2. Overview of design process

An overview of the key performance criteria and the associated desirable outcomes is provided in Figure 2.1. The performance criteria are grouped into three major categories of Amenity, Engineering and Environmental, with maintenance considered to be interactive with all three categories. The design processes documented in Section 3 are summarised in Figure 2.2 (flowchart) and Figure 2.3 (checklist).

Where this document refers to another publication, the latest edition of that publication should be used. Unless noted otherwise, it is necessary to satisfy all parts of the specified acceptable solutions that are applicable.

The applicant must not assume that drainage channels, overland flow paths, drainage outlets, energy dissipators or stormwater detention/polishing basins will automatically be permitted in public space. Further, it is unlikely that filling of existing natural drains/watercourses would be permitted without Council approval.

Prior to the design of any stormwater discharge facility into Council-controlled land or land proposed as future open space, the applicant must consult with the relevant Development Assessment Team to:

- ensure that the proposal is acceptable
- ensure that the proposal complies with the park character plans and park objectives
- ensure that the proposal complies with all the relevant codes (for example, Park Code, Stormwater Management Code and Waterway Code) and planning scheme policies of the Brisbane City Plan
- determine the levels of impact assessments required.

Stormwater outlets in any public space (existing or newly created Council asset) must be addressed at the initial development application (high level or conceptual design) stage and not be deferred to the operational works assessment stage, as the method of stormwater conveyance and treatment could influence the development's design, layout and cost.

The applicant must submit concept drawings and the checklist (Figure 2.3) to Council for initial review at the time of assessing the development application. Detail calculations and drawings can be submitted at the later stage of operational work assessment. A site inspection will probably be required prior to construction.

Figure 2.4 and Figure 2.5 are two typical examples illustrating the methods of stormwater conveyance depending on spatial constraints, open space functions, catchment and channel characteristics. The illustrated underlying principles can be applied to a wide range of public open space of varying sizes and uses. It should be noted that site-specific solutions can only be achieved through rigorous assessments of all site constraints and opportunities.
The applicant must not assume that any stormwater outlet facility will automatically be permitted in public space.

### PERFORMANCE CATEGORY

#### Amenity
- Public Usage
- Safety
- Aesthetics and Landscaping

#### Engineering
- Hydraulic Considerations
- Erosion Control

#### Environmental - Waterway Health
- Ecology
- Water Quality Management
- Maintenance

### PERFORMANCE CRITERIA

#### Amenity
- Public Usage
- Safety
- Aesthetics and Landscaping

#### Engineering
- Hydraulic Considerations
- Erosion Control

#### Environmental - Waterway Health
- Ecology
- Water Quality Management
- Maintenance

### DESIRABLE OUTCOMES

#### Amenity
- Preserve and enhance natural features of the public space.
- Public safety risks are minimised as far as practicable.
- Preserve existing and/or intended characteristics and functions of the public space.

#### Engineering
- Hydraulic capacity of the stormwater facility is sustained over the long term.
- Bed and bank erosion is minimised.

#### Environmental - Waterway Health
- Functions and values of the designated amenity are not diminished by the stormwater discharge facility.
- Preserve and enhance flora and fauna habitat values at the outlet.
- Protect and enhance the environmental values of the receiving waters at the outlet.
- Achieve a sustainable level of ongoing maintenance that is practical, cost-effective, safe and can be reasonably provided by Council.
FIGURE 2.2 DESIGN PROCESS FLOWCHART

PERFORMANCE CRITERIA

P1 AMENITY - Public Usage:
Determine functions of public space

P2 AMENITY - Safety:
Proposed facility is readily accessible and potential fall height > 1.0 metre or pipe dia > 600 millimetre or causes flood hazard?

YES

NO

P3 AMENITY - Aesthetics and Landscaping:
Determine requirements

P4 ENGINEERING - Hydraulic Considerations:
Undertake the necessary assessments

P5 ENGINEERING - Erosion Control:
Is the proposed facility likely to cause potential erosion and stability problems?

YES

NO

P6 ENVIRONMENTAL - Waterway Health
Undertake the necessary assessments

ACCEPTABLE SOLUTIONS

A1.1 Parkland Area
A1.2 Waterway Corridor

Obtain preliminary acceptance of the stormwater outlet facility in parks & waterways at the initial development application (high level) stage

A2.1 Depth Velocity Product
A2.2 Fencing
A2.3 Vegetation Barrier
A2.4 Channel Side Slope
A2.5 Pipe Grate
A2.6 Signage

A3.1 Outlet Options
A3.2 Visual Impact
A3.3 Landscaping

A4.1 Design Methodology
A4.2 Channel configuration
A4.3 Pipe Drainage
A4.4 Subsurface Drainage
A4.5 Surcharge Chambers
A4.6 Detention Storage
A4.7 Pipe Velocity
A4.8 Outlet Velocity
A4.9 Scour Protection
A4.10 Tailwater depth
A4.11 Outlet Invert Level
A4.12 Drop Outlet and Splash Point
A4.13 Outlet Location
A4.14 Outlet Angle

A5.1 Outlet Scour Formation
A5.2 Channel Erosion control
A5.3 Rock Protection
A5.4 Energy Dissipation
A5.5 Outlet Velocity Reduction

A6.1 Ecology
A6.2 Water Quality Management

Achieve a sustainable and practical level of maintenance requirements

END OF PROCESS
## Checklist

<table>
<thead>
<tr>
<th>Assessment Steps</th>
<th>Applicable? Yes/No</th>
<th>Addressed? ✓/✗</th>
<th>Acceptable Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Amenity - Public Usage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applicant must obtain acceptance of stormwater outlet facility in public space at the initial development application stage.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Consult Development Assessment Team</td>
<td></td>
<td></td>
<td>A1.1, A1.2</td>
</tr>
<tr>
<td><strong>2 Amenity - Safety</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applicant must consider safety when the stormwater facility is readily accessible and likelihood exists that a person may fall more than 1.0 m and/or pipe diameter dimension &gt;600 mm and/or the public space poses a potential flood hazard problem.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Depth Velocity Product</td>
<td></td>
<td></td>
<td>A2.1</td>
</tr>
<tr>
<td>2.2 Fencing</td>
<td></td>
<td></td>
<td>A2.2</td>
</tr>
<tr>
<td>2.3 Vegetation Barrier</td>
<td></td>
<td></td>
<td>A2.3</td>
</tr>
<tr>
<td>2.4 Channel Side Slope</td>
<td></td>
<td></td>
<td>A2.4</td>
</tr>
<tr>
<td>2.5 Pipe Grate</td>
<td></td>
<td></td>
<td>A2.5</td>
</tr>
<tr>
<td>2.6 Signage</td>
<td></td>
<td></td>
<td>A2.6</td>
</tr>
<tr>
<td><strong>3 Amenity - Aesthetics and Landscaping</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applicant must consult with Development Assessment Team for advice.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1 Outlet Options</td>
<td></td>
<td></td>
<td>A3.1</td>
</tr>
<tr>
<td>3.2 Visual Impact</td>
<td></td>
<td></td>
<td>A3.2</td>
</tr>
<tr>
<td>3.3 Landscaping</td>
<td></td>
<td></td>
<td>A3.3</td>
</tr>
<tr>
<td><strong>4 Engineering - Hydraulic Considerations</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applicant must consider all the relevant hydraulic parameters.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1 Design Methodology</td>
<td></td>
<td></td>
<td>A4.1</td>
</tr>
<tr>
<td>4.2 Channel Configuration</td>
<td></td>
<td></td>
<td>A4.2</td>
</tr>
<tr>
<td>4.3 Piped Drainage</td>
<td></td>
<td></td>
<td>A4.3</td>
</tr>
<tr>
<td>4.4 Subsurface Drainage</td>
<td></td>
<td></td>
<td>A4.4</td>
</tr>
<tr>
<td>4.5 Surcharge Chambers</td>
<td></td>
<td></td>
<td>A4.5</td>
</tr>
<tr>
<td>4.6 Detention Storage</td>
<td></td>
<td></td>
<td>A4.6</td>
</tr>
<tr>
<td>4.7 Pipe Velocity</td>
<td></td>
<td></td>
<td>A4.7</td>
</tr>
<tr>
<td>4.8 Outlet Velocity</td>
<td></td>
<td></td>
<td>A4.8</td>
</tr>
<tr>
<td>4.9 Scour Protection</td>
<td></td>
<td></td>
<td>A4.9</td>
</tr>
<tr>
<td>4.10 Tailwater Depth</td>
<td></td>
<td></td>
<td>A4.10</td>
</tr>
<tr>
<td>4.11 Outlet Invert Level</td>
<td></td>
<td></td>
<td>A4.11</td>
</tr>
<tr>
<td>4.12 Drop Outlet and Splash Point</td>
<td></td>
<td></td>
<td>A4.12</td>
</tr>
<tr>
<td>4.13 Outlet Location</td>
<td></td>
<td></td>
<td>A4.13</td>
</tr>
<tr>
<td>4.14 Outlet Angle</td>
<td></td>
<td></td>
<td>A4.14</td>
</tr>
<tr>
<td>Assessment Steps</td>
<td>Applicable? Yes/No</td>
<td>Addressed? ✓/✗</td>
<td>Acceptable Solutions</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>--------------------</td>
<td>----------------</td>
<td>---------------------</td>
</tr>
<tr>
<td><strong>5  Engineering - Erosion Control</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applicant must consider erosion control measures when:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• average outlet velocity exceeds the permissible velocity and/or</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• average outlet velocity &gt; 2 m/s and/or</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• unprotected bank is within a distance of 10 times the pipe diameter or box width/height from the stormwater outlet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.1 Outlet Scour Formation</td>
<td></td>
<td></td>
<td>A5.1</td>
</tr>
<tr>
<td>5.2 Channel Erosion Control</td>
<td></td>
<td></td>
<td>A5.2</td>
</tr>
<tr>
<td>5.3 Rock Protection</td>
<td></td>
<td></td>
<td>A5.3</td>
</tr>
<tr>
<td>5.4 Energy Dissipation</td>
<td></td>
<td></td>
<td>A5.4</td>
</tr>
<tr>
<td>5.5 Outlet Velocity Reduction</td>
<td></td>
<td></td>
<td>A5.5</td>
</tr>
<tr>
<td><strong>6  Environmental - Waterway Health</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applicant must consider ecological values.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.1 Ecology</td>
<td></td>
<td></td>
<td>A6.1</td>
</tr>
<tr>
<td>6.2 Water Quality Management</td>
<td></td>
<td></td>
<td>A6.2</td>
</tr>
</tbody>
</table>
Figure 2.4 Typical Acceptable Solution for Stormwater Catchment >30 Hectares

- Maximise use of natural channel design to enhance water quality, ecological values and visual impacts.
- Underground stormwater pipe drainage system is used only to ensure that maintenance and access requirements are preserved.
- Active recreation area must have adequate setback distances from roads, car parks, bikeways, dense bushland, watercourses, stormwater outlets, and stormwater inlets.
**Elements of the Natural Channel Drainage System**

1. Typical catchment and channel forms where pool/riffle system may be appropriate
   - Urbanised clayey soil catchment 30-100 ha and mild channel slope 1-5%. Note: low flows may not be sufficient to maintain dry weather flows and adequate pool water quality.
   - Urbanised clayey soil catchment > 100 ha and mild channel slope 1-5%.
   - Rural or bushland clayey soil catchment > 50 ha and mild channel slope 0.2-0.7%.

2. Jutemesh bank stabilisation.

3. Extensive landscaping and revegetation using native/endemic species.

4. Access provision across channel.

5. Finished surface profile using natural gravels/rocks/boulders.

6. Implement appropriate maintenance program until canopy and understorey vegetation is fully established.
Stormwater Outlets in Parks and Waterways

Section through the riffle

DETAIL 2.4b (Refer Figure 2.4 for location)
FIGURE 2.5  TYPICAL ACCEPTABLE SOLUTION FOR STORMWATER CATCHMENT <30 HECTARES

- Underground stormwater pipe drainage system is used to preserve the functions of open space or regular low flows are insufficient to sustain a natural channel system.

- Construct grass swale along the park and riparian vegetation interface, from the stormwater outlet to provide additional stormwater treatment. (Note. Grass swale is generally only appropriate for ‘dry’ sites (eg. along the high bank of a deep and well defined watercourse.)) The location of the discharge point at the riparian corridor must be selected to minimise disturbance and intrusion.

- Active recreation area must have adequate setback distances from roads, car parks, bikeways, dense bushland, watercourses, stormwater outlets, and stormwater inlets.
Stormwater Outlets in Parks and Waterways

Detail 2.5a (Refer Figure 2.5 for location)

Stormwater Outlet

- Safety fencing
- Baffle blocks (cast in situ reinforced concrete or rock boulders) to dissipate high energy levels
- Machinery access to undertake maintenance (desilting) operations
- Landscaping to soften visual intrusion.

Detail 2.5b (Refer Figure 2.5 for location)

Rock Armouring

- Maximise use of partially embedded or grouted natural rocks/boulders to control erosion immediately downstream of stormwater outlet.
- Visual impacts can be softened by planting (eg Lomandras Longifolia) between rocks.

Detail 2.5c (Refer Figure 2.5 for location)

Grass Swale

- Open, grass-lined channel with trapezoidal or parabolic cross section.
- Long shallow linear depression with low sloping sides (preferably 1 in 6, maximum 1 in 4) and gentle longitudinal slopes (<5%)
- Install subsoil drains or wetland plants on flat slopes (<1%) where drainage may be a problem
- Provide mowing edge (eg planting a row of Lomandras/Longifolia)