SC6.2 - Planning scheme policy 1 - Design and construction standards

Introduction and Purpose

The Western Downs Region has many and varied towns and areas serviced by infrastructure that has developed over years through the provision of Council constructed roads, drainage, water and wastewater as well as other services and donated assets. The provision of adequate services for these existing areas and new developments must be done in a planned manner and to reasonable standards applicable to the Region. Additionally many new developments will be required to provide internal services and infrastructure which affect the way of life or amenity for residents and workers, and may interact with Council infrastructure and therefore should also be designed and constructed to suitable standards.

The Western Downs 2050 Community Plan states:

"The Western Downs is undergoing a great degree of change and growth. It is important that these processes are managed effectively to ensure that the Western Downs has strong communities that are well connected and well serviced. It is also important that the character and valuable attributes of the Western Downs are maintained and enhanced."

This manual aims to support and bring into practice, the desires and aspirations of the people of the Western Downs. The Western Downs Regional Council Development Manual aims to meet the liveability criteria that the people of the Western Downs expect.

The purpose of this policy is to provide infrastructure design and construction standards, whereby adequate services are provided to development in a sustainable manner, applying fit for purpose considerations and whole of life costs.

Application

The Western Downs Regional Council Development Manual applies to all developments within the Western Downs Regional Council area, requiring the provision or upgrade of infrastructure both internally and/or externally.

Development shall be designed, constructed in accordance with. and assessed against the applicable parts of the manual together with relevant Australian Standards, Codes of Practice and Design Guidelines and Specifications.

Contents

Part 1 **Standards for Design of General Subdivisional Roadworks and Design**

Part 2 **Standards for Design of Stormwater Drainage Works**

Part 3a **Standards for Design of Water Reticulation Works**

Part 3b **Standards for Construction of Water Reticulation Works**

Part 4 **Standards for Design of Sewerage Reticulation Works**

Part 5 **Standards for Design and Construction of Gas Reticulation Works**

Part 6 **Standards for Design and Construction of Landscaping and Public Parks**

Part 7 **Carparking and Manoeuvring Standards**

Part 8 **Grids and Gates**

Part 9 **Vehicle Crossover and Property Access**

Part 10 **Flooding and Overland Flow Categories and Standards**

Part 11 **Filling and Excavation Requirements**

Part 12 **Erosion and Sedimentation Guidelines**

Part 13 **Presentation of Plans**

Part 1 Standards for Design of General Subdivisional Roadworks and Design

Table of Content

1.1 Introduction

1.2 The Residential Street

1.2.1 Philosophy of the Residential Street

1.2.2 Traffic Volume

1.2.3 Traffic Speed

1.2.4 Parking

1.2.5 Provision for Passing

1.2.6 Carriageway Width

1.2.7Street Classification

1.2.8 Verges

1.2.8.1 Access to Allotments (inside private property)

1.2.9 Street Reserve Width

1.2.9.1 Truncations

1.2.9.2 Kerb and Channel

1.2.10 Geometric Design

1.2.10.1 Roadway Crossfall

1.2.10.2 Vertical Curves

1.2.10.3 Pavement Tapers

1.2.10.4 Frontage Street / Roads

1.2.11 Intersections

1.2.11.1 "T-Junctions"

1.2.11.2 Lighting

1.2.11.3 General

1.2.12 Turning Area

1.2.13 Speed Control Devices

1.2.13.1 Reference Material

1.2.13.2 Device Compliance

1.2.13.3 Street Scape

1.2.13.4 Location of Devices / Charges

1.2.13.5 Design Vehicle

1.2.13.6 Control of Vehicle Speeds

1.2.13.7 Visibility Requirements (Sight Distance)

1.2.13.8 Critical Dimensions

1.2.14 Other Design Criteria

1.2.14.1 Access to Allotments

1.2.14.2 Pathways
1.2.14.3 Bikeways
1.2.14.4 Road Edge Guide Posts and Safety Barriers
1.3 The Street System
1.3.1 The Residential System
1.3.2 The Residential Neighbourhood
1.3.3 The Street / Road Interface
1.3.4 Principles of Collector System Design
1.3.5 Bus Routes
1.3.6 Neighbourhood Schematic Layout
1.3.7 The "No-Access Street"
1.3.8 Practical Collector System Design
1.3.9 The Access Street System
1.4 Pedestrians and Cyclists
1.4.1 General
1.4.2 Planning
1.4.3 Residential Precincts
1.4.4 Major Road System
1.4.5 Separate Reserves
1.4.6 Construction in Residential Streets
1.4.7 Design Standards
1.5 Design Detail
1.5.1 Kerb and Channel
1.5.2 Utility Services
1.5.3 Signs and Pavement Markings
1.5.4 Streetscape
1.6 The Road System
1.6.1 Classification of Roads
1.6.2 Freeways
1.6.3 Arterial Roads
1.6.4 Sub-arterial Roads
1.6.5 Spacing of Arterials
1.6.6 Performance Criteria and Acceptable Solutions
1.7 Development Concept Design
1.7.1 Factors in Concept Design
1.7.2 Specialist Input
1.7.3 Concept Design Process
1.8 Rural Residential Streets
1.8.1 Background
1.8.2 Design Philosophy

1.8.3 Street Hierarchy
1.8.4 Classification
1.8.5 Traffic Speed
1.8.6 Traffic Volume
1.8.7 Parking
1.8.8 Carriageway
1.8.9 Verge
1.8.10 Street Reserve Width
1.8.11 Other Design Aspects
1.8.12 Acceptable Solutions
1.8.13 Development Planning
1.9 Industrial Streets
1.9.1 Background
1.9.2 Design Philosophy
1.9.3 Street Hierarchy
1.9.4 Traffic Volume
1.9.5 Design Speed
1.9.6 Parking
1.9.7 Carriageway
1.9.8 Verge
1.9.9 Street Reserve
1.9.10 Geometric Design
1.9.11 Intersections
1.9.12 Turning Areas
1.9.13 Acceptable Solutions
1.9.14 Subdivision Layout
1.10 Multi-Unit Residential Streets
1.10.1 Introduction
1.10.2 Street Hierarchy
1.10.3 Traffic Volume
1.10.4 Traffic Speed
1.10.5 Parking
1.10.6 Carriageway
1.10.7 Verge
1.10.8 Street Reserve
1.10.9 Access
1.10.10 Other Design Aspects
1.10.11 Acceptable Solutions
1.11 Definitions
1.11.1 Definitions

Table 1.11.1 Road Definitions and Functional Hierarchy
1.12 Summary of Road Design Criteria
1.12.1 Road Design Criteria
Table 1.12.1 Urban Streets
Table 1.12.2 Rural Residential Streets
Table 1.12.3 Industrial Streets
1.13 Flexible Pavement Design
1.13.1 Reference Documents
1.13.2 Subgrade Evaluation
Table 1.13.2 Frequency of testing for subgrades
1.13.3 Pavement Materials
1.13.4 Surface Design
1.13.5 Design Traffic
1.13.5.1 Design Period
1.13.5.2 Traffic Volume
1.13.5.3 Design Traffic for Flexible Pavements
1.13.5.4 Check Method of Design of Flexible Pavements
1.13.6 Residential Streets
1.13.7 Industrial Streets
1.13.8 Rural Residential and Village Streets
1.13.9 Rural Roads
1.14 Flexible Pavement Design Workshop
1.15 Check Method - Design of Flexible Pavements
1.15.1 Pavement Materials
1.15.2 Determination of Design Traffic
Table 1.15.1 Design ESA's by Road Class
1.15.3 Minimum Pavement Thickness
Table 1.15.2 Minimum Pavement Thickness
1.16 Road Work Quality Plan

1.1 Introduction (QS1.0)

The guidelines outlined by the Queensland Streets are adopted in principle, and the design parameters used, are to be in accordance with the criteria listed in the current edition of Queensland Streets, except as amended by this document. The sections of the Queensland Streets manual to which comments refer are shown as **QS X X** or **QS X.X.**

The ideal site and road layout will result from consideration of the social, environmental and traffic factors, the development layout and engineering constraints. Complete Streets provides additional guidance on "best practice" principles for contemporary development standards and may be considered as an alternative standard where it can be demonstrated that the engineering constraints in relation to the provision of services, access and safety can be adequately addressed.

Engineering constraints include provision of services, drainage overland flow paths, vertical alignment, horizontal alignment, reasonable access to allotments, etc. and the road layout is to accommodate these constraints.

Prior to preparing the development layout plan, it should be ascertained if a layout already exists for the area in question and to ensure that the road network proposed will generally conform with the overall road hierarchy and open space plan envisaged by the Western Downs Regional Council (WDRC)

It is essential that full and accurate topographical information be available at the roadwork's design stage, to enable an accurate assessment of the suitability of the proposed road locations.

The classification and design of Streets and Roads are to be in accordance with the recommendations of Queensland Streets.

Within this standard's manual, Queensland Streets is intended to be applied as the basis for a uniform standard of residential street works and designs and as a technical support to AMCORD. It is a supplement to AMCORD, not a substitute. The sections within this Part 1 of the Manual, relate to the same sections of Queensland Streets.

The provisions of the "Road Design Criteria" (included in Section 1.12 of this document) shall take precedence over any conflicting provisions of Queensland Streets.

Existing roads external to a subdivisional development are not covered by this document, or by Queensland Streets. The internal road network of the subdivision only is covered by this document and Queensland Streets. Refer directly to Council's Engineering Services Section for treatment of the road network, external to the subdivision.

This document combined with Queensland Streets is to be used in the design of Residential Streets only. Rural Residential streets may also be designed using these principles in conjunction with the "Road Design Criteria" in Section 1.12 of this document.

Carriageway width and street layout should be considered in relation to drainage requirements (particularly overland flowpaths). *Refer also to Part 2 – Stormwater Drainage Design* of this Manual.

For reference purposes, a link to WDRC Standard Drawings is provided here.

Note: The latest version of relevant standards and referenced documents are to be used, unless otherwise agreed to by Council.

1.2 The Residential Street (QS 2.0)

The guidelines outlined by the Queensland Streets are adopted in principle, and the design parameters used, are to be in accordance with the criteria listed in the current edition of Queensland Streets, except as amended by this document.

1.2.2 Traffic Volume (QS2.2)

Entire Section adopted without amendment.

NOTE: A traffic catchment plan is required to be submitted with subdivisional applications. Traffic generation shall be based on 10 trips per day, noting Table 2.2.E "Equivalent Dwellings" of Queensland Streets

1.2.5 Provision for Passing (QS 2.5)

This Section is linked with *Section 1.2.6 – Carriageway Width*.

This Section is adopted in principle. Refer to the "Road Design Criteria" (Section 1.12) for requirements with respect to carriageway width, hence Provision for Passing Requirements.

1.2.6 Carriageway Width (QS 2.6)

This Section adopted in principle. Refer to the "Road Design Criteria" (Section 1.12) for requirements and *Standard Drawing Nos. R-002 & R-003.*

The carriageway width is measured from the invert of the kerb for mountable kerb and face of kerb for barrier kerb.

Bus Routes may be required to be provided on Collector Roads. The nominated carriageway width (measured between channel inverts) is based on a 40km/hr design speed and a truck / two parked cars situation. Refer *Queensland Streets Table 2.6F – Carriageway Width Requirements.*

1.2.7 Street Classification (QS 2.7)

This Section adopted in principle. Refer to the "Road Design Criteria" (Section 1.12) for requirements and *Standard Drawing R-002 & R-003.*

The street hierarchy and bus routes are to be confirmed at the planning stage, prior to commencement of design. In addition, Council should be contacted directly, to determine the requirements with respect to existing frontage roads for the individual development.

1.2.8 Verge (QS 2.8)

This Section adopted with the following modifications:

(a) The cross-section of the verge (i.e. that portion of the road reserve between the kerb and the property alignment), is to conform to the details of the Type Cross Section (*Drawing No. R-003)* for Access Place, Access Street, Collector Street and Trunk Collector Street. Verge Cross Section - *Figure 2.8F of Queensland Streets* is not to be used;

(b) Minimum verge width - refer to the "Road Design Criteria" (Section 1.12) for Council's requirements;

(c) Services and utilities are to be in accordance with WDRC *Standard Drawing No. R-014.* Where Ergon, Telstra or other Service Providers share a joint user trench, conduits are to be located in accordance with the current policies of those Service Providers; and

(d) Where the construction of a concrete footpath is required, it is to be 1.5 metres in width or 2.5 metres where required as a shared footpath/bikeway and located in accordance with WDRC *Standard Drawing No. R-014.*

1.2.8.2 Access to Allotments (inside private property)

This Section adopted with the following modifications:

- Property accesses should be located with a minimum clearance of 1.5m from street trees, signposts, light posts and other structures.

- Steep side slope of the natural surface can result in difficulty in providing vehicular access to allotments fronting the road. Driveway grades should be limited for safety and amenity;

- The maximum driveway grades therefore are to be as follows; and

Location	Desirable Maximum	Absolute Maximum
(a) Residential	16.6% (1 in 6)	25% (1 in 4)
(b) Industrial	10% (1 in 10)	16.6% (1 in 6)

- Standard footpath profiles are to be maintained and generally in accordance with the grades noted on the WDRC *Standard Drawings R-003 and No. R-014.*

1.2.9 Street Reserve Width (QS 2.9)

1.2.9.1 Truncations

This Section adopted with the following modifications:

- Truncations of the real property boundaries are to be provided at speed restriction devices, bends and intersections and the roadway, footpath and verge widths are to be maintained at the minimum specified widths at any point.

1.2.9.2 Kerb and Channel

This Section adopted with the following modifications:

- Concrete kerb and channel is to generally be provided on both sides of all roads and streets in a residential area.

- For roads, refer to the "Road Design Criteria" (Section 1.12) relevant to the applicable road category, to determine if concrete kerb and channel is required.

- The standard kerb and channel for streets is to be Mountable Type 1, 2 or 3 in accordance with *Standard Drawing R-008*.

- Barrier type kerb and channel with 300mm channel (Barrier Type 1 or 2) in accordance with *Standard Drawing R-008* is to be used in the following cases;

  (a) In streets adjacent to parks

  (b) Industrial streets, where heavy duty barrier type is to be used (i.e. standard barrier type, with additional 50mm base thickness)

  (c) Shopping Centres and in locations where high pedestrian volumes are likely or for greater pedestrian safety, e.g. on the frontage of schools, major sporting facilities and parks.

- Semi-mountable type kerb is to be used in the following cases:

  (a) At Medians and Traffic Islands, semi-mountable or low profile kerb Mountable Type 1, 2 or 3 for concrete infilled treatments and Mountable Type 1, 2 or 3 for landscaped treatments in accordance with *Standard Drawing R-008;*

  (b) At Roundabouts, kerb type Island Kerb 1 or 2 on the outer island and Mountable Type 1, 2 or 3 on the centre island in accordance with Standard Drawing R-008, if applicable.

- Where proposed construction adjoins existing kerb and channel the new construction is to be tapered smoothly to the existing kerb and channel.

- The grading of kerb and channel is to conform to the road centreline grading, although at locations where the kerb and channel grading diverts from the centreline grade, such as at intersections or on superelevated curves, the minimum channel grade is to be 0.4%. Every endeavour is to be made to improve the appearance, by providing vertical curves of as long a length as possible, at all changes of grade.

- At all changes in horizontal alignment, kerbs and kerb and channel are to be constructed with horizontal curves. To improve appearance where small deflections occur (e.g. on tapers), horizontal curves shall be as long as possible.

- Kerb ramps are to be provided at all kerb returns and at park entrances in accordance with *Standard Drawing R-009.*

1.2.10 Geometric Design (QS 2.10)

Entire Section adopted without amendment.

Refer to the "Road Design Criteria" (Section 1.12) for Council's requirements for various aspects of Geometric Design.

1.2.10.1 Roadway Crossfall

- The Roadway Crossfall is to be designed to include the following:

- In general, one-way crossfall and centre channels will not be permitted. All sealed pavements and shoulders are to typically have crossfalls of 4.0%, or as shown in *Standard Drawing R-002 and R-003*

- The maximum crossfall on grassed medians on divided roads is to be desirably 1 in 6 with an absolute maximum of 1 in 4

- At median openings, the pavement crossfall is not to exceed 5%.

1.2.10.2 Vertical Curves

- Vertical Curves are to be designed to include the following:

- A vertical curve, of parabolic form, is to be provided at every change of grade, where the algebraic change of grade for;

  (a) Access Places, Access Streets, Collector Streets exceeds 1.0%
  (b) Trunk Collector, Sub Arterial, Arterial, Major Arterial exceeds 0.6%

- Every effort should be made to provide vertical curves as long as possible, for improved appearance and safety; and

- A crest vertical curve that masks the commencement of a horizontal curve is to be avoided.

1.2.10.3 Pavement Tapers

Pavement Tapers are to be designed to include the following:

- Pavement tapers to existing construction are to be designed in accordance with the current AUSTROADS design manuals based on the design speed of the road but in any case a minimum taper ration of 1:10.

- Tapers are to be constructed to the same standard as the proposed full road pavements or to match existing pavement depth when adjoining existing roads, whichever is greater.

1.2.10.4 Frontage Streets/Roads

- Where the street/road frontage to a development is unsealed or unformed or less than the required width for the proposal at the time of development approval, it is to be constructed to a standard specified in the conditions of approval, or where not specified in the conditions of approval, no less than the greater of one half of the full width/road or 6.0 metres from the nominal kerb line to the bitumen edge - whichever is the greater.

- An existing sealed frontage street/road to a development is to be reconstructed to one half of the full width of the street/road unless the existing pavement is adequate for the ultimate design conditions, in which case the pavement shall be widened only with kerb and channel provided at the nominated alignment with a minimum sealed width of 6.0 metres – whichever is the greater.

1.2.11 Intersections (QS 2.11)

1.2.11.1 "T-Junctions"

This clause adopted with the following clarifications:

(a) A minimum 10 metre vertical curve is to be provided where a side road joins a through road at three way intersections.

(b) The tangent point of a vertical curve in the side road is to be located at, or outside of the kerb line of the through road.

(c) For a residential street intersecting a Trunk Collector, the geometric layout of the intersection shall be generally in accordance with *AUSTROADS Guide to Road Design – Part 4 Intersections and Crossings*.

1.2.11.2 "Lighting"

This clause adopted with the following clarifications:

- This clause is to be deleted as a reference from Queensland Streets and the following clause is to be inserted in lieu thereof:

  Note: "All intersections, heads of cul-de-sacs, major changes in direction and speed control devices are required to be effectively lit in accordance with AS1158."

- Refer to the "Road Design Criteria" (Section 1.12) for Council's requirements for Intersection and Street Lighting.

1.2.11.3 General

This clause adopted with the following clarifications:

(1) Intersections on rural roads are to be designed in accordance with the current Queensland Department of Main *Roads "Road Planning and Design Manual" (Chapter 13, Intersections at Grade) or AUSTROADS Guide to Road Design – Part 4 Intersections and Crossings.*

(2) Except as specifically varied hereunder, intersections on Streets are to be designed and located in accordance *with Section 2.11 of Queensland Streets*

(3) All new intersections of Urban Access , Urban Feeders, Collector Streets, Rural and Industrial Roads are preferably to be designed as a three way "T-Junction" intersections

(4) Where unavoidable, four way intersections are to be designed as roundabouts in accordance with the current Queensland Department of Main Roads *"Road Planning and Design Manual" Chapter 14, Roundabouts or AUSTROADS "Guide to Road Design Part 4B Roundabouts,* having particular regard to the needs and safety of pedestrians and cyclists. Refer to Council for advice on each individual case, prior to proceeding with design

(5) Four way intersections are to be designed at the junctions of Arterial and Major Arterial Roads only where signalisation (preferred) or roundabouts are proposed

(6) All channelisation is to be designed in accordance with the current Queensland Department of Main Roads *"Road Planning and Design" Manual or AUSTROADS* Publications to accommodate a Design Articulated Vehicle, providing a clearance of not less than 0.6 metres between the outer wheel track and the kerbs at all points

(7) Warrants for the provision of channelisation at intersections will be dependent on traffic volumes and intersection layout and in accordance *with Queensland Department of Main Roads "Road Planning and Design Manual" (Chapter 13, Intersections at Grade) or AUSTROADS Guide to Road Design – Part 4 Intersections and Crossings.* In general, channelisation will normally be required to be provided at

- All arterial intersection
- Most trunk collector to arterial intersections; and
- Occasional collector to collector intersections.

(8) Traffic islands are to be designed in accordance with the current *Queensland Department of Main Roads or AUSTROADS Design Manuals.* Particular attention is to be given to sight distance when commencing islands at horizontal and vertical curves

(9) All traffic islands are to be signed and delineated in accordance with the requirements of the Manual of *Uniform Traffic Control Devices (QLD).*

(10) Where a marked exclusive bicycle lane is not required, the pavement of a left turn auxiliary lane is to be preferably 3.7 metres wide and, in restricted locations, not less than 3.0 metres wide

(11) Where barrier kerb is used at intersections; widths, where practicable, are to be increased by at least 0.3 metres and preferably 0.6 metres

(12) Where practical, similar widths apply for right turn auxiliary lanes

(13) The longitudinal grade should also be considered in relation to high vehicles turning through an intersection

(14) On trunk collector streets, median openings should be provided at all intersections except at intersections with access places

(15) On sub-arterial and arterial roads, the minimum spacing of median openings should be approximately 400 metres

(16) On roads, the maximum design speed through a roundabout is to be 50km/h, however, the provisions of Queensland Streets are to apply to roundabouts in streets; and

(17) The needs of pedestrians and cyclists are to be addressed at the design stage. Provision for cyclists is to be considered on all sub-arterial and arterial roads, irrespective of whether off-road bicycle or shared bicycle/pedestrian facilities are also provided on an adjacent verge. In the case of roads, cyclist facilities are generally provided by means of marked bicycle lanes or wide kerbside lanes / parking lanes / road shoulders, conforming to the requirements of *AUSTROADS Standards*

(18) Provide LED street lighting (Refer to Ergon Standards and specifications)

1.2.12 Turning Area (QS 2.12)

This Section adopted with the following modifications.

(a) Standard Turning Areas at the head of cul-de-sacs (including temporary cul-de-sacs) are to conform to the criteria of *Section 2.12 of Queensland Streets* and be based on the typical manoeuvring areas for Council's design vehicle HRV.

(b) The turning area is to be capable of accommodating most vehicles with a single movement turn.

(c) Circular turning heads are preferred and "T" and "Y" shaped turning heads are generally not to be used.

(d) Where a full turning circle is provided the minimum kerb radii is to be:

- Approach curve tangential to the turning circle - 18m
- The turning circle - 9m

(e) Turning areas at the ends of cul-de-sac in industrial developments are to be full turning circles with the following minimum kerb radii:

- Approach curve tangential to the turning circle - 30m
- The turning circle – 12.5m

Refer to the "Road Design Criteria" (Section 1.12) for Council's requirements with respect to Turning Areas.

1.2.13 Speed Control Devices (QS 2.13)

This Section adopted with the following amendments.

1.2.13.1 Reference Material

Refer to the "Road Design Criteria" (Section 1.12) for Council's requirements with respect to Speed Control Devices.

Refer to the current *AUSTROADS Standards* for detailed design of speed control devices.

1.2.13.2 Device Compliance

The device designs should generally comply with the following:

1.2.13.3 Streetscape

- Reduce the linearity of the street by segmentation
- Avoid continuous long straight lines (e.g. kerb lines)
- Enhance existing landscape character
- Maximize continuity between existing and new landscape areas

1.2.13.4 Location of Devices / Changes

- Devices other than at intersections should be located to be generally consistent with streetscape requirements

- Existing street lighting, drainage pits, driveways, and services may decide the exact location of devices

1.2.13.5 Design Vehicle

- Emergency vehicles and service vehicles must be able to reach all residences and properties

- Where bus routes are involved, buses should be able to pass without mounting kerbs and with minimized discomfort to passengers

- In newly developing areas where street systems are being developed in line with LATM principles, building construction traffic must be catered for.

1.2.13.6 Control of Vehicle Speeds

- Maximum vehicle speeds can only be reduced by deviation of the travelled path. Pavement narrowing's have only minor effects on average speeds, and usually little or no effect on maximum speeds

- Speed reduction can be achieved using devices which shift vehicle paths laterally (slow points, roundabouts, corners) or vertically (humps, platform intersections, platform pedestrian/school/bicycle crossings)

- Speed reduction can be helped by creating a visual environment conducive to lower speeds. This can be achieved by 'segmenting' streets into relatively short lengths (less than 200m), using appropriate devices, streetscapes, or street alignment to create short sight lines

1.2.13.7 Visibility Requirements (Sight Distance)

- Adequate critical sight distances should be provided such that evasive action may be taken by either party in a potential conflict situation. Sight distances should relate to likely operating speeds

- Sight distance to be considered include those of and for pedestrians and cyclists, as well as for drivers

- Night time visibility of street features must be adequate. Speed control devices particularly should be located near street lighting, and all street features/furniture should be delineated for night time operation.

1.2.13.8 Critical Dimensions

Many devices will be designed for their normal use by motor cars, but with provision (such as mountable kerbs) for larger vehicles. Some typical dimensions include:

- Pavement narrowing's
    - Single lane 3.50m between kerbs
    - 3.75m between obstructions
    - Two lane 5.50m minimum between kerbs

- Bicycle lanes (including adjacent to pavement narrowing's) - 1.5 metres minimum

- Plateau or platform areas:
    - 75mm to 150 mm height maximum, with 1 in 15 ramp slope

- Width of clear sight path through slowing devices

    - 1.0m maximum
      (i.e. the width of the portion of carriageway which does not have its line of sight through the device blocked by streetscape materials, usually vegetation)

- Dimensions of mountable areas required for the passage of large vehicles to be determined by appropriate turning templates

- Use of vegetation in the central island where utilised as part of a speed control device is required.

1.2.14 Other Design Criteria (QS 2.14)

1.2.14.1 Access to Allotments

Refer to Clause 1.2.8.2 above

1.2.14.2 Pathways

The following design criteria are to be employed:

(a) The minimum width of land for a pathway that is not within the road verge is to be 6.0 metres.

(b) Concrete paving is to conform to the *Standard Drawing R-010*, and is to be 2.5 metres wide, located no less than 0.5 metres from either side of the pathway boundaries

(c) The concrete pavement within a pathway is to be constructed to the adjacent kerb and channel together with a kerb ramp

(d) Bollards are to be installed to restrict vehicular access at the ends of pathways but are to be located and delineated so as not to create a hazard for pedestrians and cyclists.

(e) Pathways should be located with a minimum clearance of 0.7m from street trees, signposts, light posts and other structures.

1.2.14.3 Bikeways

The following design criteria are to be employed:

(a) The minimum width of land for a bikeway, that is not within the road verge, is to be 6.0 metres to accommodate a 2.5 metre wide concrete paved bike path;

(b) The design is to be carried out in accordance *with AS 1742.9-2000, AUSTROADS Standards and the Queensland Department of Main Roads "Manual of Uniform Traffic Control Devices" (Part 9, Bicycle Facilities)*; and

(c) Bikeways located in Parks are to be constructed above the flow of a storm event with an ARI of 1 year.

1.2.14.4 Road Edge Guide Posts and Safety Barriers

(a) Road edge guide posts are to be provided at all locations where concrete kerb and channel is not constructed e.g. half road construction; tapers; ends of roads; etc;

(b) For the warrants and locations of safety barriers, refer to the *current Queensland Department of Main Roads "Road Planning and Design Manual" (Chapter 8, Safety Barriers and Roadside Furniture);*

(c) It is to be confirmed in writing by the designer that the proposed safety barriers are in accordance with the abovementioned design manual and that the safety barrier site selection criteria have been addressed;

(d) Council may request the installation of road edge guide posts at the top of embankments where safety barriers are not installed; and

(e) Council may request the installation of REGP's at the top of stormwater manhole inlets and outlets to assist with immediate differences in surface levels.

1.8 Rural Residential Streets (QS 8.0)

The guidelines outlined in this Chapter are adopted in full except as noted below;

1.8.3 Street Hierarchy (QS 8.3)

For Rural Residential Street hierarchy refer to Section 12 and *Standard Drawing R-002*.

1.9 Industrial Streets (QS 9.0)

The guidelines outlined in this Chapter are adopted in full except as noted below;

1.9.3 Street Hierarchy (QS 9.3)

For Industrial Street hierarchy refer to Standard Drawing R-003.

1.9.13 Acceptable Solutions (QS 9.13)

Refer to "Road Design Criteria" (Section 1.12)

1.11 Definitions (QS 11.0)

The definitions outlined in this Chapter are adopted without amendment. For additional definitions refer to *Table 1.11.1 - Road Definitions and Functional Hierarchy*

Table 1.11.1 - Road Definitions and Functional Hierarchy

Group	Class	Function description	WDRC terminology	Comment
Rural Arterial Roads	1	Those roads which form the principal avenue of communication between, and through major regions	Highways	Include National highways and other state highways. High speed, high volume routes
Rural Arterial Roads	2	Those roads being class 1, whose main function is to form the principal avenue of communication for movements ▪ Between capital city and adjoining states and their capital cities; or ▪ Between a capital city and key towns; or ▪ Between key towns	Main Road	State Strategic roads generally of this class. Conveys through traffic
Rural Arterial Roads	3	Those roads, not being class 1 or 2, whose main function is to form and avenue of communication of movements ▪ Between important centres and the Class 1 and Class 2 roads and or/key town; or ▪ Between important centres which have significant economic, social, tourism or recreation role ; or ▪ Of an arterial nature within a town in a rural area	Rural Arterial	Mainly Regional roads and major local government roads. Conveys through traffic Other State Controlled Roads (OSCR)
Rural Local Roads	4	Those roads which are neither Class 1,2 or 3 whose main function is to serve the purpose of collecting and distributing traffic form local areas to the wider road network, including access to abutting properties and rural residential areas	Rural Collector & Rural Residential Collector	Mainly district roads and local government collector roads local traffic LRRS roads
Rural Local Roads	5a	Those roads which are neither Class 1,2, 3 or 4 ▪ Provides primarily for main traffic movements into and through a region or locality ▪ Caters generally for higher travel speed, all vehicle types including commercial traffic ▪ Services Rural Residential Areas connecting to Class 4 Roads	Rural Feeder & Rural Residential Feeder	All weather road predominantly two-laned and mainly sealed. High quality of service. Minimum carriageway width is 8 m (refer section 12)
Rural Local Roads	5b	Those roads which are neither Class 1,2, 3, 4 or 5 ▪ Provide access to rural residential or rural properties ▪ Provide exclusively for one activity or function	Rural Access & Rural Residential Access	Rural Access All weather two lane road formed and gravelled or single lane sealed road with gravel shoulders. Good quality of service. Minimum carriageway width is 7.0m AADT approximately < 20 Rural Residential Access All weather road predominantly two-laned sealed. High quality of service. Minimum carriageway width is 8 m (refer section 12)

Rural Local Roads	5c	Provide access to low use areas, caters for low travel speed and access may be limited to dry weather	Unformed	A single lane two-way dry weather, unformed track/road, made from local materials
Urban Arterial Roads	6	Those road whose main function is to perform as the principal arteries for through traffic and freight movements across urban areas, provide access to major freight terminals freight movement and access to major transport terminals.	Urban Arterial	Generally State Strategic. Regional roads or major local government roads
Urban Arterial Roads	7	Those road not being class 6 whose main function is to: ▪ Complete the major road network road network across the metropolitan area and carry intra-urban traffic and/or commercial and industrial traffic; or ▪ Serve as a supplementary public transport corridors; or ▪ Form part of regularly spaced road network supplementary to the principal urban road network.	Major Urban Collector	Mainly Regional roads, Significant Local Government road links in urban areas. Conveys through traffic.
Urban Local Roads	8	Those roads which are neither Class 6 or 7 whose main function serves the purpose of collecting and distributing traffic from local areas to the wider road network, including access to abutting properties	Urban Collector	Local Government collector and trunk collectors. These are roads and streets that provide a link between residential access roads Industrial / Commercial access Streets to a higher class of road with in township areas. LRRS AADT approximately < 3000
Urban Local Roads	9a	Those roads which collect to class 6,7,8 roads and ▪ Whose main function is to provide access to residences and properties; or ▪ Provide exclusively for one activity or function	Urban Feeders Industrial Collector	These roads provide the access to commercial or industrial properties to allow for the carrying out day to day activities, business or occupations. AADT approximately < 1500
Urban Local Roads	9b	Those roads which collect to class 6,7,8 roads and ▪ Whose main function is to provide access to residences and properties; or ▪ Provide exclusively for one activity or function	Urban Access A&B	These roads provide the access to commercial or industrial properties to allow for the carrying out day to day activities, business or occupations. AADT approximately < 500 (Urban Access A) AADT approximately < 200 (Urban Access B)
Service Roads	10a	Those roads whose main function is provide a safe place to park along side a road of a higher order ▪ Provide exclusively for one activity or function	Parking Lanes	These roads provide parking locations parallel to major roads normally state controlled roads.
Service Roads	10b	Those roads whose main function is provide for the movement of vehicles with in council maintained facilities. ▪ Provide exclusively for one activity or function	Service Roads	These roads are roads within showgrounds, sporting facilities, community facilities, rubbish dumps, council offices, aerodromes, depots, treatment plants.

1.12 Summary of Road Design Criteria

1.12.1 Road Design Criteria

Refer to the following pages for Road Design Criteria relating to:

Table 1.12.1 Urban Streets

Table 1.12.2 Rural Residential Streets

Table 1.12.3 Industrial Streets

Table 1.12.1 Urban Streets

Description	Urban Access A (Cul-de-sac)	Urban Access B (All other streets)	Urban Feeder	Urban Collector
Typical Lot Size	500m2 - 1,500m²	500m2 - 1,500m²	500m2 - 1,500m²	500m2 - 1,500m²
Traffic Catchment (max no. of lots)	20 lots	50 lots	150 lots	300 lots
Design Speed (max)	40 kph	40 kph	50 kph	60 kph
Carriageway Lanes - No. of	1 moving, 1 parking	2 moving, 1 parking	2 moving, 1 parking	2 moving, 2 parking
Carriageway widths (measured between channel inverts)				
• Normal Situation	6	8	10	12
• Bus Route Lane (if req'd)			10	12
Verge Width (min)	5	5	7.5	9
Road Reserve Width (min)	16	18	25	30
Carriageway Longitudinal Drainage				
• Kerbing Required (yes/no)	Yes	Yes	Yes	Yes
• Swale Drains (may be considered where underground stormwater is not achievable)	Not Preferred	Not Preferred	Not Preferred	Not Preferred
Kerb Types				
• Kerb and Channel (Refer to Note 1)	WDRC STD DWG R-008 Fully Mountable Kerb 2	WDRC STD DWG R-008 Fully Mountable Kerb 2	WDRC STD DWG R-008 Fully Mountable Kerb 2	WDRC STD DWG R-008 Barrier Kerb 1
• Stormwater Kerb connectors required at subdivisional stage (yes/no) • Cast Iron / Aluminium - 100mm	Yes	Yes	Yes	Yes
Footpaths				
• Required (yes/no)	No	No	Yes	Yes

Description	Urban Access A (Cul-de-sac)	Urban Access B (All other streets)	Urban Feeder	Urban Collector
• Width (minimum) and location	N/A	N/A	1.5m, footpath one side only	1.8m one side only
On-Street Cycleways				
• Required (yes/no)	N/A	N/A	N/A	To be assessed
• Width and location (Refer to Note 2)				Extra 1.5m carriageway width, both sides
Dual Use Footpaths/ Bikeways				
• Required (yes/no)	N/A	N/A	To be assessed	Yes
• Width and location (Refer to Note 2)			2.5m, one side only	2.5m, one side only
Parking Requirements	Note 3	Note 3	Note 3	Note 3
Carriageway Grades				
• Desirable max	12%	12%	12%	12%
• Absolute max	16%	16%	16%	16%
• Desirable min	1%	1%	1%	1%
• Absolute min (Kerb and Channel)	0.40%	0.40%	0.40%	0.40%
Vertical Sight Distance				
• General Min Distance	60m	60m	80m	110m
Carriageway Crossfall				
(a) Crossfall - one way, two way or both	Two Way	Two Way	Two Way	Two Way
(b) For AC Seal				
• Min Crossfall	4%	4%	4%	4%
• Max Crossfall	5%	5%	5%	5%

Description	Urban Access A (Cul-de-sac)	Urban Access B (All other streets)	Urban Feeder	Urban Collector
(c) For Bitumen Seal				
• Min Crossfall	4%	4%	4%	4%
• Max Crossfall	5%	5%	5%	5%
Sealed Carriageway				
• Required (yes/no) / Type	Yes / Spray Seal	Yes / Spray Seal	Yes / Spray Seal	Yes / Spray Seal
• Bitumen Sealed Details (e.g. Prime & 2 Coat)	Prime & 2 coat seal or Primer Seal & Seal	Prime & 2 coat seal or Primer Seal & Seal	Prime & 2 coat seal or Primer Seal & Seal	Prime & 2 coat seal or Primer Seal & Seal
Road Widening				
• Seal Type (Refer to Note 4)	To match	To match	To match	To match
• Crossfall				
min	4%	4%	4%	4%
max	5%	5%	5%	5%
Pavement Design Method (nominate ESA's if applicable)	ARRB - APRG Report No. 21	ARRB - APRG Report No. 21	ARRB - APRG Report No. 21	**QT-** Pavement Design Manual or **Austroads -** Pavement Design (A Guide to the Structural Design of Road Pavements)
Nominal Pavement Depths (Deemed to Comply – refer Std Dwg R003)	300mm with Geofabric Seal at Subbase Level (under K&C)	300mm with Geofabric Seal at Subbase Level (under K&C)	300mm with Geofabric Seal at Subbase Level (under K&C)	450mm with Geofabric Seal at Subbase Level (300mm pavement, 150mm subgrade replacement, Soaked CBR 15/L.S 5% min or Lime Stabilisation)
Speed Control Devices				
• Required (yes/no)	Yes	Yes	Yes	No

Description	Urban Access A (Cul-de-sac)	Urban Access B (All other streets)	Urban Feeder	Urban Collector
• If Required, preferred type (horizontal, vertical or both)	Both	Both	Horizontal	N/A
Street Length				
• Max Length	Refer Queensland Streets	Refer Queensland Streets	Refer Queensland Streets	Refer Queensland Streets
Signage, as per MUTCD				
• Regulatory (yes/no)	No	No	Yes	Yes
• Warning Signs	No	No	No	Yes
Turning Facility at end of Cul-de-sac Streets				
(a) Single movement turn preferred (yes/no)	Yes (Refer Note 5)	Yes (Refer Note 5)	N/A	N/A
• Min radius in head	9.0m	9.0m	N/A	N/A
• Approach radius	18.0m	18.0m	N/A	N/A
• Min verge width at any point	5.0m	5.0m	N/A	N/A
Truncations	4.0m, 3 equal cords/or single cord	4.0m, 3 equal cords/or single	6.0m, single cord	6.0m, single cord
Utility Service Allocations				
(a) Electrical (Overhead)				Note 6
• Required (yes/no)	No	No	No	Allowable if existing
• Alignment	N/A	N/A	N/A	As existing
(b) Telstra (underground) in single trench				
• Required (yes/no)	N/A	N/A	N/A	If overhead power
• Alignment				0.5m

Description	Urban Access A (Cul-de-sac)	Urban Access B (All other streets)	Urban Feeder	Urban Collector
(c) Electrical (underground) and Telstra in shared trench				
• Required (yes/no)	Yes	Yes	Yes	Preferred
• Alignment	0.3 clearance to RP	0.3 clearance to RP	0.3 clearance to RP	0.3 clearance to RP
Transformers	Within easement internal to Property Boundary	Within easement internal to Property Boundary	Within easement internal to Property Boundary	Within easement internal to Property Boundary
Superelevation of Carriageway				
• Required (yes/no)	No	No	No	No
Private Access to Property				
• Max Grade	Note 8	Note 8	Note 8	Note 8
Street Lighting				
• Nominate Standard Required	AS/NZS 1158 Set: 2005	AS/NZS 1158 Set: 2005	AS/NZS 1158 Set: 2005	AS/NZS 1158 Set: 2005
• Road Lighting Category	P5	P5	P4	P3
• Offset (Back of Kerb to centre of pole)	0.75	0.75	0.75	0.75
Features in Paving (e.g. Paving, patterned concrete to thresholds, infill's etc.)				
• Required or Acceptable (Pavers to be interlocking concrete pavers only)	Acceptable at intersections and speed control devices	Acceptable at intersections and speed control devices	Acceptable at intersections and speed control devices	Not permitted on through lanes

NOTES:

1. Mountable layback kerb should be provided where direct property access is permitted. Traffic Islands should comprise semi-mountable kerb, unless a mountable profile is specified to allow access for larger vehicles. Barrier kerb and channel is required for all park frontages, unless satisfactory provisions are made to prevent vehicular access to parks (e.g. fence). An additional 50mm of depth is to be provided for Feeder/Collector & Industrial Streets.
2. The minimum width for a shared path facility is 2.5m. On-street cycleways may consist of either a dedicated lane or bicycle awareness zone with a minimum combined lane width of 3.7m. Refer to Myall Creek Master Plan for widths within the Dalby CBD area.
3. In accordance with relevant section of Queensland Streets.
4. Where a road being widened is in poor condition, a Prime & 2 coat seal or Primer Seal & Seal bitumen seal may be permitted at Council's discretion.
5. Circular turning movements preferred unless otherwise approved.
6. If overhead power exists along frontage of subdivision, it may remain. Poles may require relocation to suit future property boundaries and street lighting requirements.
7. Generally provided within allotment.
8. Property access should conform to standard verge cross-section. Maximum crossfall within street reserve is 15%. Maximum driveway grade is 25% with a maximum change in grade of 10%.

Table 1.12.2 Rural Residential Streets

Description	Rural Residential Access Road	Rural Residential Feeder Road	Rural Residential Collector Road
Typical Lot Size	4,000m² - 20,000m²	4,000m² - 20,000m²	4,000m² - 20,000m²
Traffic Catchment (max)	50 (20 for cul-de-sac) lot	150	300
Design Speed (max)	40 kph	50 kph	50 kph (internal streets) 60 kph (external streets where signposted)
Carriageway Lanes - No. of	2 moving, 1 parking	2 moving, 1 parking	2 moving, 2 parking
Carriageway widths (measured between shoulder points)			
• Normal Situation	8m	9m	10m
• Bus Route Lane (if req'd)	N/A	9m (plus Bus Setdown facility as required)	10m (plus Bus Setdown facility as required)
Verge Width (min)	8.5m	10.5m	10m
Road Reserve Width (min)	25m	30m	30m
Carriageway Longitudinal Drainage			
• Kerbing Required (yes/no)	No	No	No
• Swale Drains Permitted (yes/no) refer to std drawings	Yes	Yes	Yes
• Swale Drains absolute Minimum Longitudinal Grade	0.10%	0.10%	0.10%
Kerb Types (if req'd)			
• Kerb only	Edge beam as an option 32Mpa with Fibre Reinforcing	Edge beam as an option 32Mpa with Fibre Reinforcing	Edge beam as an option 32Mpa with Fibre Reinforcing

Description	Rural Residential Access Road	Rural Residential Feeder Road	Rural Residential Collector Road
• Kerb Connectors Required at Subdivisional Stage (yes/no)	N/A	N/A	N/A
Swale Drains (if allowed)			
• Configuration	As Per WDRC Standard	As Per WDRC Standard	As Per WDRC Standard
Dual Use Footpaths/Bikeways			
• Required (one side only) (yes/no)	No	No	Yes
• Width	N/A	N/A	2.0m
Parking Requirements	N/A	N/A	N/A
Carriageway Grades			
• Desirable max	12%	12%	12%
• Absolute max	20%	16%	16%
• Desirable min	0.40%	0.40%	0.40%
• Absolute min	0.10%	0.10%	0.10%
Vertical Sight Distance			
• General Min Distance	To Austroads Standards	To Austroads Standards	To Austroads Standards
Carriageway Crossfall			
(a) Crossfall - one way, two way or both	Two way	Two way	Two way
(b) Bitumen Seal			
• Min Crossfall	4%	4%	4%
• Max Crossfall	5%	5%	5%

Description	Rural Residential Access Road	Rural Residential Feeder Road	Rural Residential Collector Road
Sealed Carriageway			
• Required (yes/no) / Type	Yes / Spray Seal	Yes / Spray Seal	Yes / Spray Seal
• Bitumen Sealed Details (e.g. Prime & 2 Coat or Primer Seal & Seal)	Prime & 2 coat seal or Primer Seal & Seal	Prime & 2 coat seal or Primer Seal & Seal	Prime & 2 coat seal or Primer Seal & Seal
Road Widening			
• Seal Type	To match	To match	To match
• Crossfall			
min	4%	4%	4%
max	5%	5%	5%
Pavement Design Method (nominate ESA's if applicable)	ARRB - APRG Report No. 21	ARRB - APRG Report No. 21	**QT-** Pavement Design Manual **Austroads -** Pavement Design (A Guide to the Structural Design of Road Pavements)
Nominal Pavement Depths (Deemed to Comply refer Std Dwg R-002)	300mm with Geofabric Seal at Subbase Level	300mm with Geofabric Seal at Subbase Level	450mm with Geofabric Seal at Subbase Level (300mm pavement, 150mm subgrade replacement, Soaked CBR 15/L.S 5% min or Lime Stabilisation)
Speed Control Devices			
• Required (yes/no)	Yes	Yes	No
• If Required, preferred type (horizontal, vertical or both)	Horizontal/Vertical	Horizontal	N/A
Street Length			
• Max Length	Refer Queensland Streets	Refer Queensland Streets	Refer Queensland Streets

Description	Rural Residential Access Road	Rural Residential Feeder Road	Rural Residential Collector Road
Turning Facility at end of Cul-de-sac Streets			
(a) Single movement turn preferred (yes/no) If preferred	Yes	N/A	N/A
• Min radius in head	9.0m	N/A	N/A
• Approach radius	18.0m	N/A	N/A
• Min verge width at any point	7.0m	N/A	N/A
Truncations	4.0m, single cord	6.0m, single cord	6.0m, single cord
Utility Service Allocations			
(a) Electrical (Overhead)			
• Required (yes/no)	No	No	Allowable if existing
• Alignment	N/A	N/A	As existing
(b) Telstra (underground) in single trench			
• Required (yes/no)	N/A	N/A	If overhead power
• Alignment			0.5m
(c) Electrical (underground) and Telstra in shared trench			
• Required (yes/no)	Yes	Yes	Preferred
Transformers	Within easement internal to Property Boundary	Within easement internal to Property Boundary	Within easement internal to Property Boundary
• Alignment	0.3 clearance to RP	0.3 clearance to RP	0.3 clearance to RP
Superelevation of Carriageway			

Description	Rural Residential Access Road	Rural Residential Feeder Road	Rural Residential Collector Road
• Required (yes/no)	No	No	Yes
Private Access to Property			
• Max Grade	25% with sealed access and maximum grade change of 10%	25% with sealed access and maximum grade change of 10%	N/A
Street Lighting			
• Nominate Standard Required	AS/NZS 1158 Set: 2005	AS/NZS 1158 Set: 2005	AS/NZS 1158 Set: 2005
Road Lighting Category	P5	P4	V4
• Offset (Back of Kerb to centre of pole or from shoulder point)	0.75	0.75	0.75
Signage, as per MUTCD			
• Regulatory (yes/no)	Yes	Yes	Yes
• Warning Signs	Yes	Yes	Yes
Features in Paving (e.g. Paving, patterned concrete to thresholds, infills etc)			
• Required or Acceptable	Acceptable	Acceptable	Acceptable

Table 1.12.3 Industrial Streets

Description	Industrial Access Cul-de-sac Access Street	Industrial Collector Street
Town Planning Zone Description	Industrial	Industrial
Typical Lot Size	500m² - 50,000m²	500m² - 50,000m²
Traffic Catchment (max)	8 ha	120 ha
Design Speed (max)	50 kph	60 kph
Carriageway Lanes - No. of	2 moving, 2 parking	4 moving, no parking
Carriageway widths (measured between channel inverts)		
• Normal Situation	12m	14m
• Bus Route Lane (if req'd)		
Verge Width (min)	5.0m	8.0m
Road Reserve Width (min)	22m	30m
Carriageway Longitudinal Drainage		
• Kerbing Required (yes/no)	Yes	Yes
• Swale Drains Required (yes/no)	N/A	N/A
Kerb Types (if req'd)	32Mpa Concrete, extra 50mm thick	32Mpa Concrete, extra 50mm thick
• Kerb and Channel	Barrier (Kerb1) WDRC Std. Dwg. R-008	Barrier (Kerb1) WDRC Std. Dwg. R-008
• Semi Mountable	Islands	Islands
• Kerb Connectors Required at Subdivisional Stage (yes/no)	No	No
Swale Drains (if allowed)		

Description	Industrial Access Cul-de-sac Access Street	Industrial Collector Street
• Configuration	N/A	N/A
Footpaths		
• Required (yes/no)	No	No
• Width	N/A	N/A
On-Street Cycleways		
• Required (yes/no)	N/A	N/A
• Width		
Dual Use Footpaths/Bikeways		
• Required (yes/no)	N/A	N/A
• Width		
Parking Requirements	Yes	No
Carriageway Grades		
• Desirable max	6%	6%
• Absolute max	10%	8%
• Desirable min	1%	1%
• Absolute min	0.40%	0.40%
Vertical Sight Distance		
• General Min Distance	80m	110m
Carriageway Crossfall		
(a) Crossfall - one way, two way or both	Two Way	Two Way

Description	Industrial Access Cul-de-sac Access Street	Industrial Collector Street
(b) AC Seal		
• Min Crossfall	4%	4%
• Max Crossfall	5%	5%
(c) Bitumen Seal		
• Min Crossfall	4%	4%
• Max Crossfall	5%	5%
Sealed Carriageway		
• Required (yes/no)	Yes	Yes
• AC Preferred (at Intersections & Cul-de-sacs / Round-abouts)	Yes	Yes
• AC Seal Details	TMR - DG14mm (Min. Depth 50mm) with AMC4 7mm Primerseal	TMR - DG14mm (Min. Depth 50mm) with AMC4 7mm Primerseal
• Bitumen Sealed Preferred (yes/no)	No	No
• Bitumen Sealed Details (e.g. Prime & 2 Coat)	Prime & 2 Coat Seal	Prime & 2 Coat Seal
Road Widening		
• Seal Type	To Match	To Match
• Crossfall		
min	4%	4%
max	5%	5%
Pavement Design Method (nominate ESA's if applicable)	**QT-** Pavement Design Manual **Austroads -** Pavement Design (A Guide to the Structural Design of Road Pavements)	**QT-** Pavement Design Manual **Austroads -** Pavement Design (A Guide to the Structural Design of Road Pavements) Full Design required

Description	Industrial Access Cul-de-sac Access Street	Industrial Collector Street
Minimum Pavement Depths (Deemed to Comply)	450mm (300mm pavement, 150mm subgrade replacement, Soaked CBR 15/L.S 5% min or Lime Stabilisation)	N/A
Speed Control Devices		
• Required (yes/no)	No	No
• If Required, preferred type - horizontal, vertical or both	N/A	N/A
Street Length		
• Max Length	N/A	N/A
Turning Facility at end of Cul-de-sac Streets		
(a) Single movement turn required (yes/no)	Yes	N/A
• Min radius in head	17.5m	N/A
• Approach radius	20.0m	N/A
• Min verge width at any point	5.0m	N/A
(b) Three point turns preferred (yes/no) If preferred -	No	N/A
• "Tee" (yes/no)	No	N/A
• "Offset square" (yes/no)	No	N/A
• "Wye" (yes/no)	No	N/A
• Min verge width at any point	No	N/A
Truncations	6.0m, single chord	6.0m, single chord
Utility Service Allocations		
(a) Electrical (Overhead)		

Description	Industrial Access Cul-de-sac Access Street	Industrial Collector Street
• Required (yes/no)	No	Allowable if Existing
• Alignment	N/A	As Existing
(b) Telstra (underground) in single trench		
• Required (yes/no)	No	No
• Alignment	N/A	N/A
(c) Electrical (underground) and Telstra in shared trench		
• Required (yes/no)	Yes	Yes
• Alignment	0.3 clearance to RP	0.3 clearance to RP
Superelevation of Carriageway		
• Required (yes/no)	No	No
Private Access to Property		
• Max Grade	10% with sealed access and maximum grade change of 10%	10% with sealed access and maximum grade change of 10%
Street Lighting		
Nominate Standard Required	AS/NZS 1158 Set: 2005	AS/NZS 1158 Set: 2005
• Road Lighting Category	P4	V4
• Offset (Back of Kerb to centre of pole)	0.75	0.75
Features in Paving (e.g. Paving, patterned concrete to thresholds, infill's etc.)		
• Required or Acceptable	No	No
Signage, as per MUTCD		

Description	Industrial Access Cul-de-sac Access Street	Industrial Collector Street
• Regulatory (yes/no)	Yes	Yes
• Warning Signs	Yes	Yes

1.13 Flexible Pavement Design

The guidelines outlined below are intended to provide designers with guidance on acceptable standards for the design of flexible pavements within the WDRC Area. Where alternative methods are proposed the proponent must provide sufficient information and justification to Council for the proposed alternative solution.

1.13.1 Reference Documents

The design of pavements for residential traffic is to be carried out in accordance with the provisions of (except as amended by this document):

(a) Queensland Streets Section 2.2 - Traffic Volume

(b) APRG Report 21 - A Guide to the Design of New Pavements for Light Traffic - A Supplement to Austroads Pavement Design, Austroads, APRG, ARRB

(c) Pavement Design - a Guide to the Structural Design of Road Pavements, Austroads.

(d) Department of Transport and Main Roads – Pavement Design Manual,

The design of pavements for roads that have substantial traffic and are governed under the jurisdiction of Main Roads such as Trunk Collector Streets shall be carried out to methods outlined within Main Roads Pavement Design Manual.

The following sections outline items, which require special emphasis, clarification or modification. They do not form a stand-alone guide without reference to the above-mentioned documents.

1.13.2 Subgrade Evaluation

The Subgrade Evaluation shall adhere to the following requirements:

- A design CBR is to be determined for each identifiable unit defined on the basis of topography, geological and drainage condition of the site
- The four day soaked, four point CBR at 100% Standard Compaction is to be the standard test, as per Council's Inspection and Test Plan
- Tests are to be carried out in a NATA registered laboratory. Test results and pavement design are to be submitted to the Local Government for acceptance prior to a request for subgrade box inspection
- A copy of all test results used as the basis of the pavement design are to be provided to Council
- The sampling is to be randomly located within each length of the proposed roadway with constant subgrade material
- For less than five results the Design CBR shall be the least estimated insitu CBR result.
- For five or more results, the Design CBR shall be the 10th percentile of all estimated insitu CBR results
- The samples shall be taken generally in the position of the outer wheel path on both sides of the proposed road; and
- The frequency of testing required is to be in accordance with the specifications outlined in Table 1.13.2 Frequency of testing for subgrade

Table 1.13.2 - Frequency of testing for subgrade

TESTING TYPE	ROADS < 150 metres	ROADS > 150 metres
LABORATORY	Sample at 2 sites	Sample at 1 site every 150 m or part thereof
Soaked CBR's and Routine Soil Tests	Lab tests on all relevant material	Lab tests on all relevant material
FIELD	3 tests on subgrade	1 test on subgrade every 50m or part thereof.
Dynamic Cone Penetrometer and Field Moisture Content	Routine soil tests on subgrade from 1 of these sample sites	Routine soil tests on subgrade from 1 site in 3 of these sample sites

The following shall be noted with respect to subgrade evaluation

- Approximate methods (cone penetrometers, etc) of in-situ testing are permitted only for preliminary pavement designs or for establishing uniformity at or between laboratory test locations.
- Unsoaked laboratory tests may be performed when approved by Council and only in well drained subgrades that are not likely to remain saturated (for example, not pavements that are subject to flooding or the presence of groundwater) for extended periods of time.

1.13.3 Pavement Materials

The following shall be noted with respect to pavement materials

Pavement materials shall generally be from a certified quarry meeting MRTS 11.05 with the following minimum criteria:

- Base coarse gravel is to have a minimum CBR of 60
- Sub-base gravel is to have a minimum CBR of 45
- Minimum linear shrinkage of 2% and a maximum linear shrinkage of 8%
- Shall meet a C grading in accordance with MRTS – 11.05
- Subgrade replacement material shall have a minimum 4 day soaked CBR of 15 and minimum linear shrinkage of 5% and maximum of 15%.
- Lime stabilisation is considered an acceptable alternative subgrade replacement method. Proponents should seek advice and direction from Council prior to proposing such subgrade stabilisation method.
- Bound pavements (that is, cement treated to any content) will generally not be permitted;

Materials supplied from non-certified quarries or pits shall only be used with prior Council approval and shall meet the following minimum standards

- Minimum MRTS 11.05 Type 4
- In-Quarry Testing shall be undertaken at the rate 1 test per 500 m3 of stockpiled material. Tests shall include

- CBR
- Atterbergs
- Grading

- Additional site audit testing shall be undertaken at the rate of 1 test per 500 m3

- All materials shall be free of organic or deleterious matter or other contamination to the satisfaction of Council.

- Use of non-certified material shall only be approved where suitable alternatives are not readily available.

1.13.4 Surfacing Design

- The selection of surfacing shall be in accordance with the table in Section 1.12 and comply with the following additional requirements.
- The design of pavement surfacing shall be in accordance with the following methods unless otherwise approved by Council:

    - AAPA Sprayed Sealing Selection and Design Guidelines- 2010

- Prior to any sealing, surfaces must be dry, clean and free of loose material.

- Emulsion prime may only be used when written permission has been obtained from Council

- Modified seals may also be considered or be required under certain circumstances (eg. polymer modified, open graded or mastic seals or deep-lift AC pavements); and

- The minimum depth of AC Surfacing is:

    - 50mm in industrial areas or high volume turning areas
    - 30mm in all other areas.

- AC surfacing specification shall be in accordance with Section 1.12

1.13.5 Design Traffic

1.13.5.1 Design Period

The design period for flexible pavements shall be 20 years.

1.13.5.2 Traffic Volumes

In determining the Design Traffic Volumes, the following must be included:

- Traffic generation is to be determined in accordance with Queensland Streets Section 1.2.2 - Traffic Volume

- The minimum traffic loading in all cases shall be a minimum of $1x10^5$ ESA's;

- The relative proportion of dual-occupancies or unit developments, in permitted areas, is generally not considered to significantly impact traffic generation except where a subdivision is located near a university, retirement village, etc

- In such instances, the effect of multi-occupancy shall be taken into account. Table 2.2.E of Queensland Streets is to be used to determine the number of Equivalent Dwellings contributing to traffic generation

- Consideration is to be given where the paved width of the street or the presence of parked vehicles is such that traffic traveling in both directions is likely to partially or fully use the same road space:
    - In these instances, a multiplier in the range of 1.0 to 0.5 is be applied for single lane traffic and two lane traffic respectively

The following shall be noted with respect to traffic generation:

- In residential areas, trip generation is not to be less than 10 trips per dwelling per day.
- A lane multiplier may be applied to the AADT as follows:

    (a) For access and collector streets up to 7.5m in width, a value of 1.0 is to be applied.

    (b) For streets greater than 7.5m in width where two lane traffic is developed, a value of 0.5 may be applied.

1.13.5.3 Design Traffic for Flexible Pavements

(1) Allowances for garbage collection vehicles and buses are to be included in the design traffic calculations.

(2) Garbage collection vehicles may generally be assumed to be a medium rigid class of vehicle (MRV) with two single axles with single types (SS) and one tandem axle group with dual tyres (TAD) at 75% loading.

(3) Public transport buses may be assumed to have one single axle with single tyres (SS) and one single axle with dual tyres (SD).

(4) In areas outside the CBD, loading may be considered 50% loading and 100% otherwise.

(5) An allowance for construction traffic is also to be added to design traffic.

(6) The growth factor should be assessed for the appropriate class of road. For access and minor collector streets, the growth factor may be as low as 2% where there is a fixed ultimate catchment or alternatively up to 5 – 10% where the road or street services a growth area.

(7) The following shall be noted with respect to design traffic for flexible pavements

    (i) The proportion of commercial vehicles may be taken as

        - 4% for a local access street
        - 6% for a collector street or
        - As calculated in detail, accounting for known heavy vehicle traffic (that is, garbage collection, buses, commercial vehicles etc.)

    (ii) For fixed catchment access or collector streets the growth factor may be taken as zero. In the absence of more accurate information, for other classes of street, the growth factor should not be less than 2%.

    (iii) A calculation worksheet produced by Western Downs Regional Council is contained in Section 1.15 of this part of the manual.

1.13.5.4 Check Method of Design of Flexible Pavements

Included in Section 1.15 of this section of the manual, is a pavement design method, intended only to facilitate the checking and approval of proposed pavement designs for roadworks associated with reconfigurations and building development works.

The pavement design method included in Section 1.15, is not intended to be used in lieu of design manuals, and the design method outlined in Clauses1. 13.1 to 1.13.5 herein.

1.13.6 Residential Streets

Intentionally left blank

1.13.7 Industrial Streets

Intentionally left blank

1.13.8 Rural Residential and Village Streets

Intentionally left blank

1.13.9 Rural Roads

Intentionally left blank

1.14 Flexible Pavement Design Workshop

Intentionally left blank

1.15 Check Method - Design of Flexible Pavements

NOTE: This section is intended to facilitate the checking and approval of proposed pavement designs for roadworks associated with reconfigurations and building development works.

This section is not intended to be used in lieu of design manuals and the method outlined in Section 13.0 Flexible Pavement Design above.

1.15.1 Pavement Materials

Refer Section 1.13.3 "Pavement Materials"

1.15.2 Determination of Design Traffic

Minimum design traffic loadings for the various road classifications are to be as outlined in Table1.15.1 - Design ESA's by Road Class

Table 1.15.1 - Design ESA's by Road Class

Description	Road Class	ESA's
Urban Access A	A (20 lots max)	1.0×10^5
Urban Access B	A1 (50 lots max)	1.0×10^5
Urban Feeder	B (150 lots max)	5.0×10^5
Urban Collector	C (300 lots max)	1.0×10^6
Rural Res Access	A1 (50 lots max)	1.0×10^5
Rural Res Feeder	B (150 lots max)	5.0×10^5
Rural Res Collector	C (300 lots max)	1.0×10^6
Industrial Access	D	1.0×10^6

Industrial Collector	E	7.0×10^6
Arterial	F	DMR Design Standards

1.15.3 Minimum Pavement Thickness

The minimum Pavement Thickness is to be determined in reference to the following:

Minimum pavement thickness is to be as set out in Table 1.15.2 Minimum Pavement Thickness

Table 1.15.2 – Minimum Pavement Thickness

Minimum Total Pavement Thickness (mm) (excluding AC Surfacing)							
CBR of Subgrade	**A**	**A1**	**B**	**C**	**D**	**E**	**F Refer to TMR Design**
1 & 2	Refer to Notes for Table 1.15.2 (8)						
3	450	470	495	550	560	670	
4	375	395	420	465	520	620	
5	325	340	360	390	480	580	
6	290	310	325	350	450	550	
7	265	280	295	320	425	520	
8	240	255	265	295	400	500	
9	225	230	245	275	380	480	
10	225	225	225	255	365	465	
12	225	225	225	225	325	430	
14	225	225	225	225	305	400	
16	225	225	225	225	290	375	
18	225	225	225	225	275	355	
20	225	225	225	225	275	335	
Minimum Course Thickness							
Asphalt	30	30	30	30	50	50	
Base Course Type 3.2 (Min CBR60)	125	125	125	125	125	125	
Upper Sub Base Course Type 3.3 (Min CBR45)	100	100	100	100	150	150	
Lower Sub Base Course Type 3.3 (Min CBR45)	As required to obtain minimum thickness (100mm minimum layer thickness)						

Source: A, A1, B, C Type ARRB Special Report No. 41 - Figure 7 / D, E, Type Queensland Department of Main Roads Pavement Design Chart 1.

Notes for Table 1.15.2:

(1) This table has been derived from ARRB Special Report No. 41, Figure 7 and Department of Transport Pavement Design Manual 1990, Design Chart 1.

(2) To cater for the difference in the mechanisms of pavement failure, Class A, A1, B and C road pavement designs are based on ARRB curves and Class D and E road pavement designs are based on Department of Transport curves.

(3) All Class F roads are to be designed to DTMR standards.

(4) CBR is the 4 day soaked CBR value.

(5) If upper sub-base course minimum thickness cannot be achieved, then base course material is to be used for full pavement depth.

(6) The above pavement thicknesses are gravel thicknesses only.

(7) AC surfacing thickness is to be added to the gravel thickness to determine the total box depth.

- If the Design CBR determined for the subgrade is less than the minimum CBR given in Table 15.2 (i.e. CBR less than 3) and the subgrade is expected to be of sufficient strength to allow pavement construction to proceed (i.e. The subgrade does not exhibit visible signs of deformation or instability under proof rolling), the designed pavement thickness is to be determined as the max of + = (219 – 211 (log(ESA) + 58 ((log(ESA))2) x log(ESA/120)) or

    (a) CBR 2 = 100mm + design depth based on a design subgrade CBR of 3

    (b) CBR 1 = 200mm + design depth based on a design subgrade CBR of 3

- For subgrades that are expected to be at, or near, the design strength at the time of construction (i.e. will not support a loaded water cart without deformation), the material should be treated as a soft subgrade and one of the following measures is to be adopted;

    (a) Some form of working platform is to be provided (minimum depth 300mm, CBR 15 material)

    (b) Use of geofabric sheeting

    (c) Stabilize the soil by use of a mixture of cement or lime

- For design purposes, the subgrade improvement or working platform should be ignored and a CBR 3 used for the subgrade for all road classifications

- The thickness of the working platform or depth of stabilization is not part of the designed pavement thickness; and

- Before any of the methods outlined above are adopted, approval must be obtained from Council and any submission for its use is to be supported by technical information from the manufacturer or a recognized geotechnical testing authority.

1.16 As Constructed Plans

Accurate "As-Constructed" Plans shall be prepared to record any changes or departures from the design that may have occurred during the construction phase.

These Plans shall include but not be limited to the following:

Plan view
Longitudinal Sections
Cross Sections
Pavement construction
Pavement cross falls and levels

Kerb & channel levels
Sub soil drainage

1.15 Check Method - Design of Flexible Pavements

1.16 Road Work Quality Plan

No.	Activity	Method	Frequency	Quality Requirements	Test Confirmation				Remarks by Contractor or Engineer
					Contractor		Engineer		
					Sign	Date	Sign	Date	
1	Pre-Start Meeting	Contractor, Engineer and Council if required		All foreseeable problems and discrepancies to be resolved if possible					
2	Service Locations	Contractor to liaise with service Authorities	As required	Location of services identified within scope of works to be located					
3	Special Access requirements	Access to existing residents to be arranged if required	Prior to excavation of box	Access to be maintained or reinstated as necessary					
4	Surveyor or Engineer to Set out pegs for road works (centre line, offset and level pegs)	Set out works in accordance with approved plans	Prior to excavation	Control Stations to be clearly marked, pegs to be preserved where possible					
5	Services Relocated	Contractor to liaise with service Authorities	As required	Contractor to confirm relevant services relocated by Service Authority					HOLD POINT
RELOCATION OF ALL RELEVANT SERVICES TO BE CONFIRMED BY ENGINEER PRIOR TO PROCEEDING TO ACTIVITY 6									
6	Lot Identification	Engineer & Contractor to define extent of Lots within pavement area	Prior to excavation	Lots to be clearly identified by pegs on site and on approved plans					

7	Cut Existing Pavement Surfaces	Concrete saw or cutting wheel	Where joining any existing pavements	Depth of cut to exceed depth of seal or asphalt					
8	Excavate to Subgrade	Excavate to required pavement box depth	Each Lot	Avoid over excavation, Stormwater drainage to be diverted from box					
9	Check box depth and width	Check at key grid points with level	As required	Tolerances: Vertical +25mm, -25mm Horizontal +150mm,-50mm					
10	Compaction of Subgrade	Compaction Equipment as required	Following excavation	Minor vertical & horizontal displacement and rebound					
11	Subgrade Proof Roll by Contractor	Fully loaded 8t truck or equivalent	Following compaction	No vertical or horizontal displacement or rebound					
12	Subgrade Proof Roll by Engineer and Council	Loaded truck, 8t per axle, or equivalent	Following proof roll by Contractor	No vertical or horizontal displacement or rebound					HOLD POINT
SUBGRADE PROOF ROLL TO BE CERTIFIED PASSED BY TOOWOOMBA CITY COUNCIL PRIOR TO PROCEEDING TO ACTIVITY 14									
13	Subgrade Compaction Tests	In accordance with AS 1289	As detailed in Specification	Minimum of 97% RDD MRS 11.04					
14	Mix, place, compact & trim subbase material and proof roll	In accordance with AS 1289	As detailed in Specification	No vertical or horizontal displacement or rebound					
15	Subbase Compaction Tests	In accordance with AS 1289	As detailed in Specification	Minimum of 100% RDD MRS 11.05					HOLD POINT
SUBBASE COMPACTION RESULTS TO BE CERTIFIED PASSED BY ENGINEER PRIOR TO PROCEEDING TO ACTIVITY 16									
16	Setout pegs and stringline for kerb & channel	In accordance with approved plans	As required	Levels and peg locations to be checked prior to kerb extrusion					
17	Setout pegs and stringline for kerb & channel	In accordance with approved plans	As required	Levels and peg locations to be checked prior to kerb extrusion					

18	Extrude or pour kerb & channel	As per specification	As required	Contraction joints to be formed within 30mins of pour, smooth finish					
19	Check finished levels of kerb & channel	Survey, Visual	After each section pour	Tolerances: Vertical +10mm, -10mm Horizontal +10mm,-10mm					
20	Mix, place, compact & trim base material and proof roll by Contractor	Loaded truck, 8t per axle, or equivalent	Following trimming	No vertical or horizontal displacement or rebound					
21	Base Proof Roll by Engineer and Council	Fully loaded 8t truck or equivalent	Following proof roll by Contractor	No vertical or horizontal displacement or rebound					HOLD POINT
BASECOURSE PROOF ROLL TO BE CERTIFIED PASSED BY TOOWOOMBA CITY COUNCIL PRIOR TO PROCEEDING TO ACTIVITY 22									
22	Basecourse Compaction Tests	In accordance with AS 1289	As detailed in Specification	Minimum of 100% RDD MRS 11.05					
23	Broom and Prime finished pavement surface, or primer seal if directed by Engineer	Tractor Broom	As detailed in Specification	All loose & flakey material to be removed, dry surface & even spray distribution					HOLD POINT
PRIMED SURFACE TO REMAIN UNDISTURBED FOR A MINIMUM OF 48HRS PRIOR TO PROCEEDING TO ACTIVITY 25									
24	Broom primed pavement surface, place and compact asphalt surfacing	Paving machine and in accordance with Specification	Continuous	A.C. > 135'C at placement, 95'C-105'C breakdown & 85'C-95'C finish rolling.					
25	Asphalt Testing	Insitu Density Testing of A.C surface to Specification	As per Specification	91% of maximum density MRS 11.09					

Part 2 Standards for Design of Stormwater Drainage Works

Table of Content

2.1 Design Criteria

2.1.1 Introduction

2.1.2 Water Quality Control

2.2 Stormwater Planning

2.3 Legal Aspects

2.4 Catchment Hydrology

2.4.1 Hydrologic Methods

2.4.2 Hydrological Assessment

2.4.3 The Rational Method

2.4.4 Catchment Area

2.4.5 Coefficient of Discharge

2.4.6 Time of Concentration

2.4.7 Intensity / Frequency / Duration Data

2.4.8 Estimation of Runoff Volume

2.4.9 Method for Assessing the Effects of Urbanisation on Hydrologic Models

2.5 Detention / Retention Systems

2.6 Computer Models

2.7 Urban Drainage

2.7.1 Planning Issues

2.7.2 Design Storms - Average Recurrence Interval

2.7.3 The Major / Minor System

2.7.4 Roadway Flow Limits and Capacity

2.7.4.1 General - Basic Design Requirements for Overland Flowpaths

2.7.4.2 Major Drainage System - Location of Overland Flowpaths

2.7.4.3 Overland Flow in Roads

2.7.4.4 Overland Flow in Parks

2.7.4.5 Overland Flow from Traps in Roads

2.7.5 Gully Inlets

2.7.5.1 Type of Gully Inlets and Grates

2.7.5.2 Kerb / Gully Inlet Capacity

2.7.5.3 Kerb / Gully Location

2.7.6 Manholes
2.7.7 Pipeline Location
2.7.8 Pipe and Material Standards
2.7.9 Structural Design of Pipelines and Access Chambers
2.7.10 Minimum Cover over Pipes
2.7.11 Flow Velocity Limits
2.7.12 Pipe Grade Limits
2.7.13 Roof and Allotment Drainage
2.7.13.1 General
2.7.13.2 Roof Drainage
2.7.12.3 Roof and Allotment Drainage - General
2.7.13.4 Level of Roof and Allotment Drainage System
2.7.13.5 The Rear of Allotment Drainage System
- General
- Underground Pipes
- Easements
- Connection Stubs
- Inspection Manholes
- Discharge Points
- Connection to Kerb and Channel
- Number of Allotments Served
- Allotment Flow
- Effect of Roof and Allotment Drainage System on the Trunk Drainage System

2.7.14 Public Utilities and Other Services
2.7.15 Discharge Calculations
2.7.16 Hydraulic Calculations
2.8 Stormwater Drainage Design Charts and Tables
2.8.1 Storm Water Drainage Design Criteria
2.9 As-constructed Plans

2.1 Design Criteria (QUDM 1.00)

The Queensland Urban Drainage Manual (Q.U.D.M.) is adopted in principle, and the design parameters used, are to be in accordance with the criteria listed in the current edition of QUDM, except as amended by this document. The section of the QUDM manual to which comments refer are shown as **QUDM X 00** or **QUDM x.xx.**

This section is intended to be used for Urban Stormwater and Overland Flow Design and Construction only. It is not intended to address or provide design solutions for Riverine Flooding events. For information on Riverine Flooding – proponents should refer to the Western Downs Regional Planning Scheme – Flood Code and referenced documents.

2.1.1 Introduction

(1) The design of the proposed drainage system is to ensure that the upstream drainage is not adversely affected and that the downstream drainage system is capable of adequately catering for the discharge of the additional flow produced as a result of the development.

(2) If the existing downstream system is not capable of carrying the increased discharge, upgrading of the downstream system is required. Alternatively the increased discharge of stormwater is to be detained on the site to ensure a *non-worsening* outcome.

(3) Measures are to include, but not be limited to, investigation for upgrading the existing downstream system.

(4) The design of the proposed drainage system is to accommodate both existing and future developed flows from upstream catchments.

(5) Drainage Easements over downstream drainage paths and/or legal approval from the affected property owners is required from the development site to the point of discharge.

(6) Where possible the minor drainage system is to be piped throughout the development.

2.1.2 Water Quality Control

(1) Development that is likely to have a significant adverse impact on water quality is to compile and submit a Water Quality Management Plan that details the temporary and permanent methods of water quality control that are to be included in the development.

(2) Development is to address stormwater quality to best practices of environmental management design objectives in accordance with the SPP (State Planning Policy) current at the time of construction

(3) Temporary water quality control methods and techniques (excluding devices which divert or concentrate runoff) are to be in accordance with the QUDM and the Institution of Engineers, Australia (Qld) “Soil Erosion and Sediment Control – Engineering Guidelines for Queensland Construction Sites”.

2.2 Stormwater Planning (QUDM 2.00)

This Chapter adopted with the following comments:

(1) The adoption of the major system / minor system philosophy will impose a significant constraint on the layout planning of the development. It is likely to be more cost-effective to consider an alternative layout, than to provide the drainage required to adequately service a layout which does not address the topography of the land.

(2) Strategic and Master Drainage Planning will generally be undertaken by Council rather than by individual developers or their consultants.

(3) However, for areas where Council does not have a Master Drainage Plan, work of this nature may be required as a condition of development to support an application.

2.4 Catchment Hydrology (QUDM 4.00)

2.4.1 Hydrologic Methods (QUDM 4.01)

This Section adopted with the following comments:

(1) Time-Area methods will need to be used to provide the hydrology for detention basin design.

(2) Methods such as ILSAX are appropriate for modelling small urban catchments.

(3) Methods such as RORB and RAFTS are appropriate for modelling large urban catchments or minor creek flows. 2D models such as MIKE and TUFLOW should be used in more complex systems where interrelationship between flows paths are common.

(4) Detailed hydraulic grade line analyses are an integral part of urban stormwater design.

(5) Rational Method as per Q.U.D.M.

(6) Riverine Flood Assessments should be undertaken using the methods described in ARR.

2.4.2 Hydrological Assessment (QUDM 4.02)

This Section adopted with the following comments:

(1) The Rational Method is an appropriate hydrologic method, subject to the use of the various parameters provided by Q.U.D.M.

(2) Designers to note:

Developments must take account of upstream catchments, using runoff calculations as if the catchment was fully developed in accordance with Council's Planning Scheme.

The drainage in a catchment which is receiving discharge from an area of a higher ARI shall be designed to cater for the greater design discharge from upstream. The ARI in the downstream catchment may be reduced to its normal recurrence interval at a convenient location such as a park area where the higher design flow can surcharge safely. The surcharge location shall be approved before the drainage design is finalised.

(3) The drainage in a catchment which is receiving discharge from an area of a lower ARI shall be designed to cater for a discharge from that upstream area at the same frequency as the downstream catchment. Sufficient inlet capacity shall be provided to cater for the additional design bypass flow from the upstream catchment where it meets the catchment of higher design recurrence interval.

2.4.3 The Rational Method (QUDM 4.03)

This Section adopted with the following comment:

(1) Designers to note:

Partial Area Effects should be investigated in design, particularly in areas of mixed development.

2.4.4 Catchment Area (QUDM 4.04)

This Section adopted without amendment.

2.4.5 Coefficient of Discharge (QUDM 4.05)

This Section adopted with the following comments:

(1) It is further recommended that the coefficient of discharge should be calculated using the method presented in Book 8 of Australian Rainfall & Runoff (ARR), with the exception of 100% pervious surface.

(2) It is recommended that the coefficient of discharge be determined on the basis of a locality's typical rainfall intensity and the fraction of impervious area in the individual development.

(3) *Table 4.05.1 - Fraction Impervious vs. Development Category* as listed in Q.U.D.M. is to be used as a guide in the design process. It is recommended that an analysis of each individual catchment be undertaken to determine and/or confirm its actual fraction impervious.

(4) Reference should be made to Council's Regional Flooding and Stormwater Analysis reports for recommended C_{10} Runoff Coefficients values. *Table 4.05.2 – Table of Frequency Factors and Tables 4.05.3 (a) & 4.05.3 (b) - Tables of C10 Values* as listed in Q.U.D.M. are to also be referenced in this design process.

(5) For a particular development, it may be necessary to determine the Fraction Impervious from first principle, as per sub-clause 4 above. The Coefficient of Discharge can then be determined as previously described.

2.4.6 Time of Concentration (QUDM 4.06)

This Section adopted with the following comments:

(1) The use of *the Standard Inlet Times given in Table 4.06.1 in Q.U.D.M*. is supported. The location of the top gully inlet of a pipe drainage system, and its corresponding catchment, will usually be based on the appropriate standard inlet time.

(2) The use of the recommended maximum lengths of overland sheet flow path given in *Table 4.06.3 of Q.U.D.M*. is supported, given the increasing prevalence of substantial cut / fill earthworks in residential housing construction.

(3) The recommendations on *Standard Inlet Times given in Clause 4.06.4 of Q.U.D.M*. is highlighted, particularly for the top of a catchment, in a high density residential development. In this case, the standard inlet time should not exceed 10 minutes, unless otherwise demonstrated by the designer, to Council's satisfaction.

(4) In rural residential developments, the use of the recommended maximum length of overland sheet flow path of 200 metres given in *Table 4.06.3 of Q.U.D.M*. is supported.

2.4.7 Intensity / Frequency / Duration Data (QUDM 4.07)

This Section adopted with the following comments:

(1) Refer to the Section 8.0 of this part of the manual, for Council's Data for Intensity - Frequency – Duration Charts and Tables for the following locations:

- Dalby
- Chinchilla
- Bell
- Jandowae
- Miles
- Tara
- Wandoan

(2) Coefficients for the development of IFD curves within Computer Modelling Software are available from ARR or BOM.

(3) IFD curves, tables and coefficients for specific locations can be obtained from the following Bureau of Meteorology website http://www.bom.gov.au/water/designRainfalls/ifd/index.shtml.

2.4.8 Estimation of Runoff Volume (QUDM 4.08)

This Section adopted without amendment.

2.4.9 Methods for Assessing the Effects of Urbanisation on Hydrologic Models (QUDM 4.09)

This Section adopted without amendment.

2.5 Detention / Retention Systems (QUDM 5.00)

This Section adopted with the following comments:

(1) Designers to note:

- Detention basins are to be designed in accordance with QUDM to criteria nominated by Council for specific applications. Council is to be consulted prior to proceeding with the design of detention basins; and

(2) Design documentation for Detention Basins, including Engineering Drawings and Specifications may be required to include:

- Full hydrological and hydraulic analysis including accompanying report to substantiate design

- Geotechnical report prepared by a suitably qualified person, acceptable to Council. The geotechnical report should include recommendations on basin stability, embankment and floor material permeability, waterproofing methods proposed, and other criteria relevant to the individual situation.

(3) Rainwater tanks are not deemed to be suitable as a permanent measure to provide on-site detention for free hold sub-division developments due to practical limitations on implementation and ensuring functionality for the designed purpose.

(4) The presence of an underground stormwater pipe system designed for the ultimate development conditions shall not be interpreted as it negates requirement to provide onsite detention to attenuate post development peak flows unless there is a regional stormwater detention system available.

(5) Retention (where accepted by Council) basins shall generally be located on freehold land dedicated to Council.

2.6 Computer Models (QUDM 6.00)

This Section adopted with the following comment:

(1) Designers to note:

As a minimum, when a numerical model is used in the design of a stormwater system, then the following information should be supplied to the Council:

(i) Name and version of software package
(ii) Full details of the modelling assumptions inputs
(iii) Review of model calibration
(iv) Copy of the model's "error listing" output file
(v) Digital copies of input data, including models (i.e. supplied on request).

2.7 Urban Drainage (QUDM 7.00)

2.7.1 Planning Issues (QUDM 7.01)

This Section adopted without change.

2.7.2 Design Storms - Average Recurrence Interval (QUDM 7.02)

This Section adopted with the following comments.

(1) It is acknowledged that Council has the right to set levels of service appropriate to its development strategies.

(2) Recommended Design Average Recurrence Intervals, of Q.U.D.M. shall be used in determining the Design ARI for the Major System and the Minor System for the particular Development Category. The Major Storm ARI is to be 50 years except for Major Flow Paths as described in the notes *to table 7.02.1* and the Minor Storm ARI shall be in accordance with *Table 7.02.1.*

2.7.3 The Major / Minor System (QUDM 7.03)

Entire section adopted without amendment.

2.7.4 Roadway Flow Limits and Capacity (QUDM 7.04)

These Sections adopted with the following modifications and comments, which are highlighted:

2.7.4.1 General - Basic Design Requirements for Overland Flowpaths

(1) The requirements for overland flowpaths shall be given consideration from the initial conception of the development and a continuous system of roads and parks / reserves provided along the natural drainage routes. In flat country, earthworks may be carried out to relocate natural drainage paths if approved, to better suit the development layout provided that such earthworks do not adversely affect Riverine Flooding impacts.

(2) It is accepted that there may be circumstances where greater underground flows in excess of flows derived from the minor storm A.R.I. are necessary due to, for example, restricted downstream discharge availability. It is emphasised that such cases would be treated as exceptional and would require prior approval.

(3) In existing areas where there is limited available overland flowpaths, alternative methods may be considered such as detention basins. It should be recognised that detention basins whilst an acceptable solution are not preferred by Council.

(4) Design calculations, in accordance with the Q.U.D.M., or Australian Rainfall and Runoff (AR&R) as appropriate, shall be submitted to demonstrate that this requirement is satisfactorily complied with. This information may be required to be submitted with the development application.

2.7.4.2 Major Drainage System - Location of Overland Flowpaths

(1) Notwithstanding the requirements of Q.U.D.M., overland flowpaths from external catchments shall not be directed through private property unless contained within easements or reserves as appropriate.

(2) Overland flowpaths should not be located on pathways. Prior approval shall be obtained where an exception is sought in locating an overland flowpath. Pedestrian safety and maintenance considerations shall be factors considered in the cross-sectional configuration of the overland flowpath.

(3) Pedestrian and vehicular access to sewerage pump stations and other public utility installations shall not be impeded by overland flow at any time, particularly in times of emergency, when flooding occurs.

2.7.4.3 Overland Flow in Roads

(1) The designer's attention is drawn to the Flow Depth and Width Limitations as detailed in *Q.U.D.M. Table 7.03.1, Figure 7.03.1(a), Figure 7.03.1(b), Table 7.04.1 and Figure 7.04.1* except for Dalby. In the township of Dalby the following flow depth and width limitations apply to situations where an underground drainage system is not possible:

(i) Minor Flows are to be contained within drainage systems as per *Table 7.03.1* and;

(ii) Q20 flows are to contained wholly within the Road Reserve generally as shown in *Figure 7.03.1(a) – Building Above Top of Kerb and Channel* and ;

(iii) Major Flows (Q50) may extend into the property a distance no greater than 5m from the front boundary with a 300mm freeboard to building floor levels.

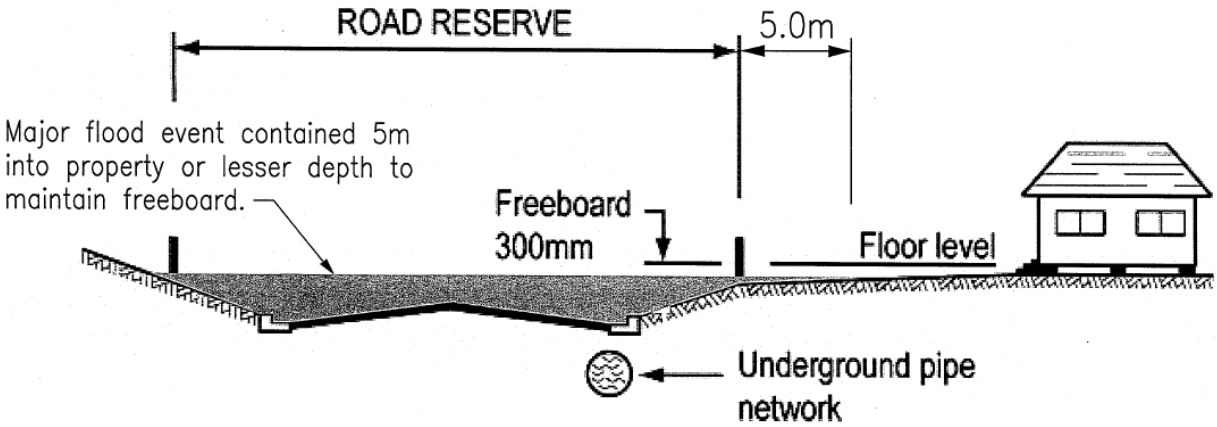


Figure 2.7.1 – Dalby Exception – Major Flow

(2) Designers will need to be aware of the provisions relating to pedestrian and vehicle safety if roads are being designed to cater for major storm overland flows. Refer Q.U.D.M. Section 7.04.2 – Pedestrian Safety and Table 7.03.1 for pedestrian safety requirements.

(3) For pedestrian safety, both the major and minor stormwater product of depth Dg and velocity Vave in the kerb and channel should not exceed 0.6m²/s. Where obvious danger is likely to occur 0.4m²/s should not be exceeded.

(4) Designers will not be required to allow for the effect of future resurfacing of roadways.

(5) However, designers must provide 50mm freeboard to the footpath crown for design flows based on roadway surface levels at the time of initial construction within the exception of developments in the Town of Dalby. Subject to normal crossfall constraints, the height of footpath crowns above the top of kerb may be increased to accommodate major flows, whilst allowing for pedestrian and vehicle safety, and access considerations to low side properties. The maximum depth of flow of 250mm at the kerb, in the major storm is to be observed.

(6) Designers should also be aware of the effects of changes of grade. Flattening off of a longitudinal grade for example, will result in a greater depth of flow and the effects of this will also need to be addressed in the design.

2.7.4.4 Overland Flow in Parks

(1) Overland flow in parks shall comply with the following requirements. The width of any overland flowpath shall be determined by calculation and shall not be allowed to extend into private property.

(2) Within parks, consideration should be given to:

(i) Safety of persons who may inadvertently or unwisely enter the stream;
(ii) Scour protection;
(iii) Downstream flood reduction, the lower velocity reducing downstream peak flow; and
(iv) Desirable maximum side slopes of 1 in 4.

2.7.4.5 Overland Flow from Traps in Roads

(1) Sags in roads and culs-de-sac at the end of a falling road grade shall be provided with an overland flow path designed to cater for excess flow not contained in the underground drainage system for a Q100 event, in order to protect the properties on the low side of the road from inundation.

2.7.5 Gully Inlets (QUDM 7.05)

This Section adopted with the following comments:

2.7.5.1 Types of Gully Inlets and Grates

Note: Precast and proprietary stormwater Pit and Inlet Systems are acceptable provided the product is approved by Council and supplied by a recognised industry participant.

(1) Kerb/Gully inlets are to be the Channel Lip in Line Type as detailed on IPWEAQ Standard Drawings or WDRC Standard Drawings as appropriate.

(2) Where alternative gully inlet systems are proposed, these systems should be supported by appropriate hydraulic testing information.

(3) Kerb/Gully pits and Field inlet pits are to be designed and constructed in accordance IPWEAQ Standard Drawings or WDRC Standard Drawings as appropriate.

(4) Grates where used, are to be bicycle-safe grates. The grate and frame details are to be in accordance with IPWEAQ Standard Drawings or WDRC Standard Drawings as appropriate.

(5) For pipelines less than, or equal to 600mm, the stormwater line shall be located from structure to structure, beneath or along the back of the kerb and channel. Generally, these pipelines are not to be located under the road carriageway.

(6) For pipelines greater than 600mm, the location for stormwater lines shall be in the road pavement (other than a kerb/gully inlet to kerb/gully inlet connection), on an offset of 2.0 metres, measured towards the road centreline from the invert of the kerb and channel. The required location should be verified with Council. Access chamber tops or access points should be located to avoid wheel paths.

(7) Generally, the stormwater pipe is not to be located behind the back of the kerb within the verge area, unless otherwise approved by Council.

(8) Kerb /Gully inlets are to be located on straights wherever possible.

(9) Kerb /Gully inlets are to be located to reduce the likelihood of conflict with future driveway locations and service crossings.

(10) Overland flow paths are to be provided at all sag points of road.

(11) Anti ponding gullies in curves and/or at intersections are to be side entry type. Chamber and grate only types are to be avoided wherever possible.

(12) Gully pits in excess of 1.5 metres deep are to be constructed as a gully pit / access chamber structure.

(13) Access chambers are to be designed and constructed in accordance with Standard Drawing D-002 & D-003 and other referenced drawings.

(14) Step irons are not required to be installed in access chambers and gully pits.

(15) Non standard structures are to be fully detailed in the Engineering Drawings.

(16) Commercial and industrial development should be connected to underground stormwater system where practical.

2.7.5.2 Kerb / Gully Inlet Capacity

(1) Blockage factors as given in *Table 7.05.1 of Q.U.D.M.* are to be applied to theoretical inlet capacities.

(2) Designers are to pay special attention to ensure that gully inlets at sags achieve the required 50mm freeboard to the footpath crown, particularly if seeking to provide a Q100 immunity to the adjoining low side properties. If surcharge via an overland flowpath from a trap in the road occurs, attention must be paid to the ponded depth requirement for gully capture.

2.7.5.3 Kerb / Gully Inlet Location

(1) Kerb/Gully inlets shall be located where required in accordance with Q.U.D.M. Where two falling grades meet at an intersection, if possible, the low point shall be located clear of the kerb return. The crossfall may be varied locally within the range of 2% to 5% to achieve this. Kerb units shall always be located on straights.

(2) Bypass flow width and flow depth requirements are to be addressed at the intersection kerb return, in accordance with *Q.U.D.M. Section 7.04.1.*

(3) The designer's attention is also drawn to situations where combinations of curves, grades or crossfalls result in flow not following the kerb and in some cases, even crossing the road crown. Gully pits are to be located accordingly.

2.7.6 Manholes (QUDM 7.06)

This Section adopted with the following modifications:

(1) The internal gully and internal manhole dimensions are to provide suitable clearances for access purposes;

(2) The minimum internal dimension of a gully pit or manhole is to be the greater of 900mm or the largest entering pipe diameter plus 300mm, depending upon the configuration and number of inlet pipes, and the relative location of the outlet pipe

(3) The maximum spacing of manholes shall be as per *Table 7.06.1 of Q.U.D.M*

(4) Provision is to be made in the walls of pits and access chambers for weep holes to drain the pipe bedding and surrounds, and where required, for the entry of subsoil drainage lines

(5) Step irons are not required to be installed in access chambers and gully pits

(6) The concrete used in the construction of the floors and walls of the unreinforced access chambers and inlet pits is to be grade N25 in accordance with *AS1379 and AS3600*

(7) The concrete used in the construction of reinforced access chambers and inlet pits is to be as shown on the standard drawings or as detailed on the approved engineering drawings

(8) Cement rendering is to be undertaken on all construction joints and rough surfaces

(9) Concrete in manholes and inlet pits is to be placed continuously without any construction joints other than the base and the top of the walls. At any construction joints, the concrete is to be well roughened to ensure a good bond

(10) The bottoms of inlet pits and access chambers to at least the height of the half diameter of the highest pipe connecting thereto and such other concrete surfaces as shown on the plans are to be benched with cement mortar; and

(11) Special benching may need to be undertaken using N25 concrete in large access chambers and at angle junctions in pipe lines.

2.7.7 Pipeline Location (QUDM 7.07)

This Section adopted with the following modifications:

(1) The location of pipelines shall be within the road reserve, as per the recommendations of Q.U.D.M. If reasonable alternative locations are available, drainage pipelines should not be located within allotments. In many cases overland flow requirements will require the provision of a pathway, drainage reserve or park, in which the pipelines may be located

(2) However, where pipelines, including rear of allotment drainage, are permitted to be located within allotments, easements in Council's favour are required to be provided over the pipelines; and

(3) The minimum easement widths shall be 3.00m. Wider easements may be required by Council to cater for multiple pipes, pedestrian access and/or overland flowpaths.

2.7.8 Pipe and Material Standards (QUDM 7.08)

This Section adopted with the following modifications:

(1) Table 7.08.1 - Jointing Requirements for Pipes – Normal Conditions, is to be deleted and the following clause inserted in its place.

a. *"The flush jointed external rubber band jointing system is acceptable for all pipe diameters in good ground conditions." In Dalby and other locations with expansive clay, RRJ must be used – Refer to Council for individual determination. Acceptable materials include RCP, RCBC, Structural PE or approved equivalent for pipes.*

(2) Pipes shall be bedded / backfilled as detailed on Standard Drawing D-004 and shall include the use of external rubber bands for flush jointed pipes.

(3) Not withstanding Clause 7.08.3(a), the minimum pipe size shall be 375mm diameter.

2.7.13 Roof and Allotment Drainage (QUDM 7.13)

2.7.13.1 General

This Clause from Q.U.D.M. adopted and the following comment is highlighted:

Developers shall provide rear of allotment underground drainage in accordance with the provisions of Q.U.D.M., and in particular, Clause 7.13 "Roof and Allotment Drainage", except as specified herein. The designer may propose surface allotment drainage where topography is a constraint to install a piped system to comply with minimum grade and cover requirements and unavailability of a drainage system to connect to.

2.7.13.2 Roof Drainage

This Clause from Q.U.D.M. adopted without amendment.

2.7.13.3 Roof and Allotment Drainage – General

The drainage system provided within allotments for the disposal of roof and allotment drainage depends upon the topography, the importance of the development, and the consequences of failure. Thus Council may determine that the provision of a piped or a surface drainage system within allotments to receive roof and allotment drainage is necessary in the following circumstances where:

(a) The allotment generally falls away from the frontage kerb and channel, such that a roof water pipe cannot be connected to the kerb and channel

(b) The proportion of impervious area within a development is such that surface runoff is likely to be intolerably high, e.g. industrial and multi-unit residential allotments

(c) The zoning may permit construction of buildings up to side or rear boundaries thus blocking or concentrating natural flow paths

(d) Where there is significant catchment draining into the rear of the property.

Refer to IPWEAQ Standard Drawing D 0110 and QUDM for typical diagrams of allotment and rear of allotment drainage systems and pits or design a surface allotment drainage system

2.7.13.4 Level of Roof and Allotment Drainage System

This Clause from Q.U.D.M. adopted without amendment.

2.7.13.5 The Rear of Allotment Drainage System

This Clause from Q.U.D.M. adopted with the following to be read in conjunction:

General

Notwithstanding the requirements of:

- Table 7.13.4 - Design Requirements for the Rear of Allotment Drainage System
- Table 7.13.5 - Recommended Design Criteria for Level II Rear of Allotment Drainage System
- Table 7.13.6 - Recommended Design Criteria for Level III Rear of Allotment Drainage System

The following shall be read in conjunction with these Tables:

> *"The effects of the rear of allotment drainage system on Council's trunk drainage system shall be determined from Q.U.D.M. Section 7.13.6 and catered for in the proposed design."*

Underground Pipes

(1) Rear of allotment drainage pipes shall be designed in accordance with Q.U.D.M. Table 7.13.4 – Design Recommendations for the Rear of Allotment Drainage System with the following qualifications:

(2) For a Level II system, refer to the "Allotment Flow Volumes" sub-clause of this Section for a listing of the design allotment flows.

(3) For a Level III, Level IV or Level V system, refer design recommendations in Q.U.D.M. Table 7.13.4.

(4) Multiple barrel pipe systems are not permitted.

(5) Pipe materials for rear of allotment drainage systems shall be either concrete, fibre reinforced cement or uPVC Class "SH" or equivalent. Rubber ring joints shall be used for all pipe materials. Pipes shall be bedded / backfilled as detailed on Standard Drawing D-004.

(6) Pipes shall be laid on an alignment from the property boundary as follows:

- Where no sewer co-exists, 1.0 metre from rear and side boundaries, contained in a 3.00 metre wide easement
- Where sewer co-exists, 2.00 metres from rear and side boundaries, contained in a 3.00 metre wide easement.

This alignment will depend upon the presence of a sewer main. Pipes shall be located within the properties being served. Where possible, the line shall be located across the back of properties to the street rather than down a side boundary.

(7) Minimum cover to pipes shall be 500mm. Designs shall ensure that minimum cover is maintained across footpaths, and within properties in the event of construction of retaining walls and levelling of allotments for building purposes.

(8) Where a sewer is nearby, the rear of allotment drainage pipe shall be laid at a level above the sewer.

Easements

Rear allotment drainage pipes or a surface allotment drainage system shall be contained in an easement in favour of Council, 3.0 metres minimum in width.

Connection Stubs

(1) One roof water connection stub shall be provided on the rear of allotment drainage line for each property. This connection shall be in the form of an oblique junction located in accordance with IPWEAQ Standard Drawing D 0110 and QUDM.

(2) For a rear of allotment drainage line of 150mm dia., 225mm dia. or 300mm dia., a connection stub shall consist of a "Y" oblique junction with a 150mm dia. branch. For a rear of allotment drainage line in excess of 300mm dia., a connection stub shall consist of a 150mm dia. x 90° short bend obvert connection and a 150mm dia. branch pipe laid perpendicular to the rear of allotment drainage line.

(3) Where connection stubs are connected to Council's underground drainage system in the street, 150mm dia. connection pipes shall be brought perpendicularly across the footpath at minimum 1 in 80 grade to the lowest front corner of the block in accordance with IPWEAQ Standard Drawing D 0110 and QUDM .

(4) Connection stubs shall be finished 1.00m above finished surface level, complete with a push-on cap, glued in position. The stub shall be identified by means of blue paint to the push-on cap, together with a blue marker stake (25mm x 25mm x 900mm long, driven 300mm into the ground) adjacent to the above ground section of the stub. The marker stake shall be marked with the word "Stormwater" and the depth to the connection stub.

(5) Any inspection opening required by the property owner shall be located in the property branch line upstream of the oblique junction. The property branch line shall be closed off with a push-on cap.

Inspection Manholes

(1) All inspection manholes shall consist of a precast system fitted with a lift-off access cover, constructed generally in accordance with *Standard Drawing D-002 & D-003.*

(2) Inspection manholes shall be constructed on the main rear of allotment drainage line, at 100 metre maximum spacing's, and at the following locations:

- Change of grade

- Change in direction
- Change of pipe size
- Pipe junctions
- End of main line

(3) Inspection manhole dimensions are to be as follows:
- 600mm diameter pit for a maximum depth to 750mm; or
- 900mm diameter pit for a depth ranging between 750mm and 1500mm; or
- 1050mm diameter manhole where depths exceed 1500mm.

Note: Depth refers to likely final depth, following cut/fill operations on the allotment.

(4) Inspection manhole Access Covers to cast-in-situ access chambers:
- Are to be a standard concrete infilled access chamber cover and frame;
- Are to be embossed “Roofwater”;
- Are to have infill concrete at grade N25;
- Are to match the finished surface ground slope and sit 50mm proud; and
- Are to be rendered trafficable within street carriageways or where vehicular loading is likely.

(5) Pipes are to be graded “obvert to obvert” provided that the following minimum falls are provided through inspection manholes:
- 0 - 30 degrees – 0.02m
- 30 - 60 degrees – 0.04m
- 60 - 90 degrees – 0.08m

(6) Inspection manholes shall, wherever possible, be located on the opposite boundary to the roofwater connection stub (that is, on the high side of the lot as traversed by the main rear of allotment drainage line). However, an inspection manhole on the low side of a lot will be required on a line discharging to Council's underground drainage system, to ensure that minimum cover is maintained in cases where a change in grade occurs between the property boundary and the footpath.

Discharge Points

(1) All rear of allotment drainage systems shall discharge into the back of a suitably located stormwater gully pit or junction box in Council's underground stormwater drainage system, or to a suitable location in a park or other reserve, where such is available.

(2) All connections to Council's underground stormwater drainage system shall include the provision of a manhole sized in accordance with the requirements of Section 7.06 - Manholes, of this document.

(3) Council's underground stormwater drainage system shall be extended upstream if necessary to reach the point at which a rear of allotment drainage system exits from private property into the road reserve.

(4) Discharge points in parks or other reserves shall be provided with outlet protection works to prevent scour. Minimum works shall consist of a concrete headwall, wingwalls, apron and downstream rock mattress / pitched rock.

(5) Discharge of a rear of allotment drainage system to kerb and channel is not permitted in areas of new subdivisional development.

(6) Where the design of the street drainage system is such that up to a maximum of two (2) properties are so isolated from a stormwater pit or access chamber that their private drainage system could not be reasonably expected to connect, discharge into the kerb and channel will be allowed subject to a hydraulic analysis as to the existing road flows and capacity of the roadway for the increased discharge. Prior agreement with this option shall be sought from Council, prior to design.

(7) Where a re-subdivision in an area of existing development is proposed, the developer is required to connect directly to an existing underground stormwater drainage system nominated by Council.

(8) Where a re-subdivision in an area of existing development is remote from Council's underground stormwater drainage system, discharge of the rear of allotment drainage system to kerb and channel may be permitted provided that local effects of such discharge can be adequately addressed.

(9) Use of tanks for peak discharge attenuation is not considered a suitable solution on free hold subdivisions.

Connection to Kerb and Channel

(1) Where a rear of allotment drainage system is not required and allotment roof drains can connect to kerb and channel, the drains across the verge shall be steel circular or rectangular hollow sections of 100mm maximum height, or equivalent Class 12 uPVC pipes placed on compacted sand bedding. Where more than one RHS is required, each shall be placed not less than 25mm apart and welded together, using a steel spacer between the sections. Galvanising of all steel components shall occur after fabrication.

(2) Pipe sections shall be connected to the kerb and channel via an approved cast iron kerb adaptor, the end of which shall match the profile of the kerb and channel.

(3) Kerb adaptors shall be provided for all lots and shall be placed in the Kerb at 1m offset from the side boundary at lowest point of the adjacent Kerb and Channel. Two (2) kerb adaptors shall be provided per lot.

(4) Kerb adaptors shall be of cast alloy or cast iron construction. PVC, Plastic or sheet metal adaptors shall not be used.

Number of Allotments Served

(1) The maximum number of allotments served by the rear of allotment drainage system shall not exceed twenty (20) under any circumstances. The designer shall give due consideration to future subdivision of adjoining parcels when determining the number of allotments which a particular system might ultimately serve.

(2) The number of allotments served shall otherwise be governed by the maximum pipe size and the hydraulic design of the pipe system where applicable.

Allotment Flow

(1) The rear of allotment drainage system shall have the hydraulic capacity to accept the full runoff from contributing allotments (that is, runoff from roofs, hardstand and pervious areas (where applicable) as determined from Q.U.D.M. Table 7.13.4, Table 7.13.5 or Table 7.13.6, depending upon the Level applicable for the rear of allotment drainage system within the particular development.

(2) Mannings Equation with a minimum ‘n’ value of 0.011 is to be used to determine pipe sizes.

(3) The minimum pipe size is to be 150 mm diameter, and the maximum pipe size is to be 375mm diameter.

(i) Residential Development
For a Level II Rear of Allotment Drainage System, in a Residential Development, the following design allotment flows are to be used:

Allotment Size	Allotment Design Flows
up to 600m²	10.0 litres / sec. / allotment
1000m² and greater	16.5 litres / sec. / allotment

For allotments of area between 600m² and 1000m², allotment design flows may be interpolated between the above nominated values.

Design flows, from allotments have been determined from roof water discharged from a 5 minute duration, 20 year A.R.I. event (Q20), as per A.S. 2180.

(ii) Unit Development Areas
Where a Level II system exists, the designer for the units or other development should investigate the capability of the existing system to cater for the Q20 design discharge run-off from the allotment and take appropriate measures.

Effect of Roof and Allotment Drainage System on the Trunk Drainage System

This section adopted without change.

2.8 Stormwater Drainage Design Charts and Tables (QUDM 8.00)

2.8.1 Stormwater Drainage Design Criteria (QUDM 8.01)

(1) Refer to the following pages for Stormwater Drainage Design Criteria relating to the following towns / townships:

- Dalby
- Chinchilla
- Miles
- Tara
- Wandoan

(2) In determining the IFD Charts and Tables for the above locations, the following co-ordinates are to be used:

- Dalby
  Latitude 27° 11’ 00.58” S
  Longitude 151° 15’ 48.47” E

- Chinchilla
  Latitude 26° 44’ 22.52” S
  Longitude 150° 37’ 30.18” E

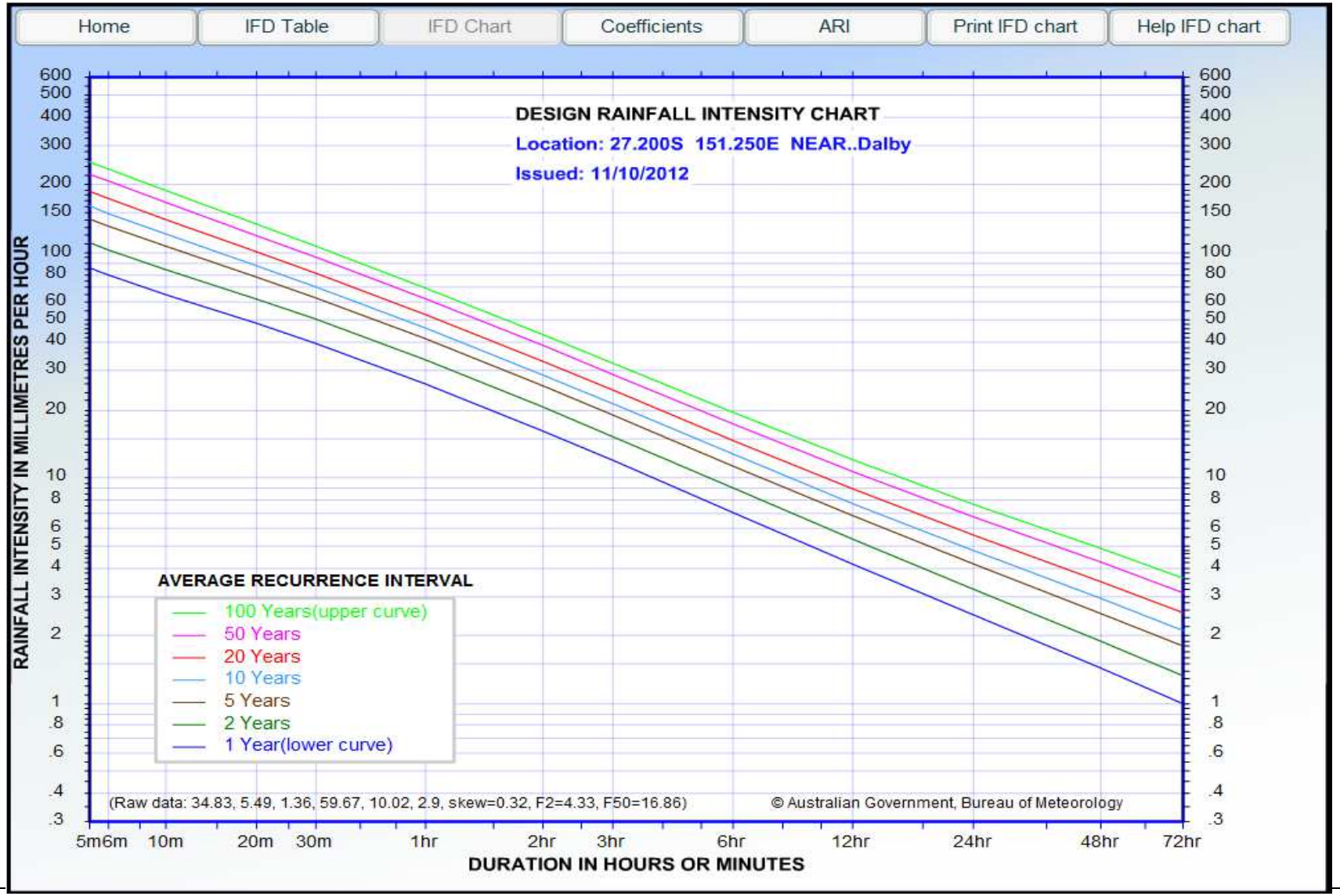
- Miles
  Latitude 26° 39’ 29.02” S
  Longitude 150° 11’ 04.61” E

- Tara
  Latitude 27° 16’ 37.53” S
  Longitude 150° 27’ 34.92” E

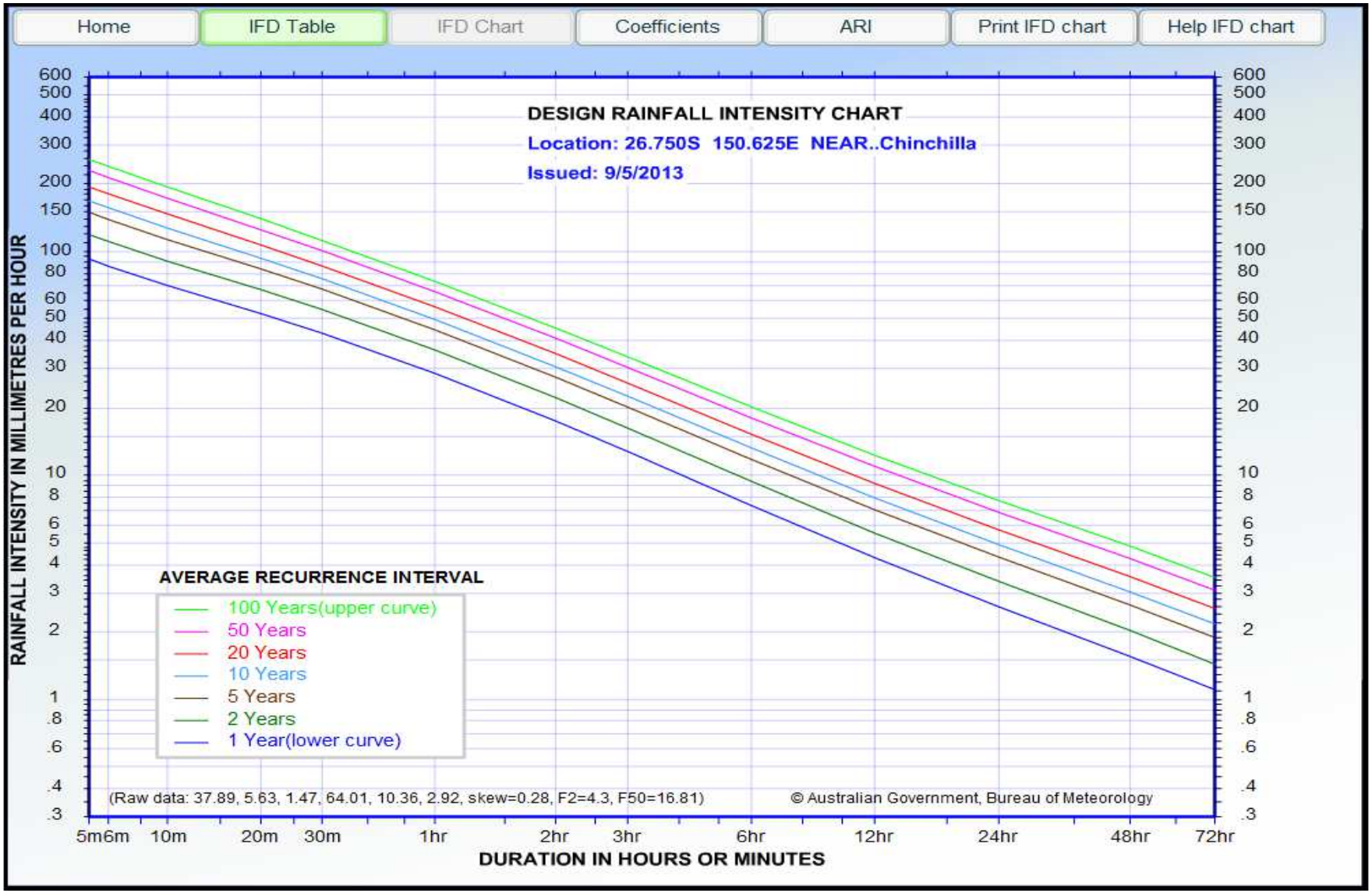
- Wandoan
  Latitude 26° 07’ 15.80” S
  Longitude 149° 57’ 41.12” E

For convenience, IFD Charts are provided on the following pages. Further charts are available by visiting http://www.bom.gov.au/w

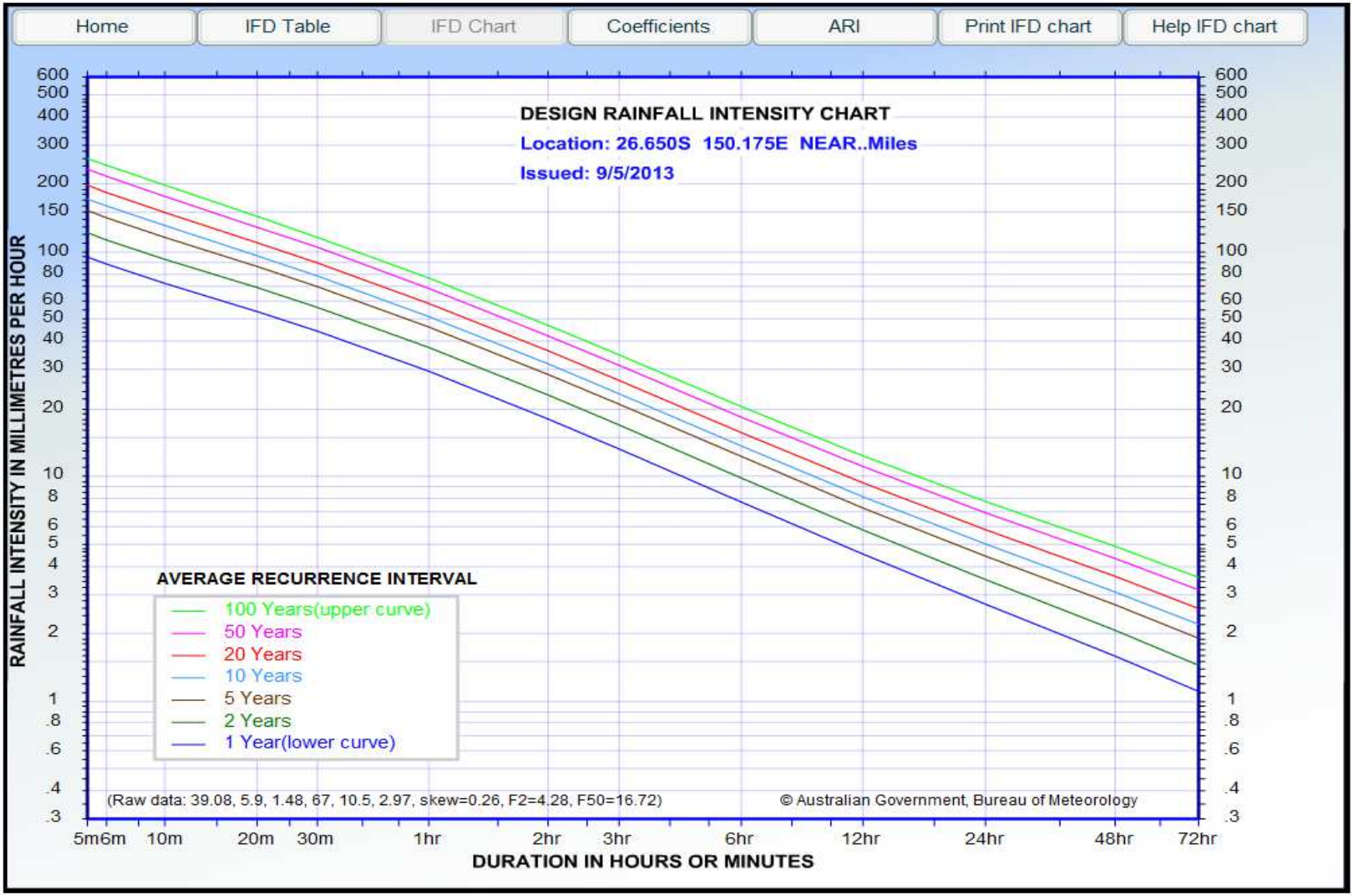
Dalby IFD Charts and Tables



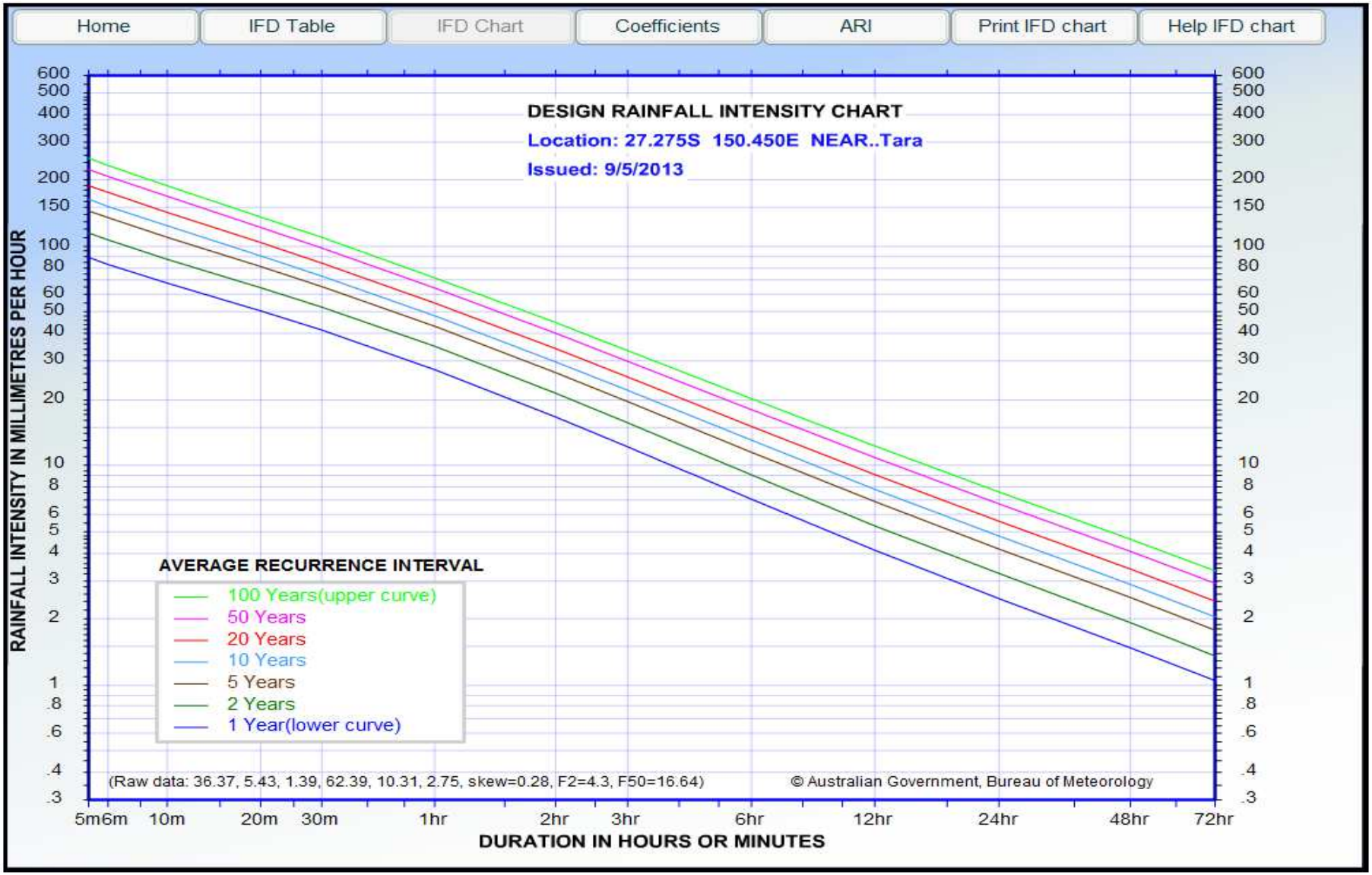
Chinchilla IFD Charts & Tables



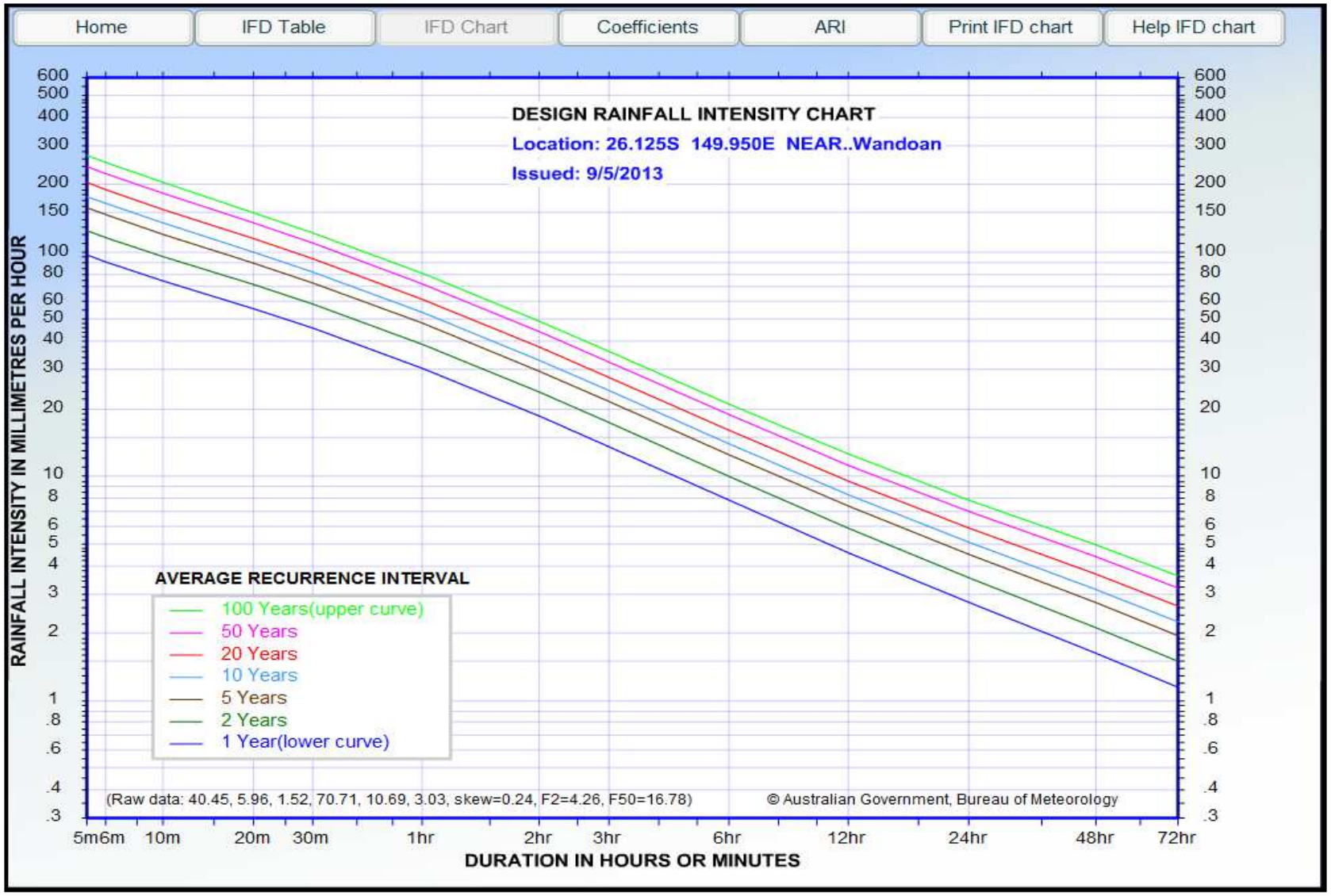
Miles IFD Charts & Tables



Tara IFD Charts & Tables



Wandoan IFD Charts & Tables



2.9 As-constructed Plans (QUDM 8.00)

Adopted with the following additions

Accurate "As-Constructed" Plans shall be prepared to record any changes or departures from the design that may have occurred during the construction phase..

"As-Constructed" Plans shall be submitted for :-
(a) Underground Stormwater Drainage
(b) Rear of Allotment Drainage

(a) Underground Stormwater Drainage
"As - Constructed" Plans
"As-Constructed" Plans shall record the following minimum standard of information as well as other details particular to the project :-

- pipe sizes, types, classes and lengths of sections of drainage lines.
- location of drainage lines.
- invert levels and grades of pipes.
- finished surface levels for structures.
- location of structures.
- structure types and dimensions.
- location of sub-soil drains and cleanout points.
- details of relocated services, if applicable.

(b) Rear of Allotment Drainage "As-Constructed" Plans
"As-Constructed" Plans shall record the following minimum standard of information as well as other details particular to the project :-

- pipe sizes, types, classes and lengths of sections of drainage lines.
- location of pipes relative to property boundaries.
- invert levels and grades of pipes.
- finished surface levels for structures.
- location of structures relative to property boundaries.
- structure types and dimensions.
- location of connection stubs relative to property boundaries.
- depth to connection stub from finished surface level.
- finished surface levels at every corner of allotments.
- details of relocated services, if applicable.

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Part 3a Standards for Design of Water Reticulation Works

Table of Content

3.1 General

3.1.1 Planning and Design Objectives

3.1.1.1 Design Requirements

3.1.1.2 Local Government

3.2 System Planning

3.2.1 System Hydraulics

3.2.1.1 Network Analysis

3.3 Hydraulic Design

3.3.1 Sizing of Mains

3.3.1.1 General

3.3.1.2 Empirical Sizing of Reticulation Mains

3.3.1.3 Fire Flows

3.3.1.4 Sizing by Analysis

3.4 General Design

3.4.1 Location of Water Mains

3.4.1.1 Water Mains in Road Reserves

3.4.1.2 Water Mains in Easements

3.4.1.3 Crossings

3.4.1.4 Water Mains in Private Property

3.4.2 Shared Trenching

3.4.3 Duplicate Mains

3.4.4 Connection of New Mains in Existing Mains

3.4.5 Termination Points

3.4.5.1 Permanent Ends of Water Mains

3.4.5.2 Temporary Ends of Water Mains

3.4.6 Reticulation Mains

3.4.7 Water Service Conduits

3.5 Structural Design

3.5.1 External Forces

3.5.1.1 Pipe Cover

3.5.2 Geotechnical Considerations

3.5.2.1 Water Main in Engineered or Controlled Fill

3.5.2.2 Filling along Route of Main

3.5.3 Pipe Anchorage

3.5.3.1 Thrust Blocks

3.5.3.2 Anchor Blocks

3.6 Appurtenances

3.6.1 Valves - General

3.6.1.1 Valves Design

3.6.2 Stop Valves

3.6.2.1 Stop Calves for Reticulation Mains

3.6.2.2 Stop Valves - Location and Arrangements

3.6.3 Hydrants

3.6.3.1 Hydrant Types

3.6.3.2 Hydrant Installation

3.6.3.3 Hydrant Outlet Connections

3.6.3.4 Hydrant Size

3.6.3.5 Hydrant Spacing

3.6.3.6 Hydrant Location

3.6.3.7 Hydrant at Ends of Mains

3.1 General

The guidelines outlined by the Water Services Association (Australia) **Water Supply Code of Australia** are adopted in principle, and the design parameters used, are to be in accordance with the criteria listed in the current edition of WSAA, except as amended by this document.
The section of the WSA guidelines to which comments refer are shown as **WSA X** and **WSA X.X**

3.1.1 Planning and Design (WSA 1.2)

3.1.1.1 Design Requirements

The design shall ensure that the water transfer, distribution and reticulation systems are functional and are designed in accordance with the provisions of:

- The Department of Natural Resources *"Guidelines for the Planning & Design of Urban Water Supply Schemes"*
- *Water Act 2000 (Sewage and Water Supply Act (1949 – 1982))*
- Council's Standard Drawings
- The Water Agency's stated requirements; and
- This manual

The Design shall provide a water supply to each property by way of a:

(a) Connection point to a water main; or
(b) Pre-laid property service connection from a water main

The Design shall address:

(a) The Water Agency's policies, customer charters and contracts
(b) The hydraulic adequacy of the system
(c) The ability of the water system to maintain acceptable water quality
(d) The ability of the reticulation system to meet all presently acting and future external demands
(e) The structural adequacy of the system
(f) The operation adequacy of the system components
(g) OH&S requirements
(h) Environmental requirements
(i) The environmental and community impact of the works
(j) The "fit-for-purpose" service life for the system by consideration of maintenance needs of system components
(k) Minimizing the life cycle costs
(l) each components suitability for contact with drinking water, disinfectant demand and biofilm formation rate; and
(m) Each components resistance to internal and external corrosion or degradation

3.1.1.2 Local Government

The local government may be contacted to provide "As Constructed" and performance information of the existing mains.

Should a conflict exist amongst the cited design guidelines and the Council's Standard Drawings, the matter is to be referred to Western Downs Regional Council for determination.

3.2 System Planning (WSA 2)

3.2.1 System Hydraulics (WSA 2.5)

3.2.1.1 Network Analysis

Entire section adopted with the following addition:

- Prior to proceeding with detailed design, it is to be ascertained whether a network analysis is required as part of the design submission. If an analysis is required, then the relevant design information is to be provided.

3.3 Hydraulic Design (WSA 3)

The guidelines outlined by the Water Services Association (Australia) are adopted in principle, and the design parameters used, are to be in accordance with the criteria listed in the current edition of WSAA, except as amended by this document.

3.3.1 Sizing of Mains

3.3.1.1 General

Entire section adopted with the following addition:

- All references to pipe diameters shall refer to the nominal diameter of the pipe.

3.3.1.2 Empirical Sizing of Reticulation Mains

Entire section adopted with the following amendment:

- Table 3.1 may be used as a guide to establish pipe main sizes. Final sizing will be determined through network analysis.

3.3.1.3 Fire Flows

Entire section adopted with the following amendment:

- In some industrial areas, additional pressure for fire fighting flow purposes may be required in the hydraulic analysis.

3.3.1.4 Sizing by Analysis

Entire section adopted without addition:

- Council may request the use of Council's model depending on the size and nature of the development. Enquiries for use of Council's model may made via the customer service center.

3.4 General Design (WSA 5)

The guidelines outlined by the Water Services Association (Australia) are adopted in principle, and the design parameters used, are to be in accordance with the criteria listed in the current edition of WSAA, except as amended by this document.

3.4.1 Location of Water Mains (WSA 5.4)

3.4.1.1 Water Mains in Road Reserves

Entire section adopted with the following additions:

(a) Where possible, water mains are to be constructed on the opposite side to the concrete footpath

(b) Where, as a result of the development, existing mains are located on non-standard alignments or have less than minimum cover, the developer shall bear the cost of relocation, replacement or lowering

(c) Where pavement widening as a result of development places existing mains under new pavement, the developer shall bear the cost of its replacement on the existing alignment, or alternatively, realignment of the water main, clear of the new pavement

(d) Mains shall not be laid on the same horizontal alignment as stormwater pipes, sewage pipes or electricity conduits. Cover to all other services is to be shown on the design plan, where crossings are required; and

(e) Brass Indicator Discs shall be installed in the kerb to indicate the alignment of the water main crossing

3.4.1.2 Water Mains in Easements

Entire section adopted with the following addition:

- WDRC requires a minimum easement width of 1.5 metres from centerline of the pipe. Confirmation of easement width should be sought prior to approval.

3.4.1.3 Crossings

Entire section adopted with the following addition:

- For the case where the water main or water service enveloping conduit crosses a road reserve, a Brass Indicator Plate is to be installed on the kerb to indicate the alignment of the water main, or the water service enveloping conduit crossing. Should no kerb be available, council may approve the use of a marker plate or post.

- Water mains are not to be laid under stormwater sewage pipes or electricity conduits; and

- The minimum separation distance between a water main and other services that cross the water mains path is 300 mm.

3.4.1.4 Water Mains in Private Property

Water mains may be permitted in private properties in large lot subdivisions where it is:

- Needed to satisfy security of service criteria, water quality issues and fire flow requirements

- Considered unreasonable or impractical to modify the subdivision layout; and

- Contained with a minimum three (3) metre wide easement along the side property boundaries.

3.4.2 Shared Trenching (WSA 5.6)

Entire section adopted with the following amendments:

- No other services are to share a trench with the water main, except for gas

- Under no circumstances are electricity conduits to be laid in the same trench as any water service. A possible exception is the case of a corner lot which requires electricity pillar boxes on each side boundary. In this case, conduits and service points are positioned on one of the corner truncation points

- Service entry points shall be on each alternate lot boundary to the electricity service entry point or pillar box, i.e. there shall not be an electricity pillar box on each side boundary of an allotment. For typical water service connection at lot boundaries, refer *Standard Drawing No. P4-004.* For typical electrical/telecommunication service connection at lot boundaries, refer *Standard Drawing No. P4-005.*

3.4.3 Duplicate Mains (WSA 5.7)

Entire section adopted with the following amendments:

- It is mandatory that water mains are to be provided on both sides of the road carriageway and be of similar size on each side of the road for any commercial or industrial subdivisional development;

- In a commercial or industrial subdivision, cross connections are to be strategically placed between dual mains on either side of the street at spacing's no greater than 350 metres.

- Cross connections will require sufficient valving to ensure continuous supply to maximum customers during maintenance

3.4.4 Connection of New Mains to Existing Mains (WSA 5.9)

Entire section adopted with the following additions:

- Service connections to larger trunk mains will generally not be permitted. Exceptions will require approval from Western Downs Regional Council

- At the point of connection with Council's existing water main, the new main is to be laid a maximum of 2.0 metres from the existing main and laid in line horizontally and vertically with the existing water main. Any additional cost incurred during the connection works undertaken by Local Government owing to the new main being on an incorrect alignment shall be at the Developer's expense.

- Connection to water network must be approved by WDRC. Connections may be required to be undertaken by Council at the developers cost.

3.4.5 Termination Points (WSA 5.10)

3.4.5.1 Permanent ends of Water Mains

Entire section adopted with the following amendment:

- Dead ends not adjacent to a hydrant are to be provided with a scouring or dosing point.
- Mains <DN100 require approval by WDRC

3.4.5.2 Temporary ends of Water Mains

Entire section adopted with the following amendment:

- Dead ends not adjacent to a hydrant are to be provided with a scouring or dosing point.

3.4.6 Reticulation Mains

The design shall identify the need for reticulation mains and shall detail their alignment and connection details in the Design Drawings. WDRC shall be consulted regarding the requirement for a detailed network analysis.

Where practical, water reticulation mains greater than 250 metres in length are to be serviced from two directions. Where the water reticulation network is serving in excess of 20 lots in any one stage, the site is to be served from two directions and not be in the form of a single dead end supply. Water reticulation mains less than 250 metres in length are to be looped to join back onto itself.

All mains within a cul-de-sac head are to looped back to join onto itself, as per details on *Standard Drawing W-004.* Dead end mains shall terminate at least 1 metre beyond the last service connection point, but less than 2 metres, as prescribed in Clause 4.8.2.

3.4.7 Water Service Conduits

Water service enveloping conduits are to be:

- Laid in accordance with *Standard Drawing Nos. SW.13, SR.22 and SR23*
- Located to avoid conflicts with electrical conduits and pillars
- Be a maximum of 25 metres in length
- Be supplied and installed by the developer; and
- Be laid at the same level as, and square to, the water reticulation main where practicable.

3.5 Structural Design (WSA 5.7)

The guidelines outlined by the Water Services Association (Australia) are adopted in principle, and the design parameters used, are to be in accordance with the criteria listed in the current edition of WSAA, except as amended by this document.

3.5.1 External Forces (WSA 7.4)

3.5.1.1 Pipe Cover

Entire section adopted with the following amendments:

(a) The required depth of cover to water mains measured from top of kerb shall be as follows:

- 100mm dia. — 600mm cover in footpaths.
  750mm cover in footpaths (shared trench with gas).
  900mm cover in road crossings.
- 150mm dia. — 600mm cover in footpaths.
  750mm cover in footpaths (shared trench with gas).
  900mm cover in road crossings.
- > 150mm dia. — 900mm cover in footpaths.
  1200mm cover in road crossings.

(b) Where a 100mm or a 150mm diameter main connects to a trunk main, cover to the smaller diameter main shall be reduced to the required depth of cover below top of kerb over a maximum of 2 pipe lengths

(c) Where normal cover to mains is unable to be maintained due to the presence of existing services or other restricting factors, the method of protection should be discussed with Council

(d) Where the grade of the footpath is non-standard, the depth of cover to the main as detailed above, shall not be measured from the kerb but shall be measured from the finished surface level; and

(e) Where a reticulation branch enters a steeply graded street, minimum cover must be maintained by cutting pipe lengths and deflecting joints to suit, or by the use of vertical bends.

3.5.2 Geotechnical Considerations (WSA 7.5)

3.5.2.1 Water Main in Engineered or Controlled Fill

Entire section adopted with the following amendment:

- WDRC requires water main to be trenched unless otherwise approved.

3.5.2.2 Filling along Route of Main

Entire section adopted with the following amendment:

- WDRC requires water main to be trenched unless otherwise approved.

3.5.3 Pipe Anchorage (WSA 5.9)

3.5.3.1 Thrust Blocks

Entire section adopted with the following amendments:

- The minimum thickness of concrete in a thrust block behind a bend, junction or fitting, measured in the plane of the thrust, shall be the equivalent of the largest pipe diameter involved. The designer shall be responsible for the provision of adequate details of thrust block sizes, based on the soil type encountered in the trench.

3.5.3.2 Anchor Blocks

Entire section adopted with the following amendments:

- Anchor blocks shall be installed at all bends, junctions and dead-ends of mains, in *accordance with W-016.*

3.6 Appurtenances (WSA 8)

The guidelines outlined by the Water Services Association (Australia) are adopted in principle, and the design parameters used, are to be in accordance with the criteria listed in the current edition of WSAA, except as amended by this document.

3.6.1 Valves - General (WSA 8.1)

3.6.1.1 Valves Design

Entire section adopted with the following addition:

- Valves and hydrants are to be cast iron bodied, be a minimum class 14 fusion bonded epoxy 250 micron thickness or approved equivalent coating

3.6.2 Stop Valves (WSA 8.2)

3.6.2.1 Stop Valves for Reticulation Mains

Entire section adopted with the following amendments:

- Valves are to be the same diameter of the main
- Valves are to be cast iron bodied conforming to AS 2638, be Class 14 minimum, and have counter clockwise rotating spindles for closing
- Valves are to be installed where necessary to isolate sections of the system for maintenance purposes such that maintenance can be carried out causing the minimum inconvenience and disturbance to the consumers; and
- The internal water main layout is to be designed to minimize the number of properties that will be without a service in case of an isolated break. Generally the maximum number of houses inconvenienced should not exceed 20. Addition valves and connection mains may be required to satisfy Western Downs Regional Council that an adequate level of water security can be achieved.

3.6.2.2 Stop Valves – Location and Arrangements

Entire section adopted with the following amendment:

- Section 6.2.5.1: the placement of valves is to be completed in relation to finished surface heights, in accordance with *W-013*

- Section 6.2.5.1: valves are to be located on the legs of tees where the mains are 300mm or greater. This requirement may be relaxed if Western Downs Regional Council is satisfied that sufficient valves are provided in the system to minimize the number of consumers without a service in the incident of an isolated break. A layout plan showing the location of valves for the area may be required to satisfy Council

- Section 6.2.5.3: valves are to be located opposite the first truncation at a three-way intersection or opposite the nearest RP boundary. Refer *Standard Drawing Nos. W-022 & W-025* for a typical valve location at an R.P. truncation at an intersection; and

- Section 6.2.5.3: valves are to be spaced at a maximum distance of 300m and to all tees to the leg of the tee and on both sides of the head.

3.6.3 Hydrants (WSA 8.8)

3.6.3.1 Hydrant Types

Entire section adopted with the following amendment:

- WDRC requires network hydrants to be of the spring top variety.

3.6.3.2 Hydrant Installation

Entire section adopted with the following amendment:

- Hydrants are to be orientated with horns parallel to the water main.

3.6.3.3 Hydrant Outlet Connections

Entire section adopted with the following amendment:

- WDRC requires hydrant outlet connections to be of the claw type.

3.6.3.4 Hydrant Size

Entire section adopted with the following amendment:

- Hydrants are to be provided with risers and tees (junction) of 80mm nominal diameter.

3.6.3.5 Hydrant Spacing

Entire section adopted with the following amendments:

- Hydrants are to be located such that all allotments are within a distance of 40m of the nearest hydrant; and

- Hydrants are to be located such that they are spaced at a maximum distance of 80m, and at crests, sags, the ends of lines in cul-de-sac, and dead-end (if permitted).

3.6.3.6 Hydrant Location

Entire section adopted with the following amendments:

- Hydrants are to be located such that, where practical, they are adjacent to common property boundaries, with a tolerance of ± 200mm; and

- Located as otherwise required by Council for special purposes.

3.6.3.7 Hydrants at Ends of Mains

Entire section adopted with the following amendments:

- Where a hydrant is placed at the end of a water main which will not be extended in the future (e.g. a cul-de-sac) the hydrant is to be installed with a hydrant bend located 0.5 metres from the boundary of the last property serviced, or the nearest truncation point, whichever is the greater; and

- In cases where the main may be extended in the future, a hydrant tee, valve and dead-end is to be used, located as near as practicable (<0.5m) to the development boundary or nearest RP boundary.

Part 3b Standards for Construction of Water Reticulation Work

Table of Content

3.7 Products and Materials Overview

3.7.1 Selection Guide for Pipeline Systems

3.7.1.1 Water Mains

3.7.1.2 Water Service Enveloping Conduits

3.8 Quality

3.8.1 Quality Assurance

3.8.1.1 General

3.9 Bedding for Pipes

3.9.1 Bedding Materials

Table 3.9.1 Bedding Materials Specifications

3.10 Pip Laying and Joining

3.10.1 Horizontal and Vertical Deflection of Pipes

3.10.1.1 General

3.10.1.2 Deflection at a Pipe Joint

3.10.2 Horizontal and Vertical Separation of Crossing Pipelines

3.10.3 Thrust and Anchor Blocks and Restrained Joints

3.10.4 Property Services and Water Metres

3.10.5 Values, Hydrants and Surface Fittings

3.10.5.1 Installation

3.10.6 Location Markers

3.10.6.1 General

3.10.6.2 Maker Posts

3.10.6.3 Parker Plates

3.10.6.4 Covers and Surrounds

3.10.6.5 Hydrant Markers

3.11 Pipe Embedment and Support

3.11.1 General

3.12 Fill

3.12.1 General

3.12.1.1 Placement

3.12.1.2 Material Requirements

- General
- Footpath and Other Non-Trafficable Areas

- New Roads and Other Trafficable Areas
- Existing Trafficked Roads

3.13 Acceptance Testing

3.13.1 Pressure Testing

3.13.1.1 System Test Pressure

- Water Reticulation Mains
- Dedicated Fire Main
- Water Reticulation Mains - PVC Pipes
- Water Reticulation Mains - All Other Cement Lined or Based Pipes

3.13.2 Bacteriological Test

3.13.2.1 Test Procedure

3.13.2.2 Satisfactory Bacteriological Test

3.14 Tolerance on As-Constructed Work

3.14.1 Horizontal Tolerances

3.14.1.1 Water Mains In-Line Structures

3.15 Connections to Existing Water Mains

3.15.1 General

3.16 Work As-Constructed Drawings

3.7 Products and Materials Overview (WSA 12)

Entire section adopted with the following amendments:

3.7.1 Selection Guide for Pipeline Systems

Entire section adopted with the following amendments:

3.7.1.1 Water Mains

- All pipes and fittings are to be manufactured by a quality endorsed company
- Pipes used for water mains are to conform to the latest revision of the following standards:

(a)

- Pipes are to be PVC-O or PVC-M rubber ring jointed thick wall PN16 conforming to AS4441 and AS4765.
- The pipes are to be suitable for a maximum working pressure of 1.6 MPa and have outside diameters which are the same as ductile iron pressure pipes to AS 2280 of the same nominal diameter.

(b)

- Rubber ring jointed ductile iron pipes of minimum Class K9 conforming to the requirements and tests of AS 2280 and the requirements and tests of the Queensland Water Resources Commission
- Ductile iron pipes are to be cement lined internally with a light thickness cement mortar lining in accordance with AS 1281; and
- Pipes are to be externally coated with two coats of bituminous paint, and polyethylene sleeved with coloured lay flat polyethylene tubing of 0.2mm thickness complying with AS 3680, Polyethylene Sleeving for Ductile Iron Pipes.

3.7.1.2 Water Service Enveloping Conduits

- Water service conduits are to be a minimum 100mm diameter. Larger diameters may be required for industrial and some commercial developments;
- Pipes used for water service conduits are to conform to the latest revision of the following Standards:
  i. uPVC or PVC-M pipe minimum Class 16
  ii. rubber ring jointed RCP minimum Class “3” to AS 4058; or
- Where concrete footpaths are to be constructed, the Developer is to:
  iii. Provide a water service conduit under the footpath in line with the conduits under the road, for future ease in installing the individual water services; and
  iv. Emboss the letter “W” in the concrete to mark the location of the conduit.

3.8 Quality

3.8.1 Quality Assurance

3.8.1.1 General

Entire section adopted with the following additions:

- Except as specifically varied hereafter, all water reticulation mains are to be constructed in accordance with the provisions of the Western Downs Regional Council Standard Drawings and this manual

- All work is to be supervised by a Registered Professional Engineer (Qld) competent in water reticulation works; and

- The works are to be undertaken by a nominated principle contractor experienced in the construction of Public (Municipal) Works. Council may request evidence of the Principal Contractor's competency in the construction of water reticulation works.

3.9 Bedding for Pipes (WSA14)

Entire section adopted with the following amendments:

3.9.1 Bedding Materials

Entire section adopted with the following additions:

- The standard types of water main construction is to be carried out generally in accordance with the details outlined in *Standard Drawing No. W-007*. It is the responsibility of the Consulting Engineer to determine the actual type of bedding to be constructed after consideration of actual conditions in the trench.

- bedding material is to be provided to ensure a minimum of 100mm below the pipe (Bedding Material) to 150mm above the pipe (Overlay Material); and

- The bedding material is to be uniform in quality and free from dirt, clay and other foreign matter and conform to the specification outlined in Table 3.9.1 Bedding Material Specifications

Table 3.9.1: Bedding Material Specifications

BS Sieve	Metric mm	Percentage by Weight Passing the Sieve
3/8	9.6	100
3/16	4.8	95-100
7	2.4	80-90
14	1.2	15-25
25	0.6	10-20
52	0.3	5-10
100	0.15	0-5
200	0.075	0-5

3.10 Pipe Laying and Joining

Entire section adopted with the following amendments:

3.10.1 Horizontal and Vertical Deflection of Pipes (WSA 15.2)

3.10.1.1 General

Entire section adopted with the following amendments:

- Water Mains are to be located and aligned as shown on Standard Drawing No W-012. Minor horizontal centerline deviations are acceptable provided the water main remains entirely

within the allocation width shown on the standard drawings. Maximum allowable centerline deviation from the given alignment shall be ± 75 mm horizontally and ± 50 mm vertically; and

- Water service enveloping conduits are to be located and aligned as shown on Standard Drawing No. W-012. Minor horizontal centerline deviations are acceptable provided the water main remains entirely within the allocation width shown on the standard drawings. Maximum allowable centerline deviation from the given alignment shall be ± 75 mm horizontally and ± 50 mm vertically.

3.10.1.2 Deflection at a Pipe Joint

Entire section adopted with the following amendments:

- The maximum design deflection allowable at a joint shall be 4°; and
- Joint deflections, to manufacturers recommendations, or DICL bends are to be provided at every change of direction of property boundaries.

3.10.2 Horizontal and Vertical Separation of Crossing Pipelines (WSA 15.3)

Entire section adopted with the following additions:

- The minimum separation between the water main and other services that cross the mains path is 300mm.

3.10.3 Thrust and Anchor Blocks and Restrained Joints (WSA 15.7)

Entire section adopted with the following amendments:

- Concrete blocks in accordance with W-016, are to be placed at all bends, horizontal and vertical tees, angle branches, crosses, dead ends, reducers, or other places where there is an unbalanced hydraulic load
- the concrete used for the blocks is to be Class N25 concrete
- The blocks are to be cast at least seven (7) days prior to pressure testing of any section of the main
- All concrete is to be placed against solid undisturbed ground
- Special attention is required where underground power is to be laid on the same side of the road as the water main to ensure integrity of the blocks
- For vertical bends with an upward thrust:

  (a) Additional concrete is to be placed so that the mass of concrete is greater that the thrust on the filling
  (b) Sufficient steel reinforcement is to be included to bind the weight of the block below the pipe centre line to the upper part of the block; and
  (c) These thrust blocks are to be designed to the manufacturer's specifications.

3.10.4 Property Services and Water Metres (WSA 15.8)

Entire section adopted with the following additions:

- Water service connections, when required, are to be installed in accordance with *W-005, W-006 & W-007; and W-008*
- Water meters are not usually installed at the time of reconfiguration, except in the case of Community Title Schemes, where the common meter, usually 100mm diameter is installed by the Local Government at the Developer's expense.

3.10.5 Values, Hydrants and Surface Fittings (WSA 15.13)

3.10.5.1 Installation

Entire section adopted with the following additions:

- Hydrants are to be installed in *accordance with W-013 W-023*
- Marker plates and posts are to be installed in *accordance with W-014*
- Kerb and pavement markings are to be *in accordance with W-014*; and
- Every buried fitting which includes botled connections or joints is to be wrapped in Denso Corrosion Protection mastic and tape in accordance with the manufactures recommendations.

3.10.6 Location Markers

3.10.6.1 General

Marker posts with distance plates, or marker plates mounted on the kerb shall be supplied and installed by the Developer opposite all valves and hydrants.

3.10.6.2 Marker Posts

Marker posts complete with distance plates (showing offset distances with a tolerance of 0.1m) where required, shall be erected on RP boundaries opposite all valves and hydrants. Marker posts shall be painted yellow for hydrants and blue for valves. For detail *refer Standard Drawing No. W-014.*

Marker posts shall only be installed in lieu of marker plates where no kerb is provided.

3.10.6.3 Marker Plates

Reflective marker plates (150mm x 75mm) indicating the distance to hydrants and valves to the nearest 0.1m are to be fixed to the kerb wherever sufficient kerb height is available (in lieu of marker posts). Marker Plates shall be fixed by an approved method to the face of the kerb in the appropriate position perpendicular to the kerb face. The marker plate shall comprise of an aluminium plate covered with a 4.5mm polycarbonate sheeting. The plate shall be fixed to the kerb face using 2 “Ramset SDMN 06030” stainless steel fasteners. A rectangle, 300mm wide and full depth of the kerb face of the appropriate colour (yellow-hydrants; white-valves) shall be painted on the kerb face around the marker plate.

Refer to the following drawing showing this information- Drawing No P4 – Hydrant & Valve Markers

3.10.6.4 Covers and Surrounds

Covers and surrounds to valves and hydrants, as well as the kerb opposite the valve should be painted the appropriate colour. The dimensions of paint to the kerb shall be 300mm wide by the full height of the kerb. It is required that the central insert be made from Cast Iron, whilst the surrounds can be made from either Concrete or Plastic.

3.10.6.5 Hydrant Markers

A single Blue Raised Reflective Pavement Marker (RRPM) shall be fixed to the road pavement to mark the location of hydrants on all sealed roads. The RRPM shall be positioned adjacent to the hydrant valve perpendicular to the kerb face, as tabulated below:

Road Type	Location of Blue RRPM
Single Lane with no pavement markings	Centreline of Road

Two Lane – Two Way with separation (broken) line marking	Centreline of Road
Two Lane – Two Way with barrier line marked	On hydrant side of barrier line
Four Lane undivided road	Centreline of Road
Four Lane with median strip	Cenreline of two lanes on hydrant side of street

3.11 Pipe Embedment and Support (WSA 16)

The guidelines outlined by the Water Services Association (Australia) are adopted in principle, and the construction parameters used, are to be in accordance with the criteria listed in the current edition of WSAA, except as amended by this document.

3.11.1 General (WSA 16.1)

Entire section adopted with the following addition:

- The standard types of water main construction are to be carried out It is the responsibility of the Consulting Engineer to determine the actual type of bedding to be constructed after .

3.12 Fill (WSA 17)

Entire section adopted with the following amendments:

3.12.1 Trench Fill (WSA 17.1)

3.12.1.1 Placement

Entire section adopted with the following addition:

- The standard types of water main construction is to be carried out generally in accordance with the details outlined in Standard Drawing No.W-007. It is the responsibility of the Consulting Engineer to determine the actual type of bedding to be constructed after consideration of actual conditions in the trench.

3.12.1.2 Material Requirements

Entire section adopted with the following additions:

General

- Approved filling is to be placed above the bedding to a minimum height of 150mm above the approved bedding; and

- Approved filling is to be free from vegetable matter and lumps of clay with:

  (a) More than 70% by weight passing the 2.4mm sieve

  (b) Not more than 30% by weight passing the 75mm sieve

  (c) The material passing the 2.4mm sieve having a miniature abrasion loss not exceeding 15%; and

  (d) The material passing the 425mm sieve having a linear shrinkage not exceeding 6%.

Footpaths and Other Non-Trafficable Areas

- Backfilling is to be carried out using selected material from excavation; and

- The material is to be placed in layers not exceeding 300mm in depth and is to be compacted to a minimum consolidation of 95% Standard Compaction.

New Roads and Other Trafficable Areas

- Backfilling above the bedding to the underside of the pavement box is to be gravel or decomposed/broken rock, free from vegetable matter and lumps of clay, having a maximum particle size of 40mm.

- The materials is to be placed in layers not exceeding 300mm in depth and compacted to a minimum consolidation of 90%, but being limited to a maximum consolidation of 98%.

Existing Trafficked Roads

- Backfilling of trenches within existing roads is to be carried out using approved bedding sand *[refer section 17.1.2 & Standard Drawing No. W-012],* lean mix concrete (which is to be a minimum 450mm above approved backfill) and asphalt surface restoration.

3.13 Acceptance Testing (WSA 19)

The guidelines outlined by the Water Services Association (Australia) are adopted in principle, and the construction parameters used, are to be in accordance with the criteria listed in the current edition of WSAA, except as amended by this document.

3.13.1 Pressure Testing (WSA 19.4)

3.13.1.1 System Test Pressure

Section amended with the following:

Water Reticulation Mains

- The mains, including valves, are to be pressure tested to 1200 kPa.

Dedicated Fire Main

- New dedicated fire mains shall be pressure tested in accordance with AS 2419.1 Section 10 – Testing. All pipe joints and anchor blocks shall be exposed during pressure testing.

3.13.1.2 Maximum Allowable Loss

Water Reticulation Mains – PVC Pipes

- No loss in PVC pipes is acceptable

Water Reticulation Mains – all Other Cement Lined or Based Pipes

- As per WSAA

3.14 Disinfection (WSA 20)

3.14.1 Bacteriological Test

Entire section amended with the following:

3.13.2.1 Test Procedure

- During pipe laying, dry chloride of lime powder having an available chlorine content of 85% to 90% shall be uniformly distributed in the pipes the rates tabulated below

Pipe Diameter (mm)	Quantity/metre length (m)
100	1 level dessertspoon per 30m length
150	1 level dessertspoon per 14m length
200	1 level dessertspoon per 7.5m length
225	1 level dessertspoon per 6m length
250	1 level dessertspoon per 5m length
300	1 level dessertspoon per 3m length
375	1 level dessertspoon per 2m length
400	1 level dessertspoon per 1.5m length

- The main is to be flushed prior to chlorination
- After flushing the main is to be charged and super-chlorinated; and
- This is to held in the main for a period of 24 hours.

3.13.2.2 Satisfactory Bacteriological Test

Entire section amended with the following:

- The mains are to the retested for a residual chlorine count of 5mg/L before flushing the chlorinated water out of the mains; and
- If a residual count of 5mg/L is not obtained, then the mains are to be scoured, re-chlorinated and the above procedure (3.13.2.1 - 3.13.2.2) repeated.

Before any water main is placed "on-maintenance" the laboratory quality tests results are to be supplied to Council by the Supervising Engineer. These tests should be carried out by a laboratory with National Association of Testing Authorities Australia (NATA) registration. Reports are to include standard plate count, total coliform and E-coli; and provide a written recommendation as to the sustainability of the newly constructed water mains to be connected to the water distribution system. Results forwarded to the Local Government for Bacteriological Test are to be in accordance with the National Health and Medical Research Council's Australian Drinking Water Guidelines. Results higher than the limits in the Guidelines are not acceptable to Council.

3.15 Tolerance on As-Constructed Work (WSA 20)

The guidelines outlined by the Water Services Association (Australia) are adopted in principle, and the construction parameters used, are to be in accordance with the criteria listed in the current edition of WSAA, except as amended by this document.

3.14.1 Horizontal Tolerances (WSA 20.2)

3.14.1.1 Water Mains and In-Line Structures

Section adopted with the following amendments to *Section (a):*

- Water Mains are to be located and aligned as shown on *Standard Drawing No. W-012*. Minor horizontal centerline deviations are acceptable provided the water main remains entirely within the allocation width shown on the standard drawings. Maximum allowable centerline deviation from the given alignment shall be ± 75 mm horizontally and ± 50 mm vertically.

- Water service enveloping conduits are to be located and aligned as shown on *Standard Drawing No. W-012*. Minor horizontal centerline deviations are acceptable provided the water main remains entirely within the allocation width shown on the standard drawings. Maximum allowable centerline deviation from the given alignment shall be ± 75 mm horizontally and ± 50 mm vertically.

3.15 Connections to Existing Water Mains (WSA 22)

Entire section adopted with the following amendments:

3.15.1 General

Section adopted with the following amendment:

- All connections or alterations to Council's water reticulation mains are to be undertaken by Council at the Developer's cost.

3.16 Work As-Constructed Drawings (WSA 24)

The guidelines outlined by the Water Services Association (Australia) are adopted in principle, and the construction parameters used, are to be in accordance with the criteria listed in the current edition of WSAA, except as amended by this document.
Section adopted with the following addition:

- On completion of the works, a certificate is to be submitted to Council from the Consultant to effect that the works have been completed in accordance with the approved plans and specifications.
- As-constructed drawings must be supplied prior to on-maintenance approval

Part 4 Standards for Design of Sewer Reticulation Works

Table of Content

4.1 General

4.1.1 Planning and Design Responsibilities and Interface

4.1.1.1 Design Responsibilities

4.2 System Planning

4.2.1 Purpose and Application

4.2.1.1 Planning Horizon

4.3 Detail Design

4.3.1 Horizontal Alignment of Sewers

4.3.1.1 General

Table 4.3.1 Location and Alignment of Sewers

4.3.1.2 Public and Private Property

4.3.1.3 Horizontal Curves in Sewers

4.3.2 Pipe Sizing and Grading

4.3.2.1 Minimum Air Space for Ventilation

4.3.2.2 Minimum Pipe Size for Maintenance Purposes

4.3.2.3 Maximum EP for Reticulation Sewers

4.3.2.4 Minimum Grade for Self Cleaning

Table 4.3.2 Sewer Capacity and Minimum Grade

4.3.2.5 Minimum Grades Requiring Anchor Blocks

4.3.3 Piping Sizing and Grading

4.3.3.1 Minimum Cover over Sewers

4.3.3.2 Vertical Curves

4.4 Property Connection

4.4.1 Limitations of Connection to Sewers

4.4.2 Methods of the Property Connection

4.4.2.1 Interface Method

4.4.2.2 Buried Interface Method

4.4.3 Location of Connection Points

4.4.3.1 Undeveloped Lots

- Location
- Size
- Depth
- Calculation of Depth Required
- Design Plans

- General
- Approval

4.4.3.2 Developed Lots

4.5 Maintenance Structures

4.5.1 Location of Maintenance Structures

4.5.2 Spacing of Maintenance Structures

4.5.2.1 General

4.5.2.2 Maintenance Structure Spacing - Reticulation Sewers

4.5.2.3 Maintenance Structure Spacing - Branch and Trunk Sewers

4.5.3 Special Considerations for Location of Maintenance Structures

4.5.4 Special Considerations for Connection of New Sewers to Existing Sewers

4.5.5 Maintenance Holes (MH)

4.5.5.1 Diameters of MHs

4.5.5.2 Ladders, Step Irons and Landings

4.5.5.3 MH Covers

4.5.5.4 Design Parameters for MSs and TMSs

4.6 Ancillary Structures

4.6.1 Water Seals, Boundary Traps and Water-Sealed MHs

4.6.1.1 General Design Parameters

4.6.1.2 Water Seals on Reticulation Sewers Entering Branch Trunk Sewers

4.6.1.3 Water Seals on Branch Sewers Entering Truck Sewers

4.6.2 Gas Check MHs

4.6.2.1 General

4.6.2.2 Design Parameters for Gas Check MHs

4.6.3 Ventilation

4.6.3.1 Design Parameters for Vents

4.6.4 Overflows / Emergency Relief Structures (ERS)

4.6.4.1 General

4.7 Design Review and Drawings

4.7.1 Design Drawings

4.7.1.1 General

4.7.1.2 Real Property Information

4.7.1.3 Sewers

4.7.1.4 Longitudinal Selection (profiles)

4.8 Products and Materials Overview

4.8.1 Additional Products and Material Information

4.9 Quality

4.9.1 Personal Qualifications

4.10 Excavation

4.10.1 Limits on Excavation

4.11 Pipe Laying and Joining

4.11.1 Horizontal and Vertical Deflection of Sewers

4.11.1.1 General

4.11.1.2 Methods of Deflection

4.11.1.3 Horizontal Curves

4.11.1.4 Vertical Curves

4.11.1.5 Compound Curves

4.11.2 Dead Ends

4.12 Maintenance Holes (MHs)

4.12.1 Internal Coating of Concrete MHs

4.13 Fill

4.13.1 Trench Fill

4.13.1.1 Material Requirements

4.14 Connection of Exiting Sewers

4.15 Work As-Constructed Details

4.1 General (WSA 1)

The guidelines outlined by the Water Services Association (Australia) **Gravity Sewerage Code of Australia** are adopted in principle, and the design parameters used, are to be in accordance with the criteria listed in the current edition of WSAA, except as amended by this document.
The section of the WSA guidelines to which comments refer are shown as **WSA X** and **WSA X.X**

4.1.1 Planning and Design Responsibilities and Interfaces (WSA 1.2)

4.1.1.1 Design Responsibilities

Entire section adopted with the following additions:

Except as specifically varied hereafter, the design and construction of reticulation sewers is to comply with:

- *"WSAA-02 – Sewerage Code of Australia" by Water Services Association of Australia (WSAA);*
- *"Planning Guidelines for Water Supply and Sewerage" by Queensland Department of Natural Resources & Water (QWRC, Queensland Water Resources Commission);*
- *Western Downs Regional Council's "Sewage Pump Station Electrical Switch Board Specification";*
- *Western Downs Regional Council Standard Drawings; and*
- *This manual.*

Sewers within the development are to be sized to accept the ultimate design flows from any contributing external catchments and the sewers are to be constructed to the external boundaries of the development at lines and levels for the connection of future sewers.

Prior to proceeding with design, "As Constructed" sewer information relevant to the proposed development should be obtained from Council together with confirmation of the approved point(s) for connection.

Should a conflict exist amongst the cited design guidelines and Council's Standard Drawings, the matter is to be referred to Western Downs Regional Council for determination. Generally the hierarchy is as follows:

- Standard Drawings
- This specification
- WSAAA guidelines

Where sewers are proposed through land other than that owned by the Developer, written approval is to be obtained from the property owner and submitted with the design drawings. An Operational Works Permit will not be issued without this approval.

Where an external catchment would be serviced by gravity sewers traversing the proposed development, the boundaries and area of the catchment is to be shown on the layout plans.

Refer to Council for agreement on the population densities used in determining the anticipated design flows, for the development and any contributing external catchments.

4.2 System Planning (WSA 2)

4.2.1 Purpose and Application

Entire section adopted with the following addition:

4.2.1.1 Planning Horizon

- Planning horizons for WDRC are a vailable upon request. Developments impacting trunk infrastructure will be subject to interrogation with Councils network model.

4.3 Detail Design (WSA 5)

4.3.1 Horizontal Alignment of Sewers (WSA 5.3)

Entire section adopted with the following amendments:

4.3.1.1 General

All sewer lines are to be located with properties and aligned as outlined in Table 4.3.1 Location and Alignment Sewers.

Table 4.3.1: Location and Alignment of Sewers

Location	Alignment
Private Property (front boundary)	3.00m (refer Note 1 & Note 6)
Private Property (side boundary)	1.50m
Private Property (rear boundary)	1.50m (refer Note 2)
Private Property adjacent to roofwater drainage	2.00m (refer Note 3)

Notes for Table 4.3.1:

1. *A sewer may cross a road to reduce the number of access chambers to be used, provided house connections are not located under the roadway.*
2. *Where sewer lines are located along the road frontage of allotments, to reduce the number of access chambers where truncations occur, the sewer may (subject to the approval of the Local Government prior to design) be located within a zone from 0.5 metres to the building setback less 2.0 metres.*
3. *The sewer alignment is to be located at 1.50 metre offset from rear boundaries adjacent to inter allotment drainage lines, which are to be on a 2.0 metre offset, to avoid clashes of access chambers.*
4. *In special circumstances and with Council's consent, other alignments may be approved due to the location of site constraints such as fences, verges or other services. Sewers should be constructed to alignments nominated in Table 4.2, unless otherwise approved.*

4.3.1.2 Public and Private Property

- Sewers shall be run parallel to boundaries at minimum offsets of 1.5 metres

4.3.1.3 Horizontal Curves in Sewers

- Horizontal curve in sewers are not to be used

4.3.2 Pipe Sizing and Grading (WSA 5.5)

4.3.2.1 Minimum Air Space for Ventilation

- Option A is the preferred solution.

4.3.2.2 Minimum Pipe Sizes for Maintenance Purposes

- The minimum size of property connections is 100DN unless otherwise specified through hydraulic design.

4.3.2.3 Maximum EP for Reticulation Sewers

Entire section amended:

- For details on the maximum EP that may be served by reticulation sewers, refer to specifications in Table 4.3.2 Sewer Capacity at Minimum Grade

4.3.2.4 Minimum Grades for Self Cleaning

Entire section adopted with amendments, where applicable, to Section 4.5.7.1, as listed:

- The minimum grades for various pipe diameters are outlined in Table 4.3.2 Capacity at Minimum Grade, which also provides capacity and equivalent populations served relative to minimum grades. Adoption of the minimum grades outlined in Table 4.3.2 Capacity at Minimum Grade will satisfy self-cleansing flow requirements.

Table 4.3.2: Sewer Capacity at Minimum Grade

Pipe Dia mm	[1]Minimum Grade	[2]Capacity of Pipe at Minimum Grade l/s	[3]Equivalent Population Served EP
150	1 in 200	5.38	404
150	1 in 150[4]	6.22	467
225	1 in 290	24.05	1807
300	1 in 420	43.03	3233
375	1 in 570	66.98	5032
450	1 in 730	96.24	7231
525	1 in 900	130.74	9823
600	1 in 1000	177.08	13304
675	1 in 1200	221.06	16608
750	1 in 1500	261.89	19676

Notes for Table 4.3.2:

1. *Minimum grades are as recommended in the QWRC Guidelines. A minimum grade of 1 in 150 is preferred for 150mm dia sewers, but 1 in 200 is permissible where 1 in 150 is impractical and the contributing catchment is greater than 60 equivalent persons.*
2. *Capacities are based on 150mm dia sewers flowing ½ full and larger diameters flowing ¾ full, with Mannings 'n' taken = 0.013 and internal diameter = nominal diameter.*
3. *Equivalent Population served is based on PWWF = 5 x ADWF.*
4. *The last length between two manholes or the last length to an end shall have a minimum grade of 1 in 60.*

4.3.2.5 Minimum Grades Requiring Anchor Blocks

Anchor blocks are to be designed and constructed to the detail shown in Standard Drawing No. **ss23**, when:

- The grade of 100 dia. pipe is steeper than 1 in 5

- The grade of 150 dia. pipe is steeper than 1 in 5
- The grade of 225 dia. pipe is steeper than 1 in 10
- The grade of 300 dia. pipe is steeper than 1 in 15

4.3.3 Piping Sizing and Grading (WSA 5.5)

4.3.3.1 Minimum Cover over Sewers

- Where conflict exists (between the WSAA and this manual), the details outlined in this manual take precedent and are applicable.

- Sewers and house connections are to be designed and constructed at the shallowest possible depth such that:

    (a) All properties can be completely drained for the calculated minimum depth of property connection

    (b) Minimum cover requirements for structural purposes are to be met as per the following table:

Location	Alignment
Street Carriageway	1.20m
Verge (footpath)	1.20m
Private Property	1.00m (to Av. Lot Level)
Parkland	1.20m

    (c) Other services are not fouled
    (d) Stormwater drains are not pierced
    (e) All sewers pass under water mains
    (f) Minimum access chamber depths, as outlined in *Standard Drawings No. SS.02 and SS.03* are satisfied

When sewers are laid, it is desirable that there is at least 1.5 metres *horizontal* separation from any existing or proposed water main. Where this separation is not achievable, the sewer may be laid closer provided the water main is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and with the bottom of the water main at least 0.5 metres above the top of the sewer.

Where a water main crosses under or over a sewer, there should be at least *0.2* metres vertical distance between the outside of each main. Where a water main crosses under a sewer, special structural support should be provided for the sewer.

Maximum depth of sewers shall be 4.0 metres. Refer to Council for approval of design and construction of sections of sewer deeper than 4.0 metres.

Where fill is placed over an existing sewer or soil is removed, the Developer is responsible for the

4.3.3.2 Vertical Curves

Entire section deleted and replaced with the following:

- Vertical curves in sewers are not to be used

4.4 Property Connection (WSA 6)

Entire section adopted with the following additions:

4.4.1 Limitations of Connection to Sewers (WSA 6.2)

- Reticulation sewers are defined as sewers of 150mm, 200mm, 225mm, 250mm and 300mm diameters used to collect and convey sewage from properties. House connections to larger sewers will generally not be permitted. Exceptions will require approval from Western Downs Regional Council.

4.4.2 Methods of the Property Connection (WSA 6.3)

4.4.2.1 IO Interface Method

- The property owner owns the IO.

4.4.2.2 Buried Interface Method

- WDRC does not use the buried interface method.

4.4.3 Location of Connection Points (WSA 6.5)

4.4.3.1 Undeveloped Lots

Location

The location of property connection points on undeveloped lots shall be:

(a) on the lowest corner of the lot, 1.50 m from the boundary, such that the whole of the allotment can be drained, as outlined in (c) below;

(b) where this is not possible for a particular allotment, then Council approval is required, after which the allotment is not to be included in the declared sewered area with notation to that effect on the "As-Constructed" plans;

(c) made to manholes where possible and shall extend 1.50m past the rear of allotment drainage pipes and all easement and/or R.P. boundaries; and

Sizes

The size of property connections on undeveloped lots shall be:

(a) Residential 100 mm diameter

(b) Other 100 mm diameter unless otherwise required

Depths

The depth of property connections on undeveloped lots shall be:

(a) Absolute minimum 1000 mm cover to rear of properties

(b) Absolute minimum 1000 mm cover to front of properties

(c) Maximum depth to invert 1.5 metres (may only be varied if there is sufficient cover to serve the lot).

Calculation of depth required

The required depth of the property connection shall be calculated as follows:

(a) calculate the R.L. of the lowest point

(b) subtract 0.50m from finished surface level to the invert at the head of the house sewer drain (for cover requirements to pipework)

(c) subtract the following product depth:

- Divide the distance from the low point of the Lot to the connection by 60. This allows for a 1 in 60 grade for a 100mm dia. residential house drain.

Design plans

(a) Design plans shall indicate the R.L. at each corner of each Lot, taking into consideration any proposed earthworks, together with the Average Lot level.

General

(a) It should be noted that house connections to sewer lines extend up to and include the inspection opening;

(b) Combined house drains are not permitted;

(c) Where fill is placed over an existing sewer, house connections on this sewer are to be raised to the minimum depth capable of draining the entire property.

Approvals

Written approval is to be obtained from the property owner and submitted to the Local Government with the design drawings when the house connections are proposed through land other than that owned by the Developer. An Operational Works Permit will not be issued without this approval.

4.4.3.2 Developed Lots

Entire section adopted with the following additions:

Given the prevalence of "lost" connections, it is considered reasonable for the Consultant providing incorrect "As-Constructed" information to be held responsible.

Where property connections cannot be located at the point shown on the "As-Constructed" information, the following procedure shall be adopted:

(a) Council will notify the Consulting Engineer of the "lost" connection. If the connection is still not located within 24 hours, Council's Sewerage Maintenance Foreman will be informed.

(b) Council will notify on site that the connection is not as shown. Council will then install a new property connection at a suitable location.

(c) The Consulting Engineer will be charged for the costs incurred by Council in providing this property connection.

(d) The Consulting Engineer may also be charged for claims by Plumbers or Drainers for time spent searching for the missing connection.

4.5 Maintenance Structures (WSA 7)

Entire section adopted with the following amendments:

4.5.1 Location of Maintenance Structures (WSA 7.2)

The design shall include the maintenance structures at the following locations:

(a) Every change in direction of sewer
(b) Every change of grade of sewer
(c) Every change of invert level
(d) Every change of pipe diameter
(e) Ends of lines where more than two properties are connected; and
(f) At the lower side of the allotment (where practicable).

4.5.2 Spacing of Maintenance Structures (WSA 7.3)

4.5.2.1 General

Entire section adopted with the following amendment:

In positioning manholes, consideration shall be given to future sewer reticulation requirements. Manholes are to be located in such positions that will allow for future extensions to be connected directly to existing manholes.

4.5.2.2 Maintenance Structure Spacing – Reticulation Sewers

Entire section adopted with the following amendments:

Manholes (Access Chambers) are to be constructed at a spacing of 90 metres, and at the ends of lines where ends are more than 35 metres from the previous access chamber.

The access chamber may be replaced with a maintenance shaft from the end of a line provided:

(a) It has a maximum length of 35 metres
(b) It is not connected to more than two (2) properties; and
(c) The gradient of the sewer is not less than 1 in 100.

4.5.2.3 Maintenance Structure Spacing – Branch and Trunk Sewers

Entire section deleted and replaced with the following amendment.

- Manholes are to be constructed at a maximum spacing of 90 metres.

4.5.3 Special Considerations for Location of Maintenance Structures (WSA 7.4)

Entire section adopted with the following amendments:

- Manholes (Access Chambers) are to be constructed 1.5 metres from boundaries and clear of property boundaries.

4.5.4 Special Considerations for Connection of New Sewers to Existing Sewers (WSA 7.5)

Entire section adopted with the following amendment

- Connections to existing sewers must be undertaken by Council at the developer's expense unless otherwise approved.

4.5.5 Maintenance Holes (MH) (WSA 7.6)

4.5.5.1 Diameters of MHs

Entire section adopted with the following amendment:

- Sewer manholes shall be 1050mm dia. fitted with lift-off lids, stamped “Sewer” (or similar).

4.5.5.2 Ladders, Step Irons and Landings

Entire section adopted with the following amendment;

- WDRC does not require the use of ladders or step irons.

4.5.5.3 MH Covers

Entire section adopted with the following amendment:

- Sewers shall be finished to 50mm above finished surface level to allow for top dressing. Manhole lids shall be rendered trafficable within street carriageways or where vehicular loading is likely.

4.5.5.4 Design Parameters for MSs and TMSs

Entire section adopted with the following amendment:

- WDRC requires a maximum depth of 3.0 metres.

4.6 Ancillary Structures (WSA 8)

4.6.1 Water Seals, Boundary Traps and Water-Sealed MH (WSA 8.2)

4.6.1.1 General Design Parameters

Entire section adopted with the following amendment:

- Is not required by WDRC

4.6.1.2 Water Seals on Reticulation Sewers Entering Branch or Trunk Sewers

Entire section adopted with the following amendment:

- Is not required by WDRC

4.6.2.3 Water Seals on Branch Sewers Entering Trunk Sewers

Entire section adopted with the following amendment:

- Is not required by WDRC

4.6.2 Gas Check MHs

4.6.2.1 General

Entire section adopted with the following amendment:

- Is not required by WDRC

4.6.2.2 Design Parameters for Gas Check MHs

Entire section adopted with the following amendment:

- Is not required by WDRC

4.6.3 Ventilation (WSA 8.4)

4.6.3.1 Design Parameters for Vents

Entire section adopted with the following amendment:

- WDRC requires use of section B - at SPSs (refer to S-XXX) & Cat MHs where pressure mains discharge to gravity sewer. Inducts are required every 500m for trunk sewer greater than 225DN.

4.6.4 Overflows / Emergency Relief Structures (ERS) (WSA 8.7)

4.6.4.1 General

Entire section adopted with the following amendment:

- Generally not permitted by WDRC

4.7 Design Review and Drawings (WSA) 10

4.7.1 Design Drawings (WSA 10.2)

4.7.1.1 General

Entire section adopted with the following addition:

- Drawings should be presented on A1 or B1 sheets. A3 sheets may be used provided that the detail is legible. Illegible drawings will not be checked and will be returned to the Consulting Engineer for rectification.

4.7.1.2 Real Property Information

Entire section adopted with the following amendments:

- Design Drawings shall include at least the following real property information:

  (a) House connection with set-out information and the direction of the connection
  (b) Surface levels to each corner of every Lot (Finished Surface Levels if applicable)
  (c) Lot numbers
  (d) Street names
  (e) North point

4.7.1.3 Sewers

Entire section adopted with the following amendments:

- Design Drawings shall include at least all the following sewer details:

  (a) Positions of sewers as heavy continuous linework
  (b) Alignments of sewers relative to real property boundaries
  (c) Manholes and End of Lines
  (d) Manholes shown as blocked-in circles
  (e) Manhole numbers, shown to be inside of a circle, adjacent to the manhole
  (f) Manholes numbers, consisting of two figures separated by an oblique stroke, e.g. 4/3, the first number denoting the manhole and the second the sewer line. (Contact Council for a sequential numbering system of manhole, if so requested)

(g) Existing manholes shown as a double blocked-in circle
(h) Existing manhole numbers, to be shown inside a double circle, adjacent to the manhole
(i) Ends of lines, indicated by, e.g. E/5
(j) Ties to manholes to be shown in fine print
(k) Distances between manholes
(l) Direction of flow
(m) Existing sewers, to be shown in thin linework
(n) Bench marks
(o) Other services

4.7.1.4 Longitudinal Sections (profiles)

Entire section adopted with the following amendments applying:

- Longitudinal sections shall be similar to those shown on *Sample Drawing No. 30*.

Specific items to be shown are:

(a) The minimum acceptable horizontal and vertical scales shall be 1:1000 and 1:100 (at A1) respectively unless otherwise approved by Council.

(b) Show junctions with dimensions and levels to three decimal places. The junctions are to be shown alongside the relevant manhole indicating the chainage and diameter of the junction.

(c) Manhole type and cover type shall be shown and the location of the footpath shall be indicated.

(d) The internal diameter, cover type and invert levels of all existing manholes to which proposed sewers are draining shall be verified by site inspection.

(e) The number of existing internal or external drops in all existing manholes to which proposed sewers are draining shall be shown.

(f) The internal diameter of the downstream receiving sewer shall be shown.

(g) Existing and proposed services from other Authorities within the Development shall be located by chainage. Service size and elevation level at crown or invert shall be shown.

(h) Type, class and diameter of sewer.

(i) Proposed manholes are to be shown as a blocked-in line with the manhole number in a circle.

(j) Existing manholes are to be shown as a double line with the manhole number in a double circle.

(k) Sections shall be drawn so that sewers drain to the left hand side of the drawing.

(l) Number and spacing of bulkheads (if applicable).

(m) Control level (average lot level) for each lot in the subdivision shall be shown by a small cross on the longitudinal section, with the lot number and invert level of the proposed property connection.

4.8 Products and Materials Overview (WSA 13)

4.8.1 Additional Product and Material Information

Entire section adopted without amendment.

4.9 Quality

4.9.1 Personal Qualifications

Construction works are to be supervised by an RPEQ Personnel constructing utilities infrastructure must have a minimum 5 years' experience and suitable qualifications pertaining to the product and materials used.

4.10 Excavation (WSA 14)

4.10.1 Limits on Excavation

Entire section adopted with the following amendment:

- Benching is limited to a single bench of 1.5 metres vertically and horizontally. Trenches in excess of this depth shall require shoring.

4.11 Pipe Laying and Jointing (WSA 16)

4.11.1 Horizontal and Vertical Deflection of Sewers (WSA 16.2)

4.11.1.1 General

Entire section adopted with the following addition:

- Pressure mains are to be a minimum 100mm internal diameter RRJ PVC-O of minimum Class 16 with DICL FBE or equivalent, coated fittings, or PE100 SDR11 with electro fusion or buttweld fittings, laid within the verge on a standard alignment of 3.0m (high side) from the property boundary, with a minimum 1.0m cover.

4.11.1.2 Methods of Deflection

Entire section deleted and replaced with the following:

- Deflection in sewers is not to be used

4.12.1.3 Horizontal Curves

Entire section deleted and replaced with the following:

- Horizontal curve in sewers is not to be used

4.11.1.4 Vertical Curves

Entire section deleted and replaced with the following:

- Vertical curve in sewers is not to be used

4.11.1.5 Compound Curves

Entire section deleted and replaced with the following:

- Compound curve in sewers is not to be used

4.11.2 Dead Ends (WSA 16.8)

Entire section adopted with the following amendment:

- WDRC requires dead ends to be terminated with a maintenance shaft or manhole.

4.12 Maintenance Holes (MHs) (WSA 17)

4.12.1 Internal Coating of Concrete MHs

Entire section adopted with the following addition.

- WDRC requires rising main discharge manholes to be epoxy coated.

4.13 Fill (WSA 20)

4.13.1 Trench Fill (WSA 20.1)

4.13.1.1 Material Requirements

Entire section adopted with the following amendment.

(a) Original material

Delete (b) & (c)

4.14 Connection of Existing Sewers (WSA 23)

Entire section adopted with the following amendment:

- Connection to sewer must be approved by WDRC. Connections may be required to be undertaken by Council at the developers cost.

4.15 Work As-Constructed Details (WSA 25)

Entire section adopted with the following additions:

- "As Constructed" plans shall include:

  (a) all pipe materials and sewer diameters
  (b) alignments to property boundaries (to a tolerance of 0.1m)
  (c) locations of end caps of property connections in relation to property boundaries (to a tolerance of 0.1m)
  (d) installation date and joining type
  (e) property boundaries, indicated by a chainage from the next downstream manhole
  (f) invert levels and finished levels of manholes (to a tolerance of 0.01m)
  (g) finished surface levels at each R.P. peg (to a tolerance of 0.01m)

Note that the top of the end cap to the property connection stub shall be located 1.0 m above finished surface level.

5.2 Standard Drawings

Table 1 Listing of Approved Standard Drawings

Drawing Number	Title
WATER SERVICES	
General locality plan	

WAT-1100	WSA 03-2002-2.2 Standard Drawing - Typical locality plan
Design site plan	
WAT-1101	WSA 03-2002-2.2 Standard Drawing - Typical site plan
W-001	WWDRC - Water Reticulation Design Layout (currently EDROC-25)
Typical Mains Construction	
WAT-1102	WSA 03-2002-2.2 Standard Drawing - Typical Mains Construction - Reticulation Main Arrangements
W-002	WDRC - Water Supply - Typical Mains Construction - DN63 Cul-De-Sac Arrangement
WAT-1105	WSA 03-2002-2.2 Standard Drawing - Typical Mains Construction - Connection to Existing Main
IPWEAQ W-0020	IPWEAQ Standard Drawing – Water Reticulation – Sample As-Constructed Plan
Property Services	
W-101	WDRC - Water Supply - Property Services - Single Service Main to Meter
W-102	WDRC - Water Supply - Property Services - Split Service Main to Meter
W-103	WDRC - Water Supply - Property Services - Dual Service Main to Meter
W-104	WDRC - Water Supply - Property Services - Garden & Median Strip
W-105	WDRC – Water Meter Assemblies – DN20 – DN25 Dual Check Above Ground
W-106	WDRC – Water Meter Assemblies – DN20 – DN25 Dual Check Below Ground
W-107	WDRC - Water Supply - Property Services - Detector Check 100mm Fire Service
W-108	WDRC - Water Supply - Property Services - Submetering General Arrangement
Embedment / Trenchfill and Restraints	
W-201	WDRC - Water Supply – Embedment / Trenchfill – Typical Trench Details
WAT-1200	WSA 03-2002-2.2 Standard Drawing – Soil Classification Guidelines and Allowable Bearing Pressures for Anchors and Thrust Blocks
IPWEAQ W-0041	IPWEAQ Standard Drawing – Water Main Thrust Block Details
WAT-1205	WSA 03-2002-2.2 Standard Drawing – Thrust Block Details Concrete Blocks
WAT-1207	WSA 03-2002-2.2 Standard Drawing – Thrust and Anchor Blocks - Gate Valves and Vertical Bends
Installation Practices	

W-301	WDRC - Water Supply – Installation Practices – Valve & Hydrant Assembly
W-302	WDRC - Water Supply – Identification Markers & Marker Posts
IPWEAQ W-0030	IPWEAQ Standard Drawing – Backflow Prevention Device Slab and Pole Mounted Cubicle
IPWEAQ W-0061	IPWEAQ Standard Drawing – C.I. Hydrant and Valve Boxes
SEWERAGE SERVICES	
Installation Practices	
W-301	WDRC - Water Supply – Installation Practices – Valve & Hydrant Assembly
W-302	WDRC - Water Supply – Identification Markers & Marker Posts
IPWEAQ W-0030	IPWEAQ Standard Drawing – Backflow Prevention Device Slab and Pole Mounted Cubicle
IPWEAQ W-0061	IPWEAQ Standard Drawing – C.I. Hydrant and Valve Boxes

5.3 References

- *Water Supply Code of Australia - WSA 03-2002 Version 2.2* 2002*,* 2nd edn, Water Services Association of Australia Inc, Melbourne.
- *Water Supply Code of Australia - WSA 03-2002 Version 2.3* 2004*,* 2nd edn, Water Services Association of Australia Inc, Melbourne.
- *Dual Water Supply Systems Version 1.2: A Supplement to the Water Supply Code of Australia - WSA 03-2002* 2005*,* 1st edn, Water Services Association of Australia Inc, Melbourne.
- *Sewerage Supply Code of Australia - WSA 02-2002 Version 2.2* 2002*,* 2nd edn, Water Services Association of Australia Inc, Melbourne.
- *Sewerage Supply Code of Australia - WSA 02-2002 Version 2.3* 2004*,* 2nd edn, Water Services Association of Australia Inc, Melbourne.
- *Sewerage Pumping Station Code of Australia - WSA 04-2005 Version 2.1* 2005*,* 2nd edn, Water Services Association of Australia Inc, Melbourne.
- *Department of Natural Resources & Mines: Planning Guidelines for Water Supply and Sewerage* 2005*,* Water Department of Natural Resources and Mines, Brisbane.
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- *Underground Distribution Construction Policy Manual (GAS)* 2004, ENERGEX Limited, Brisbane.
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- *Standard Drawings – Underground Distribution Construction (GAS)* 2004, ENERGEX Limited, Brisbane.
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- *Petroleum and Gas Act 2004 (Qld)*
- *Local Government Act 1993* (Qld)
- *Workplace Health and Safety Act 1995* (Qld)
- *Water Act 2000* (Qld)

Part 5 Standards for Design and Construction of Gas Reticulation Works

Part 6 Standards for design and construction of Landscaping and public parks

Table of Content

6.1 Introduction

6.2 Landscaping Standards

6.3 Specific Documentation Requirements

6.3.1 When are Landscaping Plans and Documents Required in the Development Application Process

6.3.2 Landscape Plan Presentation Standards

6.3.3 Types of Landscape Plans that may be Required

6.3.3.1 Concept Plan and Written Rationale

6.3.3.2 Landscape Plan

6.3.3.3 Landscape Plan with Open Space Rationale

6.3.3.4 Planting Plan

6.3.3.5 Vegetation Management Plan

6.3.3.6 A Site Analysis Plan

6.3.3.7 Rehabilitation Plan

6.3.3.8 Open Space Management Plan - Park Dedication and Design

6.3.3.9 Maintenance Management Plan

6.4 Street Tree Requirements

6.4.1 Verge Planting and Street Trees

6.4.2 Planting Areas

6.4.3 Plant Characteristics

6.4.4 Maintenance Preferences

6.4.5 Street Trees General

6.4.6 Street Tree Locations

6.4.7 Street Tree Planting Guidelines

6.5 General Plat Selection and Planting

6.5.1 Species Selection and Planting for Car Parks

6.5.2 Shade and Screening in Car Parks

6.5.3 Buffer Planting

6.5.4 Landscape Buffering Recommendations

6.5.5 Plant Selection

6.6 Parkland Standards

6.6.1 Constraints

6.6.2 Area and Perimeter Specifications

6.6.3 Park Location

6.6.4 Planting in Parks

6.6.5 Park Design
6.6.6 Park Embellishments
6.6.7 Playground and exercise equipment
6.6.8 Edging
6.6.9 Turfed Areas
6.6.10 General
6.6.10.1 Acceptable Embellishments Criteria Including Pay and Exercise Equipment
6.6.11 Slope
6.6.12 Considerations When Assessing Irrigation
6.6.13 Condition at 'On' and 'Off' Maintenance
6.6.14 Extension of 'Off' Maintenance Period
6.7 Landscape
6.7.1 Climate - General
6.7.2 Soils
6.7.2.1 Chinchilla
6.7.2.2 Dalby
6.7.2.3 Tara
6.7.2.4 Miles
6.7.2.5 Wandoan
6.8 Plant List for Each Region
6.8.1 Generalisations about planting in the Western Downs
6.9 Unacceptable Plants
6.9.1 What is a Declared Plant
6.9.1.1 Class 1
6.9.1.2 Class 2
6.9.1.3 Class 3
6.10 Appendix A - Plant List
6.10.1 Chinchilla
6.10.1.1 Medium to Large Trees
6.10.1.2 Large Shrubs to Small Trees
6.10.1.3 Trees and Shrubs
6.10.1.4 Small Shrubs
6.10.1.5 Groundcovers and Climbers
6.10.2 Dalby
6.10.2.1 Medium to Large Trees
6.10.2.2 Large Shrubs to Small Trees
6.10.2.3 Medium Shrubs
6.10.2.4 Small Shrubs
6.10.2.5 Groundcover

6.10.2.6 Climbers
6.10.3 Miles
6.10.3.1 Medium to Large Trees
6.10.3.2 Large Shrubs to Small Trees
6.10.3.3 Trees and Shrubs
6.10.3.4 Small Shrubs
6.10.3.5 Groundcovers and Climbers
6.10.4 Tara
6.10.4.1 Medium to Large Trees
6.10.4.2 Large Shrubs to Small Trees
6.10.4.3 Trees and Shrubs
6.10.4.4 Small Shrubs
6.10.4.5 Groundcovers and Climbers
6.10.5 Wandoan
6.10.5.1 Medium to Large Trees
6.10.5.2 Large Shrubs to Small Trees
6.10.5.3 Trees and Shrubs
6.10.5.4 Small Shrubs
6.10.5.5 Groundcovers and Climbers
6.11 Appendix B - Weed List

6.1 Introduction

The Design and Construction and Regional Standards Manual is intended to assist the applicant to conform to the minimum requirements of Council for design intent, installation, performance and maintenance of landscape works associated with development proposals.

The landscape component is designed to ensure that the land is managed in the most sustainable, accessible, durable and environmentally friendly way possible. This manual complements the Western Downs Planning Scheme and supports the Open Space Strategy.

This document supports the maintenance of the existing character of the Western Downs; it also supports safe, healthy open spaces, respect for existing maintenance regimes and a strategic approach to the installation of park assets.

One of the aims of Part 6 - Landscaping Manual is to encourage creativity in the design and construction of high quality, long lasting public landscapes which can be effectively managed at reasonable cost to Council.

6.2 Landscaping Standards

6.2.2 The Aim of Landscaping in Development

(1) To provide landscaping which protects and enhances the amenity and character of the area and protects the personal health and safety of each member of the community.

(2) To protect and enhance the nature conservation values of the environment of the area from adverse impacts of development.

(3) To be designed to be robust and to withstand natural processes.

(4) For land to be suitably allocated for parks and where open space exists in a development; it must not be called a park unless it fits Council's criteria.

To allow for the growth of innovative and progressive landscape design, variations to these minimum requirements will be considered by Council, upon request.

6.3 Specific documentation Requirements

6.3.1 When are landscape plans and documents required in the development application process?

All Material Change of Use or Reconfiguration of a Lot Applications need to address landscaping. The Planning Manager will determine what information is required depending on the specifics of the application. This will take the form of plans and rationales. At the very least an initial concept plan and a landscape plan will be required.

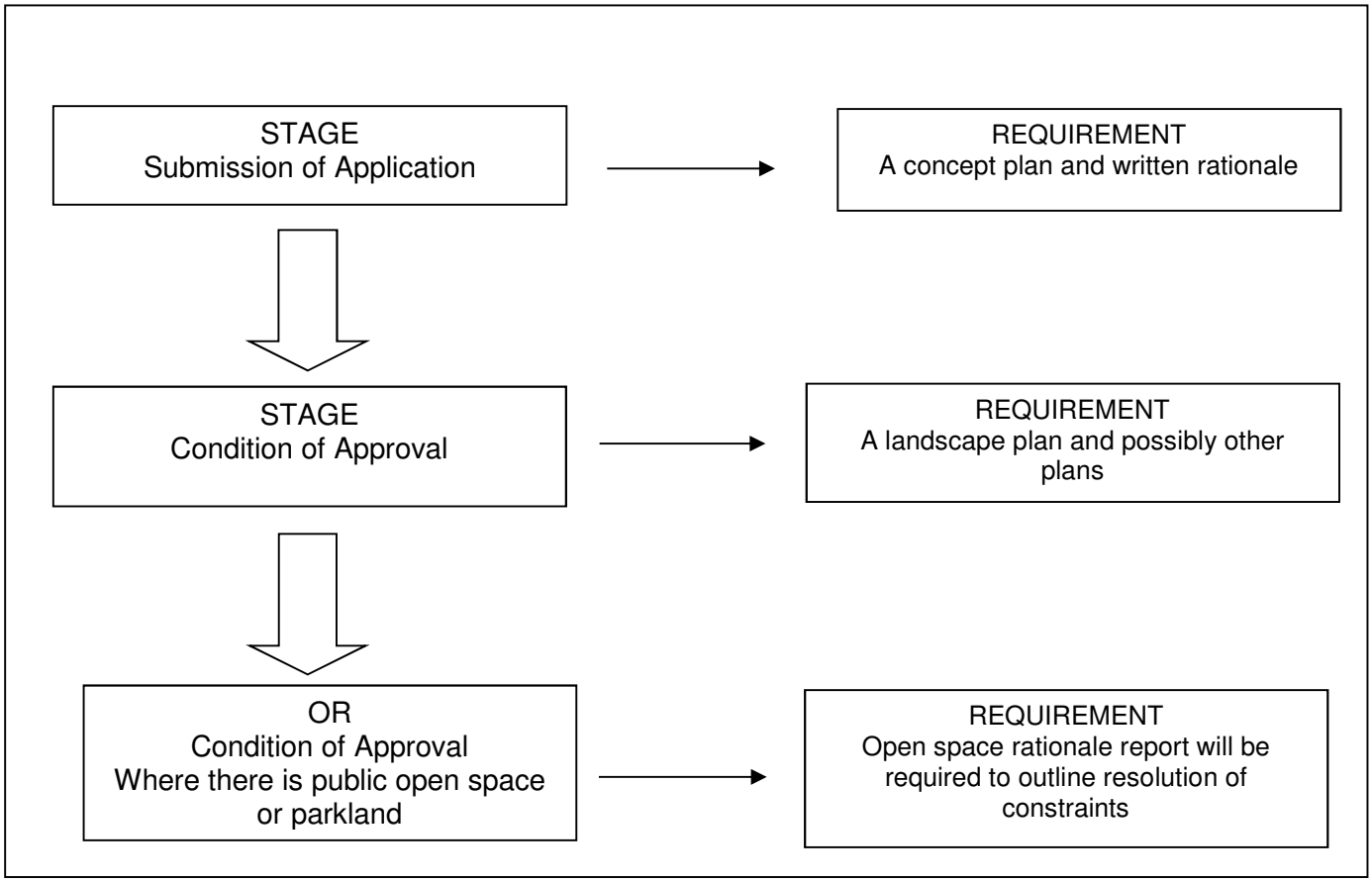

Figure 1: The process for applications for a material change of use or reconfiguration of a lot

6.3.2 Landscape Plan Presentation Standards

A Suitably qualified person to prepare Landscape Plan**.** The Landscape Plan shall be prepared by a suitably qualified and experienced landscape architect, horticulturalist, or other person experienced in landscape design and construction.

Landscaping Plans must have:

(a) Plant Schedule or where appropriate, a planting plan must contain

- Full botanical name
- Common name
- Height at maturity
- Spread at maturity
- Pot size
- Total numbers of species
- Legible plant symbology in legend so species are identifiable on the plan

6.3.3 Types of Landscape Plans that may be requested for Large Scale Developments

6.3.3.1 Concept Plan and Written Rationale

A landscape concept plan provides general information about the layout of the landscaping of the subdivision. Where the development is smaller and requires no provision of parkland, this mainly includes landscaping internal to the development. Where parkland is included, the landscape concept plan can also include basic traffic and pedestrian flows, connectivity to other parklands and other

open space; and may also illustrate landscape planning that addresses themes such as liveability, character and water overflow management. A written rationale can explain the design intent and link the basic themes of the design to Council's strategies for the region.

Concept plans indicate the location, size and function of the proposed landscape works and are to include the following, where applicable:

(a) Location and type of circulation patterns between various buildings, open spaces and public amenities
(b) Description and resolution of land use conflicts between the site and adjoining properties
(c) Location, type and function of buffer strips and other privacy provisions in relation to any land use conflicts
(d) Extent and description of landscape works in general
(e) Function of vegetation mass
(f) Flood levels
(g) General description of expected on-going maintenance regime where Council will eventually be responsible

For larger developments involving parkland, concept plans should address the following:

(a) Brief description of the site conditions and soil characteristics
(b) Site levels and contours
(c) General identification of the hardscape materials
(d) General identification of the areas to be landscaped notating:
    - **Form** - lawn, groundcover, vine, shrub, tree
    - **Function** - buffer, feature, ornamental, environmental
    - **Culture** - native (local), exotic, mixed
    - **Size** - describe the maximum/minimum size of plants by defining the restriction or provision of the view generated by the plant's placement e.g. Shrubs in car park median - traffic site visibility not restricted by shrubs at maturity, Crime Prevention Through Environmental Design principles

6.3.3.2 Landscape Plan

The Planning Manager may put conditions on the approval requesting detailed information about the landscaping and park embellishments. A landscape plan will be required to satisfy this requirement. It must address all conditions of approval cited by the Planning Manager. Where parkland is approved, then all park structures and embellishments must be clearly identified on the landscape plan.

As a minimum, the landscape plans should show the following:

- Proposed subdivision layout
- Open space area(s) including scale, contours and other relevant topographical information
- Existing and proposed linkages
- Road network
- Landscaping species lists
- Proposed minimum embellishments
- Environmental buffers
- Rehabilitation areas
- Planting plan
- Hard and softscape treatments

6.3.3.3 Landscape Plan with Open Space Rationale

In addition to the requirements for landscape plans, where open space/parkland is proposed show the following where relevant:

- Recreation nodes
- Bollards
- Cycle/walking tracks
- Pedestrian access and linkages
- Landscape buffer planting
- Individual protected trees, vegetation communities, significant flora and fauna, including habitats and corridors
- Existing features to be retained and removed
- Lakes, ponds and other low lying areas prone to ponding
- Open space rationale linking to the Western Downs Open Space Strategy. This is to be a text document to accompany the landscape plan.

6.3.3.4 Planting Plan

The planting plan outlines the location and type of each plant on the plan. This information is required in table format. A plant schedule is required on a planting plan, to be divided into trees, palms, shrubs, ground covers, climbers etc.

- Full botanical name in alphabetical order
- Common name
- Height at maturity
- Spread at maturity
- Quantity and pot size of each species
- Approximate calliper size at planting for trees only in pot size > 300mm
- Height and spread at planting for trees only in pot size > 300mm
- Spacing of all species and staking (if necessary)
- Legible plant symbology in legend so species are identifiable on the plan

6.3.3.5 Vegetation Management Plan

A vegetation management plan should contain at least:

- Property boundaries
- Existing or proposed building locations, driveways and access
- Waterways/water bodies
- Location of affected vegetation
- Location of vegetation to be protected
- Vegetation species and distances between structures and vegetation
- Revegetation areas

6.3.3.6 A Site Analysis Plan

An existing site analysis plan is generally submitted in concept plan format as part of the development application requirements. It is useful to include significant existing landscape elements within this plan. A specific site analysis plan is required for larger developments. The purpose of the site analysis is to assist both the applicant and Council in assessing the most beneficial development layout that optimises the existing 'natural' assets of the site. The site analysis indicates the location, identification and extent of vegetation and the effect and/or use of this vegetation in the proposed layout of the development.

The plan is to include the following:

(a) Existing contours of the site with reference made to physical constraints which dictate suitable and unsuitable building areas, road access, drainage patterns, waterways and temporary wetlands. Slopes steeper than 20% and flood affected areas must be included
(b) Existing access roads to the site
(c) Surveyed locations and extent of mass vegetation including locations of trees with diameters of 450 mm or greater located amongst the mass vegetation and any associated significant habitat areas
(d) Surveyed locations of any free standing trees in open areas not associated with mass vegetated areas
(e) Individual trees to be identified by species and/or genera and mass vegetation to be identified by vegetation type; notate information on drawing and include the condition, average diameter of the trunk of individual trees and 'significance' value (high, medium, low) per identification
(f) Photos of the vegetation are to be submitted with the plan; include a 'known' object in the photo to demonstrate the scale of the picture
(g) Abutting land uses and/or vegetation description including residential, commercial, industrial, farm or grazing land, bushland, wetlands and established parkland
(h) Road and allotment layout
(i) Major stormwater or drainage elements
(j) High to medium bushfire risk areas
(k) Limitations to infrastructure services such as water and sewage.

The development layout should show an obvious intent to conserve the significant vegetation and utilise the inherent features of the site with minimum disturbance and minimum development works expenditure.

6.3.3.7 Rehabilitation Plan

A rehabilitation plan will be required where areas of the site require rehabilitation works. It should contain:

- Existing vegetation
- Buffers
- Regrowth areas
- Species list

6.3.3.8 Open Space Management Plan - Park Dedication and Design

For each open space area proposed for dedication to Council, whether for recreation or environmental purposes, the following issues will be required to be considered:

- Parkland size, shape and distribution
- Function and connectivity
- Context
- Environmental impact/protection
- Access/location
- Community impact
- Safety

6.3.3.9 Maintenance Management Plan

A Maintenance Management Plan (MMP) is required for open space/parkland that will be handed over to Council. This is required at the commencement of the 'On Maintenance' period. This plan will contain the measures required to maintain the open space and relate directly to the concept plan and the landscape plan and rationale. The maintenance management plan will include provision of

detailed maintenance zones and maintenance regimes. It is to include accepted horticultural practices and codes/best practices necessary to establish the proposed landscape works in the maintenance period.

This information should give a clear indication of possible future management issues, in order to provide appropriate resources to maintain the areas to the required standard.
This is required to cover the following matters:

(a) Future management and maintenance regimes for protection of significant vegetation areas, ecological systems, waterways and fauna
(b) Tree management procedures
(c) Future management and maintenance regimes for sediment and erosion control devices
(d) Proposed future need for infrastructure including public facilities
(e) Maintenance of built form and hard surfacing
(f) Management and control of declared plants and recognised environmental weeds; and
(g) Management of rubbish

6.4 Street Tree Requirements

6.4.1 Verge Planting and Street Trees

Refer to Council's Urban Street Tree Policy for details regarding requirements for street trees. This policy does not over ride conditions stipulated by Council's Planning Department for a particular development.

The following is a basic outline of what is required:

- One street tree per lot.
- Street trees must be planted central to the lot boundary in the verge and be a reasonable distance from infrastructure on lot boundaries.
- Refer to P-001 *Standard Drawing* Parks and Gardens *Tree Planting in Street Verges*

6.4.2 Planting Areas

The planting area will usually consist of small shrubs and ground covers. High maintenance plants will not be accepted. After the "On Maintenance" period of establishment watering, there are to be no irrigation requirements.

6.4.3 Plant Characteristics

The selection of plants should reflect the purpose/function required, eg to provide shade, be hardy and require low maintenance.

6.4.4 Maintenance Preferences

(a) The use of long life plants rather than short life.
(b) Species choice must match the planting space available. Adequate space must be provided to allow root growth to proliferate within the space, and not into the adjacent surfaces/structures
(c) No irrigation once established and no pruning requirements
(d) No interference with existing above and below ground services, signage, street lighting, footpath, kerb and channel, structures, road structures and surfaces
(e) If specified, for aggressive tree roots use polypropylene root barrier or approved equivalent, minimum 600 mm depth to road side of tree pit.

6.4.5 Street Trees General

(a) All street trees are to have a min. 900mm clear trunk height for a 2.0m high tree at planting and be able to attain a clear trunk height of 1800 mm on maturity

(b) Significant existing trees should be identified and incorporated into parkland and road reserve planting where possible

(c) Avenues of consistent species where possible, allowing for use of individual feature trees at focal points e.g. roundabouts, ends of a local access road, medians of main collector road, etc.

(d) Species chosen should reflect the character and the conditions of the area. The species choice must be appropriate for the available space allowing for future growth including root development to accommodate the ultimate size and shape of the tree. Use Council's street tree list and submit a planting plan for approval.

(e) Street trees should be in scale with the streetscape

6.4.6 Street Tree Locations

Setback from the kerb should be sufficient to enable safe access and exit from parked vehicles and clear visibility at driveway crossovers and at pedestrian crossings. Consideration must be given to the location of underground services, street lights and traffic signs. All street trees must be planted a minimum 1.5 metres from the back of the kerb. This applies to all cul-de sacs, urban access roads, urban feeders and urban collectors.

Refer to P-*003 Standard Drawing* Parks and Gardens *Tree and Service Locations - Typical Urban Road*

Street trees must not be planted:

- Closer than 10 metres apart along any street
- Within 10 metres of any corner property alignment at any intersection
- Within 5 metres of any electric light pole
- Within 3 metres of any vehicular entrance
- Directly in front of any pedestrian entrance to any property
- Within a 2 metre wide section adjacent to the property alignment on the footpath
- In table drains unless approved
- Closer than 1.5 metres from the back of the kerb

Street trees should be planted in a central location to each residential allotment frontage.

Street trees planted in the vicinity of electricity infrastructure must be species selected from and planted according to guidelines issued by Ergon Energy under the "*Plant Smart"* title for the Western Downs Regional Council area. Appendix A of this manual is a list of recommended plants for use in the Western Downs including trees with height predictions. Appendix 3 C is the Ergon Energy recommended tree list for planting under powerlines. Refer to the Queensland Government's weed list: (http://www.ergon.com.au/__data/assets/pdf_file/0006/8673/Western-Downs-Approved-Brochure.pdf) or tree species submitted to Council for approval.

No plantings of poisonous or pest varieties of trees is permitted.

6.4.7 Street Tree Planting Guidelines

Street trees must:

- Be a minimum container size of 25 - 45 litres (larger is acceptable)
- Be a minimum semi-mature nursery stock
- Be staked with two hardwood stakes min 38 x 38 x 2000 mm

- Have root barrier installed where roots are considered potentially invasive (e.g. all ficus species), minimum 600 mm
- Planting techniques should include appropriate soil for maximum tree development and growth, it is unnecessary to increase the depth of the planting zone beyond 1.0 m, the greater benefit is in increasing the soil volume laterally
- If tree guards are used to protect trees from temporary accidental damage, they should be designed for easy removal once the tree is of sufficient size to no longer require protection. They should be removed at final inspection for Off Maintenance.

Refer to P-001 *Standard Drawing* Parks and Gardens *Tree Planting in Street Verges*

6.5 General Plant Selection and Planting

The Darling Downs is home to some significant national parks and state forest areas. It is of paramount importance that sound plant advice is sought before planting adjacent to these sensitive areas. Consideration must be given to appropriate plant choice as birds and other animals can distribute seeds into nearby bush-land and rainforest fringes causing destruction of natural habitat.

Plants must be drought tolerant. Endemic and native species are recommended.

6.5.1 Species Selection and Planting for Car Parks

Planting is not to restrict circulation, public safety and visual access to signage and associated businesses.

(a) The uses, types and form of adjacent development, existing natural features associated landscapes must be considered, Including but not limited to:
(b) Level of impact of the proposed planting on visual amenity, uses and activity
(c) No irrigation requirements
(d) No known environmental weeds or nuisance plants or invasive roots
(e) Climatic and growth habit of the plant to match the sites' requirements
(f) Species ability to thrive in circumstances where compaction will be a factor
(g) The natural tendency for the tree species to develop a single trunk (avoid species with multiple stems)
(h) Soil and sub soil conditions
(i) Traffic engineering requirements
(j) Trees within carpark areas (excluding landscaped buffer strips) are to have a minimum 900mm clear trunk height for a 2.0metres high tree at planting and be able to attain a clear trunk height of 1800mm on maturity
(k) All shrub planting is to be a max maintained height of 900mm from the road pavement (not top of kerb)
(l) All trees and shrubs are to be located so as to maintain adequate sight distance in accordance with traffic visibility
(m) Where trees are planted singularly, the planting pit is to have roughened sides and a decompacted base.
(n) Planting is to be contained and maintained within planting bed areas. Planting bed areas are to be a minimum of 4m² and planted in a natural soil profile.

6.5.2 Shade and Screening in Car Parks

In order to maximise the shade provided by trees planted within carpark areas, a north/south aisle orientation is desirable. This will increase shadow coverage over individual car parking spaces. (An east west orientation of the parking aisles will provide shade only to the southern aisles.)

To provide a good shade volume, shade trees can be planted every five to eight car parking bays minimum. Whole parking bays can be provided as garden beds to support these trees.

Where an open ground level area of carpark exceeds 300m² or accommodates in excess of 12 cars, at least five per cent (5%) of the car parking area including access aisles should be designed to include adequate landscaped areas so as to provide space for the deep planting of shade trees and shrubs. Any landscaped setbacks to the perimeter of the carpark are not to be included in this calculation.

6.5.3 Buffer Planting

The intent of buffer planting is to reduce the impact of incompatible land uses by creating buffer areas that provide for visual amenity and ameliorate the effects of noise/air pollution and wind. Buffer strips are to be sensitively designed as an integral part of the site works being appropriate to their function, whilst enhancing visual amenity and having regard to future maintenance regimes. A landscaped buffer strip may comprise of planting only, or be a combination of planting and fencing.

Planting is to consist of primarily shrubs and trees complemented by use of appropriate ground covers.

Buffer planting should specify and detail:

- Plant species, sizes and spacing that will provide the required screening function with relation to the specified objective for the required screening function within 3 years of plant growth
  Location of street trees to the frontage of the building
- Tyre stops and bollards to landscaped areas and tree stations that abut road frontages, car park aisles and bays, driveways and any other landscaped area accessible by vehicles
- Location of a buffer planting to side and rear building elevations, utility structures, trade entrances, storage and disposal areas, property boundaries and areas of high noise and air pollution generation
- Benign nature of plant material i.e. planting is not to create potential to cause damage, create a nuisance or major loss of sunlight, to adjacent properties.
- Maintenance regime of Council approved standard landscaped buffer strip.

6.5.4 Landscape Buffering Recommendations

Widths of landscaped buffer strips; for example a 3 metre minimum landscaped buffer strip has an effective screening of approximately 4-5 metres high, a 6 metre landscaped buffer strip has an effective screening of approximately 5-8 metre high.

Buffer Dimensions (side buffers over 10 metres wide)

- A minimum width of 10 metres should consist of 2 rows of off-set plantings
- Plants should be 4-5 metres apart
- Trees and large shrubs should be 4-5 metres apart
- Small shrubs should be 2-3 metres apart
- Heights of plants at maturity should be highest in the central row and lowest at the edge rows initial plantings where possible to commence at 1.5 metres height
- For buffers 3 metres or less, heights should be varied but 60% of overall height must be selected from trees and tall shrub lists

6.5.5 Plant Selection

(a) Use a variety of species with different growth habits
(b) Include species with different foliage for texture and effective screening
(c) All buffer planting to be 100% native and/or endemic species. No exotic plants accepted.

6.6 Parkland Standards

Landscape plans and specifications must be approved prior to the installation of landscape works on what will become Council maintained land (such as a park).

New parks will be acquired to meet specific activity or community use shortfall in line with the prissily infrastructure plan . Parks are designed to encourage walking, talking, sitting, gathering, playing and similar activities for residents who reside in close proximity to the park. Parks provide gathering places for families and groups to meet and celebrate. Activity areas should be designed to encourage social interaction and a connected community. A park may also function as a pedestrian/bicycle corridor. Vegetation patterns provide for a range of uses e.g. provision of shade, aesthetic appeal, and suburban open space. Parks may include significant areas of remnant vegetation.

Basics for all land to be considered for parkland:

6.6.1 Constraints

- To be free of hazards and constraints
- Not to be listed on the Contaminated Land Register or the Environmental Land Register
- Not to be encumbered by easement(s) of any type or form, or to be known to be subject of planned programmed future easement encumbrance(s)
- Not to predominantly have an overland drainage function
- Not to all lie below the Q100 flood level
- Land within creek corridors is generally unsuitable for active recreation

6.6.2 Area and Perimeter Specifications

- Should be greater than 15 metres wide for linear linkage parks unless part of a linkage or minor entry point in which case a 5 metres minimum applies
- Land under high voltage power lines or within 50 metres of the line easement should not be counted as contributing to the Minimum Level of Supply (MLS)
- Land for sporting use should be at least 150 metres in any direction
- Land for sporting use should have more than 60% flat to gentle slopes (max 1:10)
- Not less than 50% road frontage adjoining park perimeter where possible
- Preferred shape for a park is square to rectangular with the sides no greater than ratio 2:1
- Should not be less than 100 metres wide
- Should not have a gradient greater than 1:5
- The area of water bodies contained within proposed public open space is not to be included in the area of proposed parkland

6.6.3 Park Location

- Dedicated park land must be internal to a development or be located where it will be internal to a residential area identifiable by peripheral urban collector roads
- Dedicated park land must be able to be classified in the WDRC Parks hierarchy structure and meet its criteria for inclusion
- Not to be adjacent or close to noxious or noisy activities
- Parks should be located with consideration to adjoining land uses and be adequately buffered from incompatible use

6.6.4 Planting in Parks

- All parkland to be free of environmental weeds and class 1 & 2 declared plants
- Turf is to be Zoysia, Buffalo Grass, Queensland Blue Couch or native grass such as 'Nara' native turf

- Park trees not to be located within 10 metres of privately owned adjacent land
- All plants must be drought resistant species
- Where ponding may occur choose species that will tolerate sitting in water
- Protect existing vegetation and topographic features where possible
- Protect and retain vegetation of cultural, historic or amenity value
- Select trees from the tree list in this document
- Mulch around the base to the edge of the canopy
- Hardwood stakes to stabilise newly planted trees are to be straight and free from knots
- Stakes to be removed after 12 months
- Fertiliser to be placed in tree pit where required
- All planting media to conform to AS 4419 -2003 Soils for landscaping and garden use
- Locate trees to provide shade and shelter to park embellishments
- Recommended to shade pathways with trees planted at 6 metre intervals
- Plants or trees not to be closer than 1.2 metres unless in a mulched garden bed for mowing purposes
- All park trees to have a clear trunk minimum 900mm height for a 2 metre high tree at planting and be able to attain a clear trunk height of 1800mm on maturity
- Trees to be planted in accordance with P.002 Standard Dramry

Refer to P-002 *Standard Drawing* Parks and Gardens *Tree Planting in Parks*

6.6.5 Park Design

- Crime prevention through environmental design (CPTED) principles must apply to design of park elements e.g. park furniture to be oriented for supervisors to clearly view children at play

6.6.6 Park Embellishments

- Park embellishments must include signage and shaded seating
- Parks should not contain toilets unless required by condition of the park hierarchy
- Elements selected for a park should be sensitive to the setting of the park (urban to natural) and provide an identified mix of two to three opportunities across communities for a local recreational park. This should include seating
- Park furniture should be robust and termite and pest-resistant
- Local recreational/neighbourhood parks should not include irrigation
- All external shade structures must be durable; no finger jointed or other glued timber palings to be used
- Street and park furniture is to be installed on concrete pads and bolted for easy replacement
- All park embellishments to be vandal and graffiti resistant
- Avoid finished height difference between slab and turf surface
- Bin locations to be determined in consultation with Council
- Shade sails to be strong and durable and have easily replaceable components
- Garden edging to be made from robust materials, be termite and pest resistant, be low maintenance and with a lifespan of 15-20 years
- All park structures, embellishments and trees to be a minimum of 1.2 metres apart unless sharing the same concrete pad or in a garden bed or in a mulch zone such as a playground

6.6.7 Playground and Exercise Equipment

- Playgrounds to be located no closer than 25 metres to private properties, road reserves, dense bushland, watercourses and any other areas that may jeopardise the safety of children or where their play may disturb neighbours

- Playgrounds and exercise equipment should be shaded either by trees or shade structures. Council will look favourably on the planting of advanced trees around playgrounds and over seating
- Playgrounds and exercise equipment in an area that floods in a less than 10% Annual Exceedance Probability (AEP) flood event must have rubber soft fall pads installed
- Playground and soft fall design and construction is to comply with the requirements of the relevant and current Australian Standards both in supply and installation
- Playgrounds to have a design life of a minimum 10 years and a warranty of 10 years for steel structural items, 5 years on all plastic (need to check warranties)
- Soft fall should be a light colour to avoid creating a heat sink

6.6.8 Edging

- All edging is to be designed with smooth navigable lines and be able to sustain the movement of tractor mowers and maintenance vehicles where necessary
- Playground loose soft fall must be edged
- All garden/mass planting areas, signposts, bollards etc. associated with development, are to be contained with a fixed durable edge.
- All edging to be level with turf

6.6.9 Turfed Areas

- Turfed areas are not to be used on batters steeper than 1:4
- Where open space areas are proposed as public park areas, the road reserve area is to be established turf

6.6.10 General

A post-installation inspection independent audit must be conducted independently to verify compliance with the relevant Australian Standards on all park structures. Council is to be supplied with an inspection checklist from the time of installation. A copy of the manufacturer's certificate of conformity and copies of the test reports to AS 4685:2004 (or more recent standard if superseded) be given to Council. A manufacturer must be selected who will ensure a reasonable supply of spare parts and repair facilities. All certificates and warranties on installed park furniture and playgrounds to be presented to Council at beginning of maintenance period.

6.6.10.1 Acceptable embellishments criteria including play and exercise equipment (Table)

Embellishment	Warranty/Life Span	Relevant Australian Standard
BBQ	Cabinet - durable – min 10 years	AS 60335
Bike rails	Design life – 15 years	AS 2890
Bins	Durable – min 20 years	AS 4123
Play and Exercise Equipment		AS 4685 and AS 4422 (softfall) AS 4685.1-.6 2004 Playground equipment AS/NZS 4422 1996 Playground Surfacing - Specifications, requirements and test method AS/NZS 4486 1997 Playgrounds and Playground equipment -

		Development, installation, inspection, maintenance and operation AS 1428.1-.4 Design for Access and Mobility
Picnic Tables and Benches	Durable – min – 15 years	
Shade sails	Design life – min 10 years, steel work – 10 years, membrane – UV degradation on fabric - 10 years	AS4174 (UV Protection)

6.6.11 Slope

The following identifies preferred gradient/slope ranges of typical areas that require hard surfacing:

- Pathways/Bikeways 1% - 8%
- Entrance walks 1% - 4%
- Pedestrian Ramps up to 8%
- Ball play areas 1% - 3%
- Adventure Playground Pad 1% - 3%
- Terrace and sitting areas 1% - 2%

The following identifies preferred gradient/slope ranges of typical areas that require soft landscaping treatment: (have included this because of Miles e.g. of raising house pads and creating a lake with slopes)

- Grassed swales 2-10%
- Terrace and sitting areas 1-2%
- Grassed banks up to 1:4
- Planted banks up to 1:3

6.6.12 Considerations when Assessing Irrigation

- Purpose and function of area being serviced by irrigation
- Maintenance requirements of planting
- Cost of continued maintenance and operation of irrigation system and associated infrastructure
- Continued costs of potable water supply
- A 'no irrigation' regime with resilient planting will be looked on favourably

6.6.13 Condition at on and off Maintenance

- To be 'as new'
- All large open and grassed open space areas are to have established grass cover of 90% and be left in a mowable condition, with the exception being where such vegetation performs an environmental or visual function
- All surface rock over 25mm is to be removed from open space areas where mowing is intended
- All construction debris and rubbish/litter is to be removed
- All sediment and erosion control devices, irrigation, hard surfacing and fire-fighting infrastructure are to be left in good repair to the satisfaction of Council
- No weeds
- Plants such as street trees to be healthy and showing signs of establishment

6.6.14 Extension of off Maintenance Period

If a private resident/private developer wishes to continue responsibility for maintenance of landscape works and associated irrigation systems after the 'off ' maintenance period, a written agreement from Council will be required which details:

(a) Responsibilities for water costs
(b) Responsibilities for management of planting and associated irrigation, hard surfacing and other built Elements
(c) Maintenance requirements of planting
(d) Extent of time of the agreement
(e) Continued costs of potable water supply
(f) Spraying times and spraying patterns for irrigation
(g) A public risk insurance policy is to be entered into by the private resident/managing body/developer of the development or residence adjacent to cover the landscaped area and irrigation system within the road reserve area for the specified period of time.

6.7 Landscape

It is important to be aware of the climatic and soil conditions in areas to be landscaped and planted.

6.7.1 Climate - General

The climate in the Western Downs is subtropical and more extreme than coastal areas. Hot summers can be characterised by dumping thunderstorms with generally drier winters. Long periods without rain have been recorded. The maximum daily temperatures in summer average around 30.8°C, maximum temperatures can be in the low 40°Cs and winter mornings can record below 0°C. Typical winter days include frosty mornings (average minimums 2.8°C - 4°C) with average winter maximum temperatures of just below 20° C. Chinchilla records winter minimums of -5°C and summer maximums of 44°C. Gardeners should consider plants that can survive long periods of low rainfall, very hot temperatures in summer and frost unless placed in a protected area. All towns within the Western Downs that have reticulated water are subject to water restrictions.

6.7.2 Soils

All soils benefit from organic matter being dug into them and applications of mulch. A long term regime of mulching over time will improve the structure of the soil. Soil texture and structure may have changed depending on the influence of previous gardeners so a pH test is a good idea. It is important to choose plants that suit the conditions. Adding conditioners such as seaweed and worm juice will add nutrients to the soil. After drought many soils will develop water repellent properties which will require attention. Soil testing is a good idea. The following information about soils in the Western Downs town centres is general information only.

6.7.2.1 Chinchilla

The soil in and around Chinchilla varies, generally on the north and east sides the soil is red loam. The red loam is acidic and generally drainage is good. The west side tends to be more gravelly and clay. Some parts of Chinchilla are sandy and some parts have black soil. An addition of organic matter will assist with water retention and improve soil structure. Mulching will also assist with water retention.

6.7.2.2 Dalby

Generally the soil in and around Dalby is alkaline black soil. This cracking clay contracts and expands depending on its moisture content. Generally it does not have good drainage. Black soil will benefit from having organic matter added to it. A regular mulching regime over years will alter soil structure and improve drainage. Raising garden beds will immediately improve drainage.

6.7.2.3 Tara

Generally the soils around Tara are shallow sandy alkaline soils with good drainage. For gardeners this means these soils need organic matter added to them and a good mulching regime to build structure which will assist with water retention and add nutrients.

6.7.2.4 Miles

Soils in Miles are generally sandy brown textured loam that can be gravelly. Generally these soils are alkaline. Drainage is good and water holding capacity of these soils is poor. Again, addition of organic matter such as compost and mulching will improve these soils.

6.7.2.5 Wandoan

Soils in Wandoan are generally sandy brown textured clay with good drainage. Water holding capacity will be improved with the addition of organic matter such as compost. Mulching will improve these soils.

6.8 Plant Lists for Each Region

The plant lists in appendix 1 are a guide only. They have not been ratified by Council. They are to assist developers when choosing plants that will suit the climate and soils in the area. These lists reflect the WDRC's Community Plan which states that: "Landscaping focuses on local species which enhance local character and improves sustainability." The purpose of this list is also to assist people by choosing non-invasive plants that grow in each of the areas of the Western Downs. Accordingly, the use of plants endemic to the local area are encouraged, particularly in rural and regional areas. This section provides a species list to assist with planting choice. Not all species will be available in nurseries, the choice is broad to offer a range so that there will be many species on the list that are available from local nurseries. Nurseries continue to stock well known natives such as grevilleas, callistemons and eremophilas that all grow across the Western Downs. The following list is an advisory list. New hybrids and cultivars are coming onto the market all the time. Talk to your local nursery to get advice about the planting area; micro-climates, patches of different soil types and aspect all contribute to planting conditions. This list contains plants that can be categorised as low maintenance and hardy. Effort has been made to include plants that will tolerate frost and drought. Many plants that are moderately frost tolerant will benefit from being protected when young, and all plants will benefit from being properly watered in after planting or transplanting. Always water fewer times and for longer encouraging deep root growth. All plants will benefit from good gardening practices such as mixing organic matter into the soil and mulching well. The list is in tabular form below and includes important information relating to habitat and growing conditions. This is not an exhaustive list, it is a guide and will be updated regularly as more is known about introduced species, more hybrids and cultivars become available and more endemic species are sold through nurseries. Ask local nurseries about endemic plants because using them is the safest and most responsible planting practice and should be promoted.

6.8.1 Generalisations About Planting in the Western Downs

It is generally accepted that most grevilleas will grow very successfully in Chinchilla, Kogan, Tara, Miles, Bell and surrounding areas. Grevilleas grown in Dalby are usually grafted onto Grevillea robusta rootstock. Callistemons and Melaleucas grow successfully throughout the Western Downs. Eremophilas grow very well in Dalby and successfully throughout the Western Downs. Plants need to be able to withstand dry winters with frost and hot summers with dumping thunderstorms leaving pools of water. Microclimates through the area and general changes in weather patterns such as La Nina and El Nino effects will create vast variations in these basic conditions.

The lists for each region are divided into these main categories:

- Medium to large trees (over 10 metres) (including exotics for street trees)
- Large shrubs to small trees (5-10 metres) (including exotics for street trees)
- Medium shrubs (2-5metres)
- Small shrubs (0.2-2metres)
- Groundcovers
- Climbers

Uses key:

S	street tree
L	identified as providing local character
B	buffer planting
F	farm/windbreak
E	endemic for garden use
G	garden use
R	revegetation
W	wildlife habitat

6.9 Unacceptable Plants

Any species listed as a Noxious or Environmental Weed will not be permitted in landscaping for developments in Western Downs Regional Council area. It is recommended that plants known to be toxic are not planted in public areas e.g. oleander. Species in **Appendix 2 Plants Not To Be Planted In Western Downs** are not recommended for planting in the Western Downs due to their high reproduction rates and their ability to rapidly spread into areas of native vegetation and cropping land. These plants have been declared weeds using the classifications of the Queensland Government. Any plant identified as a weed in neighbouring councils that is not listed may also be considered a weed in Western Downs. Toowoomba Regional Council and South Burnett Regional Council have comprehensive weed lists. New information is being added all the time.

6.9.1 What is a Declared Plant?

The Queensland Government classifies weeds into 3 classes of Declared Plants of Queensland. The following information is taken from the Queensland Government's Department of Agriculture, Fisheries and Forestry fact sheet. No plant declared a weed or noxious plant under the *Land Protection (Pest and Stock Route Management) Act 2002* and included in all classes of declared plants must be used as a street tree or planted in any development in the Region. Declaration under the Act imposes a legal responsibility for control by all landowners on land under their management.

6.9.1.1 Class 1

A Class 1 pest is one that has the potential to become a very serious pest in Queensland in the future. We need to prevent the introduction, possession and sale of these species so that they can't escape to become pests. All landholders are required by law to keep their land free of Class 1 pests. It is a serious offence to introduce, keep, release or sell Class 1 pests without a permit.

6.9.1.2 Class 2

A Class 2 pest is one that has already spread over substantial areas of Queensland, but its impact is so serious that we need to try and control it and avoid further spread onto properties that are still free of the pest. By law, all landholders must try to keep their land free of Class 2 pests and it is an offence to possess, sell or release these pests without a permit. Fines apply.

6.9.1.3 Class 3

A Class 3 pest is one that is commonly established in parts of Queensland but its control by landowners is not deemed to be warranted unless the plant is impacting, or has the potential to impact, on a nearby 'environmentally significant area' (e.g. a national park).
It is an offence to sell, introduce, release or supply a Class 3 pest. Fines apply.

Species not declared under the Land Protection (Pests and Stock Route Management) Act 2002 may still be declared at a local government level under local laws. The Western Downs list is contained in Appendix 2.

Refer to the following fact sheet from the Queensland Government for lists of declared plants: http://www.daff.qld.gov.au/documents/Biosecurity_EnvironmentalPests/IPA-Declared-Plants-Qld-

PP1.pdf Refer also to Weeds Australia (www.weeds.org.au) or more specifically to the Brigalow belt regional web page of Weeds Australia:
http://www.weeds.org.au/cgi-bin/weedident.cgi?tpl=region.tpl&state=qld&region=bbs

6.10 Appendix A

This list is a guide only. Heights are advisory only. Heights of plants vary depending on situation, care and climate. Trees in Dalby will not reach the heights of the same trees in coastal areas.

6.10.1 Chinchilla

6.10.1.1 Medium to Large trees (over 10 metres)

This list includes exotics that can be used for street trees and in many cases are being used as street trees.

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Acacia Pendula	Weeping Myall	Graceful, weeping habit and blue-grey foliage	Prefers well drained sandy soils but will grow in clay soils	Frost and drought tolerant, will grow in part-shade	S G W
Angophora costata	Smooth Barked Apple	Height to 25m. Trunk gnarled and crooked, pink to pale grey bark, cream flowers in summer, bark sheds in Spring	Well drained soil but is tolerant of many conditions	Drought tolerant, new tips can suffer frost damage	L F W
Brachychiton australis	Broad Leaved Bottle Tree	Grows to 12m, fast growing, large maple like leaves, deciduous while flowering, cream flowers in early summer	Will grow in most soils: well-drained to poorly drained soils and alkaline soils	Frost and drought tolerant	S G
Brachychiton Discolour	Lacebark tree	Height to 12m, pink flowers when semi-deciduous	Tolerates a range of soils, can be slow growing	Frost and drought tolerant	S G

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Brachychiton rupstris	Bottle tree	Height to 20m, bottle shape develops in 5-8 years, drops leaves before flowering in Spring	Tolerates a variety of soil types	Frost and drought tolerant	L F E G W
Brachychiton populneaus	Kurrajong	Height to 10m, cream coloured bell shaped flowers in summer	Tolerates a variety of soil types	Drought tolerant and moderately frost tolerant	S
Caesalpinia ferrea	Leopard tree	Large tree to 15m, smaller in harsh conditions, bright yellow flowers, dappled grey bark, used as a street tree	Likes well-drained oil	Will tolerate long periods of dryness and light frosts	S L
Casuarina cristata	Belah	Large tree to 20m, fine needle foliage and rough grey bark	Tolerates a variety of soil types	Frost and drought tolerant	S F
Casuarina cunninghamian-a		Height to 15m, narrow tree with irregular shape and dense foliage	Tolerates poor soils, prefers well drained soils, slightly acidic to very alkaline	Frost and drought tolerant, prefers full sun	S F
Ceratonia siliqua	Carob	Height to 12m, dark green foliage	Prefers a free draining soil but will tolerate harsh environments	Frost and drought tolerant	F
Cupaniopsis Anacardioides	Tuckeroo	Small tree with dark green leathery foliage, grey trunk, yellow fruit	Tolerant of a wide range of soils, very hardy tree	Drought tolerant, will tolerate light frost	S B G

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Eucalyptus argophloia	Chinchilla white gum	Height to 35m, narrow tree	Most soil types, mildly acidic to mildly alkaline	Frost and drought tolerant	L F
Flindersia australis	Crow's Ash	Height to 10m	Tolerates most soils	Drought tolerant and tolerates light frost, more tolerant with age	B G W
Flindersia brayleyana	Qld maple	Height over 15m, with columnar shape, shiny foliage, white flowers in summer	Needs well drained soil	Tolerates moderate frost	S B G W
Flindersia maculosa	Leopard wood	Height to 15m, beautiful tree with mottled trunk	Tolerates most soils	Frost and drought tolerant	S B F E G W
Flindersia schottiana	Cudgerie Silver Ash	Height to 15m, white scented flowers	Good drainage and acidic soil	Drought tolerant and moderately frost tolerant	S L
Ginkgo biloba	Maidenhair tree	Butterflied fan-like leaves, autumn colours	Tolerates almost all soil types, likes well drained soil	Full sun, frost and drought tolerant	S
Gmelina leichardtii	White beech	Height to 15m in cultivation (probably less)	Well drained soil	Drought tolerant, will bounce back from frost	S L
Grevillea robusta	Silky oak	Height to 20m, used as a street tree	Tolerates alkaline soil	Drought and frost tolerant	S L

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Guioa semiglauca	Wild quince	Height to 12m in rainforests, probably much smaller, fluted trunk when older	Mildly acidic to mildly alkaline	Drought tolerant and observed to be frost tolerant	S G
Jacaranda mimisifolia	Jacaranda	Tropical tree, height to 12m, in September loses leaves and displays spectacular purple flowers, used as a street tree	Tolerates most soil conditions	Drought tolerant and moderately frost tolerant	S G
Jagera pseudorhus	Foambark	Rainforest tree to 10m, will not reach rainforest heights, brownish hairy flowers, pioneer species	Adapts to most soils	Drought tolerant and moderately frost tolerant	G
Liriodendron tulipifera	Tulip tree	Height to 20m, large leaves	Adapts to most soils	Drought tolerant	S
Lysiphyllum hookerii syn Bauhinia hookerii	White bauhinia	The native Bauhinia is a rounded and attractive tree with pendulous outer branches. It can grow to 12m, slow growing	Clay Soils	Full sun, partial sun or shade. Dry or moderately wet areas	S B E G R W
Macadamia interifolia	Macadamia nut	Edible nuts	Will grow in most well drained soils	Position away from hot winds	G

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Magnolia grandiflora	Bull bay magnolia	A beautiful dense tree to 25m, elegant white cup shaped flowers	Well drained soil	Drought and frost tolerant	S
Melaleuca irbyana	Weeping paperbark	Height 8m to 12m with thick spongy, papery bark and weeping branches	Will grow on poorly drained soil and clay soils	Drought and moderately frost tolerant	S B F G W
Melaleuca stypheliodes	Prickly-leaved paper bark	Height to 20m, dense rounded canopy and drooping branchlets, bark peels off	Tolerant of most soil types, due to its deep-rooting characteristics, lawn can be grown under its canopy	Drought and frost tolerant	S B F G R W
Polyscias murrayi	Pencil cedar	Height to 15m, umbrella shapes	Tolerates most soils, prefers well drained soils	Drought tolerant and tolerates light frost	S
Pyrus calleryana	Callery pear	Height to 14m, columnar shape, showy blossoms	Able to handle wet heavy soils	Drought and frost tolerant	S G
Rhodosphaera rhodanthema	Deep yellow wood	Medium tree to 12m, columnar shape	Tolerant of most soils, mildly acid, prefers good drainage	Drought and frost tolerant	S B F G
Quercus suber	Cork oak	Height to 20m in Melb, so less here	Intolerant of compaction	Drought tolerant once established, frost tolerant	S

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Stenocarpus sinuatus	Qld firewheel tree	Small tree in cooler areas, spectacular orange flowers	Prefers deep, moist, well-drained soil, will grow well on sandy loams to clay loams.	Drought tolerant and frost to -2, protect when young	G
Toona ciliata	Red cedar	Height to 20m, fast growing majestic tree, sprays of white aromatic flowers	Prefers well-drained soil	Drought and frost tolerant	S L

6.10.1.2 Large shrubs to small trees (5-10 metres)

This list includes exotics that can be used for street trees and in many cases are being used as street trees

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Agonis flexuosa	WA Peppermint	h-10m w-5m long narrow leaves, small white flowers, weeping habit			
Banksia integrifolia subs. Integrifolia	Coast Banksia	Height to 5m, will grow higher in favourable conditions	Prefers sandy acidic soil but will grow in sandy clay loam	Drought tolerant and moderately frost tolerant	S G W
Banksia integrifolia subs. monicola	Banksia	Height to 5m, will grow higher in favourable conditions	Light to medium clay	Drought and frost tolerant	S G W
Elaeocarpus eumundi	Eumundi quandong	Height to 8m, dense shiny foliage excellent screening plant	Prefers free draining soils	Drought tolerant, will tolerate light frost	B
Elaeocarpus reticulatus	Blueberry Ash			Drought and frost tolerant	B
Callistemon viminalis	Weeping bottle brush	Medium tree to 8m brilliant red bottle brush flowers in Spring and Autumn	Tolerates poor drainage	Frost and drought tolerant	S L B F E G R W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Eucalyptus crenulata	Buxton silver gum	Fast growing tree to 8m, fine crenulated solver/pink foliage	Tolerates waterlogging, sandy and clay soils but prefers well drained soils	Drought and frost tolerant	
Eucalyptus torquata	Coral gum	Small to medium tree to 6m	Tolerant of most soil types and climatic conditions, but does prefer full sun and well-drained soil.	Drought and frost tolerant	
Geijera parviflora	Wilga	Medium tree to 9m, ornamental weeping foliage, round shape, strongly scented, small white flowers	Endemic, so tolerates most soil conditions, prefers good well drained soil	Drought and frost tolerant	S L B E G W
Gordonia axillaris (Franklinia axillaris)	Fried egg plant	Height to 5m, huge 'fried egg' flowers, prunes well into a hedge	Prefers slightly acidic soil	Moderately drought and frost tolerant	
Botanical Name	**Common Name**	**Features**	**Soils**	**Conditions**	**Appropriate uses**
Hakea laurina	Pin cushion hakea	Height to 5m, small round tree with curly leaves and bright red and cream pin cushion flowers in winter	Tolerates any soil that is lime free	Drought tolerant, in frosts new tips will burn, can cover until up to 1m	

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Hakea petiolaris	Sea urchin hakea	Small tree to 9m	Well drained and slightly acidic soil	Drought and moderately frost tolerant	
Harpullia pendula	Tulipwood	Small tree with a dense crown of glossy green leaves with smooth grey bark, will not grow as big as coastal specimens	Tolerates soil conditions	Drought and frost tolerant	S G
Hymenosporum flavum	Native frangipani	Small to medium tree to 10m, cream to golden scented flowers	Tolerant of most soils, prefers well drained soil	Drought and frost tolerant	
Lagerstroemia indica	Crepe myrtle	Beautiful small flowering tree	Tolerant of most soil types	Drought and frost tolerant	S G
Leptospermum petersonii	Lemon scented tea tree	Height to 5m, many small white flowers	Tolerates poor soil	Drought tolerant, protect from frost	G W
Malus floribunda	Japanese crab apple	Small tree to 5m, beautiful floral display, round and dense	Well drained soil	Drought tolerant once established, frost tolerant	G
Malus ioensis 'Plena'	Crab apple	To 6m, masses of mildly fragrant double flowers in late spring	Prefers slightly acidic, well-drained soil	Drought and frost tolerant	S L G

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Melaleuca decora	White feather honey myrtle	Height to 6m, mass of cream yellow flowers in spring	Tolerates most soils	Drought and frost tolerant	B G R W
Melaleuca linariifolia	Snow in Summer	Height to 8m, white fluffy flowers cluster over the plant in summer	Tolerates all soils	Drought and frost tolerant	B F G W
Notelaea longifolia	Large mock olive	Usually small tree to 3m but can grow up to 9m	Tolerates most soils	Drought tolerant and tolerates mild frost	B F G W
Pistacia chinensis	Chinese pistachio	Height 6-10m	Adapts to most soils, prefers acidic well-drained soils	Drought and frost tolerant	S G
Pittosporum angustifolium	Weeping pittosporum	Height to 6m, slow growing, weeping foliage	Wide range of well drained soils	Drought and frost tolerant	S L B F E G W
Pittosporum rhombifolium	Qld holly	Height to 8m	Tolerates most soils	Drought tolerant and moderately frost tolerant	G

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Syzygium australe	Lillly pilly, brush cherry	Height to 8m, compact form, good for hecging	Tolerates most soils	Drought tolerant and reasonably frost tolerant, is extremely hardy once established	S B F G
Syzygium leuhmannii	Small leaved lilly pilly, riberry	Height to 8m, fluffy white flowers, pink new growth	Tolerates most soils	Drought tolerant and moderately frost tolerant	B F G W
Syzygium paniculata	Magenta cherry	Height to 8m in cultivation	Tolerates most soils	Drought and frost tolerant	B F
Ulmus parvifolia	Chinese elm	Small to medium tree, height to 10m	Tolerates most soils	Drought and frost tolerant	G

6.10.1.3 Trees and shrubs (2-5 metres)

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Acacia chinchillensis	Chinchilla wattle	Grows to 3m	Well drained soils	Frost and drought tolerant, in partial shade or full sun	L B E G W
Alyogyne hakeifolia		Medium shrub to 3m, purple, pink or yellow flowers, needle-like foliage	Intolerant of bad drainage	Drought tolerant, shelter from heavy frost	BGW
Alyogyne huegelii	Lilac hibiscus	Grows to 2.5m, medium sized bushy shrub, good understorey plant, small purple hibiscus flower	Can cope with heavy soil, but likes reasonably well-drained soils	Drought tolerant, shelter from heavy frost	B G W
Brachychiton bidwillii	Little kurrajong	Grows to 3m. orange-red flowers on bare branches, flowers best in full sun	Tolerates a wide range of soil types, likes well-drained soil	Frost and drought tolerant.	L G W
Ceratopetalum gummiferum	NSW Christmas bush	Grows to 5m, red 'flowers' in December	Well drained soil	Frost tolerant	G W
Eucalyptus argophloia dwarf	Dwarf Chinchilla white gum	Height to 4m, weeping form	Thrives on heavy soil	Frost and drought tolerant	S L B F E G R W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Eucalyptus boliviana		Height to 5m, bluish leaves	Prefers deep loam soil	Frost and drought tolerant	F G R W
Gossypium sturtianum	Sturt's Desert Rose	Height to 3m with hibiscus like flowers	Prefers well drained soil	Drought tolerant and moderately frost tolerant	G W
Gossypium sturtianum var. nandewarense	Sturt's Desert Rose	Height to 3m with pinky hibiscus like flowers	Prefers well drained soil	Drought tolerant and more resistant to frosts than sturtanum	G W
Botanical Name	**Common Name**	**Features**	**Soils**	**Conditions**	**Appropriate uses**
Indigofera australis	Pink pea flowers	Grows to 2.5m	Well drained acid soils	Tolerates moderately heavy frost, semi shaded position	B E G R W
Jacksonia scoparia	Native dogwood	Grows to 4m Pea - like yellow flowers in spring, grey green arching branchlets	Well drained sandy and loamy soils	Full sun, part shade	E G W
Kunzea baxteri	Crimson kunzea	Grows to 4m	Well drained soil	Drought tolerant, sheltered position - tolerates light frost	B G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Kunzea opposita		Grows 1.5-3m, pink flowers at the end of branchlets	Well drained soil	Drought tolerant, may be damaged by heavy frost	E G W
Leptospermum lanigerum	Woolly tea tree	Grows to 3m, pendulous habit	Most soils	Drought and frost tolerant	B F G W
Magnolia Little Gem	Little gem	Small tree to 3m	Well drained soil	Drought and frost tolerant	G
Melaleuca elliptica	Granite bottle brush	Round shrub 3m x 3m	Tolerates most soils	Drought and frost tolerant	B F G W
Melaleuca nesophila	Showy honey myrtle	Thick foliage, pink pompom like flowers in spring and summer	Low maintenance, hardy plants, tolerates alkaline soils, prefers well drained soils	Frost and drought tolerant	B G W
Persoonia pinifolia	Pine leaved geebung, pine needle appearance, flowers grow in racemes from December to June	Height 2-4m	Free draining acid soil	Drought and frost tolerant	B G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Pultenaea flexilis	Graceful bush pea	Shrub to 3m, narrow leaves, yellow flowers at the ends of the branches in abundance	Free draining soil	Shelter plant from frost, moderately drought tolerant	B G W
Waterhousia floribunda	Weeping lilly pilly	Height to 5m, shiny weeping foliage,	Well drained soil	Drought tolerant and moderately frost tolerant	S B
Xanthorrhoea johnsonii	Grass tree	Grass tree, typically single trunked specimens that grow up to 5m tall.	Well drained soil is best.	An open sunny situation.	

6.10.1.4 Small shrubs (0.2-2 metres)

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Austromyrtus dulcis	midginberry	Low spreading shrub with fine myrtle foliage under 1m high	Good drainage	Frost tolerant	B G W
Botanical Name	**Common Name**	**Features**	**Soils**	**Conditions**	**Appropriate uses**
Calytrix tetragona	Common fringe myrtle	Bright green shrub with aromatic leaves when crushed, starry pink flowers	Well drained soils	Drought and frost tolerant	L B E G W
Correa 'Dusky Bells'		Evergreen shrub to 1m high and 2-4m in diameter, flowers March to September, attracts birds	It grows wells on friable, well-drained and fertile loam.	Drought and frost tolerant	E
Crinum pedunculatum	River lily, spider lily	Bulbous perennial herb, strappy leaves, white spider flowers	Tolerates poor drainage and clay soils	Frost tolerant, tolerates dry conditions but may suffer, grows in sun or shade	B G
Dianella longifolia	Smooth-leaved flax lily	Tufted perennial herb to 400mm, flowers Oct to Dec, follows with blue fruits	Prefers well drained soil	Drought and frost tolerant, prefers shady spot.	E G R

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Dianella revoluta	Blue Flax Lily	Perennial clumping herb to 1m	Tolerant of most soil types	Very hardy once established, drought and frost tolerant	E G R
Hibbertia obtusifolia	Guinea flower	200mm high, 1m wide, good for border planting	Light clay to sandy soils	Drought and frost tolerant	E G R
Hovea lanceolata	Lance leaf hovea	Height to 2m, purple pea flower	Good drainage	Drought tolerant and moderately frost tolerant	E G W
Leptospermum rotundifolium	Round leaved tea tree	Height to 1.5m, and 3m wide dense and stiff, mass of flowers	Tolerant of most soil types	Drought and frost tolerant	B G W
Lomandra filiformis	Wattle mat rush	Perennial tussock to 200 mm with inconspicuous flowers, good bank stabiliser	It grows in a variety of well-drained soil types from clays to humus-rich and sandy or rocky soils	Drought and frost tolerant	E G R W
Philotheca myoporoides	Native daphne Long leaf wax flower	800 mm high x 800 mm wide. White star like flowers with rough centre	Well drained soil	Moderate frost tolerance, hardy once established	B G W
Prostanthera nivea	Snowy mint bush	Height to 2m	Tolerates most soil types	Drought and frost tolerant	B G W
Senna odorata	Southern Cassia	Shrub to 2m high / 1.5m wide, moderately fragrant yellow or orange flowers	Tolerates most soils	Tolerates light frost	B F G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Swainsona galegifolia	Darling pea	Shrubby perennial to 1m, prune after flowering, useful quick cover	Tolerates most soils	Drought tolerant, maybe set back by frost	B E G W

6.10.1.5 Groundcovers and Climbers

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Callerya megasperma	Native wisteria	Bushy climber	Good drainage	Drought tolerant and moderately frost tolerant - will recover	G
Eremophila biserrata		Prostrate shrub that spreads by developing roots at the leaf nodes	Must have good drainage	Drought and frost tolerant	G
Eremophila debilis Syn Myoporum debilis	Winter apple or Amula	Prostrate shrub spreads 1-2m, flowers white - purple mauve	Clay soils	Will grow in part shade or full sun	E G R

6.10.2 Dalby

6.10.2.1 Medium to Large trees (over 10 metres)

This list includes exotics that can be used for street trees and in many cases are being used as street trees

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Acacia implexa	Lightwood	Height to 10m, long light green foliage and fluffy cream flowers in Summer	Tolerant of most soil types	Drought and frost tolerant	S B F R W
Acacia pendula	Weeping Myall	Graceful, weeping habit and blue-grey foliage	Prefers well drained sandy soils but will grow in clay soils	Drought and frost tolerant, will grow in part-shade	S L G W
Botanical Name	**Common Name**	**Features**	**Soils**	**Conditions**	**Appropriate uses**
Acacia salicina	Sally wattle, black wattle	Weeping habit to 12m	Alkaline soils	Moderately drought tolerant, tolerates frosts to -5C	S
Araucaria cunninghamii	Hoop pine	Rough circular bar	Tolerates most soils	Drought and frost tolerant	S
Agonis flexuosa	Willow myrtle, weeping peppermint	h-10m w-5m long narrow leaves, small white flowers, weeping habit			S
Brachychiton acerifolius	Illawarra flame tree	8-15m high	Tolerates most soils		S

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Bolusanthus speciosus	Wysteria tree	Height to 8m, a small elegant upright tree with rough bark, deciduous leaves, racemes of fragrant mauve flowers in Spring	Grows in heavy alkaline soil	Can tolerate dry conditions and being constantly moist, will handle moderate frost but needs protection when young	S
Brachychiton australis	Broad leaved bottle tree	5 - 8m, conical shape, non-invasive root system	Tolerates alkaline soils	Drought and frost resistant	S
Brachychiton australis	Broad leaved bottle tree	Grows to 12m, fast growing, large maple like leaves, deciduous while flowering, cream flowers in early summer	Will grow in most soils: well-drained to poorly drained soils	Drought and frost tolerant	S L G
Brachychiton rupstris	Bottle tree	Height to 20m, bottle shape develops in 5-8 years, drops leaves before flowering in Spring	Tolerates a variety of soil types	Drought and frost tolerant	L F E G W
Brachychiton populneaus	Kurrajong	Height to 10m, cream coloured bell shaped flowers in summer	Tolerates a variety of soil types	Drought tolerant and moderately frost tolerant	S
Caesalpinia ferrea	Leopard tree	Deciduous tree to 10m, yellow flowers, patchy coloured bark	Most soils	Will tolerate periods of dryness and light frost	S

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Calodendron capense	Cape chestnut	To 8m, lovely orchid-like flowers	Most soils	Drought and moderately frost tolerant	S
Capparis mitchellii	Wild orange	Small tree 5-8m white flowers	Likes good drainage	Drought and frost resistance, slow growing	E R W
Casuarina cristata	Belah	Grows to about 12m	Tolerates alkaline soils, likes full sun	Tolerates temperatures to -7	S F
Ceratonia siliqua	Carob	Grows to 10m high. Can take up to 15 years to produce pods. Male and female trees.	Will grow in poor soils	Drought and frost tolerant	B F
Croton insularis		Small tree 12m	Tolerant of low water, mildly alkaline to mildly acidic soils.	Hot overhead sun to warm low sun.	B G W
Cupaniopsis anacardiodes	Tuckeroo	Medium size coastal tree	Tolerant of most soils and urban conditions.	Protect from frost when young.	S
Eremophila mitchellii	False sandalwood	Small tree or multi-stemmed shrub to 10m	Most soils	Drought and frost tolerant	S L
Fraxinus angustifolia	Desert ash	Medium tree	Tolerant of most soil types	Drought and frost tolerant	S

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Fraxinus angustifolia 'raywood'	Claret ash	Medium tree to 12m, foliage turns red in autumn	Tolerant of most soil types	Drought and frost tolerant	S
Fraxinus oxycarpa	Desert ash	Height to 15m	Tolerates alkaline soils	Drought and frost tolerant, best in full sun	S L G
Geijera parviflora	Wilga	Medium tree to 9m, ornamental weeping foliage, round shape, strongly scented, small white flowers	Endemic, so tolerates most soil conditions, prefers good well drained soil	Drought and frost tolerant	S L B E G W
Jacaranda mimisifolia	Jacaranda	Tropical tree, height to 12m, in September loses leaves and displays spectacular purple flowers	Tolerates most soil conditions	Drought tolerant and moderately frost tolerant	S G
Lysiphyllum hookerii syn Bauhinia hookerii	White bauhinia	The native Bauhinia is a rounded and attractive tree with pendulous outer branches. It can grow to 12m, slow growing	Clay Soils	Full sun, partial sun or shade. Dry or moderately wet areas	S B E G R W
Melaleuca bracteata	White cloud tree	Medium size tree	Tolerates most soils	Drought and frost tolerant	S L B E G

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Melaleuca irbyana	Weeping paperbark	Height 8m to 12m with thick spongy, papery bark and weeping branches	Will grow on poorly drained soil and clay soils	Drought and moderately frost tolerant	S B F G W
Melaleuca stypheliodes	Prickly-leaved paper bark	Height to 20m, dense rounded canopy and drooping branchlets, bark peels off	Tolerant of most soil types, due to its deep-rooting characteristics, lawn can be grown under its canopy	Drought and frost tolerant	S B F G R W
Peltophorum pterocarpum	Yellow poinciana	Medium tree		Drought tolerant and moderately frost tolerant	S
Pyrus calleryana 'Chanticleer'	Callery pear	Height to 14m, columnar shape, showy blossoms	Able to handle wet heavy soils	Drought and frost tolerant	S G
Quercus rubra syn. borealis	Red oak	Height to 10m, broad spreading crown	Adapts to most soil conditions	Drought and frost tolerant	S
Syzygium australe	Lilly pilly, brush cherry	Height to 8m, compact form, good for hedging	Tolerates most soils	Drought tolerant and reasonably frost tolerant, is extremely hardy once established	S B F G
Syzygium leuhmannii	Small leaved lilly pilly, riberry	Height to 8m, fluffy white flowers, pink new growth	Tolerates most soils	Drought tolerant and moderately frost tolerant	B F G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Toona ciliata	Red cedar	Height to 20m, fast growing majestic tree, sprays of white aromatic flowers	Prefers well-drained soil	Drought and frost tolerant	S L
Tristaniopsis laurina 'DOW10' Luscious	Water gum	Small to medium tree with glossy foliage and a dense growth habit with yellow sweetly scented flowers	Suitable in a range of soils	Drought and frost tolerant	S

6.10.2.2 Large shrubs to small trees (5-10 metres)

This list includes exotics that can be used for street trees and in many cases are being used as street trees

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Callistemon 'Harkness'	Bottlebrush	Height to 6m, large bright red flowers	Tolerant of most soil types	Drought and frost tolerant	S B G
Callistemon salignus	Willow bottle brush	Height to 7 m	Tolerant of most soils types, tolerates waterlogging	Drought and frost tolerant	S B G
Callistemon viminalis	Weeping bottle brush	Medium tree to 8m brilliant red bottle brush flowers in Spring and Autumn	Tolerates poor drainage	Drought and frost tolerant	S L B F E G R W
Cycas revoluta	Cycad	A low growing cycad. Up to 6m	Prefers a sunny, well drained spot, with deep soil, but will still thrive in less than ideal conditions	Frost and drought tolerant	
Elaeocarpus reticulatus	Blueberry Ash			Drought and frost tolerant	B G
Eucalyptus leucoxylon macrocarpa		Small gum height 4-9m	Tolerates heavy alkaline soils	Drought and frost tolerant	
Eucalyptus leucoxylon subsp.megalocarpa		Small gum height 4-9m	Tolerates heavy alkaline soils	Drought and frost tolerant	

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Hymenosporum flavum	Native frangipani	Small to medium tree to 10m, cream to golden scented flowers	Tolerant of most soils, prefers well drained soil	Drought and frost tolerant, may need additional water in very dry periods	
Lagerstroemia fauriei	Crepe myrtle	Small tree to 8m	Tolerant of most soils	Good drought and heat tolerance	S B G
Melaleuca decora	White feather honey myrtle	Height to 6m, mass of cream yellow flowers in spring	Tolerates most soils	Drought and frost tolerant	B G R W
Melaleuca linariifolia	Snow in Summer	Height to 8m, white fluffy flowers cluster over the plant in summer	Tolerates all soils	Drought and frost tolerant	B F G W
Melaleuca viridiflora	Broad leaved paperbark	Height 3-10m, common green-cream form and a red flowering form	Wide range of soils and particularly well on heavy clays which are waterlogged when wet	Drought and frost tolerant	S L B E G W
Notelaea longifolia	Large mock olive	Usually small tree to 3m but can grow up to 9m	Tolerates most soils	Drought tolerant and tolerates mild frost	B F G W
Pittosporum angustifolium	Weeping pittosporum	Height to 6m, slow growing, weeping foliage	Wide range of well drained soils	Drought and frost tolerant	S L B F E G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Pittosporum rhombifolium	Qld holly	Height to 8m	Tolerates most soils	Drought tolerant and moderately frost tolerant	G
Pyrus calleryana 'Aristocrat'	'Aristocrat' callery pear	Small to medium tree to 10m	Tolerates most soils: clay, loam, sand, acidic, occasionally wet, alkaline,	Grows in full sun, drought and frost tolerant	S
Sapium sebiferum	Chinese tallow wood	Height to 8m, deciduous tree with medium heart shaped leaves	Tolerant of a wide range of soils	Drought and frost tolerant	S
Ulmus parvifolia	Chinese elm	Small to medium tree, height to 10m	Tolerates most soils	Drought and frost tolerant	S G

6.10.2.3 Medium shrubs (2-5 metres)

Callistemons, eremophilas and melaleucas

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Acacia decora	Showy wattle				B
Alyogyne huegelii		Medium open shrub to height 2-2.5m, mauve flowers	Prefers good drainage	Moderately frost tolerant and drought tolerant	G
Botanical Name	**Common Name**	**Features**	**Soils**	**Conditions**	**Appropriate uses**
Baeckea virgata	Twiggy heath myrtle	Bushy erect shrub to 3m high and 3m wide	Tolerates poor soils	Drought and frost tolerant	B G W
Callistemon pallidus	Lemon bottlebrush	Dense erect shrub to 3m high and with 2m spread. Creamy yellow flower spikes in spring and summer	Hardy plant, tolerates most soils including poorly drained soils	Drought and frost tolerant	B G
Eremophila bignoniflora	Dogwood	Shrub to 5m, cream flowers	Tolerates most soils	Drought and frost tolerant	B G W
Eremophila calorhabdos		1-4m, erect shrub, that appears clustered at the base	Tolerates most soils, prefers good drainage	Drought and frost tolerant	B G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Grevillea olivacea	Olive grevillea	Grows to 4m high, red, yellow or orange flowers between Jun and October	A grevillea that likes alkaline soil! Raised beds for good drainage	Drought and frost tolerant	
Melaleuca nesophila	Showy honey myrtle	Thick foliage, pink pompom like flowers in spring and summer	Low maintenance, hardy plants, tolerates alkaline soils, prefers well drained soils	Drought and frost tolerant	B G W
Myoporum insulare	Boobialla	Multi-stemmed prostrate to erect shrub with tiny white flowers	Tolerates most soils, prefers well-drained soils	Drought and frost tolerant	G
Pyrus fauriei 'westwood'	Westwood Asian pear	To 4m, small wide tree with dense glossy canopy and good autumn colour	Tolerates poor drainage and heavy soils	Frost tolerant and appears drought tolerant	S
Rhodamnia maideniana		A bushy shrub with ornamental foliage and small, pink flowers and black berries that are attractive to birds. Height to 3m	Requires well-drained moist soil.	Prefers semi-shaded position.	
Xanthorrhoea johnsonii	Grass tree	Grass tree, typically single trunked specimens that grow up to 5 metres tall.	Well drained soil is best.	An open sunny situation.	

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Atriplex nummularia	Old Man Saltbush	Dense, grey/silver shrub with whitish branches	Clay soils	Drought and frost tolerant, will handle shallow flooding	BEFGR
Chrysocephalum apiculatum	Yellow buttons			Drought and frost tolerant, will grow in semi shade but prefers full sun.	EG

6.10.2.4 Small shrubs (0.2-2 metres)

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Chrysocephalum semipapposum	Clustered everlasting			Drought and frost tolerant will grow in semi shade under eucalypts but refers full sun.	EG
Correa pulchella	Australian fuchsia	Evergreen shrub height 0.3 - 1.0m, pendant tubular flowers between April and September	Well drained alkaline soils	Drought and frost tolerant.	
Crinum pedunculatum	River lily, spider lily	Bulbous perennial herb, strappy leaves, white spider flowers	Tolerates poor drainage and clay soils	Frost tolerant, tolerates dry conditions but may suffer, grows in sun or shade	B G
Lavendula dentata	French lavender	Shrub to 1m tall and 1.5m wide	Well drained soil, tolerates alkaline soil	Drought and frost tolerant	
Leiocarpa brevicompta	Flat billy buttons	Annual or biennial	Most soils	Drought and frost tolerant	
Melalueca diosmatifolia	Rosy paperbark or rosy honey-myrtle	Small to medium round shrub less than 1.5m, narrow leaves, pale pink flowers	Various soils but often on light soils with heavier waterlogged subsoils	Drought and frost tolerant, sunny open position	
Melaleuca nesophila 'Little Nessy'	Little Nessy	Thick foliage, pink pompom like flowers in spring and summer	Low maintenance, hardy plants, tolerates alkaline soils	Drought and frost tolerant	B G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Myoporum montanum	Western boobialla	Small to medium shrub with glossy light green leaves	Hardy plant in most soils	Drought and frost tolerant	B G W
Ricinocarpos pinifolius	Wedding bush	Shrub to 1.5m, moderately fragrant flowers mid-winter to late spring	Low maintenance, overhead sun, all soil types – mildly acidic to mildly alkaline	Drought and frost tolerant	
Tetratheca Thymifolia 'Bicentennial Belle'		Native, to 1m, this is a small, evergreen plant with a cottage garden quality. Compact, lightly suckering and ever flowering shrub producing masses of delicate mauve-pink pendent bell flowers.	Good drainage	Frost hardy and drought tolerant, full sun	
Westringia fruticosa	Native rosemary	Shrub to around 1.5m, good round shape, improved with pruning	Hardy, tolerates most soils	Drought and frost tolerant	B G W

6.10.2.5 Groundcovers

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Carpobrotus glaucescens	Pigface	Creeping plant to 300mm high and 1-2m spread, fleshy blue-green leaves and purplish-pink flowers	Well drained position	Drought and frost tolerant, full sun	
Botanical Name	**Common Name**	**Features**	**Soils**	**Conditions**	**Appropriate uses**
Dianella longifolia	Smooth-leaved flax lily	Tufted perennial herb to 400mm, flowers Oct to Dec, follows with blue fruits	Prefers well drained soil	Drought and frost tolerant	E G R
Dianella revoluta	Blue Flax Lily	Perennial clumping herb to 1m	Tolerant of most soil types	Very hardy once established, drought and frost tolerant	E G R
Enchylaena tomentosa	Ruby saltbush or barrier saltbush	Prostrate to 1m wide, red berries, semi-succulent leaves with hairs giving a grey appearance	Tolerant of most soil types	Drought and frost tolerant	E R W
Eremophila biserrata		Prostrate shrub that spreads by developing roots at the leaf nodes	Must have good drainage	Drought and frost tolerant	G
Eremophila debilis	Winter apple or Amula	Prostrate shrub spreads 1-2m, flowers white - purple mauve	Clay soils	Will grow in part shade or full sun	E G R

6.10.2.6 Climbers

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Pandorea pandorana	Wonga wonga vine	Cream or yellow tubular flowers, twining plant	Adaptable to most soils	Once established will tolerate dry periods, protect from frost	E G
Botanical Name	**Common Name**	**Features**	**Soils**	**Conditions**	**Appropriate uses**
Hardenbergia violacea and cultivars	False sarsaparilla	Purple or white pea like flowers	Most soils, grow in alkaline soils	Likes sunny position, frost tolerant once established	G W
Hibbertia scandens	Guinea flower	Yellow flowers		Tolerates moderate frost, drought tolerant, likes a sunny position	
Solanum jasminoides	White potato creeper	White flowers	Well drained soil		

6.10.3 Miles

6.10.3.1 Medium to Large trees (over 10 metres)

This list includes exotics that can be used for street trees and in many cases are being used as street trees.

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Acacia melanoxylon	Blackwood	Dark green foliage, dark furrowed bark	Good drainage	Drought and frost tolerant	S B G W
Acacia pendula	Weeping Myall	Graceful, weeping habit and blue-grey foliage	Prefers well drained sandy soils but will grow in clay soils	Frost and drought tolerant, will grow in part-shade	S G W
Angophora costata	Smooth barked apple	Height to 25m. Trunk gnarled and crooked, pink to pale grey bark, cream flowers in summer, bark sheds in Spring	Well drained soil but is tolerant of many conditions	Drought tolerant, new tips can suffer frost damage	L F W
Botanical Name	**Common Name**	**Features**	**Soils**	**Conditions**	**Appropriate uses**
Brachychiton australis	Broad leaved bottle tree	Grows to 12m, fast growing, large maple like leaves, deciduous while flowering, cream flowers in early summer	Will grow in most soils: well-drained to poorly drained soils and alkaline soils	Frost and drought tolerant	S G
Brachychiton discolor	Lacebark tree	Height to 12m, pink flowers when semi-deciduous	Tolerates a range of soils, can be slow growing	Frost and drought tolerant	S G

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Brachychiton rupstris	Bottle tree	Height to 20m, bottle shape develops in 5-8 years, drops leaves before flowering in Spring	Tolerates a variety of soil types	Frost and drought tolerant	L F E G W
Brachychiton populneaus	Kurrajong	Height to 10m, cream coloured bell shaped flowers in summer	Tolerates a variety of soil types	Drought tolerant and moderately frost tolerant	S
Caesalpinia ferrea	Leopard tree	Large tree to 15m, smaller in harsh conditions, bright yellow flowers, dappled grey bark	Likes well-drained oil	Will tolerate long periods of dryness and light frosts	S
Casuarina cristata	Belah	Large tree to 20m, fine needle foliage and rough grey bark	Tolerates a variety of soil types	Frost and drought tolerant	
Casuarina cunninghamiana		Height to 15m, narrow tree with irregular shape and dense foliage	Tolerates poor soils, prefers well drained soils, slightly acidic to very alkaline	Frost and drought tolerant, prefers full sun	F
Ceratonia siliqua	Carob	Height to 12m, dark green foliage	Prefers a free draining soil but will tolerate harsh environments	Frost and drought tolerant	F

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Citriobatus pauciflorus		Small orange fruits make this shrub very ornamental. It has small needle-like spinesand is favoured by birds as a safe nesting site. Height 3m	Prefers well-drained soils.	A slow-growing plant that requires a sheltered site with plenty of light.	
Cupaniopsis Anacardioides	Tuckeroo	Small tree with dark green leathery foliage, grey trunk, yellow fruit	Tolerant of a wide range of soils, very hardy tree	Drought tolerant, will tolerate light frost	S B G
Eucalyptus argophloia	Chinchilla white gum	Height to 35m, narrow tree	Most soil types, mildly acidic to mildly alkaline	Frost and drought tolerant	L F
Flindersia australis	Crow's Ash	Height to 10m	Tolerates most soils	Drought tolerant and tolerates light frost, more tolerant with age	S E G W
Flindersia brayleyana	Qld maple	Height over 15m,with columnar shape, shiny foliage, white flowers in summer	Needs well drained soil	Tolerates moderate frost	S
Flindersia maculosa	Leopard wood	Height to 15m, beautiful tree with mottled trunk	Tolerates most soils	Frost and drought tolerant	S B F E G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Flindersia schottiana	Cudgerie Silver Ash	Height to 15m, white scented flowers	Good drainage and acidic soil	Drought tolerant and moderately frost tolerant	S L
Ginkgo biloba	Maidenhair tree	Butterflied fan-like leaves, autumn colours	Tolerates almost all soil types, likes well drained soil	Full sun, frost and drought tolerant	S
Gmelina leichardtii	White beech	Height to 15m in cultivation (probably less)	Well drained soil	Drought tolerant, will bounce back from frost	S L
Grevillea robusta	Silky oak	Height to 20m	Tolerates alkaline soil	Drought and frost tolerant	S L
Guioa semiglauca	Wild quince	Height to 12m in rainforests, probably much smaller, fluted trunk when older	Mildly acidic to mildly alkaline	Drought tolerant and observed to be frost tolerant	S G
Jacaranda mimisifolia	Jacaranda	Tropical tree, height to 12m, in September loses leaves and displays spectacular purple flowers	Tolerates most soil conditions	Drought tolerant and moderately frost tolerant	S G
Jagera pseudorhus	Foambark	Rainforest tree to 10m, will not reach rainforest heights, brownish hairy flowers, pioneer species	Adapts to most soils	Drought tolerant and moderately frost tolerant	

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Lysiphyllum hookerii syn Bauhinia hookerii	White bauhinia	The native Bauhinia is a rounded and attractive tree with pendulous outer branches. It can grow to 12m, slow growing	Clay Soils	Full sun, partial sun or shade. Dry or moderately wet areas	S B E G R W
Melaleuca irbyana	Weeping paperbark	Height 8m to 12m with thick spongy, papery bark and weeping branches	Will grow on poorly drained soil and clay soils	Drought and moderately frost tolerant	S B F G W
Melaleuca stypheliodes	Prickly-leaved paper bark	Height to 20m, dense rounded canopy and drooping branchlets, bark peels off	Tolerant of most soil types, due to its deep-rooting characteristics, lawn can be grown under its canopy	Drought and frost tolerant	S B F G R W
Polyscias murrayi	Pencil cedar	Height to 15m, umbrella shapes	Tolerates most soils, prefers well drained soils	Drought tolerant and tolerates light frost	
Pyrus calleryana	Callery pear	Height to 14m, columnar shape, showy blossoms	Able to handle wet heavy soils	Drought and frost tolerant	S G
Quercus suber	Cork oak	Height to 20m in Melb, so less here	Intolerant of compaction	Drought tolerant once established, frost tolerant	S

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Rhodosphaera rhodanthema	Deep yellow wood	Medium tree to 12m, columnar shape	Tolerant of most soils, mildly acid, prefers good drainage	Drought and frost tolerant	S B F G
Stenocarpus sinuatus	Qld firewheel tree	Small tree in cooler areas, spectacular orange flowers	Prefers deep, moist, well-drained soil, will grow well on sandy loams to clay loams.	Drought tolerant and frost to -2, protect when young	G
Toona ciliata	Red cedar	Height to 20m, fast growing majestic tree, sprays of white aromatic flowers	Prefers well-drained soil	Drought and frost tolerant	S L

6.10.3.2 Large shrubs to small trees (5-10 metres)

This list includes exotics that can be used for street trees and in many cases are being used as street trees

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Acacia implexa	Lightwood	To 10m	Good drainage	Drought and frost tolerant	S B G W
Agonis flexuosa	WA Peppermint	Height to 10m width to 5m long narrow leaves, small white flowers, weeping habit	Tolerates alkaline soils, likes good drainage	Reasonable drought and frost tolerant	G W
Botanical Name	**Common Name**	**Features**	**Soils**	**Conditions**	**Appropriate uses**
Banksia integrifolia subs. integrifolia	Coast Banksia	Height to 5m, will grow higher in favourable conditions	Prefers sandy acidic soil but will grow in sandy clay loam	Drought tolerant and moderately frost tolerant	S G W
Banksia integrifolia subs. monicola	Banksia	Height to 5m, will grow higher in favourable conditions	Light to medium clay	Drought and frost tolerant	S G W
Breynia oblongifolia		Colourful fruits are attractive to birds. Height to 3m	Tolerates a variety of soil types.	Easily grown under tree canopies. Light frost.	

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Elaeocarpus eumundi	Eumundi quandong	Height to 8m, dense shiny foliage excellent screening plant	Prefers free draining soils	Drought tolerant, will tolerate light frost	B
Elaeocarpus reticulatus	Blueberry Ash			Drought and frost tolerant	B
Callistemon viminalis	Weeping bottle brush	Medium tree to 8m brilliant red bottle brush flowers in Spring and Autumn	Tolerates poor drainage	Frost and drought tolerant	S L B F E G R W
Eucalyptus crenulata	Buxton silver gum	Fast growing tree to 8m, fine crenulated solver/pink foliage	Tolerates waterlogging, sandy and clay soils but prefers well drained soils	Drought and frost tolerant	
Eucalyptus torquata	Coral gum	Small to medium tree to 6m	Tolerant of most soil types and climatic conditions, but does prefer full sun and well-drained soil.	Drought and frost tolerant	
Geijera parviflora	Wilga	Medium tree to 9m, ornamental weeping foliage, round shape, strongly scented, small white flowers	Endemic, so tolerates most soil conditions, prefers good well drained soil	Drought and frost tolerant	S L B E G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Gordonia axillaris (Franklinia axillaris)	Fried egg plant	Height to 5m, huge 'fried egg' flowers, prunes well into a hedge	Prefers slightly acidic soil	Moderately drought and frost tolerant	
Hakea laurina	Pin cushion hakea	Height to 5m, small round tree with curly leaves and bright red and cream pin cushion flowers in winter	Tolerates any soil that is lime free	Drought tolerant, in frosts new tips will burn, can cover until up to 1 m	
Hakea petiolaris	Sea urchin hakea	Small tree to 9m	Well drained and slightly acidic soil	Drought and moderately frost tolerant	
Harpullia pendula	Tulipwood	Small tree with a dense crown of glossy green leaves with smooth grey bark, will not grow as big as coastal specimens	Tolerates soil conditions	Drought and frost tolerant	S G
Hymenosporum flavum	Native frangipani	Small to medium tree to 10m, cream to golden scented flowers	Tolerant of most soils, prefers well drained soil	Drought and frost tolerant	
Lagerstroemia indica	Crepe myrtle	Beautiful small flowering tree	Tolerant of most soil types	Drought and frost tolerant	S G
Leptospermum petersonii	Lemon scented tea tree	Height to 5m, many small white flowers	Tolerates poor soil	Drought tolerant, protect from frost	G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Malus floribunda	Japanese crab apple	Small tree to 5m, beautiful floral display, round and dense	Well drained soil	Drought tolerant once established, frost tolerant	G
Malus ioensis 'Plena'	Crab apple	To 6m, masses of mildly fragrant double flowers in late spring	Prefers slightly acidic, well-drained soil	Drought and frost tolerant	S L G
Melaleuca decora	White feather honey myrtle	Height to 6m, mass of cream yellow flowers in spring	Tolerates most soils	Drought and frost tolerant	B G R W
Melaleuca linariifolia	Snow in Summer	Height to 8m, white fluffy flowers cluster over the plant in summer	Tolerates all soils	Drought and frost tolerant	B F G W
Notelaea longifolia	Large mock olive	Usually small tree to 3m but can grow up to 9m	Tolerates most soils	Drought tolerant and tolerates mild frost	B F G W
Pittosporum angustifolium	Weeping pittosporum	Height to 6m, slow growing, weeping foliage	Wide range of well drained soils	Drought and frost tolerant	S L B F E G W
Pittosporum rhombifolium	Qld holly	Height to 8m	Tolerates most soils	Drought tolerant and moderately frost tolerant	G

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Syzygium australe	Lillly pilly, brush cherry	Height to 8m, compact form, good for hecging	Tolerates most soils	Drought tolerant and reasonably frost tolerant, is extremely hardy once established	S B F G
Syzygium leuhmannii	Small leaved lilly pilly, riberry	Height to 8m, fluffy white flowers, pink new growth	Tolerates most soils	Drought tolerant and moderately frost tolerant	B F G W
Syzygium paniculata	Magenta cherry	Height to 8m in cultivation	Tolerates most soils	Drought and frost tolerant	B F

6.10.3.3 Trees and shrubs (2-5 metres)

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Acacia chinchillensis	Chinchilla wattle	Grows to 3m	Well drained soils	Frost and drought tolerant, in partial shade or full sun	L B E G W
Alyogyne hakeifolia		Medium shrub to 3m, purple, pink or yellow flowers, needle-like foliage	Intolerant of bad drainage	Drought tolerant, shelter from heavy frost	BGW
Alyogyne huegelii	Lilac hibiscus	Grows to 2.5m, medium sized bushy shrub, good understorey plant, small purple hibiscus flower	Can cope with heavy soil, but likes reasonably well-drained soils	Drought tolerant, shelter from heavy frost	B G W
Bauhinia galpinii		Evergreen sprawling shrub 2-3m x 3-4m, leaves mid green. January - April.	Tolerates most soils.	Can tolerate light frosts. Hedge and screen plant.	B G W
Brachychiton bidwillii	Little kurrajong	Grows to 3m. orange-red flowers on bare branches, flowers best in full sun	Tolerates a wide range of soil types, likes well-drained soil	Frost and drought tolerant.	L G W
Ceratopetalum gummiferum	NSW Christmas bush	Grows to 5m, red 'flowers' in December	Well-drained soil	Frost tolerant	B G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Dodonaea viscosa	Sticky hop bush	Variable height 1-3m	Well-drained soil	Drought and frost tolerant	B G W
Eucalyptus argophloia dwarf	Dwarf Chinchilla white gum	Height to 4m, weeping form	Thrives on heavy soil	Frost and drought tolerant	S B F E G R W
Eucalyptus boliviana		Height to 5m, bluish leaves	Prefers deep loam soil	Frost and drought tolerant	G
Gossypium sturtianum	Sturt's Desert Rose	Height to 3m with hibiscus like flowers	Prefers well drained soil	Drought tolerant and moderately frost tolerant	G W
Gossypium sturtianum var. nandewarense	Sturt's Desert Rose	Height to 3m with pinky hibiscus like flowers	Prefers well drained soil	Drought tolerant and more resistant to frosts than sturtanum	G W
Grevillea sp eg 'Honey Gem, 'Hookeriana' 'Misty Pink', and 'Moonlight'	Brush flowers, all different colours	Heights vary	Good drainage	Drought and frost tolerant	B G W
Indigofera australis	Pink pea flowers	Grows to 2.5m	Well drained acid soils	Tolerates moderately heavy frost, semi shaded position	B E G R W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Jacksonia scoparia	Native dogwood	Grows to 4m Pea - like yellow flowers in spring, grey green arching branchlets	Well drained sandy and loamy soils	Full sun, part shade	E G W
Kunzea baxteri	Crimson kunzea	Grows to 4m	Well-drained soil	Drought tolerant, sheltered position - tolerates light frost	B G W
Kunzea opposita		Grows 1.5 - 3m, pink flowers at the end of branchlets	Well-drained soil	Drought tolerant, may be damaged by heavy frost	E G W
Leptospermum lanigerum	Woolly tea tree	Grows to 3m, pendulous habit	Most soils	Drought and frost tolerant	B F G W
Magnolia Little Gem	Little gem	Small tree to 3m	Well-drained soil	Drought and frost tolerant	G
Melaleuca elliptica	Granite bottle brush	Round shrub 3m x 3m	Tolerates most soils	Drought and frost tolerant	B F G W
Melaleuca groveana	Grove's paper bark	Small tree to 5m, white flowers, narrow hard leaves		Drought tolerant and frost tolerant	E R W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Melaleuca nesophila	Showy honey myrtle	Thick foliage, pink pompom like flowers in spring and summer	Low maintenance, hardy plants, tolerates alkaline soils, prefers well drained soils	Frost and drought tolerant	B G W
Persoonia pinifolia	Pine leaved geebung, pine needle appearance, flowers grow in racemes from December to June	Height 2-4m	Free draining acid soil	Drought and frost tolerant	B G W
Pultenaea flexilis	Graceful bush pea	Shrub to 3m, narrow leaves, yellow flowers at the ends of the branches in abundance	Free draining soil	Shelter plant from frost, moderately drought tolerant	B G W
Waterhousia floribunda	Weeping lilly pilly	Height to 5m, shiny weeping foliage,	Well-drained soil	Drought tolerant and moderately frost tolerant	S B

6.10.3.4 Small shrubs (0.2-2m)

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Austromyrtus dulcis	Midginberry	Low spreading shrub with fine myrtle foliage under 1m high	Good drainage	Frost tolerant	B G W
Calytrix tetragona	Common fringe myrtle	Bright green shrub with aromatic leaves when crushed, starry pink flowers	Well drained soils	Drought and frost tolerant	L B E G W
Correa 'Dusky Bells'		Evergreen shrub to 1m high and 2-4m in diameter, flowers March to September, attracts birds	It grows wells on friable, well-drained and fertile loam.	Drought and frost tolerant	E
Crinum pedunculatum	River lily, spider lily	Bulbous perennial herb, strappy leaves, white spider flowers	Tolerates poor drainage and clay soils	Frost tolerant, tolerates dry conditions but may suffer, grows in sun or shade	B G
Dianella longifolia	Smooth-leaved flax lily	Tufted perennial herb to 400mm, flowers Oct to Dec, follows with blue fruits	Prefers well-drained soil	Drought and frost tolerant, prefers shady spot.	E G R
Dianella revoluta	Blue Flax Lily	Perennial clumping herb to 1m	Tolerant of most soil types	Very hardy once established, drought and frost tolerant	E G R

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Hibbertia obtusifolia	Guinea flower	200mm high , 1m wide, good for border planting	Light clay to sandy soils	Drought and frost tolerant	E G R
Hovea lanceolata	Lance leaf hovea	Height to 2m, purple pea flower	Good drainage	Drought tolerant and moderately frost tolerant	E G W
Leptospermum rotundifolium	Round leaved tea tree	Height to 1.5m, and 3m wide dense and stiff, mass of flowers	Tolerant of most soil types	Drought and frost tolerant	B G W
Lomandra filiformis	Wattle mat rush	Perennial tussock to 200mm with inconspicuous flowers, good bank stabiliser	It grows in a variety of well-drained soil types from clays to humus-rich and sandy or rocky soils	Drought and frost tolerant	E G R W
Lomandra longifolia	Long leaved mat rush	Perennial tussock to1.5m, robust	Well-drained soil	Drought and frost tolerant	E G R W
Lysiphyllum hookerii syn Bauhinia hookerii	White bauhinia	The native Bauhinia is a rounded and attractive tree with pendulous outer branches. It can grow to 12m, slow growing	Clay Soils	Full sun, partial sun or shade. Dry or moderately wet areas	S B E G R W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Melalueca diosmatifolia	Rosy paperbark or rosy honey-myrtle	Small to medium round shrub less than 1.5m, narrow leaves, pale pink flowers	Various soils but often on light soils with heavier waterlogged subsoils	Drought and frost tolerant, sunny open position	B G W
Philotheca myoporoides	Native daphne Long leaf wax flower	800mm high x 800mm wide. White star like flowers with rough centre	Well-drained soil	Moderate frost tolerance, hardy once established	B G W
Prostanthera nivea	Snowy mint bush	Height to 2m	Tolerates most soil types	Drought and frost tolerant	B G W
Senna odorata	Southern Cassia	Shrub to 2m high and 1.5m wide, moderately fragrant yellow or orange flowers	Tolerates most soils	Tolerates light frost	B F G W
Swainsona galegifolia	Darling pea	Shrubby perennial to 1m, prune after flowering, useful quick cover	Tolerates most soils	Drought tolerant, maybe set back by frost	B E G W

6.10.3.5 Groundcovers and Climbers

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Eremophila biserrata		Prostrate shrub that spreads by developing roots at the leaf nodes	Must have good drainage	Drought and frost tolerant	G
Eremophila debilis Syn Myoporum debilis	Winter apple or Amula	Prostrate shrub spreads 1-2m, flowers white - purple mauve	Clay soils	Will grow in part shade or full sun	E G R
Grevillea spp prostrate		Many different colours	Good drainage	Drought and frost tolerant	W

6.10.4 Tara

6.10.4.1 Medium to Large trees (over 10 metres)

This list includes exotics that can be used for street trees and in many cases are being used as street trees

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Acacia aneura	Mulga	Needle like grey foliage	Well drained sandy soil	Drought and frost tolerant	L B F E G R W
Acacia elata	Cedar wattle	Wattle to 10m	Well-drained soil	Drought and frost tolerant	
Acacia pendula	Weeping Myall	Graceful, weeping habit and blue-grey foliage	Prefers well drained sandy soils but will grow in clay soils	Frost and drought tolerant, will grow in part-shade	S G W
Acacia harpophylla	Brigalow	Medium tree to 15m, black, thick, furrowed bark	Heavy clay, often alkaline on surface	Drought and frost tolerant	S L B F E G W
Angophora costata	Smooth barked apple	Height to 25m. Trunk gnarled and crooked, pink to pale gray bark, cream flowers in summer, bark sheds in Spring	Well-drained soil but is tolerant of many conditions	Drought tolerant, new tips can suffer frost damage	L F W
Brachychiton australis	Broad leaved bottle tree	Grows to 12m, fast growing, large maple like leaves, deciduous while flowering, cream flowers in early summer	Will grow in most soils: well-drained to poorly drained soils and alkaline soils	Frost and drought tolerant	S G

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Brachychiton discolor	Lacebark tree	Height to 12m, pink flowers when semi-deciduous	Tolerates a range of soils, can be slow growing	Frost and drought tolerant	S G
Brachychiton rupstris	Bottle tree	Height to 20m, bottle shape develops in 5-8 years, drops leaves before flowering in Spring	Tolerates a variety of soil types	Frost and drought tolerant	L F E G W
Brachychiton populneaus	Kurrajong	Height to 10m, cream coloured bell shaped flowers in summer	Tolerates a variety of soil types	Drought tolerant and moderately frost tolerant	S
Caesalpinia ferrea	Leopard tree	Large tree to 15m, smaller in harsh conditions, bright yellow flowers, dappled grey bark	Likes well-drained oil	Will tolerate long periods of dryness and light frosts	S
Casuarina cristata	Belah	Large tree to 20m, fine needle foliage and rough grey bark	Tolerates a variety of soil types	Frost and drought tolerant	
Casuarina cunninghamiana	River oak	Height to 15m, narrow tree with irregular shape and dense foliage	Tolerates poor soils, prefers well drained soils, slightly acidic to very alkaline	Frost and drought tolerant, prefers full sun	F

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Ceratonia siliqua	Carob	Height to 12m, dark green foliage	Prefers a free draining soil but will tolerate harsh environments	Frost and drought tolerant	F
Cupaniopsis Anacardioides	Tuckeroo	Small tree with dark green leathery foliage, grey trunk, yellow fruit	Tolerant of a wide range of soils, very hardy tree	Drought tolerant, will tolerate light frost	S B G
Eucalyptus argophloia	Chinchilla white gum	Height to 35m, narrow tree	Most soil types, mildly acidic to mildly alkaline	Frost and drought tolerant	L F
Flindersia australis	Crow's Ash	Height to 10m	Tolerates most soils	Drought tolerant and tolerates light frost, more tolerant with age	
Flindersia brayleyana	Qld maple	Height over 15m, with columnar shape, shiny foliage, white flowers in summer	Needs well-drained soil	Tolerates moderate frost	S
Flindersia maculosa	Leopard wood	Height to 15m, beautiful tree with mottled trunk	Tolerates most soils	Frost and drought tolerant	S B F E G W
Flindersia schottiana	Cudgerie Silver Ash	Height to 15m, white scented flowers	Good drainage and acidic soil	Drought tolerant and moderately frost tolerant	S L

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Ginkgo biloba	Maidenhair tree	Butterflied fan-like leaves, autumn colours	Tolerates almost all soil types, likes well-drained soil	Full sun, frost and drought tolerant	S
Gmelina leichardtii	White beech	Height to 15m in cultivation (probably less)	Well-drained soil	Drought tolerant, will bounce back from frost	S L
Grevillea robusta	Silky oak	Height to 20m	Tolerates alkaline soil	Drought and frost tolerant	S L
Guioa semiglauca	Wild quince	Height to 12m in rainforests, probably much smaller, fluted trunk when older	Mildly acidic to mildly alkaline	Drought tolerant and observed to be frost tolerant	S G
Jagera pseudorhus	Foambark	Rainforest tree to 10m, will not reach rainforest heights, brownish hairy flowers, pioneer species	Adapts to most soils	Drought tolerant and moderately frost tolerant	
Lysiphyllum hookerii syn Bauhinia hookerii	White bauhinia	The native Bauhinia is a rounded and attractive tree with pendulous outer branches. It can grow to 12m, slow growing	Clay Soils	Full sun, partial sun or shade. Dry or moderately wet areas	S B E G R W
Magnolia grandiflora	Bull bay magnolia	A beautiful dense tree to 25m, elegant white cup shaped flowers	Well-drained soil	Drought and frost tolerant	S

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Melaleuca irbyana	Weeping paperbark	Height 8m to 12m with thick spongy, papery bark and weeping branches	Will grow on poorly drained soil and clay soils	Drought and moderately frost tolerant	S B F G W
Melaleuca stypheliodes	Prickly-leaved paper bark	Height to 20m, dense rounded canopy and drooping branchlets, bark peels off	Tolerant of most soil types, due to its deep-rooting characteristics, lawn can be grown under its canopy	Drought and frost tolerant	S B F G R W
Polyscias murrayi	Pencil cedar	Height to 15m, umbrella shapes	Tolerates most soils, prefers well drained soils	Drought tolerant and tolerates light frost	
Rhodosphaera rhodanthema	Deep yellow wood	Medium tree to 12m, columnar shape	Tolerant of most soils, mildly acid, prefers good drainage	Drought and frost tolerant	S B F G
Stenocarpus sinuatus	Qld firewheel tree	Small tree in cooler areas, spectacular orange flowers	Prefers deep, moist, well-drained soil, will grow well on sandy loams to clay loams.	Drought tolerant and frost to -2, protect when young	G
Toona ciliata	Red cedar	Height to 20m, fast growing majestic tree, sprays of white aromatic flowers	Prefers well-drained soil	Drought and frost tolerant	S L

6.10.4.2 Large shrubs to small trees (5-10m)

This list includes exotics that can be used for street trees and in many cases are being used as street trees

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Agonis flexuosa	WA Peppermint	Height to 10m width to 5m long narrow leaves, small white flowers, weeping habit	Tolerates alkaline soils, likes good drainage	Reasonable drought and frost tolerant	G W
Banksia integrifolia subs. integrifolia	Coast Banksia	Height to 5m, will grow higher in favourable conditions	Prefers sandy acidic soil but will grow in sandy clay loam	Drought tolerant and moderately frost tolerant	S G W
Banksia integrifolia subs. monicola	Banksia	Height to 5m, will grow higher in favourable conditions	Light to medium clay	Drought and frost tolerant	S G W
Corymbia ficifolia	Red flowering gum	Height to 6m red flowering gum	Prefers free draining soil	Drought and frost tolerant	S B G
Elaeocarpus eumundi	Eumundi quandong	Height to 8m, dense shiny foliage excellent screening plant	Prefers free draining soils	Drought tolerant, will tolerate light frost	B
Elaeocarpus reticulatus	Blueberry Ash			Drought and frost tolerant	B

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Callistemon viminalis	Weeping bottle brush	Medium tree to 8m brilliant red bottle brush flowers in Spring and Autumn	Tolerates poor drainage	Drought and frost tolerant	S L B F E G R W
Eucalyptus crenulata	Buxton silver gum	Fast growing tree to 8m, fine crenulated solver/pink foliage	Tolerates waterlogging, sandy and clay soils but prefers well drained soils	Drought and frost tolerant	B F G W
Eucalyptus torquata	Coral gum	Small to medium tree to 6m	Tolerant of most soil types and climatic conditions, but does prefer full sun and well-drained soil.	Drought and frost tolerant	B F G W
Geijera parviflora	Wilga	Medium tree to 9m, ornamental weeping foliage, round shape, strongly scented, small white flowers	Endemic, so tolerates most soil conditions, prefers good well-drained soil	Drought and frost tolerant	S L B E G W
Hakea laurina	Pin cushion hakea	Height to 5m, small round tree with curly leaves and bright red and cream pin cushion flowers in winter	Tolerates any soil that is lime free	Drought tolerant, in frosts new tips will burn, can cover until up to 1 m	G W
Hakea petiolaris	Sea urchin hakea	Small tree to 9m	Well drained and slightly acidic soil	Drought and moderately frost tolerant	G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Harpullia pendula	Tulipwood	Small tree with a dense crown of glossy green leaves with smooth grey bark, will not grow as big as coastal specimens	Tolerates soil conditions	Drought and frost tolerant	S G
Hymenosporum flavum	Native frangipani	Small to medium tree to 10m, cream to golden scented flowers	Tolerant of most soils, prefers well-drained soil	Drought and frost tolerant	G W
Lagerstroemia indica	Crepe myrtle	Beautiful small flowering tree	Tolerant of most soil types	Drought and frost tolerant	S G
Leptospermum petersonii	Lemon scented tea tree	Height to 5m, many small white flowers	Tolerates poor soil	Drought tolerant, protect from frost	G W
Melaleuca bracteata	Black tea tree	Small tree	Clay soils with good drainage	Drought and frost tolerant	S B E G W
Melaleuca decora	White feather honey myrtle	Height to 6m, mass of cream yellow flowers in spring	Tolerates most soils	Drought and frost tolerant	B G R W
Melaleuca linariifolia	Snow in Summer	Height to 8m, white fluffy flowers cluster over the plant in summer	Tolerates all soils	Drought and frost tolerant	B F G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Notelaea longifolia	Large mock olive	Usually small tree to 3m but can grow up to 9m	Tolerates most soils	Drought tolerant and tolerates mild frost	B F G W
Pittosporum angustifolium	Weeping pittosporum	Height to 6m, slow growing, weeping foliage	Wide range of well-drained soils	Drought and frost tolerant	S L B F E G W
Pittosporum rhombifolium	Qld holly	Height to 8m	Tolerates most soils	Drought tolerant and moderately frost tolerant	G
Syzygium australe	Lillly pilly, brush cherry	Height to 8m, compact form, good for hecging	Tolerates most soils	Drought tolerant and reasonably frost tolerant, is extremely hardy once established	S B F G
Syzygium leuhmannii	Small leaved lilly pilly, riberry	Height to 8m, fluffy white flowers, pink new growth	Tolerates most soils	Drought tolerant and moderately frost tolerant	B F G W
Syzygium paniculata	Magenta cherry	Height to 8m in cultivation	Tolerates most soils	Drought and frost tolerant	B F

6.10.4.3 Trees and shrubs (2-5m)

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Acacia chinchillensis	Chinchilla wattle	Grows to 3m	Well drained soils	Frost and drought tolerant, in partial shade or full sun	L B E G W
Alyogyne hakeifolia		Medium shrub to 3m, purple, pink or yellow flowers, needle-like foliage	Intolerant of bad drainage	Drought tolerant, shelter from heavy frost	BGW
Alyogyne huegelii	Lilac hibiscus	Grows to 2.5m, medium sized bushy shrub, good understorey plant, small purple hibiscus flower	Can cope with heavy soil, but likes reasonably well-drained soils	Drought tolerant, shelter from heavy frost	B G W
Brachychiton bidwillii	Little kurrajong	Grows to 3m. orange-red flowers on bare branches, flowers best in full sun	Tolerates a wide range of soil types, likes well-drained soil	Frost and drought tolerant.	L G W
Ceratopetalum gummiferum	NSW Christmas bush	Grows to 5m, red 'flowers' in December	Well-drained soil	Frost tolerant	B G W
Eucalyptus argophloia dwarf	Dwarf Chinchilla white gum	Height to 4m, weeping form	Thrives on heavy soil	Frost and drought tolerant	S B F G R W
Eucalyptus boliviana		Height to 5m, bluish leaves	Prefers deep loam soil	Frost and drought tolerant	B G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Gossypium sturtianum	Sturt's Desert Rose	Height to 3m with hibiscus like flowers	Prefers well-drained soil	Drought tolerant and moderately frost tolerant	G W
Gossypium sturtianum var. nandewarense	Sturt's Desert Rose	Height to 3m with pinky hibiscus like flowers	Prefers well-drained soil	Drought tolerant and more resistant to frosts than sturtanum	G W
Grevillea sp eg 'Honey Gem, 'Hookeriana' 'Misty Pink', and 'Moonlight'	Brush flowers, all different colours	Heights vary	Good drainage	Drought and frost tolerant	B G W
Indigofera australis	Pink pea flowers	Grows to 2.5m	Well drained acid soils	Tolerates moderately heavy frost, semi shaded position	B E G R W
Jacksonia scoparia	Native dogwood	Grows to 4m Pea - like yellow flowers in spring, grey green arching branchlets	Well drained sandy and loamy soils	Full sun, part shade	E G W
Kunzea baxteri	Crimson kunzea	Grows to 4m	Well-drained soil	Drought tolerant, sheltered position - tolerates light frost	B G W
Kunzea opposita		Grows 1.5-3m, pink flowers at the end of branchlets	Well drained soil	Drought tolerant, may be damaged by heavy frost	E G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Leptospermum lanigerum	Woolly tea tree	Grows to 3m, pendulous habit	Most soils	Drought and frost tolerant	B F G W
Magnolia Little Gem	Little gem	Small tree to 3m	Well drained soil	Drought and frost tolerant	G
Melaleuca elliptica	Granite bottle brush	Round shrub 3m x 3m	Tolerates most soils	Drought and frost tolerant	B F G W
Melaleuca nesophila	Showy honey myrtle	Thick foliage, pink pompom like flowers in spring and summer	Low maintenance, hardy plants, tolerates alkaline soils, prefers well drained soils	Frost and drought tolerant	B G W
Persoonia pinifolia	Pine leaved geebung, pine needle appearance, flowers grow in racemes from December to June	Height 2-4m	Free draining acid soil	Drought and frost tolerant	B G W
Pultenaea flexilis	Graceful bush pea	Shrub to 3m, narrow leaves, yellow flowers at the ends of the branches in abundance	Free draining soil	Shelter plant from frost, moderately drought tolerant	B G W

6.10.4.4 Small shrubs (0.2-2m)

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Austromyrtus dulcis	Midginberry	Low spreading shrub with fine myrtle foliage under 1m high	Good drainage	Frost tolerant	B G W
Calytrix tetragona	Common fringe myrtle	Bright green shrub with aromatic leaves when crushed, starry pink flowers	Well drained soils	Drought and frost tolerant	L B E G W
Correa 'Dusky Bells'		Evergreen shrub to 1m high and 2-4m in diameter, flowers March to September, attracts birds	It grows wells on friable, well-drained and fertile loam.	Drought and frost tolerant	E
Crinum pedunculatum	River lily, spider lily	Bulbous perennial herb, strappy leaves, white spider flowers	Tolerates poor drainage and clay soils	Frost tolerant, tolerates dry conditions but may suffer, grows in sun or shade	B G
Dianella longifolia	Smooth-leaved flax lily	Tufted perennial herb to 400mm, flowers Oct to Dec, follows with blue fruits	Prefers well drained soil	Drought and frost tolerant, prefers shady spot.	E G R
Dianella revoluta	Blue Flax Lily	Perennial clumping herb to 1m	Tolerant of most soil types	Very hardy once established, drought and frost tolerant	E G R

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Grevillea 'Robyn Gordon'	Height to 1.5m	Red flowers	Well drained soils	Drought and frost tolerant	G W
Grevillea 'Superb'	Height to 1.5m	Apricot orange flowers	Well drained soils	Drought and frost tolerant	G W
Grevillea 'Coconut Ice'	Height to 2m	Pink and red flowers	Well drained soils	Drought and frost tolerant	G W
Grevillea 'Peaches and Cream'	Height to 1.5m	Yellow pink and orange colours in flowers	Well drained soils	Drought and frost tolerant	G W
Grevillea spp cultivars	All heights	All colours	Well drained soils	Drought and frost tolerant	G W
Hibbertia obtusifolia	Guinea flower	200mm high , 1m wide, good for border planting	Light clay to sandy soils	Drought and frost tolerant	E G R
Hovea lanceolata	Lance leaf hovea	Height to 2m, purple pea flower	Good drainage	Drought tolerant and moderately frost tolerant	E G W
Leptospermum rotundifolium	Round leaved tea tree	Height to 1.5m, and 3m wide dense and stiff, mass of flowers	Tolerant of most soil types	Drought and frost tolerant	B G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Lomandra filiformis	Wattle mat rush	Perennial tussock to 200mm with inconspicuous flowers, good bank stabiliser	It grows in a variety of well-drained soil types from clays to humus-rich and sandy or rocky soils	Drought and frost tolerant	E G R W
Philotheca myoporoides	Native daphne Long leaf wax flower	800mm high x 800mm wide White star like flowers with rough centre	Well drained soil	Moderate frost tolerance, hardy once established	B G W
Prostanthera nivea	Snowy mint bush	Height to 2m	Tolerates most soil types	Drought and frost tolerant	B G W
Senna odorata	Southern Cassia	Shrub to 2m high and 1.5m wide, moderately fragrant yellow or orange flowers	Tolerates most soils	Tolerates light frost	B F G W
Swainsona galegifolia	Darling pea	Shrubby perennial to 1m, prune after flowering, useful quick cover	Tolerates most soils	Drought tolerant, maybe set back by frost	B E G W

6.10.4.5 Groundcovers and Climbers

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Eremophila biserrata		Prostrate shrub that spreads by developing roots at the leaf nodes	Must have good drainage	Drought and frost tolerant	G
Eremophila debilis Syn Myoporum debilis	Winter apple or Amula	Prostrate shrub spreads 1-2m, flowers white - purple mauve	Clay soils	Will grow in part shade or full sun	E G R
Grevillea prostrate forms			Well drained soils	Drought and frost tolerant	G

6.10.5 Wandoan

6.10.5.1 Medium to Large trees (over 10 metres)

This list includes exotics that can be used for street trees and in many cases are being used as street trees.

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Acacia pendula	Weeping Myall	Graceful, weeping habit and blue-grey foliage	Prefers well drained sandy soils but will grow in clay soils	Frost and drought tolerant, will grow in part-shade	S G W
Angophora costata	Smooth barked apple	Height to 25m. Trunk gnarled and crooked, pink to pale gray bark, cream flowers in summer, bark sheds in Spring	Well drained soil but is tolerant of many conditions	Drought tolerant, new tips can suffer frost damage	L F W
Brachychiton australis	Broad leaved bottle tree	Grows to 12m, fast growing, large maple like leaves, deciduous while flowering, cream flowers in early summer	Will grow in most soils: well-drained to poorly drained soils and alkaline soils	Frost and drought tolerant	S G
Brachychiton discolor	Lacebark tree	Height to 12m, pink flowers when semi-deciduous	Tolerates a range of soils, can be slow growing	Frost and drought tolerant	S G
Brachychiton rupstris	Bottle tree	Height to 20m, bottle shape develops in 5-8 years, drops leaves before flowering in Spring	Tolerates a variety of soil types	Frost and drought tolerant	L F E G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Brachychiton populneaus	Kurrajong	Height to 10m, cream coloured bell shaped flowers in summer	Tolerates a variety of soil types	Drought tolerant and moderately frost tolerant	S
Caesalpinia ferrea	Leopard tree	Large tree to 15m, smaller in harsh conditions, bright yellow flowers, dappled grey bark	Likes well-drained oil	Will tolerate long periods of dryness and light frosts	S
Casuarina cristata	Belah	Large tree to 20m, fine needle foliage and rough grey bark	Tolerates a variety of soil types	Frost and drought tolerant	
Casuarina cunninghamiana		Height to 15m, narrow tree with irregular shape and dense foliage	Tolerates poor soils, prefers well drained soils, slightly acidic to very alkaline	Frost and drought tolerant, prefers full sun	F
Ceratonia siliqua	Carob	Height to 12m, dark green foliage	Prefers a free draining soil but will tolerate harsh environments	Frost and drought tolerant	F
Cupaniopsis Anacardioides	Tuckeroo	Small tree with dark green leathery foliage, grey trunk, yellow fruit	Tolerant of a wide range of soils, very hardy tree	Drought tolerant, will tolerate light frost	S B G
Eucalyptus argophloia	Chinchilla white gum	Height to 35m, narrow tree	Most soil types, mildly acidic to mildly alkaline	Frost and drought tolerant	L F

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Flindersia australis	Crow's Ash	Height to 10m	Tolerates most soils	Drought tolerant and tolerates light frost, more tolerant with age	S E G W
Flindersia brayleyana	Qld maple	Height over 15m, with columnar shape, shiny foliage, white flowers in summer	Needs well drained soil	Tolerates moderate frost	S
Flindersia maculosa	Leopard wood	Height to 15m, beautiful tree with mottled trunk	Tolerates most soils	Frost and drought tolerant	S B F E G W
Flindersia schottiana	Cudgerie Silver Ash	Height to 15m, white scented flowers	Good drainage and acidic soil	Drought tolerant and moderately frost tolerant	S L
Ginkgo biloba	Maidenhair tree	Butterflied fan-like leaves, autumn colours	Tolerates almost all soil types, likes well drained soil	Full sun, frost and drought tolerant	S
Gmelina leichardtii	White beech	Height to 15m in cultivation (probably less)	Well drained soil	Drought tolerant, will bounce back from frost	S L
Grevillea robusta	Silky oak	Height to 20m	Tolerates alkaline soil	Drought and frost tolerant	S L
Guioa semiglauca	Wild quince	Height to 12m in rainforests, probably much smaller, fluted trunk when older	Mildly acidic to mildly alkaline	Drought tolerant and observed to be frost tolerant	S G

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Jacaranda mimisifolia	Jacaranda	Tropical tree, height to 12m, in September loses leaves and displays spectacular purple flowers	Tolerates most soil conditions	Drought tolerant and moderately frost tolerant	S G
Jagera pseudorhus	Foambark	Rainforest tree to 10m, will not reach rainforest heights, brownish hairy flowers, pioneer species	Adapts to most soils	Drought tolerant and moderately frost tolerant	
Melaleuca irbyana	Weeping paperbark	Height 8m to 12m with thick spongy, papery bark and weeping branches	Will grow on poorly drained soil and clay soils	Drought and moderately frost tolerant	S B F G W
Melaleuca stypheliodes	Prickly-leaved paper bark	Height to 20m, dense rounded canopy and drooping branchlets, bark peels off	Tolerant of most soil types, due to its deep-rooting characteristics, lawn can be grown under its canopy	Drought and frost tolerant	S B F G R W
Polyscias murrayi	Pencil cedar	Height to 15m, umbrella shapes	Tolerates most soils, prefers well drained soils	Drought tolerant and tolerates light frost	
Pyrus calleryana	Callery pear	Height to 14m, columnar shape, showy blossoms	Able to handle wet heavy soils	Drought and frost tolerant	S G
Quercus suber	Cork oak	Height to 20m in Melb, so less here	Intolerant of compaction	Drought tolerant once established, frost tolerant	S

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Rhodosphaera rhodanthema	Deep yellow wood	Medium tree to 12m, columnar shape	Tolerant of most soils, mildly acid, prefers good drainage	Drought and frost tolerant	S B F G
Stenocarpus sinuatus	Qld firewheel tree	Small tree in cooler areas, spectacular orange flowers	Prefers deep, moist, well-drained soil, will grow well on sandy loams to clay loams.	Drought tolerant and frost to -2, protect when young	G
Toona ciliata	Red cedar	Height to 20m, fast growing majestic tree, sprays of white aromatic flowers	Prefers well-drained soil	Drought and frost tolerant	S L

6.10.5.2 Large shrubs to small trees (5-10 m)

This list includes exotics that can be used for street trees and in many cases are being used as street trees.

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Agonis flexuosa	WA Peppermint	Height to 10m width to 5m long narrow leaves, small white flowers, weeping habit	Tolerates alkaline soils, likes good drainage	Reasonable drought and frost tolerant	G W
Banksia integrifolia subs. integrifolia	Coast Banksia	Height to 5m, will grow higher in favourable conditions	Prefers sandy acidic soil but will grow in sandy clay loam	Drought tolerant and moderately frost tolerant	S G W
Banksia integrifolia subs. monicola	Banksia	Height to 5m, will grow higher in favourable conditions	Light to medium clay	Drought and frost tolerant	S G W
Breynia oblongifolia		Colourful fruits are attractive to birds height to 3m	Tolerates a variety of soil types.	Easily grown in a variety of conditions.	
Callistemon 'Kings Park Special' (any appropriate height callistemon)	'Kings Park Special'	A small bushy Australian native tree to 5m high	Tolerate a range of soils.	Full sun, part shade, drought and frost tolerant.	B
Callistemon viminalis	Weeping bottle brush	Medium tree to 8m brilliant red bottle brush flowers in Spring and Autumn	Tolerates poor drainage	Frost and drought tolerant	S L B F E G R W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Croton insularis		Small tree 3-4m	Tolerant of low water, mildly alkaline to mildly acidic soils.	Hot overhead sun to warm low sun.	
Cycas revoluta		A low growing cycad. Up to 6m	Prefers a sunny, well drained spot, with deep soil, but will still thrive in less than ideal conditions	Frost and drought tolerant	
Elaeocarpus reticulatus	Blueberry Ash			Drought and frost tolerant	
Eremophila	Longifolia	Rounded shrub or small tree to 6m.	Endemic to area	Drought tolerant, fast growing.	
Eremophila	Mitchellii	Shrub or small tree to 8m.	Endemic to area	Drought tolerant and frost tolerant.	
Eucalyptus crenulata	Buxton silver gum	Fast growing tree to 8m, fine crenulated solver/pink foliage	Tolerates waterlogging, sandy and clay soils but prefers well drained soils	Drought and frost tolerant	
Eucalyptus torquata	Coral gum	Small to medium tree to 6m	Tolerant of most soil types and climatic conditions, but does prefer full sun and well-drained soil.	Drought and frost tolerant	
Hakea	Purpurea	Untidy, rounded or erect shrub to 1.8m high.	Endemic to area	Drought tolerant and frost tolerant.	

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Harpullia pendula	Tulipwood	Small tree with a dense crown of glossy green leaves with smooth grey bark, will not grow as big as coastal specimens	Tolerates soil conditions	Drought and frost tolerant	S G
Hymenosporum flavum	Native frangipani	Small to medium tree to 10m, cream to golden scented flowers	Tolerant of most soils, prefers well drained soil	Drought and frost tolerant	
Lagerstroemia indica	Crepe myrtle	Beautiful small flowering tree	Tolerant of most soil types	Drought and frost tolerant	S G
Leptospermum petersonii	Lemon scented tea tree	Height to 5m, many small white flowers	Tolerates poor soil	Drought tolerant, protect from frost	G W
Malus floribunda	Japanese crab apple	Small tree to 5m, beautiful floral display, round and dense	Well drained soil	Drought tolerant once established, frost tolerant	G
Malus ioensis 'Plena'	Crab apple	To 6m, masses of mildly fragrant double flowers in late spring	Prefers slightly acidic, well-drained soil	Drought and frost tolerant	S L G
Melaleuca decora	White feather honey myrtle	Height to 6m, mass of cream yellow flowers in spring	Tolerates most soils	Drought and frost tolerant	B G R W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Melaleuca linariifolia	Snow in Summer	Height to 8m, white fluffy flowers cluster over the plant in summer	Tolerates all soils	Drought and frost tolerant	B F G W
Notelaea longifolia	Large mock olive	Usually small tree to 3m but can grow up to 9m	Tolerates most soils	Drought tolerant and tolerates mild frost	B F G W
Pittosporum angustifolium	Weeping pittosporum	Height to 6m, slow growing, weeping foliage	Wide range of well drained soils	Drought and frost tolerant	S L B F E G W
Pittosporum multiflorum		Small orange fruits make this shrub very ornamental. It has small needle-like spines and is favoured by birds as a safe nesting site. 3m	Prefers well-drained soils.	A slow-growing plant that requires a sheltered site with plenty of light.	
Pittosporum rhombifolium	Qld holly	Height to 8m	Tolerates most soils	Drought tolerant and moderately frost tolerant	G
Syzygium australe	Lillly pilly, brush cherry	Height to 8m, compact form, good for hecging	Tolerates most soils	Drought tolerant and reasonably frost tolerant, is extremely hardy once established	S B F G

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Syzygium leuhmannii	Small leaved lilly pilly, riberry	Height to 8m, fluffy white flowers, pink new growth	Tolerates most soils	Drought tolerant and moderately frost tolerant	B F G W
Syzygium paniculata	Magenta cherry	Height to 8m in cultivation	Tolerates most Soils	Drought and frost tolerant	B F

6.10.5.3 Trees and shrubs (2-5m)

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Acacia chinchillensis	Chinchilla wattle	Grows to 3m	Well drained soils	Frost and drought tolerant, in partial shade or full sun	L B E G W
Alyogyne hakeifolia		Medium shrub to 3m, purple, pink or yellow flowers, needle-like foliage	Intolerant of bad drainage	Drought tolerant, shelter from heavy frost	BGW
Alyogyne huegelii	Lilac hibiscus	Grows to 2.5m, medium sized bushy shrub, good understorey plant, small purple hibiscus flower	Can cope with heavy soil, but likes reasonably well-drained soils	Drought tolerant, shelter from heavy frost	B G W
Brachychiton bidwillii	Little kurrajong	Grows to 3m. orange-red flowers on bare branches, flowers best in full sun	Tolerates a wide range of soil types, likes well-drained soil	Frost and drought tolerant.	L G W
Ceratopetalum gummiferum	NSW Christmas bush	Grows to 5m, red 'flowers' in December	Well drained soil	Frost tolerant	
Eremophila	Bignoniiflora x polyclada	This spectacular Australian native shrub handles a range of harsh conditions. 4m in height.	Preferring a sunny site with good drainage.	It will tolerate some frost and drought and this hardy plant is quite stunning.	B E G R W
Eucalyptus argophloia dwarf	Dwarf Chinchilla white gum	Height to 4m, weeping form	Thrives on heavy soil	Frost and drought tolerant	S B F G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Eucalyptus boliviana		Height to 5m, bluish leaves	Prefers deep loam soil	Frost and drought tolerant	B G W
Gossypium sturtianum	Sturt's Desert Rose	Height to 3m with hibiscus like flowers	Prefers well drained soil	Drought tolerant and moderately frost tolerant	G W
Gossypium sturtianum var. nandewarense	Sturt's Desert Rose	Height to 3m with pinky hibiscus like flowers	Prefers well drained soil	Drought tolerant and more resistant to frosts than sturtanum	G W
Grevillea	Longistyla	Bushy, multi-stemmed shrub, 3 - 4m high x 2 - 3m wide; outer branches rusty-brown and slightly hairy towards the ends.	Endemic to area	Drought tolerant and frost resistant.	
Grevillea sp eg 'Honey Gem, 'Hookeriana' 'Misty Pink', and 'Moonlight'	Brush flowers, all different colours	Heights vary	Good drainage	Drought and frost tolerant	B G W
Indigofera australis	Pink pea flowers	Grows to 2.5m	Well drained acid soils	Tolerates moderately heavy frost, semi shaded position	B E G R W
Jacksonia scoparia	Native dogwood	Grows to 4 m Pea - like yellow flowers in spring, grey green arching branchlets	Well drained sandy and loamy soils	Full sun, part shade	E G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Kunzea baxteri	Crimson kunzea	Grows to 4m	Well drained soil	Drought tolerant, sheltered position - tolerates light frost	B G W
Kunzea opposita		Grows 1.5-3m, pink flowers at the end of branchlets	Well drained soil	Drought tolerant, may be damaged by heavy frost	E G W
Leptospermum lanigerum	Woolly tea tree	Grows to 3m, pendulous habit	Most soils	Drought and frost tolerant	B F G W
Magnolia Little Gem	Little gem	Small tree to 3m	Well drained soil	Drought and frost tolerant	G
Melaleuca elliptica	Granite bottle brush	Round shrub 3m x 3m	Tolerates most soils	Drought and frost tolerant	B F G W
Melaleuca nesophila	Showy honey myrtle	Thick foliage, pink pompom like flowers in spring and summer	Low maintenance, hardy plants, tolerates alkaline soils, prefers well drained soils	Frost and drought tolerant	B G W
Persoonia pinifolia	Pine leaved geebung, pine needle appearance, flowers grow in racemes from December to June	Height 2-4m	Free draining acid soil	Drought and frost tolerant	B G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Pultenaea flexilis	Graceful bush pea	Shrub to 3m, narrow leaves, yellow flowers at the ends of the branches in abundance	Free draining soil	Shelter plant from frost, moderately drought tolerant	B G W
Rhodamnia maideniana		A bushy shrub with ornamental foliage and small, pink flowers and black berries that are attractive to birds. 3m	Requires well-drained moist soil.	Prefers semi-shaded position.	
Xanthorrhoea johnsonii		Grass tree, typically single trunked specimens that grow up to 5 metres tall.	Well drained soil is best.	An open sunny situation.	

6.10.5.4 Small shrubs (0.5-2m)

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Austromyrtus dulcis	Midginberry	Low spreading shrub with fine myrtle foliage under 1m high	Good drainage	Frost tolerant	B G W
Calytrix tetragona	Common fringe myrtle	Bright green shrub with aromatic leaves when crushed, starry pink flowers	Well drained soils	Drought and frost tolerant	L B E G W
Correa 'Dusky Bells'		Evergreen shrub to 1 m high and 2-4 m in diameter, flowers March to September, attracts birds	It grows wells on friable, well-drained and fertile loam.	Drought and frost tolerant	E
Crinum pedunculatum	River lily, spider lily	Bulbous perennial herb, strappy leaves, white spider flowers	Tolerates poor drainage and clay soils	Frost tolerant, tolerates dry conditions but may suffer, grows in sun or shade	B G
Dianella longifolia	Smooth-leaved flax lily	Tufted perennial herb to 400 mm, flowers Oct to Dec, follows with blue fruits	Prefers well drained soil	Drought and frost tolerant, prefers shady spot.	E G R
Dianella revoluta	Blue Flax Lily	Perennial clumping herb to 1m	Tolerant of most soil types	Very hardy once established, drought and frost tolerant	E G R

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Eremophila	Maculata	Low, multi-stemmed shrub, rounded or almost prostrate to 1.5m.	Endemic to area	Drought tolerant and frost tolerant.	
Grevillea 'Robyn Gordon'	Height to 1.5m	Red flowers	Well drained soils	Drought and frost tolerant	G W
Grevillea 'Superb'	Height to 1.5m	Apricot orange flowers	Well drained soils	Drought and frost tolerant	G W
Grevillea 'Coconut Ice'	Height to 2m	Pink and red flowers	Well drained soils	Drought and frost tolerant	G W
Grevillea 'Peaches and Cream'	Height to 1.5m	Yellow pink and orange colours in flowers	Well drained soils	Drought and frost tolerant	G W
Grevillea spp cultivars	All heights	All colours	Well drained soils	Drought and frost tolerant	G W
Hibbertia obtusifolia	Guinea flower	200 mm high , 1 m wide, good for border planting	Light clay to sandy soils	Drought and frost tolerant	E G R
Hovea lanceolata	Lance leaf hovea	Height to 2m, purple pea flower	Good drainage	Drought tolerant and moderately frost tolerant	E G W

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Leptospermum rotundifolium	Round leaved tea tree	Height to 1.5m, and 3m wide dense and stiff, mass of flowers	Tolerant of most soil types	Drought and frost tolerant	B G W
Lomandra filiformis	Wattle mat rush	Perennial tussock to 200 mm with inconspicuous flowers, good bank stabiliser	It grows in a variety of well-drained soil types from clays to humus-rich and sandy or rocky soils	Drought and frost tolerant	E G R W
Philotheca myoporoides	Native daphne Long leaf wax flower	800 mm high x 800 mm wide White star like flowers with rough centre	Well drained soil	Moderate frost tolerance, hardy once established	B G W
Prostanthera nivea	Snowy mint bush	Height to 2m	Tolerates most soil types	Drought and frost tolerant	B G W
Senna odorata	Southern Cassia	Shrub to 2m high and 1.5m wide, moderately fragrant yellow or orange flowers	Tolerates most soils	Tolerates light frost	B F G W
Swainsona galegifolia	Darling pea	Shrubby perennial to 1m, prune after flowering, useful quick cover	Tolerates most soils	Drought tolerant, maybe set back by frost	B E G W

6.10.5.5 Groundcovers and Climbers

Botanical Name	Common Name	Features	Soils	Conditions	Appropriate uses
Eremophila biserrata		Prostrate shrub that spreads by developing roots at the leaf nodes	Must have good drainage	Drought and frost tolerant	G
Eremophila debilis **Syn Myoporum debilis**	Winter apple or Amula	Prostrate shrub spreads 1-2 m, flowers white - purple mauve	Clay soils	Will grow in part shade or full sun	E G R

6.11 Appendix 2

Weed List Western Downs

Any plant not in this list but included in the Queensland Government's Weed list and/or included in the Brigalow Belt area for Weeds Australia is to be treated as a weed in the Western Downs.

Botanical Name	Common Name
Acacia famesiana	Mimosa bush
Acacia karroo	Karoo thorn
Acacia nilotica subspecies indica	Prickly Acacia
Allamanda cathartica	Yellow allamanda
Asparagus scandens.	asparagus fern
Catharanthus roseus	Pink periwinkle
Celtis sinensis	Chinese Elm
Cinnamomum camphora	Camphor Laurel
Coffea arabica	Coffee Tree
Coreopsis lanceolata	Coreopsis
Cotymbia torelliana	Cadagi Gum
Cynodon dactylon	Couch grass
Duranta erecta	Duranta
Ficus elastica	Rubber Tree
Gleditsia triacanthos	Honey locust tree
Gloriosa superb	Glory lily
Koelreuteria formosana	Golden Rain Tree
Ligustrum sinense	Privet
Lonicera japonica	Japanese honeysuckle
Melia azedarach	White cedar
Murraya paniculata	Murraya
Olea europea	Olive
Paulownia tomentose	Paulownia
Pinus elliotti	Radiata Pine Trees
Schefflera actinophylla	Qld. Umbrella Tree
Schinus terebinthifolia	Broad Leafed Pepper Tree

Senna bicapsularis	Cassia
Senna floribunda	Cassia
Senna pendula	Easter Cassia
Spathodea campanulata	African Tulip Tree
Syagrus romanzoffia	Cocos Palm

Part 7 - Car Parking and Manoeuvring Standards

Sufficient manoeuvring of the B99 design vehicle must be achieved. The B99 vehicles must have adequate manoeuvring within the development and able to enter/exit the property.

The guidelines outlined by the *AS/NZS 2890.1 Part 1 Off-street Parking* are adopted in principle, and the design parameters used, are to be in accordance with the criteria listed in *AS/NZS 2890.1:2004*. Car parking and manoeuvring areas shall be designed in accordance with the current version and requirements of:

- AS/NZS 2890.1 – Parking Facilities – Part 1 Off-street car parking
- AS/NZS 2890.2 – Parking Facilities – Part 2 Off-street commercial vehicle facilities
- AS/NZS 2890.3 – Parking Facilities – Part 3 Bicycle parking facilities
- AS/NZS 2890.5 – Parking Facilities – Part 5 On Street Parking
- AS/NZS 2890.6 – Parking Facilities – Part 6 Off-street parking for people with disabilities

The following specific requirements shall be used when applying the above AS/NZ Standards

- The design vehicle for car parks shall be a B99 vehicle.
- The minimum width of any single park or adjoining car parks shall be 2.6m
- The minimum length of any single park shall be 5.4m
- Vehicles must enter and exit a site in a forward gear except as follows:
    - Where the site is a single detached dwelling house; or
    - Where the site is a multiple dwelling unit with no greater than 2 units and does not join a collector or higher order road or does not have a constructed pedestrian footpath at the frontage to the site.

Part 8 - Grids and Gates

Grids and Gates shall be designed, constructed and maintained in accordance with:

- Local Law No. 1 (Administration) 2011
- Subordinate Local Law No. 1.16 (Gates and Grids) 2

Part 9 - Vehicle Crossovers and Property Access

Vehicle crossovers and property accesses shall be designed, installed and maintained in accordance with:

- Local Law No. 1 (Administration) 2011 and
- Western Downs Regional Council – Access Policy

Vehicle crossovers and property accesses to the development should be constructed with a 1.0 metre minimum clearance from the edge of the crossover to any existing or proposed infrastructure, including any stormwater gully pit, manhole, service infrastructure or power poles.

Part 10 Flooding Overland Flow Categories and Standards

Table of Content

10.1 Flooding Categories

Table 10.1.1 Flooding Immunity Levels - Buildings

Table 10.1.2 Community Infrastructure Flood Immunity Levels

10.2 Stormwater Overland Flow Categories

Table 10.2.1 Stormwater Overland Flow Path Immunity Levels

Table 10.2.2 Community Infrastructure Stormwater Overland Flow Immunity Levels

10.1 Flooding Categories

Development shall be categorised as shown below and the flood levels applicable to that category applied to building and operational works associated with development.

Table 10.1.1– Flood Immunity Levels – Buildings

Development Type	Minimum design floor or pavement levels (m)	Development Type Included in Category
Category A	100y ARI + 0.5 metres	Class 1 – 4 buildings where adjacent to a Major Flow Path.
Category B	100y ARI + 0.3 metres	Class 1- 4 Buildings – Habitable Floor Levels Class 5 – 10 Buildings Utilities and Essential services (excluding water and wastewater services) All Classes – areas for the storage or hazardous or dangerous goods.
Category C	100y ARI	Class 1-4 Buildings – Non-Habitable Floor Level Class 5-10 Buildings – remainder of floor area.
Category D	100y ARI	Nil
Category E	50y ARI	Parking and Manoeuvring areas and Stockpile Areas Garages.

Table 10.1.2 – Community Infrastructure Flood Immunity Levels

Development Type	Minimum design floor or pavement levels (m)	Development Type Included in Category
Utility installation (other)	100y ARI + 0.5 metres or greater height determined at the time of application and having consideration for the proposed development	Any uses not included in Table 8.2.4.3 of the planning scheme document
Air services	100y ARI + 0.5 metres	Strip, taxiways, operations buildings and control towers etc. (Other buildings as per table 10.1)

10.2 Stormwater Overland Flow Categories

Table 10.2.1 - Stormwater overland flow path immunity levels

Development Type	Minimum design floor or pavement levels (m)	Development Type Included in Category
Category A	50y ARI + 0.5 metres	Class 1 – 4 buildings where adjacent to a Major Flow Path.
Category B	50y ARI + 0.3 metres	Class 1- 10 Buildings – Where adjacent to a Minor Flow Path All Classes – areas for the storage or hazardous or dangerous goods.
Category C	50y ARI	Class 1-4 Buildings – Non-Habitable Floor Level Class 5-10 Buildings – remainder of floor area.
Category D	50y ARI	Nil

Category E	20y ARI	Parking and Manoeuvring areas and Stockpile Areas Garages

Table 10.2.2 – Community Infrastructure Stormwater Overland Flow Immunity Levels

Development Type	Minimum design floor or pavement levels (m)	Development Type Included in Category
Utility installation (other)	100y ARI + 0.5 metres or greater height determined at the time of application and having consideration for the proposed development	Any uses not included in Table 8.2.4.3 of the planning scheme document

Part 11 Filling and Excavation Requirements

Earthworks and filling shall be carried out in accordance with:

- AS3798: Guidelines on Earthworks for Commercial and Residential Developments; and
- Department of Transport and Main Roads Technical Standard MRTS04, General Earthworks.

Part 12 Erosion and Sedimentation Guidelines

Erosion and Sedimentation Control works shall be designed, constructed and maintained generally in accordance with:

- Council's standard drawing nos. D-005, D-006 and D-007, as applicable:
- IPWEAQ Standard Drawings and
- Best Practice Erosion and Sediment Control - BPESC (International Erosion Control Association).

Part 13 Presentation of Plans

All plans submitted to Council must be in accordance with *AS 1100.101-1992 Technical drawing Part 101:* General principles and *AS/NZS 1100.501:2002 Part 501*: Structural engineering drawing for structural design and should address the following:

Table of Content

13.1 Drawing Quality
13.2 Sheet Size
13.3 Preferred Scales
13.5 Base Sheet Information
13.5.1 Title Block
13.5.2 Architect or Approved Designer on Subdivisions Larger than 20 Lots
13.5.3 General
13.5.4 Dimensioning

13.1 Drawing Quality

Line work and text must retain legibility through the processes of photocopying, scanning and conversion to PDF. Text should be easily read at A3. Ensure hatching and other symbology is legible.

13.2 Sheet Sizes

- General A3 plans is the preferred size.

13.3 Landscaping Plans

- A1 and reduced to A3 are the preferred sizes, A4 acceptable for specifications and details.

13.4 Preferred Scales

Scale of plans should be at a standard scale and divisible by xxx

- Concept plans - minimum 1:500, preferred 1:100/1:200
- Sketch plans and working drawings - minimum 1:200
- Construction details - minimum 1:50

13.5 Base Sheet Information

13.5.1 Title Block

- Project or estate name
- Street address and suburb
- Real property description
- Applicant's name
- Council's issued application reference number (after initial submission)
- Design certification, (signed by RPEQ Engineer for Civil plans and Landscape

13.5.2 Engineer Architect or Approved Designer on subdivisions larger than 20 lots

- Scale
- Drawing and sheet number
- Date
- Schedule of Amendments

13.5.3 General

- North arrow
- Legend
- Locality map
- Property reserve and easement boundaries
- Notation of any preceding and future related landscape drawings

13.5.4 Dimensioning

- Linear dimensions are to be indicated in metres and millimetres where applicable
- Levels to be reduced to Australian Height Datum and indicated to 0.01m
- Slope batters to be indicated in percentage or ratio format