
9 MASTER PLANNING

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9.1 GENERAL

A stormwater master plan is prepared to consider, in detail, what stormwater management practices and measures are to be provided for a small urban precinct, individual development, or a large public works project. These plans will have a local focus responsive to specific functions (open space and recreation provision, second class water supply, drainage provision, etc.). They prescribe individual area management techniques and practices. If a stormwater strategy plan is available for a catchment, each local area stormwater master plan will be required to accommodate the principles and policies identified in the broader strategy plan.

Reference to the stormwater strategy plan is required when considering:

- local network design parameters
- opportunities and constraints for incorporation of management components
- model analysis of overall water quantity and quality control
- hydraulic performance

Ideally, a stormwater master plan should be prepared for a local urban area prior to implementing structural and non-structural management measures identified in the strategy plan for the catchment. That is, detailed master planning should precede the design, construction, and operation phases of a development project.

9.2 PREPARING MASTER PLANS

The following tasks indicated in Figure 9.1 should be carried out for the preparation of a stormwater master plan.

(a) Task 1 : Establish Objectives and Standards

Objectives and standards should be established to guide the planning process. These may be obtained from the strategy plan for the catchment (if one exists) and/or from the acceptance criteria described in Chapter 4. However, technical, economic, environmental, legal, financial, administrative, political, and other constraints may prevent complete achievement of the established objectives or, more particularly, the supporting standards. Nevertheless, the objectives and standards should provide the basis for and give direction to the planning process and should be used to determine the expected success of the recommended plan.

(b) Task 2 : Collect Data

Data collected for the master planning process provides the factual basis for the plan and allows an appreciation of

past conditions and an understanding of present conditions within the catchment. The data collected for the development of the strategy plan for the catchment should be used if available. This data may need to be supplemented with additional data necessary to further define the characteristics of the area under investigation.

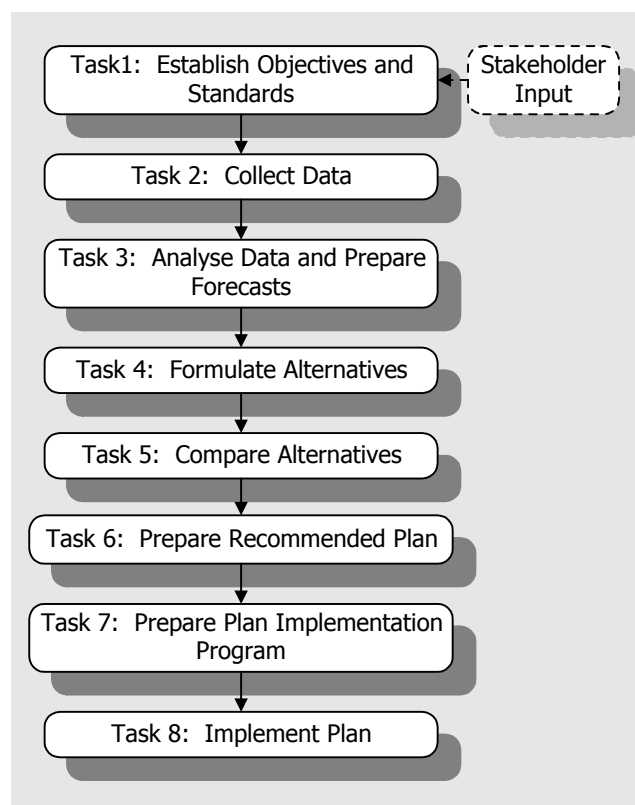


Figure 9.1 Tasks in Developing a Stormwater Master Plan (after Welsh, 1989)

(c) Task 3 : Analyse Existing Conditions

The main purpose of this phase is to use the data and information collected under the data collection phase to understand the present state of stormwater resources in the catchment.

The water quantity and quality characteristics for the existing catchment conditions must be determined, preferably by the use of an appropriate computer model (refer Chapter 17). The objectives for modelling existing catchment conditions will depend on whether the catchment under consideration is an existing or a new urban development.

For existing developments, models are required to:

- determine the capacity of existing major and minor conveyance systems in terms of flow and ARI

- determine the location and extent of any flooding under major and minor system design flows
- determine the pollution loads for existing land uses within the catchment
- determine the performance of any existing water quality control structures

For proposed developments, models are required to:

- determine natural catchment flows within the catchment which may be used as flow limits for development proposals
- determine natural pollutant loadings within the catchment which may be used as pollutant load limits for development proposals

(d) Task 4 : Formulate Alternatives

Formulation of alternatives is the most important part of the stormwater master planning process because the substance of the recommended plan originates from this step. Alternative formulation is a partly creative, partly systematic effort where alternatives are conceptualised, screened, and if promising, further developed. The range of potential management practices presented in Table 8.2 may be used as a basis for selecting components for alternative proposals.

The essential conceptual, technical, economic, environmental, financial, legal, administrative, political, and other features of each alternative should be examined as illustrated in Figure 8.3.

In formulating alternative proposals, the water quantity and quality characteristics must be determined, preferably by the use of an appropriate computer model (refer Chapter 17). The objectives for modelling proposed catchment conditions will depend on whether the catchment under consideration is an existing or a new urban development.

For existing developments, models are required to:

- assess the impact of land use changes such as urban consolidation and 'infill' development
- determine the effectiveness of structural augmentation proposals or non-structural management strategies in reducing flooding problems within the catchment and receiving waters
- determine the effectiveness of proposed structural water quality measures or non-structural management measures in reducing pollutant levels within the catchment and receiving waters

For proposed developments, models are required to:

- determine the effectiveness of the proposed conveyance systems and runoff quantity control

measures in reducing post-development peak flows to pre-development conditions or other required limits

- determine the effectiveness of proposed water quality structures in reducing post-development pollutant loads to pre-development levels or other agreed limits

(e) Tasks 5 & 6 : Compare Alternatives and Select Recommended Plan

Having formulated a set of possible alternative solutions for managing stormwater, the alternatives should be compared and a subset selected to comprise a recommended plan. The essential features of each alternative such as size, costs, benefits, and positive and negative attributes should be compared in summary form for presentation to decision-makers, and the community if so required.

Alternatives should be compared on the basis of how well they achieve the established objectives. An objective versus alternative matrix may be used to compare alternatives. An example matrix is shown in Figure 9.2.

OBJECTIVES	ALTERNATIVES							
	Do nothing	Floodplain management	Levees to protect residential area	Channel improvement	Community detention basins	On-site detention	Community Retention basins	On-site retention
	1	2	3	4	5	6	7	8
Maximum prevention of flood damages	○	●	●	●	●	●	●	●
Least disruptive to physical environment	●	●	●	●	●	●	●	●
Least harmful to flora and fauna	●	●	●	●	●	●	●	●
Ratio of benefits to costs	NR	NR	●	○	○	●	●	●
Minimises construction costs	NR	NR	●	●	○	○	●	○
Minimises local costs	NR	●	●	●	●	○	●	○
Least disruptive to people	●	●	●	●	●	●	●	●
Guides floodplain use	○	●	○	○	○	○	○	○

ACHIEVEMENT LEVEL
 ● HIGH ● INTERMEDIATE ○ LOW NR - NOT RATED

Figure 9.2 Objectives Vs. Alternatives Matrix (after Walesh, 1989)

As the positive and negative features of each alternative are considered and compared with features of other alternatives, the possibility of composite alternatives may

arise. Composite alternatives might achieve a technically improved solution or might be a means of obtaining support among decision-makers, and the community if so required.

(f) Task 7: Prepare Plan Implementation Program

The questions of when the plan elements are to be implemented, who has the primary responsibility for implementing them, and how the implementation is to be carried out, including financing, should be addressed. For plans prepared on a catchment basis, implementation may need to be carried out on a jurisdictional or sectoral basis by a number of different Local Authorities. The number of implementers can vary widely depending on the size and complexity of the stormwater master plan.

Responsibility for taking the lead in implementing elements of a recommended plan can rest with government units and agencies at all levels and with private entities.

The elements of the recommended plan should be prioritised into relative order and the expected time for implementation of each element stated. Prioritisation should be determined based on the following factors:

- the operation of certain components of the stormwater management system may be dependent on the existence of other components
- higher priority should be given to those elements of the recommended plan that are likely to provide the greatest benefit in relation to the stated objectives
- some elements may not be implemented if action is not taken immediately or at some other appropriate time to capitalise on special circumstances or opportunities (e.g. special grants)

Special opportunities that could have a bearing on the implementation of a plan, such as possible sources of financing, should be identified.

Other aspects of how a plan is to be implemented are clear identification of desired endorsements, agreements, and required approvals and permits. For example, implementation of a stormwater master plan for a catchment that encompasses all or parts of several communities may benefit from official endorsement by the governing bodies of each community, may require inter-community agreements, and may require permits from State and Federal agencies.

(g) Task 8: Implement Plan

Of all the steps in the planning process, plan implementation is the most unpredictable. The extent to which a comprehensive stormwater master plan is accepted and the enthusiasm with which the public and

private sectors will push for its implementation will depend on the following factors:

- the credibility of the plan as determined by the quality of the technical work and the thoroughness of the community involvement program carried out during the planning process
- the frequency and severity of stormwater-related problems and the level of concern that past problems will occur again

The ultimate test of a stormwater master plan is the degree to which stormwater problems have been mitigated and the degree to which potential stormwater problems have been prevented from occurring. For community-funded projects, as step-by-step implementation proceeds, each achievement should be strategically publicised. As these projects are paid for with public funds, the public should be informed about the return on their investment.

9.3 MASTER PLAN COMPONENTS

Master plans should consist of two major components, namely; a technical report, and supporting plans.

9.3.1 Technical Report

This report should provide a comprehensive analysis of existing and proposed stormwater quantity and quality conditions for the catchment. The report should provide narrative descriptions of existing conditions and how the proposed system will meet the master plan objectives, and contain all necessary technical data for both existing and proposed conditions. The report should include the following:

- all assumptions, parameters, and input data used in hydrological models
- hydraulic performance data (stage, storage, discharge) for all hydrologic system elements
- flow data for all conveyance facilities, including streams, swales, pipes, open channels, and floodways which will support the proposed system
- floodplain analysis identifying flows, velocities, and extent of flooding including any backwater analyses required to determine conveyance system capacity within and downstream of the master plan catchment
- erosion analysis of local and downstream open drainage systems, identifying flows, velocities, areas of existing and future deposition and channel erosion, and characterisation of sediment
- geotechnical analysis of the catchment and proposed improvements which specifically address soils and slope stability for proposed ponds/wetlands, channel conditions, building setbacks from steep slopes, vegetative preservation and controls, existing and

proposed drainage facilities, and downstream system stability

- method of conceptual design for maintaining existing flow regimes in any existing or proposed watercourses that may be altered by development
- method, conceptual design, and location of water quality control facilities
- description of maintenance design features and provisions that will ensure reliable and long-term operation of facilities
- ecological analysis, including the physical and biological features of streams, ponds/wetlands, and engineered waterways
- input and output files from hydrologic and/or hydraulic computer models included as an appendix
- a construction phasing plan that will ensure stormwater and erosion and sediment control during development

9.3.2 Supporting Plans

A conceptual or preliminary plan of the proposed stormwater conveyance, runoff quantity control, and water quality control systems, based upon accurate field

topographic mapping and geological data (if available) should be provided along with sufficient details to identify systems elements. Plans should be of adequate scale and detail for accurate definition and location of all system elements and must provide support for hydrologic model characterisation. In general, the following information is required:

- delineation of sub-catchments of appropriate size and land use for computer model characterisation and hydraulic analysis of all tributary flows
- location and size of all existing and proposed hydrologic features and facilities in the catchment, including ponds/wetlands, swales and floodways, streams, channels, pipes, and culverts, etc
- an overall plan, and/or profile, and cross-sections of conveyance systems with frequency of flooding for existing and developed conditions identified
- identification of existing areas of in-stream erosion, sedimentation, and/or unstable slopes
- identification of soils and preliminary analysis for controlling erosion during construction and for use in hydrologic modelling
- identification of upstream and downstream habitat condition