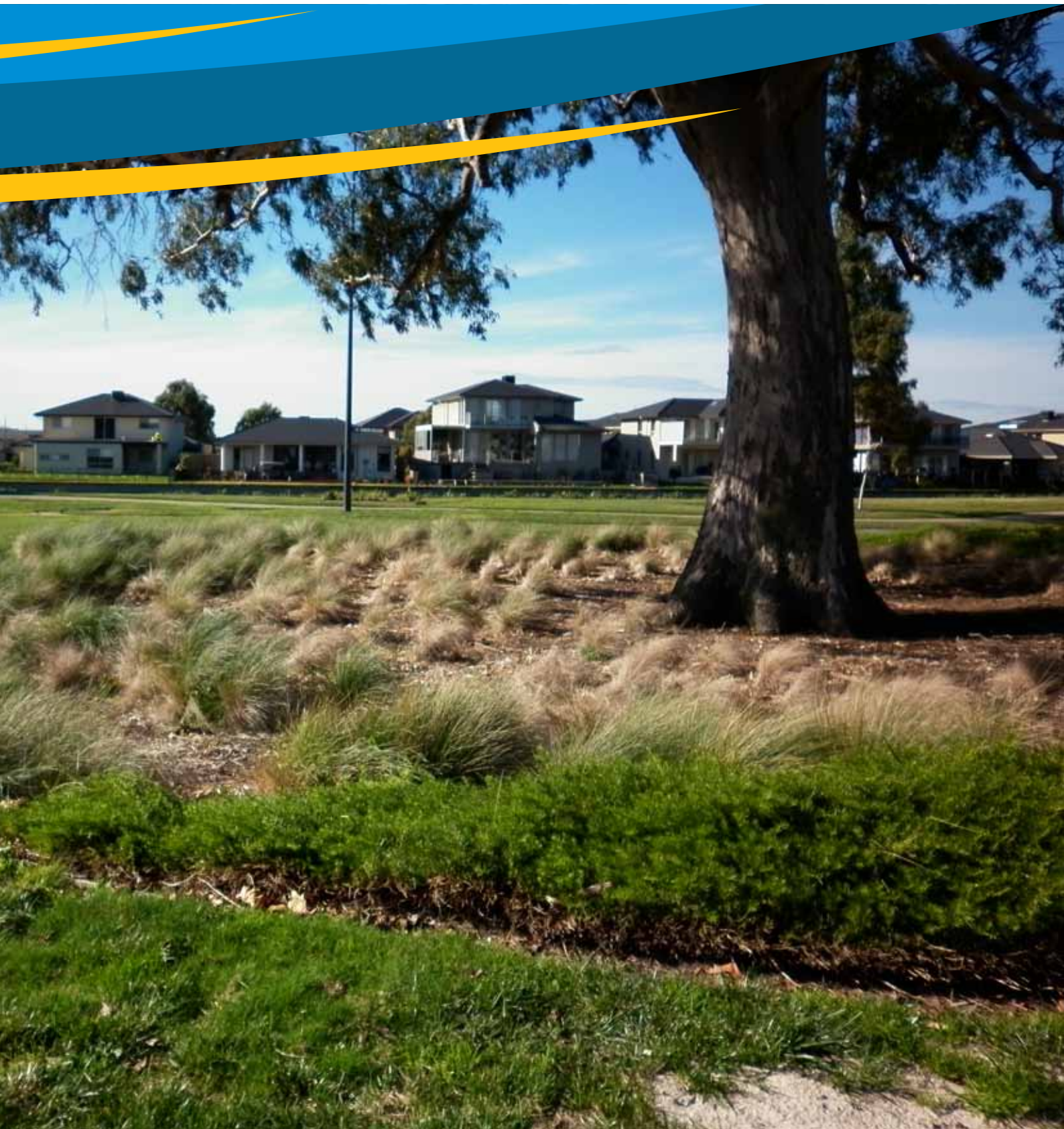
FRANKSTON
WSUD GUIDELINES



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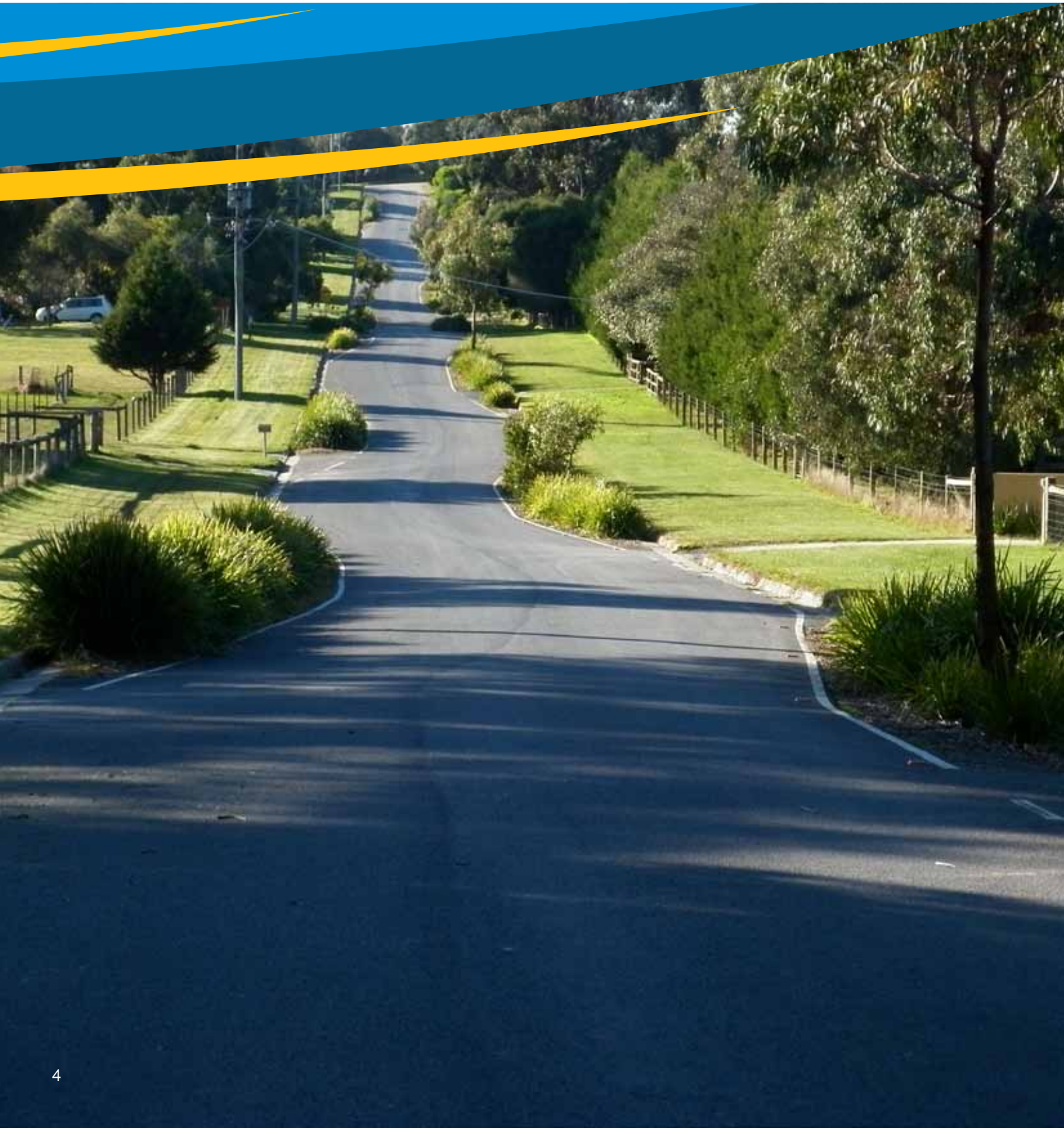
1. INTRODUCTION



FRANKSTON CITY COUNCIL HAS A VISION TO IMPROVE THE SUSTAINABLE WATER MANAGEMENT WITHIN THE MUNICIPALITY, WITH THE AIM OF IMPROVING THE WATER QUALITY IN MAJOR WATERWAYS, REDUCING FLOODING ISSUES AND IMPROVING WATER CONSERVATION. FRANKSTON CITY COUNCIL RECOGNISES THE IMPORTANCE OF SUSTAINABLE WATER MANAGEMENT, BOTH FOR THE COMMUNITY AND THE ENVIRONMENT. A NUMBER OF PROGRAMS ARE ALREADY IN PLACE TO HELP EDUCATE AND PROMOTE SUSTAINABLE WATER MANAGEMENT TO THE WIDER COMMUNITY, HOWEVER COUNCIL ARE SEEKING WAYS TO FURTHER IMPROVE.

Water Sensitive Urban Design (WSUD) is a key component of sustainable water management. WSUD can be used to improve stormwater quality and for water conservation, as well as to reduce local inundation and to more closely mimic the natural system. Council has adopted an approach to more widespread implementation of WSUD, in a bid to further enhance sustainable water management within the municipality.

WSUD can be applied on a range of scales to both existing and future developments. By creating the Frankston WSUD Guidelines, Council aim to create a consistent and coordinated approach for the implementation of WSUD projects. The guidelines are intended for both external parties, such as developers and consultants, and for use within Council. The guidelines have been created for use in a single project phase or to guide the entire lifecycle thinking of a WSUD project.

1.1 BACKGROUND

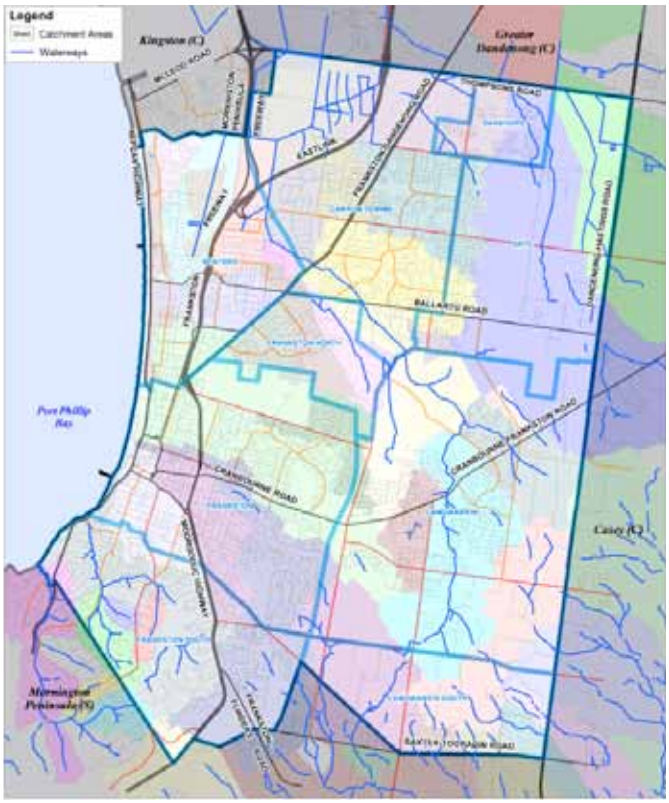
Frankston City Council is located approximately 40km south of Melbourne. It covers an area of approximately 131 km^2 with a population estimated at just below 130,000. The Frankston municipality contains a Central Activities District, indicating growth to be an important part of future planning and design.

The Council area is bound by Port Phillip Bay to the west, Kingston City Council and City of Greater Dandenong to the north, City of Casey to the east and Mornington Peninsula Shire Council to the south (refer to Figure 1.1).

The council area encompasses a number of large catchments, with stormwater draining to a number of major waterways, including; Port Phillip Bay, Westernport Bay, Seaford Wetlands, Boggy Creek, Kananook Creek, Sweetwater Creek, Balcombe Creek, Watson's Creek and Eastern Contour Drain. The management of urban stormwater in the Frankston municipality is the responsibility of both the Council and Melbourne Water. Melbourne Water is typically responsible for management of catchments greater than 60 hectares, and Council has responsibility for catchments smaller than this area.

The waterways in this area are recognised as high regional importance and social value, however are generally in a poor condition (Regional River Health Strategy, Melbourne Water). By implementing WSUD throughout the municipality Council aim to improve the quality of these waterways.

Figure 1.1 Frankston City locality map (source: Frankston City Council, 2011)



1.2 WHAT IS WATER SENSITIVE URBAN DESIGN

1.2.1 DEFINITION

Water Sensitive Urban Design (WSUD) is a component of sustainable water management that recognises the value of stormwater. It enables water conservation, water quality improvement, and stormwater detention to be incorporated into urban planning and design. WSUD can be used in place of traditional stormwater conveyance to more closely mimic the natural system, thereby reducing the impacts of development on our environment. It seeks to conserve water, reduce peak flows by minimising impervious surfaces and retaining stormwater on site, and to improve stormwater quality before it enters our waterways, bays and groundwater systems.

WSUD can be implemented on a range of scales and can be incorporated into different development types, including integration with existing drainage systems. It is suitable for use in a range of environments from highly urbanised cities and residential areas to rural areas.

1.2.2 GUIDING PRINCIPLES

Frankston City Council has four main guiding principles for sustainable water management and WSUD:

- improve water quality entering the waterways
- minimise flooding and local inundation
- water conservation
- educate the community in the value of stormwater.

These guiding principles form the basis of the Frankston WSUD Guidelines. All WSUD projects have the opportunity to contribute to these objectives. The implementation of WSUD can also offer other benefits, including improved landscape and improved groundwater quality.

1.2.3 WSUD ASSETS TYPES

Table 1.1 shows a number of different WSUD assets and their various functions. For more detail on each of the assets refer to Appendix A or the relevant guideline documents.

Table 1.1 WSUD assets functions

WSUD asset	Function			
	Stormwater treatment	Flow attenuation	Stormwater conveyance	Storage for stormwater reuse
Bioretention basins & rain gardens	✓			
Bioretention Swales	✓	limited	✓	
Gross pollutant traps (GPTs)	✓			
Ponds & shallow lake systems	limited			✓
Porous pavements		✓		
Rainwater tanks		✓		✓
Sand filters	✓			
Sedimentation basins	✓	limited		
Stormwater harvesting systems		✓		✓
Swales – vegetated swales, grass swales & buffer strips	✓	limited	✓	
Wetlands (constructed wetlands)	✓	✓		

1.3 PURPOSE OF THE GUIDELINES AND HOW TO USE THEM

These guidelines set out Council's expectations for WSUD. The guidelines have been developed for use by internal and external stakeholders such as developers and consultants. The Frankston WSUD Guidelines should act as a first point of reference for WSUD projects in the Frankston municipality and not in replacement of existing published documents. They aim to provide clarity and consistency for the process of implementing WSUD projects. They also provide an opportunity to raise community awareness and for community education on WSUD and the related waterway and bay health, and water conservation.

The guidelines provide the following information for designers and for those involved in the approvals process:

- guidance on the process of implementing WSUD projects in the Frankston municipality
- Council targets and objectives for WSUD projects
- Council approved WSUD assets
- guidance on the type and amount of information that should be submitted at each project phase, including references to relevant checklists.

The Frankston WSUD Guidelines can be used for the entire project process or for a single phase of the project (e.g. design). A flowchart showing the overall process is provided in Section 2.

1.4 COUNCIL REFERENCE DOCUMENTS AND REGULATORY CONSIDERATIONS

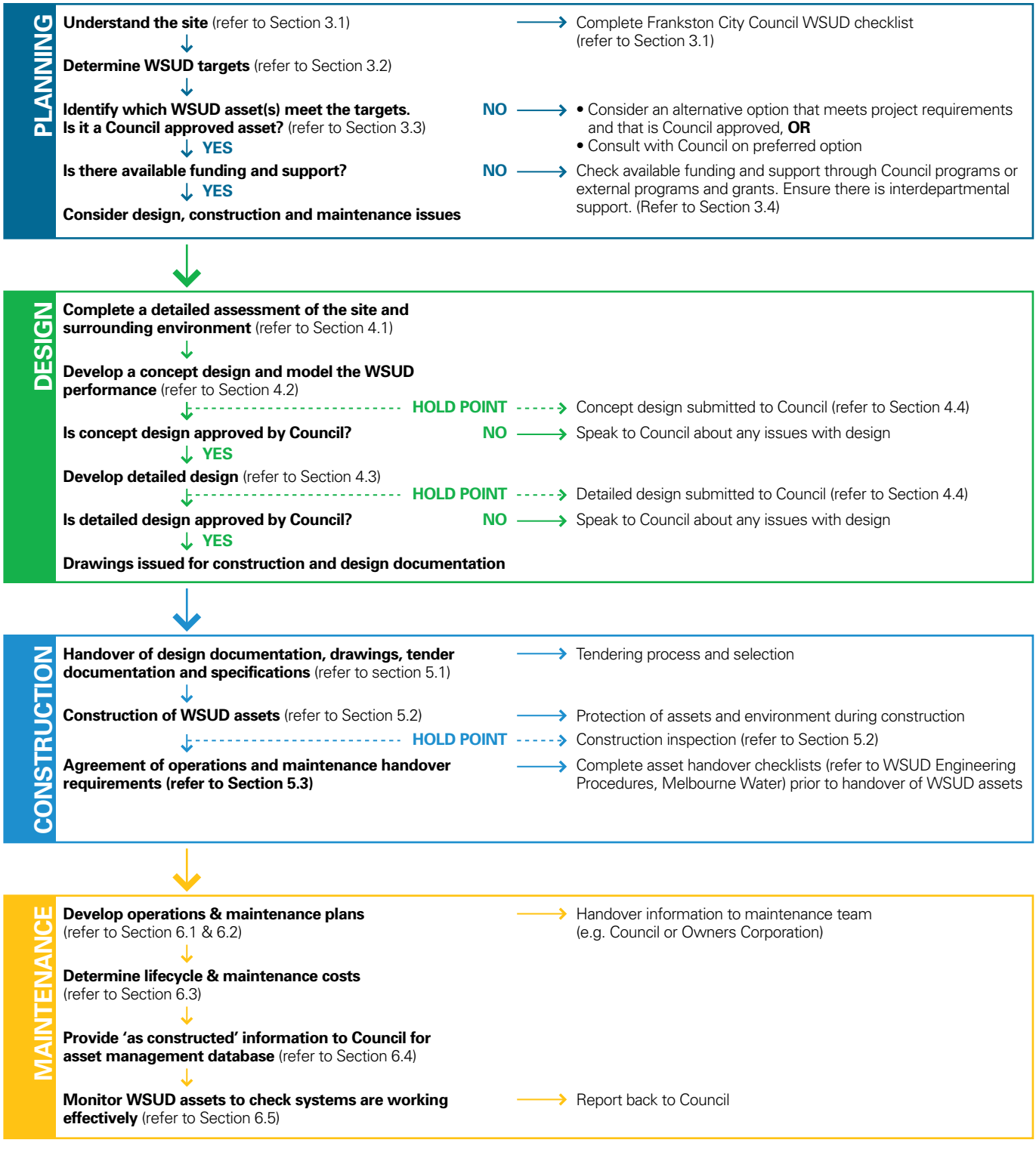
There are a number of different state and national guidelines and policies that are relevant to WSUD. Council has also developed a number of policies, strategies, plans and guidelines that are relevant for the implementation of WSUD projects in Frankston City. Reference should be made to these documents and compliance with government policies for all WSUD projects. Table 1.2 lists the relevant documents that support the uptake of WSUD within the Frankston municipality.

Table 1.2 WSUD reference documents

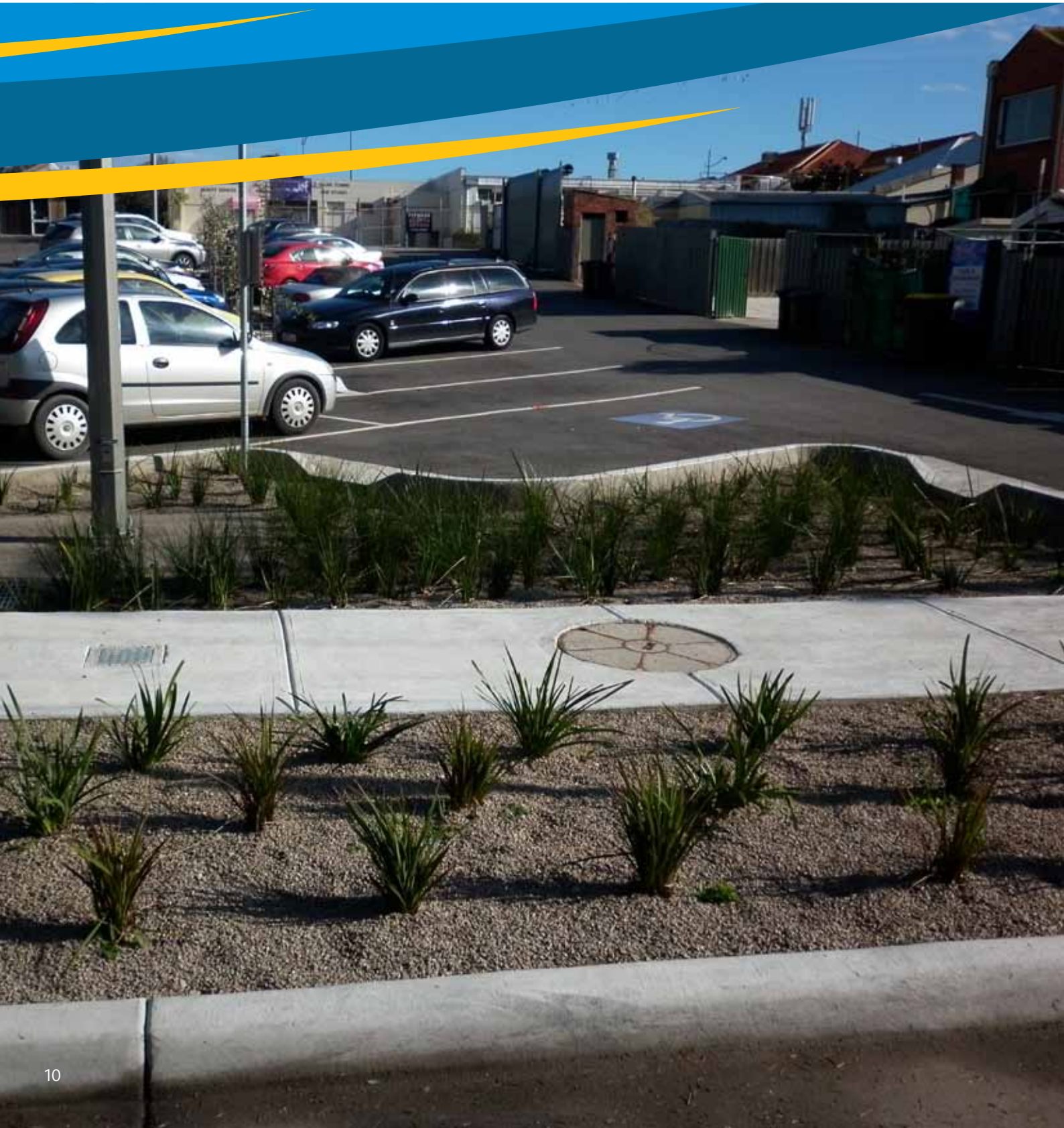
Reference documents – policies, strategies, plans and guidelines
Frankston City Council
Integrated Water Management Plan
Sustainable Water Use Plan (2006)
Stormwater Management Plan (2001)
Frankston Flood Management Plan (2011)
Environmental Sustainability Policy (2010)
Litter Strategy 2004-2007 (2005)
Ecologically Sustainable Development Design Guide – Buildings (2009)
Ecologically Sustainable Development Design Guide – Urban Design (2010)
Frankston 2025 Community Vision
Council Plan
Climate Change Impacts and Adaptation Plan
Carbon Neutral Action Plan
State and regional
Environment Protection Act – Victoria (1970)
Planning and Environment Act – Victoria (1987)
State Environmental Protection Policy – Waters of Victoria (EPA Victoria, 2003)
Urban Stormwater Best Practice Environmental Management Guidelines (Victorian Stormwater Committee, 1999)
Victorian Planning Provisions (Clause 11, 12, 14, 15, 18, 55 and 56)
Securing Our Water Future Together – White Paper (DSE, 2004)
Our Water Our Future (DSE, 2007)
Better Bays and Waterways Plan (Melbourne Water, 2009)
Land Development Manual (Melbourne Water)
Port Phillip and Westernport Regional Catchment Strategy (Port Phillip and Westernport CMA, 2004)
Victoria Regional River Health Strategy (DSE, 2002)
Integrated Water Management Strategy (South East Water)
Linking People and Spaces (Parks Victoria, 2002)
National
Australian Guidelines for Water Recycling: Stormwater Harvesting and Reuse (National Water Quality Management Strategy) (Natural Resource Management Ministerial Council, Environment Protection and Heritage Council, and National Health and Medical Research Council, July 2009)
National Water Initiative
Water for the Future Campaign (Department of the Environment, Water, Heritage and the Arts)

2. IMPLEMENTING WSUD IN FRANKSTON CITY COUNCIL

THE FLOW CHART BELOW OUTLINES THE PROCESS OF IMPLEMENTING WSUD PROJECTS IN FRANKSTON. IT HIGHLIGHTS THE KEY STAGES AND HOLD POINTS FOR EACH OF THE FOUR PHASES: PLANNING, DESIGN, CONSTRUCTION AND MAINTENANCE, WITH FURTHER DETAIL COVERED IN THE LATER SECTIONS OF THE DOCUMENT.



3. **PLANNING**



WSUD NEEDS TO BE CONSIDERED AT ALL STAGES OF A PROJECT STARTING FROM THE PLANNING PHASE. THE PLANNING PHASE SHOULD BE USED TO GAIN AN UNDERSTANDING OF THE SITE AND WSUD OBJECTIVES, PRIOR TO DESIGN DEVELOPMENT, TO ACHIEVE THE BEST WSUD OUTCOME. THE PLANNING PHASE CAN ALSO BE USED TO IDENTIFY FUNDING OPPORTUNITIES AND TO DEVELOP A PROJECT SCOPE. AN ESSENTIAL COMPONENT OF A SUCCESSFUL PLANNING PHASE IS CONSULTATION WITH COUNCIL AND ENSURING THERE IS INTERDEPARTMENTAL INVOLVEMENT THROUGH THE ENTIRE PROCESS.

THIS SECTION OF THE DOCUMENT IDENTIFIES CONSIDERATIONS FOR THE PLANNING PHASE, INCLUDING SITE CHARACTERISTICS, LAND AVAILABILITY, DESIRED WSUD OUTCOMES, COUNCIL'S WSUD TARGETS, APPROVED WSUD ASSETS AND POTENTIAL FUNDING OPPORTUNITIES.

3.1 UNDERSTAND THE SITE

The first step in WSUD projects is to gain an understanding of the site, drainage characteristics and surrounding environment. Developments in Frankston City Council are typically smaller developments as there is limited Greenfield area within the municipality. An understanding of the existing drainage system and drainage characteristics is also important to properly integrate WSUD with the existing systems.

3.1.1 CHECKLIST FOR WSUD PROJECTS

The following checklist should be used as a tool to determine the site and drainage characteristics, and as a prompt for the type of information that should be collected in the planning phase (refer to Table 3.1). Information collected will be used in project planning meetings, and as background information for the design phase. Information that is not available is to be discussed in the project planning meeting. A preliminary drainage strategy may also be required, depending on the assessment by Council.

Table 3.1 Checklist for Frankston City Council WSUD projects – site and drainage characteristics

Checklist for WSUD projects		
Assess the site		**Reference information**
What is the size of the site?	ha	Refer to design plans
Land allocation for WSUD assets	ha	Refer to WSUD Engineering Procedures (Melbourne Water, 2005)
What is the type of development?	☐ Residential ☐ Commercial ☐ Industrial ☐ Capital works ☐ Renewal ☐ Other	Refer to design plans
What is the extent of development and change in permeable area?		Refer to design plans
Who owns the land and who will manage the site?	Land owner: Manager:	Speak to Council and/or developer
Assess the catchment and existing drainage conditions		**Reference information**
What is the local topography?		Site survey
Is the site or downstream area subject to flooding?	☐ Yes ☐ No	Refer to Frankston Planning Schemes (LSIO & SBO) and Frankston Flood Management Plan
Demonstrate a defined access point to site		Refer to design plans
What waterway does the site drain to?		Port Phillip Bay, Westernport Bay, Seaford Wetlands, Kananook Creek, Boggy Creek, Sweetwater Creek, Balcombe Creek, Watson's Creek, or Eastern Contour Drain
Does the site drain to an environmentally sensitive area?	☐ Yes ☐ No If yes, describe:	Yes Refer to Frankston Planning Scheme (ESO and SLO) and speak to Council Environment Department
How can WSUD be integrated with the existing and proposed drainage systems?		Refer to Council drainage plans
What are the desired WSUD outcomes?		Improve water quality, reduce local inundation, water conservation
Other considerations		**Reference information**
Are there any environmental or cultural heritage considerations for this site?		Speak to Frankston City Council Environment Department and refer to Frankston City Heritage Study, Environmental Sustainability Policy and Frankston Planning Schemes (ESO, HO, SLO, EMO and EAO)
Are there any planning constraints?		Refer to Frankston Planning Schemes and Speak to Frankston City Council Planning Department

3.1.2 MELBOURNE WATER DEVELOPMENT SERVICES SCHEMES

Melbourne Water's Development Services Schemes can be used as another point of reference for sites that fall within the scheme areas. The Development Services Schemes were prepared for Melbourne Water as a planning tool, to ensure future urban development met the required stormwater targets. The schemes outline the stormwater infrastructure requirements for the particular catchment and estimated costs for the infrastructure. Table 3.2 shows the Development Services Schemes within the Frankston area.

Table 3.2 Frankston City Council Development Services Schemes

Scheme name	Scheme number
Ballarto Road	1202
Upper Boggy Creek	1203
Langwarrin	1204
Skye Road North	1205
Lower Carrum Downs	1208
Upper Carrum Downs	1209
Wells Road	1210
Little Boggy Creek	1221
Potts Road West	1222
Lathams Road	1230
Baxter West	2323
Baxter East	2324
Langwarrin South	2331

3.1.3 PROJECT PLANNING MEETING

A project planning meeting, or project inception meeting, is to be held during the planning phase. The meeting should be used to discuss the WSUD project including items listed in the Checklist for WSUD Assets (Table 3.1). The project planning meeting should also be used to discuss the following:

- size of the upstream catchment and drainage characteristics
- capacity of downstream drainage system or waterway
- any issues with further growth or integrating with the existing drainage system
- expected pollutants or any focus for pollutant removal
- WSUD targets (refer to Section 3.2)
- opportunities for community engagement and education
- funding avenues and opportunities to develop a business case (refer to Section 3.4).

3.2 PROJECT OUTCOMES AND WSUD TARGETS

The WSUD outcomes and targets need to be determined for each project. Consideration should be given to the existing Council strategies and/or government policies when determining the objectives for a particular project. Project targets may include:

- water quality improvement
- water conservation
- reduced local runoff and inundation
- maintaining environmental flows
- improved landscape and aesthetics
- recreation benefits
- maintenance or enhancement of local ecology, biodiversity and habitat
- an integrated system that combines these outcomes.

3.2.1 FRANKSTON CITY COUNCIL WSUD TARGETS

Council's WSUD targets are a combination of Council specific targets as well as those set out in the Victorian Best Practice Environmental Management Guidelines (1999). The targets have been grouped into three categories: stormwater quality, environmental flows and flooding, and water conservation.

Stormwater quality:

- reduce litter (refer to Frankston Litter Strategy, 2005)
  - focus on litter hot spots, including commercial and residential building sites, parks and recreation areas, commercial and industrial sites, shopping centres, waterways and wetlands, roadways and car parks, and coastal areas
- Best Practice Environmental Management Guidelines targets for on-site treatment of urban stormwater (Victorian Stormwater Committee, 1999)
  - 80% reduction in Total Suspended Solids (TSS)
  - 45% reduction in Total Phosphorus (TP)
  - 45% reduction in Total Nitrogen (TN)
  - 70% reduction in gross pollutants (litter)
- treat stormwater at the source.

Environmental flows and flooding:

- maintain environmental flows
- maintain the peak discharge from the 1.5yr ARI storm event at pre-development levels for stormwater quality treatment systems and 1 in 5yr ARI for entire drainage system (refer to Urban Stormwater Best Practice Environmental Management Guidelines)
- maintain outflows (volumes and peak flows) for connection into the existing drainage system and cause no detriment to this system
- reduce local inundation.

Water conservation:

- reduce Frankston City Council's water consumption by 35% from 2000-2001 levels by 2012-2013 and a further 10% by 2017-2018 (Frankston City Council Sustainable Water Use Plan, 2006)
- reduce Frankston City Council water consumption for open space, playing fields and parks and gardens by 30% from 2000-2001 levels by 2012-2013 and a further 10% by 2017-2018 (Frankston City Council Sustainable Water Use Plan, 2006)
- reduce water use per capita by 25% from 2000-2001 levels by 2015 (Frankston City Council Sustainable Water Use Plan, 2006 – in accordance with Victorian Government targets).

3.3 APPROVED WSUD ASSET TYPES

The WSUD assets for a particular project should be selected based on the desired outcomes and targets as well as those approved by Council. The Council approved WSUD assets are shown in Table 3.3. More detail on each of the WSUD asset can be found in Appendix A or the WSUD Engineering Procedures (Melbourne Water, 2005).

Table 3.3 WSUD assets approved by Council

WSUD asset	Approved for use				Not approved for use
	Residential (multi dwelling)	Residential (multi dwelling greater than 5)	Commercial and industrial	Rural and open space reserves	
Stormwater quality improvement					
Bioretention swales	✓ Open space reserves within Residential 1 Zone ✓ Median strips on divided roads	✓ Open space reserves within Residential 1 Zone ✓ Median strips on divided roads	✓ Car parks ✓ Median strips on divided roads ✓ Commercial precincts	✓ Median strips on divided roads	✗ Not suited to steep land (> 4%)
Bioretention basins and rain gardens	✓ Unit developments (this may require Owners Corporation responsibility)	✓ Unit developments (this may require Owners Corporation responsibility)	✓ Car parks ✓ Street scapes	✓ Drainage reserves & open space reserves	✗ In areas that restrict vehicle or pedestrian access, permanent subsurface flow conditions & where functionality of the open space is compromised
Vegetated swales/ grass swales/ buffer strips	✓ Open space reserves within residential 1 zone & drainage reserves ✓ Central median strips	✓ Open space reserves within residential 1 zone & drainage reserves ✓ Central median strips	✓ Central median strips ✓ Car parks ✓ Median strips & verges	✓ Roadside verges on rural roads and central median strips on connector and arterial roads ✓ Parks & reserves	✗ Narrow nature strips and centre medians
Gross pollutant traps		✓ As Owners Corporation asset (including management & maintenance responsibilities) ✓ When there is suitable maintenance access		✓ Parks & reserves as a Council asset	
Sand filters	✓ As Owners Corporation asset (including management & maintenance responsibilities) ✓ When there is suitable maintenance access ✓ Retrofitted into existing developments	✓ As Owners Corporation asset (including management & maintenance responsibilities) ✓ When there is suitable maintenance access ✓ Retrofitted into existing developments			✗ Not approved as a Council asset
Sedimentation basins	✓ As a temporary measure during construction ✓ Only where there is suitable access for maintenance	✓ As a temporary measure during construction ✓ As part of a wetland system or treatment train ✓ Only where there is suitable access for maintenance	✓ As a temporary measure during construction ✓ As part of a wetland system or treatment train ✓ Only where there is suitable access for maintenance	✓ As a temporary measure during construction ✓ As part of a wetland system or treatment train ✓ Only where there is suitable access for maintenance	✗ Wet basin where catchment is < 60 ha

WSUD asset	Approved for use				Not approved for use
	Residential (multi dwelling)	Residential (multi dwelling greater than 5)	Commercial and industrial	Rural and open space reserves	
Constructed wetlands		✓ Where catchment is > 60 hectares ✓ Only where there is suitable access for maintenance	✓ Where catchment is > 60 hectares ✓ Only where there is suitable access for maintenance	✓ Where catchment is > 60 hectares ✓ Only where there is suitable access for maintenance	✗ Not suited to steep land
Ponds and shallow lake systems				✓ At the end of a wetland system ✓ As storage for water reuse schemes ✓ Where wetland systems are not feasible	✗ Not suited to steep land
Reduce local inundation					
Porous pavements	✓ Pedestrian & bike paths ✓ Driveways (except in turning areas for vehicles)	✓ Pedestrian & bike paths ✓ Driveways (except in turning areas for vehicles)	✓ Shopping strips & streetscapes	✓ Pedestrian & bike paths	✗ Not suited to areas used as a turning circle for vehicles
Ponds and shallow lake systems				✓ Open space reserves	✗ Not suited to steep land
Water conservation					
Stormwater harvesting & reuse systems	✓ Supplied to EPA 'fit for purpose' standard	✓ Supplied to EPA 'fit for purpose' standard	✓ Supplied to EPA 'fit for purpose' standard	✓ Sports ovals, public open space ✓ Supplied to EPA 'fit for purpose' standard	✗ Non-compliant with water / sewerage authority, EPA, Melbourne Water and Council requirements ✗ Non-compliant with NWQMS Australian Guidelines for Water Recycling (2009)

3.4 FUNDING OPPORTUNITIES

Funding for the implementation of WSUD projects may be available through Council or external support. The names of these funding programs and grants may change, however the list below gives an indication of the type of funding that may be available.

- Frankston City Council support (refer to www.frankston.vic.gov.au):
  - Capital works programs
  - Community Grants Program (these include environmental initiatives and are available for eligible community groups – refer to the Frankston City Council website for more information)
- external support – refer to Business Victoria www.business.vic.gov.au for a list of state and national grant programs. External funding support may include the following:
  - Commonwealth Government grants and programs, for example:
    - > Commonwealth Government Rainwater and Greywater Rebates
  - State Government grants and programs
  - Melbourne Water programs (refer to www.melbournewater.com.au), for example:
    - > Melbourne Water support for the 10,000 Rain Gardens Program
    - > Living Rivers Program
  - private sector support, for example through the property or construction sector.

3.5 DESIGN, CONSTRUCTION AND MAINTENANCE CONSIDERATIONS

The final part of the planning phase is to consider factors that may impact the design, construction and maintenance phases:

- design considerations:
  - potential site constraints
  - WSUD assets that meet the required outcomes
  - integrating WSUD with existing and proposed drainage systems
- construction considerations:
  - designs that are simple to construct
  - site access & site constraints
- maintenance considerations:
  - designs that are simple to maintain
  - designs that minimise lifecycle and maintenance costs
  - designs that minimise energy use and greenhouse gas emissions
  - site access
  - budgeting for maintenance.

3.6 PLANNING CASE STUDY – BEACH STREET EAST SHOPPING CENTRE UPGRADE

The upgrade to the Beach Street East Shopping Centre was identified through Council's Neighbourhood Shopping Centre Streetscape Masterplan. The planning phase formed a key part of this project, and lead to a project that benefited both the community and environment.

Background information and WSUD targets identified

The early planning phase was used to identify opportunities to implement WSUD as part of the upgrade. The targets were to improve stormwater quality entering waterways, reduce peak flows and increase groundwater recharge. It was also a goal to improve the amenity of this area for the benefit of the community.

Funding opportunities identified

External support was sought during the planning phase, and discussions with Melbourne Water lead to co-funding of the project by Melbourne Water as part of the Living Rivers Stormwater Program.

Community Engagement

Community consultation also formed a key part of the planning and design phases for this project, to ensure the community were satisfied with the design outcomes. Community awareness and education for sustainable water management was also promoted during this project.

The success of the planning phase allowed for a range of WSUD assets to be incorporated into the streetscape as part of the shopping centre upgrade, leading to both social and environmental benefits.

4. DESIGN OF WSUD

THE DESIGN OF WSUD ASSETS OCCURS THROUGH TWO KEY STAGES – THE CONCEPT DESIGN AND THE DETAILED DESIGN. THE DESIGN IS TO BE DEVELOPED BASED ON THE OUTCOMES FROM THE PLANNING PHASE. DURING THE DESIGN PHASE THERE ARE TWO MAIN HOLD POINTS WHERE COUNCIL APPROVAL IS REQUIRED; AFTER COMPLETION OF THE CONCEPT DESIGN AND FOLLOWING THE COMPLETION OF THE DETAILED DESIGN. HOWEVER, IT IS IMPORTANT TO HAVE COUNCIL CONSULTATION AND INTERDEPARTMENTAL INVOLVEMENT THROUGH THE ENTIRE DESIGN PHASE.

THIS SECTION OF THE DOCUMENT PROVIDES GUIDANCE ON THE DESIGN PROCESSES, AND THE APPLICATIONS, PERMITS AND COUNCIL APPROVALS PROCESS.

4.1 BACKGROUND INFORMATION

Background information on the site is required before commencing the design of WSUD. Information from the planning phase is to be used to gain an understanding of the site and the surrounding environment (refer to the checklist for WSUD projects shown in Table 3.1). In addition, further investigations should be undertaken during the design phase to gather more detailed information. Additional information that should be collected includes:

- site characteristics and surrounding environment
  - site layout and potential locations for WSUD assets
  - topographic information, including contours
  - underground services
  - legal point of discharge
  - planning constraints
  - geotechnical characteristics
  - environmental and cultural heritage features
  - climatic conditions
- an assessment of the downstream hydrology and upstream catchment conditions, including an understanding of any existing flooding issues
- the required WSUD targets, and whether multiple WSUD outcomes can be achieved with the design
- water demand management and water conservation, including local opportunities for water reuse.

When assessing the site information, it is important to determine how the WSUD assets will integrate with the existing drainage system. The drainage system in the Frankston municipality already has areas with existing flooding issues, so WSUD should be designed to reduce local inundation.

4.2 CONCEPT DESIGN PROCESS

The concept design phase involves developing concept design options to meet the required WSUD targets. WSUD assets should be chosen based on these targets, the Council approved assets, and the findings from the initial site investigation (refer to Section 3 – Planning). Appendix A outlines the function and applicability of various WSUD assets. For more detail refer to the WSUD Engineering Procedures (Melbourne Water, 2005).

This section outlines the design considerations and modelling processes that should be completed and documented as part of the concept design.

4.2.1 DESIGN CONSIDERATIONS

There are a number of design considerations that should be investigated as part of the concept design phase, including: environment and heritage, climate change, local inundation and community engagement and education. The amount of information and detail that is required will vary for each project, and will depend on how significant that particular design factor is to the site. These design factors may also impact the type of WSUD asset that is used for the project. Findings from these investigations should be documented in the concept design report.

4.2.1.1 ENVIRONMENT & HERITAGE

Environmental and cultural heritage features should be considered for all projects. The level of detail required from the investigation will vary depending on the specific site. In some cases a desktop investigation will be sufficient, and in others a full environment and heritage study may be required. Incorporating WSUD into the local landscape features should also be considered.

The reference documents shown in Table 4.1 should be used as a first point of reference for environmental and cultural heritage information.

Table 4.1 Reference documents for environment and heritage

Environmental or heritage consideration	Frankston City Council reference documents	External reference documents
Cultural heritage	Frankston City Heritage Study (Stage 1 – 1995 and Stage 2 – 1997) www.frankston.vic.gov.au/fhs/index.htm Frankston Central Activities District Heritage Review (July, 2010) Frankston Planning Scheme – Heritage Overlay (refer to Victorian Planning Schemes online)	Heritage Victoria www.dpcd.vic.gov.au/heritage Heritage Council of Victoria http://vhd.heritage.vic.gov.au/ Aboriginal Affairs Victoria website (Department of Planning and Community Development, Victoria)
Environment and sustainability	Environmental Sustainability Policy (2010) ESD Design Guide – Urban Design (2009) Frankston Planning Scheme – Environment Significance Overlay (refer to Victorian Planning Schemes online) Frankston Planning Scheme – Significant Landscape Overlay (refer to Victorian Planning Schemes online) Frankston Planning Scheme – Erosion Management Overlay (refer to Victorian Planning Schemes online)	
Biodiversity		Biodiversity Interactive Map (Department of Sustainability and Environment, Victoria)
Planting and landscape	Frankston Vegetation Study (2006) Foreshore Flora and Fauna Report (2010) Landscape Town Planning Guidelines (October, 2006) Landscape Character Map (fact sheet)	Ecological Vegetation Class (EVC) map for Port Phillip and Westernport (Department of Sustainability and Environment Victoria, and Victorian Resources online – Department of Primary Industries)
Geology		GeoVic Interactive Map (Department of Sustainability and Environment, Victoria)

4.2.1.2 CLIMATE CHANGE

WSUD designs should consider climate change and the impacts it may have on design. Council's climate change documents address the risks associated with climate change and identify actions to reduce these potential risks. The documents include:

- Climate Change Impacts and Adaptation Plan
- Carbon Neutral Action Plan (in development)

The Climate Change Impacts and Adaptation Plan identifies drainage and infrastructure as major risk areas. The document also outlines a number of actions that should be taken to better prepare for potential climate change risks, including: upgrading existing drainage infrastructure, ecologically sustainable design, protecting the natural environment, integrating WSUD, using alternative water supplies, and onsite water retention. These factors should be considered in the design of WSUD assets.

4.2.1.3 LOCAL INUNDATION

The Municipality has areas of land that are declared flood prone and construction within these declared areas are subject to development requirements. Parts of the existing drainage infrastructure system are old and under capacity and any new development will have the potential to further impact the drainage system, so designs need to integrate properly without causing detriment to the existing system. The design flow needs to be selected and design elements chosen to minimise any local inundation.

Reference should be made to the Frankston Planning Schemes (refer to the Victorian Planning Schemes online) in particular the Land Subject to Inundation Overlay (LSIO) and Special Building Overlay (SBO), for areas that currently have inundation issues. Reference should also be made to the Frankston Flood Management Plan (2011).

4.2.1.4 COMMUNITY ENGAGEMENT AND EDUCATION

WSUD projects should aim to include community engagement and education. This can be achieved through a number of ways, including:

- signage
- creating a feature design for the community
- landscape and streetscape
- letter drops and newsletters
- community input and feedback into the design.

Currently Council is involved in a number of different programs to engage and educate the community on water and environmental issues. Designers should consider if any of these programs or methods of engaging the community are relevant to the project. Community engagement is particularly important for projects located in high exposure areas within Council.

4.2.2 MODELLING WSUD PERFORMANCE

WSUD treatment performance should be modelled using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC). Modelling can be completed for individual WSUD assets or for a collection of WSUD measures (treatment train), to meet the required targets. The input parameters for the model will vary depending on the site characteristics (refer to the sections below for more detail). The Melbourne Water MUSIC Guidelines (2010) provide information on the use of MUSIC and MUSIC parameters (refer to the Melbourne Water website for more information www.melbournewater.com.au).

Stormwater harvesting system performance should be determined using a water balance model. MUSIC can provide a basic water balance model, however in some cases this may not be accurate enough and a more detailed model may need to be used.

The following sections outline some of the model inputs and modelling methods for WSUD.

Fraction impervious

Fraction impervious values are to be nominated based on the land use type. Refer to the MUSIC Guidelines (Melbourne Water, 2010) for typical fraction impervious values for different zones.

Rainfall data

A rainfall distribution map for Greater Melbourne was developed by Melbourne Water (refer to MUSIC Guidelines, 2010). The map identifies rainfall bands, and the associated rainfall station and reference year for areas across Greater Melbourne. Frankston City Council sits within two rainfall bands; the western part having a mean annual rainfall (MAR) of 650-750mm, and the eastern section with a higher MAR of 750-850mm. The reference stations for these bands, as nominated by Melbourne Water are:

- Melbourne City (MAR 650-750mm) – on the western side of Frankston City Council
- Koo Wee Rup (MAR 750-850mm) – on the eastern side of Frankston City Council

Refer to Table 4.2 for the reference rainfall station, reference year and time step to be used when modelling WSUD assets. Refer to the Rainfall Distribution Plan in the MUSIC Guidelines (Melbourne Water, 2010) to see the rainfall band locations.

Table 4.2 Reference rainfall station

Model type	Rainfall reference station	Reference year	Time step
Stormwater treatment	Melbourne City	1966	6 minute
	Koo Wee Rup	2004	6 minute
Stormwater harvesting	Melbourne City *	Up to 10 years of data	1 hour
	Koo Wee Rup*		

* Note another relevant rainfall station with a long data series may be chosen. If another rainfall station is chosen an analysis may have to be completed to ensure the mean rainfall values for that station match those for Frankston. Rainfall series should also have a minimum amount of missing data.

Modelling for stormwater quality

Stormwater treatment assets should be chosen based on the Council approved WSUD assets (refer to Table 3.3) and site characteristics. One or more of these treatment assets may be used to meet the required targets (refer to Appendix A for a summary of the function and applicability of various WSUD assets). Refer to the MUSIC Guidelines (Melbourne Water, 2010) for more information on the different treatment nodes and associated input parameters.

Treatment performance modelled in MUSIC should aim to meet the stormwater quality improvement targets of a reduction in Total Nitrogen by 45%, Total Phosphorus by 45%, Gross Pollutants by 70% and Total Suspended Solids by 80%, or the targets set out in the planning phase for that particular project (refer to Section 3.3). Stormwater quality improvement results are to be documented in the concept design report, and the MUSIC model supplied to Council for review.

Modelling for stormwater quantity

Stormwater harvesting systems should be chosen based on the Council approved WSUD assets (refer to Table 3.3). A water balance model can be used to investigate the performance of a particular system, with the rainfall data and demand profiles as an input for the model. The rainfall data should be based on that listed above, unless there is another relevant rainfall data set with a long series of data (preferably over 10 years) and with minimum data missing from the series. A longer rainfall data series provides more accurate results in the model. If an alternative rainfall data series is used this should be approved by Council and details of the data series included in the concept design report. The recommended time step for stormwater harvesting models is 1 hour, however this time step may vary depending on the set up for the proposed stormwater harvesting system.

The demand profile will need to be determined for each site and also input into the water balance model. Demand profiles are typically estimated as a monthly percentage of an annual demand, however can also be input as an annual demand or daily demand.

A basic water balance model can be set up using MUSIC. Refer to the MUSIC Guidelines (Melbourne Water, 2010) for details on input parameters and losses that may be included in the model. MUSIC models and results are to be submitted to Council as part of the concept design documentation.

Details of the stormwater harvesting system performance should be included in the concept design report.
The system performance, or reliability of the system to supply water, can be measured as a percentage of time that the water supply meets the demand. This can be calculated as a percentage for each time step in the model.

4.2.3 APPROVAL OF CONCEPT DESIGN

Following the concept design, there is a hold point where designs are to be submitted to and approved by Council, before proceeding with the detailed design. Section 4.4 outlines the specific applications (including the required documentation), permits and the approvals processes required for both the concept and detailed design.

4.3 DETAILED DESIGN PROCESS

The detailed design process involves the development of detailed design drawings and design reports. This design must be consistent with the approved concept design. Reference should be made to the WSUD Engineering Procedures (Melbourne Water, 2005) for design requirements for the different WSUD assets (refer to the Melbourne Water website for more information – www.melbournewater.com.au).

4.3.1 DESIGN CONSIDERATIONS

There are a number of factors that are relevant for the detailed design phase. Design considerations include; safety in design, landscape and planting, construction, maintenance and defect liability period, ongoing lifecycle and maintenance costs.

4.3.1.1 SAFETY IN DESIGN

Safety considerations for the design of WSUD assets may include:

- site access (for construction and maintenance) – for staff and machinery/vehicles
- safety considerations for construction
- public access
- appropriate signage to identify risks (for example deep water, use of recycled water, confined spaces etc.)
- batters to open water (refer to Melbourne Water guidelines – wetlands and ponds)
- batters for maintenance – minimum of 1 in 5
- risks of using recycled water, refer to NWQMS Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 2) – Stormwater Harvesting and Reuse (2009)
- flood depths and water velocities.

4.3.1.2 LANDSCAPE AND PLANTING

Landscape and planting is an important component of WSUD for both aesthetics, to create a community feature, and functionality. Planting can often form a key component of the treatment process and can offer additional functionality such as stabilising banks and minimising erosion. The landscape and planting plans are therefore necessary for the detailed design phase.

Landscape and planting plans should be submitted with each detailed design. The vegetation should be chosen based on the type of WSUD asset (refer to external reference documents in Table 4.3), as well as to match the specific environment and vegetation native to the Frankston area (refer to Council reference documents in Table 4.3). Landscape and planting plans should also include vegetation that can be easily maintained.

Table 4.3 Landscape and planting plans reference documents

Frankston City Council reference documents	External reference documents
Landscape Character Planting Guide (fact sheet)	WSUD Engineering Procedures: Stormwater – Appendix A Suggested plant species for WSUD treatment elements (Melbourne Water, 2005)
Landscape Character Map (fact sheet)	Constructed Wetlands Guidelines – Appendix 4 Suggested plant species for wetlands (Melbourne Water, 2010)
Sustainable Gardening in Frankston and Guide to Local Plants and Weeds (1996) http://www.sgaonline.org.au/pdfs/frankston.pdf	Stormwater Biofiltration Systems Adoption Guidelines – Section 3.5.12 Vegetation (Facility for Advancing Water Biofiltration, 2009)

4.3.1.3 CONSTRUCTION, MAINTENANCE AND DEFECT LIABILITY REQUIREMENTS

Documentation of the planned construction and maintenance issues should be addressed and included as part of the detailed design reporting. This documentation may include:

- a Site Environmental Management Plan
- preferred site access and access to the WSUD asset (for both construction and maintenance) for staff, machinery and vehicles as required
- asset handover arrangements, including defect liability and timeframes if applicable
- maintenance plans or procedures, which outline the responsibilities, requirements and indicative costs for maintenance.

Defect liability periods should also be considered during the design phase. The defect liability periods applicable to WSUD assets owned by Council commence after practical completion of the asset, and are outlined below:

- bioretention basins and swales, rain gardens and sand filters – 24 months
- sedimentation basins, wetlands, lakes and ponds:
  - civil assets (e.g. GPTs, pipes and concrete structures) – 12 months
  - landscape vegetation and plantings – 24 months.

4.3.1.4 LIFECYCLE AND MAINTENANCE COSTS

An estimate of the ongoing lifecycle and maintenance costs is to be made during the design phase. Information on cost estimates is to be included in the design documentation. Refer to Section 6.3 for further information on cost estimates.

4.4 APPLICATIONS, PERMITS AND COUNCIL APPROVALS

Council approvals may be required for the concept and detailed design. The information required, and therefore the submissions to Council, for each phase of the design will differ. This section outlines the applications, permits and approvals process for WSUD projects.

Applications

Concept design applications should include the following:

- design report, including the design intent, modelled WSUD performance and assumed model input parameters, and any other design considerations
- concept design drawings
- maps or plans showing drainage, contour and catchment information
- electronic copy of the MUSIC model.

Detailed design applications should include the following:

- design report – to address all stormwater drainage, quality and conservation issues
- detailed design drawings
- site management plan - to meet construction phase requirements
- digital data for the Frankston City Council asset management database (refer to the D-Spec Standard manual)
- maintenance plans or procedures
- life cycle and maintenance costs.

Permits

Planning Permits

For some buildings and works a planning permit may be required. In other cases WSUD may be incorporated into a development via permit conditions. If a planning permit is required a concept design must be submitted with the permit application. There may also be additional requirements – refer to all sections of the Frankston Planning Scheme. For further information on planning permits refer to the Frankston City Council website www.frankston.vic.gov.au.

Infrastructure Permits

An Asset Protection permit may also be required for works on site to protect Councils assets during construction (Refer to Council's General Local Law No. 7 (2003) Clause 3.6). Refer to Frankston City Council website for more detail on Council permits (www.frankston.vic.gov.au).

Approvals

Council approval will be based on the WSUD design and design documentation submitted. The performance of the WSUD assets must meet the required targets and any Council design requirements. Design reports must also address any design issues (as outlined in Section 4).
If sufficient information is not supplied to Council they may request that further information be provided. Note that detailed designs submitted must be consistent with the concept design.

If a planning permit is required an Application for Planning Permit and any supporting information must also be submitted to Council. Refer to the Frankston City Council website for more information on Planning and Asset Protection Permits.

4.5 DESIGN CASE STUDY – GEORGE PENTLAND BOTANIC GARDENS LAKE RECONSTRUCTION

The design work for the reconstruction of the lake in the George Pentland Botanic Gardens began in 2009. The existing lake was a popular location for leisure activities and an important community feature, however problems from leaking had arisen due to a degrading lake wall and silting of the clay liner. Frankston City Council therefore decided to reconstruct the lake.

Community engagement and environmental considerations

The focus of the design for the reconstruction was to maintain the aesthetics for the community, to promote community education as well as improve the environmental value and treatment function of the lake system.

Site investigation and water conservation opportunities

During the design phase an investigation of the site was completed and an existing stormwater drain was identified within the park area. This formed a component of the new design, with the stormwater from this drain being treated in the lake system, before being used for irrigation.

Modelling WSUD performance

A model of the lake system was developed as part of the design phase to check the treatment function of the system. It was found that with a range of WSUD features to treat and store the stormwater, it would be suitable for use as irrigation water.

The final design included a range of WSUD assets such as rain gardens, rock chutes, the reconstructed lake with wetland planting and an open water section, retaining wall structures and a 150kL underground storage tank.
To improve the aesthetics of the park and opportunities for community education other features such as a boardwalk and stonework were also included in the design.

5. CONSTRUCTION AND ASSET HANDOVER

THE CONSTRUCTION AND HANDOVER PHASES INCLUDE THE HANDOVER OF DESIGN DOCUMENTATION, FOLLOWED BY THE CONSTRUCTION PHASE, AND ULTIMATELY THE HANDOVER OF OPERATIONS AND MAINTENANCE DOCUMENTATION FOR THE MAINTENANCE PHASE. IT IS IMPORTANT THAT SUFFICIENT INFORMATION IS HANDED OVER AT EACH STAGE TO ENSURE THAT THE CONSTRUCTION MATCHES THE INTENDED DESIGN AND TO PROVIDE A CLEAR UNDERSTANDING OF THE MAINTENANCE REQUIREMENTS FOR THE WSUD ASSETS.

5.1 DESIGN DOCUMENTATION

Design documentation, including detailed design drawings, tender documents and specifications, are to be provided to the construction team. A feedback loop between the design and construction teams will be required to clarify any design issues and uncertainties, where further information is required or for designs that may be very challenging to construct.

5.1.1 DETAIL DESIGN DRAWINGS

Detailed design drawings will be provided for the construction phase, once the design has been approved by Council. Drawings need to include sufficient information for construction to be completed and need to be easy to understand. Detail design drawings may also include references to Frankston City Council standard drawings.

Designs need to consider construction and maintenance issues such as:

- site access for construction and maintenance – access tracks need to be designed for the type of equipment or vehicles that will be needed during these phases
- construction and maintenance issues
- Environmental Management Plan (EMP) – to be developed for the construction phase
- Traffic Management Plan if required
- locations of underground services
- safety considerations.

5.1.2 TENDER DOCUMENTS AND SPECIFICATIONS

Tender documents and specifications are to be developed at the beginning of the construction phase. Separate documents are to be developed for the civil works and the landscape works. Timing of works, hold points and material supply and availability should be determined at this stage. Once these documents have been developed the tendering process and selection can be completed.

5.2 CONSTRUCTION PHASE REQUIREMENTS

Prior to construction commencing, a pre-construction meeting should take place. The pre-construction meeting involves a handover of the design information for a particular site. The pre-construction meeting can be used to clarify any uncertainties, required asset protection measures, permits or any other local or site issues. Reference should be made to the WSUD Engineering Procedures (Melbourne Water, 2005) for construction considerations for the different WSUD assets.

A clear understanding of the construction documentation is required to ensure the construction matches the intended design. Any uncertainties should be discussed in the pre-construction meeting, or further information should be requested from the designers.

5.2.1 ASSET PROTECTION DURING CONSTRUCTION

The WSUD assets, surrounding environment and other council assets all need to be protected during the construction phase. Refer to the project Environmental Management Plan for environmental protection measures. Council assets (for example footpaths, nature strips, signs, nature strip trees, vegetation, underground assets, pits and road pavement) must not be damaged as a result of works (refer to Council's Local Law No. 7 (2003) and Frankston City Council Building and Works Code of Practice (April, 2006)). Required asset protection measures are to be confirmed in the pre-construction meeting, and may include:

- silt fences
- straw bales
- fences/bollards around WSUD assets
- sacrificial layers in treatment systems
- inclusion of temporary turf or geofabric with planting, for sediment control before plants are established
- temporary diversions of stormwater around WSUD assets during construction.

Litter and building site waste must also be managed properly on site (refer to Frankston City Council Building and Works Code of Practice (April, 2006)).

5.2.2 CONSTRUCTION INSPECTION

During the construction phase there are a number of hold points, where approval and sign off by the Superintendent is required. At these hold points, an inspection of the construction works by the Superintendent is also required. Refer to Council Specification Section 2 – in particular Section 2.A2 and Appendix A for construction works activities and required hold points and sign offs for construction works. The construction inspections may also include material testing and provision of samples.

Inspections and sign offs will be required both during the construction phase as well as a final inspection following completion of construction. The construction checklists in the WSUD Engineering Procedures (Melbourne Water, 2005) can be used as a guide for the type of inspection required for specific WSUD assets. Refer to Table 5.1 for reference list of construction inspection checklists for various WSUD asset types.

Table 5.1 Construction inspection checklists for WSUD assets

WSUD asset	Reference
Sedimentation basin	Section 4.4.3 of WSUD Engineering Procedures (Melbourne Water, 2005)
Bioretention swale	Section 5.4.3 of WSUD Engineering Procedures (Melbourne Water, 2005)
Bioretention basin	Section 6.4.3 of WSUD Engineering Procedures (Melbourne Water, 2005)
Sand filters	Section 7.4.3 of WSUD Engineering Procedures (Melbourne Water, 2005)
Wetlands	Section 8.4.3 of WSUD Engineering Procedures (Melbourne Water, 2005)
Constructed wetlands	Section 9.4.3 of WSUD Engineering Procedures (Melbourne Water, 2005)
Ponds and lakes	Section 10.4.3 of WSUD Engineering Procedures (Melbourne Water, 2005)
Infiltration measures	Section 11.4.3 of WSUD Engineering Procedures (Melbourne Water, 2005)
GPTs	Refer to manufacturer specifications

Note: Refer to the Melbourne Water website (www.melbournewater.com.au) for further information on the WSUD Engineering Procedures.

A check of the specific Frankston City Council construction requirements should also be completed, for example preferred Council planting types. Other items specific to the project or site should also be included during the construction inspections, for example managing high flows and any building phase damage.

5.3 AGREEMENT OF OPERATIONS AND MAINTENANCE HANDOVER REQUIREMENTS

Following the completion of construction (in accordance with the design plans) the maintenance period begins. At this stage there is a hold point where a number of actions are required prior to handover of the WSUD asset for operations and maintenance. These actions include:

- develop maintenance and operation plans (refer to Section 6)
- Council consultation and approval of maintenance plans
- construction inspection (refer to Section 5.2.2)
- completion of asset handover checklist (refer to Section 5.3.1)
- inform relevant parties of maintenance responsibilities (e.g. Council or Owners Corporation).

After the maintenance period has started an off maintenance inspection is conducted to ensure the WSUD asset is constructed and operating as per design. For Council assets, an inspection will be conducted following construction as well as regular inspections during the maintenance phase (refer to Section 6 for more detail on the maintenance phase). For assets managed by Owners Corporations, Council will only conduct an inspection following construction. Refer to Section 5.3.1 below for more information on the asset handover checklists.

5.3.1 ASSET HANDOVER CHECKLISTS

An asset handover checklist should be completed following practical completion and prior to the handover of WSUD assets. This should occur to ensure the WSUD assets have been constructed according to the design and to ensure the correct maintenance information is provided to the maintenance team (e.g. the Council Maintenance team or Owners Corporation). It is recommended that the WSUD Engineering Procedures (Melbourne Water, 2005) checklists be used as a guide for the different WSUD types. Refer to Table 5.2 for a reference list of the WSUD asset handover checklists.

Table 5.2 Asset handover checklists for WSUD assets

WSUD asset checklist	Reference
Sedimentation basin checklist	Section 4.4.4 of WSUD Engineering Procedures
Bioretention swale	Section 5.4.4 of WSUD Engineering Procedures
Bioretention basin	Section 6.4.4 of WSUD Engineering Procedures
Sand filters	Section 7.4.4 of WSUD Engineering Procedures
Wetlands	Section 8.4.4 of WSUD Engineering Procedures
Constructed wetlands	Section 9.4.4 of WSUD Engineering Procedures
Ponds and lakes	Section 10.4.4 of WSUD Engineering Procedures
Infiltration measures	Section 11.4.4 of WSUD Engineering Procedures
GPTs	Refer to manufacturers specifications

Other items specific to the particular design or project may have to be included on the checklist, for example:

- marker locations for systems or pits that may be hidden by overgrown vegetation
- locks on pits etc. – using appropriate council locks
- confined space warnings (e.g. for GPTs)
- safety or interpretive signs.

A maintenance schedule should also be developed and Council and the developer should walk over the site prior to asset handover. Refer to Section 6 for further detail on maintenance requirements.

6. MAINTENANCE AND OPERATION

THE MAINTENANCE REQUIREMENTS VARY FOR THE DIFFERENT WSUD ASSETS. IT IS THEREFORE IMPORTANT TO HAVE A MAINTENANCE PROCEDURE THAT CLEARLY OUTLINES THE MAINTENANCE REQUIREMENTS TO ENSURE THE WSUD ASSETS MAINTAIN THEIR FUNCTIONALITY. THE ONGOING MAINTENANCE COSTS SHOULD ALSO BE ESTIMATED PRIOR TO HANDOVER SO THE COSTS CAN BE FACTORED INTO THE BUDGETS.

6.1 OPERATION PLANS

Operation plans should be developed for WSUD assets that Council may inherit that are difficult to operate. Requirement for an operation plan will be determined on a case by case basis by Council. Examples of when an operation plan may be required include, but are not limited to:

- wetlands that include penstocks to control inflow and water level
- stormwater harvesting schemes with complex control systems – Council will need information on how to operate the system.

Operation plans may include the following type of information:

- photographs of relevant components
- make and manufacturer
- purpose of the component
- maintenance requirement
- expected frequency of maintenance.

Refer to Appendix 6 of the Constructed Wetland Guidelines (Melbourne Water, 2010) for an example of an operation and responsibility plan.

6.2 MAINTENANCE PLANS

Maintenance plans or procedures are to be developed and then handed over following the construction phase. The maintenance plan may be a Council plan or one specific to the project. The plan needs to clearly outline:

- the maintenance procedure and how to maintain the WSUD asset
- description or plan showing the location of assets that require maintenance. Marker locations may also be required for pits or other infrastructure that cannot be easily found (e.g. once vegetation is established), but requires maintenance
- maintenance responsibilities – the plan must state who is responsible for the ongoing maintenance (e.g. Council or an Owners Corporation), do they require training on how to maintain the system and do they require a maintenance notice from Council?
- an estimate of the ongoing maintenance costs.

Maintenance plans also need to consider the impact that non-council owned assets may have on Council owned assets, and the required maintenance for this.

6.2.1 DEVELOPING A MAINTENANCE PLAN

Maintenance plans should include the following information:

- required inspections and frequency
- maintenance tasks and frequency (refer to maintenance considerations below, Appendix A and WSUD Engineering Procedures)
- procedure to maintain the WSUD asset and any specific equipment that may be required
- materials list and supplier details
- manufacturers documents, warranties and schedules
- plant list
- site specific requirements (e.g. if locks are required on parts of the system to prevent vandalism)
- monitoring method
- maintenance access – maintenance access must be all weather access and must not impact the environment or amenity.

Maintenance plans should be reviewed and approved by Council prior to commencement of maintenance period.

6.2.2 MAINTENANCE CONSIDERATIONS FOR WSUD ASSETS

Maintenance requirements vary for different WSUD assets and sites, but may include:

- inspection of assets
- cleaning the asset, removal and safe legal disposal (in accordance with EPA standards) of litter, debris, silt and sediment
- removal and replacement of the filter media
- edge control and erosion management
- vegetation management and weed removal
- maintaining pumps
- ongoing monitoring and reporting.

Refer to Appendix A and the WSUD Engineering Procedures (Melbourne Water, 2005) for lists of the required maintenance for different WSUD assets.

6.2.3 VEGETATION MANAGEMENT

Ongoing maintenance of vegetation is required for WSUD assets, and is particularly important in the first 2 years following construction, before the plants are fully established. Vegetation management may include:

- removal of weeds (refer to Frankston City Council Weed Guide and Plant Guide – Mornington Peninsula Pest Plants)
- replacement of plants and mulch
- tree pruning
- mowing.

For further information on vegetation management refer to Maintaining Water Sensitive Design Elements (EPA, 2008) and WSUD Engineering Procedures (Melbourne Water, 2005).

6.3 LIFECYCLE AND MAINTENANCE COSTS

The lifecycle and maintenance costs for WSUD systems need to be determined and included in maintenance budgets. Maintenance costs can be estimated based on past experience, or one of the following resources can be used as a guide:

- information from the maintenance team
- information from the private developers maintenance plan
- indicative costs outlined in Maintaining WSUD Elements (EPA, 2008).

6.3.1 REPLACEMENT AND RENEWAL

Replacement and renewal costs need to be included in budgeting. Well estimated costs are required, and again can be based on past experience, input from the maintenance team or from maintenance plans.

Information from the maintenance, replacement and renewal costs from a project should be used to inform future budgets.

6.4 ASSET MANAGEMENT

Frankston City Council uses the Hansen 8 Asset Management Information System (AMIS) to register and manage all WSUD assets. The system follows the D-Spec standard specification, and WSUD information provided to Council will need to be in accordance with this specification. The asset management database system will combine geographic information and asset management information, and provide a streamlined method for Council to track these assets. It will also provide opportunities for Council to forecast maintenance and associated costs.

All future 'as constructed' information will need to be provided to Council in the correct electronic format to be included in the database. Refer to the D-Spec standard specification for more information on the type and format of information required by Council.

6.5 MONITORING AND REPORTING

Ongoing monitoring of WSUD systems needs to occur, to ensure the WSUD assets maintain their functionality. The monitoring method should be outlined in the maintenance plan and should clearly state the required monitoring frequency. The system effectiveness and maintenance requirements for all Council assets should be included in ongoing reporting back to Council, to be considered in future designs and to inform future maintenance budgets.

APPENDIX A
WSUD ASSET INFORMATION SHEETS

BIORETENTION BASINS AND RAIN GARDENS
INFORMATION SHEET

Description

Bioretention basins and rain gardens are types of biofiltration systems that are used for stormwater quality improvement. The systems include a number of elements including a filter media and vegetation. Stormwater filters through the system allowing uptake of stormwater pollutants through the vegetation and filter media. Bioretention basins are particularly efficient at removing fine particulate or soluble contaminants such as nitrogen. The extended detention time also adds to the treatment function as well as reducing peak flows.

Function

- Stormwater treatment
- Flow attenuation

Indicative costs (low, moderate or high)

- Installation costs – moderate
- Maintenance costs – moderate

Applicability

- Residential areas, commercial areas including car parks and street scapes, drainage reserves and open space reserves
- Not suitable in locations where system may restrict permanent subsurface flow conditions

Design and maintenance considerations

- Filter media is sensitive to blocking, so must be protected during construction phase
- Hydraulic conductivity of filter media should be tested prior to construction and before handover (refer to WSUD Engineering Procedures, 2005)
- It is recommended that vegetation be selected in consultation with landscape architects

For further information refer to:

- Adoption Guidelines for Stormwater Biofiltration Systems (FAWB, 2009)
- WSUD Engineering Procedures: Stormwater – Chapter 6 (Melbourne Water, 2005)

BIORETENTION SWALES
INFORMATION SHEET

Description

Bioretention swales are a type of biofiltration system located in the base of a swale. Bioretention swales offer both stormwater treatment and conveyance functions. The systems are designed to filter stormwater through the filter media and planted sections to improve stormwater quality.

Function

- Stormwater treatment
- Stormwater conveyance
- Flow attenuation

Indicative costs (low, moderate or high)

- Installation costs – moderate
- Maintenance costs – moderate

Applicability

- Suited to highly urbanised areas including residential areas, commercial areas, car parks and street scapes, drainage reserves and open space reserves
- Typically suited to slopes of 1 to 4%, where flow velocities during major storm events do not exceed 2m/s (note measures can be taken to reduce flow velocities)
- Not suited to steep land

Design and maintenance considerations

- Filter media is sensitive to blocking, so must be protected during construction phase
- Hydraulic conductivity of filter media should be tested prior to construction and before handover (refer to WSUD Engineering Procedures – Melbourne Water, 2005)
- Velocity-depth check should be undertaken for public safety (refer to WSUD Engineering Procedures – Melbourne Water, 2005)
- It is recommended that vegetation be selected in consultation with landscape architects

For further information refer to:

- Adoption Guidelines for Stormwater Biofiltration Systems (FAWB, 2009)
- WSUD Engineering Procedures: Stormwater – Chapter 5 (Melbourne Water, 2005)

CONSTRUCTED WETLANDS
INFORMATION SHEET

Description

Constructed wetlands are artificially created shallow water bodies that contain extensive vegetation. They typically contain a number of zones of varying depth and vegetation type and cover to improve stormwater quality (refer to Melbourne Water's Constructed Wetlands Guidelines (2010) for more information). Stormwater pollutants are removed through various processes, including: sedimentation, filtration and pollutant uptake through vegetation.

Function

- Stormwater treatment
- Flow attenuation

Indicative costs (low, moderate or high)

- Installation costs – high
- Maintenance costs – moderate

Applicability

- Suited to large catchments with high volumes of runoff, including large residential or commercial developments, rural areas or open space reserves
- Not suited to steep land or areas where land availability is restricted

Design and maintenance considerations

- Constructed wetlands should treat at least 90% of mean annual runoff
- Wetlands should be designed with a high flow bypass to take flows higher than the design flow (typically 1 in 1 year event), refer to Section 9.3.6 of the WSUD Engineering Procedures: Stormwater (Melbourne Water, 2005)
- Riser outlets are to be designed to achieve required detention time in the wetland. Riser outlets should also be sized to act as an emergency overflow
- A minimum freeboard of 0.3m for the embankment is required
- Wetlands are to be designed and constructed with appropriate maintenance access (refer to Melbourne Water's Constructed Wetlands Guidelines (2010))
- Wetland design must meet safety requirements and implement reasonable safety measures (refer to Section 6 of the Constructed Wetlands Guidelines, Melbourne Water, 2010), including approach batter slopes, safety benches and signage

For further information refer to:

- Constructed Wetlands Guidelines (Melbourne Water, 2010)
- WSUD Engineering Procedures: Stormwater – Chapter 9 (Melbourne Water, 2005)

GROSS POLLUTANT TRAPS (GPTS)
INFORMATION SHEET

Description

Gross Pollutant Traps (GPTs) remove large pollutants, such as litter and debris, from stormwater runoff. GPTs can act as a pre-treatment as part of a larger treatment train, or as a stand-alone treatment measure.

Function

- Stormwater treatment

Indicative costs (low, moderate or high)

- Installation costs – moderate
- Maintenance costs – low

Applicability

- Residential developments as an Owners Corporation asset
- Parks and reserves as a Council asset
- Suitable for conventional drainage systems, but not as part of a natural waterway

Design and maintenance considerations

- Designs should include suitable access for ongoing maintenance
- Designs should consider any safety requirements (e.g. confined space warnings)
- Refer to manufacturers specifications for specific design and maintenance requirements

For further information refer to:

- WSUD Engineering Procedures: Stormwater – Chapter 14 (Melbourne Water, 2005)

PONDS AND SHALLOW LAKE SYSTEMS
INFORMATION SHEET

Description

Ponds and shallow lake systems are most effective for stormwater treatment when incorporated into a treatment train. They can be used as a stand-alone measure where other treatment assets or not appropriate, however are more likely to meet BPEMG targets when incorporated with other treatment measures.

Ponds and shallow lake systems can also be used as storages for stormwater harvesting systems and flow attenuation. They have the potential to add greater amenity and habitat than other storage options, such as underground storage tanks.

Function

- Flow attenuation
- Storage for stormwater harvesting systems
- Limited stormwater treatment

Indicative costs (low, moderate or high)

- Installation costs – high
- Maintenance costs – moderate

Applicability

- Suitable for parks and open space reserves
- At the end of a wetland system or where wetland systems are not feasible
- As a storage for stormwater harvesting systems

Design and maintenance considerations

- Designs need to reduce the risks of algal blooms, refer to Section 10.3.2 of the WSUD Engineering Procedures: Stormwater (Melbourne Water 2010)
- Designs must meet safety requirements and implement reasonable safety measures, including approach batter slopes, safety benches, planting method, hand rails and signage. It is recommended that an independent safety audit be conducted for all designs

For further information refer to:

- WSUD Engineering Procedures: Stormwater – Chapter 10 (Melbourne Water, 2005)

POROUS PAVEMENTS
INFORMATION SHEET

Description

Porous pavement allows increased infiltration of stormwater runoff compared to conventional pavement. Porous pavements typically fall under two main categories; porous concrete or asphalt pavement, or, pavers that are constructed with a gap between them. Both options promote infiltration and therefore increase flow attenuation. Porous pavement can also offer some treatment function through the filtration of stormwater runoff.

Function

- Flow attenuation through increased infiltration of stormwater runoff

Indicative costs (low, moderate or high)

- Installation costs – moderate
- Maintenance costs – low

Applicability

- Pedestrian and bike paths
- Shopping strips and streetscapes
- Driveways in residential developments (except in the turning area for the vehicles)

Design and maintenance considerations

- Design of porous pavement needs to consider required traffic loading
- Porous pavements are best suited to areas without heavy traffic loads, as pollutants from the traffic can causing the systems to block
- Porous pavements can become easily blocked, so maintenance regimes should include regular removal of accumulated sediment, debris and any weeds. Porous pavement should also be checked for cracks and holes (WSUD Engineering Procedures: Stormwater – Section 14.4.3 and Table 14.3, Melbourne Water, 2005)

For further information refer to:

- WSUD Engineering Procedures: Stormwater – Chapter 14 (Melbourne Water, 2005)

RAINWATER TANKS
INFORMATION SHEET

Description

Rainwater tanks are used to collect roof runoff as an alternative water supply to mains water. They are primarily used to conserve potable mains water use, but also reduce stormwater runoff volumes, and to a limited degree reduce the pollutant loads.

Rainwater tanks can vary in size and shape, and can therefore be used on a range of scales and development types, including individual residences. They are applicable where there is a high roof area compared to the occupancy.

Source: Melbourne Water

Function

- Alternative water supply (water conservation)
- Stormwater attenuation

Indicative costs (low, moderate or high)

- Installation costs – low
- Maintenance costs – low

Applicability

- Residential areas including individual households
- Commercial and industrial areas where there is high roof area compared to demand

Design and maintenance considerations

- Rainwater tanks are to be installed in accordance with the Plumbing and Drainage Standards (AS/NZS 3500 2003)
- A water balance model should be completed during the design phase to see how much water will be available for use
- Tanks should be sized in accordance with the reference curves as shown in Section 12.4.2 of the WSUD Engineering Procedures: Stormwater Manual (Melbourne Water, 2005)
- Water must be supplied to EPA 'fit for purpose' standards, and compliant with water/sewer authority, Melbourne Water, Council and EPA requirements
- Must be compliant with NWQMS Australian Guidelines for Water Recycling (2009)

For further information refer to:

- WSUD Engineering Procedures: Stormwater – Chapter 12 (Melbourne Water, 2005)

SAND FILTERS
INFORMATION SHEET

Description

Sand filters comprise a filter media but with no vegetation. They can therefore be used in areas of confined space or even in underground systems, where vegetation isn't supported. Sand filters treat stormwater via the process of filtration through a sedimentation chamber (which retains larger pollutants) and then through the filter media (which retains some of the finer pollutants).

Source: Melbourne Water

Function

- Stormwater treatment
- Limited flow attenuation

Indicative costs (low, moderate or high)

- Installation costs – low/moderate
- Maintenance costs – moderate

Applicability

- Suitable for residential areas – either retrofitted into existing developments or in new developments
- Highly urbanised areas and areas with limited space

Design and maintenance considerations

- Sand filters must have suitable access for ongoing maintenance
- Sand filters require regular maintenance, to maintain the treatment functionality and to prevent the system from blocking
- An impervious liner may be required to contain water within the system (e.g. if there is a significant structure nearby)

For further information refer to:

- WSUD Engineering Procedures: Stormwater – Chapter 7 (Melbourne Water, 2005)

SEDIMENTATION BASINS
INFORMATION SHEET

Description

Sedimentation basins are primarily used to remove coarse to medium sized sediment from stormwater runoff. They typically form part of a treatment train as a pre-treatment measure, but can also be used in isolation particularly during construction phase works. Sedimentation basins detain stormwater runoff and reduce flow velocities thereby allowing sediment to settle.

Source: Melbourne Water

Function

- Stormwater treatment
- Flow attenuation

Indicative costs (low, moderate or high)

- Installation costs – high
- Maintenance costs – moderate/high

Applicability

- As a temporary treatment measure during construction
- As part of a wetland system or treatment train
- Only where there is suitable access for ongoing maintenance

Design and maintenance considerations

- Sedimentation basins may require a large area of flat land
- Designs should include a high flow by pass to cater for flows up to the 100 year storm event (note if sedimentation basin is part of a treatment train the high flow bypass may also need to bypass other sections of the treatment system)
- Designs need to cater for suitable access for ongoing maintenance requirements, and the size and shape of the basin should be considered when determining maintenance access
- Sedimentation basin design must meet safety requirements and implement reasonable safety measures (refer to Chapter 4 of WSUD Engineering Procedures: Stormwater, Melbourne Water, 2005), including approach batter slopes, safety benches and signage

For further information refer to:

- WSUD Engineering Procedures: Stormwater – Chapter 4 (Melbourne Water, 2005)

STORMWATER HARVESTING AND REUSE SYSTEMS
INFORMATION SHEET

Description

Stormwater harvesting systems are used to capture stormwater to be used in place of potable water, or where potable water is not available for use. Stormwater harvesting and reuse systems typically consist of a diversion structure to divert the stormwater into the system, and a storage and distribution system (e.g. a pump and pipes) to supply the stormwater for use. Stormwater harvesting systems are applicable to a range of uses as they can vary greatly in magnitude, and can be combined with treatment systems depending on the specific water quality requirements.

Source: Melbourne Water

Function

- Alternative water supply (water conservation)
- Stormwater treatment

Indicative costs (low, moderate or high)

- Installation costs – high
- Maintenance costs – moderate

Applicability

- Suited to a range of uses including residential developments, commercial developments and for public recreation and sporting reserves
- Only when supplied to EPA 'fit for purpose' standard and compliant with water authority, Melbourne Water and Council requirements

Design and maintenance considerations

- Water must be supplied to EPA 'fit for purpose' standards, and compliant with water/sewer authority, Melbourne Water, Council and EPA requirements
- Must be compliant with NWQMS Australian Guidelines for Water Recycling (2009)
- A water balance model should be completed during the design phase to see how much water will be available for use

For further information refer to:

- WSUD Engineering Procedures: Stormwater – Chapter 7 (Melbourne Water, 2005)

VEGETATED SWALES, GRASS SWALES AND BUFFER STRIPS
INFORMATION SHEET

Description

Vegetated and grass swales can be used in place of more conventional stormwater conveyance. They can also offer the benefit of treatment function and some flow attenuation. Vegetated swales are often used in conjunction with buffer strips (or strips of vegetation where runoff can pass through).

Function

- Stormwater treatment
- Stormwater conveyance
- Limited flow attenuation

Indicative costs (low, moderate or high)

- Installation costs – low/moderate
- Maintenance costs – moderate/high

Applicability

- Residential, commercial and industrial areas, including central median strips, roadside verges and car parks
- Roadside verges on rural roads
- Parks and reserves

Design and maintenance considerations

- Longitudinal slope – swales are most efficient with slopes of 1% to 4%
- Side slopes should not exceed 1 in 4
- Flow depths and velocities should be checked, particularly where there is public access (refer to WSUD Engineering Procedures: Stormwater (Melbourne Water, 2005) for standards)

For further information refer to:

- WSUD Engineering Procedures: Stormwater – Chapter 8 (Melbourne Water, 2005)


Frankston City