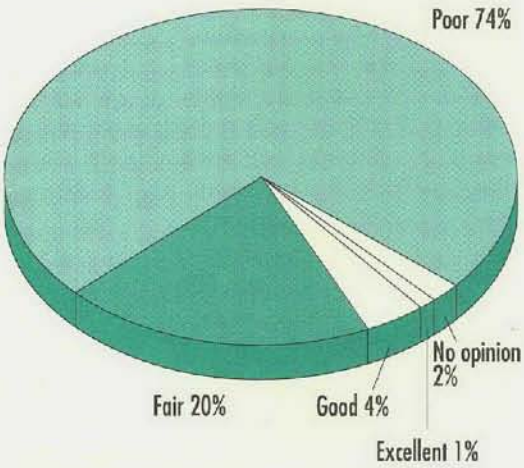
Problems Preventing a Clean up



The respondents believe that lack of political will and too many bureaucracies are two of the biggest obstacles to cleaning up Toronto's waterfront and rivers.

Source: Environics Poll. 1991

River and Lakefront Water Quality



Three-quarters of the respondents rate the water quality in the area's rivers and waterfront as poor.

Source: Environics Poll. 1991

Restoring the health of the Great Lakes Basin ecosystem may be the single greatest challenge facing people living in the Great Lakes Basin. In the words of the IJC Water Quality Board in its 1991 report:

> We who live around the Great Lakes are at an historic point. After years of experience with pollution, we now have a very good idea of what must be done to restore a healthy ecosystem. We have the know-how to clean up our lakes, but to do so we now have to make serious decisions.

Now, in order to illustrate the complex water quality problems in the Great Lakes Basin, we look closer to home — at the Metro Toronto Remedial Action Plan.

The Metro Toronto Remedial Action Plan

The Metro Toronto waterfront is one of 43 polluted areas around the Great Lakes in which a Remedial Action Plan (RAP) is being developed. RAPs were initiated in 1985, when the IJC recommended that governments on both sides of the border develop them to restore water quality. They were intended to be blueprints for remedial and preventive measures, and to be developed using an ecosystem approach. The requirement to carry out these RAPs was

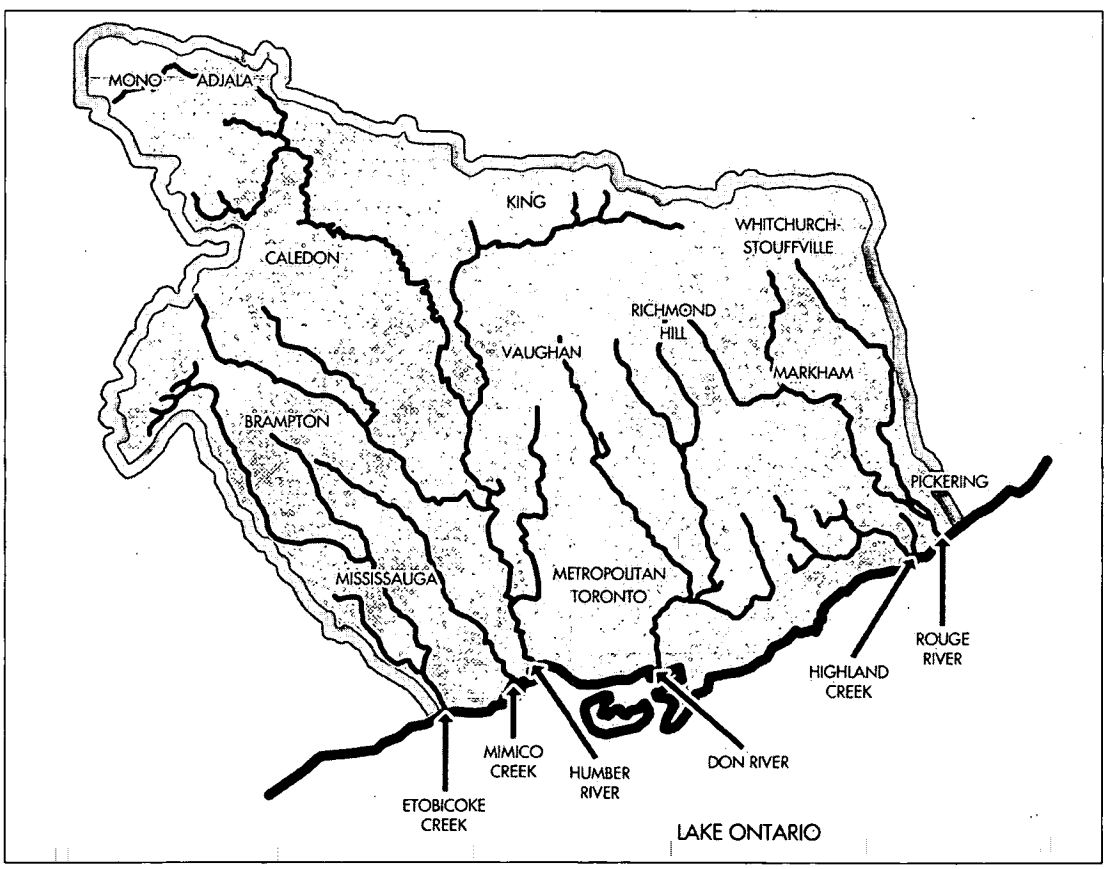
enshrined in the Great Lakes Water Quality Agreement when it was renegotiated in 1987.

The Metro Toronto and Region Remedial Action Plan was originally envisaged as a strategy for cleaning up the waterfront between Etobicoke Creek and the Rouge River. But, as it became apparent that cleaning up the waterfront would be impossible without cleaning up the rivers that drain into it, the RAP's geographic area was expanded. It now includes the watersheds of the Etobicoke, Mimico, and Highland creeks, and the Humber, Don, and Rouge rivers — an area of some 2,000 square kilometres (772 square miles) which crosses many political boundaries, and includes five regional governments and 17 local municipalities.

The Ontario Ministry of the Environment is the lead agency in the Metro RAP, working closely with Environment Canada. A RAP steering committee (the RAP Team), which guides the process, is made up of senior representatives from the federal and provincial governments, and others from Metro Toronto, the Metropolitan Toronto and Region Conservation Authority, and the municipalities of Toronto, Scarborough, and Etobicoke.

Scientific and technical advisory committees, comprising government staff, provide assistance and advice to the RAP Team. A voluntary Public Advisory Committee, which offers ongoing feedback and community outreach, has broad representation from

Map 3.2 Metro Toronto and Region Remedial Action Plan area



many sectors, including industry, tourism, agriculture, environmental groups, labour, recreation, municipalities, and others.

The RAP is intended to build on the work already carried out in the area. This includes the Waterfront Remedial Action Plan, completed by the City of Toronto in 1987. The RAP also builds on extensive studies carried out in the early 1980s under the Toronto Area Watershed Management Studies (or TAWMS). The RAP process is intended to bring "value added", which was not part of earlier studies like TAWMS, through the use of a comprehensive ecosystem approach, and to involve the public at every step of the process.

THE ENVIRONMENTAL PROBLEMS

Of the 17 Canadian areas on the Great Lakes where RAPs are being carried out, perhaps none faces more complex problems than those on the Metro Toronto waterfront. Some 2.5 million people live in the Metro RAP area, the southern part of which is highly urbanized and suffers stresses typical of dense population — the impact of sewage; contaminated stormwater from urban streets, roofs, and parking lots; physical restructuring of the natural environment; sewer dumping of toxic chemicals from households and small industries; and other problems.

The northern part of the RAP area is still largely rural, and there agricultural run-off of soil, pesticides, and fertilizers degrades streams and rivers. There, too, development pressures destroy rural lands to provide housing, and run-off during construction causes silting of streams and rivers.

If one were to fly over the Metro Toronto RAP area, the physical restructuring that has been carried out would be plain to the eye. First, of course, there are the urban areas — islands of heat, light, and air pollution — linked by a network of roads and bridges. The lower courses of all the area's streams and rivers (except the Rouge) have been dramatically altered. Blocked by dams, straightened and encased in concrete channels, they provide a hostile environment for aquatic life. Some feeder streams have been lost altogether. Habitats for terrestrial wildlife have been fragmented and lack continuity. Wetlands have been paved over, and built dock walls mean that, in many places along the waterfront, there are no shallows for fish. After a hundred years of lakefilling, erosion control, and other alterations, little of the natural shoreline remains.

The waters of the Metro Toronto RAP area suffer from population stresses as well: they contain high levels of phosphorus due to combined sewer overflows and sewage treatment plant effluents. Beaches are closed routinely every summer because of high bacterial levels that result from combined sewer overflows. Levels of heavy metals in water occasionally exceed Provincial Water Quality Objectives, especially in highly degraded areas such as the Keating Channel and the Inner Harbour. Bottom sediments are laden with heavy metals and organic chemicals. Consumption of some fish is restricted because of contamination.

The largest sources of pollution are the sewage treatment plants, combined sewer overflows, and stormwater run-off. The four sewage treatment plants in the area, which can treat 1,240 million litres (273 million gallons) of sewage a day, are the main sources of phosphorus, and they also pass through significant amounts of heavy metals and organic chemicals from

homes and industries. There are highly polluted zones around the outfall pipes of these plants.

In heavy rainstorms, combined sewers overflow and send a mixture of stormwater and untreated sewage through 35 outfalls into the Don and Humber rivers and, through another 34 outfalls, directly into Lake Ontario.

In an urban environment, stormwater is a mixture of rain and various pollutants from streets, roofs, parks, gardens, and parking lots. Urban stormwater carries a significant load of bacteria, metals, and organic chemicals, and is funnelled through some 2,250 outfalls into the streams, rivers, and waterfront of the Metro RAP area.

Other sources of pollution include deposition from the air; groundwater contaminated from industrial activities; agriculture or leaking landfill sites; historic contaminants in bottom sediment; and sources "upstream" in the Great Lakes, including the Niagara River.

Problems with the RAP Process

By necessity, remedial action planning is an arduous, time-consuming task. There is no cookbook in which to find the recipe for a Remedial Action Plan, complete with ingredients and the methods to be employed. Each RAP deals with a unique set of problems and is being developed differently. Some, it would appear, are having more success than others. Observers of the Metro Toronto RAP process have identified a number of problems with the RAP process as it has been undertaken in Toronto.

One criticism often levelled at the Metro Toronto RAP is the amount of time being taken to develop it: the original target date set by the IJC to complete RAPs was 1987. This date was overly optimistic, and did not reflect the complexity of the task at hand. Work did not start on the Metro Toronto RAP until 1986, and almost nothing but research was carried out for the first two years. Since that time, efforts have concentrated on developing goals and principles to guide the process, on defining the problems, and on identifying potential remedial options.

Five years after the RAP was initiated, and four years after it was originally to be finished, selection of remedial options has yet to begin. The current target date for the draft Stage 2 document is late 1992.

Remedial Action Plans are developed in stages: Stage 1 defines the problem; Stage 2 selects remedial options; and they are implemented in Stage 3. The scope of the problems facing the Metro waterfront, and the sources of those problems, were detailed in the draft Stage 1 RAP document, *Environmental Conditions and Problem Definition*, released in September 1988. The recent IJC review of this report found that the problem definition and description were inadequate, and that the document focused on conventional pollutants and did not satisfactorily describe the sources and causes of ecosystem impairment due to persistent toxic substances.

In April 1990, the RAP Team released the *Draft Discussion Paper on Remedial Options.* At the Royal Commission's second set of hearings on the environment, this document was criticized as unintelligible to the average reader, and not useful for the process of selecting remedial options. In its 1990 report, *Watershed*, the Royal Commission recommended that the remedial options paper be

rewritten to make it more understandable, that it be reorganized on a watershed basis, and that it clearly link the RAP goals, the impaired uses, and the remedial options. Environment Canada and the Ministry of the Environment indicated to the IJC in September 1991 that they would not be rewriting the *Draft Discussion Paper on Remedial Actions*, but would be updating the remedial options in the Stage 2 document.

If it is to be implemented successfully, a Remedial Action Plan must have broad public support. In the Hamilton Harbour RAP, for example, continuous efforts have been made to inform the general public, to get people excited and involved in the RAP.

This has not been the case in the Metro Toronto RAP, where public outreach has generally been limited to contact with Public Advisory Committee members and representatives of their sectors, with a few newsletters being sent to a wider audience. In general, the Metro Toronto public does not know that a RAP is being developed and has not been involved in goal-setting or debates over remedial options. An outreach program scheduled for the winter of 1991/92 is intended to begin this process by widely distributing the Strategies document, which intended to raise the public profile of the RAP, outline the problems, and indicate the general direction in which the RAP is proceeding.

Developing a Remedial Action Plan that can actually be implemented is possible only if all stakeholders are involved. We have already commented on the lack of a strategy to involve the general public, but it would also appear that some of the municipalities and regions that should be part of the process are not involved in any meaningful way. For example, traced to its sources, the Humber River's main branch starts in Mono Township in Dufferin County, while the east branch originates in Richmond Hill in the Region of York. But there is no evidence that these municipalities and regions pay heed to the RAP in their land-use planning, budget processes or public works planning. Although the municipal sector is represented on the Public Advisory Committee, and representatives of some "downstream" municipalities sit on the RAP Team, it does not appear that all five regional and 17 municipal governments are true partners in developing the RAP.

This lack of involvement by all stakeholders is one aspect of a larger, more troubling problem: the lack of an ecosystem approach. While, from the start, the RAP Team's intentions have been to use an ecosystem approach, in general it has failed to do so thus far. Problems in the draft Stage 1 report include: lack of integration and synthesis of information; concentration on the waterfront and lack of attention to the problems affecting the watersheds; little information about wildlife habitats, land use adjacent to the waterfront and watersheds, and contaminants in aquatic birds. Most important, the information collected to date, and the potential remedial options, are *not* organized on a watershed basis. Instead, the Metro RAP area is treated as a 2,000-square-kilometre (772-square-mile) monolithic block.

As noted, the IJC has said that lack of resources is a problem endemic to RAPs throughout the basin. The Royal Commission has twice commented on the limited resources for the Metro RAP, recommending increased funding, both to the Public Advisory Committee (in *Watershed*) and the overall program (in *Pathways*). In the past

Rouge Valley at Lake Ontario

two years, funding levels have increased to a limited extent.

One of the most serious criticisms levelled at the Metro Toronto RAP is that its development has had the effect of delaying beneficial projects that would otherwise have proceeded in the wake of TAWMS and other studies. Since the RAP started in 1986, some projects have indeed proceeded; for example, a detention tank in Toronto's Eastern Beaches has been built to reduce beach closures by detaining stormwater and combined sewer overflows during rainstorms. Repairs to sewers have been carried out, and work has been done to trace and disconnect illegal sewer hook-ups. Beaches have been cleaned and physically improved. Unfortunately, there is no way to judge whether or not remedial actions would have proceeded more quickly in the absence of the RAP planning process. In part this is because, while municipalities are spending money on items that can be considered "remedial", in some cases the costs of remedial actions are buried in those of routine maintenance and operations.

The potential for delay is a problem in any long-term planning exercise — the need to balance action against the need to develop a strategic, unified, and comprehensive plan. Recognizing this, one of the principles adopted in the Metro RAP is that parties should proceed with remedial actions that are "consistent with RAP goals and principles" while the RAP itself is being developed. This echoes the "two-track" recommendation of the IJC (1988) *Revised Great Lakes Water Quality Agreement of 1978 as Amended by Protocol Signed November 18, 1987*, which encourages acceleration of existing programs while RAPs are under development.

One burden RAPs everywhere (including Toronto) have had to bear is that of too-great expectations. For many reasons — lack of knowledge, bureaucratic buck-passing — RAPs have been touted as the answer to any and all water quality problems in areas such as Toronto. This is simply not true. The Metro Toronto Remedial Action Plan is a site-specific clean-up plan; as such, it deals best with problems originating within its boundaries. Through the RAP, programs can be developed to do such things as keep the beaches open, preserve and rehabilitate local wildlife habitat, manage stormwater better, improve sewage treatment plants, and, to some degree, reduce sewer dumping of chemicals.

But there are problems that require a basin-wide approach, especially when sources lie outside the Metro RAP area. It will take basin-wide efforts to ban persistent chemicals, set multi-media standards for chemical exposure for humans and wildlife, and control deposition of toxic chemicals from air. They will also be required to reduce pollution from "upstream" in the Great Lakes, develop standards for sediment quality, technologies to treat sediments, and prosecute those not in compliance with environmental laws and regulations.

Grassroots Action

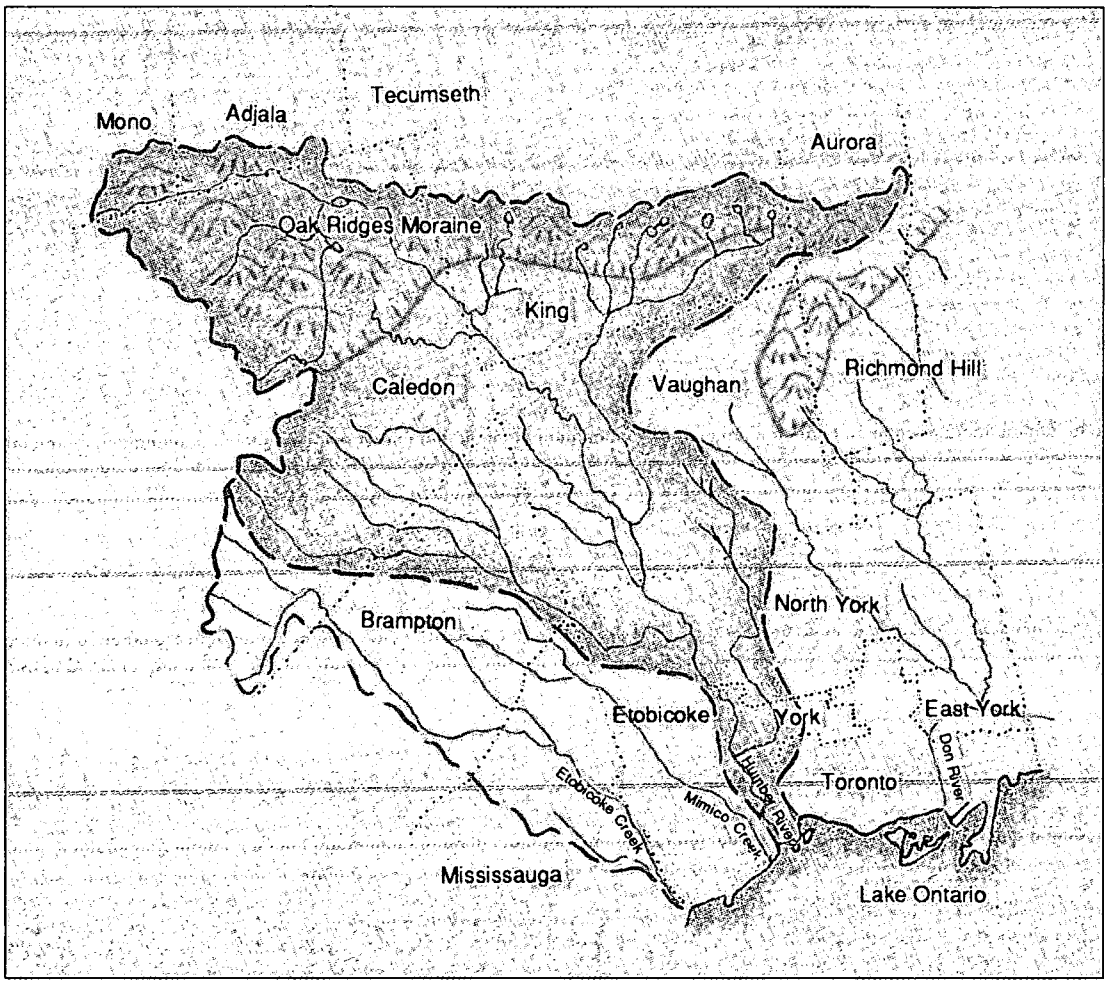
In recent years, a number of grassroots initiatives have emerged, aimed at cleaning up waters in the Metro RAP area. These come from groups that include the Task Force to Bring Back the Don, the Black Creek Project, Save the Rouge Valley System, and Action to Restore a Clean Humber (ARCH). All sprang up to fill what was perceived as a void in government action; the work of ARCH is a good example.

ARCH, formed in 1989, is the newest of these citizens' groups; it is a non-governmental body made up of experts from various disciplines, and of others who have a stake in the Humber. Among its current projects: monitoring development that might affect the watershed and developing a computerized database to assist in clean-up actions. The organization sees its overall purpose as being to resolve the current jurisdictional logjam and to define an effective mechanism for implementing water quality programs on the Humber. To meet these goals, ARCH acts as a catalyst with government and the private sector, urging that clean-up action begin.

ARCH believes that we know how to clean up the Humber River, and that the impediments to progress are not technical or scientific, but institutional. Therefore, ARCH proposes to build on the substantial work already done in the Humber watershed, including the *Humber River Water Quality Management Plan*, completed in 1986 under TAWMS. This plan contains a host of recommendations for restoring water quality in the Humber River watershed, including measures to eliminate combined sewer overflows, reduce flooding, address sewer dumping from homes and industries, and control erosion, among others. According to ARCH, only a few recommendations of minor consequence from the Humber River Water Quality Management Plan have been implemented by Metro Toronto; most remain as "potential remedial options" in the list generated in the RAP process.

In June 1991, ARCH submitted an unsolicited proposal to the Metro Toronto RAP Team for funding to develop a

Map 3.3 Humber River watershed



watershed-based mechanism for implementation of the RAP. The idea was to use the Humber River as a prototype for implementation based on the "watershed partnerships", as articulated by the Royal Commission in *Watershed.* This could then be used as a model for co-ordinated action in the other watersheds. ARCH argued that the Humber River was a logical choice because it has the largest watershed, and affects the greatest number of municipalities. By early December 1991, Environment Canada, the Ontario Ministry of the Environment, and Metro Toronto had agreed in principle to the ARCH proposal, and funding for the project was imminent. While the initiative is laudable, it is unfortunate that ARCH is having to develop a prototype for implementation in the advance of the actual plan — the RAP.

From the earliest days of the RAPs, those involved in developing the plans have been haunted by the question of how to implement them. ARCH is focusing on two of the keys needed to unlock the implementation puzzle: involvement of all key players and use of a watershed approach. The group comprises people who, first and

foremost, like their river, feel some sense of stewardship for it, and want to see it restored. Founding members living near the mouth of the river established connections with upstream dwellers and found that people in York and Peel regions and Dufferin County like their river, too! But the members of ARCH realized that merely involving citizens was not enough; all the players had to be at the table — every level of government, and the private sector as well. Therefore, they proposed a study to determine the best way of doing just that.

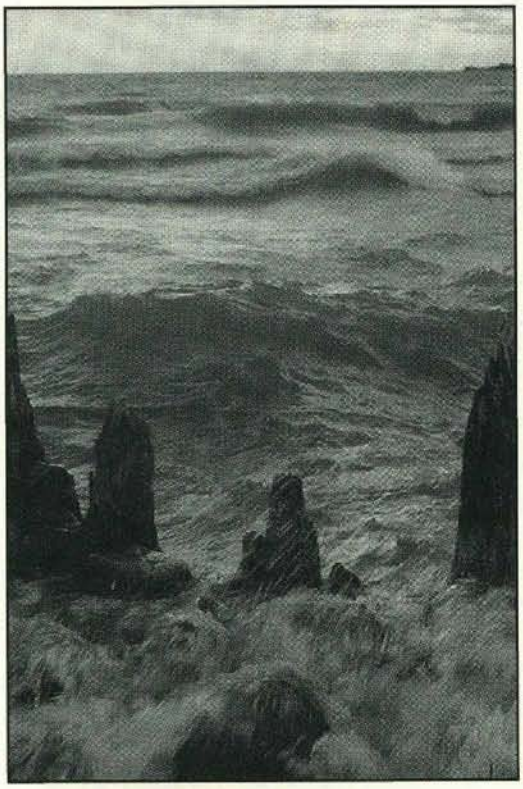
The ecosystem approach requires that activities be managed based on "ecological units". What is an appropriate ecological unit? For ARCH's members, logic suggested a unit that was manageable and understandable — the watershed of a river. Watershed planning is firmly grounded in a scale people can comprehend, where they can feel a sense of stewardship.

There is no doubt that support for such a strategy extends beyond the Humber River watershed. Speaking of Watershed Partnerships, the Commission's *Watershed* report said:

> Public support for this collaborative approach is very high. Indeed it is clear that people are prepared to back a common vision that takes into account the long-term health and well-being of the waterfront and its river valleys. The hundreds of deputants before the Commission bore witness to that fact.
>
> They may be well ahead of their governments. Clearly, they want their various levels of government to build on this consensus and move toward restoring the integrity of the waterfront and the ecosystem that sustains and determines it.

Action on the Great Lakes

The health of the Greater Toronto waterfront, as measured by the quality of water, is inextricably tied to the health of the Great Lakes Basin ecosystem. If we are going to clean up our waterfront, we must act regionally (perhaps even globally) as well as locally. This review of the state of the Great Lakes has touched on many of the complex problems facing us, and the institutional stumbling blocks that have so far impeded progress on clean-up. The public pressure for action on remediation grows and grows. But where do we go from here?



Waves breaking, Newcastle

The Royal Commission believes that there is a clear need to clean up the waters along the Greater Toronto waterfront and its watersheds. The following eight major

recommendations are made to accelerate the process of regeneration.

The Great Lakes Water Quality Agreement

In moving to improve water quality in the Great Lakes, it seems natural to start with the Great Lakes Water Quality Agreement (GLWQA). First signed by Canada and the U.S. in 1972, expanded in 1978, and reaffirmed in 1987, in many ways the GLWQA is a heartening document. Its overall goal is framed in ecological terms: to restore the integrity of the Great Lakes Basin ecosystem. The agreement contains both general and specific objectives for measuring ecological health.

It also includes commitments by the parties to develop many programs to prevent pollution from industrial, municipal, and agricultural sources, as well as from dredging, shipping, and other activities. In addition, the parties commit themselves to carrying out surveillance and monitoring programs, and to developing Remedial Action Plans, Lakewide Management Plans, and more. The GLWQA is filled with noble intentions, good words, and logical strategies to help clean up the Great Lakes Basin. Nonetheless, it is obvious that many of the most fundamental commitments made under the GLWQA have not been kept.

It is important to understand that point because we are close to the time (in 1992) when the GLWQA is due to be renegotiated. During that process, there is a temptation to "improve" the agreement by broadening its scope, refining its strategies, and adding more annexes. Those in favour of renegotiation argue that the GLWQA can be improved by better defining terms, setting priorities, and articulating the ecosystem approach more clearly.

The Royal Commission sees risks inherent in trying to renegotiate the Agreement now, especially the risk of expending bilateral effort on theoretical discussions at a time when the public is demanding action on Great Lakes clean-up. The Commission is not convinced that adding more words to the GLWQA will solve the problems in the Great Lakes in any way. Rather, we believe that "improving" the GLWQA would probably only generate more deadlines that will not be met, and more commitments that will not be kept.

In short, the Royal Commission considers that the problems of Great Lakes water quality are not primarily attributable to GLWQA shortcomings. The Great Lakes Water Quality Agreement is, if not perfect, a good foundation on which to build a strategy for restoring the Great Lakes. But there are structures *outside* the agreement that must be improved if meaningful progress is to be achieved in cleaning up the Great Lakes. Two changes, discussed in the next sections, are essential if that is to happen: a more effective International Joint Commission and a better Canada/Ontario Agreement.

The International Joint Commission

The International Joint Commission has played a valuable and unique role as the independent watchdog of progress on environmental matters in the Great Lakes, and as a facilitator of intergovernmental co-operation. However, since 1987, there has been a steady erosion of the Commission as the result of cutbacks in funding, loss of trained staff, and changes in its

committee structure that have left today's IJC unsure even of its role.

Attempts to restore the Great Lakes ecosystem will benefit from a strong and focused IJC which can act as a catalyst, an integrator, an independent fact-finder, observer, and watchdog. To be able to do this, the IJC should be supported with sufficient resources to carry out its obligations. This would allow the Commission, for example, to increase its in-house expertise rather than having to depend on the governments it monitors to provide it.

Since the IJC's 1985 biennial meeting in Kingston, public input has played an ever-increasing role in its reports on progress in cleaning up the Great Lakes. This input has been significant in increasing the Commission's attention to accountability.

Public interest in Great Lakes issues will probably continue to increase in the years ahead, as remediation starts. The Royal Commission believes that the public in the basin area can offer the IJC valuable expertise and opinion, and that a mechanism should be set up to formalize this transfer of information on an ongoing basis. This could be done through a standing Citizens' Advisory Committee which could advise the IJC and its boards on matters coming before them.

RECOMMENDATION

17. The Royal Commission recommends that the Government of Canada work with its U.S. counterpart and the IJC to:

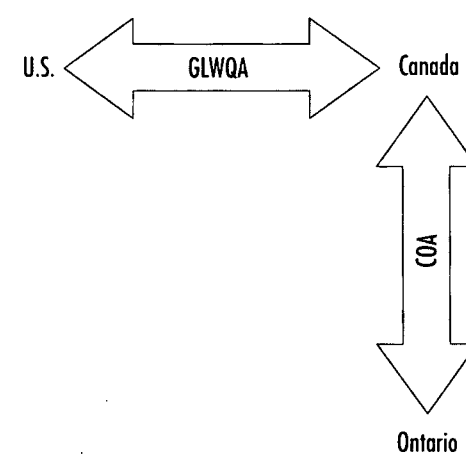
- strengthen the role of the IJC and clarify its responsibilities;
- ensure that the IJC has sufficient, secure, multi-year funding to carry out its responsibilities; and
- set up a standing Citizens' Advisory Committee to provide ongoing advise to the IJC.

THE CANADA/ONTARIO AGREEMENT

Most Great Lakes watchers focus on the relationship between Canada and the U.S., as articulated and defined by the GLWQA. But that overlooks the jurisdictional realities in Canada, where responsibility for many environmental issues lies with the provincial, not the federal, government. Therefore, in implementing commitments under the GLWQA, the relationship between Canada and Ontario is more important than that between Canada and the U.S. It is articulated in the Canada/Ontario Agreement (COA).

The COA is one of the best-kept secrets in the environmental world, almost unknown to the general public, and little understood even by many environmental groups active on issues in the Great Lakes Basin. This is more than somewhat ironic, given the fact that COA is the key (on the

Relationships and responsibilities for Great Lakes water quality



Canadian side) to implementing the Great Lakes Water Quality Agreement. Just as the GLWQA spells out Canadian and American responsibilities in cleaning up the Great Lakes, the COA spells out federal and provincial government responsibilities in cleaning them up.

There have been Canada/Ontario agreements concerning the Great Lakes since 1971. The current COA was signed in April 1985, and expired on 31 March 1991. (It has since been temporarily extended for an indefinite period.) The COA contains the same principles as the GLWQA: the virtual elimination of persistent toxic substances, shared funding of publicly owned waste treatment works, and co-ordinated planning processes to control all sources of pollution. It also uses the same general and specific clean-up objectives found in the GLWQA.

The fundamental objective of the COA is to restore the Great Lakes Basin ecosystem. Its purpose is to "renew and strengthen co-operation between Canada and Ontario in meeting the obligations assumed by Canada under the revised [GLWQ] Agreement" and "to provide for the cost-sharing of specific programs which Ontario will undertake to assist Canada in meeting these obligations" (COA 1985).

In the 1985 version, Canada and Ontario agreed they would contribute equally to the costs of programs carried out under the COA (except for construction of sewage treatment facilities). The Agreement also placed a cap on the amount of money that would be spent: a total of $22.1 million over six years. Echoing the GLWQA, this version spelled out what Canada and Ontario would undertake in controlling pollution in the Great Lakes. It included programs and other measures to deal with:

- treatment of municipal and industrial wastes;
- phosphorus management;
- pollution from shipping and dredging;
- pollution from land-use activities;
- hazardous polluting substances and persistent toxic substances;
- Remedial Action Plans; and
- annual inventories of polluters and compliance rates.

Canada and Ontario need to renegotiate the Agreement and the Royal Commission believes it is imperative that the COA be changed to allow the GLWQA's objectives to be reached. Observers have suggested a number of improvements that should be made during the renegotiation process.

First, COA negotiations between Canada and Ontario should be carried out publicly rather than, as in the past, by bureaucrats behind closed doors. While this approach might have been acceptable as recently as 1985, today's public demands a role in the development of such important tools. For example, in 1987, when the GLWQA was renegotiated by Canada and the U.S., then-Secretary of State for External Affairs Joe Clark appointed two members of non-governmental organizations to the Canadian negotiating team. Such appointments would ensure accountability at a critical time in the Great Lakes Basin clean-up process. Moreover, because municipalities will play a large role in funding local clean-up initiatives, they, too, must be given a role in negotiations.

We are moulded, we say, by the conditions and surroundings in which we live; but we too often forget that environment is largely what we make it.

Carman, B. 1904. *The kinship of nature.* Boston: Page.

Second, the new COA must be more results-oriented, better designed for implementation. As it stands, the agreement is largely a mechanism for co-ordination. But if it is to achieve the objective for which it was designed — to meet the obligations assumed by Canada under the GLWQA — the COA must provide a framework within which GLWQA commitments can be implemented. This means that the COA must include strategic targets, administrative structures, measures of performance, and timetables. Furthermore, it should articulate clearly the roles and responsibilities of the various players involved.

Third, the COA must address program funding to meet GLWQA commitments, including reasonable apportioning of costs between the parties. It also must ensure that sufficient funds are provided to enable targets to be reached. Clearly, the funding cap set in the 1985 COA (on average, $3.7 million a year) is totally inadequate in dealing with the problems at hand. Under the Remedial Action Plans alone, the estimated costs for clean-up on the Canadian side are in the $19-billion range. Add to that the costs of Great Lakes monitoring, and programs to control pollution from industrial and municipal sources, rural and urban run-off, atmospheric deposition, dredging, and others, and it is clear that funding must be of a very different order of magnitude.

If the two governments cannot afford to provide this, they should say so candidly, to ensure that the public is not misled. In the very near term, significant funding will be required for Remedial Action Plans' so-called Track I options. These, as defined by the IJC, are existing programs that can be accelerated before the Remedial Action Plan is entirely complete.

Fourth, there is the matter of accountability. Every two years, Canada and the U.S. report to the IJC on their progress, and it then reports on overall progress in the Great Lakes Basin. The Canadian report, however, is essentially a list of programs under way. The COA parties should develop a set of indicators to measure progress of RAPs. These should be simple and easy to understand — the number of beaches posted to warn of pollution, the number of species of fish restricted for human consumption or the incidence of reproductive problems in aquatic birds.

The parties should make annual public reports on what they have accomplished, referring to this set of indicators, and should reveal which parties have spent what monies. This will allow the Canadian public to ascertain where its tax dollars are being spent, and measure tangible progress.

Fifth, on an ongoing basis, the public should be part of COA activities. This could be accomplished by giving a seat to members of the public on the various COA committees, or by creating a standing committee of citizen advisors.

RECOMMENDATION

18. The Royal Commission recommends that the federal and provincial governments renegotiate the Canada/Ontario Agreement and:

- conduct public negotiations, with the explicit involvement of municipalities and non-governmental organizations;
- ensure that the new COA contains strategic targets, administrative structures, and timetables against which progress can be measured;
- explore funding options including full-cost pricing of sewer and water services;
- ensure that the new COA contains mechanisms for apportioning the costs of clean-up between the parties, that adequate funds are available to carry out programs to meet the commitments made under the GLWQA, and that funds are available to accelerate Track I RAP programs;
- develop a set of indicators of progress under Remedial Action Plans, and report annually to the Canadian public on progress made, as measured by those indicators, and by monies spent; and
- include the public on an ongoing basis in COA activities and monitoring.

Municipal/Industrial Strategy for Abatement

At this time, the Municipal/Industrial Strategy for Abatement (MISA) program is Ontario's prime vehicle for reducing the flow of toxic pollutants into Ontario waters. While it is intended to set tough new standards for direct industrial dischargers, municipal sewage treatment plants, and indirect industrial dischargers (who discharge to municipal sewage systems), the program, as we have seen, has been plagued with delays: control of direct industrial dischargers is almost four years behind schedule, while virtually nothing has been done with the municipal and indirect industrial sectors. This is not acceptable.

During the three years of its existence, the Royal Commission has viewed with mounting frustration the lack of progress on MISA. Combined with the lack of enforcement of existing regulations, it places Canada in a poor position relative to American efforts at pollution control in the Great Lakes.

Recommendation

19. The Royal Commission recommends that the Province of Ontario move quickly to reduce pollution entering the Province's waterways, specifically by developing MISA as rapidly as possible so that it:

- sets regulations for direct industrial dischargers;
- decides on a program, including targets and timetables, to control pollution from the municipal sector, and moves to implement such a program; and
- decides on a program, with targets and timetables, to control industries that discharge to municipal sewage treatment systems, and moves to implement such a program.

The Metropolitan Toronto and Region Remedial Action Plan

The success of the Canadian Remedial Action Plans depends, in large part, on a renegotiated Canada/Ontario Agreement. Without a COA that provides funding agreements and funds for cleaning up the

Great Lakes, it will be impossible to implement RAPs effectively. The same is true of RAP planning, which ends with development of a Stage 2 document spelling out responsibility and timetables for paying for clean-up activities. In addition to a strong, effective COA, there are other planning issues that must be addressed in developing Metro's RAP.

The Metropolitan Toronto RAP, which has encountered its share of difficulties since it was started in 1986, is an attempt to develop a blueprint for cleaning up an immense and complex set of problems created by the fact that 2.5 million people live, work, and play in a relatively small area.

The most serious of these is the lack of a true ecosystem approach to tackling Metro's waterfront and watersheds. Using such an approach requires a fundamental shift from traditional ways of thinking — the compartmentalized approach to environmental protection, concerned with managing the external environment. The ecosystem approach, on the other hand, stresses integration, not compartmentalization, and is based on managing human activities *within* a natural system of which we are just one part. Shifts to ecosystem thinking cannot be legislated but are the result of changes to personal philosophy and values. Nonetheless, there are two concrete actions that can help move the Metro Toronto RAP to an ecosystem approach.

First, the IJC has asked that the Stage 1 (problem definition) document be rewritten to better reflect the problems and set the groundwork for an ecosystem approach in developing the RAP. The *Draft Discussion Paper on Remedial Options* also needs updating and reorganization on a watershed basis. While the RAP Team intends to make updates as part of the Stage 2 document, the Commission believes these should be done before Stage 2 is finished, particularly because ecosystem/watershed ideas are the building blocks needed in order to select remedial options for the final plan.

Second, as articulated in *Watershed*, we believe that a watershed approach should be taken in the Metro Toronto RAP: remedial options should be arranged and tied to restoring water quality in each of the six major watersheds, co-ordinated and integrated by the overall RAP. Because, according to the ecosystem approach, activities must be managed according to ecological units, we also think that the municipalities within these watersheds should be brought into the RAP development process as true partners.

To be effective, the RAP requires three additional improvements: adequate funding, solid public backing, and quick implementation. The Royal Commission is not convinced that the Metro Toronto RAP has received the resources necessary to fulfil its objectives. Of the 17 Canadian RAPs, this initiative is arguably the most complex, covers the largest area, and potentially affects the greatest number of people.

The Metro RAP has never effectively reached out to the general public to elicit support for cleaning up the watersheds and waterfront. However, broad public acceptance and support of the RAP is critical to implementing it successfully. Without it, a plan — however worthy — is likely to sit on a shelf gathering dust.

The RAP Team is taking steps to involve the general public through activities

planned around the release of a document outlining its strategies. But this is only part of what is needed. The Team must develop an ongoing, comprehensive program of outreach to raise awareness and involve Metro Toronto's general public. Perhaps the best way to do this is by using a watershed approach, creating enthusiasm in people for cleaning up their own river, creek or stretch of waterfront.

Finally, the delays in the RAP process are unfair to those members of the public who have invested so much time and effort in its development. These hold-ups also threaten to make the RAP redundant: while development of the RAP has been dragging, regions and municipalities have proceeded on projects costing millions of dollars — all in the absence of a unifying framework.

For example, Metro Toronto has carried or is carrying out environmental assessments on expanding the Main Sewage Treatment Plant, the R. L. Clark Filtration Plant, and the Don Trunk Sanitary Sewer. It is also studying the future of the North Toronto Sewage Treatment Plant and developing a water conservation strategy. The City of Toronto is conducting a Sewer System Master Plan. Each of these projects has implications for water quality in the watersheds and along the waterfront, and should be taking place with guidance from the RAP. But expanding the Main Sewage Treatment Plant, for example (the subject of one of Metro's environmental assessments), has not been selected as a preferred remedial option because option selection has not yet taken place.

Clearly, completion of the Stage 2 Remedial Action Plan is a priority. The Royal Commission believes that the federal and provincial governments should take whatever action is necessary to guard against further slippage in deadlines for completing the Metro Toronto RAP.

RECOMMENDATIONS

20. The Royal Commission recommends that the federal and provincial governments use an ecosystem approach in developing the Metro Toronto and Region Remedial Action Plan. This means that:

- as soon as possible, and in advance of the draft Stage 2 document, the problem definition should be rewritten to

For if there is any scale at which ecological consciousness can be developed, at which citizens can see themselves as being the *cause* for the environmental *effect*, it is at the regional level; there all ecological questions are taken out of the realm of the philosophical and the moral and are dealt with as immediate and personal. People do not, other things being equal, pollute and damage those natural systems on which they depend for life and livelihood if they see directly what is happening; nor voluntarily use up a resource under their feet and before their eyes if they perceive that it is precious, needed, vital; nor kill off species they can see are important for the smooth functioning of the ecosystem.

Sale, K. 1985. *Dwellers in the land: the bioregional vision.* San Francisco: Sierra Club.

better reflect current information on the causes and sources of ecosystem impairment, and the potential remedial options should be updated to incorporate current information, as well as the input received from the reviews of the RAP committees;

- a watershed approach should be used to identify the problems, select remedial options, and measure progress; and municipalities should be involved as partners in developing the RAP on a watershed basis.

21. The Royal Commission further recommends that the federal and provincial governments allocate more resources to the Metro RAP, to reflect the actual complexity and scope of problems here, and the size of the population affected.

22. The federal and provincial governments should carry out an effective, continuing program of public awareness and involvement to raise the profile of the RAP and build support for its implementation.

23. The federal and provincial governments should take all steps necessary to eliminate further delays in developing the RAP and should ensure that the target date for completing the draft Stage 2 RAP (late 1992) is met.

Greater Toronto Bioregion Program: Research and Information Network

Good scientific information, in a form that can be integrated and made readily available to all stakeholders and interested parties, is a key prerequisite of ecosystem-based decision-making. Throughout its work, the Royal Commission found that there was a great deal of information about the Greater Toronto waterfront and bioregion, but it is scattered in many locations and is difficult to synthesize because of differences in approach and methodology.

In discussing these issues in *Pathways*, its report on the environmental audit of the East Bayfront/Port Industrial Area, the audit team recommended that a research and information network be established, devoted to ecosystem studies in the Greater Toronto bioregion. It noted that many information systems and databases already exist; the fundamental need is to link them together, co-ordinate research efforts, and make information accessible to government agencies, non-profit groups, the private sector, and the public.

Subsequently, the Canadian Centre for Inland Waters (CCIW) convened several exploratory meetings of representatives from interested federal and provincial departments, the Royal Commission, universities, and the private sector. They agreed that a Greater Toronto bioregion information program is essential for future decision-making and management of the environment in the region. Among the initiatives that require such a program are the Metro Toronto Remedial Action Plan, pollution prevention strategies, the Oak Ridges Moraine planning study, the proposed Greater Toronto shoreline regeneration plan, watershed strategies, and ecosystem-based municipal plans.

A prototype information system, RAISON (Regional Analysis by Intelligent

Systems on a Microcomputer), has been developed by the National Water Research Institute at CCIW. It has been used successfully in evaluating the issue of acid rain, and was recently judged by NATO to be one of the most advanced systems of its type in the world.

An information network and ecosystem-based research initiative for the Greater Toronto bioregion is fully compatible with the federal government's Science and Technology Framework for the Green Plan. That plan emphasizes the desirability of partnerships under which the federal government will be able to work with other levels of government to achieve common objectives, applying an ecosystem approach. It also proposes to establish a national environmental information network to support state-of-the-environment reporting and environmental forecasting.

The suggested Greater Toronto Bioregion Program could be a vital part of such a network, focused on supporting decision-making in Canada's area of greatest population concentration, population growth, and environmental stress. This practical program has great potential to begin the vital process of building co-operation among governments, institutions, the private sector, and non-government organizations.

RECOMMENDATION

24. The Royal Commission recommends that the federal government, in concert with other interested parties, establish a research and information network for ecosystem studies in the Greater Toronto bioregion. Such a computer-based network should:

- use new technologies in artificial intelligence and expert systems to compile, synthesize, and output information;
- address existing gaps in scientific understanding of the complex links between socio-economic activities and environmental quality;
- transfer knowledge and technologies to decision-makers in the Greater Toronto bioregion and to the private sector for worldwide marketing; and
- be implemented by a new ecosystem research alliance. Such an alliance could include scientists and environmental managers from regional universities and colleges; representatives of the federal, provincial, and municipal governments; the Centre for Green Enterprise and Industry, the Canadian Waterfront Resource Centre; conservation authorities; the computer industry; environmental consultants; and non-government organizations.

The Royal Commission believes that the eight recommendations in this chapter will move us towards the Metro Toronto RAP goals of "swimmable, fishable, and drinkable" water. If they are implemented, these recommendations should provide, through the IJC, a strong and credible watchdog to oversee clean-up of the Great Lakes. Through a revamped Canada/Ontario Agreement, they should ensure that the commitments made under the Great Lakes Water Quality Agreement are met. Adopting a true ecosystem approach in the Metro Toronto RAP will provide a sound planning framework in which to develop the plan, and a renegotiated Canada/Ontario Agreement will

ensure that funding is available for implementation.

An accelerated MISA will reduce dramatically the pollution entering Ontario's waters and provide a base on which to build future, more comprehensive programs.

Finally, establishing a program to collect comprehensive, integrated, and accessible information on the state of the environment will allow better ecosystem planning, monitoring, and analysis.

CHAPTER 4: SHORELINE

In the past decade, there has been increased concern about the nature and extent of lakefilling, measures used to control shoreline erosion, and other shoreline modifications in the Greater Toronto bioregion. Reports prepared for the Ministry of the Environment (MOE) during the 1980s revealed the existence of extensive heavy metal and organic contamination in some soils used for lakefill. The Royal Commission's first interim report (1989) described other concerns as well:

> The [Ministry of the Environment] analyses clearly revealed that, while lakefilling operations have had little or no short-term impact on surface-water quality, they do contribute to general sediment contamination, with potentially damaging effects on the biological food chain.
>
> . . . extensive modifications of the Lake Ontario shoreline have altered natural coastal processes, causing contaminants to accumulate in sediments; in the past, such pollutants would have been transported offshore.
>
> There has been no comprehensive assessment of the cumulative impact of lakefilling on Toronto's waterfront.

While understanding that lakefilling and other forms of shoreline modification can have beneficial effects, the Commission reiterated its concern about these practices in *Watershed*, its 1990 interim report. In that document, the Commission confirmed that it believed the situation was serious enough to require a moratorium on new lakefill projects, pending further study. The Commission recommended that the Province bring forward comprehensive lakefill policies for public review as soon as possible.

The provincial response was prompt: as a first step, in December 1990 the Minister of the Environment told the Legislature that she had asked the Royal Commission to address ". . . policies, practices, technology, and methods available to regenerate the shoreline areas".

The minister's choice of the phrase "regenerate the shoreline" was regarded as significant. Clearly, she wanted something much broader than a study of lakefill: the word "regeneration" suggested a desire to establish a shoreline that was healthier and more beneficial to the surrounding

community. Lakefill would be a significant consideration in the study, but would be placed in the context of the broader issues of a sustainable environment, economy, and society.

The Commission created the Shoreline Regeneration Work Group, nine people with diverse backgrounds and expertise, who were asked to investigate issues and options. The Work Group first met in February 1991, and its report, *Shoreline Regeneration for the Greater Toronto Bioregion*, was released the following September. The report, combined with submissions at earlier public hearings and with other presentations, gave the Commission broad information about the problems and opportunities posed by shoreline regeneration.

History of Shoreline Modification

It is important to recognize that the shoreline of Lake Ontario has evolved since the retreat of the glaciers about 15,000 years ago. We can neither return the lakeshore to "the way it used to be" nor hold it in its current state: forces beyond human control ensure that it constantly changes.

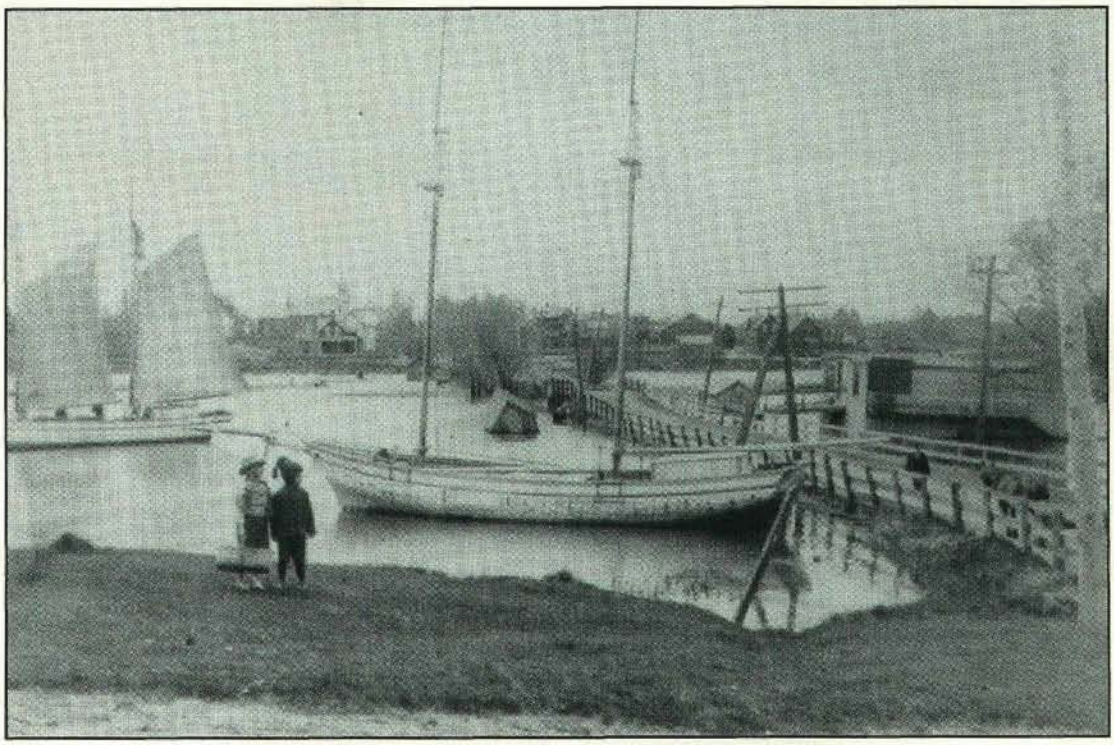
Until the 18th century and the arrival of European settlers, human inhabitants of areas around Lake Ontario adapted themselves rather than attempt to change the waterfront. The forces of wind, water, frost, and ice sculpted the shore: frost shifted the ground, cracked the rocks, and hastened erosion of river, stream, and lake banks. Wind gave the waves energy. The waves pounded relentlessly against the shores, dislodging rocks and soil. Sand eroded from the shore was augmented by sediment discharged from the mouths of rivers and streams; this gritty material tumbled in the shallow nearshore waters and eroded the lake bottom and shore.

While sediment was the grindstone, ice propelled by waves was the battering ram: ice and wave-borne sediment attacked the shores and peninsulas, which retreated gradually. In sheltered areas, as waves and currents lost their ability to carry sediment, they deposited sand, which created and nourished beaches, bars, peninsulas, and islands. Erosion from what we now know as the Scarborough Bluffs, augmented by discharge from the Don River, created a peninsula and, later, the Toronto Islands.

Littoral sediments constantly replenished the bars that provided the essential barrier for many river and stream mouth marshes; these protected the marshes from invasion by icy water from Lake Ontario's depths. The warm waters of the marshes provided a rich nursery for all kinds of aquatic plants, fish, birds, and animals.

Eighteenth-century European explorers and traders found native inhabitants, and a lush and vibrant natural community around the mouth of each river and stream. Protected by spits or gravel bars, a wide variety of fish fed and multiplied. Large quantities of wildfowl inhabited the marshes found at the mouths of tributaries, like Bronte and Sixteen Mile creeks, and rivers such as the Credit, Humber, and Don.

The beaches, woods, marshes, and islands provided rich and varied habitat for deer, lynx, beaver, black bear, and many other species of flora and fauna. More than 50 species of fish, 270 types of birds, and countless animals inhabited the region. Abundant shelter and food provided attractive incentives for European settlement. Then, as now, humans attempted to change



The stone hookers' last stand at Port Credit

the shore, and to bend it to their needs. The first modifications, primitive piers, were constructed to allow deep draft sailing vessels to load and discharge directly on the shore.

Sailing ships required ballast, and buildings needed stone for foundations and walls. Loose rock from beaches and shallow waters was easily gathered and delivered to shipping and construction companies; soon a thriving fleet of "stone hookers" was at work along the shore, their crews using devices like pitch forks with the tines bent at right angles. These tools were employed to loosen and lift stone from the bottom. In the 1830s, the stone hookers removed as much as 43,000 tonnes (47,000 tons) of stone annually.

Unfortunately, the full value of these nearshore stones to the lake was unrecognized at the time: they served as armour for the lake bottom and shore and, once they were removed, erosion of the lakeshore banks accelerated. Farmers, alarmed by the loss of their shorefront property and pasture, successfully urged the Legislature to pass the so-called Three-Rod Law, in 1857. The law, which prohibited stone hookers from operating within three rods (15 metres) of the shore, came too late, after much of the damage had been done. Fish habitat was destroyed, shoreline facilities and farming land were damaged or lost.

It was a pattern often repeated to the present day: those involved in a worthy enterprise (such as gathering stone, an essential foundation for development) failed to consider the consequences for the natural environment. Nor did they fully consider the damage to the shoreline economy (farming and fishing). The activity was unregulated at first; only when the damage

Table 4.1 Major lakefill projects in the Greater Toronto bioregion

Project	Area	
	(hectares)	(acres)
J.C. Saddington Park	10	24
Lakefront Promenade Park	30	74
Colonel Samuel Smith Waterfront Area	28.5	70
Humber Bay Park — East and West	40	99
Ontario Place	38	94
Tommy Thompson Park (land and water)	470	1,161
Ashbridge's Bay	17	42
Bluffer's Park	42	104

Source: Reid, R., R. Lockhart, and B. Woodburn. 1990. *A green strategy for the Greater Toronto waterfront.* Publication no. 8. Toronto: Royal Commission on the Future of the Toronto Waterfront.

became serious were limits set, a reaction that effectively "closed the door after the horse had escaped".

In the next 130 years, shoreline modifications of increasing magnitude dramatically changed the shape of the Greater Toronto bioregion's shore. The largest of these initiatives, filling the Ashbridge's Bay Marsh to create 428 hectares (1,057 acres) of land for industrial and recreational use, emerged from the 1912 Waterfront Plan of the Board of Toronto Harbour Commissioners (THC). Most of the fill material was sediment dredged from the Inner Harbour, but included construction debris, excavated soil, sewage sludge, incinerator refuse, and municipal garbage.

More recently, the 1967 Waterfront Plan for the Metropolitan Toronto Planning Area proposed massive lakefilling, chains of artificial islands, public open space, and marinas with a combined capacity of 5,000 boats (Metropolitan Toronto). The 1967 plan inspired a series of artificial headlands configured to protect boat clubs and marinas. Since the 1950s, 676 hectares (1,668 acres) of land have been created through lakefill, and plans exist for many more. In *Pathways* and in *Shoreline Regeneration*, Royal Commission publications 11 (Barrett and Kidd 1991) and 13, lakefill projects and the associated decline in water quality are described in more detail.

Many projects and modifications have taken place on the shore of the Greater Toronto bioregion, and the nature of change varies. *Shoreline Regeneration* includes the following description of the Greater Toronto bioregion waterfront.

A Bird's-Eye View of the Shore Today

Flying over the western shoreline of Lake Ontario, one is struck by the intensity of development: from the sand beach of the Burlington Bar to Oakville, much of the shoreline is protected with hard coverings (revetments) of concrete, rubble, and large quarried stone (armourstone), as well as with short groynes jutting into the lake. Occasional narrow cobblestone or gravel beaches remain, but the evidence of change is everywhere.

At the harbour entrance to Oakville Creek, the lack of beach at either side of the groynes suggests that littoral transport is not great. To the east, the St. Lawrence Cement Co. and Gulf Oil Co. concrete piers stretch offshore to navigable water. Residential development surrounds one of the few remaining wetlands, the Rattray Marsh, which is protected from the lake by the barrier formed by its tree-covered bar. Even further east, as the shale subsides below lake level, a different shore forms — one that is low and sandy, created from fine glacial material near Lorne Park, west of Port Credit.

At Port Credit, commercial and industrial development mixes with public open space built on reclaimed land behind steep stone revetments. A major lakefill structure east of the Credit River provides marina facilities next to the heavily armoured shoreline of the Lakeview Generating Station and Lakeview Sewage Treatment Plant.

The dominant features on the Metro Toronto waterfront are lakefill structures: the Colonel Samuel Smith project at Kipling Avenue projects 700 metres (770 yards) from a low-density residential area. Four kilometres (2.6 miles) to the east are two adjacent lakefill headlands at the mouth of Mimico Creek that provide shelter for boats as well as parkland. A breakwall, constructed as part of the 1912 Toronto Harbour Commissioners' plan, protects low parkland that stretches east from the Humber River to the lakefill structure that supports Ontario Place.

The west shore of the Toronto Islands offers one of the longest sand beaches remaining on the waterfront. The south shore has been fortified with a rubble mound breakwater, groynes, and a concrete seawall. Cut off from its sand supply by the Leslie Street Spit, the shore is being eroded more quickly. The Ward's Island beach, anchored by the new Eastern Gap entrance structure, has reoriented itself to face southwest. Nearly all the Inner Harbour shore is vertical concrete and steel; the Outer Harbour has been created by the Leslie Street Spit, a lakefill structure extending five kilometres (three miles) into 16 metres (52 feet) of water, protected by a veneer of eroding concrete, brick, and asphalt rubble.

Mouth of the Rouge River

Immediately next to the spit is the Ashbridge's Bay lakefill, where the east-facing embayment has filled with littoral sand. Beyond the groynes and breakwalls along the Eastern Beaches rise the Scarborough Bluffs, where the Metropolitan Toronto and Region Conservation Authority (MTRCA) is installing shore protection structures of fill and rubble. The sharp incline of the bluffs is caused by erosion, the result of wave action on their underwater base. Unprotected, they retreat at a rate averaging a third of a metre (one foot) per year. Bluffer's Park lakefill at the foot of Brimley Road occupies nearly two kilometres (1.2 miles) of shoreline and extends 600 metres (660 yards) offshore, intercepting all littoral drift from the east.

Residential development at the top of the bluffs near East Point gives way to open space and scattered industrial use. Much of the shoreline is in a natural state, although occasional storm-sewer outfalls intrude.

Further east, Frenchman's Bay is separated from Lake Ontario by a natural sand bar broken by an entrance structure that permits navigation. Part of the Pickering Generating Station is built on reclaimed land with heavy armourstone revetments and cooling water intake groynes.

From Pickering to Whitby the shoreline is characterized by low bluffs two to seven metres (14 to 23 feet) high, with low-density residential or agricultural uses predominating. Various creeks have small estuarine wetlands behind gravelly beaches and bars; the estuary at Whitby has long been a commercial harbour with entrance groynes interrupting the sand and gravel bar. From Whitby to Oshawa, the shoreline varies from

seven-metre (23-foot) bluffs descending to stream estuaries, each fronted by a small beach. Much of the land is low-density residential or cottage-lined beaches.

On the east side of the Oshawa Harbour entrance groynes, reclaimed land has been created by construction of a confined dredge spoil disposal facility. The Oshawa Second Marsh is a large estuarine wetland next to the more exposed McLaughlin Bay. From Darlington Provincial Park, the shoreline rises to bluffs 12 metres (40 feet) high, which occasionally "slump" toward the lake. Darlington Generating Station, built partly on reclaimed land, employs massive armourstone revetments across its extensive shoreline.

At Raby Head, the bluffs are some 12 metres (40 feet) high, descending to a small coastal wetland just west of a large cement company dock, where a 32-hectare (79-acre) lakefill structure projects 675 metres (738 yards) into the lake.

Continuing east, the shoreline is a series of 10-metre (33-foot) bluffs, cut by creeks with small estuarine marshes behind sand and gravel baymouth bars. The estuaries at Port Darlington and Bond Head have been partially dredged for marinas and the baymouth bars are cut by entrance groynes. Still farther east, the pattern is repeated, with some bluffs reaching as high as 20 metres (66 feet); vegetation there suggests a lower rate of erosion. The area behind the bluffs is almost entirely agricultural.

Significance of Shoreline Modification

The Commission's interim reports acknowledge that lakefilling and human alterations of the shore have provided substantial benefits to the region: Ontario Place, Harbourfront, and Bluffers Marina, for example, were constructed on lakefill and have improved the social, cultural, and economic life of the community. These and other projects have expanded the land base; improved public access and amenities such as parks, beaches, and boat-mooring capacity; and/or increased fish and wildlife habitat.

Tommy Thompson Park, located on the five-kilometre (three-mile) spit at the foot of Leslie Street, demonstrates some of the benefits of lakefill, both planned and accidental. Planned benefits include extensive boat mooring capacity, and facilities for sailboards, dinghy sailing, rowing, and canoeing in the sheltered waters of the Outer Harbour, in the lee of the spit. The spontaneous emergence of grasses, herbs, shrubs, and trees provides exceptional habitat for a variety of birds and animals, an urban wilderness of amazing variety. The shallow, sheltered cells within the park provide fish with refuge from the periodic cold-water upwellings that occur, with deadly consequences, along much of the Lake Ontario shore. As a result, populations of perch, pumpkinseed, and pike have expanded rapidly.

Public access to the shoreline has been enhanced by the artificial headlands at Humber Bay East and Bluffer's Park, and elsewhere thousands enjoy picnicking, walking, and other types of recreation. Groynes and other forms of shoreline erosion control have created new beaches near Oakville and various other places where people can view the lake and enjoy the heat of the summer sun. Homes and properties along the Scarborough Bluffs, among other areas, were saved by measures to halt or

delay erosion. As well, commerce has benefited from lakefilling: thousands of new boat berths have supported the boat building and service industry. Sport fishing, mainly salmon charters and private boats from facilities at Port Credit, Bluffers, and other new marinas, brings millions of dollars in revenue to the region. Extensive condominium, tourism, and commercial facilities stand on land created by lakefilling.

There has been another benefit, particularly to the downtown waterfront area of Metro Toronto: the lake has been a convenient, inexpensive repository for large volumes of material excavated from downtown construction sites.

These benefits extract a price, however, as described in *Shoreline Regeneration*:

> Much of the excavated material used for lakefill was contaminated with lead, other heavy metals, and organic materials that found their way into the lake sediments and the food chain. This [fill] material, combined with the much larger sources of pollution, the sewage treatment plants, storm sewers, and urban rivers, has degraded the water quality of the shore. The combined impact of urban development — filling wetlands and river estuaries, and armouring for erosion control, in addition to vast quantities of silt released from lakefill sites — has damaged much of the natural habitat both above and below the water line.

The Commission's Shoreline Regeneration Work Group found that the environmental price was higher than necessary, and sometimes outweighed apparent benefits. In this respect, the Work Group agreed with the position taken by many critics of lakefill who made submissions to the Royal Commission during public hearings.

The lake has been a convenient, inexpensive repository for large volumes of material excavated from downtown construction sites.

Shoreline Regeneration Issues

Concerns about the negative effects of shoreline modification give rise to several issues, including:

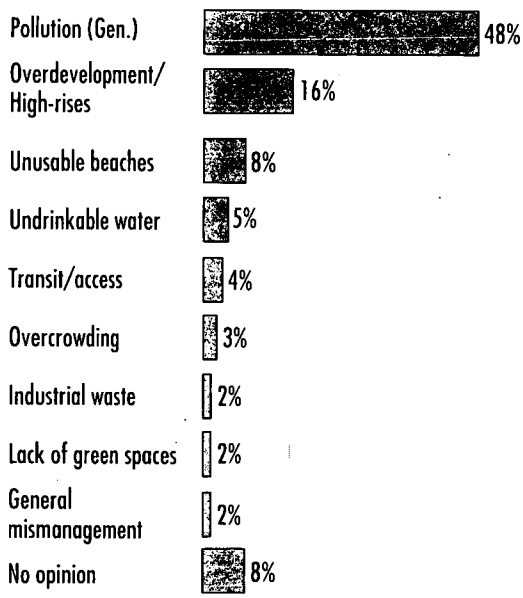
- the environmental effects of lakefill structures and erosion control measures, including cumulative effects of many activities, loss or damage to both aquatic and terrestrial habitat, obstruction of sand movement, elimination of traditional sources of sediment through shoreline armouring, and accelerated erosion in other places;
- the degree to which current guidelines and control procedures for materials for lakefilling ensure safety;
- lack of standards for lakefilling methods and structural designs;
- disposal of the waste materials from construction and excavation, including that judged not suitable for lakefill;
- changes in economic opportunities, and the wisdom of spending public money to protect private and public land through armouring — as opposed to acquiring — hazard lands;
- similarly, constructing artificial headlands for private boat clubs; and

- the impact of shoreline modification on aesthetics, access, vistas, and recreation.

These concerns should be considered in the context of general apprehension about the safety of Lake Ontario as a source of drinking and bathing water. The preceding chapter of this report describes Lake Ontario's condition and the impact of pollution, even from sources far from the Greater Toronto bioregion's shoreline; it also examines efforts by the International Joint Commission, the Metro Toronto RAP, and other groups to address these problems.

The contaminated sediments, overloaded sewage plant, or toxic pollutants from the Niagara River and elsewhere will take considerable time to correct. Lakefilling, however, is a discretionary activity and can be stopped as a pollution source tomorrow — if we choose to do so. There are choices of methods and materials, as well as of locations at which lakefilling would be allowed.

Major Waterfront Concern



Pollution is considered the waterfront's major issue by the respondents.

Source: Environics Poll. 1991.

Impact of Lakefill Structures and Erosion Control Measures

Artificial headlands — peninsulas created by lakefilling to shelter boat basins — have become common on the shore of the Greater Toronto bioregion. They have created negative impact on the environment in four ways:

- materials used for fill have contributed to contamination and turbidity of the water;
- structures have blocked the lake's ability to rinse its shoreline;

We are a species that, through its intelligence, has exceeded its biological constraints but in the process lost its sense of place in the biosphere. Convinced of our knowledge and ability to control nature, we exploit the very life-support systems of the planet in the name of short-term comfort and economic profit. Wilderness is disappearing throughout the world so quickly that each remaining untouched area becomes that much more rare and precious.

Suzuki, D. 1989. *Carmanah: Artistic Visions of an ancient rainforest.* Vancouver: Western Canada Wilderness Committee.

- transport of sand along the waterfront has been limited; and
- aquatic habitat has been destroyed.

Loss of shallow lake bottom for breeding and feeding at the site reduces habitat, while large amounts of sediment — material that blocks the light and blankets the lake bed — is lost during construction, thus imposing further, indirect harm. In a deep, dark, silt-covered environment, few aquatic species flourish. Light is essential to the growth of some plant organisms that fuel the aquatic food chain. High turbidity results in altered and reduced biotic life and spawning capacity, in the zone that could be most productive.

Embayments and boat basins in artificial headlands, which provide shelter from cold-water upwelling in the exposed lake, can be a positive factor in aquatic habitat. Above the water line, the natural growth of plants, shrubs, and trees on lakefill and erosion control projects have provided new habitat for a wide variety of birds and animals. These benefits would be much more valuable, however, if this attractive environment were not so contaminated.

The new headlands, which have extended as far as five kilometres (3 miles) into the lake, are a significant barrier to longshore movement by waves and current. As a result, suspended and floating materials are trapped and deposited nearby, where they create various pollution problems.

Erosion control embraces a variety of materials applied to the shore to slow or stop the loss of land by wave action. They include vertical steel pilings, concrete walls, large quarry stones (armourstone), construction rubble, and old tires. MTRCA has undertaken massive erosion control measures at the foot of the Scarborough Bluffs and erosion control efforts by individuals and agencies are estimated to cover as much as 70 per cent of the shore from Burlington to Scarborough.

In addition to habitat loss, erosion control impounds the sediment that would normally drift along the shore, renew beaches, and repair storm damage done to sand and gravel bars that are essential to protecting estuarine marshes. Further, the structures may change wave patterns and accelerate erosion elsewhere on the shoreline.

Cumulative Effects

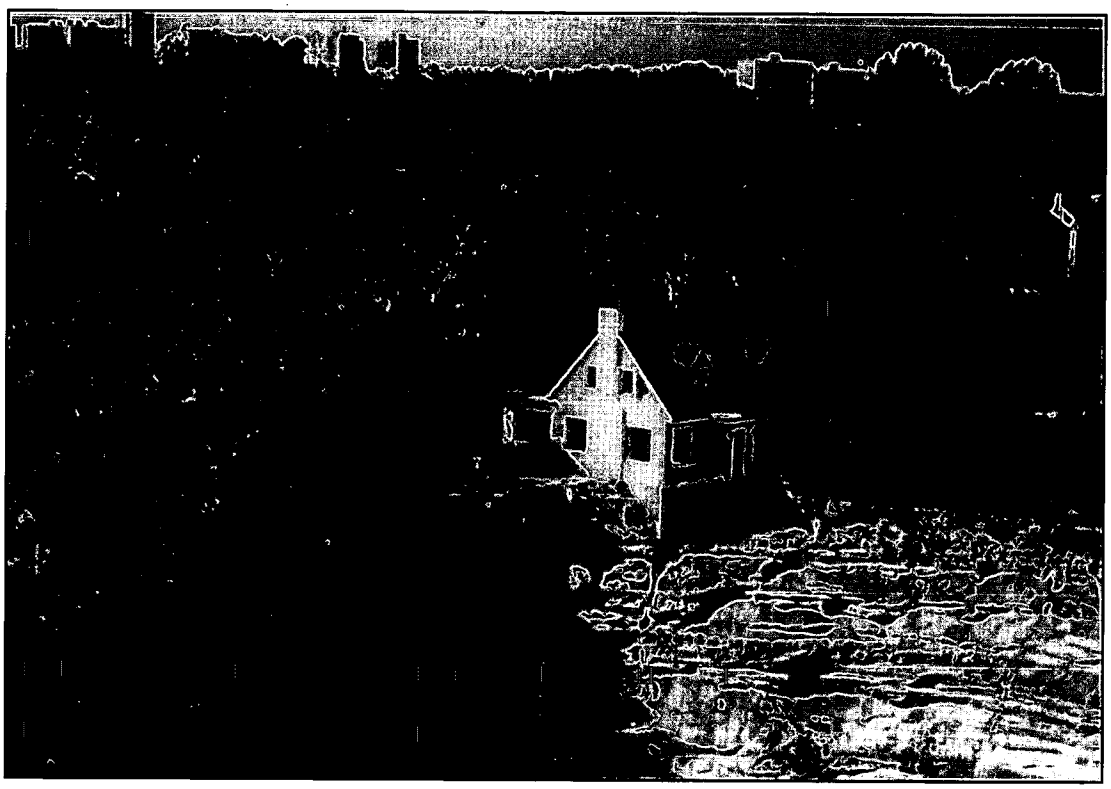
As the Shoreline Regeneration Work Group observed:

> It became evident that many larger problems along the waterfront were not the result of one horrendous event but, rather, the cumulative effect of many acts or interventions. Treating each project in isolation from the rest of the shore was a common cause of significant degradation.

The tendency to treat lakefill and erosion control projects singly is understandable, when each is proposed at a different time, has a different set of characteristics and location, and is subject to decisions by different municipalities and agencies. Nonetheless, they are not independent, and their combined impact will, at some point, exceed the carrying capacity of the shore.

The impact of one artificial headland may be acceptable; but there are now eight new headlands, with many more planned. At some point, the shoreline circulation of water may be so impeded that it creates a regional cesspool.

Similarly, it would be hard to prove that 100 metres (110 yards) of armoured



House atop eroded Scarborough Bluffs

shore have starved any beaches or eliminated a significant amount of shallow-water aquatic habitat. However, 50,000 metres (31 miles) of armoured shore is another matter. It is estimated that 90 per cent of aquatic life depends on the shallow nearshore zone that is destroyed by many forms of erosion control. Losing such large areas leads to reduced food supply and spawning capacity. As discussed previously, shoreline modification damages habitat, but that is partially offset by some benefits. Clearly, the important issue is how to alter practices and technology so that they have a positive overall effect on habitat.

Loss of habitat, combined with other stresses such as contaminants and the presence of exotic species like the lamprey eel, has placed great stress on aquatic life forms. Along the Greater Toronto shore, the number of types of fish, which are an indicator of the health of aquatic ecosystems, has already decreased from 50 to approximately 25 and, in some areas, is as low as 11.

Cumulative effects — the combination of various stresses over time — is a difficult but important issue in evaluating the present and future health of the region's aquatic ecosystem.

Safety of Current Guidelines and Control

Materials for open water disposal — lakefilling — are controlled according to a system defined by the Ministry of the Environment, using maximum levels of contaminants set out as "Sediment Guidelines". In the Metro area, the control system is operated for MOE by the Metropolitan

Toronto and Region Conservation Authority. MTRCA samples soil in large construction sites, and accepts or rejects fill from them, based on the results of its tests of contents. In the past, trucks were sampled when they arrived at the lakefill site, but results were not available until days after the sampling. MTRCA records show that some material used in lakefill (25 per cent in 1989, 15 per cent in 1990) was contaminated beyond the levels suggested by the existing MOE sediment guidelines.

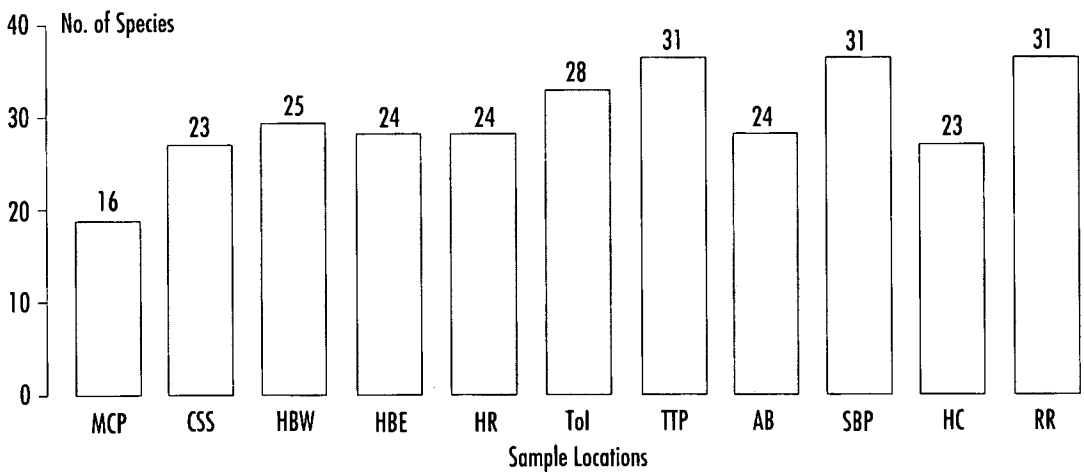
The Royal Commission was given persuasive evidence, based on MOE research, showing that toxic materials moved from contaminated sediments to nearby plants and fish. Aquatic life accumulates some of the contaminants and introduces them, in concentrated form, to the food chain. This pattern has raised public and regulatory concern.

Established in 1976, current MOE sediment guidelines consider a very limited range of toxic contaminants to establish nominally safe levels in materials for open water disposal. Many toxic substances are omitted. Recent work on contaminants in the 1976 list has shown that some are higher than the "no-effect level", that is, the greatest concentration that showed no measurable effects when tested on indicator species. Considering this new information, the 1976 guidelines can no longer be relied on to define concentrations that are not harmful.

STANDARDS FOR MARINE CONSTRUCTION

There are no standards or codes to define what level of storms artificial headlands must be able to withstand, what water levels they must attain or even how fill must be controlled to avoid pollution and turbidity. Without such minimum standards, it is not surprising that minimum initial cost can

Figure 4.1 Number of fish species found — Toronto waterfront fish collections, 1989



Notes:

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CSS: Colonel Samuel Smith
HBW: Humber Bay West
HBE: Humber Bay East
HR: Humber River
Tol: Toronto Islands
TTP: Tommy Thompson Park
AB: Ashbridge's Bay
SBP: Scarborough Bluffer's Park
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Source: Buchanan, I.D. 1991. *Presentation for the Royal Commission on the Future of the Toronto Waterfront.* Maple: Ontario. Ministry of Natural Resources.

House atop eroded Scarborough Bluffs

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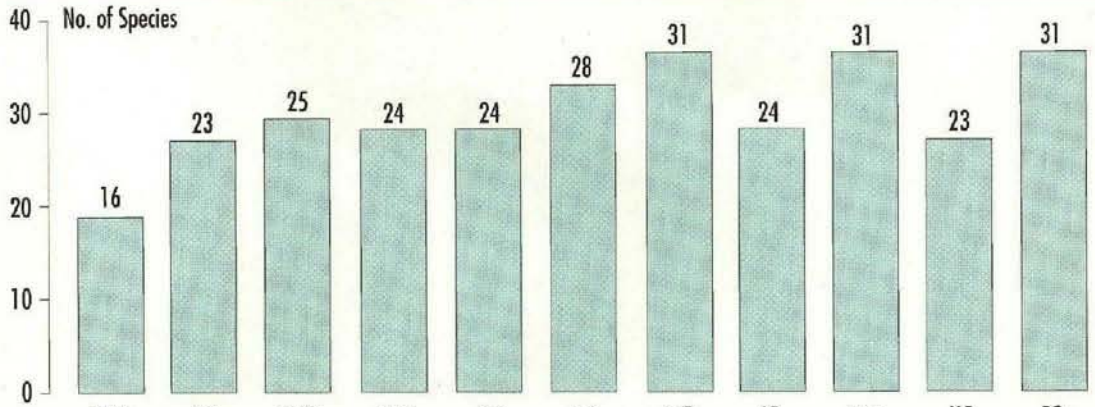

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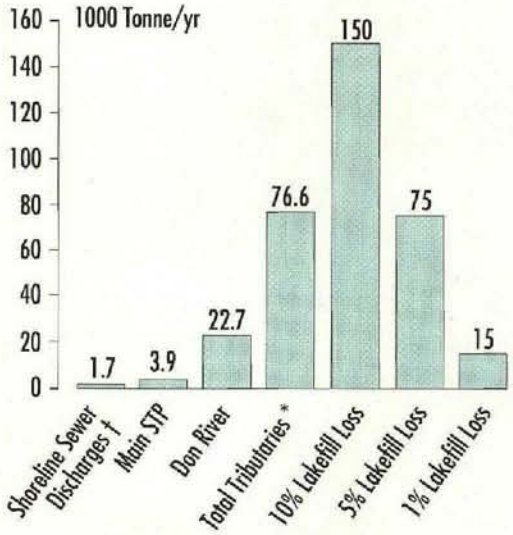
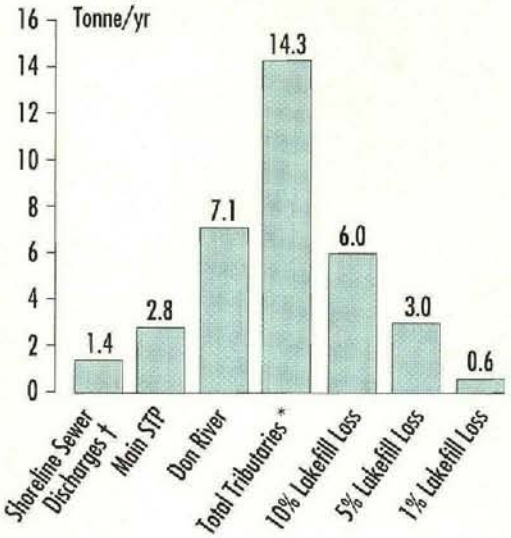
become the governing factor on deciding how to construct these headlands. Operators may dump soft loose fill into open water,

Figure 4.2 Metropolitan Toronto waterfront pollution sources

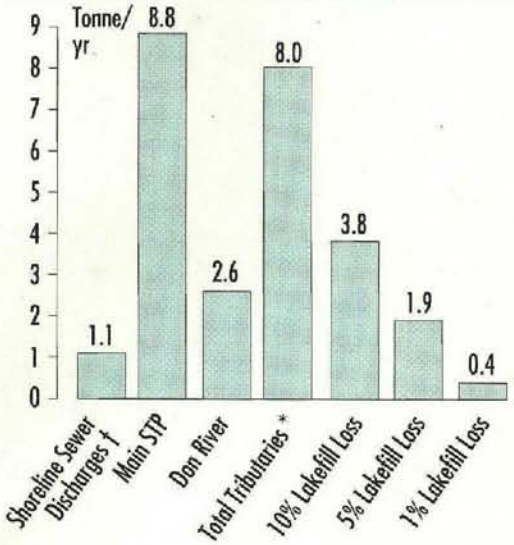
Suspended Solids



Lead



Copper



and leave such material exposed to waves and current. As a result, substantial quantities of fill escape, create turbidity, and mix with the water along the Greater Toronto shoreline.

Precisely how much material is lost during construction of lakefill projects is not known. However, the Shoreline Regeneration Work Group estimated that it is between one and ten per cent of material deposited annually. One per cent might be achieved with very tight control. Ten-per-cent fill loss could be expected with year-round filling at an unprotected site, plus additional loss due to a major storm. Current practice is believed to fall about mid-way between these extremes. Figure 4.2 compares suspended solids contributed by lakefill along the Metro waterfront during a typical year with the other major pollutant

Notes:

† Input from storm and combined sewers discharging on Lake Ontario shoreline.

* Tributaries include Etobicoke Creek, Mimico Creek, Humber River, Don River, Highland Creek, Rouge River.

Source: Metro Toronto Remedial Action Plan, 1988. *Environmental conditions and problem definition.* Toronto: Metro Toronto Remedial Action Plan.

MARCH OF THE MOTORIZED MASTODONS

Each morning, an elephantine procession emerges from the depths of downtown construction sites: a herd of dusty dump trucks struggles to the street level, then lumbers through the canyons between office towers toward the lakeshore. Brakes squealing, engines snorting, the vehicles rumble through intersections, harassed by taxis, cycle couriers, and pedestrians preoccupied with the day's work ahead. The trucks bear a massive burden of rubble and soil extracted from the foundations of large buildings, to make way for parking, passageways, and the subterranean shops of downtown Toronto. Their destination is the dusty peninsula near the mouth of the Don River.

South of the flaking concrete pillars that support the aging expressway, the loaded trucks gain speed and momentum, surging toward the open spit. There, freed of traffic, stoplights, and human obstacles, they stampede the length of the peninsula, a swirl of dust and gulls rising in the eddies behind their bulky frames. At the water's edge, they grind to a stop, turn, and await a turn to dump their burden of rock and soil. One by one, each struggles to the bank, arches its back, and relieves itself at the water's edge. Most of the material hangs on the banks or slides below the surface, while some dances away, suspended in the wavy turbulence, to be deposited far along the shore.

This pattern will be repeated more than a thousand times a week — nearly sixty thousand times a year. The land area expands and the water surface contracts in a ritual that has continued and accelerated for the last century.

sources, including tributaries and sewage treatment plants (STPs).

Not only is lakefilling a very significant contributor to suspended solids and water turbidity in the region, those effects are increased dramatically when construction practices allow a greater proportion of fill to escape.

Given that some lakefill is contaminated and that some of it escapes, fill contributes copper and lead contamination to water in the region. However, even at the highest percentage loss, lakefill ranks well behind other sources (see Figure 4.2).

To summarize, in light of new information, current guidelines for fill sediments are inadequate: the control system allows some material exceeding guidelines to be deposited, and lack of codes permits construction methods which result in large amounts of fill mixing freely with water along the shore.

Furthermore, lakefill projects contribute indirectly to shore contamination. As a result of wave action, sediments and nearshore waters naturally progress along an exposed shore; unobstructed they disperse widely, taking with them any attached contaminants from partially treated sewage, storm water or other sources. At an artificial barrier like that at Humber Bay East (lakefill), sediment is trapped and deposited; the result is a contaminant sink, often accompanied by foul odours and floating debris.

Disposal of Waste Materials from Construction

Earlier it was mentioned that lakefill was considered an inexpensive and convenient waste disposal arrangement. The practice has been a particularly prevalent on the Metropolitan Toronto's downtown waterfront, where land values are extremely high. These high values preclude disposal on-site, and the need for large underground parking facilities dictates that a great deal of material must be excavated at each location.

While the average annual amount of fill is immense, it varies from year to year, depending on the amount of construction activity. Estimates of volume from 1984 to the year 2000 were prepared by Environmental Applications Limited for the Ministry of the Environment; they projected average annual volume of 1,050 tonnes (1,155 tons) — the contents of roughly 60,000 dump trucks per year.

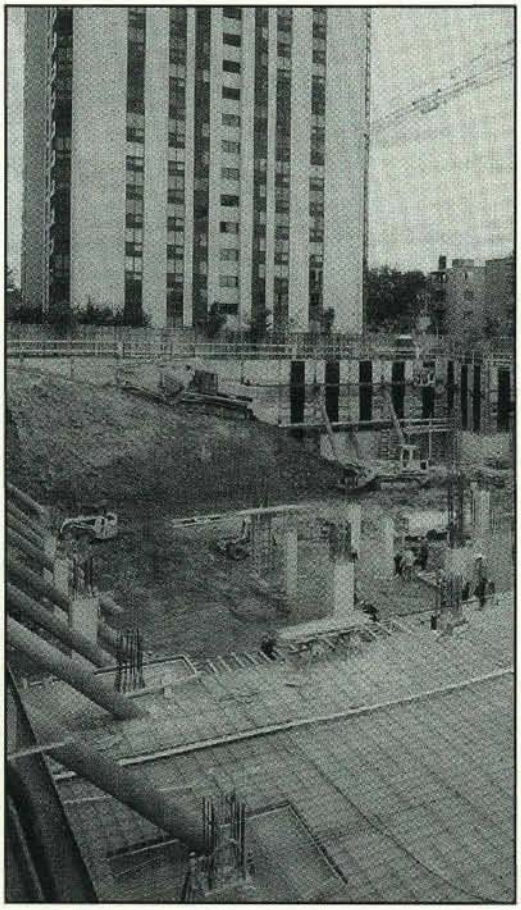
But how will Toronto dispose of up to 60,000 dump-truck loads of waste if lakefill is banned, or restricted by tighter standards? While relatively low levels of contaminants in this material mean that it should not be mixed with water or otherwise introduced to the food chain, most of the fill does not require the control provided in sanitary landfill. The most critical issues for MOE and the construction industry are how to classify, and where to deposit, material unsuitable for lakefill.

Economic Issues

Everyone receives some form of personal benefit from the expenditure of public funds: motorists drive on public highways; pedestrians stroll in public parks. However, when shoreline modifications are carried out with public funds, personal benefits at public expense can become an issue.

Constructing artificial headlands that protect and house private boat clubs is a case in point: the appropriateness of using public funds to build sheltered harbours for private clubs surrounded by chain link fences that deny public access is questionable. Although everyone may enter the public park, only a select group may enter the grounds of a private club.

Another issue arises from publicly funded erosion control measures undertaken to protect private property. Those who benefit from erosion control are easily identified, but the consequences of such activity are hard to predict: whose property



A downtown Toronto construction site

The Great Outdoors is still great. But we found that we are facing a deterioration of the natural resource base, and of the recreation infrastructure. Accelerating development of our remaining open spaces, wetlands, shorelines, historic sites, and countrysides, and deferred maintenance and care of our existing resources, are robbing future generations of the heritage which is their birthright. We are selling the backyard to buy groceries. . . Report of the President's Commission on Americans Outdoors.

Howe, L. 1987. *Keeping our garden state green: a local government guide for greenway and open space planning.* New Jersey: New Jersey Department of Environmental Protection.

will suffer from accelerated erosion as a consequence of the initial measures? Whose beach will no longer receive the sand that is the owner's riparian right? Having used public money to protect one property, how does the government refuse to safeguard another one, nearby, particularly if there is a link between one government erosion control structure and the subsequent complaint?

Alternatives to shoreline armouring include purchasing hazard lands, a strategy that may prove less costly and improve public access. In addition, expanded public ownership of nearshore hazard lands can increase opportunities for natural links between stream valleys.

There are many ways in which shoreline regeneration can contribute to the economic vigour of the waterfront: a waterfront free of debris and sewage is a more attractive place for tourism, conventions, and recreation. The more attractive the setting, the more tourist dollars available and the more sales of nearby commercial establishments. Real estate and housing on a cleaner, greener waterfront could meet shelter needs while, at the same time, providing amenities that bring a higher return. Cleaner water, restored fish habitat, and boat-launching facilities built on lakefill may increase boat-chartering and related service industries. The point is that all these economic opportunities depend on the basic resource — healthy water and waterfront ecosystems. The question is how to expand and enhance these opportunities.

Aesthetics, Access, and Recreation

Some shoreline issues are difficult to express in economic terms; they are generally those that fall in the broad categories: aesthetic aspects, access, and recreation.

Aesthetics

Aesthetic considerations include:

- variety in landscaping techniques for parks and public open space;
- protection of open-water views;
- incompatible development on or next to fill;
- odour and appearance problems arising from debris trapped in embayments;
- protection of natural shoreline features such as beaches and bluffs; and
- protection of built heritage and connections with the past.

Traditional management and landscaping of public lands limit habitats. Variety in landscaping, that is, providing areas with native wild grasses, flowering plants, shrubs, and trees, as well as formal park settings, will increase diversity of habitat and species.

Unobstructed open-water vistas are among the most valued amenities on the

waterfront. Proposals for lakefilling that would block those views, or that would support towering waterfront developments, represent a threat to those values and a challenge to planning waterfront areas. Protecting shoreline views involves paying attention to the height and location of buildings, and the design of programs for tree-planting on public land.

Incompatible developments — parking lots or busy marinas next to quiet residential areas, structures that trap debris or contaminated water — can degrade the value of both public and private waterfront land. Planning must consider adjacent land uses.

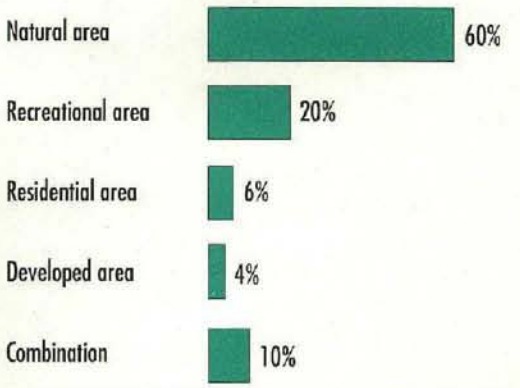
The variety of the bioregion's shoreline is one of its important assets. Bluffs, such as those in Scarborough, depend on erosion of the base to maintain their steep face; therefore, erosion control at the base, and normal wearing away of the cap, will eventually eliminate the sharp slope that gives the area its character. As mentioned earlier, armourstone at the water's edge impounds the sediment that would normally move downshore to renew the natural beaches that the public values highly. We cannot stop erosion and retain its benefits, any more than we can "eat our cake and have it too".

Certain shoreline modification activities may conflict with the public need to retain connections with the built heritage and the past. For example, lakefill has reduced the Harbour Commissioners' building from being what it once was in Toronto — a striking waterfront welcome to the City — to just another inland office. Fort York, which once commanded the harbour, lies hidden behind approximately 800 metres (0.5 mile) of fill and structures, its role, purpose, and location equally obscured; the visitor may find it difficult to comprehend that this fort was once central to the defense of Upper Canada. Achieving progress without compromising our connection to the past is another challenge for shoreline regeneration.

Access

Accessibility is an important factor in enhancing the public value of the waterfront, but must be achieved in a way that is fair to landowners and shows due consideration for the many other demands on the public purse. Some public utilities need special security and some other land should be set aside for use as sanctuary and natural areas. Transportation corridors parallel to the shore, such as the railways and expressways, provide barriers to recreational access. A lakeshore that is hidden behind a wall of industrial, public or private fences provides few public benefits. The issue is how to provide for a continuous waterfront trail at or near the shore, and access to the water at reasonable intervals, while achieving

Desired Waterfront Development Objectives



Nearly two-thirds of the respondents would like to have more natural areas on the waterfront.

Source: Environics Poll. 1991.

fairness to existing landowners, and costs that are affordable.

Recreation

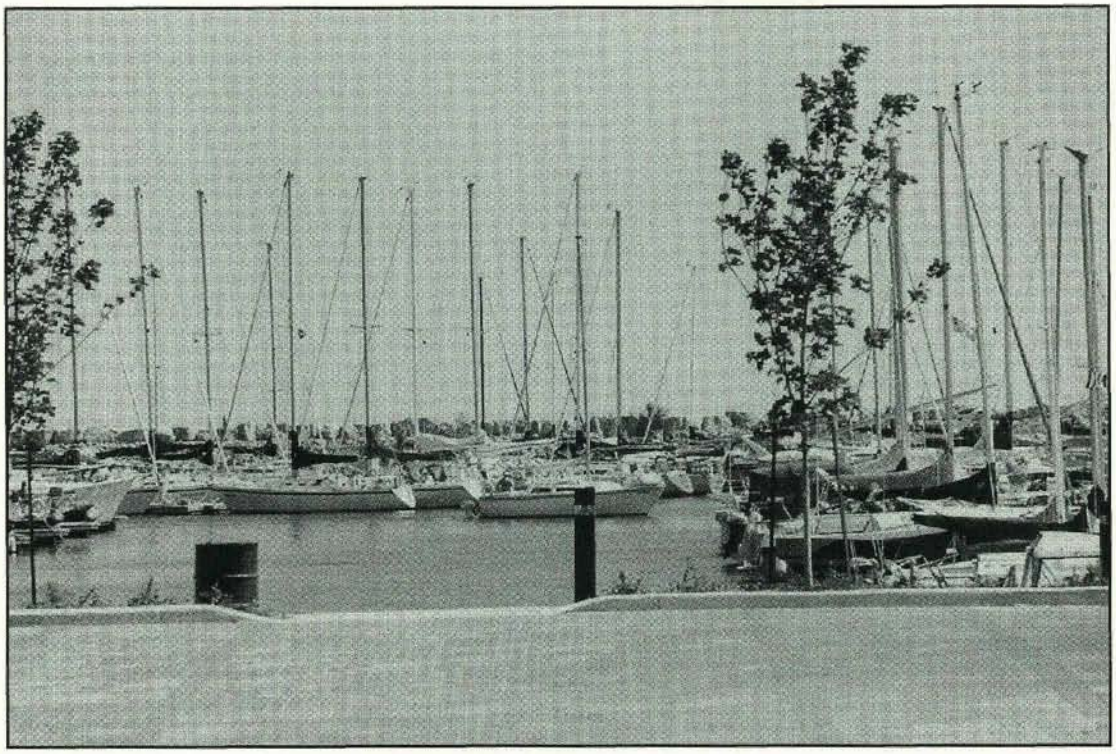
Many forms of recreation, both active and passive, can and should be enjoyed along the shore: active pursuits include cycling, running, fishing, power-boating, sailing, swimming, and rowing. Less vigorous activities include picnicking, walking, birdwatching, sunbathing, photographing, and simply observing the passing scene.

While these pastimes are among the most valuable to the community, they can create conflicts, both among activities and with other values on the shore. For example, some residents of the shore object to the traffic and noise created in their neighbourhoods by visitors to aquatic parks like Bluffer's; birdwatchers object to motorized invasion of natural areas.

Regenerating the shoreline with lakefill can increase the types of recreational opportunities available, by creating new land at a cost of construction that is one-fifth to one-tenth that of acquisition. The environmental costs vary with the lakefill site and construction methods but must be added for fair comparison with acquisition of existing land. An ecosystem approach to land-use planning must balance and allocate the benefits, while minimizing the conflicts — a process that includes many issues that must be considered.

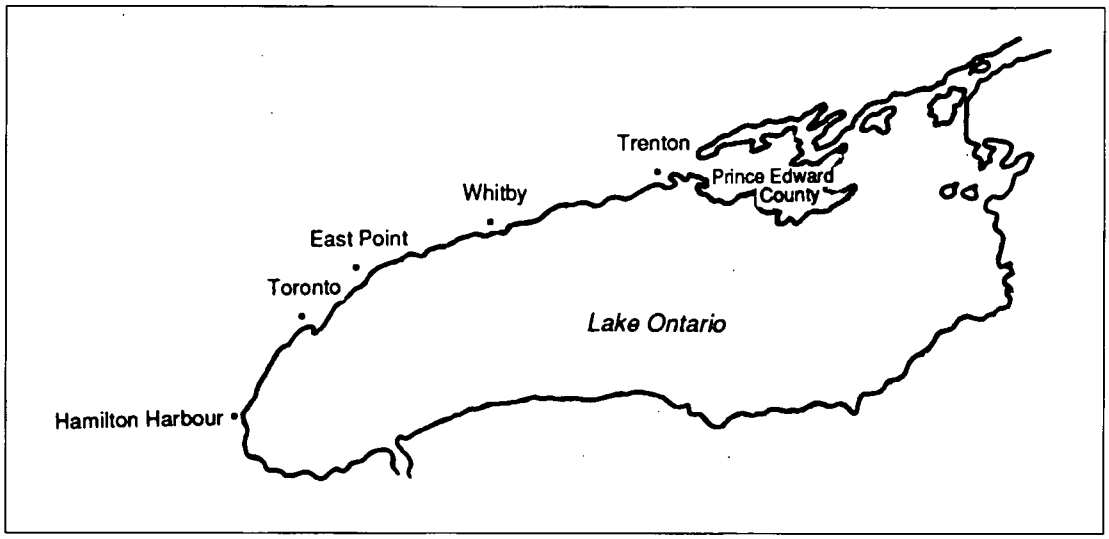
How Has Shoreline Modification Caused Problems?

The Royal Commission heard considerable testimony that shoreline modifications are part of the problem of shoreline degradation. There has been significant evidence



Lakefront Promenade Marina, Mississauga

Map 4.1: Lake Ontario northern shoreline



that they can also be part of the solution but, before that can happen, the root causes of past difficulties must be identified.

Collectively, we are fouling our own nest and acting against our own best interests. To the best of our knowledge, no person or group sets out to destroy natural habitat, drive away species, or close the beaches of the Greater Toronto bioregion. These consequences are the result of accident or neglect, the unplanned consequence of millions of independent actions, all focused on another goal — whether that goal is to protect property from erosion or to construct boat berths and parks for public use.

Damage occurs because of the way projects, including shoreline modification, are evaluated: each is considered individually by persons or agencies looking at one aspect, whether that is road connections or hazard land protection. They are sometimes considered solely on the basis of economic feasibility, and from a narrow local viewpoint, without much regard for other developments elsewhere. Given that the most serious problem is the lack of broad responsibility, the Shoreline Regeneration Work Group attempted to establish who was in charge, and found that:

> . . . the Lake Ontario shoreline in the GTB comes under the jurisdiction of 11 local municipalities, five conservation authorities, four regional governments, at least six federal and provincial ministries, several Crown corporations, and two harbour commissions.
>
> As a result of the profusion of responsible agencies, governments, and boards, some projects — such as the construction of a dock projecting into the lake — receive detailed scrutiny from all three levels of government. Obviously the multijurisdictional approach results in a patchwork quilt of regulations rather than a comprehensive approach to setting and achieving goals for developing and protecting the shore.
>
> With so many levels, departments, ministries, and special purpose bodies,

it is difficult to find one that is clearly in charge.

It is not surprising that, with no co-ordination, there is no ecosystem approach to the evaluation of various projects, or the whole shoreline of the Greater Toronto bioregion. Nor is it possible to evaluate cumulative or incremental effects of a project or series of projects, because there is no estimate of the carrying capacity of the shore. While there are plans for segments of the shore, there is little progress toward comprehensive ecosystem rehabilitation, and so the losses are legion and the gains are few.

Failure to consider coastal processes, that is, erosion and deposition of sediment as a result of the action of wind and waves, is another concern in lakeshore planning. The littoral cell, a section of shore where barriers restrict the longshore movement of sediment so that very little is gained or lost, provides a minimum physical unit. The barriers which limit movement may be natural, like the Toronto Islands, or artificial, like the Leslie Street Spit. Since a littoral cell contains the physical movement of sand, it can provide a basis for planning boundaries, although the exact cell boundary is sometimes difficult to determine, and subject to change due to new structures and physical changes on the shore.

A shoreline where the general movement of sediment is in one direction may consist of a chain of sub-cells. Within the Greater Toronto bioregion, longshore movement is westbound from East Point in Scarborough to the mouth of Hamilton Harbour. Between East Point and Whitby, very little material is produced, and direction of movement varies. Sediment movement is generally eastward from Whitby to Prince Edward County.

Coastal processes cannot be considered properly when evaluated by a municipality or conservation authority whose view is limited to a segment of a littoral cell. For example, an artificial headland created in Mississauga can affect the Halton shore by blocking the movement of littoral sand to the west. The same headland can impair the quality of water drawn into Mississauga because of obstruction of contaminants moving east from the rivers and sewage treatment plants of Metropolitan Toronto.

Coastal processes cannot be considered properly when evaluated by a municipality or conservation authority whose view is limited to a segment of a littoral cell.

Planning a shoreline embracing one or more complete littoral cells is consistent with an ecosystem approach, and is not a new idea. Recognizing the problems inherent in a piecemeal approach, the three conservation authorities with responsibility for the littoral cell in the eastern part of the Greater Toronto bioregion conducted a combined study. In 1990, Sandwell Swan Wooster Inc., consulting engineers, submitted a report titled *Lake Ontario Shoreline Management Plan* to the Central Lake Ontario, Ganaraska Region, and Lower Trent Region conservation authorities. This plan had a logical planning envelope, and a consistent approach to hazard land management and protection of environmentally sensitive areas. Many issues of concern in the Greater Toronto bioregion were raised, such as policies for shoreline erosion control and fill and construction guidelines.

In summary, the damage to the shoreline environment is not deliberate, but happens as the unplanned consequence of pursuing other goals. The provincial ministries of the Environment and Natural Resources and the federal Department of Fisheries and Oceans have an interest in protecting the shore: they are trying to minimize the damage, but there is a lack of co-ordination, no overall plan, and no one agency or body with a mandate to improve the shoreline. No one has estimated the carrying capacity so that cumulative effects can be controlled or been given a mandate to establish or enforce codes or standards for marine construction. It is not surprising, therefore, that most incremental changes have degraded the natural environment and reduced its potential benefits for the residents and economy of the region.

Why Should We Be Concerned?

A healthy shoreline is a priceless asset for the Greater Toronto bioregion: it offers drinkable water, recreation, rest, and solace at the doorstep of millions, and is an exciting stimulant for commerce, tourism, and the economy. It is worth defending, and it is not yet too late to do so.

Much of the shoreline east of Scarborough remains in a relatively healthy state, and adequately maintaining it will require wisdom and fortitude, but little money. The most significant parts of the remaining shoreline west of Scarborough can be protected or restored.

The Greater Toronto bioregion is expecting a large increase in population and density; people, industry, and other activity will substantially increase strains on the waterfront and its natural systems. Some will collapse. This, given existing and persistent environmental degradation, suggests that positive measures must be taken soon to preserve the benefits we enjoy today.

What is the Problem?

While there is a great deal of planning along the waterfront of the Greater Toronto bioregion, there has been little progress toward effective shoreline regeneration.

One problem is the general lack of a co-ordinated, ecosystem approach to planning. Municipal waterfront plans are usually based on boundaries without an ecosystem rationale, leaving each municipality vulnerable to the actions of its neighbours. A related problem is the inability to consider cumulative environmental effects, because planning is done for a portion of a natural system.

Resolving intra-municipal planning issues is a responsibility of the provincial government. In some cases, federal agencies are involved as well. Many of these agencies have specialized interests such as "protect the environment", "expand the housing supply", and "enhance transportation" without much incentive to work together. Given the specialized viewpoints, complicated planning issues, and lack of agreed goals, objectives, and timetables, endless review and delay is the common result. The waterfront is plagued by jurisdictional gridlock.

What Can be Done?

Effective co-ordination is the missing element. A mechanism is needed to integrate special interests, establish goals and timetables, strike balanced decisions, negotiate compromises, and thereby break the gridlock. Based on a review of experience in

other jurisdictions, and the situation within the Greater Toronto bioregion, the Commission has concluded that a co-ordinated shoreline regeneration plan would provide the required mechanism.

If it is to bring about shoreline regeneration, this plan must contain three elements:

- a co-ordinating agency with the mandate, will, and skill to involve all responsible parties in planning and acting on shoreline regeneration;
- positive goals and objectives for protecting and regenerating the shore, as well as co-ordinated action to achieve those goals and objectives; and
- constraints on certain development activities in order to ensure a healthy, resilient, productive shoreline with increased aesthetic, social, and economic value to the community.

A co-ordinating agency with the mandate, will, and skills needed to improve the situation will be able to bring the interested municipalities and agencies together, and to facilitate agreement on goals, principles, and timetables for the plan area. In order to encourage integration of the various interests, the co-ordinating agency will need a mandate to act as the primary negotiator for the province in arbitrating disagreements.

The Greater Toronto bioregion has unique advantages, but is not alone in facing a maze of waterfront jurisdictions: in the United States, for example, the San Francisco Bay Conservation and Development Commission has 13 counties and cities working co-operatively to protect common resource. On a broader scale, the government of the United States, through the Coastal Zone Management Act (CZMA), has applied constraints and incentives to create partnerships to protect the Great Lakes.

In Canada, the Fraser River Estuary Management Plan (FREMP) involves approximately 60 agencies, including six Native bands, two harbour commissions, the federal and provincial governments, and all area municipalities. In each case, a co-ordinating agency was created to bring them all together to protect and develop the waterfront resource.

The Greater Toronto bioregion's need for such a co-ordinating agency was recognized by the Shoreline Regeneration Work Group which, in its report to the Royal Commission, said that the Waterfront Regeneration Trust recommended in *Watershed* could be:

> . . . a valuable vehicle for shoreline regeneration; it should pursue only those shoreline modifications that meet ecological criteria and ensure that newly created lands remain in public ownership for the benefit of future generations.

Desirable Characteristics of a Shoreline Regeneration Plan

Protecting and restoring the shoreline in keeping with the nine regeneration principles described in Chapter 1 will require some limitations on how and where development may proceed. Such constraints could be established using a readily understood control pattern — such as maps with "red" zones for the most restrictive natural or historical areas; "orange" zones for areas in which moderate constraints are necessary; and "green" zones to identify the most flexible

areas. Certain areas, in the "red" zones, will be too important to the goals of public access, habitat protection or enhancement to allow construction, erosion control or lakefilling.

The plan should emphasize such opportunities as initiatives that increase access, tourism, boating, walking, swimming, wildlife, fishing, trail hiking, and greenways. Increasing these opportunities can be an important tool in reducing conflicts between uses, as well as stresses on existing facilities.

The plan should not attempt to establish all social, commercial, transportation, and other goals and objectives for the shoreline: other plans and mechanisms, such as those being undertaken by regional and area municipalities, address such needs. However, the Shoreline Regeneration Plan will provide enhanced opportunities for social and commercial development, and should be integrated with those other plans.

There are other characteristics that would contribute substantially to a successful plan; they include:

- an overall "red" designation for the shoreline, until the plan identifies discrete areas, as an incentive for stakeholders to participate in, negotiate, and complete the plan;
- a clearly defined, efficient approval and control process (one-wicket application);
- a consultative approach to developing and administering the plan, including provision for regular public input and review;
- adequate resources for agencies responsible for developing and implementing the plan; and
- powers adequate for protecting natural areas and enforcing any restrictions required by the plan.

Defining the boundaries for the plan is important. An ecosystem approach suggests that the planning envelope should have a natural system rationale. On land, watersheds normally provide the logical dimensions. In the case of the waterfront, a large littoral cell or a combination of cells would provide a reasonable unit. There is some uncertainty as to the precise limits of these cells along the Greater Toronto waterfront and cell definition should be an early priority for planning. Population density and development pressure provides another basis for giving priority to certain areas. A plan for the shore between Burlington Bay and the Trent River would capture a substantial combination of littoral cells embracing the whole Greater Toronto bioregion, as well as an area under significant pressure for change.

IMPLEMENTING THE PLAN

The following recommendations are designed to implement a Shoreline

Whether they begin with the policies and programs of the state, in the head offices of large corporations, in the workplace, or at someone's kitchen table, the end result of sustainable development must be the creation of sustainable communities.

Wismer, S. 1990. 8 "Assessing sustainable development in an urban context." In *Ethical dimensions of sustainable development and urbanization: seminar papers.* Winnipeg: Institute of Urban Studies.

Regeneration Plan and to deal with existing or future problems that could affect the efficiency and effectiveness of that plan.

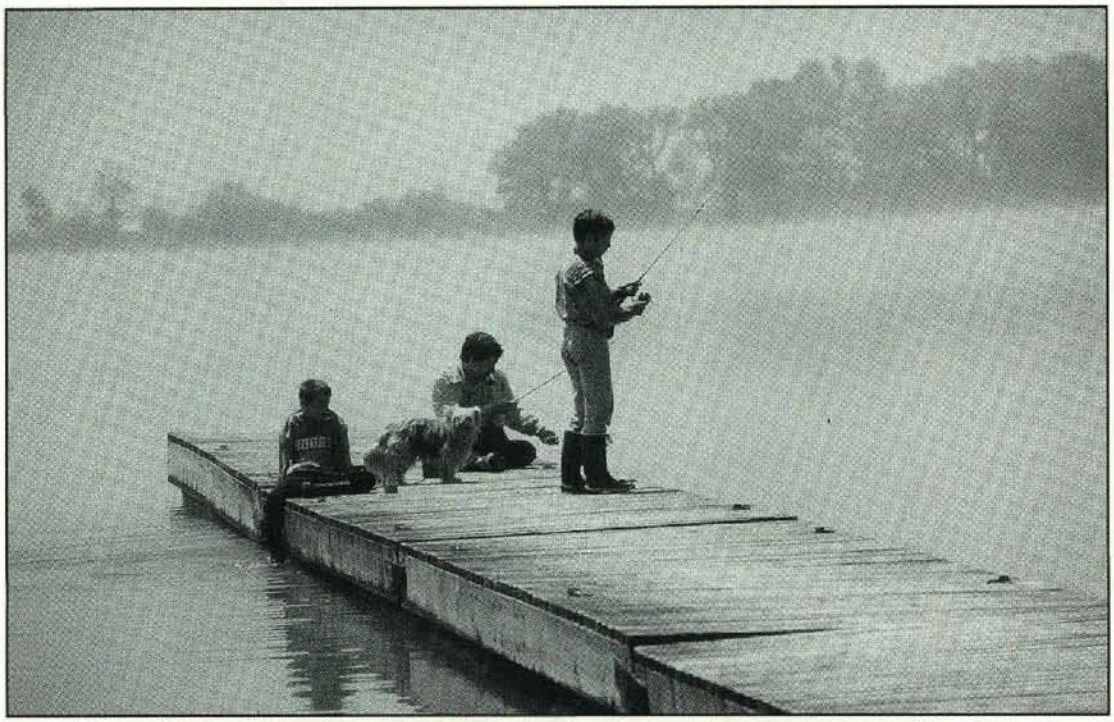
In order to implement the Shoreline Regeneration Plan, co-operation is needed from all levels of government. Such a partnership approach, which recognizes constraints and provides incentives but does not remove authority and responsibility, is the most effective approach to planning on the waterfront.

Success will depend on the incentives provided by a process that both safeguards environmental and public values, and streamlines the approvals required. The framework for ecosystem-based planning described in Chapter 2 should be examined as a possible model. Having satisfied themselves with the rigour of the ecosystem planning process, the federal and Ontario agencies responsible for approvals should be prepared to co-operate with timetables. For example, proposals that conform to the plan could receive "credits" toward completion of any environmental assessment required.

Further, there must be rewards and incentives to negotiate the shoreline plan, and to support its implementation. The most important incentive for municipalities and conservation agencies would be breaking the jurisdictional "log-jam", and predictable, steady progress of plans and projects through provincial agencies, once those plans comply with the agreed plan.

RECOMMENDATION

25. The Royal Commission recommends that the Province of Ontario ensure preparation of a Shoreline Regeneration Plan to protect and regenerate the shoreline of the Greater Toronto bioregion, employing an ecosystem



Fishing in the fog, Darlington

approach. This plan should be developed with the full participation of relevant departments of the governments of Canada and Ontario, as well as those of affected regions, area municipalities, conservation authorities, the private sector, non-governmental groups, and the public. It should emphasize:

- protection of remaining natural areas;
- rehabilitation of degraded areas;
- a mechanism for considering cumulative environmental effects; and
- improvement of access and recreational opportunities.

Any shoreline plan should have the benefit of expertise in the affected community; therefore, before a plan proceeds, interested groups and individuals should have the opportunity to comment on and improve the ideas advanced by the Royal Commission and its work groups. Such input would allow the shoreline planning process to proceed with the support of improved community confidence and focus.

RECOMMENDATION

26. The Royal Commission recommends that as early as possible in the process, the Province ensure public consultation, including public hearings, to permit interested parties and the public to respond to recommendations on shoreline regeneration, made in the Commission's *Watershed* and *Shoreline Regeneration* documents, as well as in this final report.

It is important to prevent construction of major new projects without the benefit of the shoreline plan, because these may create unnecessary harm and foreclose options for future benefits.

RECOMMENDATION

27. The Royal Commission recommends that the Province place a moratorium on approval of all major new lakefill and shoreline erosion control projects, pending approval of a Shoreline Regeneration Plan.

Notwithstanding the need for a moratorium, some small projects might have no material influence on the plan, or there might be demonstration projects that could provide valuable insights and other benefits without compromising the integrity of the plan. The criteria for "small" and "demonstration" should be determined very early, to avoid uncertainty.

RECOMMENDATION

28. The Royal Commission recommends that criteria, performance standards, and procedures be established for small or demonstration projects that

The old way of doing things has proven hollow and sometimes quite destructive, though we have not yet learned the rules for the new ways of doing things, so we are in the age of in-between.

Morris, D. 1990. "The ecological city as a self-reliant city." In *Green cities: ecologically-sound approaches to urban space.* Montreal: Black Rose Books.

The social, economic and ecological forces that shape the city are completely interlocked in the world that we experience. Neither our institutions nor the structure of our systems of governance reflect this reality, nor do they respect the logic of the interdependent systems that they represent.

Jacobs, P. 1991. *Sustainable urban development.* Montreal: Third Summit of the World's Cities.

could be undertaken without compromising the integrity of the Shoreline Regeneration Plan.

Before the Shoreline Regeneration Plan is Complete

An effective shoreline plan, efficiently administered, is essential to the long-term health of the waterfront. While development and agreement on the plan may take several years, some matters merit immediate action. It is proposed that the Ministry of the Environment prepare up-to-date sediment standards for open-water disposal and construction standards for lakefilling, to be applied to completing current work as well as any small or demonstration projects. In addition, consideration can proceed on finding alternative means of dealing with materials produced by construction, as well as creation of greenways and the Waterfront Trail.

Lakefilling is discretionary activity. Given the link established between sediment contaminants and uptake by plants and fish in the aquatic food chain, it seems reasonable to avoid knowingly and voluntarily damaging aquatic ecosystems and the quality of our drinking and bathing water.

Recommendation

29. The Royal Commission recommends that the Province adopt new sediment guidelines for open-water disposal; these should reflect the latest scientific studies, and should establish contaminant limits at levels that will protect aquatic ecosystems.

Appropriate sediment standards are one step in protecting the quality of water on the shore; applying such standards effectively, using a quality assurance system, is the important second step. This is essential, particularly in view of the Commission's information that, in the past, 15 to 25 per cent of material deposited at lakefill did not meet existing sediment standards.

Recommendation

30. The Royal Commission recommends that the provincial Ministry of the Environment and the Metropolitan Toronto and Region Conservation Authority review the quality assurance system used to monitor and control the quality of materials accepted for lakefill and that all necessary improvements be made to improve its effectiveness.

There are several codes and standards governing house construction, but none for massive lakefill structures that may contain large quantities of contaminated sediments. Considering that some of Ontario's engineers and engineering firms are known and respected worldwide, it is clear that we have the expertise needed to set appropriate standards and practices that will ensure the safety of the public and the natural environment.

RECOMMENDATION

31. The Royal Commission recommends that the federal and provincial governments consult with marine construction engineers, academics, and experts with relevant information, regarding practical codes and standards applicable to lakefill and erosion control structures. Possible topics include standards related to the range of water levels, intensity of storms, allowable fill loss, turbidity, and any other issues connected to public safety, public property, and aquatic habitat.

As soon as new and tighter MOE draft sediment guidelines are applied, a great deal of slightly contaminated material would be rejected as lakefill. The precise volume is unknown, but is estimated to be at least half of all material currently being accepted. This means that, once construction activity recovers from the recession, as many as 1,000 truckloads per week would require new disposal sites. In the past, this material was accepted at the Leslie Street Spit for less than $100 per load. Even at current rates (more than $1,000 per load), this material would not be welcome at sanitary landfill sites, because capacity is limited. Furthermore, the degree of contamination on most loads is low enough that disposal in licensed sanitary fill sites is not necessary. Obviously, a practical alternative is needed.

RECOMMENDATION

32. The Royal Commission recommends that the Ministry of the Environment create a new "restricted fill" waste classification for excavated soil that is unsuitable for open water disposal, but does not require the degree of control imposed for sanitary landfill. Moreover, the MOE should actively assist in identifying and licensing suitable sites.

The classic "3 Rs" approach to any waste problem — reduce, reuse, recycle — can be applied to construction excavation wastes.

Reducing the amount of excavate produced by deep excavations for parking lots can be achieved by building above-ground parking garages, reducing the number of parking spaces required below buildings, and increasing public transit capacity. This excavate is the material that is most often used in lakefill.

Other considerations such as aesthetics, safety, security, and the very high value of downtown land will dominate decisions about parking. But, because excavation is typically less than five per cent of a building's cost, and the cost of new transit would dwarf even the recently inflated price of landfill disposal, the requirement for underground parking is unlikely to change quickly.

Recycling is a practical approach for some bricks and broken concrete, but these materials represent a small proportion of overall construction waste.

Reuse offers some very interesting options. If the material is regarded as a resource, rather than a problem, there are possibly some positive ways of employing it. For example, small amounts could be utilized to landscape nearby grounds, in order to provide contour and texture. Further away, they could be used in noise berms and toboggan or ski hills. On a still larger scale, millions of cubic metres could

raise the elevation of industrial lands currently under redevelopment in downtown Toronto, such as the Railway Lands, Port Industrial Area, Garrison Common, and Ataratiri.

The Commission has been advised that, assuming that contaminated soils below can be sealed properly, large amounts of material could be utilized in these ways. Benefits would include raising some lands above the floodplain of the Don River, achieving pleasing slopes and contours, "hiding" expressways and rail corridors in newly created ravines, and improving sound buffers and general drainage. It has been estimated that, in downtown Toronto, as much as 12 million cubic metres (15 cubic million yards) could be diverted from waste disposal sites — an amount that would exceed the projected production of excavated soils over the next decade.

RECOMMENDATION

33. The Royal Commission recommends that the possibility of using excavated material be evaluated in the preparation of plans and proposals for redeveloping downtown Toronto sites, such as Garrison Common, the Railway Lands, the Port Industrial Area, and Ataratiri.

WATERFRONT GREENWAY AND TRAIL

Although a Waterfront Greenway and Trail should be part of the Shoreline Regeneration Plan, there is no need to wait for the plan before encouraging initiatives that will help regenerate the terrestrial edge of the shore and make it more accessible. Parts of the Waterfront Trail exist, and further development is under way. The greenway concept can help create the natural network that will encourage more species at the waterfront. Greenways and shoreline regeneration initiatives are highly complementary. (See next chapter for an extensive examination of the greenway concept.)

RECOMMENDATION

34. The Royal Commission recommends that the Waterfront Greenway and Trail be integrated into the proposed Shoreline Regeneration Plan for the Greater Toronto bioregion, and that work should proceed while the plan is being prepared, providing that it does not compromise the plan's integrity.