



3. Stormwater Management Objectives

3.1 Western Australian Stormwater Management Objectives

The Stormwater Management Manual for Western Australia (Department of Environment, 2004) presents a new approach to the management of stormwater, based on the principle that stormwater is a resource with social, environmental and economic value. The manual reflects the Western Australian State Water Strategy (Government of Western Australia, 2003) and includes the following objectives:

- » Water Quality: to maintain or improve the surface and groundwater quality within the development areas relative to pre-development conditions.
- » Water Quantity: to maintain the total water cycle balance within the development areas relative to the pre-development conditions.
- » Water Conservation: to maximise the reuse of stormwater.
- » Ecosystem Health: to retain natural drainage systems and protect ecosystem health.
- » Economic Viability: to implement stormwater management systems that are economically viable in the long term.
- » Public Health: to minimise the public risk, including risk from injury or loss of life, to the community.
- » Protection of Property: to protect the built environment from flooding and waterlogging.
- » Social Values: to ensure that social, aesthetic and cultural values are recognised and maintained when managing stormwater.
- » Development: to ensure the delivery of best practice stormwater management through planning and development of high quality developed areas in accordance with sustainability and precautionary principles.

These general objectives have been further developed into more specific stormwater management objectives for the Maddington-Kenwick Industrial Area.

3.2 Water Quality

Waterway water quality targets

Waterway water quality targets are intended to protect and enhance environmental values in the receiving water bodies into which the stormwater run-off will discharge. In the case of the Maddington-Kenwick Industrial Area, the receiving waterways are initially Yule Brook and Bickley Brook and ultimately the Canning River and the Swan-Canning Estuary. These are important ecosystems as well as valuable recreational waterways and are subject to the *Environmental Protection (Swan and Canning Rivers) Policy 1988*.



The Swan-Canning Cleanup Program (SCCP) is a key instrument for the implementation of the *Environmental Protection (Swan and Canning Rivers) Policy 1988* and has developed specific water quality targets for the Swan-Canning system. These include short and long term targets for nutrient concentrations in tributaries of the Swan-Canning river system, including Yule Brook and Bickley Brook, presented in Table 1.

Surface water from the proposed industrial area will also discharge directly and indirectly to wetlands, including the Greater Brixton Street chain of wetlands and other conservation value and multiple use wetlands in the area.

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000) identify trigger values for key water quality parameters applicable for a range of ecosystem types in south-west Australia, including lowland rivers (Yule Brook and Bickley Brook), estuaries (Lower Swan-Canning) and wetlands. Although not intended to be directly applied to urban stormwater run-off, the ANZECC Guidelines provide useful trigger values for the protection of conservation value wetlands in the area and are presented in Table 1.

Table 1 Receiving waterway water quality targets

Guideline	Total nitrogen (mg/L)	Total phosphorus (mg/L)
Swan-Canning Cleanup Program targets		
Tributaries (Yule Brook and Bickley Brook):		
short-term	2.0	0.2
long-term	1.0	0.1
Estuary target (Upper Canning)	1.33	0.30
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000) – Aquatic ecosystems in south-west Australia		
Lower Swan-Canning (Estuaries)	0.75	0.03
Yule Brook, Bickley Brook (Lowland rivers)	1.2	0.65
Wetlands	1.5	0.06

Existing water quality

There are currently no available water quality data for groundwater or surface water run-off in the study area and only limited available data on water quality in the receiving waterways and wetlands.

The Water Corporation monitors water quality in the Yule Brook Main Drain at Bush Close, Brixton Street and Binley Brook, all downstream of the study area. Historical data (Chinnery, Water Corporation, *pers. comm.*) show that the drain generally has moderate concentrations of total phosphorus (< 0.2 mg/L) and total nitrogen (< 2 mg/L), although peak total phosphorus and total nitrogen concentrations have been measured at Brixton Street gauging station as high as 0.3 mg/L and 2.1 mg/L



respectively and total nitrogen concentrations at Binley Brook have been reported as high as 2.8 mg/L.

The Swan River Trust has reported the current nutrient status of Yule Brook to be low for both total phosphorus (< 0.1 mg/L) and total nitrogen (<1.0 mg/L) and of Bickley Brook to be low for total phosphorus (< 0.1 mg/L) but moderate for total nitrogen (1 – 2 mg/L) (Swan River Trust, 2000).

Australian Runoff Quality (ARQ) (National Committee on Water Engineering and Engineers Australia, 2004) reports ranges of base flow and stormflow concentrations for several land-uses. Of particular importance for this study are the nutrient export rates for rural and industrial areas, presented in Table 2.

The available information suggests that under the current rural land-use, stormwater run-off from the study area probably meets the SCCP short-term water quality targets for Yule Brook and may meet the long-term targets, although this would need further monitoring to confirm. Changes in land-use from rural to industrial/commercial is expected to significantly increase nutrient concentrations in stormwater run-off to values above the SCCP short-term and long-term targets.

Table 2 Predicted nutrient and sediment export rates

Predicted export rates	TN (mg/L)	TP (mg/L)	TSS (mg/L)
Rural (ARQ):			
Storm flow	2.0	0.2	100
Baseflow	1.0	0.04	18
Industrial/commercial (ARQ):			
Storm flow	2.2	0.3	145
Baseflow	2.0	0.15	14.5
SCCP waterway targets:			
Short-term	2	0.2	
Long-term	1	0.1	

Catchment water quality design objectives

Two catchment water quality related design objectives were considered for stormwater management in the Maddington-Kenwick Industrial Area:

- » the predicted nutrient and sediment concentrations to receiving waterways will not be increased by the development; and
- » the predicted average nutrient and sediment concentrations from the development will be reduced to levels that support the SCCP long-term water quality targets for Yule Brook and Bickley Brook.

In the absence of high quality data for existing runoff quality, it is not possible to determine useful criteria for assessment of drainage design options in accordance with



the first design criteria. Consequently, the SCCP long-term water quality targets are used to assess the design.

In the absence of more site specific pollutant generation characteristics for the proposed developed catchments, the nutrient export rates proposed by Australian Runoff Quality were used to predict nutrient and sediment concentrations from the developed catchment. Modelling conducted as part of this study in assessing the performance of the recommended drainage design is presented in Section 7.1.

3.3 Flood Management

A key objective of stormwater management is the protection of property and infrastructure by the safe conveyance of excessive runoff from extreme events. This includes the protection of property and infrastructure within the Maddington-Kenwick Industrial Area as well as downstream and so needs to consider the impact of peak discharge from the study area.

The following objectives have been used for flood management in the proposed Maddington-Kenwick Industrial Area:

- » The peak discharge to receiving waterways resulting from the 10 year and 100 year ARI event will not be increased by development;
- » For the 100 year ARI event the overland flow path will make use of existing natural drainage lines and will be directed away from development; and
- » All development will be required to be at least 0.3 m above the 100 year ARI water level.

3.4 Serviceability objective

To maintain a high level of serviceability for roads and infrastructure within the proposed development area it is proposed that the road drainage network is designed to convey the 10 year ARI peak flow. This will ensure that all roads remain trafficable in the 10 year ARI event.

3.5 Groundwater management

The proposed Maddington-Kenwick Industrial area is located in an area of shallow depth to groundwater and adjacent to important groundwater dependent ecosystems. The core groundwater management objectives adopted for the development of the stormwater management plan is development should not affect the AAMGL.

Water quality data in Yule Brook suggests that current nutrient export from the study area probably meets the short-term targets for the SCCP targets. Consequently, existing concentrations of nutrients in groundwater are not likely to be a critical water quality issue. A comprehensive monitoring program will need to be implemented to assess the impact of any future development on groundwater quality.



3.6 Wetlands

The proposed Maddington-Kenwick Industrial Area is partly located on an area of palusplain adjacent to Yule Brook and includes a number of wetlands (Figure 3), including several conservation category (EPP wetlands) and resource enhancement wetlands and large areas of multiple use wetlands.

The Water and Rivers Commission (now Department of Environment) Position Statement accords conservation category wetlands the highest priority for protection and conservation and any activity likely to impact on these wetlands is unlikely to be approved.

The Water and Rivers Commission Position Statement also identifies resource enhancement category wetlands as priority wetlands with the objective of management, restoration and protection towards improving their conservation value and any activity likely to impact on these wetlands is unlikely to be approved.

The Water and Rivers Commission Position Statement suggests that the use, development and management of these wetlands should be considered in the context of ecologically sustainable development and best management practice catchment planning. Development in these areas should be based on Water Sensitive Urban Design (WSUD) principles and can incorporate these wetlands in drainage systems.

The Department of Environment will require a buffer zone around all conservation category wetlands (EPP wetlands) and possibly around all resource enhancement category wetlands. Given the proposed land-use in the Maddington-Kenwick Industrial Area it is expected that the required buffer will be 100-200 m (depending on land-use). Such a buffer will prevent any meaningful development of most of the area between Coldwell Road (west of Yule Brook) and Victoria Road (east of Yule Brook), representing most of Area 2 and approximately half of Area 3 of the proposed development.

Existing drains in the development area currently run through the Greater Brixton Street EPP wetlands. An existing open unlined drain runs through the Yule Brook Nature Reserve from Boundary Road to Brook Road where it discharges to Yule Brook. An existing open unlined drain runs through the Brixton Street wetlands southwesterly from Bickley Road, crossing Brixton Street and eventually discharging into Binley Brook.

The wetland management objectives adopted for the development of the stormwater management plan are:

- » Existing drains located within conservation and resource enhancement wetlands should be retained to maintain the existing hydrological regime.
- » No new drainage should be located in conservation category wetlands or their buffers.
- » Where overland flow paths discharge to conservation category wetlands, peak flows should not be increased by development.