Redland Water and Waste

Desired Standards of Service Review - Sewerage

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Redland Water and Waste

Desired Standards of Service Review - Sewerage

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1. Introduction

MWH was commissioned by Redland Water & Waste to undertake a review of the Draft Desired Standards of Service (prepared in February 2005) for the assessment and provision of water supply and sewerage infrastructure, for the future development of Redland Shire. In accordance with the project brief this review is presented in separate reports.

The review and update of the Draft Desired Standards of Service (DSS) has occurred in three parts:

1. Review of the Current Sewerage Design Criteria (This report)
2. Review of the Current Water Supply Design Criteria (Separate Report)
3. Integrated Water Management (IWM) Criteria and opportunities.(Part of the Water Report)

Comparisons have been undertaken with design criteria adopted by other SEQ water authorities. Where applicable and justifiable the current criteria have been amended.

As part of the review the consistency of the criteria with the recently published NRM&W *Water and Sewerage Planning Guidelines* has been considered. The national WSAA Water Supply and Sewerage Codes have been reviewed to identify areas requiring change.

The final revised design criteria are presented in Section 5 of the report. It is proposed to include these recommendations in the overall infrastructure DSS currently being developed by council.

1.1 Purpose of the Document

The Desired Standards of Service (DSS) for water supply and sewerage is intended to form an integral part of the overall Water and Sewerage Infrastructure Charges Plan. The DSS is required to define the design standards to which infrastructure is to be provided as well as the linkage between these criteria and user benefits and environmental effects as required by the Integrated Planning Act (IPA - 2004)

1.2 Why Develop Desired Standards of Service

Desired Standards of Service relate to the characteristics that influence network planning and generally dictate the size of infrastructure items to be provided for a given level of demand. It is particularly important that in an environment in which developers pay directly for infrastructure that consistent, sustainable and affordable standards of service are required of all public (Federal, State and Local) and private sector providers alike. It is also important for consistent standards to be applied across ICP and agency boundaries, even though the criteria and measures might themselves, change.

The parameters used for describing the Standards of Service are generally related to one of two categories, those that shape or form a network (planning criteria), and those that define the required sizing of elements to achieve the desired outcomes (design criteria). It is these planning and design criteria that ultimately affect the cost of the network to be provided, and therefore need to be justified to the community.

1.3 Triggers for Defining Standards of Service – Planning & Design Criteria

To provide a level of service (at a definable cost) which is commensurate with the expectation (service objectives) of the community, criteria against which the planning and operational performance of the network are to be assessed need to be developed. There are a number of matters that will trigger these considerations and hence the measures against which networks are assessed. The more significant are health and safety factors, although published standards and 'best practice' associated with a range of operational matters need also to be considered. Published standards often have a quantitative basis, whilst policy based standards will usually be drafted in a qualitative or "code" format. The DSS criteria may therefore contain both quantitative and qualitative performance measures.

Table 1 below identifies the 'triggers' and indicates the generic areas, which will be covered by the standards of service.

Table 1 Standard of Service Triggers

Areas of Interest	Measurable Criteria
Network Design	Capacity, network performance, amenity etc
Health and Safety	Water quality, treatment effluent standard, etc.
Social	Noise, odour, etc
Environmental	Reduction of greenhouse gases, sewage overflows etc
Economic	Life cycle considerations, design life, cost

The quantitative standards specify values for each of the criteria. Qualitative standards set down the rules where it may be necessary to trade off one type of standard against another.

2. Planning Criteria

The Desired Standards of Service for the sewerage system are required to link to the Key Programs and Objectives of the RSC Corporate Plan, Our Redland's-Our Future, and the Redland Water Total Management Plans. These standards also form the basis for planning of the respective systems for the purposes of the ICP. Desired Standards of Service are reflected in the various Design Criteria, which are developed for achieving the Desired Standards of Service as outlined in this section of the report.

As part of establishing the Desired Standards of Service (DSS), it is necessary to consider the requirements of the Integrated Planning Act i.e. the balance between the user benefits which will be obtained and the likely environmental effects. This has been carried out and documented in Table 2.

Table 2: Desired Standards of Service – Sewerage Planning Criteria

Desired Standard of Service	User Benefit	Environmental Effect
Corporate / Business Long Term Objectives	• Community and Customer Service • Quality and Safety	• Environmental Protection
Generic Objective • Reduce sewer spillage (overflow and blockage) *RSC Corporate Plan* • To process wastewater in an ecologically sustainable manner. *RSC KPI* ➢ Sewer overflows per 100km of sewer main *RSC Annual Target* ➢ 2.5	• Reduced impact from noise; visual effect; impacts from blockages, overflows and spills.	• Noise reduction • Provision of "green" areas • Reduction in release of nitrogen and phosphorous to the environment • Reduction in greenhouse gases • Improved community health
Generic Objective • System design will aim to achieve minimum life cycle cost. *RSC Corporate Plan* • To process wastewater in an ecologically sustainable manner *RSC KPI* ➢ Operations maintenance and administration costs per property serviced. *RSC Annual Targe* ➢ Under development	• Cost effective service for community • Reduced energy cost • Reduced maintenance costs • Reduced overall operation costs • Reduced replacement costs	• Reduction in disposal of waste • Greenhouse gas reduction • Reduced environmental effects from chemical production.
Generic Objective • System design will aim to minimise energy consumption. *RSC Corporate Plan* • Provide Council with a strategic milestone framework to reduce greenhouse gas emissions. TMP-00-01-013 *RSC KPI* ➢ Establish targets for greenhouse gas emissions, ➢ Complete strategy for greenhouse gas emissions. *RSC Annual Target:-* By June 2003.	• Reduced cost of energy • Cost effective service for community	• Greenhouse gas reduction

Desired Standard of Service	User Benefit	Environmental Effect
Corporate / Business Long Term Objectives	• Community and Customer Service • Quality and Safety	• Environmental Protection
Generic Objective • System design will aim to minimise wet weather overflow events by reducing infiltration and inflow. *RSC Corporate Plan* • To process wastewater in an ecologically sustainable manner *RSC KPI* ➢ % Compliance with Environmental Protection Act licences. *RSC Annual Target:-* • 97%.	• Reduced cost of energy for transport, treatment and disposal • Minimise customer overflow issues • Maximise life of system	• Reduced overflows to local waterways
Generic Objective • Treatment processes will adopt appropriate technology to minimise energy and chemical use. *RW Target & Time Frame:- Under Development*	• Reduced cost of energy and chemicals • Cost effective service for community	• Reduced greenhouse gases • Reduced environmental effects from chemical production
Generic Objective • Treatment processes to achieve effluent quality standards in accordance with license and facilitate environmentally sustainable reuse. *RW Target & Time Frame:-* Under development	• Beneficial reclaimed water use • Opportunity for cost recovery for reclaimed water treatment • Reduction in use of potable water supply and treatment • Reduced cost of potable water treatment	• Reduction in release of nitrogen and phosphorous to the environment • Reduction of raw water extraction from source
Generic Objective • Optimise the use of reclaimed water and biosolids. *RW Target & Time Frame:-* Under development	• Reduced cost of water for industry • Reduced cost of nutrient addition for agriculture	• Reduction in release of nitrogen and phosphorous to the environment • Reduction of raw water extraction from source

3. Design Criteria

Table 3 below presents the draft design criteria as well as a comparison with other similar local authorities. Where the recommended DSS is different to the Draft DSS of February 2005 the reasons for these changes are discussed in Section 4 of this report.

Table 3 : Draft Design Criteria

Item	Parameter	MWH Proposed Design Criteria	Basis of Criteria	SEQ Comparisons	Discussion
Sewage Loading					
1	Average Dry Weather Flow (ADWF)	250 L/EP/d	Based on assessment of actual inflows into the shire's WWTPs (data up to 2000)	LW: 250 L/EP/d PW: 220 L/EP/d GCW: 275 L/EP/d	▪ GCW allow extra for infiltration and design STP for 250 L/EP/d ▪ NRM&W recommend using STP data and gauging data (Ch 5 S5.2.2) ▪ No change proposed
2	Peak Wet Weather Flow (PWWF)	5 x ADWF or 1,250 L/EP/d	Based on Section 5.3 of the QDNRM Guidelines.	BW: 5xADWF for <100,000 EP 4xADWF for >100,000 EP All other Councils: 5 x ADWF	▪ In accordance with NRM&W (Section 5.2.2) ▪ WSAA uses a complex formula adapted from SWC empirical approach. Applicability / reliability not tested in Queensland to date ▪ No change proposed
Gravity Sewer Design					
3	Flow calculation approach	Manning's Equation	Based on industry standard in WSAA Part 1	Adopted by all councils	▪ No change proposed
4	Manning's 'n'	0.013	Previous NRM&W Sewerage Guidelines	GCW: 0.013 LW: 0.013 BW: 0.013 or based on actual material where known	▪ WSAA Sewerage Code of Australia Part 1 Table 4.5 (varies from 0.0128 to 0.013) ▪ No change proposed
5	Minimum velocity @ PDWF	0.7 m/s	NRM&W and WSAA adopt 0.7m/s at PDWF + GWI	NRM&W: 0.7m/s BW: 0.6 m/s at PDWF (1.8 x ADWF) GCW: 0.6 m/s	▪ 0.7m/s adopted to ensure self-cleansing flows are achieved

Item	Parameter	MWH Proposed Design Criteria	Basis of Criteria	SEQ Comparisons	Discussion
6	Maximum velocity @ PWWF	2.0 m/s	Adopted operational maximum for steep sewers	BW: 2.0 m/s WSAA: 3.0 m/s Others do not specify	▪ 2.0m/s adopted to avoid the occurrence of super-critical flows
7	Depth of Flow @ PWWF – Existing system	At least 1.0 m below MH cover level and no spillage through overflow structures	Same as majority of SEQ councils. Meets intent of NRM&W guidelines i.e. contains PWWF in sewer with no overflows	NRM&W: Not mentioned BW: 1m above pipe obvert consistently over length of sewer GCW: as per proposed LW: as per proposed PW: as per proposed	▪ No change proposed
8	Depth of Flow @ PWWF – New sewers	Design for pipe full capacity	Adopted from previous DSS	NRM&W: 0.75 x diameter WSAA: minimum airspace of 40% at PDWF BW: 1.0 x diameter GCW: 0.75 x diameter LW: 1.0 x diameter	▪ Maximum flow capacity at closer to 100% depth ▪ Velocity criteria must also be achieved ▪ No change proposed
Pumping Station Design					
9	Wet Well Operational Volume (excluding emergency storage)	0.9 x (C1xADWF) (or single pump capacity) / N Where N = 12 for < 50 kW and 5 for > 50 kW	NRM&W Guidelines Ch 7 Table 5.15	BW have adopted N = 10 and 5 as well as PWWF for each pump in two pump stations All other councils: as per proposed	▪ No change proposed
10	Emergency Storage	4 hours of ADWF	NRM&W Guidelines Ch 7 Table 5.15	GCW: 4 hours LW: 4 hours PW: 4 hours BW: 3 hours for new stations	▪ May vary dependent on risk assessment of overflow. Storage includes gravity sewers, manholes and wet well. ▪ No change required
11	Single Pump Capacity	C1xADWF for >1,000 EP C1 minimum = 3.5 5x ADWF for <1,000 EP	NRM&W Guidelines Ch 7 Table 5.15	BW: PWWF Others: as per NRM&W	▪ Should this criteria not be used the EPA should be consulted ▪ No change proposed
12	Total Pumping Capacity	5 x ADWF	NRM&W Guidelines Ch 7 Table 5.15	BW: 5 x ADWF as standby Others: as per NRM&W	▪ No change proposed
Rising Main Design					

Item	Parameter	MWH Proposed Design Criteria	Basis of Criteria	SEQ Comparisons	Discussion
13	Flow Equation	Hazen Williams	Historical standard	WSAA: No preference NRM&W: Not specified LW: Hazen Williams GCW: Hazen Williams BW: Mannings	▪ No change proposed
14	Friction Factors	110 for d ≤ 300 mm 130 for d > 300 mm	Historical standard adopted by other SEQ councils	WSAA: 70 to 90 GCW: for d ≤ 300 mm – 100 @ TWL and 120 @BWL and for d . 300 mm - 120 @ TWL and 140 @BWL BW: Mannings LW: as per proposed	▪ No change proposed
15	Minimum Velocity	0.75 m/s at PDWF or single pump flow	NRM&W Guidelines Ch 7 Table 5.15	WSAA: 0.7 m/s BW: 0.6m/s Others: 0.75 m/s	▪ No change proposed
16	Preferred Minimum Velocity (all pumps)	1.0 m/s	Previous DSS to reduce slime growth	NRM&W and WSAA: not specified GCW: not specified BW: 1.0 m/s	▪ Change from 1.2m/s in Draft DSS
17	Maximum Velocity	2.5 m/s	NRM&W Guidelines Ch 7 Table 5.15	NRM&W: 2.5 m/s WSAA: not specified BW: 3.0 m/s GCW: 2.0 m/s	▪ No change proposed

* NRM&W = Natural Resources Mines & Water, WSAA = Water Services Association Australia, GCW = Gold Coast Water, BW = Brisbane Water, TWL = Top Water Level, BWL = Bottom Water Level, LW = Logan Water, PW = Pine Water, SWC = Sydney Water Corporation

4. Discussion of Design Criteria

This section discusses the reasons behind proposed changes to design criteria outlined in Table 3 : Draft Design Criteria.

4.1 Average Dry Weather Flow

The current ADWF is 250 L/EP/d (including dry weather groundwater infiltration) was derived through the assessment of actual inflows to the treatment plants using data from 1998 to 2000. This flow generation falls in the range outlined in the NRM&W guidelines, i.e. 150 to 275 L/EP/d.

A comparison with other authorities shows that 250 L/EP/day is similar to the adopted flow from other authorities. It is proposed to continue to adopt this figure for all catchments in the shire.

4.2 Peak Wet Weather Flow

Peak wet weather flow has been defined as 5*ADWF only. The use of 1250 L/EP/day has been removed from the criteria as it is superfluous.

4.3 Wet Well Operational Volume

An amendment to the number of pump starts to be used for wet well operational volume was made. The adopted range of pump starts per hour is to be based on pump power ratings as follows:

- Pump power < 30 kW N = 12
- Pump power 30 < kW < 50 N = 8
- Pump power > 50 kW N = 5

5. Recommended Design Criteria

The recommended Desired Standards of Service design criteria for the sizing of sewerage infrastructure in Redlands Shire are outlined in Table 4.

Table 4 : Recommended Design Criteria - Sewerage

Item	Parameter	Design Criteria
Sewage Loading		
1	Average Dry Weather Flow (ADWF)	250 L/EP/d
2	Peak Wet Weather Flow(PWWF)	5 x ADWF
Gravity Sewer Design		
3	Flow calculation approach	Manning's Equation
4	Manning's 'n'	0.013
5	Minimum Velocity @ PDWF	0.7m/s
6	Maximum Velocity @ PWWF	2.0m/s
7	Depth of Flow @ PWWF – Existing system	At least 1.0 m below MH cover level and no spillage through overflow structures
8	Depth of Flow @ PWWF – New sewers	Design for pipe full capacity
Pumping Station Design		
9	Wet Well Operational Volume (excluding emergency storage)	$\frac{0.9 \times Q}{N}$ Where N = 12 for < 30 kW N = 8 for 30 < kW < 50 N = 5 for > 50kw
10	Emergency Storage	4 hours of ADWF
11	Single Pump Capacity	C1 x ADWF where >1,000 EP 5x ADWF where <1,000EP
12	Total Pumping Capacity	5 x ADWF
Rising Main Design		
13	Flow Equation	Hazen Williams
14	Friction Factors	110 for diameters ≤ 300 mm 130 for diameters > 300 mm
15	Minimum Velocity (on a Daily Basis)	0.75 m/s
16	Preferred Minimum Velocity (all pumps)	1.0 m/s
17	Maximum Velocity	2.5 m/s