STORMWATER MANAGEMENT:

Emerging Planning Approaches
and
Control Technologies

CHAPTER 4

" INTEGRATING WATER MANAGEMENT OBJECTIVES INTO MUNICIPAL PLANNING PROCESS"

CHAPTER 4

4.1 *INTRODUCTION*

4.1.1 *Training Objectives*

The goal of this Chapter is to develop an understanding of:

1. the global objectives of watershed management from a historical and municipal perspective,

2. key environmental issues of importance in watershed management such as flood hazard, water quality impairment, erosion and baseflow depletion,

3. the relationship between municipal land use planning, Capital Works planning and the water resources planning process,

4. the policies addressing water resources management in the municipal environment, and

5. implementation of Stormwater Management policies.

In this module, the municipal land use and the capital works planning processes are reviewed within the context of water resources management, and in particular stormwater management.

4.1.2 Background

A watershed can cover an area that would include many municipalities. While land use planning may be similar, the planning of capital works projects, the operation procedures and requirements vary from municipalities to municipalities. This makes a watershed plan more difficult to formulate and nearly impossible to implement.

Water and related resources are a matter of provincial significance because they are essential elements of our natural ecosystem. They sustain human, plant and animal life, and are important for agriculture, recreation, industry, energy production, domestic purposes, among a myriad of uses. A reliable supply of clean water is fundamental to our economic, as well as social and individual, well-being. Municipalities have to implement Provincial objectives and policies all while responsibly managing the diminishing funds available through transfers

and realty taxes. In municipal planning, this means a fierce competition for funding between transportation, library needs, parks needs and water resources needs.
Municipal stormwater should be managed as a natural and sustainable resource. There is general concern, among water resource managers and the public alike about the condition of Ontario's water resources, in terms of both quality and quantity. Many municipalities are facing tough challenges in the protection of water supplies, the provision of water-based recreational opportunities, maintenance of fish habitat, flooding and erosion control, and general maintenance of the quality and integrity of rivers, lakes, groundwater and wetlands. To help municipalities, many tools are available. These are simplistically separated into two categories.

- Preventive/protection tools, such as the land use planning process, the public education, community outreach, watershed planning; and
- Remedial tools such as capital works planning, infrastructure renewal, sewer needs studies, pollution control studies, MISA, and Environmental Assessment studies.

In all circumstances, it is important to consider the sustainability of the water resources, and to manage them as effectively as possible, so that present and future generations will not need to bear the cost of necessary remedial works.

4.1.3 Review of Municipal Organization

A municipality is both a corporation and another level of government. As a government, permitted under the Municipal Act, a municipality may enact by-laws that in effect are laws within the physical boundaries of the municipality (i.e., Smoking Bylaw, Noise By-Law, Sewer Use Bylaw). To carry out its responsibilities and functions, a municipality sets a mill rate used to set the realty tax amount for each lots and parcel within its boundaries.

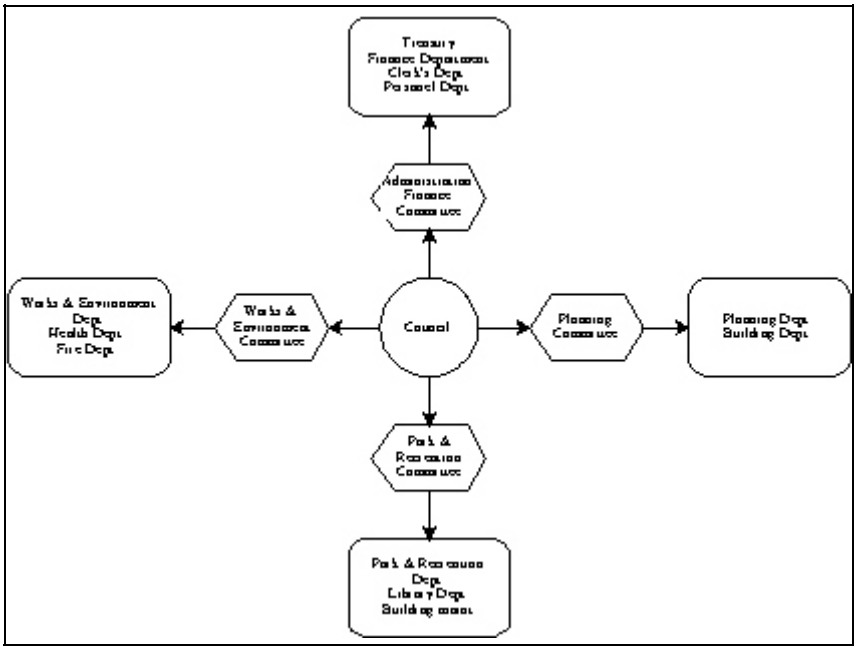


Figure 1 Municipal Organization

A council governs a municipality, made of councillors directly elected every 2-3 years by its residents. These councillors do not represent any political party, although political partisanship is common. To facilitate approval,

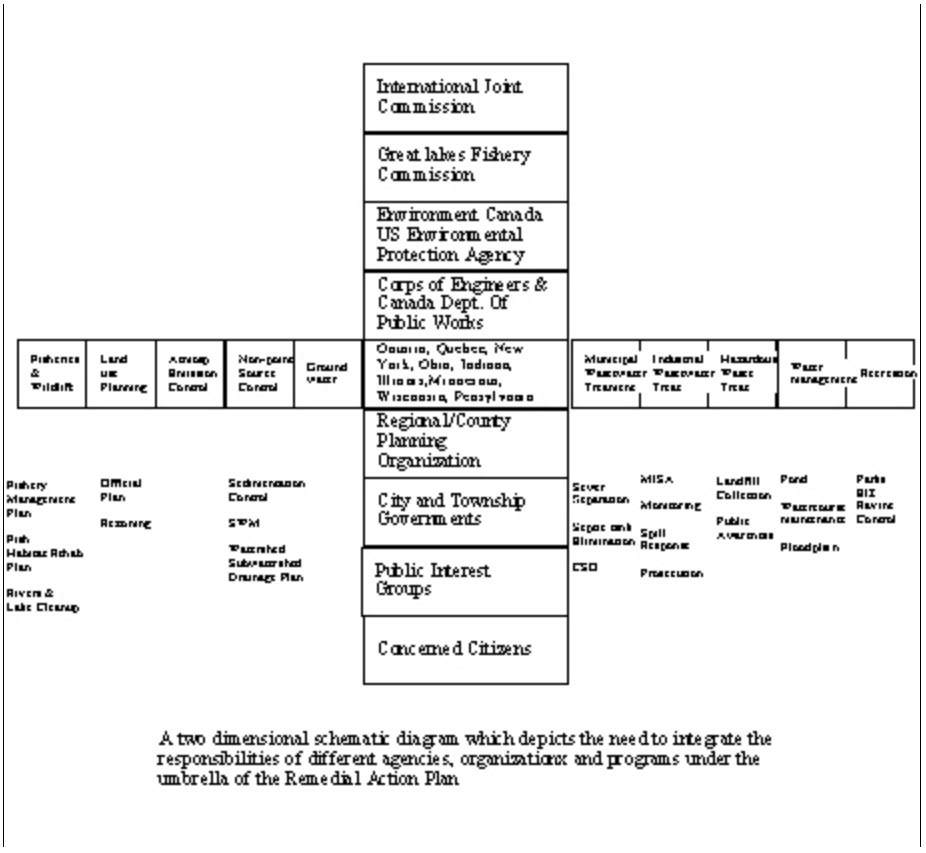
council receives reports from various Committees. Staff's reports are first reviewed and debated at these committees. Public presentations (also called deputations) are made at both Council and Committee level. Staff must be present at both Council and Committee to answer any question. (Figure 1)

As a corporation, a municipality is subject to all liabilities and laws applied to a private organization. However, its finance is annually subject to review and approval by the Ontario Municipal Board. It must carry insurance for negligence, accidents, torts, nuisances etc.(Ie Scarborough Golf & Country Club VS City of Scarborough). It may borrow monies (Debenture) against future revenue (usually 13-16 %) to carry out its Capital Works and Expenditures. Salaries and Studies are from Current Budget.

4.2 *HISTORY OF WATERSHED PLANNING*

Human activities can influence natural processes. It is apparent that the greatest proportion of water management problems and issues arise from human activities themselves. Urbanization and human activities impact our water resources. These impacts include degraded aquatic communities, loss of water supply, groundwater contamination, deteriorating water quality, and increased flooding and erosion. The population, in general, is becoming more aware of, and supportive of, the need for environmental protection and wise management, and its close relationship to the province's economic health.

Because of its closeness to the community and the public, a municipality is ideally suited to deal with many issues related to stormwater management, Watershed Planning, and Remedial Action Plan (figure 2). Traditionally, municipalities have always been responsible for drainage. Many Provincial Acts allow municipalities to plan, construct and maintain drainage facilities. Some of these Acts also allow two Municipalities to enter into an



A two dimensional schematic diagram which depicts the need to integrate the responsibilities of different agencies, organizations and programs under the umbrella of the Remedial Action Plan

Figure 2 Remedial Action Plan

agreement to receive and discharge storm runoff to each others (i.e., Markham & Scarborough). The Conservation Authority Act allows a Municipality to enter into an agreement with the Ministry of Natural Resources to be a member of a Conservation Authority. In doing so, a municipality must also cost-share the Capital Cost and Current cost associated with the Conservation Authority.

Water management in this municipal context is a complex and challenging dilemma -- to use water wisely for beneficial uses, and to maintain the integrity of the ecosystem for its intrinsic value, for all life's sake. The Royal Commission on the Future of the Toronto Waterfront expresses the same view this way:

> *"Traditionally, human activities have been managed on a piecemeal* basis, *treating the economy separately from social issues or the environment. But the* ecosystem *concept holds that these are inter-related, that decisions made in one area aff'ect all the others. To deal effectively with the environmental problems in any ecosystem requires a holistic or 'ecosystem' approach to managing human activities. "* Watershed, 1990

Figure 4-3 schematically presents the evolution of Subwatershed Plans throughout the 1980s and early 1990s. As illustrated, Subwatershed Plan issues grew from five engineering drainage related issues in the early 1980s to some 18 issues in 1990. By the late 1980s, there was the expectation that Subwatershed Plans should go beyond mitigating impacts associated with development to make recommendations for the protection and enhancement of the natural resources/features. These new objectives and approaches to Subwatershed Plans were influenced by the concepts of ecosystem planning and sustainable development that gained profile and support during this same period

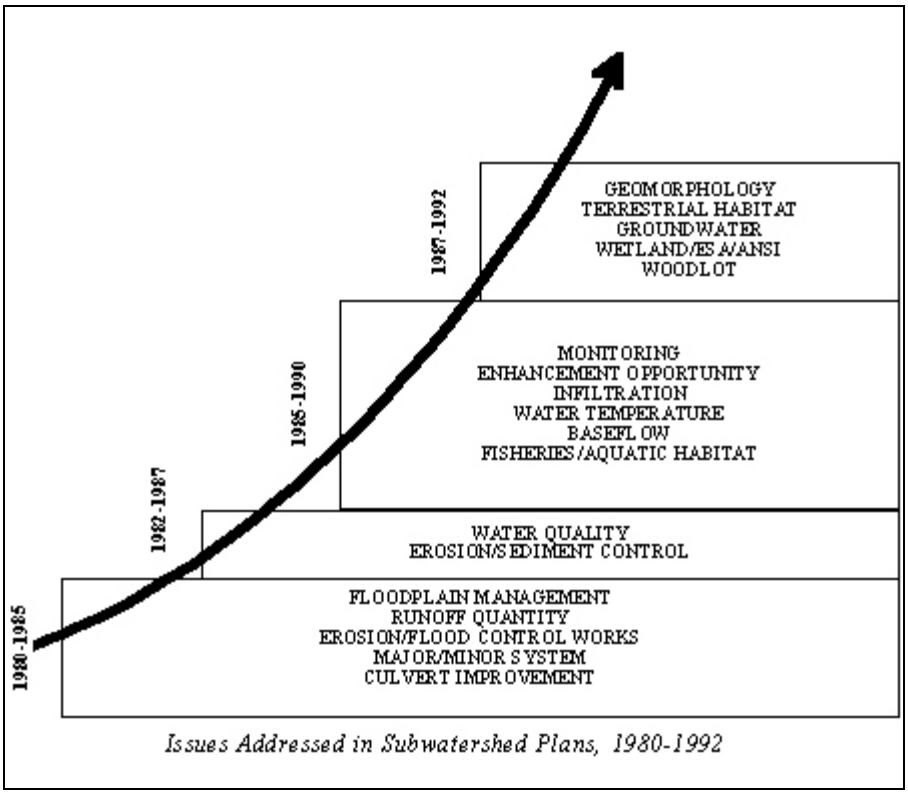


Figure 3 Evolution of Stormwater Management

4.3 STORMWATER MANAGEMENT ISSUES

Runoff Quantity Control:
Traditionally, stormwater issues were primarily focused on flood hazards. Stormwater was viewed as a "nuisance"; something to be rid of, and the stream channel was thought to be merely an extension of the urban storm sewer system. Resolution of flood related problems was the primary rationale behind the creation of Conservation Authorities (CAs). During the 1950s and 1960s the CAs were involved in the construction of numerous large flood control reservoirs. The Fanshaw, Clairville, and Kelso reservoirs are legacies of this era. The role of urban stormwater in the creation or aggravation of flood hazards within flood sensitive areas, although identified in the 1930s, was not effectively recognized until the 1960s and 1970s.

Urban hydrology, a key element of stormwater management, became recognized as a distinct area of specialization during this period and the concept of stormwater management became a means of restoring the storage characteristics of an urbanized watershed back to pre-development conditions. Stormwater management (SWM) was developed for quantity control of large, flood producing, runoff events. At this stage, SWM encompassed the use of pipe storage, dry ponds, and rooftop/parking lot storage, for control of flow rate and erosion.

Runojf Quality Control:
Although its significance as a pollutant source was recognized decades earlier, concern with regard to the quality of urban stormwater runoff did not begin to emerge until the 1960s. However, it was still considered secondary to major Point Source (PS) pollution sources such as industrial effluent, combined sewer overflows (CSOs), and primary Sewage Treatment Plant (STP) discharges. It was not until the late 1970s and early 1980s, after a massive effort to cleanup these other pollutant sources failed to produce the desired water quality in the receiver, that more attention was focused on contaminants in urban stormwater runoff. During this period facilities for water quality control were primarily detention-based controls, such as wet ponds or extended dry ponds, supplemented with street sweeping and catch basin cleaning.

Erosion Control:
The impact of urban development on stream channel morphology was identified in the late 1950s and early 1960s. However, the typical response to stream instability problems up to the 1980s, was to "improve" the channel. This involved various combinations of straighten.ing, grade control, and hardlining of the stream. By the late 1970s and early 1980s the view of the channel as an extension of the sewer system gave way to an understanding that the stream channel and its valley system are amenities and as such, resources to be coveted and maintained or enhanced.

Baseflow Maintenance:
Baseflow represents that river or stream flow which is associated with dry weather periods.

It was recognized that urbanization may impact groundwater recharge and the storage characteristics of the surface water system. Until the 1980's, when baseflow depletion became an environmental issue in response to fishery concerns, conflicts regarding baseflow were principally focused on conflicts surrounding water taking activities.

Baseflow maintenance is now addressed, in part, through constraint mapping and land use zoning which are designed to exclude or restrict development in recharge areas.

Present Philosophy:
In the late 1980s the piece meal approach to stormwater management began to be replaced with a more holistic approach based on ecosystem concepts. Under the traditional approach, development was imposed on the landscape with little regard for natural features and designed channels replaced natural drainage systems. Present approaches attempt to integrate natural resource features and land use planning to strategically locate developable areas and identify constraints and opportunities for stormwater management facilities within these areas.

As watershed plans and programs were completed and endorsed in southern Ontario in the early 1980s, the Master Drainage Plan was promoted and subsequently recognized as the preferred mechanism for the planning and design of urban drainage systems to minimize impacts of urban stormwater runoff on receiving watercourses. Although these Master Drainage Plans often recognized the importance of meeting broader environmental objectives of the watershed plans, they generally addressed only the quantity of urban runoff and its impacts and influences on flood control, erosion control and major/minor system design.

In the mid-to-late 1980s, a fundamental change occurred when the requirement to address the quality of runoff from urbanizing areas was introduced. Initially, water quality concerns focused on sediment control during construction. In addition, the importance of treating storm runoff for water quality in order to address fisheries protection and other water use issues was recognized.

Concerns for the protection and enhancement of the aquatic environment in general and fisheries resources in particular (as it relates to their value as an environmental indicator), grew to encompass a broader range of issues to be addressed including the maintenance of baseflow, cool water temperature, and stream geomorphology. More recently, the protection of terrestrial resources and ground water systems has introduced new areas of study into these analyses and urban designs.

The concept of using watersheds and subwatersheds for land use and resource management is appropriate for a number of reasons:

1. Water continuously moves through watersheds and influences many life cycles and

physical processes throughout its cycle.

2. An action or change in one location within a watershed has potential implications for many other natural features and processes that are linked by the interactive movement of surface and groundwater.

3. Water movement does not stop at political boundaries, so that watersheds and subwatersheds may encompass all or part of several municipalities.

The Ganaraska Region Conservation Authority was the first agency established on a natural resource boundary basis. This occurred almost 50 years ago, in 1946. The *Conservation Authorities Act of* 1946 established "conservation authorities" with jurisdiction over natural areas based on watersheds. Conservation authorities are the only agencies in Ontario with administrative borders based on surface water drainage boundaries. This makes them particularly well suited for coordinating watershed management activities. There are 38 conservation authorities (CAs) in Ontario; five of these are in Northern Ontario.

Environmental studies have been conducted in Ontario since the 1940's, but these were largely inventories of existing conditions in the watershed. Over time, the complexity of these studies increased and evolved from simple assessments to multidisciplinary studies that are moving toward consideration of the carrying capacity and integrity of the ecosystem. Clearly, there has been a shift from remediating problems to proactively protecting and enhancing the environment.

4.4. MUNICIPAL PLANNING PROCESS FOR WATER RESOURCES MANAGEMENT

A municipality should not rely only on the Municipal Land Use Process to implement provincial stormwater management objectives and directions. Available are many other municipal programs such as the Capital Works program, Maintenance program, Parks program (ie. Rouge Park), Community Outreach program (ie Fishing Week, Paint-a-Fish, Tree planting, Rain Barrel).

4.4.1 Municipal Land Use Process

The major trait of the Municipal Land Use process is the need to urbanize. The process is triggered by the Development Industry when the economic climate is best suited for housing supply. In most case, the Land Use Process deals with land that was previously farm land,

woodlot or floodplain and it deals with the creation of subdivisions. Where land was previously developed, integrating water management objectives is more difficult and will be dealt with in subsequent sections.

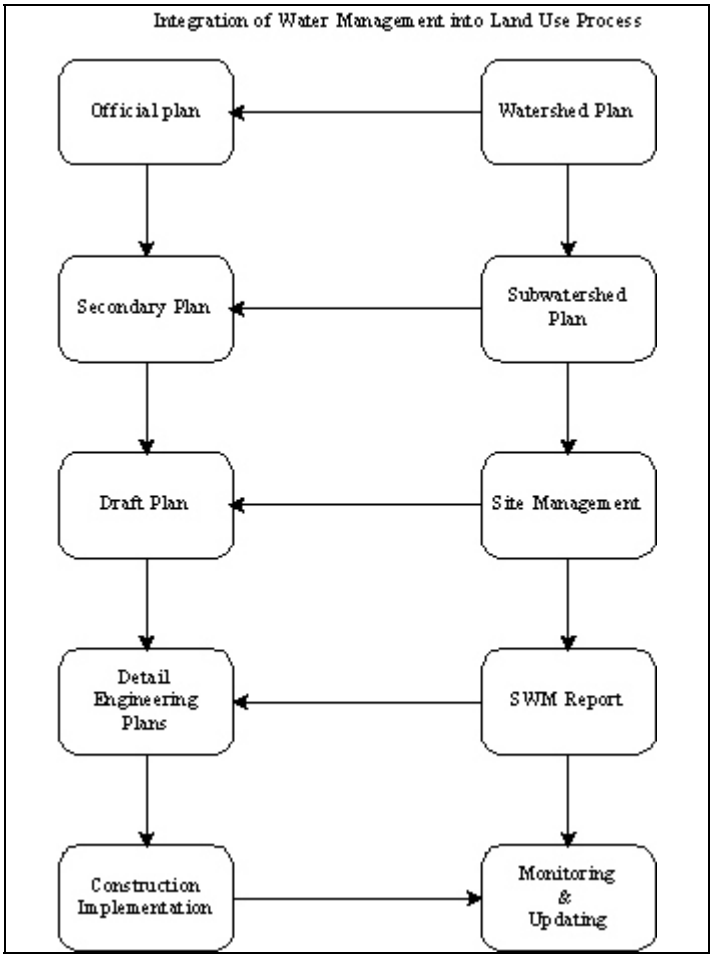


Figure 4 Municipal Land Use Process

Under the *Planning Act,* the municipal land use planning process sets out a distinct framework for the development of environmental, social and economic goals and objectives for the municipality. To achieve this, a municipality must follow a set of steps requiring public input and consultation.

The Official Plan

An Official Plan is a Policy document of the municipal council, which sets out the municipality's views on how land should be used in the community. It provides direction for future planning activities. It deals with location and size of school, parks, residential, industrial, commercial lands, major transportation issues, environmental conservation and protection in broad terms and the services required for development to occur in an orderly fashion. The Official Plan contains policies that guide future municipal expenditures for road, water supply, sewage disposal and other public facilities. Certain recommendations of the Watershed plan should be incorporated into the Official Plan. In general, the policies of the official plan should clearly recognize the importance of the quality of surface water and related resources to the environmental, social and economic well being of the municipality. The policies should also reflect the municipality's commitment to maintaining the quality and quantity of water and related resources to maintain the integrity and well-being of the aquatic ecosystem. These policies should address the following environmental issues;

- *Commitment to Integrated and Coordinated Water Resource Management*
  Municipalities should support and seek the fullest possible participation in the water and related resource management initiatives of other agencies in order to develop comprehensive integrated water and related resource planning programs.

  Where a watershed plan has been prepared, for example, by a conservation authority,

in consultation or partnership with the Ministries of Environment and Energy, Natural Resources and the municipality, the mun.icipality should incorporate relevant parts of the watershed management plan into the official plan. When a watershed plan is in preparation but is not yet finalized, the municipality should state its intention to re-evaluate and, if necessary, amend its official plan to incorporate new water resource management policies contained in the watershed plan.

- *Maintenance of Natural Watercourses*
  The official plan should contain provisions to protect and maintain all lakes and streams as natural distinct ecosystems. In this regard, land withi.n the area of influence should, wherever possible, be retained in or rehabilitated to a natural vegetated riparian state. Modification to stream or lake beds should be prohibited or limited by strict conditions.

  Specific building setbacks for riparian lands should be developed in consultation with the Ministry of Natural Resources and the local conservation authority. Streams, lakes and associated setback areas, as components necessary to the integrity of natural systems, should be placed in appropriate restrictive designations and zones in the official plan and comprehensive zoning by-law. These provisions will have the effect of prohibiting the placement or removal of fill, buildings and structures, except those structures required for erosion and sedimentation control, and conservation purposes.

- *Control of Discharges to Surface Water and Groundwater*
  Municipalities should make every effort to prevent or avoid, if possible, the discharge of untreated municipal sanitary sewage and contaminated stormwater runoff and land drainage to receiving water bodies. The official plan should recognize that it is unacceptable for the municipality to route urban stormwater/drainage through concrete channels. In other words, municipal land drainage systems should be maintained in their natural conditions, and underground sewerage should be minimized. If these are required in isolated cases for the protection of life or property, however, they must comply with provincial requirements. Accordingly, municipalities should adopt by-laws to control waste discharges to municipal sewers, such as the Model Sewer Use By-law. They should also advocate and encourage stormwater best management practices, which include management techniques.

- *Enhancement of Water Conservation Practices*
  Municipalities should adopt policies to maintain and enhance water and related resources by promoting water conservation measures, developing water budgets for ground water aquifers, and should encourage innovative municipal standards such as the use of cisterns and water efficient plumbing fixtures.

- *Water QualitylQuantity Targets*

Policies should be included in the official plan by which the municipality requires that all proposed changes in land use address potential impacts on the quality and quantity of water and related resources by:

- maintaining or enhancing the natural hydrological characteristics including the baseflow of watercourses

- maintaining storage levels in lakes during periods of minimum baseflow, where appropriate, for low flow augmentation

- requiring the development and monitoring of water budgets for ground water aquifers protecting or enhancing a fish and wildlife habitat

- maintaining or enhancing water quality as measured by indicators such as temperature, turbidity, bacterial counts, oxygen levels and nutrients

- prohibiting, and if not possible, minimizing alterations to natural drainage systems by maximizing the retention of natural vegetation and maintaining vegetative buffer strips along watercourses

- prohibiting, and if not possible, minimizing sediments entering a stream or lake to the greatest degree practicable

- ensuring that no persons or property are placed at increased risk due to increased flooding or erosion

These targets should be met on a watershed, subwatershed and site-specific basis.

- *Identification and Protection of Significant Hydrogeological Areas*
  Where hydrogeologic areas exist, such as recharge/discharge areas and headwaters, that are known to be susceptible to contamination, the official plan should include policies to afford them protection from potential sources of contamination. Municipalities, in consultation with the Ministry of Environment and Energy and Health Units, should control land use activities and servicing arrangements so as to reflect the location and extent of areas with differing capacities to sustain long-term operations of on-site sewage systems without ground water or surface water impairment, or risk to public health.

- *Protection of Inland Lakes*
  The official plan should include policies for developing shoreland management plans, which include setting development capacities for inland lakes. These should be developed in consultation with municipalities and agencies adjacent to the same lake

system and the affected public. The intent of these policies is to prevent excessive nutrient enrichment and dissolved oxygen depletion in these lakes as a result of the cumulative impacts of shoreland development.

After establishing a sustainable level of development, the municipality will state in its official plan policies the maximum permissible number of lots allowed on each lake within a watershed and the distribution of lots among municipalities sharing the lake system shoreland.

- *Protection of Human Life and Property from Water-relaled Hazards*
  Policies should be included in the Official Plan to prohibit land uses which threaten human life and property due to the presence of water related hazards including:

  - flood-prone lands
  - soils prone to water related slope instability
  - unstable soils

The Secondary Plan
A Secondary Plan is an amendment to the Official Plan. It covers a smaller area but set more specific policies. It may contain Statutory provision, Planning context, Development policies, specific land use location

For large scale and/or multi-ownership proposals normally requiring a major official plan amendment, a subwatershed plan would be very beneficial to all concerned. This should be developed and approved by the municipality and/or the conservation authority, or the Ministry of Natural Resources and Ministry of Environment and Energy where conservation authorities do not exist. The plan demonstrates how water and related resources will be managed to meet surface and ground water quality and quantity targets. The plan must examine the entire subwatershed's goals, objectives, principles and policies, and not just portions to be occupied by a development proposal. This will require cooperation with other municipal jurisdictions outside the individual area municipal boundary.

An alternative approach may be to define distinct subwatershed units on a separate schedule to the official plan, and specify the timing of studies in support of the development of a subwatershed plan. If possible, subwatershed plans and the official plan should be tied administratively in their development. The official plan should recognize the aims and contributions of watershed and subwatershed planning. This parallelism will help streamline the development approval process. *Where a watershed plan exists, the subwatershed plan will conform to the goals and objectives of the watershed plan.*

The Draft Plan of Subdivision
A Draft Plan is a plan showing lotting proposal. It is a plan used to set condition of

development (i.e., Minister's Conditions) leading to final Approval and Registration. The Plan shows information dealing with road width, Street names, location of School and Parks, and is accurately surveyed.
A variety of site-specific plans are prepared in support of draft approval of plans of subdivision, and other development applications which require the use of site plan control. Familiar examples are stormwater management plans, flood control plans, sediment and erosion control plans, and plans for servicing of roads, water and sewers. These plans specify how requisite servicing and environmental design/management needs will be addressed in a manner satisfactory to the local municipality, conservation authority, and where appropriate, provincial agencies.

When site management plans are formulated in accordance with principles and targets of the subwatershed plan, the site plans are more effective, the objectives of the subwatershed plan have practical application, and the environment generally benefits. Where this has occurred, the review agencies may consider it unnecessary to review individual site plans, because those plans have been developed according to criteria identified in the subwatershed plan. Approvals for the construction and operation of facilities identified in these plans, however, may still be necessary under specific legislation administered by provincial ministries.

When specifications for facility design, performance and location are established in a subwatershed plan, it has been shown that both time frames and expenditures are reduced for completing detailed field studies, design work and environmental assessments for site management facilities. The advantage of this overview of site management in the subwatershed plan is not only a set of criteria for site planners to follow, but also consideration of site management on a systemic basis. Facilities are not considered on their own but as part of a range of optional facilities and locations, for example, for stormwater management, or for flood and erosion control measures that take into account downstream considerations.

Where no subwatershed plan or watershed plan exists, it is difficult to assess overall cumulative impacts of land use on water and related resources. In these situations, measures should be taken to minimize, to the extent possible or practical, the impacts on water and related resources, in a manner satisfactory to MNR and the local conservation authority. For small scale development proposals normally processed as severances, site planning and spot zoning by-law amendments, water resources management will be limited to the identification of specific stormwater, erosion and sedimentation control design and construction measures.

In all situations, local by-laws can be used to address routine site management requirements, e.g., topsoil protection, urban forests, sensitive terrestrial habitats.

Detail Engineering Drawings
When a subdivision has received a Draft approval, Engineering Drawings and a Subdivision

agreement are prepared. These are reviewed for compliance with Municipal Criteria, Provincial Guidelines and Approval. At this stage, the following should be submitted to approving agencies;

- Engineering Drawings should show road plans and profiles, sanitary and storm sewer, sewershed plans, grading plan, any watercourse work details, a major/minor flow plan, detail drawings of any structural BMP's, location and species of material used in soil bioengineering and Erosion/Sedmentation Control Plan.

- Stormwater management report should accompany the engineering drawings. The report should show calculation for major and minor flow, volume calculation, stage-discharge calculation, any backwater calculation, storage calculation, and any sedimentation calculation. The report should outline the sources of material and the species of material used in the constructed wetland.

- Landscaping drawings should show tree preservation measures, number and calibers of proposed species of vegetation and plants. Along watercourses, it may be necessary to show a plan of vegetation at planting stage and a plan showing plants at maturity. This provides an indication of future canopies (about 80% at noon).

Construction
Construction of services may start as soon as an MOEE's Certificate of Approval is received. In many case, this may occur before the Final Approval and Registration of the Subdivision Plan. For work in or near a watercourse, construction should follow construction timing to respect the protection of Fish Habitats and requirements. Additional approvals are required for watercourse works, outfall constructions, watercourse crossing, cut and fill operation and for the taking of water from the watercourse.

Prior to any disturbance of soil or any construction activities, limits of buffer zones are delineated, erosion and sedimentation control measures implemented and location of stockpiles established.

4.4.2 *Other Municipal Planning Processes*

Land use planning process is not the only one which can benefit from the proper planning and management of water resources. As a municipality grows to full maturity, the importance of municipal land use process shifts from subdivision to Intensification, Infill and Severance, The infrastructures are reaching their lifespan or are not meeting new Provincial or Federal directions (ie., Remedial Action plans) and must be repaired, replaced, retrofited and remediated.

The main traits of a Remedial Plan is the lack of space, lack of natural features to protect,

lack of rehabilitation vision, lack of points sources, need for spill control, importance of aesthetic, lack of examples and a more aggressive public. In the past, remedial works were driven by the need to minimize the maintenance and operation cost, which came from Current budget.

Lack of Space

To carry out the construction of Quality/Quantity ponds requires space to build them. In many municipalities, ponds have been constructed on Utilities Corridors and existing parks. However this creates a different problem. Where a wet pond can be a focal point for a new subdivision, in a retrofit situation, it become a liability. Constructed in parks, the design of these facilities requires that attention be paid to how quickly the pond will fill. In some existing retrofit pond, alarms have been installed and connected to nearest Works yard. The requirements for buffer zone is nonexistent in a mature municipality. The best that can be hoped for is the adoption of municipal Bylaw protection of valleys and ravines such as Scarborough's Ravine Bylaw, Toronto's Tree Bylaw.

Lack of Natural Feature to protect

During the planning of a subdivision, the preservation of trees, ANSI's, ESA and EIZ is identified in the watershed plan, the subwatershed plan and during the subdivision review and approval process. In the remedial situation, it becomes important to save each and every trees along any streets. Planned properly, it is possible to minimize the root destruction during excavation. In the reconstruction of Queen Mary's Drive, in the City of Etobicoke, municipal Forestry Department staff provided care, inspection and fertilizer for each individual tree to ensure their survival, **one year** before the actual reconstruction of sewers. During the construction, deflectors were fitted to heavy equipments' mufflers to divert heat from the foliage. The same type of care was shown during the 1.7 Km rehabilitation of Berry Creek, also in Etobicoke. Earthmoving operations and removal of concrete and gabion were carried on one side of the creek only to preserve all vegetation on one side of the creek. None of the vegetation in the two examples have any provincial, federal values.

Lack of Rehabilitation Vision

Up until recently, rehabilitation means meeting transportation needs, operation and maintenance schedule and structural adequacies. In mature municipalities and in the development of a comprehensive remedial plan, the Vision of an "Urban Environment" still needs to be defined. The simple requirement of post to predevelopment flow is total meaningless. The vision of "Fishable, Drinkable and Swimmable" may be achieved in the Rouge River in Scarborough, but can the same be said in the Black Creek?

Need for Spill Control

In mature municipalities, spills are more frequent for several reasons. In older areas, oil furnace still is the predominent form of heating. For each filling of home heating tank, the chance of a spill increase. In new subdivisions, this problems does not exist. Hydro

transformers located at the top of poles still pose a great risk of spills. Table 1 represents oil spills that occurred in Metropolitan Toronto in 1993 and 1994.

TABLE 1: SPILL LOCATION IN METRO TORONTO (1993 & 1994)

Location	No. of incidents	Volume in Litres
Gas Stations	45	53,012
Parking	103	83,957
Transformers	79	4,358
Storage Depots	57	29,092
Buildings with oil furnace	19	5,672
Others	305	46,238

Importance of aesthetic

Because past remedial works have been more concerned with their use by people, the planning of these works never considered the creation of wildlife and aquatic habitats. To the human eyes, the parallel lines of curbs and gutters and of a concrete channel, the curvilinear alignment of a pathway, the cut grass along the edge of a creek, all give a sense of an orderly society. To achieve this aesthetic, functionalities of waterway and vegetation have been sacrificed.

Lack of examples

Again until recently, there were very few examples of remedial works that took a holistic approach to its planning and execution. In the area of natural channel design, the present science and technology have not provided sufficient tools to create a cold water fish habitat. To remove a concrete channel and replace it with vegetation is not sufficient. Previous floodplains have been filled, taking the storage capacity, meanders have been straightened, increasing velocity and resulting in higher energy to be dissipitated. Baseflows are non-existent, and where there is one, the temperature and the concentration of pollutant make it unsuitable for any aquatic and benthic life. But most important, there is a lack of remedial technology available.

A more aggressive public

A public meeting in a mature municipality would draw a bigger crowd than in a developing municipality. At these meetings, the public is more vocal, is more coordinated and the NIMBYS is more pronounced. The Dunker project and the Toronto Western beach tunnel drew large public opposition despise the fact that these projects were for the cleanup of the

Lake Ontario.

4.5 STORMWATER MANAGEMENT IN REMEDIAL WORKS

4.5.1 Stormwater pollution

In the mid of 1980's the Federal and the Provincial governments started the development of a Remedial Action Plan in 17 Areas of Concerns. In support of the Metropolitan Toronto RAP, the Ministry of Environment and Energy, with the participation of the waterfront municipalities, undertook a wet and a dry weather studies to better quantify contaminants inputs from the 103 direct sewer discharges to the waterfront In 1992, the Ministry released the results, (Paul Theil Associates Limited, Metropolitan Toronto Water Wet weather Study - Phase 1, 1992,) that showed that the annual loadings from storm sewers outfalls are equal or exceed the annual loading from CSO's outfalls. This resulted in a change in the direction of the Remedial Action Plan for these municipalities. Table 2 represents pollutants concentrations from both the Cities of Scarborough and Etobicoke. It became apparent then that very little attention has been paid to the development of a remedial strategy to address stormwater management.

The tools available to carry out remedial works fall into two categories: (Figure 5)

- *Management Option*
  Watershed Plan, Subwatershed Plan, Pollution Control Studies are Administrative tools that can be used by municipalities to manage stormwater. These do not have a direct reduction but provide a framework to integrate remedial works with other works undertaken by municipalities. Operational tools can have both a preventive or remedial values. Spill control is a good example of an operational tool for the prevention of pollution to creeks and lakes.

- *Structural Option*
  Structural option covers Storage, End-of-pipe and Offshore BMP's. Many of these have been developed in the recent years to address the problem of remediation. The Flow Balancing System, the Etobicoke Exfiltration System and the High-rate Treatment are examples of Best Management Practices that have been developed specifically for retrofitting and remediation.

TABLE 2 STORM WATER
ESTIMATED EVENT MEAN CONCENTRATION BY LAND USE

PARAMETER	UNIT	COMMERCIAL	RESIDENTIAL	INDUSTRIAL
GENERAL CHEMISTRY				
Alkalinity	mg/L	103.000	63.300	110.000
Cyanide	mg/L	0.002	0.007	0.002
COD	mg/L	601.000	724.000	837.000
Phenolics	ug/L	17.200	17.400	14.300
Total Sus. Solids	mg/L	220.000	88.600	172.000
Total Solid	mg/L	722.000	307.000	468.000
Solvent Extract	mg/L	7.080	7.910	9.680
Ammonium	mg/L	0.088	0.480	0.190
Nitrate	mg/L	0.990	3.660	10.100
Nitrite	mg/L	0.110	0.037	0.047
Total k. nitrojen	mg/L	1.790	2.370	2.930
Total Phosphorus	mg/L	0.500	0.420	0.650
BACTERIOLOGY				
E-Coli	CH	18,200	155,000	38,800
Fecal Coliform	CH	21,900	289,000	38,300
HEAVY METAL				
Silver	mg/L	0.005	0.003	0.002
Aluminum	mg/L	6.650	1.380	1.570
Arsenic	mg/L	0.001	0.001	0.002
Barium	mg/L	0.074	0.026	0.051
Cadmium	mg/L	0.001	0.001	0.018
Chromium	mg/L	0.011	0.009	0.027
Copper	mg/L	0.066	0.027	0.460
Iron	mg/L	12.600	2.950	5.470
Mercury	ug/L	0.088	0.051	0.039
Manganese	mg/L	0.250	0.120	0.130
Nickel	mg/L	0.028	0.007	0.015
Lead	mg/L	0.084	0.037	0.048
Selenium	mg/L	0.001	0.001	0.001
Zinc	mg/L	0.300	0.120	0.320

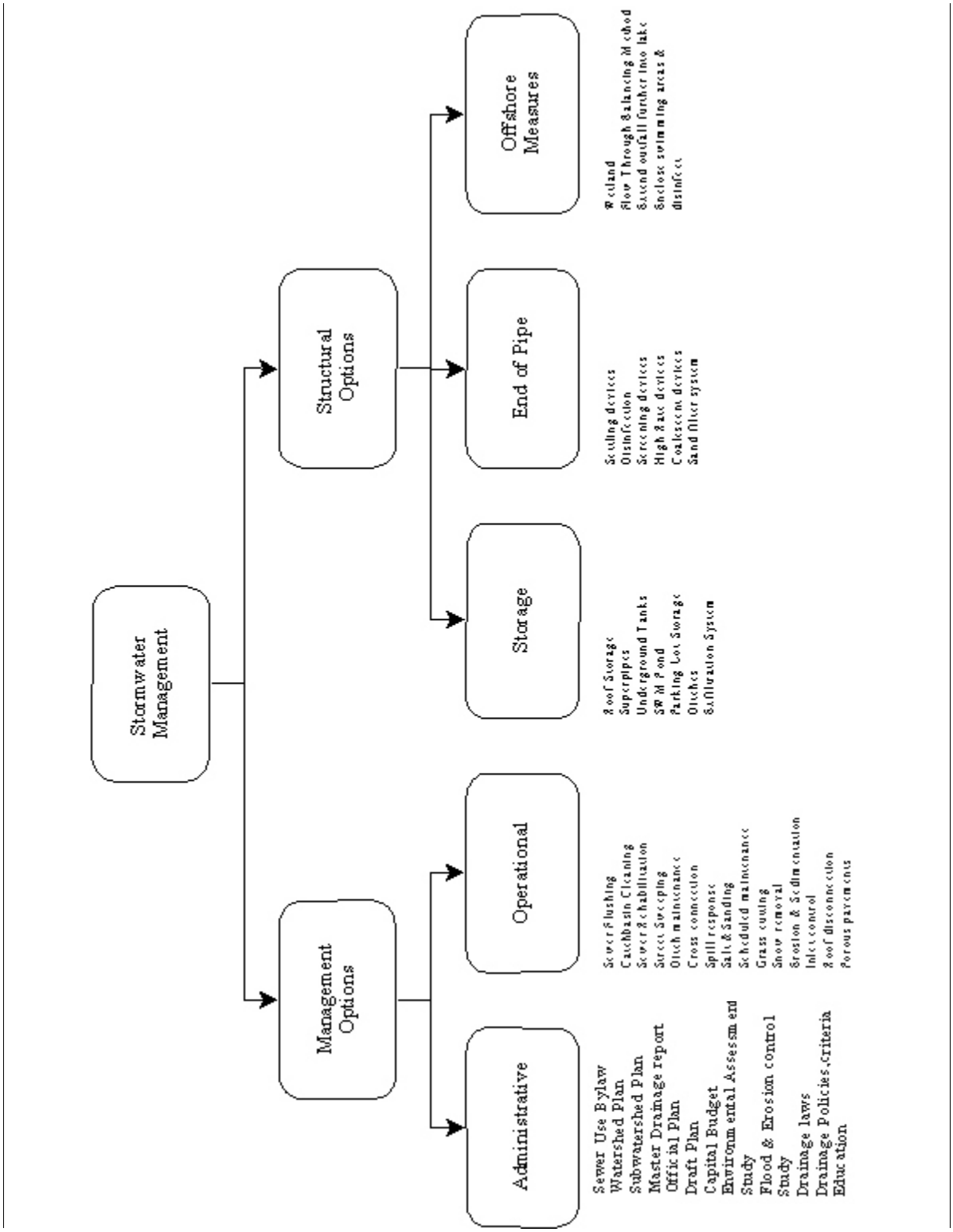


Figure 5 Stormwater Management Tools

4.5.2 Municipal Technology Assessment

Municipalities that are contemplating remedial works, should address many concerns. These have been summarized into a Municipal Technology Assessment developed in the City of Etobicoke. These are;

- Local conditions and physical constraints,
- Design criteria, parameters and methodology,
- Construction techniques, cost and availability of material
- Performance evaluation and effectiveness,
- Maintenance requirements,
- Public acceptance,
- Approval process, and
- Cost benefit and funding.

4.6 DEVELOPMENT OF MUNICIPAL STORMWATER MANAGEMENT PROGRAM

Because of the need to address environmental and water resources concerns throughout all services provided by a Municipality, it was found that the Land Use Planning Process and the Watershed Planning Process did not adequately address these. Being development driven, it did not "trigger" the need to address stormwater quality in maintenance, operation, transportation, watercourse maintenance, winter operations, sanitary sewage and potable water planning.

It was found that the most effective way to achieve the integration of water management into municipal strategies is the development of a single program endorsed and adopted by council. This will provide direction to all municipal departments in the planning and execution of their responsibilities and daily activities. Official Plan would be updated by Planning Department, Parks Department would reduce the use of herbicide in their parks and leave a strip of uncut grass along the water edge of streams and rivers, Works Department must consider remediation of water resource in the execution of their Capital Works program. The Etobicoke's Stormwater Management programme is a good example of how a fully mature municipality dealt with its water resources.

A synopsis of Etobicoke's Storm Water Management Programme is presented.

STORMWATER MANAGEMENT POLICY

"Recognizing that storm water is a resource which can be utilized to improve our physical environment, the City is undertaking a programme to manage the collection and transport of storm water in a manner designed to reduced pollution in the receiving waters while enhancing the physical environment as much as reasonably possible in an economic and well planned fashion. This programme will consider the safety and welfare of residents with due consideration for environmental, social, and legal impacts , and within the framework of applicable Federal, Provincial and Municipal statutes, by-laws and policies."

STORM WATER MANAGEMENT GOALS

- To minimize the risk and threat to life and the destruction of property from urban runoff.

- To protect, and wherever possible, enhance the quality of storm runoff into the receiving waters.

- To protect and enhance the functionality of the City's waterways.

- To re-establish the natural hydrologic cycle as much as possible.

- To implement the Storm Water Management Programme with due regard for the ecosystem.

STORM WATER MANAGEMENT GUIDING PRINCIPLES

- To ensure that adequate major and minor system is provided and maintained for the drainage of surface waters.

- To ensure that storm runoff controls are designed and implemented with due regard for volume, frequency and duration.

- To prevent development in areas susceptible to flooding during major storm events and areas of unstable slopes.

- To take a natural approach to watercourse design and construction by restricting the use of artificial hard surface to only those areas where erosive conditions cannot be controlled by others means.

- To practice and enforce erosion and sedimentation controls during all phases of development, redevelopment or others construction.

- To reduce the number of storm drainage outlets to the receiving waters whenever possible while making provision for storm water treatment facilities wherever possible.

4.7 PLANNING AND IMPLEMENTING REMEDIAL WORK PROJECT

The least disruptive and most cost efficient manner of undertaking any Capital project is to combine several small projects into one. A road reconstruction, for example, should include the reconstruction of storm and sanitary sewers as well as water main. Where a sanitary trunk is located along a gabion channel, an opportunity exists to reconstruct the creek into a natural design type of channel. In most instance each project is carried out independently, thus losing opportunity In all cases, Capital Project should follow closely the Environmental Assessment Process.

4.7.1 ***Environmental Assessment Process***.

Remedial works carried by a municipality usually fall in a Class Environmental Assessment for municipal Road Projects or for Municipal Water and Wastewater projects.

A Class Environmental Assessment (Class EA)is an approved planning document which describes the process that proponents must follow in order to meet the requirements of the Environmental Assessment Act (EA Act). The Class Environmental Assessment (Class EA) approach allows for the evaluation of the environmental effects of alternatives to a project and alternative methods of carrying out a project, includes mandatory requirements for public input and expedites the environmental assessment of smaller recurring projects.

Class Environmental Assessments is a method of dealing with projects which display the following important characteristics in common:

recurring
usually similar in nature usually limited in scale
have a predictable range of environmental effects responsive to mitigating measures.

Projects which do not display these characteristics would not be able to use the planning process of this Class EA and must undergo an individual environmental assessment. Should they do, they would fall into one of the three schedules.

Schedule A projects are limited in scale, have minimal adverse effects and include the

majority of municipal maintenance and operational activities. These projects are approved and may proceed to implementation without following the Class EA planning process.

Schedule B projects have the potential for some adverse environmental effects. The proponent is required to undertake a screening process, involving mandatory contact with directly affected public and with relevant government agencies, to ensure that they are aware of the project and that their concerns are addressed. If there are no outstanding concerns then the proponent may proceed to implementation. If, however, the screening process raises a concern which cannot be resolved, then the "bump-up" procedure may be invoked; alternatively, the proponent may elect voluntarily to plan the project as a Schedule C undertaking.

Schedule C projects have the potential for significant environmental effects and must proceed under the full planning and documentation procedures specified in this Class EA document. Schedule C projects require that an Environmental Study Report be prepared and submitted for review by the public. If concerns are raised that cannot be resolved, the "bump-up" procedure may be invoked.

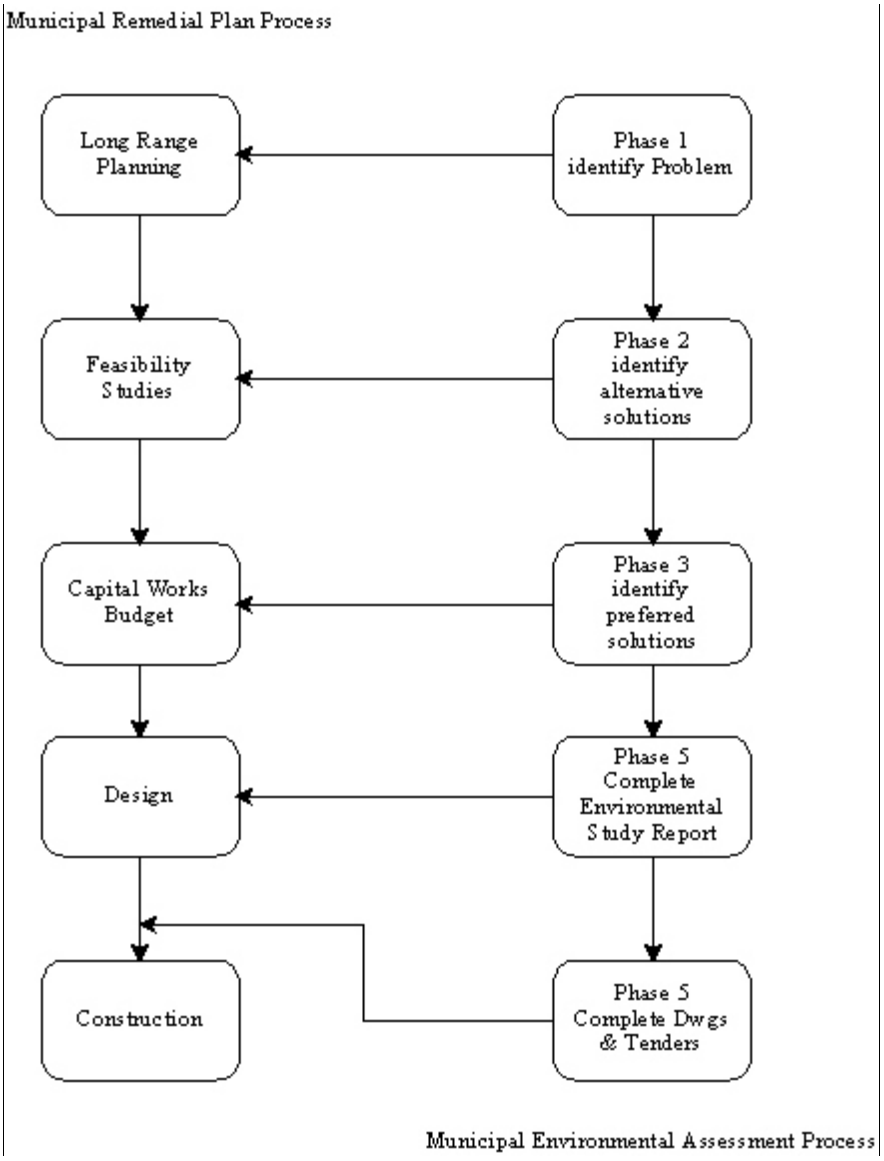


Figure 7 Remedial Works Process

The Class EA planning process represents an alternative for municipalities to carrying out

individual environmental assessments for most municipal projects in Ontario. The MEA Class EA documents (1993) therefore reflects the five key principles of successful planning under the EA Act:

l. **Consultation with affected parties early on, such that the planning process is a co-operative venture**. The proponent should seek to involve all affected parties as early as possible, so that their concerns can be identified and addressed before irreversible decisions are made. Early consultation allows for improved understanding of environmental concerns before the undertaking is selected and focuses the planning on matters of concern.

2. **Consideration of a reasonable range of alternatives,** both the functionally different "alternatives to" and the "alternative methods" of implementing the solution. The "do nothing" alternative, which provides a benchmark for the evaluation of alternatives, must be considered.

3. **Identification and consideration of the effects of each alternative on all aspects of the environment**, i.e., the impact on the natural, social, cultural, technical and economic\financial environment. The level of detail will vary depending primarily on the significance of the effect and the stage of the study.

4. **Systematic evaluation of alternatives in terms of their advantages and disadvantages, to determine their net environmental effects**. The planning process must include distinct points where alternatives are evaluated and the net environmental effects are identified. The decision-making process should be phased, narrowing progressively to a preferred alternative. The process must recognise the dynamic nature of environmental decision-making, and must be sensitive to changing conditions and new information and must be flexible enough to deal with them.

5. **Provision of clear and complete documentation of the planning process followed, to allow "traceability" of decision-making with respect to the project**. The document should set out the approach, and the way in which the principles of environmental planning were followed in the planning process.

The preceding figure 7 illustrates the process followed in the planning and design of projects covered by this Class EA. The figure incorporates steps considered essential for compliance with the requirements of the Act and step taken by many large municipalities in the planning of their Capital Works program, all of which may be summarized as follows:

Phase 1 Identification of the problem or deficiency. In the municipal process for planning of Capital projects, a Need study would be undertaken. Some typical studies are Transportation Studies, Pollution Control Studies, Sewer Need

Studies, Water Networks Analysis, Road Needs Studies, Flooding and Erosion Studies etc. These have two common traits;

a) They are long range in nature (ie Master Planning) and
b) They deal with deficiencies or problems.

Phase 2 Identification of alternative solutions to the problem, by taking into consideration the existing environment, and establish the preferred solution taking into account public and agency review and input. At this point, determine the appropriate Schedule for the undertaking: proceed through the following Phases for Schedule C projects. Municipalities should clearly document various alternative solutions that they have tried. In some cases, the problems can be remedied by a Public Education Program (ie. Rain Barrel) or greater enforcement (ie. Stoop&Scoop).

Phase 3 Examination of alternative methods of implementing the preferred solution, based upon the existing environment, public and government agency input, anticipated environmental effects and methods of minimizing negative effects and maximizing positive effects. Depending on council's policies, a project cannot be tabled until "Pre-Planning" works have been carried out. For example, Year 1 projects should all have firm cost estimate, land requirements surveyed, feasibility studies done, Screening of EA done. Year 2 & 3 are set aside for all Pre-Planning and for cost estimating. Capital Budget are submitted to Committees for approval recommendation to Council.

Phase 4 Documenting, in an Environmental Study Report a summary of the rationale, and the planning, design and consultation process of the project as established through the above Phases and making such documentation available for scrutiny by review agencies and the public. It is important that the municipality has updated design criteria. Design methodology should be dictated by the technology selected.

Phase 5 Completion of contract drawings and documents, and proceed to construction and operation; monitor construction for adherence to environmental provisions and commitments. Where special conditions dictate, also monitor the operation of the completed facilities.

The work undertaken in the preparation of Master Plans should recognize the Planning and Design Process of this Class EA, and should incorporate the five key principles of successful environmental planning previously identified It is imperative that public and agency consultation take place during each phase of the study process, specifically at the initiation

of the Master Planning study, so that the scope and purpose of the study is understood, and at the selection of the preferred set of alternatives. The documentation of the evaluation of alternatives should clearly state relevant assumptions and methods used in the analysis so that these can be verified by monitoring during the implementation phase. **Thus, the Master Planning process should satisfy the first two phases in the Planning & Design Process of the Class EA.**