7 PLANNING FRAMEWORK

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7.1 INTRODUCTION

From a functional point of view, urban stormwater management consists of planning, design, construction, and operation functions, ideally carried out in the order indicated in Figure 7.1. These functions are shared with or are common to most public services and facilities. Unfortunately, the planning function receives too little attention in urban stormwater management as well as in other public services and utilities.

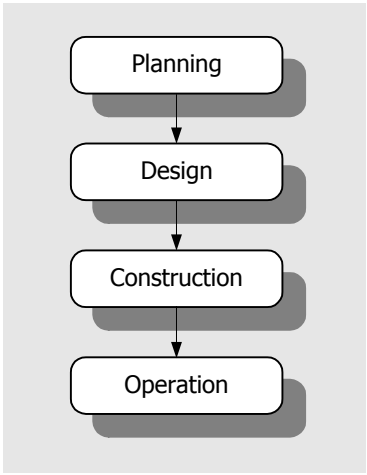

Figure 7.1 Stormwater Management Phases

Urban stormwater systems consist of various integrated components, each of which is intended to perform one or more functions in controlling the quantity and quality of stormwater runoff. Many of these components are out of sight or are small and easily overlooked. To a large extent, components of a stormwater system are visible or noticed only when they malfunction, or are alleged to malfunction.

Another somewhat unique characteristic of urban stormwater systems is that they function infrequently, that is, immediately after rainfall events. This contrasts with most other municipal services, which are not only visible but also function essentially on a continuous basis.

The public generally take the urban stormwater system for granted. Accordingly, public interest in and willingness to pay for planning, designing, constructing, and operating stormwater systems tends to literally rise and fall in relation to the frequency of flooding or other related problems. This is particularly true for the planning function, which generally seems to enjoy the least support from the general public and elected officials. Stormwater planning is normally only undertaken in reaction to serious flooding, pollution, or other related problems. During and immediately after a flood, the community is often willing to fund remedial efforts and planning projects. However, months later, when the planning has been completed and costly recommendations made, public interest wanes, little or nothing is done, and the cycle is repeated.

Prevention of flooding using land zoning regulations, flow control storages, or flood protection works is usually difficult to justify politically, before any floods have actually occurred. This means that planning of flood-free urban developments can be very difficult and that flood problems are inevitable.

7.2 NEED FOR PLANNING

Stormwater runoff and its management impacts directly on the community's quality of life by either enhancing or adversely affecting both the built and natural environments. Urban stormwater problems are complex involving economic, environmental, legal, financial, administrative, and political facets. Stormwater planning is a method of addressing these complex quantity and quality problems in a co-ordinated and holistic manner on a total catchment basis.

There is an obvious need for stormwater systems to be planned and integrated into the urban form with other municipal services at the earliest possible stage in the planning process for urban development. Stormwater management planning should not be done after all of the other decisions have already been made as to the form and layout of a new urban area. It is this latter approach which creates stormwater problems which are costly to correct. The extent to which existing stormwater problems are ultimately addressed and future problems prevented depends on the degree to which this integration is achieved. For established areas, particularly those undergoing landuse change or urban consolidation, there is a need to reconsider how stormwater is managed and assess how these changes impact on both the built and natural environments.

Unfortunately, the importance of focusing on how stormwater runoff is to be managed has not always been recognised in the past. In many instances, planning for individual urban developments has been based on criteria, which did not include a complete consideration of the importance of stormwater management. This has resulted in problems ranging from increased risk of inundation elsewhere in the catchment and adverse water quality associated with receiving waters to a reduction in the extent and quality of linked open space.

Waterways provide a direct link between all landuses. How stormwater is managed can impact on each landuse in terms of water quality, flood risk, traffic disruption, amenity, recreational opportunities etc. An understanding of these inter-relationships will influence the form of new development and determine what improvements need to be made within established areas. All changes to landuses and the management of land, whether it be increases in the impervious area or the excessive use of garden fertilisers, affect the quantity and quality of stormwater runoff.

Stormwater runoff will occur no matter how well, or how poorly, stormwater management planning is done. The quality of the planning effort determines the ultimate costs to the developer and the community, and the ultimate effect on the community and other urban subsystems.

Stormwater management planning may not lead to the best or optimum solutions for stormwater problems, as a best or optimum solution may not be possible or economically feasible. However, the planning process will hopefully lead to good courses of action and avoid a multitude of erroneous, and probably unnecessarily expensive, courses of action.

7.3 PLANNING PRINCIPLES

Stormwater management planning should apply Integrated Catchment Planning principles to ensure that all components of the plan are planned and co-ordinated so as to achieve the desired result. Integrated Catchment Planning is a philosophy that balances social, economic, and environmental concerns to achieve sustainable development. It emphasises sound land and water management in the upper catchment to reduce the need for expensive 'end-of-pipe' solutions in the lower catchment and in receiving waters. Without co-ordinated planning, potential benefits may not be fully realised or drainage improvements in one location may worsen problems in another.

Planning of stormwater management systems is a multi-faceted exercise involving direct interaction between professionals having expertise in the following fields:

- Town planning
- Hydrology and hydraulics
- Public health
- Ecology
- Costing

In some instances it will be necessary to include additional specialists (e.g. botanists, soil scientists, chemists) depending on the characteristics of the area and the nature of the proposed development.

Experience has shown that the following principles apply when planning and designing urban stormwater systems (ASCE, 1992):

(a) Stormwater drainage is a regional phenomenon that does not respect boundaries between government jurisdictions or between public and private properties

Stormwater management should be a central part of an overall catchment management program involving both the community and government. Overall, those government authorities most directly involved must provide co-ordination and strategic planning, but the planning must be integrated on a regional level if optimum results are to be achieved. The ways in which proposed local stormwater systems fit existing regional systems must be quantified and discussed in a stormwater strategy plan.

(b) Stormwater drainage is a sub-system of the total urban water resource system

Stormwater system planning and design must be compatible with catchment management plans and in particular, should be co-ordinated with planning for landuse, open space, and transportation. Erosion and sediment control, flood control, site grading criteria, and regional water supply all closely inter-relate with urban stormwater management. Stormwater strategy planning should normally address all of these considerations.

(c) Every urban area has two drainage systems, whether or not they are actually planned and designed for

One is the minor drainage system, which is designed to provide public convenience and to accommodate relatively moderate frequent flows. The other is the major drainage system, which carries more runoff and operates when the rate or volume of runoff exceeds the capacity of the minor drainage system. Both systems should be carefully considered.

(d) Stormwater management is a space allocation problem and therefore an intrinsic part of the town planning process

The volume of runoff present at a given point in time in an urban region cannot be compressed or diminished. All the components of a stormwater drainage system have the potential to both convey and store runoff. If adequate provision is not made for the space demands of stormwater systems, runoff will overflow or encroach onto other landuses, will result in damage, or will impair or even disrupt the functioning of other urban systems and services

(e) Getting rid of runoff as quickly as possible may not be a responsible stormwater management practice

Urbanisation tends to increase downstream peak flow rates by increasing runoff volumes and velocities. Providing conveyance-oriented stormwater systems only in development areas may result in increased costs to both private developers and the community through adverse downstream effects. A storage-oriented approach to stormwater management should be adopted wherever possible.

(f) Planning and design of stormwater systems generally should not be based on the premise that problems can be transferred from one location to another

Providing conveyance-oriented solutions to solve stormwater-flooding problems usually only serves to transfer the problem to another location further downstream. A storage-oriented approach by temporarily

storing runoff in detention and/or retention facilities can reduce the capacity required in downstream conveyance systems, and thereby reduce the likelihood of flooding problems being transferred downstream.

(g) An urban stormwater strategy should be a multi-purpose, multi-means effort

There are a number of competing demands placed upon space and resources within an urban area. A stormwater management strategy should therefore meet a number of objectives including flood control, water quality enhancement, groundwater recharge, wildlife habitat, wetlands creation, protection of landmarks and amenities, control of erosion and sediment deposition, and creation of open space.

(h) Planning and design of stormwater management systems should consider the features and functions of natural drainage systems

Every catchment contains natural features that may contribute to the management of stormwater runoff under existing conditions. Existing features such as natural watercourses, depressions, wetlands, floodplains, permeable soils, and vegetation provide natural infiltration, help control the velocity of runoff, extend the time of concentration, filter sediments and other pollutants, and recycle nutrients. Plans for urban development should carefully identify and map the existing natural system. 'Natural' engineering techniques can preserve and enhance the natural features and processes within a development area and maximise post-development economic and environmental benefits, particularly in combination with open space and recreational uses. Good planning and design can improve the effectiveness of natural systems, rather than negate, replace, or ignore them.

(i) In new developments, stormwater flow rates after development should approximate pre-development conditions, and pollutant loadings should be reduced

Three inter-related concepts should be considered:

- The perviousness of a catchment should be maintained to the greatest possible extent
- The rate of runoff should be reduced. Preference should be given to stormwater management systems, which use practices that maintain vegetative and porous land cover. These systems will promote infiltration, filtering, and slow down the runoff rate.
- Pollution control is best accomplished by implementing a series of measures, which can include source control, minimisation of directly connected impervious area, and construction of on-site, community, and regional facilities to control both runoff and pollution.

(j) Stormwater management systems should be planned and designed, beginning with the outlet or point of outflow from the catchment

The downstream conveyance system or receiving water should be evaluated to ensure that it has sufficient capacity to accept design discharges without adverse backwater or downstream impacts such as flooding, streambank erosion, and sediment deposition.

(k) Stormwater management systems should not be put in place if they cannot be maintained or will not receive regular maintenance

Failure to provide proper maintenance reduces both the hydraulic capacity and pollutant removal efficiency of the system. The keys to effective maintenance are the clear assignment of responsibilities to an established agency and a regular schedule of inspections to determine maintenance needs and to ensure that required maintenance is done. Demonstrated past local maintenance performance should be the basis for the selection of specific planning and design criteria.

7.4 PLANNING APPROACH

It is recommended that urban stormwater management planning be undertaken in two distinct but complementary stages, namely:

- Stormwater Strategy Planning
- Stormwater Master Planning

These two levels or stages of planning form part of a tiered management approach to total catchment management, shown in Figure 7.2, that integrates catchment wide, metropolitan/municipal, and local area planning and management considerations.

Catchment management planning is undertaken to establish objectives and practices for the management of water resources within a catchment. Plan development should concentrate on whole of catchment issues, comprise a broad range of objectives, and involve extensive community consultation.

A catchment management plan prescribes:

- the sustainable concentrations of potential pollutants and flow regimes for critical nodes throughout the catchment
- the allocation of sustainable flow and constituent concentrations and loads across landuse categories
- permissible landuses and management practices within the catchment which are consistent with meeting sustainable flow regimes and concentrations

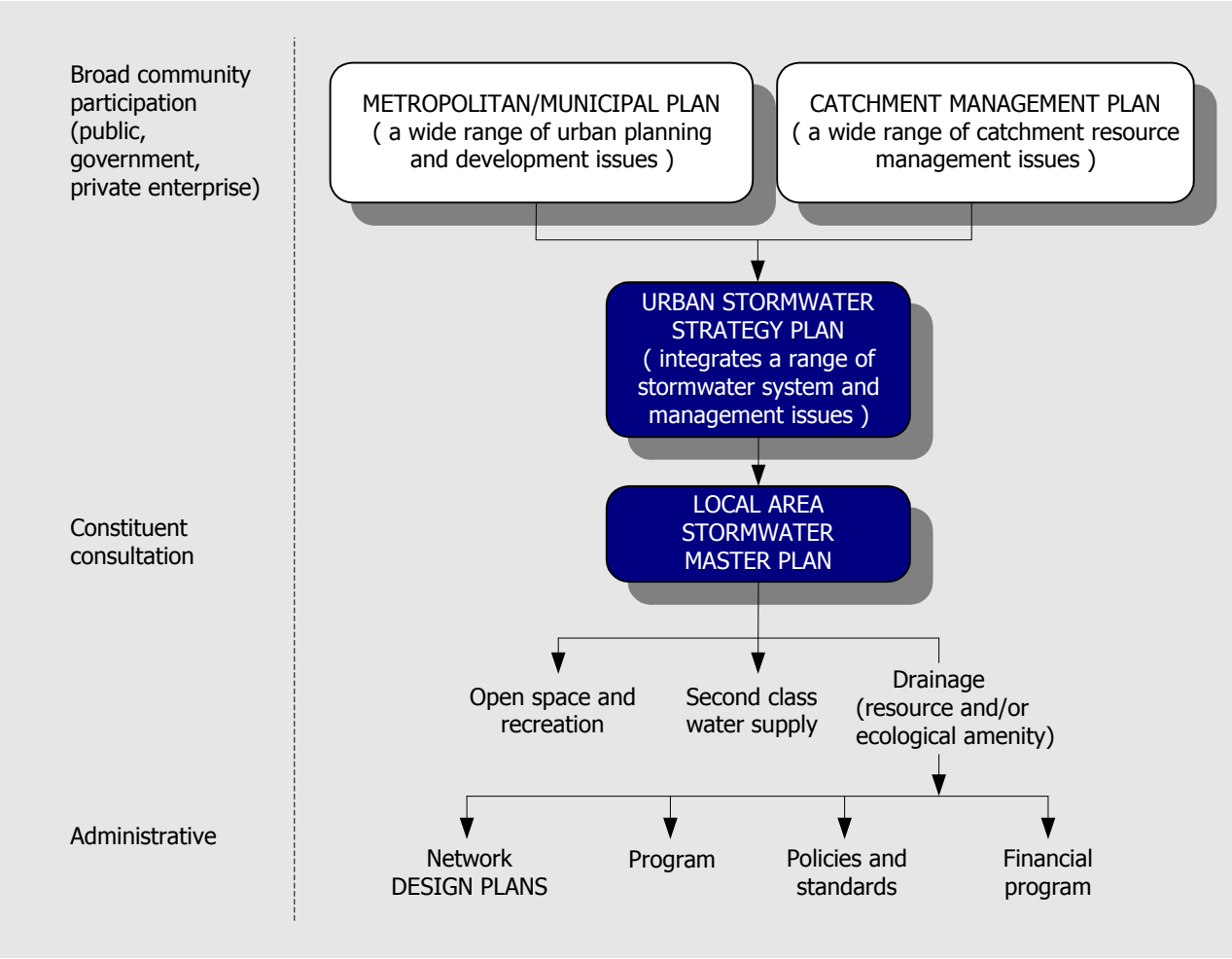

Figure 7.2 Tiered Planning Approach (after NSW EPA, 1996a)

Metropolitan or municipal planning is undertaken to establish the form and extent of urban landuse within a catchment and to meet the constraints of sustainable flows and constituent loads specified in the catchment management plan. The metropolitan area (or the urban part of the municipality) is one of the significant landuses within the catchment. Whether a plan covers a municipality or the whole of the metropolitan area depends mainly on the responsibilities for stormwater management within each State and Territory.

A metropolitan/municipal plan prescribes the pattern of urban development, including:

- permissible landuses, location (zoning), and conditions of use
- roads, public transport, cycle, and pedestrian corridors and networks
- major open space systems
- landscape provision
- recreation and facilities provision
- ecological or natural amenity provision

A metropolitan/municipal plan may also contain information which is relevant to stormwater strategy planning and stormwater master planning, including:

- topographic details
- geotechnical information
- flooding, and other hazard areas
- drainage and other service corridors, including existing quantity or quality control infrastructure
- groundwater conditions
- second class water supply facilities
- descriptions of ecosystems requiring protection

Stormwater strategy planning and stormwater master planning are discussed in detail in the following chapters.

Both catchment management planning and metropolitan or municipal planning are outside the scope of the manual and will not be discussed in detail.