

Stormwater Management Planning and Design Manual

March 2003



**Ministry of the
Environment**

Stormwater Management Planning and Design Manual

March 2003

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PREFACE

The "state-of-the-art" of stormwater management has been rapidly evolving and this manual is one step in this evolutionary process. The manual provides technical and procedural guidance for the planning, design, and review of stormwater management practices. It is important that the manual be viewed as a tool for understanding the performance requirements of stormwater management projects and not as a rulebook for all stormwater management solutions.

The manual provides practical guidance which has been found effective in specific circumstances. However, users must exercise judgement and flexibly adapt the guidance provided. Stormwater management solutions need to consider specific site conditions and this must be recognized when applying the guidance provided in the manual.

It is not the intent of the Ministry to limit innovation with the manual. Significant effort has been made to write the manual in a manner that does not inadvertently restrict creative solutions. The Ministry encourages the development of innovative designs and technologies. Where the designer can show that alternate approaches can produce the desired results or even better, such designs should be considered. However, the designer is responsible for the designs which are made with respect to stormwater management for any given site. This manual should be used in conjunction with other established manuals and practices. It updates the Stormwater Management Practices Planning and Design Manual (June 1994).

This manual will also be used as a baseline reference document in the review of stormwater management applications for approval under section 53 of the Ontario Water Resources Act as administered by the Ministry of the Environment.

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The consultants for the project were Aquafor Beech Ltd. (Dave Maunder) and Marshall Macklin Monaghan Ltd. (Doug Andrews) in association with the Centre for Watershed Protection and Environmental Water Resources Group.

EXECUTIVE SUMMARY

Stormwater management is required to mitigate the effects of urbanization on the hydrologic cycle including increased runoff, and decreased infiltration, of rain and snowmelt. Without proper stormwater management, reduced baseflow, degradation of water quality, and increased flooding and erosion can lead to reduced diversity of aquatic life, fewer opportunities for human uses of water resources, and loss of property and human life.

Watershed planning integrates environmental and land use planning. Criteria for the protection of water quantity, water quality, habitat, and biota are established to help achieve the goals set for the watershed. Strategies to manage human activities within the watershed are developed to meet protection criteria. A stormwater management strategy may include protection of natural areas, design of communities to reduce stormwater generation, and pollution prevention programs, as well as the stormwater management practices which are the focus of this technical manual.

A combination of lot level, conveyance, and end-of-pipe stormwater management practices are usually required to meet the multiple objectives of stormwater management: maintaining the hydrologic cycle, protection of water quality, and preventing increased erosion and flooding. Lot level and conveyance controls may be classified as storage or infiltration controls. Storage controls are designed to detain stormwater. Although the volume of runoff does not decrease, the risk of flooding is reduced because all the stormwater runoff does not arrive at the stream at the same time. Infiltration controls are necessary for soil moisture replenishment and groundwater recharge. They can achieve water quality enhancement but are ideally suited for infiltration of relatively clean stormwater including rooftop and foundation drainage. Pre-treatment of road drainage is necessary to prevent clogging of a system and to protect groundwater quality.

End-of-pipe stormwater management practices must control the effects of urbanization which remain after preventative techniques and lot level and conveyance measures have been applied. End-of-pipe facilities are usually required for flood and erosion control and water quality improvement, although lot level and conveyance controls can reduce the size of the end-of-pipe facilities required.

Design guidance is provided for individual lot level, conveyance, and end-of-pipe practices. It includes physical constraints to the use of the practices, such as, soil type and depth to groundwater; sizing and configuration; and design details which vary considerably but which may include inlets and outlets, filter media, and distribution pipes. The guidance also includes cold climate considerations and the incorporation of vegetation in design.

Proper maintenance is critical to the successful performance of a stormwater management system. During the first two years of operation, inspections after significant storms will ensure that the system is functioning properly. After this, annual checks may be done to identify maintenance needs. Blockages may need to be cleared from inlets and outlets. Unhealthy vegetation may need to be tended or replaced. The design of stormwater management practices for water quality improvement is based primarily on settling of sediment. Therefore, at some point, accumulated material will need to be removed.

A preferred stormwater management system will be selected based on its cost, as well as other factors such as technical feasibility, effectiveness, and social acceptability. The overall cost must include capital, operating, and maintenance costs. Information provided may be used for preliminary estimates of cost. However, refinement of estimates to reflect site-specific considerations will be required.

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