

WATER: BACKGROUND REPORT

**City of Toronto's Environmental Plan
"Clean, Green and Healthy"**



City of Toronto

FEBRUARY 2000

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1.0 Background

"Water: Background Report for the City of Toronto's Environmental Plan" and "Water: Strategic Directions" are part of a series of background and strategic documents on Water, Land and Air. These reports were prepared by the Environmental Impact Assessment & Policy Development Unit of Works & Emergency Services in collaboration with Environmental Task Force members and staff, Toronto Public Health, Urban Planning & Development Services, the Healthy City Office and Corporate Services. Participants involved in this process are listed in Appendix A.

These reports were developed to provide background information and analysis for the Environmental Plan and reflect the results of a review of environmental initiatives current as of November/December 1999. The Environmental Plan was endorsed by the Environmental Task Force in February, 2000 and the reports have been revised to consider comments received during this process. These reports also serve to provide part of the foundation for an integrated environmental policy framework that is currently being developed by the Environment Impact Assessment & Policy Development Unit.

2.0 Introduction

Water is a precious resource that is key in supporting life on our planet. The natural cycle moves water throughout the ecosystem by the processes of precipitation, run-off, infiltration, evaporation and condensation. The City of Toronto has six watercourse systems (Etobicoke Creek, Mimico Creek, Don River, Humber River, Highland Creek and the Rouge River). These natural water systems are important drainage systems conveying storm and snow melt waters from and through the City and the watercourses provide aquatic habitat for a variety of wildlife species.

Development and urban growth within Toronto and surrounding regions over the past 200 years have resulted in very intense pressures on the ecosystem, and the alteration of the hydrological cycle and natural environment. The International Joint Commission has designated Toronto one of 42 Areas of Concern in the Great Lakes basin because of degraded environmental conditions in its surface waters. Contaminant sources include discharges from wastewater treatment plants, storm sewers and combined sewer overflows (RAP, 1994). As well, Lake Ontario is the last in the chain of Great Lakes and the Toronto waterfront is influenced by water from the Niagara River and elsewhere. It also receives direct atmospheric deposition to the nearshore and watercourses, as well as runoff contaminated with pollutants originating in the large watershed to which Toronto belongs. Environmental impacts of these sources include bacterial contamination of recreational beach areas, stressed aquatic systems, loss of aquatic habitat and contaminated sediments.

Through urbanization, the increase in non-porous surface area has resulted in an increase in stormwater flows causing flooding, erosion and loss of aquatic habitat in local watercourses. Land use practices have impacted the aquatic environment through deliberate or accidental chemical spills under dry weather conditions and chemical wash-off during wet weather. During wet weather, pesticides and herbicides from lawn and garden applications, animal feces, fluids leaked from automobiles onto paved surfaces, contaminants deposited onto hard surfaces from automobile exhaust and industrial stack emissions and chemicals from storage areas are washed off and carried by stormwater to the nearest receiving water body. Untreated sewage is discharged through sewer outfalls during wet weather in areas of the City serviced by combined sewers. Toxic contaminants discharged to sanitary sewers that cannot be treated through wastewater treatment plants are discharged directly to the aquatic environment.

3.0 Toronto's Sewer System

3.1 Types of Sewers

There are three types of sewers: sanitary, storm and combined. Sanitary sewers convey sanitary sewage and foundation drainage to treatment plants where it is cleaned before being released into Lake Ontario. A sewer is "combined" when one pipe transports both sanitary and storm drainage. During dry weather, combined sewers carry all contents to treatment plants. However during wet weather, the runoff component overwhelms the sewers capacity and results in basement flooding in low lying areas, and the discharge of combined sewage through combined sewer overflows (CSOs) to area streams and the waterfront because it bypasses the treatment process. During wet weather conditions, storm sewers collect the City's rainwater or snowmelt from residential and commercial properties, as well as roads, and transport it to the nearest receiving water body.

3.2 Historical Context

Sewer systems were developed in response to severe human health effects that were caused by disease vectors and a result of human activities. In the early 1800's, scientific discoveries were made that linked disease and mortality to poor sanitation and sewage collection and disposal. The removal of human waste became a priority, and the construction of engineered systems designed to move these unwanted materials was aimed at reducing the frequency and severity of these epidemics.

This section is intended to provide an historical context to assist in understanding the evolution of the sewer system as necessary infrastructure to improve human health and the state of the environment in which humanity lived. When developing strategies for improving the water environment, one shouldn't lose sight of what our sewershed provides us in terms of improved environmental and human health conditions, and work towards the integration of watershed and sewershed approaches. That said, it is also important to consider natural methods of managing our stormwater before relying on a piped solution.

3.3 Evolution of the Piped Solution

Roadside ditches were the first types of sewers constructed when the City first began urbanizing. The ditches served to help prevent roads from flooding during rainfall events. At that time, human waste was disposed of through backyard privies or waste heaps in common areas. The first "drains" or sewers were built in the 1830's to move the waste away from the urban centres to the nearest receiving water body where it could be diluted and washed away. These sewers were also used as connection points for the disposal of stormwater during wet weather. At the time, the discharge of sanitary sewage diluted with "clean" stormwater was not considered to be a problem.

In 1910, the first sewage treatment plant was built near Ashbridges Bay. The plant was constructed to treat the dry weather discharges from the expanded combined (sanitary sewage and stormwater) sewer network. Overflow points to the nearest receiving water body were provided within the sewer system to minimize system flooding and protect the sewage treatment plant from damage during wet weather flow conditions. Although combined sewers were still being built in some areas until the 1960s, separated storm sewer systems were built in newer areas to intercept runoff from road surfaces and alleviate the combined or sanitary sewers and the sewage treatment plants from this extraneous flow. These separated storm sewers also were constructed to reduce basement flooding.

Sewer separation was at one time considered a solution to the environmental degradation caused by combined sewer overflows. However, studies later showed that, for many contaminants, concentrations in stormwater and combined sewer overflow discharges were similar. Sewer separation is now only pursued to alleviate basement flooding in combined sewer areas of the City.

Currently, there are 1,300 km of combined sewers (with 79 combined sewer overflow discharge points), 4,550 km of sanitary sewers and 4,550 km of storm sewers discharging via about 2,600 sewer outfalls (W&ES Fact Sheets, 1999). Most of the combined sewers are located in the older sections of the City, largely within the City core. About 3% of the system is greater than 100 years old, while about 30% is between 50 and 100 years old (Michael D'Andrea, W&ES, pers. comm., Oct. 27, 1999).

4.0 Current State of the Environment

4.1 Stormwater

Storm sewers are designed to intercept road drainage, through roadside catchbasins, during wet weather conditions and convey this runoff to the nearest receiving water body. However, because of the amount of impervious surface areas within urban areas the runoff volumes and flow rates are substantially increased. In addition, washoff from these impenetrable surface areas contain vast amounts of contaminants. Area watercourses are impacted both by the physical and chemical stresses created by the flows. Watercourses can be natural (e.g. creeks, streams and rivers), or man-made (e.g. concrete channels or underground pipes). During dry weather, storm sewers can also be a direct source of contaminants as a result of accidental or deliberate chemical spills to roadside catchbasins. Much of Toronto was built before stormwater management was required in new developments.

In urban areas, the carrying capacities of the storm and combined sewer systems vary widely. One common factor is that the systems have difficulty handling the runoff from very infrequent and intense storms. The impacts can include sewer backup into basements (basement flooding), flooded properties and roads, maintenance hole covers blown off and water gushing from these holes, swollen and rapidly flowing streams, and degraded water quality. Also, during these heavy rains, run-off water from the streets overwhelms the combined sewer pipes and the system surcharges, allowing a mixture of rainwater and untreated sanitary sewage to flow into the rivers and eventually, the lake.

Stormwater runoff quantity control to reduce flooding and erosion has been in place for many years. However, quality control of stormwater runoff is relatively new in comparison. Stormwater must be viewed as a resource to be managed and used in support of societal benefits. Both quantity and quality concerns need to be addressed in order to achieve any significant improvements in water quality. Protection of this resource demands preservation or enhancement of the quality of stormwater runoff and where possible, restoration of the natural hydrologic cycle.

4.2 Wastewater

Wastewater is collected by the extensive sewer system and conveyed to a wastewater treatment plant where it undergoes treatment processes that remove solids, chemicals and other undesirables before the water is released into the natural water supply. Sanitary sewer systems are designed with allowance for a limited amount of infiltration. However, as the pipes settle and age, deterioration occurs in the form of loose joints, cracks and collapse in some cases. During heavy rains, excessive infiltration through crevices can stress the system and exceed its hydraulic capacity, creates additional load to the sewage treatment plants downstream and can cause basement flooding in low lying areas.

Water and Wastewater Services Division maintains 358 km of trunk collector sewers including eight pumping stations throughout the City as well as operating four treatment plants (W&ES Fact Sheets, 1999). It has specialized branches dealing with wastewater related issues: Industrial Waste Control for the control of industrial discharges, Systems and Services for the continual maintenance and rehabilitation of the sewer system, and Quality Control Laboratory that provides analytical services.

Toronto's wastewater treatment plants, namely the Ashbridges Bay, North Toronto, Highland Creek and Humber treatment plants, operate under the guidelines set by the Ministry of Environment (W&ES Fact

Sheets, 1999). The sewage treatment plants treat the wastewater completely, including the removal of suspended solids, biochemical oxygen demand (BOD), and phosphorus. These plants also provide effluent disinfection, and disposal of wastewater sludge, including sludges generated. After biological treatment and before discharge in Lake Ontario, chlorine is added to sewage effluent to disinfect it. Chlorine use poses human and environmental health risk to the people that work at the treatment facilities and the residents that live near the plant, as well as impacting the water quality near the outfall (City of Toronto, Toronto Public Health Division, 1999).

4.3 Drinking Water Supply

Lake Ontario is the only source of Toronto's drinking water. Works and Emergency Services is responsible for providing drinking water to Toronto and to the southern portion of the Region of York (SOER, 1995).

There are many impurities in the raw lake water that can harm human health if the water is ingested without treatment. These impurities are physical (materials that do not dissolve in water and make the water appear "dirty"), chemical (substances dissolved in the water from both natural and man-made processes), and biological (viruses, bacteria, algae, and other small living organisms). Works and Emergency Services is also obligated to treat drinking water, ensure that there is adequate water pressure in Toronto's part of the distribution system, and store and distribute water to consumers.

The water distribution system is made up of about 5800km of watermain and about 500,000 water service connections to homes, industries, commercial establishments and institutions (W&ES, Fact Sheets, 1999). Currently 28 per cent of the watermains are between 50 to 75 years old, 16 per cent are between 75 and 100 years and 7 per cent are over 100 years old (Michael D'Andrea, pers. comm., October 27, 1999). The expected life expectancy of a watermain ranges from 60 to 100 years (Abhay Tadwalkar, pers. comm., Oct 29, 1999).

Watermains and water services deteriorate as they age. Exterior deterioration of watermains is caused by stray electricity and aggressive soils, and this leads to pitting and periodically to leaks and breaks. Internal deterioration in the form of rust build up on the inner pipe wall (tuberculation) due to the water-metal interface. This results in episodes of 'red'/orange'/yellow'/rusty water and reduced flow in the watermain. Generally the reduced flow is not always the cause of low water supply flow to homes. Low flows to homes are usually caused by deterioration in the water service connection in the form of passivation, a coating of the inner wall with calcium carbonate, similar to the scale build-up observed in kettles and pots.

The City of Toronto produces drinking water by treating water drawn from Lake Ontario. Toronto's drinking water is routinely tested for many chemicals, and in 1998 complied with the province's standards for biological contaminants. Trihalomethane, a disinfection by-product created when chlorine is added to the drinking water, had levels far below the federal guideline. Aluminum levels have been reduced and are now below the operational guideline recommended by the Federal-Provincial Subcommittee on Drinking Water. Fluoride levels are maintained at approximately 1.0 part per million (TRCA, 1999)

Lead can enter the drinking water distribution system from lead-based or lead soldered pipes. Levels of lead in flushed water are lower than the provincial guideline, but lead levels in standing water can be significantly higher than the guideline. Levels of tritium are below guidelines established by the Advisory Committee for Environmental Standards (City of Toronto, Toronto Public Health Division, 1999).

Occasionally during the summer months, the presence of naturally-occurring algae and higher water temperatures in Lake Ontario can cause a noticeable taste and odour. Testing has confirmed that the quality of water continues to meet provincial standards during these occurrences.

Although Toronto's water quality meets, and in most cases exceeds these standards, it should be noted that backwash water does exceed the provincial water quality objectives/guidelines for a number of substances, including total phosphorus, aluminium, iron, copper, and phenols. Partial retention and clarification of backwash water is currently undertaken to reduce these loadings to the lake.

4.4 Rehabilitation and Restoration of Natural Habitats

The City of Toronto has an area of about 630 square kilometres. The watershed in which the City of Toronto resides includes over three million people, as has an area about 2,000 square kilometres. Extensive urbanization and the activities it entails, along with increased population, exerts increased pressure on the watersheds and waterfront of this city. Despite combined sewer overflow abatement measures (e.g. sewer separation) across the City and advances in stormwater management technologies and their application, the potential for continual impact of wastewater discharges on the aquatic environment still exists. Other solutions, beyond these end-of-pipe controls are required. Therefore, more research and work needs to be done to ensure the health of fish and wildlife habitats.

While the Toronto waterfront has substantially less wetland habitat than it did historically, over 120 hectares of provincially significant wetlands exist today along its waterfront, including 46.9 hectares of additional wetlands that were added through re-evaluation. Almost 20 hectares of wetland have also been created along Toronto's waterfront and at river mouths in the last eight years. Today, it is less likely that existing wetlands will be removed due to development pressures. In an attempt to improve stormwater quality the City of Toronto and others such as the TRCA have undertaken projects that have created wet ponds which have a wetland component (e.g. Centennial Eco-Park and Terraview – Willowfield Gardens Park) (TRCA, 1999).

A number of renaturalization projects have been undertaken by a number of City Departments and agencies. For example, the Works & Environment Department of the former City of Scarborough has renaturalized watercourses (Markham Branch of Highland Creek) and retrofitted stormwater management facilities (Meadowvale Stormwater Pond at Meadowvale and Kingston Road). The Department of Economic Development, Culture & Tourism (Parks and Recreation and Policy & Research Sections) have undertaken renaturalization in a number of locations including High Park. The TRCA retrofitted an area of the lower Don River known as the Don Brickworks.

Rouge Park, a partnership of area Municipalities (including the City of Toronto), Toronto & Region Conservation Authority, the Province, and the environmental group, Save the Rouge Valley System has undertaken extensive work to improve natural areas, to restore the watercourse and to remove invasive species. The Ontario Ministry of Natural Resources in conjunction with Rouge Park Alliance partners is working on the Rouge Marsh rehabilitation at the mouth of the Rouge River.

The City, TRCA, the Black Creek Project and the Lambton Golf Club are jointly conducting a feasibility study to determine the best options for naturalizing and rehabilitating the lower Black Creek channel and floodplain (between Jane Street and the Humber River). This is a proactive offer by private owners to consider naturalizing a degraded watercourse through partnership with the City and other agencies, and is an unexpected opportunity to improve local water quality impacts on the western waterfront. These benefits are within the context of the Remedial Action Plan recommendations and assist in moving forward in the International Joint Commission delisting process.

5.0 Getting to Clean, Green & Healthy

5.1 Framework for Action

Co-operation on many fronts highlights the commitment of the people of the United States and Canada to prevent further degradation of and to protect the future of the Great Lakes. This commitment has been reflected through the Great Lakes Water Quality Agreement (GLWQA), national programs for environmental protection and the involvement of governments, non-government agencies and groups, researchers, industries, communities and individuals.

The 1994 Canadian-Ontario Agreement (COA) set out a plan of action that established priorities, targets and schedules for environmental issues of concern in the basin, as well as Canada's commitments under the GLWQA. The COA established a results-oriented approach that identified more than 50 targets to be achieved during the six-year term of the Agreement. These targets address three main objectives: the restoration of degraded areas throughout the Great Lakes basin, the prevention and control of pollution, and the conservation and protection of human and ecosystem health.

The City of Toronto, other municipalities, agencies, businesses, and citizens all have key roles in restoring our waterfront and watersheds. A Remedial Action Plan for the City of Toronto and Region was developed through a partnership between various levels of government and the public, and encompasses the entire City, including its six major watersheds. The main purpose of the RAP is to develop a comprehensive process for restoring the watercourses in the stated area by cleaning up polluted areas. The general goals of the RAP are to make our waters fishable, swimmable, drinkable, and aesthetically pleasing water and aquatic habitats.

Restoration puts emphasis on priority activities under the Remedial Action Plan (RAP) program to restore 60 per cent of the impaired beneficial uses in Canada's 17 designated Areas of Concern (AOCs). Specific impaired uses that the Toronto and Region RAP is addressing include:

- Restrictions on fish and wildlife consumption;
- Degradation of benthos;
- Restrictions on dredging;
- Eutrophication with undesirable algae;
- Beach closures; and
- Degradation of aesthetics.

In 1994 "*Clear Waters, Clear Choices: Recommendations for Action*" recommended remedial strategies to restore impaired uses (RAP, 1994). It was prepared by all levels of government, the private sector and the public, and summarized a wide range of activities and associated environmental improvements or degradation.

5.2 City of Toronto: Official Plan

The City of Toronto was amalgamated in 1998. At the moment there are Official Plans for the former Regional Municipality of Metropolitan Toronto and each of the former municipalities within Metro (Toronto, Etobicoke, York, North York, East York and Scarborough). Each of the former municipalities had Official Plan policies that related in some way to protection of natural areas. Those of Metropolitan Toronto, Toronto, Scarborough, North York, Etobicoke and East York included policies related to the protection of some valley lands. Work is underway to replace the existing Official Plans with a new City of Toronto Official Plan that will contain a vision for the City of Toronto, including green space and natural areas.

The former Metro Toronto Official Plan provides policy for many aspects directly related to the RAP goals on environmental health, flood control, protection of natural areas & green spaces, water quality protection. In its 1994 Official Plan, the former Metro Toronto established four objectives:

- eliminate the discharge of toxic contaminants:
 - ◆ understanding that these toxic contaminants that are discharged into the Lake and other watercourses are persistent; and
 - ◆ conducting additional research into targeting the sources of toxic contamination (household/industrial) as to reduce discharge.
- improve near-shore water quality to swimmable standards:
 - ◆ implementing waterfront improvement as to increase near-shore water quality to swimmable standards; and
 - ◆ separating the combined sewer systems and detaining combined sewer outfall and storm water discharges.
- decrease water consumption:
 - continuing to decrease water consumption from all sectors including residential, industrial, commercial and institutional as water use per capita is still higher than in the 1970s.
- reduce contaminant loadings from water run-off:
 - decreasing the type and amount of persistent toxic contamination that enters the water system from urban and rural run off; and
 - acting on limiting storm water run off, protecting and enhancing storm water quality and protecting and enhancing natural hydrological processes.

The policies in the Official Plans of the other former municipalities contained some policies (that are not detailed here) which related to RAP objectives but are not consistent City-wide.

These objectives remain in place in the post-amalgamation period. In a large city such as Toronto, the everyday activity of people and businesses impacts the water environment. In an urban setting, it is impossible to completely eliminate the consequences of human activity on the water environment; however Toronto can continue to work towards minimizing the human impact on this system. To help improve the conditions within the urban water environment, a comprehensive view is somewhat in place in parts of the City but needs to be harmonized across the City of Toronto. This view needs to that best integrates the built system with the natural system. Existing stewardship action needs to be expanded City-wide as the Toronto community must become better custodians of the water environment and strive to live more sustainably. In other words, individual and collective actions must be redoubled to reduce water use and prevent pollution from entering the water environment.

The following section identifies some of the strategies and actions currently undertaken in the City of Toronto to make our water environment drinkable, swimmable, fishable and aesthetically pleasing. This is by no means a detailed evaluation of the identified strategies/actions, but is intended to indicate the range of strategies/actions executed to address water issues.

5.3 Current Activities

5.3.1 Stormwater Management

5.3.1.1 Wet Weather Flow Management Master Plan

The City has undertaken the development of a Wet Weather Flow Management Master Plan. The Plan, developed through a strategic planning process, will establish a wet weather flow management policy

and formulate strategies for the prevention, control and reduction of wet weather flow impacts across the City. Wet weather flow quantity and quality issues are to be managed on a watershed basis supporting a new philosophy developed with key stakeholders:

“Rainwater is to be treated as a resource to be utilized to enhance and nourish the City’s environment. Wet weather flow quantity and quality issues are to be managed on a watershed basis to enhance and preserve ecosystem health through a hierarchy of source, conveyance and end-of-pipe control and/or treatment measures. Source control measures will be considered first in this hierarchy in a manner that is balanced with the other two measures in terms of environmental, social and economic impacts.”

The cost and magnitude of works required to deal with the wet weather flow problems will make immediate implementation of the entire plan impractical. The plan will have to be phased in, possibly over many decades. Priorities must be developed that are related to environmental improvement. Other factors that must be considered include the delineation of responsibilities, implementation and operational costs, available resources and affordability, monitoring results and emerging technologies.

5.3.1.2 Stormwater Retention/Detention Areas

The Toronto and Region Conservation Authority (TRCA) has encouraged the construction of stormwater management measures, such as retention/detention ponds, as part of new developments. The City of Toronto has constructed and is continuing to construct stormwater management facilities in known problem areas. This reduces flooding by directing as much excess storm runoff as possible away from roads and sewers to properly designed storage facilities rather than randomly occurring flood locations. The water contained in these facilities is slowly released to streams or back into the sewer system. Flood control facilities are designed to control runoff from large storm events.

Stormwater quality/erosion control facilities (required since 1990) are designed to capture the first 25 millimetres of rainwater in every storm and to then discharge it slowly into the stream or back into the storm sewer system over a 24-hour period. This is the part of a storm that washes most of the pollutants such as oil from parking lots, driveways, roads and other surfaces into the storm sewer system. While the water is held in the retention area, a large portion of the pollutants settle. Quantity and quality control functions are usually combined in one facility. They not only reduce the likelihood of flooding by reducing the volume of water in the rivers during heavy rain, but also reduce the number and volume of pollutants flowing into the watercourses.

A retention pond, such as Milliken Park near Steeles Avenue and Markham Road in the Scarborough community, always contains water. It also has the capacity to handle excess rainwater when necessary. In addition, these "wet ponds" are often built to allow for settlement of suspended solids through extended detention time. A detention pond, such as Scarden Park at Warden Avenue and Cass Avenue, also in the Scarborough community, is a dry area such as a park or an open space with the necessary mechanics to close off access to sewers and direct water into the detention area.

Specialized stormwater detention and retention facilities can be used to collect and store combined sewer overflow to allow settling of the most contaminant materials before discharging the run off back into the sewer system, or the to watercourse or lake. Beaches in Eastern Toronto and Centre Island have remained safe for swimming a majority of the time over the last few years, partly because many of the sewer lines serving those areas have been separated. Another major factor has been the construction of the Eastern Beaches Detention Tanks to trap combined sewer overflow for proper treatment at the Main Treatment Plant. Construction on the Western Beaches Storage Tunnel began in October of 1998 and when it is completed (scheduled for the end of 2000) there will be further improvement in beach water quality along the western beaches.

To further reduce the problem of Combined Sewer Overflows, Works and Emergency Services has implemented a program to separate combined sewers, and investigate the building of interception

tunnels and detention tanks. The "Combined Sewer Elimination Program" is aimed at installing storm sewer pipes adjacent to the existing combined sewers. The storm sewers will carry stormwater and snowmelt and the old combined sewer will handle sanitary sewage only, eliminating the overflow in wet weather. Although this is a piped solution, environmental conditions will be improved. Toronto has implemented a roof downspout disconnection program for its residents to reduce the amount of rainwater that enters the combined system.

5.3.1.3 *City Operations -- Best Maintenance Practices*

The City undertakes regular storm sewer maintenance (cleaning catchbasins and outfalls) to ensure that the system is operating effectively and efficiently. Also, the storm water system is routinely monitored to trace dry weather sources of contamination and to identify illegal or incorrect connections to the storm water system.

The City of Toronto has implemented an "Integrated Plant Health Care" program through the Pesticide sub-committee of the Toronto Interdepartmental Environment team that phases-out corporate use of pesticides and herbicides to control weeds and emphasizes preventative measures for managing parks. The consequence of virtually eliminating pesticides is apparent in the improvement of run off that comes from City owned greenspaces. In 1999, the City of Toronto has reduced its pesticide use by 96% thereby improving the quality of stormwater discharged from City property (Siu Fong, Community & Neighbourhood Services Department, Toronto Public Health Division, pers. comm., Oct. 29, 1999).

5.3.1.4 *Community Programs*

The City's Household Hazardous Waste Program is designed to discourage residents from depositing toxic substances into sewers and on land by providing opportunities for such substances to be collected and taken to designated waste transfer stations for proper disposal by the City.

The Storm Drain Marking Program commonly, referred to as the Yellow Fish Road program, invites school and youth groups to show their communities the connection between storm sewers and streams, and how to prevent their contamination through hazardous waste disposal into the sewer system.

The former City of Toronto established a program to disconnect downspouts on residential buildings in 1994. This strategy has been expanded to reach the entire new City of Toronto to reduce the amount of rainwater entering the combined sewer system. The program is free and voluntary, and has disconnected approximately 11,000 or nine per cent of the targeted residences (Ted Bowering, Works & Emergency Services, Technical Services, pers. comm., Oct. 28, 1999).

Associated with this program is a rain barrel program as a practical and effective method of recycling water that would otherwise be discharged into the sewer system. This is also a water conservation initiative as it reuses this soft non-chlorinated water to water gardens, wash cars, etc., instead of consuming more treated metered water. City residents benefit, as money can be saved on water bills.

5.3.1.5 *Sewer Use By-Law*

The City of Toronto has drafted a new sewer use by-law that sets the toughest standards for sewer discharges in Canada and strict financial penalties for non-compliance. Industrial polluters will be required to establish pollution prevention plans. The by-law adds another 29 compounds to the list of chemicals banned from the City's sewer system, including benzene, chloroform, dichlorobenzene, toluene, aldrin/dieldrin, DDT, PCBs and chlordane. The City is conducting workshops for affected companies, regarding the implementation and preparation of pollution prevention plans (W&ES, Sewer Use By-Law, 1999).

5.3.2 Wastewater Discharge Management

5.3.2.1 System Improvements

The discharge of non-treatable contaminants to the sanitary system must be eliminated. The efficiency of the treatment systems must be improved by reducing the amount of wastewater and by optimizing the design and operation of all system components, including sewers and sewage treatment plants. This is done by continuous upgrades of the City sewer system and treatment plants utilizing modern technology as well as implementation of the water conservation program.

Routine sewer use controls aimed at improved performance and protection of sewage treatment plants are being enhanced through pollution prevention efforts such as the sewer use by law and household hazardous programs. Sewage treatment plant upgrades need to continue on a regular basis as part of an ongoing program and through larger planning studies. Thus actions and strategies regarding wastewater discharges can be grouped into two main categories, source control and end-of-pipe.

5.3.2.2 Source Control Strategies

In addition to a new sewer use by-law that sets the toughest standards for sewer discharges in Canada, the Household Hazardous Waste program has been designed as an initiative that encourages households to stop pouring hazardous wastes down their drain and into the sewer system (City of Toronto, W&ES, Sewer Use By-Law, 1999). Households can drop off hazardous wastes at neighbourhood depot or have their wastes collected by a "toxic taxi". Control methods that reduce the quantity of wastewater that must be treated include downspout disconnection and infiltration, rainbarrels, storm gardens, soak away pits, and the Water Efficiency Plan that is currently being developed.

5.3.2.3 "End-of-Pipe" Strategies

Improving the efficiency and effectiveness of the treatment of wastewater will reduce the environmental impacts of the discharges. The City's sewage treatment plants treat the wastewater, including the removal of suspended solids, biochemical oxygen demand (BOD), and phosphorus. These plants also provide effluent disinfection, and disposal of wastewater sludge, including sludges generated during the treatment process. The treatment of wastewater at the treatment plant is accomplished through the processes such as raw sewage pumping, preliminary treatment, primary settling, activated sludge treatment, final settling, chlorination, phosphorus removal, sludge dewatering and disposal, air treatment and odour control.

The Main Treatment Plant (MTP) Environmental Assessment report's recommendation for disinfection of final effluent was to test, or pilot, ultraviolet disinfection technology at the Ashbridges Bay Treatment Plant (formerly the MTP) to assess its effectiveness. This technology is now being used at the Ashbridge's Bay Treatment Plant as a disinfecting alternative to chlorine. Each plant's effluent has its own unique signature attributable to the particular treatment plant process and to a lesser degree the make-up of what enters the plant. Successful ultraviolet disinfection depends on the ability of the ultraviolet light to effectively destroy the ability of micro-organisms to reproduce, the potential for applying this technology on a large scale, and cost effectiveness. So far the testing at the Ashbridges Plant has been very successful and in 2000, other treatment facilities will also implement ultraviolet disinfection technology (W&ES, Fact Sheets, 1999). The MTP EA report also recommended a switch from incineration of sludges into beneficial reuse of biosolids. This switch is presently underway and will be completed for the Ashbridges Bay treatment plant by the end of 2000.

The Works Best Practices Program will integrate industry best practices in the Water and Wastewater Services Division. The result of implementing this program will be cost reduction and improved effectiveness at the plants. The process includes redesigning work and management practices, using automation and modern technology, improving business practices, and developing multi-skilled workers.

5.3.3 Drinking Water Treatment

The Water Supply Section of Water and Wastewater Services ensures that the water produced meets or better all standards set for drinking water quality by the provincial and federal environmental ministries. There are five different processes our water goes through on its way through the system of water supply pipes, reservoirs and storage tanks. These processes include coagulation, flocculation, and sedimentation; filtration; disinfection; fluoridation; and ammoniation.

The supply of water in Toronto is regulated under the Ontario Water Resources Act and the Ministry of Environment has jurisdiction over ensuring that the water supply in any municipality is to an acceptable standard. The Water and Wastewater Services continually samples and analyses the water quality in distribution systems throughout Toronto.

The City is currently exploring to reduce or eliminate the taste and odour episodes in the future (W&ES, Fact Sheets, 1999). Testing has confirmed that the quality of water continues to meet provincial standards. The City has begun to install activated carbon filters to address these taste and odour incidences, and should continue to explore how to minimize these problems (Abhay Tadwalkar, W&ES, pers. comm., Oct 29, 1999).

5.3.4 Water Efficiency

5.3.4.1 Water Efficiency Plan

In Toronto, on average, 1.2 billion litres of water per day must be supplied to the City's residents and businesses. The average residential water use is about 250 litres per person per day (W&ES, Fact Sheets, 1999). If this rate of water consumption is projected into the future, residents and businesses in the City of Toronto will need so much more water that production and wastewater treatment capacity will need to be expanded at a cost hundreds of millions of dollars. The City of Toronto is developing a Water Efficiency Plan that will outline an overall strategy to reduce water use by 15% by the year 2011 (Roman Kaszczij, W&ES, pers. comm., Oct. 27, 1999).

By implementing water efficiency measures, the City will be able to defer the costs associated with new facilities. Also, by decreasing the amount of water that is consumed, the amount of water that is discharged into the sanitary and combined sewers may also be reduced.

There are many strategies to improve the efficient use of water. These can be organized into the following categories: operations and maintenance, residential and industrial, commercial and institutional (IC&I) programs, rate structures, regulations and public education.

5.3.4.2 Operations and Maintenance

Unaccounted for Water is generally considered as the difference between the volume of distributed water and billed water, and includes water used for fire fighting, parks irrigation, street cleaning, flushing of watermains, leakage, water theft and errors in accounting practices. Approximately 10 per cent of municipal water is unaccounted for and leakage generally accounts for about 60 % of the total (W&ES, Fact Sheets, 1999). Operations and Maintenance measures are implemented to improve the efficiency of the distribution system, and to reduce environmental impact caused by water that leaks from the system. The Water and Wastewater Division has completed leak reduction programs on the water distribution system in several areas within the City.

5.3.4.3 Residential Programs

In Toronto, about 52 percent of municipal water is used in the single and multi-family residential sectors (Roman Kaszczij, W&ES, pers. comm., Oct. 27, 1999). Residential programs address three areas of water use: plumbing fixtures, appliances and outdoor water use with the main goal of reducing this water consumption.

Plumbing fixture programs include the delivery of water efficient showerheads, aerators, toilet retrofit devices and ultra low flush toilets that reduce the amount of indoor water consumption. Showerheads, aerators and toilet retrofit devices are distributed to householders in water efficiency kits. Over 80,000 water efficiency kits have been distributed to date (Pam Georgopoulos, W&ES, pers. comm., Oct. 27, 1999). Toilet replacement programs are designed to accelerate fixture replacement. They may involve municipal incentives or rebates to encourage purchase of toilets. Water efficient appliances, such as horizontal-axis washing machines are now widely available. The Toronto Housing Company and the Works and Emergency Services Department completed a joint pilot project where 50 horizontal-axis washing machines were installed into apartment buildings. Customer satisfaction with the machines was very high and the water and energy savings were 46% and 68% respectively (W&ES, Fact Sheets, 1999).

Strategies for reducing outdoor water use include landscape water audits that highlight opportunities to improve water efficiency without changing the landscape design. Proper lawn watering techniques can also greatly reduce water consumption. Watering during off-peak hours (11:00 p.m. to 8:00 a.m.) is encouraged. Xeriscaping and naturalization goes one step further to propose landscape changes which reduce the need for irrigation while retaining the same benefits associated with urban landscapes. Rainwater re-use involves the disconnection of rainwater downspouts from the sewer system and diversion of the rainwater to a rain barrel, a cistern, or directly to the landscape.

5.3.4.4 Industrial, Commercial and Institutional Programs

The industrial, commercial and institutional (IC&I) sector consumes about 38 percent of the municipal water supply. The wide range of potential IC&I measures may be grouped into three types: generic measures applicable to all sectors, controlling internal use and sector specific initiatives.

Water audits are used to identify potential water saving measures. The City of Toronto supports water audits in the IC&I sector and in the past had provided workshops for over 100 IC&I customers. Cooling water reduction addresses a large use for water, once-through cooling. The remedies vary from installing a closed loop, reusing the water to cool other equipment, better control of flow rates, or converting from water to air cooling. Re-using greywater involves capturing used water that has not been exposed to sewage and using it for irrigation or flushing toilets. Deep Lake Water Cooling will soon be an alternative.

The City of Toronto employs special programs to better control the consumption of water in its facilities. A computer controlled irrigation system for parks, golf courses, street medians etc., uses weather station data to calculate the correct amount of water needed on a daily basis.

Industries have specific initiatives that are unique to their sectors. For example, the hospitality industry offers considerable potential to improve efficiency through replacement of fixtures and appliances and through decreasing its water use by implementing voluntary laundry service reduction.

5.3.4.5 Rate Structures

Three factors that determine the price charged to water consumers include the type of costs included in the water rates, the rate structure, and the price per unit of water. Full-cost pricing includes all the direct and indirect costs of water supply and sewage treatment on the water bill.

Some rate structures encourage efficiency while others do not. Conservation related rate structures, inclining block rate schedules), seasonal rates (higher rates during peak seasonal demand periods provide a direct incentive to save water because the more water consumed, the higher the cost to the consumer. Providing information on the water bill enables customers to make wise decisions and reduce water-use. A new water bill was developed in 1999 to help customers see their actual consumption on a monthly basis and compare their consumption to the City average of 250 litres per person per day. The water meter installation program allows consumers that previously paid for water on a “flat rate” to measure actual water use and be charged only for water that is consumed.

5.3.4.6 Regulations

Regulations have already had a significant effect on future water use in Toronto through the Ontario Plumbing Code. Since 1996, it has mandated water efficient fixtures in all new construction (W&ES, Fact Sheets, 1999). City of Toronto residents are familiar with summer lawn watering restrictions. These restrictions have in the past been voluntary, but these could be mandatory if necessary.

5.3.4.7 Education and Awareness

Many water efficiency programs depend on individual actions for their success. Public education and awareness is an essential strategy that the City of Toronto has implemented through public education and promotional programs, formal school and community wide training programs. The City's program has included newspaper, transit shelter and radio advertisements, a semi-annual water efficiency newsletter for City residents, a media relations program, distribution of education materials such as pamphlets, fact sheets and booklets and water efficiency displays are used at trade shows, malls and special events. Major capital improvement projects have been undertaken and are planned to help improve water quality. Water quality at Toronto's beaches has improved and will continue to improve with the implementation of both City and community projects.

5.3.5 Rehabilitation and Restoration of Natural Habitats

In recent years, a significant amount of rehabilitation and restoration has been done in parts of the City of Toronto. As well, tree planting (by the City, TRCA and specially community interest groups) and terrestrial and aquatic restoration has taken place. The results so far have been very positive.

Many of the aquatic habitat rehabilitation actions have been undertaken by the City of Toronto and others co-ordinated by the TRCA with financial assistance from the City of Toronto, Environment Canada, the Ministry of Natural Resources, and the Ministry of the Environment. The City of Toronto, Ministry of Natural Resources, and many community groups have also been responsible for leading habitat rehabilitation initiatives. These activities include restoring greenspace, reforestation, stream bank stabilization, aquatic habitat enhancement, increasing fish stocks and the population of other aquatic species, creating wetlands, watercourse naturalization (e.g. “daylighting of former creeks and streams”), and increasing local awareness. Projects include:

- Lake Trout Spawning Shoal - Colonel Samuel Waterfront Park (1997-);
- Chester Springs Wetland - Lower Don Lands (1995-);
- Estuary Wetland Creation Project – Mimico Creek (1992 -);
- Terraview-Willowfield – Scarborough (1996-98);
- Mud Creek Restoration & Wetland – Don Brickworks (1995-);
- Shoreline Regeneration - Sylvan Avenue (1994-);
- Markham Branch Renaturalization of about 2 kilometres of Highland Creek (1997-2000);
- Scarborough Dunker's Flow Balancing System - includes a wetland component (opened 1999);
- Etobicoke Stormwater Management Facility – includes a wetland area; and
- Centennial Creek EcoPark stormwater facility, wetland, Renaturalization (opened 1999).

5.3.6 Efforts at Other Levels of Government

In October 1997, Environment Canada and the Ontario Ministry of Environment signed an agreement with the Waterfront Regeneration Trust and the Toronto and Region Conservation Authority to provide leadership and coordination for the implementation of the Remedial Action Plan (TRCA, 1999). Their activities include:

- organizing the annual Clean Waters summit bringing all stakeholders together to assess progress, collaborate successes, share information and set directions for future work;
- presenting annual awards of excellence for work in areas of water quality, habitat restoration and outreach/education to schools, businesses, agencies and community groups;
- preparing the annual RAP progress report;
- producing newsletters;
- monitoring;
- developing watershed initiatives; and
- delivering the "RAP on Wheels" program.

The Ministry of Environment (MOE) retains its joint responsibilities with Environment Canada under the Canada-Ontario Agreement respecting the Great Lakes Ecosystem. The MOE has a role to play in achieving the RAP objectives through its core business activities of abatement/compliance, environmental planning (including stormwater management and pollution prevention), and monitoring.

Environment Canada maintains all of its responsibilities under the Great Lakes Water Quality Agreement. It continues to participate in the watershed initiatives, and work closely with the TRCA and the WRT to ensure that the RAP goals are being met. Environment Canada has also committed to using its databases and scientific knowledge of the Lake Ontario ecosystem to conduct preliminary work on delisting targets and criteria.

5.4 Water Environment Strategy and Planning

The amalgamation redesign of the City of Toronto included administrative strategies such as the establishment of key offices to work together to improve the conditions of the water environment. The development of an effective overall water quality strategy for the City that integrates and communicates all of the separate and joint initiatives will require contributions and expertise from many departments. These groups will include Works and Emergency Services (Water & Wastewater Services Division and Technical Services Divisions), Urban Planning & Development (City Planning Division), Economic Development, Culture & Tourism (Parks & Recreation), Community & Neighbourhood Services (Toronto Public Health), and the Chief Administrative Office, and will reflect the mandates and activities of these departments. The City is well positioned to collaborate with governmental agencies, such as the Toronto and Region Conservation Authority and the Waterfront Regeneration and the public to develop a comprehensive water quality strategy for the City.

Embarking on a comprehensive water quality strategy is timely. A recent survey conducted by COMPASS Inc., determined that 86% of Ontario residents are concerned about the quality of our drinking water and these people are not confident that action will be taken to improve both the quality and quantity issues relating to the water environment. Water quality, including the quality of our drinking water, will undoubtedly be one of the biggest environmental problems that our City has to face as we head into the next millennium.

6.0 Conclusions

Improving water quality in the City of Toronto requires strong commitments from all levels of government, the community as well as every citizen. The watercourses and the near-shore waters of Lake Ontario have been impacted from years of human use. Reducing stress on the water is vital to the overall health of the ecosystem, including human health.

Demographic trends and land use will also have implications for the water environment. Increasing populations in the City as well as in the Greater Toronto Area will raise the demand for the supply of water. This added stress must be offset by effective water use efficiencies. This growth in population places enormous pressure on current wastewater, stormwater, and water supply systems. This reinforces the need for effective “at source” controls for discharges and run-off, and for the continued requirement for stormwater management measures to be considered as part of all new developments, and in retrofit projects.

To improve the conditions of the water environment on the water environment, the City of Toronto needs a comprehensive water quality strategy and plan to minimize human impact on the water environment. This will require contributions and expertise from the policy, technical and operational units created by amalgamation, other relevant departments and divisions, all governmental levels, and the public. An overall water quality strategy would include, and not be limited to, surface water quality priorities, infrastructure planning and maintenance, wet weather flow management, effective monitoring of watercourses, by-laws, development review, rehabilitating and restoring aquatic habitats, public education and awareness, and pollution prevention. An increased understanding of the City’s groundwater conditions will augment on-going research and investigation into the City’s surface water quality.

In particular, public education and awareness; multi-stakeholder, integrative and holistic planning and management; partnerships that include information and resource sharing, will be key strategies to building a healthier urban ecosystem. Increasing everyone’s awareness on water issues will raise everyone’s commitment to reducing contaminant loadings, increasing water conservation and efficiency, remediating water conditions, and rehabilitating and restoring natural aquatic habitats.

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Appendix A: Acknowledgements

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