Contents

SC6.2 PSP No. 2 – Engineering Standards – Roads and Drainage Infrastructure[1]

SC6.2.1 Introduction

(1) The guidelines in this document relate to the planning, design and construction of roads, drainage and associated civil infrastructure for the Toowoomba Regional Council.

(2) These guidelines provide the basis for the planning and determination of development applications that will deliver community civil assets to the Council. They also form the basis for design and delivery for Council's constructed infrastructure works and strive to achieve high standards of safety, amenity, convenience, economy and sustainability.

(3) These guidelines explain the requirements for the design, construction and delivery of civil infrastructure in the following sections:

(a) SC6.2.1 – Introduction
(b) SC6.2.2 – Road and Street Design
(c) SC6.2.3 – Pavements
(d) SC6.2.4 – Drainage Design
(e) SC6.2.5 – Earthworks
(f) SC6.2.6 – Road and Public Space Lighting
(g) SC6.2.7 – General Construction
(h) SC6.2.8 – Specifications
(i) SC6.2.9 – Appendices:
  (i) SC6.2.9.1– RPEQ certificate
  (ii) SC6.2.9.2– Pre – 'on maintenance' inspection checklist of works
  (iii) SC6.2.9.3 – Compliance requirements for public (municipal) works
  (iv) SC6.2.9.4 – Engineering certification checklist – 'on maintenance'
  (v) SC6.2.9.5 – Road hierarchy typologies and standard drawings
  (vi) SC6.2.9.6 – Development works project quality plans (examples).

SC6.2.1.1 Purpose of the planning scheme policy

(1) The purpose of the planning scheme policy is to assist with the implementation of the Toowoomba Regional Planning Scheme 2012 by:

(a) providing guidance and, where applicable and necessary, specifying standards of work, including for infrastructure
(b) specifying administrative arrangements in relation to work associated with infrastructure
(c) specifying the circumstances in which the Council may accept a security for the completion of work.

SC6.2.1.2 Authorised legislation

(1) The planning scheme policy is based on Chapter 3, Part 4, Division 2, and Chapter 3, Part 5 of the *Sustainable Planning Act 2009* (the Act).

(2) The planning scheme policy was amended for alignment with the Planning Act 2016 (the Act) by the Minister's rules under section 293 of the Act on 3 July 2017.

[1] Amended on 10 January 2014

SC6.2.1.3 Relationship to the Toowoomba Regional Planning Scheme 2012

(1) This planning scheme policy is to be read in conjunction with the assessment provisions specified in the Toowoomba Regional Planning Scheme 2012.

(2) Table SC6.2.1 provides advice on the relationship among the Integrated DA Rules process, the supporting information sought by Council and the corresponding sections within the guidelines.

Table SC6.2.1 DA Rules process, applicant information and guideline reference

IDAS Process Breakdown	Applicant to Provide	Guideline Reference
(1) **DESIGN INCEPTION**	(a) Site Analysis	SC6.2.4.1.4.2 Step 1 Site Analysis
	(b) Constraint Analysis (Flooding, Geotechnical, Ecological, Services etc.)	SC6.2.2.1 General
(2) **CONCEPT DESIGN**		
(3) **PRE-LODGEMENT MEETING MCU**	(a) Allotment Design	SC6.2.2.1 General
	(b) Road Hierarchy	SC6.2.2.1.1.9 Road Elements
	(c) Drainage risk assessment (note: subject to site analysis, more rigorous preliminary design may be required)	SC6.2.4.1.1 Risk Assessment
	(d) Concept Open Space Plan	SC6.2.4.1.4.2 WSUD
(4) **MCU APPLICATION**		
(5) INFORMATION REQUEST		
(6) INFORMATION RESPONSE		
(7) DETERMINATION		
(8) DEVELOPMENT CONDITIONS		
(9) **MCU CONDITIONS COMPLIANCE**		
(10) ROL APPLICATIOIN PREPARATION	(a) Detail Lot Calc Plan	
	(b) Concept Road Design (Horizontal and Vertical Alignment)	SC6.2.2.1.2 Geometric Design Standards
	(c) Construction Methodology – Bulk Earthworks Plan	SC6.2.5.1 Earthworks General
	(d) Concept water and sewer design	As per Water Infrastructure Policy 4.3.2 and Wastewater Infrastructure Policy 4.3.3
	(e) Concept Open Space Management Plan	
	(f) Concept Stormwater Management Plan	SC6.2.4.1.5 Preparing Concept SWMP
(11) **PRE-LODGEMENT MEETING ROL**		
(12) **ROL APPLICATION**		

IDAS Process Breakdown	Applicant to Provide	Guideline Reference
(13) INFORMATION REQUEST		
(14) INFORMATION RESPONSE		
(15) DETERMINATION		
(16) DEVELOPMENT CONDITIONS	(a) Detailed Open Space Management Plans	
	(b) Detailed Stormwater Management Plans	SC6.2.4.1.5 Preparing Detailed SWMP
(17) **ROL CONDITIONS COMPLIANCE**		
(18) OPW APPLICATION PREPERATION	(a) Detailed Road Design Plans	SC6.2.2.1.2 Design Requirements – Roads and Bikeways
	(b) Detailed Stormwater Drainage Plans	SC6.2.4. Design Requirements - Stormwater Drainage
	(c) Detailed Stormwater Treatment Design Plans	SC6.2.4.1.4 Stormwater Quality Improvement
	(d) Street LightingErgon Standard Street Lighting Lamps and Luminaires design	SC6.2.6 Ergon Standard Street Lighting Lamps and Luminaires
	(e) Detailed water and sewer design	As per Water Infrastructure Policy 4.3.2 and Wastewater Infrastructure Policy 4.3.3
	(f) Detailed Bulk Earthworks Plans	SC6.2.5 – Earthworks
(19) **PRE LODGEMENT MEETING OPW**		
(20) **OPW APPLICATION**		
(21) INFORMATION REQUEST		
(22) INFORMATION RESPONSE		
(23) DETERMINATION		
(24) DEVELOPMENT CONDITIONS		
(25) **OPW CONDITIONS COMPLIANCE**	(a) Prior to Commencement of Construction Requirements	SC6.2.7.7 Construction Procedures
	(b) Sedimentations and Erosions Control Plans	SC6.2.5.6 & SC6.2.4.1.4.2 Erosion and Sedimentation Control Management Plan
	(c) Pavement Design	SC6.2.3 Pavements
(26) **PRE START MEETING**		SC6.2.7.9 Pre-Start meeting
(27) **CONSTRUCTION STANDARDS**		SC6.2.8 Specifications
(28) **COMPLIANCE INSPECTIONS**		SC6.2.7.8 – Inspections

IDAS Process Breakdown	Applicant to Provide	Guideline Reference
(29) **MATERIALS TESTING**	(a) Standard Specifications	SC6.2.7.8 – Testing SC6.2.8 – Specifications
(30) **"ON MAINTENANCE" INSPECTION**		SC6.2.7.13 – On- Maintenance
(31) **AS-CONSTRUCTED INFORMATION & TEST RESULTS**	(a) As-Constructed Survey	SC6.2.7.16 – "As-Constructed" requirements
	(b) Materials Test Results	
	(c) Construction Certification	
(32) **"OFF MAINTENANCE" INSPECTION**		SC6.2.7.15 Off-Maintenance
(33) **ASSET MANAGEMENT**		

SC6.2.1.4 Definitions

(1) Terms used in this planning scheme policy are defined in Schedule 1 — Definitions.

SC6.2.1.5 Interpretation of the planning scheme policy

(1) Any term used in the planning scheme policy that is not defined in Schedule 1 — Definitions is to be interpreted in accordance with Part 1.3 of the Toowoomba Regional Planning Scheme 2012.

SC6.2.1.6 Commencement

(1) The planning scheme policy commences on **10 January 2014.**

SC6.2.1.7 General approach to the design and construction of public (municipal) works

(1) Toowoomba Regional Council's philosophy in the adoption of construction standards embraces the following values:

(a) serviceability
(b) performance
(c) safety
(d) aesthetics and the environment
(e) recognition of codes of practice.

(2) Where this planning scheme policy does not cover particular issues, the Council will return to these basic values to determine its requirements.

(3) 'Serviceability' relates to the quality, durability and practicality of the constructions intended to be handed to the Council.

(4) The Council assumes that, in general, the capital costs of items will be in inverse ratio to the ownership cost in perpetuity.

(5) For this reason, the Council will normally place a greater priority on the ownership costs.

(6) For instance, where significant durability advantages can be obtained for a small amount extra, the higher standard will be sought.

(7) Equipment of Australian manufacture will generally be specified, unless it is demonstrably inferior to an imported alternative.

(8) 'Performance' means the ability of the facility to accommodate the likely loading — hydraulic, structural, mechanical or traffic volume — in its design lifetime.

(9) Performance will be specified, often with limiting minimum criteria for materials and dimensions.

(10) Safety aspects are to be considered in the construction and operation of all aspects of the built environment. This includes the safety of future maintenance staff as well as the public.

(11) The design and construction are to follow established aesthetic principles for creating the project's finished appearance.

(12) The environment created should be capable of ready and economical maintenance after construction (for example, elaborate labour-intensive landscaping solely to enhance the marketability of a project is generally unsustainable in the long term).

(13) Every attempt has been made to incorporate national codes of practice and Queensland Government standards in the design and construction requirements. This should minimise disputes and confusion.

(14) Local requirements have been added to satisfy local conditions or ensure conformity to a narrower standard, so as to limit spare parts inventory and supply delays.

SC6.2.1.8 Inconsistencies

(1) Where any provision of codes of practice, manuals or other technical documentation (e.g. Complete Streets, Queensland Urban Drainage Manual, Austroads or DMR manuals) does not accord with this planning scheme policy (including the standard drawings and schedules), the provisions of the planning scheme policy (including the standard drawings and schedules) take precedence.

SC6.2.2 Road and street design

SC6.2.2.1 General

(1) The aim of this guideline is to provide developers and their consultants with general guidelines for horizontal and vertical road design for developments (residential, rural residential, rural and industrial) and associated major roads. This guideline provides Toowoomba Regional Council's minimum standards for development and associated roadworks, including works required to join existing development.

(2) The optimum design for developments, streets and roads considers the social, environmental and traffic factors, the development layout and physical constraints — that is, it ensures that:

- (a) the road layout accommodates engineering constraints, including topography, drainage overland flow paths, vertical alignment, reasonable access to allotments etc.
- (b) before the development layout plan is prepared, the following have been ascertained:
  - (i) whether a site analysis, mapping the constraints and opportunities, has been conducted
  - (ii) whether a layout already exists for the area, and how this proposal will integrate with it
  - (iii) that the network proposed will conform to the Council's overall road hierarchy and open space plan
  - (iv) whether planning studies have been undertaken for the area
- (c) streets and roads are classified to conform to the road hierarchy
- (d) streets and roads are designed in accordance with the general parameters outlined in this policy
- (e) full and accurate topographical information is available at the roadworks and drainage design stage, to enable an accurate assessment of the suitability of the proposed infrastructure locations
- (f) where a conflict or inconsistency occurs between cited manuals, the manual with the latest publication date takes precedence.

(3) The developer and its consultant team are urged to prepare a conceptual design that includes the above information and present it to Council during the pre-lodgement process to obtain Council's general acceptance of their methodology before they lodge the full application. The pre-lodgement process is a valuable tool and opportunity for identifying and exploring significant design issues associated with the development.

SC6.2.2.2 Road hierarchy

(1) The functional hierarchy of roads enables an efficient street and road systems that caters for the movement of people and goods, while maintaining the amenity of the urban area. Road hierarchy is described graphically in Figure SC6.2.1 and explained in the following section.

(2) This section must be read in conjunction with Council's standard drawings 101384-001 to 101387-001: 'Typical cross-sections'.

(3) The hierarchy and associated cross-sections represent Council's minimum standard for its street and road system. The developer may submit, for the lower order roads (local access and below) an alternative cross-section and alignment that meets equivalent service delivery criteria, is a part of an overarching urban design concept and complies with the principles of the Institute of Public Works, Queensland, *Complete streets*.

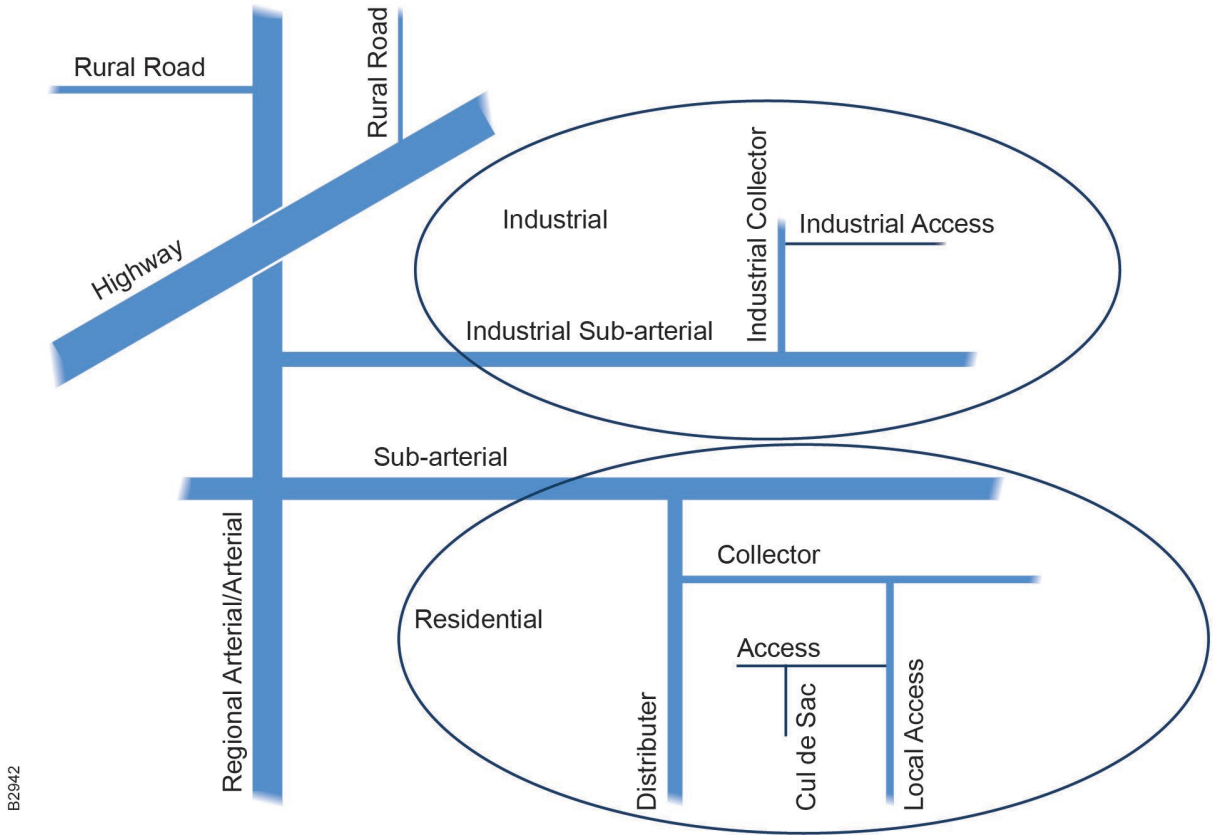


Figure SC6.2.1 Functional hierarchy of roads

SC6.2.2.2.1 Highways

(1) Highways are national and state roads connecting major centres, large cities and state-significant activities. Desirable capacity is four to eight lanes, and 45,500 to 91,000 vehicles per day (VPD).

(2) The speed environment is established in conjunction with the Department of Transport and Main Roads (DTMR).

(3) Direct access to highways is not typically available. Intersections are typically spaced more than 5 km apart in the rural precinct (using staggered T intersections), and 2 to 3 km apart in the urban area (grade separation is preferred).

(4) On-street parking and bus/coach set-downs are not permitted on highways.

(5) Cycling paths, where provided, are off-road, 2.5 to 4.0 m wide, and have grade-separated crossings.

(6) Design for tree planting in highway reserves is done in consultation with DTMR.

(7) Intersections with highways are designed to accommodate the turning movements of vehicles up to Class 11 Type 1 road trains.

SC6.2.2.2.2 Regional arterial roads

(1) Regional arterial roads are used for traffic circulating through the Council region, and link regional activities and centres. Desirable capacity is four to six lanes, and 33,150 to 49,920 VPD.

(2) The speed environment for regional arterial roads is 60–80 km/h in the urban environment, and 80–100 km/h in the rural environment.

(3) Direct access is not typically available to regional arterial roads. Intersections are typically spaced more than 1 km apart; they use a staggered T configuration in the rural precinct and are either signalised or a roundabout in the urban area.

(4) On-street parking is not permitted. Indented bus/coach set-downs with deceleration/acceleration lanes are provided in the urban area, and localised widening in the rural precinct.

(5) Cycling paths, where provided, are 1.5 m wide, on-road cycle lanes and a 2.5 m shared path on both sides of the road, with temporal or grade-separated crossings.

(6) Intersections with regional arterial roads are designed to accommodate the turning movements of vehicles up to Class 11 Type 1 road trains.

SC6.2.2.2.3 Subarterial roads

(1) Subarterial roads are used for traffic circulating within the CBD and other regionally significant activities (e.g. airport, base hospital, University of Southern Queensland).

(2) The speed environment for sub-arterial roads is 60–80 km/h in the urban area, 60 km/h in the inner urban area, and 80–100 km/h in the rural precinct.

(3) Direct access to subarterial roads is typically limited — it is not permitted within 60 m of an intersection in the urban area, or 150 m in the rural precinct. Intersections are typically spaced more than 0.5 km apart; they use a staggered T configuration in the rural precinct and are either signalised or a roundabout in the urban area.

(4) On-street parking is limited to service vehicles and short-term stays (subject to available width), indented bus/coach set-downs with deceleration/acceleration lanes in the urban area, and on localised widening in the rural precinct.

(5) Cycling paths, where provided, are 1.5 m wide, on-road cycle lanes and a 2.0 m shared paths, on both sides of the road, with temporal separation crossings.

(6) Intersections with subarterial roads are designed to accommodate the turning movements of vehicles up to Class 11 Type 1 road trains.

SC6.2.2.2.4 Distributer roads

(1) Distributor roads allow traffic to move through a district. Access is provided for up to 120 ha of industrial land.

(2) The speed environment for distributer roads is 60 km/h in the urban environment, 50–60 km/h in the inner urban area, and 80–100 km/h in the rural precinct.

(3) Direct access to distributor roads is typically limited and not provided within 40 m of an intersection in the urban area, or 100 m in the rural area. Intersections are typically spaced more than 200 m apart; they use a priority T configuration in the rural precinct and either a priority T or a roundabout in the urban area.

(4) On-street parking is typically limited to service vehicles and short-term stays (subject to available width), indented bus/coach set-downs or use of designated parking lanes, where available, in the urban areas, and on localised widening in the rural precincts.

(5) Cycling paths, where applicable, are 1.5 m on-road cycle lanes and a 2.0 m shared paths, on both sides of the road, with temporal separation at signals or pedestrian crossings.

(6) Intersections with distributer roads are designed to accommodate the turning movements of vehicles up to Class 10 B-double trucks (Class 11 Type 1 road trains by permit) in the urban area, Class 11 Type 1 road trains in the industrial area, and Class 10 B-double trucks in the rural precinct.

SC6.2.2.2.5 Collector roads

(1) Collector roads move local traffic to the distributer network. Access is provided for up to 300 dwellings or 30 ha of industrial land.

(2) The speed environment for collector roads is 40–60 km/h in the urban area, 10–50 km/h in the inner urban area and 80–100 km/h in the rural precinct.

(3) Direct access to collector roads is typically permitted, but not within 25 m of an intersection in the urban area or within 100 m of an intersection in the rural area. Intersections are typically spaced more than 100 m apart; they use a priority T configuration in the rural precinct and either a priority T or a roundabout in the urban area.

(4) On-street parking is typically limited to service vehicles and visitor/short-term stays (subject to available width), indented bus/coach set downs or use of designated parking lanes, where available in the urban area, and on localised widening in the rural precinct.

(5) Cycling paths, where provided, are on-road cycle lanes, combined with parking, on both sides of the road, and include pedestrian crossings or slow points combined with refuges.

(6) Intersections with collector roads are designed to accommodate the turning movements of vehicles up to Class 9 semitrailers in the urban area, Class 11 Type 1 road trains in the industrial area, and Class 10 B-double trucks in the rural precinct.

SC6.2.2.2.6 Local access/access streets

(1) Local access streets provide access for up to 175 dwellings or 8 ha of industrial land.

(2) The speed environment for access roads is 40–50 km/h in the urban environment, 10–50 km/h in the inner urban area, and 80–100 km/h in the rural precinct.

(3) Direct access is typically permitted to access roads, but not within 20 m of an intersection in the urban area or 100 m of an intersection in the rural precinct. Intersections are typically spaced more than 100 m apart; they use a priority T configuration in the rural precinct and either a priority T or a roundabout in the urban area.

(4) On-street parking is typically permitted (subject to available width), with indented bus/coach set-downs or designated parking lanes, where available, in the urban areas, and on localised widening in the rural precinct.

(5) Cycling paths, where provided, are on-road cycle lanes, combined with parking, on both sides of the road, and include pedestrian crossings or slow points combined with refuges.

(6) Intersections with local access roads are designed to accommodate the turning movements of up to Class 6 service vehicles in the urban area, Class 11 Type 1 road trains in the industrial area, and Class 9 semitrailers in the rural precinct.

SC6.2.2.2.7 Cul-de-sacs

(1) A cul-de-sac provides access for up to 12 dwellings and typically has a maximum length of 100 m.

(2) Cul-de-sac heads provide for a single turning movement. The minimum head radius is 10 m and the approach radius is 20 m.

(3) The speed environment for cul-de-sac roads is 40 km/h in the urban area, 10–50 km/h in the inner urban area and 80–100 km/h in the rural precinct.

(4) Direct access to a cul-de sac is typically permitted.

(5) On-street parking is typically permitted (depending on the available width).

(6) Cycling provision is joint use of the road, and includes pedestrian crossings or slow points combined with refuges.

SC6.2.2.2.8 Laneways

(1) Laneways provide rear-of-allotment access to garages for dwellings on narrow allotments in addition to normal front of property street frontage.

(2) The speed environment for laneways is 20 km/h in the urban area and 10–20 km/h in the inner urban area.

(3) Direct access to laneways is typically permitted.

(4) On-street parking is typically restricted due to the available width.

(5) The minimum width of a laneway at the end of a cul-de-sac is 10 m.

SC6.2.2.2.9 Road design elements

(1) Table SC6.2.2 summarises key design elements for each of the road classifications for use in the detailed geometric design. In many cases these elements represent the minimum requirement. The engineering of these elements needs to be considered when preparing the concept design and this information brought to Council for review and approval in the pre-lodgement meeting process.

Table SC6.2.2 Road design elements

Road classification	Longitudinal grades %					Street leg length			Design speed km/h	Min vertical curve length m	Surface treatment
	Max	Des. Max	Min	Des. Min	Crossfall /%	Max length	Min CL radius	Min kerb return radius			
Residential & rural residential											
Regional arterial	16	12	0.5	1	2W/3%	NA	Austroads	Austroads	80	60	50mm AC
Sub-arterial	16	12	0.5	1	2W/3%	NA	Austroads	Austroads	80	60	50mm AC
Distributer street	16	12	0.5	1	2W/3%	NA	Austroads	Austroads	80	60	50mm AC
Collector street	16	12	0.5	1	2W/3%	120	30	10	60	40	30mm AC
Local access street	16	12	0.5	1	1&2W/3%	100	25	10	50	30	30mm AC
Local access street	16	12	0.5	1	1&2W/3%	100	15	8	40	20	30mm AC
Cul-de sac	16	12	0.5	1	1&2W/3%	100	15	8	40	20	30mm AC
Laneway	16	12	0.5	1		75	NA	8	20	20	Concrete
Bus routes		10									
Industrial											
Sub-arterial	10	6	0.5	1	2W/3%	Match layout	Match design vehicle	Match design vehicle	60	40	50mm AC
Distributer street	8	6	0.5	1	2W/3%				60	40	50mm AC
Collector street	8	6	0.5	1	2W/3%				50	30	50mm AC
Local access street	8	6	0.5	1	2W/3%				50	30	50mm AC

VC lengths ref Austroads Part 3 – Geometric design Table 8.9
Where design speed is < 50 km/h, the stopping sight distance shall be determined at 50 km/h for the vertical geometry.
1W – one-way cross-fall
2W – two-way cross-fall

SC6.2.2.3 Design

SC6.2.2.3.1 General

(1) The design of the road and street hierarchy must accord with the criteria listed in the planning scheme codes and policies, and with:

(a) the current Association of Australian and New Zealand Road Transport and Traffic Authorities (Austroads) and DTMR manuals and guidelines. Generally, Austroads guides are to be used in conjunction with standard specifications and any 'guides to road planning and design practice' advice that is issued by DTMR from time to time. The 'desirable' standard for design shall be used. Where the 'desirable' standard cannot be achieved on infill sites, consult with Council officers to obtain approval on the overall design standard to be achieved. All design exceptions are to be certified by a Registered Professional Engineer of Queensland (RPEQ)

(b) the principles outlined in the Institute of Public Works, Queensland (IPWEAQ) publication *Complete streets*, keeping in mind that this publication covers streets (collector, local access and cul-de-sacs) and is based on the following hierarchy:

(i) pedestrians

(ii) cyclists

(iii) public transport users

(iv) motorists

(c) Water Sensitive Urban Design (WSUD) Technical Design Guidelines for South East Queensland Healthy Waterways

(d) Manual of Uniform Traffic Control Devices (Qld)

(e) Crime Prevention through Environmental Design (CPTED) — Guidelines for Queensland

(f) Healthy Spaces and Places Guidelines (http://www.healthyplaces.org.au/site/).

(2) A guideline to assist designers in the application of extended design domain (EDD) principles is currently being developed.

(3) Every effort should be made to improve appearance by providing vertical curves that are as long as possible.

(4) The longitudinal grade should take into account high vehicles turning through an intersection.

(5) Provision for cyclists is to be considered in accordance with the road hierarchy. 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 Austroads requirements.

(6) Carriageway cross-sections are, as a minimum, to conform to the requirements of Toowoomba Regional Council's Standard Drawings.

(7) Split-level roads/streets should be avoided unless no alternative designs are available and the designer can demonstrate that this is the best solution.

(8) All grades over 12% are to be bitumen-sealed.

(9) The road/street vertical alignment is to extend for the full width of the road/street typologies.

(10) Property access should conform to the standard verge cross-section. Maximum cross-fall within the street reserve is 15%. Maximum driveway grade is 25%, with a maximum change of grade of 10%.

SC6.2.2.3.2 Intersections

(1) Intersections on roads and streets are to be designed in accordance with the current Austroads guides and in accordance with road hierarchy descriptions within in this policy for pedestrians and cyclists.

(2) All new intersections of local access streets, and collector and distributor roads, in rural and industrial areas are preferably to be designed as three-way intersections.

(3) Where four-way intersections are unavoidable, they must be designed as roundabouts in accordance with the Austroads Guide to Road Design, and must give particular regard to the needs and safety of pedestrians and cyclists.

(4) Four-way intersections are to be designed at the junctions of subarterial and regional arterial roads only where signalisation (preferred) or roundabouts are proposed.

(5) Provision of channelisation at intersections will depend on traffic volumes and intersection layout.

(6) In general, channelisation will need to be provided:

(a) at all arterial intersections
(b) at most distributor–arterial intersections
(c) at some collector–collector intersections.

(7) Particular attention is to be given to sight distance when commencing islands at horizontal and vertical curves.

(8) On distributor streets, median openings should be provided at all intersections except at intersections with local access places.

(9) On subarterial and arterial roads, the minimum spacing of median openings should be approximately 500 m.

(10) All intersection threshold treatments shall be constructed of concrete (in accordance with Standard Drawing) and shall be highly visible (in accordance with the Manual of Uniform Traffic Control Devices).

SC6.2.2.3.3 Truncations

(1) Truncations of the real property boundaries are to be provided at speed restriction devices, bends and intersections, and the roadway and footpath widths are to be maintained at the minimum specified widths at any point. Increased width will be required at signalised intersections and pedestrian crossings.

(2) Minimum truncation shall be 6 m with three chords of equal length. This truncation may need to be increased to accommodate intersection design layout, pedestrian crossings and sight distances.

SC6.2.2.3.4 Pavement tapers

(1) 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.

(2) Tapers are to be constructed to the same standard as the proposed full road pavements.

SC6.2.2.3.5 Street/road frontage

(1) Where the street/road frontage to a development is unsealed or unformed 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 one half of the full road width plus one 3.5 m wide traffic lane from the nominal centre line to the bitumen edge. Pavement is to be an additional 0.5 m wider.

(2) The full drainage system required within the road corridor is to be designed. However, it only needs to be constructed in accordance with the development approval.

(3) An existing, sealed, street/road frontage 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 that case, the pavement only shall be widened, with kerb and channel provided at the nominated alignment. The minimum total width is to be no less than one half of the full width of the street/road (i.e. one 3.5 m wide traffic lane from the nominal centre line to the bitumen edge). Pavement is to be an additional 0.5m wider.

(4) An assessment must be made as to whether the existing road reserve is the correct width. Additional land may be required to provide a road corridor that complies with the road category in the hierarchy.

(5) For a street/road at the end of staged development or where the road will eventually be continued, the preferred treatment is construction of a circular turning movement.

(6) Road widening/reconstruction should match the existing profile and cross-section, subject to meeting minimum cross-fall of 3% (2% is the absolute minimum).

SC6.2.2.3.6 Pathways and bikeways

SC6.2.2.3.6.1 *Pathways*

(1) The minimum width of land for a pathway is to be 5 m. Where an overland stormwater flow path is required, the width must include waterway width, concrete path and any services requirement. The minimum width is 10 m.

(2) Concrete paving must conform to the IPWEAQ Standard Drawing No. SEQ R-065. It must be located no less than 0.5 m from either side of the pathway boundaries.

(3) The concrete pavement within a pathway must be constructed to the adjacent kerb and channel, and must include a kerb ramp.

(4) Bollards must 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.

(5) Where a service is to be installed, pathway land must be widened to ensure that the service is clear of the path.

(6) Pathways located in parks are to be constructed above the flow of a storm event with an average recurrence interval (ARI) of two years.

(7) Pathways must include Ergon Standard Street Lighting Lamps and Luminaires, in accordance with SC6.2.6 Road and public space lighting.

(8) Pathways and bikeways should comply with AS/NZ 1428.1-2009 wherever possible, with the exception of where the pathway is adjacent to a road and may follow the grade of the road.

SC6.2.2.3.6.2 *Bikeways*

(1) The minimum width of land for a bikeway is 10 m, to accommodate a concrete, paved bike-path that is a minimum of 2 m wide.

(2) Bikeways located in open-space and drainage reserves are to be constructed above the flow of a storm event with an ARI of two years.

(3) Bikeways must include Ergon Standard Street Lighting Lamps and Luminaires, in accordance with SC6.2.6 Road and public space lighting.

SC6.2.2.3.7 Kerbing and channelling, swale drains

(1) Concrete kerbs and channels are to be provided on both sides of all streets, except where swale drains are approved for use. This includes industrial areas and the inner city.

(2) The standard kerbs and channels for lower order streets up to and including collectors (with the exception of laneways) are to be lay-back, in accordance with Council's Standard Drawings.

(3) Barrier-type kerbs and channels with a 450 mm channel (type B1) in accordance with IPWEAQ Standard Drawing SEQ R-80 are to be used in the following cases:

(a) higher order roads of distributer level and above, and all industrial roads
(b) streets adjacent to parks
(c) shopping centres and in locations where high pedestrian volumes are likely or for greater pedestrian safety (e.g. on the frontages of schools, major sporting facilities and parks).

(4) Semi-mountable-type kerb is to be used:

(a) at medians and traffic Islands: semi-mountable or low-profile kerb type SM3 for concrete in-filled treatments and type SM5 for landscaped treatments, in accordance with IPWEAQ Standard Drawing SEQ R-80.
(b) at roundabouts: kerb type M5 on the outer island and type SM4 on the centre island, in accordance with IPWEAQ Standard Drawing SEQ R-80.

(5) The grading of kerbing and channelling is to conform to the road centreline grading. However, 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 0.5%.

(6) Every effort is to be made to improve the appearance, by providing vertical curves that are as long as possible at all changes of grade.

(7) Kerbs and channels are to be constructed with horizontal curves at all changes in horizontal alignment. To improve appearance, where small deflections occur (e.g. on tapers), horizontal curves shall be as long as possible.

(8) Kerb ramps are to be provided at all kerb returns and at park entrances.

(9) Stormwater kerb connections must be installed at subdivision stage for all road classifications, except at industrial precincts where drainage is directly connected to the underground system.

(10) All concrete shall be a minimum of N32. Slump concrete (slip-formed), not kerb mix, is to be used.

(11) Industrial kerbing must have an additional minimum 50 mm concrete base thickness over standard profiles. Slump/slip-form concrete, not kerb mix, shall be used in industrial areas.

(12) In industrial areas where there is a large volume of high-order vehicles, all kerbing must be designed for these heavy loads.

(13) Pavement must extend a minimum of 300 mm behind the back of the kerb. The minimum pavement thickness under the kerb must be:

(a) for urban, residential and rural residential areas: 100 mm
(b) for industrial areas: 150 mm.

(14) Swale drains are only permissible in drainage reserves and parklands. They are to be constructed clear of infrastructure, with a maximum side slope of 1 in 6 (grass/turf surface treatment) or 1 in 4 (special cases with landscaped surface treatments), and with a minimum longitudinal grade of 0.7% and maximum grade of 5%.

SC6.2.2.3.8 Signs and road markings

(1) All signs shall be designed, manufactured and installed in accordance with the current edition of the Manual of Uniform Traffic Control Devices. Street name signs must be erected at each intersection. Suitable direction and way-finding signage is to be considered. Refer to IPWEAQ Standard Drawings.

SC6.2.2.3.9 Road-edge guide posts and safety barriers

(1) Road-edge guide posts must be provided at all locations where concrete kerbing and channelling is not constructed (e.g. half-road construction, tapers, ends of roads etc.), in

accordance with the Queensland Department of Transport and Main Roads Manual of Uniform Traffic Control Devices.

(2) All safety barrier site selection criteria shall be addressed. For higher order roads, safety barriers shall be designed in accordance with the DTMR Road Planning and Design Manual and Council requirements. In urban residential and industrial precincts safety barriers shall be located at steep embankments and roadside obstacles and hazards in accordance with the Austroads Guide to Road Design Part 6: Roadside Design, Safety and Barriers.

SC6.2.2.3.10 Clear zones

(1) Clear zones shall be provided, as a functional element, in accordance with the Austroads design manuals for roads classified as 'distributor' and above.

(2) Risk assessment for structures placed in clear zones must be undertaken in accordance with the DTMR RISC program. Both quantitative evaluation and qualitative evaluation are to be undertaken (see Chapter 8 of the DTMR Road Planning and Design Manual). The RISC program and latest accident costs are available from the DTMR web site (http://www.tmr.qld.gov.au/Business-and-industry/Road-systems-and-engineering/Software/RISC.aspx).

SC6.2.2.3.11 Speed control

(1) Speed control should be built in to the street geometry on collector roads and local access streets in the urban and rural residential precincts to create an environment where drivers are actively discouraged from driving at more than a very moderate speed. Speed control does not apply to the higher order roads ('distributor' and above) or industrial roads.

(2) Consideration should be given to using a combination of the following measures to achieve these outcomes:

(a) intersections with sharp corner angles and/or smaller radii
(b) width of stormwater flows where smaller radii are used
(c) short straights and short distances between intersections
(d) raised intersections
(e) landscaping/streetscaping
(f) on-street parking
(g) indented parking — an acceptable street layout solution to help provide a reduced-speed environment.

SC6.2.2.3.12 Tree planting

(1) Table SC6.2.3 provides a guide to appropriate sizes and spacings for trees on each type of road or street.

Table SC6.2.3 Tree planting guide

Functional element	Desirable street tree size	Desirable interval	Minimum planting distance from back of kerb			
Design speed km/h			60	70–80	90	>100
Highway	Tall[1(a)]	15–20 m	Refer relevant authority			
Regional arterial	Tall	12–15 m	3.2 m	4.7 m	5.7 m	For clear-zone requirement, refer Austroads guidelines.
Sub-arterial	Medium[1(b)]	7–15 m	2 m	2.5 m	3.5 m	
Distributor	Medium	7–12 m	2 m	Refer to road and street cross-sections.		
Collector	Small[1(c)]	7–10 m	1.5 m			
Local access 75 to 175 dwellings	Small	7–10 m	1.5 m			
Local access <75 dwellings	Small	7–10 m	1.5 m			
Cul-de-sac	Small	7–10 m	1.5 m			
Laneway	No street trees					

Notes:
1) Tree sizes:
(a) Tall = 12 m+ at maturity
(b) Medium = 8–12 m at maturity
(c) Small = 4–8 m at maturity.

(2) Street trees must be planted 4 m offset from edge of driveways, and 10 m from apex of corners and outside of visibility sight lines.

(3) The relevant road authority must be contacted to obtain approval for trees on higher order roads.

(4) Special requirements will apply under overhead powerlines.

(5) Desirable street trees are to be 7–10 m clear of street lights. Narrow canopy trees (e.g. pencil style) may be placed closer with approval.

(6) Minimum pot size is 25 L. Larger pot sizes may be required in some locations.

(7) Tree establishment will be assessed at the 'on maintenance' inspection.

(8) Landscaping in other areas of the corridor (e.g. features in the parking lane, kerb indentation) is permitted as long as the visibility and clear-zone requirements are met.

SC6.2.3 Pavements

SC6.2.3.1 Pavement design

SC6.2.3.1.1 Aim

(1) This guideline provides Toowoomba Regional Council's minimum standards for pavement designs for roadworks associated with Council and development works. It is to be used in conjunction with Part 2: Pavement Structural Design of the Austroads Guide to Pavement Technology, and the Department of Transport and Main Roads (DTMR) Pavement Design Manual. It is not intended to be used instead of design manuals. However, any pavement designs not satisfying the minimum requirements of this document will necessitate consultation with Council's General Manager of Infrastructure Services.

SC6.2.3.1.2 Determination of subgrade strength

(1) A design California Bearing Ratio (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 CBR at a compaction of 100% standard compaction is to be the standard test. Tests are to be carried out in a NATA-registered laboratory.

(2) Test results and pavement design are to be submitted to Council for acceptance before a request is submitted for subgrade box inspection.

(3) 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 in situ CBR result. For more than four results, the design CBR shall be the 10th percentile of all estimated in situ CBR results. The samples shall be taken in the general position of the outer wheel path on both sides of the proposed road. A sketch plan showing the location of all tests is to be submitted with the test results for pavement design approval.

(4) The frequency of testing required shall be in accordance with Table SC6.2.4.

Table SC6.2.4 Testing frequency

Testing type	Roads <120 m	Roads >120 m
Laboratory	Sample at two sites	Sample at one site every 60–100 m
Four-day soaked CBRs and routine soil tests	Laboratory tests on all relevant materials	Laboratory tests on all relevant materials
Field	Three tests on subgrade	One test on subgrade every 50 m
Dynamic cone and field moisture content	Routine soil tests on subgrade from one site	Routine soil tests on subgrade from one site in three

SC6.2.3.1.3 Pavement materials

(1) Pavement materials shall be in accordance with the requirements of the DTMR technical specification MRST 05 Unbound Pavements.

(2) Material types shall be:
- (a) Type 2 — K & C type construction
- (b) Type 3 — open (gravel) shoulder type construction
- (c) Type 4 — may be used as selected subgrade when it meets specification

(3) Minimum pavement strength shall be:

(a) base course Type 2.1 — minimum CBR 80
(b) upper sub-base course Type 2.3 — minimum CBR 45
(c) lower sub-base course Type 2.5 — minimum CBR 15.

SC6.2.3.1.3.1 *Concrete pavements*

(1) Full-depth concrete roads are generally used only on heavily trafficked roads, but a full-depth concrete road may be designed for local streets. Where a consultant adopts this option, the concrete pavement must be designed in accordance with the Austroads Guide to Pavement Technology. Special attention must be paid to the jointing details in regard to rideability and the provision of additional conduits for future services. Concrete pavement designs developed for any road classification shall be submitted to Council for approval.

SC6.2.3.1.3.2 *Treated pavement materials*

(1) Treated pavements, which may include cement stabilisation or other stabilisation of sub-base material and treatment of imported base course material, are acceptable to Council. However, full details of the proposal must be submitted to Council for approval. A NATA-registered laboratory must undertake all the required testing.

SC6.2.3.1.3.3 *Cement-treated materials*

(1) The properties of a cement-treated layer are influenced by the nature of the material to be stabilised, percentage and type of additive, and the efficiency of the mixing process.

(2) Pavements including cement-treated materials shall be designed in accordance with the DTMR Pavement Design Manual. Testing of proposed construction materials shall be undertaken as part of the design process confirm that the material satisfies design requirements. Test results, together with the proposed design shall be submitted to Council at least two weeks before commencement of construction.

SC6.2.3.1.4 Design traffic loadings

(1) Unless Council determines otherwise, minimum design traffic loadings for the various road classifications are defined in Table SC6.2.5. These values are minimum values, and are a guide only. Designers are to complete a full traffic study and pavement design for the higher order and industrial roads, and then submit these to council for approval. The design life is to be 25 years for lower order roads (cul-de-sac, local access and collector), and 40 years for higher order roads (distributor level and above).

(2) Table SC6.2.5 details design equivalent standard axles (ESAs) for each functional class in the road hierarchy (urban roads).

Table SC6.2.5 Design equivalent standard axles (ESAs) by road class (urban roads)

Description	ESAs
Cul-de-sac	1.75×10^4
Local access <75 lots	4.6×10^4
Local access 75–175 lots	1.9×10^5
Collector	9.3×10^5
Distributor	By design
Subarterial	By design
Regional arterial	By design
Industrial	By design

(3) For 'rural' class roads, a traffic study is to be undertaken. The study must determine the number of commercial vehicles, and the design ESA is to be based on a 40-year design life.

(4) For 'industrial' class roads, traffic generation is to be based on the generation rates as presented in the NSW Roads and Marine Services document "RTA Guide to Traffic Generating Developments" Version 2.2, October 2002. All calculations are to be based on a 40-year design life.

SC6.2.3.1.5 Minimum pavement thickness

(1) Table SC6.2.6 details the minimum pavement thickness for each road class in the road hierarchy.

(2) For a pavement with low subgrade CBR, if the design CBR determined for the subgrade is less than the minimum CBR given in Table SC6.2.6 (i.e. CBR less than 3) for subgrades that are 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 shall be determined as follows:

(a) CBR 2 = 100 mm + design depth based on a design subgrade CBR of 3
(b) CBR 1 = 200 mm + design depth based on a design subgrade CBR of 3.

For example:

(c) Road class = Collector (from Table 3.2)
(d) Design CBR = 2 (determined in accordance with SC6.2.3.1.2)
(e) Total pavement design = 490 (from Table 4.2:18) + 100 + 30 (asphalt surfacing) = 620 mm*
(f) Pavement to be composed of:
    (i) asphalt 30 mm
    (ii) base course 125 mm (CBR 80, Type 2.1)
    (iii) upper sub-base 100 mm (CBR 45, Type 2.3)
    (iv) lower sub-base 265 mm (CBR 15, Type 2.5)
    (v) Total = 620 mm*

*This is the depth at which Council officers will measure the joint subgrade. The subgrade shall exhibit no visible signs of deformation under proof-rolling by a loaded water cart.

(3) For subgrades that are not 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), some form of treatment will be required before construction can proceed. The material should be treated as a soft subgrade and one of the following measures shall be adopted:

(a) some form of working platform provided (minimum depth of 300 mm, CBR 15 material)
(b) use of geofabric sheeting
(c) soil stabilised by use of a lime mixture (minimum depth of 300 mm).

(4) Lime subgrade stabilisation is to be approved by Council and is to be designed in accordance with the DTMR Testing Protocol for Lime Stabilisation.

(5) For design purposes, the subgrade improvement or working platform should be ignored and a CBR of 3 used for the subgrade for all road classifications. The thickness of the working platform or depth of stabilisation is not part of the designed pavement thickness.

(6) Before any of the above methods is adopted, approval must be gained from the Manager, Infrastructure Asset Management, Toowoomba Regional Council, and any submission for its use must be supported by technical information from the manufacturer or a recognised geotechnical testing authority.

Table SC6.2.6 Minimum pavement thickness (mm) – excluding AC surfacing

CBR of subgrade	Cul-de-sac	Local access, <75 lots	Local access, 75–175 lots	Collector, 300 lots	Distributor	Sub-arterial	Regional arterial	Industrial
1	For stable subgrades: 200 mm + design depth based on a design subgrade CBR of 3 (refer SC6.2.3.5 (2)							
2	For stable subgrades: 100 mm + design depth based on a design subgrade CBR of 3 (refer SC6.2.3.5 (2))							
3	285	320	410	490	705	735	800	By design
4	250	270	350	420	605	630	685	
5	220	240	315	370	535	555	605	
6	200	215	280	330	480	500	545	
7	200	200	260	305	440	460	500	
8	200	200	240	280	405	420	460	
9	200	200	200	265	375	395	425	
10	200	200	200	250	355	370	400	
12	200	200	200	220	315	330	355	
14	200	200	200	200	300	300	325	
16	200	200	200	200	300	300	300	
18	200	200	200	200	300	300	300	
20	200	200	200	200	300	300	300	
Minimum course thickness								
Asphalt	30	30	30	50	50	50	50	50
Base course Type 2.1 (min. CBR 80)	125	125	125	125	150	150	150	150
Upper sub-base Type 2.3 (min. CBR 45)	100	100	100	100	150	150	150	150
Lower sub-base Type 2.5 (min. CBR 15)	As required to obtain minimum thickness (100 mm minimum layer thickness)							

Notes:

1) *If upper sub-base course minimum thickness cannot be achieved, then base course material is used for full pavement depth.*
2) *The above pavement thicknesses are gravel thicknesses only. AC surfacing thickness is to be added to the above gravel thickness to determine the total box depth.*
3) *For rural roads two coats of bitumen seal are required (refer typology).*
4) *Minimum AC depth in industrial areas shall be 50 mm.*
5) *Laneways are to be concrete pavements.*

SC6.2.4 Drainage design

SC6.2.4.1 Introduction

(1) The design policy provides for the holistic design of stormwater drainage, integrating the management of stormwater quantity and quality through and from the developed site.

(2) Council and the developer have a duty of care to implement a stormwater drainage strategy that does not result in any demonstrable harm to property upstream or downstream from the proposed development. State Planning Scheme Policy 4/10 includes legislative requirements that stormwater discharge from developments meet specified outcomes for stormwater quality and quantity.

(3) These guidelines provide information to help the developer's consultant team meet Toowoomba Regional Council's, and the state's, minimum requirements for the management of stormwater associated with development.

SC6.2.4.2 Risk assessment

(1) The design solution for managing stormwater associated with a development site will be derived from an initial risk assessment of the type and scale of development proposed. The flow chart in Figure SC6.2.2 provides guidance on the appropriate methodology for the consultant team to employ when developing a design strategy and solution based on the risk.

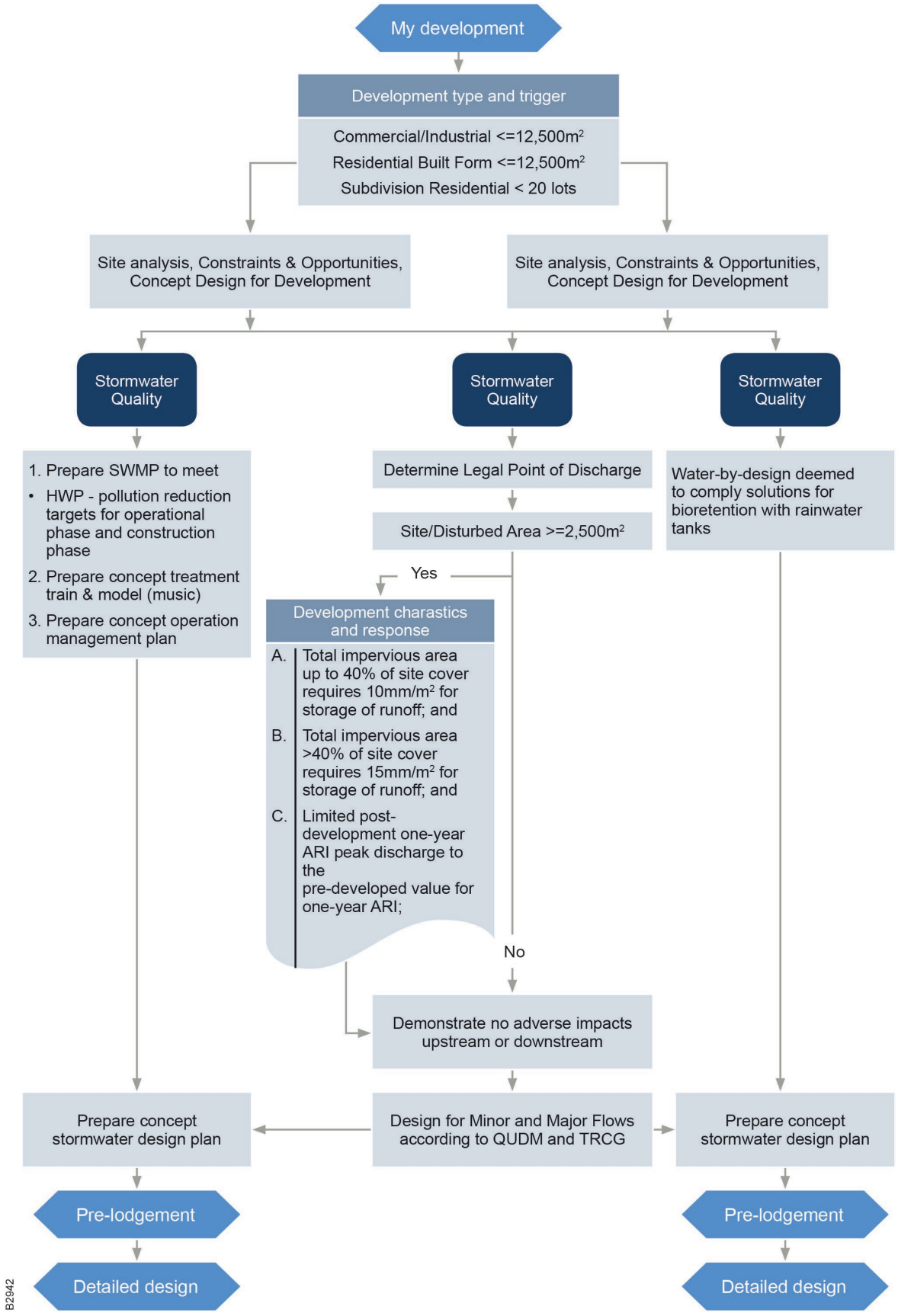


Figure SC6.2.2 Risk assessment

SC6.2.4.3 Design for stormwater quantity and quality

(1) The risk assessment process described in Figure SC6.2.2 indicates the steps required to produce a design that manages both stormwater quantity and quality. Normally, the design processes for stormwater quality and quantity are separate as they consider different design criteria, analysis and design functions and models. For clarity, this guideline considers the processes separately; however, it is expected that the consultant team will consider and design the facilities and infrastructure holistically to optimise the use of the site and reduce the risk to Council and the surrounding community.

(2) Council is in the process of developing catchment-scale regional drainage master plans that will identify the design criteria for specific catchment and waterway requirements (e.g. waterway environmental values). Compliance with the requirements of a regional drainage master plan is compulsory where such a plan is in place.

SC6.2.4.4 Design for stormwater quantity

SC6.2.4.4.1 Introduction

(1) Before it prepares designs, the consultant team is urged to engage with Council to discuss the project and seek available information on the area it proposes to develop.

(2) Design parameters are to accord with the criteria listed in the planning scheme codes and policies, and with the following:

(a) Urban catchments up to 500 ha and rural residential catchments with a rainfall run-off response time of less than 60 minutes must comply with:

(i) Queensland Urban Drainage Manual (QUDM 2008)

(ii) Healthy Waterways Water Sensitive Urban Design Guidelines.

(b) Large urban, large rural residential and rural catchments must comply with the Department of Transport and Main Roads (DTMR) Road Drainage Design Manual.

(3) In addition to complying with the requirements of the minor and major systems, the consultant team must demonstrate the following, as a minimum, in its proposed designs:

(a) The design does not adversely affect upstream drainage and does not worsen the downstream condition.

(b) The design's hydraulic grade lines (shown on plans drawn to scale) conform to the freeboard, pipe cover, head loss, blockage and depth–velocity ratio requirements as required by the latest version of QUDM 2008, as amended by this policy.

(c) The design has adequate capacity to safely manage the peak discharge of the additional flow produced as a result of the proposed development.

(d) The downstream receiving drainage system has adequate capacity to safely convey the peak discharge of the additional flow resulting from the proposed development.

(e) The downstream receiving drainage system, however, with inadequate capacity in terms of the above, measures including (but not limited to) on-site detention or upgrades with regional detention facilities.

SC6.2.4.4.2 Lawful point of discharge

(1) All parties involved in the process of development are charged with a duty of care to ensure that there will be no case of actionable damage to properties upstream or downstream as a consequence of the development.

(2) It is the responsibility of the consultant team to establish a suitable lawful point of discharge (see QUDM 2008 Section 3.02: Definition and Description of Lawful Point of Discharge) for the drainage from the development, for Council's approval. In its determination, the consultant team must have considered all available options on their merits, not simply on

cost, before presenting its selected option to Council. The consultant team must provide to Council:

(a) written approval from adjoining property owners whose property lies between the development and the lawful point of discharge
(b) estimation of costs to Council associated with upgrading/retrofitting existing infrastructure downstream from the lawful point of discharge to provide for the proposed development. Supporting information is to include the methodologies available for providing relief drainage and associated costs.

(3) Typical options available to the consultant team for locating the lawful point of discharge are:

(a) to concrete kerb and channel, gullies, a natural watercourse or existing enclosed stormwater drainage system abutting the development. The consultant team must obtain approval from Council for any connection to existing Council infrastructure
(b) to the road reserve provided the concentration of stormwater does not adversely affect the drainage capacity of the road and/or adjoining properties
(c) through adjoining private property provided prior permission is obtained from the property owner(s) in writing and this written permission is contractually binding on the property and its future owners
(d) to concrete kerb and channel and then to a new stormwater inlet to be provided by the developer at a location removed from the site
(e) to kerb and channel or an existing enclosed drainage system higher than the proposed development by pumping from a drainage pit within a site. This method will only be considered suitable for a basement carpark of a multi-storey building where a back-up generator is provided. The pumping infrastructure will remain the asset of the site owner, and will not form part of Council-owned infrastructure. The consultant team must clearly demonstrate that the alteration to catchment boundaries will not cause a worsening of any kind to existing drainage systems, property or public safety.

SC6.2.4.4.3 Minor and major systems see QUDM 2008 7.02, 7.03)

(1) The consultant team must ensure that the proposed drainage design meets the standards required of minor and major drainage systems for the scale and type of development proposed. The required standards are summarised in Table SC6.2.7.

(2) The full definitions of the minor and major systems are provided in Section 7.03 of QUDM 2008. In general, the minor drainage system is the underground (or piped) component of the design and its collection system, including kerb and channel, and cross-drainage under minor roads. The major drainage system is the aboveground and overland flow component of the design, including any engineering structure associated with open-channel flows; it excludes kerb and channel.

Table SC6.2.7 Drainage design standards

Development category	Design parameter	Design standard
2–5 dwelling units per hectare (typically in rural/rural residential/environmental protection areas where predominant uses include houses on large allotments and farms)	Minor drainage system	Minimum 2-year average recurrence interval (ARI)
	Major drainage system	Minimum 100y ARI (less piped flow if applicable)
>5 and ≤20 dwelling units per hectare (typically in low-density residential areas comprising mainly one- or two-storey single houses)	Minor drainage system	Minimum 2-year ARI
	Major drainage system	Minimum 100-year ARI (less piped flow, if applicable)
>20 dwelling units per hectare (typically in low-medium- to high-density residential areas comprising multi-unit dwellings)	Minor drainage system	Minimum 10-year ARI
	Major drainage system	Minimum 100-year ARI (less piped flow, if applicable)

Development category	Design parameter	Design standard
Industrial areas	Minor drainage system	Minimum 2-year ARI
	Major drainage system	Minimum 100-year ARI (less piped flow, if applicable)
New use centre activities (incorporating a wide range of commercial, retail and residential uses)	Minor drainage system	Minimum 10-year ARI
	Major drainage system	Minimum 100-year ARI (less piped flow, if applicable)
Major roads (distributer roads and above, major industrial access through-roads)	Kerb and channel flow	Minimum 10-year ARI (1)
	Cross-drainage (culvert) flow	Minimum 50-earyARI (2)
	Roadway flow width and depth limits	See QUDM 2008 Table 7.03.1 & 7.04.1
Minor roads (collector roads, local access streets, minor industrial access)	Kerb and channel flow	Refer to the relevant development category, minimum 2-year ARI
	Cross-drainage (culvert) flow	Minimum 10-year ARI (2)
	Roadway flow width and depth limits	See QUDM 2008 Table 7.03.1 & 7.04.1

Notes:
1) *The design ARI for the minor drainage system in a major road shall be that indicated for the major road, not that for the development category of the adjacent area.*
2) *Culverts under roads should be designed to accept the full flow for the minor system ARI shown. In addition, the designer must ensure that adequate public safety controls (e.g. d*V product) exist and that the nominated major-storm flow does not cause unacceptable damage to adjacent properties, or adversely affect the use of the land. If upstream properties are at a relatively low elevation, it may be necessary to install culverts of capacity greater than that for the minor-system ARI design storm to ensure unacceptable flooding of upstream properties does not occur. In addition, the downstream face of causeway embankments may need protection where overtopping is likely to occur.*

(3) Classifications of minor and major roads for the purpose of drainage design are given in Table SC6.2.8.

Table SC6.2.8 Functional element and QUDM 2008 classification

Functional element	QUDM 2008 classification
Highway	Major road
Regional arterial	Major road
Subarterial	Major road
Distributor	Major road
Collector	Minor road
Local access, cul-de-sac, laneway	Minor road

(4) Considering major, and to a lesser extent minor, flow events, and how to manage their conveyance though the site is a key component in the preparation of the development's concept and detailed design. The consultant team is urged to use Council's pre-lodgement meeting process to discuss and resolve the issues associated with designing for the major and minor flows.

(5) A combined underground and overland drainage system for the minor and major systems is to be designed in conjunction with other civil infrastructure components required for the development. Designing major underground pipe systems with no overland flow component is not acceptable to Council except in extraordinary circumstances where overland flow is demonstrated to be impractical. QUDM 2008 details the minimum

requirements and circumstances where a major underground pipe system is used with no dedicated open space for overland flows.

(6) Development that is proposed in the vicinity of a known flood hazard (see Flood Hazard Overlay Map), the consultant team must provide designs that comply with the requirements of the Flood Constraints Code and the State Planning Policy 1/03: Mitigating the Adverse Impacts of Flood, Bushfire and Landslide.

(7) The consultant team is urged to look beyond the locality of their development and consider whole catchment management issues. A whole-of-water-cycle approach, a coordinated and collaborated interdisciplinary approach and systems approach to problem solving by the consultant team is therefore encouraged.

SC6.2.4.4.4 Extent of drainage works

(1) Council requires the developer to meet the full cost of providing an appropriate drainage system that has sufficient capacity to convey the design run-off from all upstream catchments through the development. The drainage system shall be designed to minimise impact of any kind to any upstream or downstream properties. The applicant must demonstrate that such discharge would in no way adversely affect any land, drainage system or watercourse.

(2) All development applications identified in the risk assessment described above are to include a stormwater management plan demonstrating the feasibility and function of the proposed drainage system(s) within the site, its compliance with any relevant Council master drainage scheme and its connection to the lawful point of discharge.

(3) Where they are available, Council will provide the consultant team with a master drainage plan and access to planned overlays for the region. The consultant team must provide designs that meet with the requirements of the master plan and overlays. Where such information is unavailable or where Council deems that an available plan/overlay is not up-to-date or incomplete, Council may accept work from the developer's consultant team on the master plan, for consideration. The consultant team is urged to contact Council at the earliest opportunity to gauge available information before design commences.

(4) In general, the minimum stormwater drainage works to be constructed by the developer include the following.

SC6.2.4.4.4.1 *Urban areas*

A. Residential precincts and industrial and commercial precincts

(1) The minor drainage system will consist of:

(a) kerb and channel on both sides of all roads
(b) gully pits located so the flow in the channel does not exceed specified limits
(c) roof and allotment drainage systems; in particular, drainage from lots that front waterways shall be discharged to the street unless topographical constraints determine otherwise
(d) full piped drainage from all gully pits and other inlets that discharges at the boundary of the development at a lawful point of discharge approved by Council. Where the piped system traverses private property an easement with a minimum width of 6 m shall be dedicated in favour of Council.

(2) The major drainage system will consist of an overland flow system; the system will manage run-off that exceeds the capacity of the pipe system by carrying the design flow through the development clear of allotments (i.e. via road or drainage reserve).

SC6.2.4.4.4.2 *Rural precincts*

A. Rural residential precincts

(1) The minor and major drainage systems are generally to consist of open natural watercourses within allotments, and may include full piped drainage within road reserves. They shall have:

(a) generally, gravel shoulders and swale drains, but in some circumstances may require kerb and channel on both sides of all roads with associated gully pits and piped drainage
(b) stabilised overland flow paths/watercourses, where required, for scour and erosion protection
(c) pipe or pre-cast concrete box culvert structures (including drainage aprons) at road crossings of all natural watercourses; the structures shall extend to the limits of the road reserve. Cross-drainage design shall take into account the possible debris load from the catchment. Council's preferred option for this is the provision of pre-cast reinforced-concrete box culverts; masonry block construction is not permitted.

B. Rural precincts

(1) The minor and major drainage systems are generally to consist of open natural watercourses. They shall have:

(a) generally, gravel shoulders without kerb and channel on all roads
(b) pipe or pre-cast concrete box culverts, bridges or concrete causeways at road crossings of all natural watercourses; these structures shall extend to the limits of the road formation. Easements shall be provided either side of the reserve to allow necessary scour protection works and future maintenance works as required. These easements shall be a minimum of 5 m in length, encapsulate the watercourse, and allow machine access to either side of the watercourse from the road reserve. Depth-of-flow indicators and delineator posts shall be used to better define the areas of more frequent inundation. Cross-drainage design shall take into account the possible debris load from the catchment. Council's preferred option for this the provision of reinforced-concrete box culverts; masonry block construction is not desirable
(c) earth table drains and catch drains in road reserves that are stone-pitched or concrete-lined, where required, for scour protection
(d) rural access pipe crossings for entry to all allotments in accordance with Council's Standard Drawings.

SC6.2.4.4.5 Roofwater and inter-allotment drainage systems (see QUDM 2008 7.13)

(1) The requirement and design for inter-allotment drainage shall be determined with reference to Section 7.13 of QUDM 2008: Roof and Allotment Drainage, except as modified by this guideline.

(2) Inter-allotment drainage may be considered necessary to address the circumstances described in QUDM 2008 Section 7.13.3, with the additional clause:

(3) The finished surface level of the allotment is less than 400 mm, at the middle of the allotment, above the lowest top of kerb along the frontage kerb and channel.

(4) The level of inter-allotment drainage required is described in Table SC6.2.9 (see also QUDM 2008 Table 7.13.3 'Levels of roof and allotment drainage').

Table SC6.2.9 Inter-allotment drainage levels required by QUDM 2008 land use classifications

Land use	Drainage level
Residential (choice, living, township, rural <4,000 m²)	II
Centres (district, local, principal, major), industry (low, medium and high impact)	IV, V

Note:
Not required for Sport and Recreation, Open Space, Extractive Industry, Environmental Management and Conservation, or Rural Residential >4,000 m² classifications.

(5) The minimum pipe size must be 150 mm diameter, and the maximum pipe size must be 375 mm diameter. Single-barrel pipes with rubber ring joints must be used in all cases (see QUDM 2008 Table 7.13.4).

(6) Manning's Equation, with a minimum 'n' value of 0.011, is to be used to determine pipe sizes. Pipes may be graded 'obvert to obvert' provided that the following minimum falls are provided through pits and access chambers:

(a) 0–30 degrees — 0.02 m
(b) 30–60 degrees — 0.04 m
(c) 60–90 degrees — 0.08 m.

(7) Recommended design criteria for Level II drainage may be determined from QUDM 2008 Table 7.13.5, with the following amendments to the applicable flow:

(a) 10 L/s per allotment up to 600 m²
(b) 16.5 L/s per allotment 1,000 m² or greater
(c) interpolation for allotments 600 m² to 1,000 m².

(8) The main 'line' of the pipe is to be located 1 m from rear boundaries and 1 m from side boundaries (see Standard Drawing 101450-001 and sample drawings 101397-001, 101398-001 and 101451-001).

(9) Easements are required over all inter-allotment drains >300 mm diameter and shall have a minimum width of 3 m.

(10) Access chambers are to be provided at the following locations:

(a) change of grade
(b) change of pipe size
(c) change of direction
(d) end of line
(e) minimum 100 m spacing.

(11) At least one stub connection point is to be provided on the main line for each property (see Standard Drawings).

(12) Direct connection of inter-allotment drainage to the kerb and channel will not be permitted without Council approval. If this is approved, refer to Council's drainage specification for the connection details.

(13) Discharge of inter-allotment drainage to a public reserve may be allowed where no alternative drainage structure is available. Outlets must be designed with scour protection, concrete headwalls, wingwalls and apron.

SC6.2.4.4.6 Easements (see QUDM 2008 3.06)

(1) The width of the easement is to be determined by the designer or Council, and will depend on the location, type and purpose of the easement.

(2) Drainage reserves or easements shall be required over downstream drainage paths from the development site to the lawful point of discharge.

(3) Drainage easements with a minimum width of 6 m shall be required over all pipe installation from 300 mm diameter to 600 mm diameter, except for pipes installed at shallow depths. For pipes installed at shallow depth (up to an invert level of 1.2 m), the width of easement may be reduced to 3 m.

(4) All pipes over 600 mm diameter and all open waterways/drains shall be installed on Council-controlled land.

(5) Drainage easements shall be required over drainage paths (natural or constructed) in rural residential areas up to 4,000 m².

(6) Where a residential or rural residential subdivision discharges into land zoned 'rural', an easement of minimum dimensions 20 m long and 10 m wide is required over the downstream drainage path.

SC6.2.4.4.7 Catchment hydrology (see QUDM 2008 4.0)

SC6.2.4.4.7.1 *Hydrologic assessment (see QUDM 2008 4.02)*

(1) The design of the proposed drainage system must accommodate both existing and fully developed flows for the minor and major drainage from upstream catchments.

SC6.2.4.4.7.2 *The Rational Method (see QUDM 2008 4.03)*

(1) The Rational Method is an appropriate hydrologic method, subject to the use of the various parameters provided by QUDM 2008.

(2) Partial-area effects should be investigated in design, particularly in areas of mixed development.

SC6.2.4.4.7.3 *Coefficient of discharge (see QUDM 2008 4.05)*

(1) For a particular development, it may be necessary to determine the Fraction Impervious from first principles. The coefficient of discharge can then be determined as described in QUDM 2008.

SC6.2.4.4.7.4 *Time of concentration (see QUDM 2008 4.06)*

(1) In rural catchments, culvert discharge is to be determined in accordance with the Department of Transport and Main Roads Road Drainage Design Manual, including Planners and Designers Instruction No. 3, for rural catchments and with:

(a) rainfall intensity tables, as detailed in this schedule.
(b) time of concentration, using the Bransby-Williams Formula.

SC6.2.4.4.7.5 *Intensity, frequency and duration data (see QUDM 2008 4.07)*

(1) Designers must refer to the latest edition of Australian Rainfall and Runoff — A Guide to Flood Estimation, produced by Engineers Australia, for relevant hydrological design data regarding intensity, frequency and duration (IFD).

SC6.2.4.4.8 Detention/retention systems (see QUDM 2008 5.0)

(1) Council considers that detention basins should be designed on an individual basis in consultation with Council.

(2) It is desirable to construct the base of these areas so that increased use of these areas for passive recreation can be achieved and the area can be easily maintained. To achieve this, the base needs to be well drained and water should not pond. This may be achieved by installing a low-flow pipe through the basin or by constructing suitable swale drains around the basin perimeter.

(3) All batters on basins must be flatter than 1 in 6 (1 mV:6 mH).

(4) In small developments up to 20 dwellings, underground concrete structures (e.g. large-diameter pipes) may be used as detention structures.

SC6.2.4.4.9 Computer models (refer QUDM 2008 6.0)

(1) Council recommends the use of computer models in drainage design, as long as the software is capable of providing electronic outputs that are compatible with Council drainage design software.

(2) Council supports the QUDM 2008 comment regarding model calibration and sensitivity analyses when using computer models in drainage design.

SC6.2.4.4.10 Urban drainage (refer QUDM 2008 7.0)

(1) In existing areas where available overland flowpaths are limited, alternative methods may be considered, such as detention basins.

(2) Design calculations, in accordance with the QUDM 2008 or Book 8 of ARR (1998) as appropriate, shall be submitted to demonstrate that this requirement is satisfactorily met. This information may be required to be submitted with the development application.

SC6.2.4.4.10.1 *Location of overland flowpaths*

(1) Notwithstanding the requirements of QUDM 2008 Clause 3.06, overland flowpaths from external catchments shall not be directed through private property unless they are contained within easements.

(2) Overland flowpaths should not be located in pathways. Prior approval shall be obtained from Council where an exception is sought in locating an overland flowpath.

(3) Where an overland stormwater flowpath is required, the width must include:
- (a) waterway width
- (b) concrete path
- (c) any services requirement, (minimum service requirement width to be 10m).

(4) Pedestrian safety and maintenance considerations shall be factors considered in the cross-sectional configuration of the overland flowpath.

(5) Pedestrian and vehicular access to wastewater 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.

SC6.2.4.4.10.2 *Overland flow in roads (see QUDM 2008 7.04)*

(1) In addition to the requirements of QUDM 2008, designers must provide 50 mm freeboard to the footpath crown for design flows based on roadway surface levels at the time of initial construction. Subject to normal cross-fall constraints, the height of footpath crowns above the top of kerb may be increased to accommodate major flows, while allowing for pedestrian and vehicle safety and access considerations to low-side properties. In a major storm, the maximum depth of flow must be 250 mm.

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

SC6.2.4.4.10.3 *Overland flow in drainage reserves*

(1) Overland flow in drainage reserves 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. A minimum width of 5 m is to be allowed from the top of the open drain to the property boundary (see the Standard Drawings).

(2) Within drainage reserves, consideration should be given to:
- (a) safety of persons who may inadvertently or unwisely enter the stream
- (b) scour protection
- (c) downstream flood reduction, the lower velocity reducing downstream peak flow
- (d) desirable maximum side slopes of 1 in 6
- (e) the effect of the location of overland flowpaths on existing native vegetation.

(3) The Standard Drawings suggest possible overland flow treatments that can be used within drainage reserves.

SC6.2.4.4.10.4 *Overland flow in open-space reserves*

(1) Land required in open space for overland flowpath will be considered against 'drainage' requirements rather than 'open space' requirements in the context of the development.

(2) In its application, the consultant team must demonstrate planning for drainage in open-space areas, from project identification to designs. For example, for public safety purposes, the design must demonstrate all public buildings and community facilities with amenities (i.e. toilets and/or food preparation facilities) are located 300 mm above the Q100 water levels where in overland flow paths.

(3) As well, the drainage standards must be considered within the context of planning strategies, and in particular, with regard to the nature of the intended function and constraints of the land — for example:

- (a) general open space areas with a low to high need for access by pedestrians and cyclists
- (b) passive areas with a low to high visitation
- (c) active areas in areas of low to high tourist significance
- (d) natural watercourses with low to high environmental significance.

(4) Council may consider dual use of open-space areas (e.g. Council parks and gardens) for downstream drainage where the land is dedicated in favour of Council (i.e. with easements/reserves). It is expected that the consultant team will consider the following as a minimum when considering dual use:

- (a) major flood capacity
- (b) convenience flood capacity — minor event in terms of interval event and the time to drain ponded sites
- (c) maintenance costs (e.g. batter slopes between 1 in 4 and 1 in 6)
- (d) safety (e.g. maximum velocity 2 m/s)
- (e) stability factors (e.g. resistance to scour, slip)
- (f) ecological considerations (e.g. preserving valuable areas, and appropriate planting in waterway areas, minimum impact on existing riparian/aquatic ecosystems).

(5) Within open-space reserves, consideration should be given to:

- (a) safety of persons who may inadvertently or unwisely enter the stream
- (b) scour protection
- (c) downstream flood reduction, the lower velocity reducing downstream peak flow
- (d) desirable maximum side slopes of 1 in 6
- (e) the effect of overland flow paths on existing native vegetation
- (f) designing to create a feature in the landscape
- (g) designing to slow stormwater movement and encourage infiltration
- (h) designing to use shallow grassed/riprap swales and/or contour banks that do not present maintenance or mowing difficulties (maximum 1:6 slopes)
- (i) existing canopy vegetation on the site
- (j) maintenance considerations
- (k) the natural hydrology of the site
- (l) the width of any swale/open-drain profile to ensure it does not constitute more than 25% of the width of the open-space reserve at any one point
- (m) the desirability of having a road/street along one side.

SC6.2.4.4.10.5 *Overland flow from traps in roads*

(1) Sags in roads and cul-de-sacs at the end of a falling road grade shall be provided with an overland flowpath 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.

SC6.2.4.4.11 Stormwater inlets (refer QUDM 2008 7.05)

SC6.2.4.4.11.1 *Types of stormwater inlets and grates*

(1) Stormwater structures must be designed and constructed in accordance with the Standard Drawings.

(2) Gully pits are to be 'lip in line' (i.e. CM gully pits or approved similar).

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

(4) Grates, where used, must be bicycle-safe.

SC6.2.4.4.11.2 *Gully inlet capacity*

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

SC6.2.4.4.11.3 *Gully inlet location*

(1) In addition to the requirements stated in QUDM 2008, gully inlets shall be located:

(a) on straights, wherever possible
(b) to reduce the likelihood of conflict with future driveway locations.

(2) Anti-ponding gullies in curves are to be avoided wherever possible. If used, they are to be side-entry type, chamber and grate only.

(3) Where two falling grades meet at an intersection, if possible the low point shall be located clear of the kerb return. The cross-fall may be varied locally within the range of 2% to 5% to achieve this. Kerb units shall always be located on straights.

SC6.2.4.4.11.4 *Access chambers (see QUDM 2008 7.06)*

(1) In addition to the requirements stated in QUDM 2008, the internal gully and internal access chamber dimensions are to provide suitable clearances for access purposes.

(2) The minimum internal dimension of a gully or access chamber is to be the greater of the following:

(a) 900 mm
(b) the largest entering pipe diameter plus 300 mm.

(3) Gully pits more than 1.5 m deep are to be constructed as a gully pit/access chamber structure located on the footpath, in accordance with Standard Drawings.

(4) Access chambers are to be designed and constructed in accordance with Standard Drawings.

(5) Non-standard structures are to be fully detailed in the engineering drawings.

SC6.2.4.4.11.5 *Pipeline location (refer QUDM 2008 7.07)*

(1) In addition to the requirements stated in QUDM 2008, the following is required in regard to pipeline location:

(a) Where pipelines (not including rear-of-allotment drainage) are permitted to be located within allotments, easements in Council's favour are required to be provided over the drain lines. The minimum easement widths shall be in accordance with these guidelines (see SC 4.2.4.1.3.6: Easements).

(2) Pipes laid longitudinally along the road are to be installed as follows:

(a) Pipes less than 600 mm diameter may be laid directly under the kerb and channel from the centre of one gully pit chamber to the centre of the next gully pit chamber.
(b) For pipes 600 mm diameter and greater, the centreline of the pipe must be offset 0.75 m from the lip of kerb and channel towards the road centreline and an offset chamber must be constructed.

SC6.2.4.4.11.6 ***Pipe and material standards (see QUDM 2008 7.08)***

(1) In addition to the requirements for pipes stated in QUDM 2008 Table 7.08.1, the flush-jointed external rubber band jointing system is acceptable for all pipe diameters in good ground conditions.

(2) Pipes shall be bedded/backfilled as detailed in the Standard Drawings; external rubber bands can be used for flush-jointed pipes.

(3) With the exception of inter-allotment drainage systems, the minimum pipe size is 375 mm diameter.

(4) The class of pipe (minimum class 2) is to be as specified or as shown on the engineering drawings, in accordance with the strength requirements of pipes in roadways or in deep trenches or under fills, and taking into account any construction loading.

(5) Rubber ring jointed pipes are to be used where flow velocities are greater than 2 m/s.

SC6.2.4.4.11.7 ***Discharge calculations (see QUDM 2008 7.15)***

(1) Stormwater discharge calculation for the major and minor systems is to be undertaken in accordance with Section 7.15 of QUDM 2008.

(2) For the purpose of checking a proposed development, Council requires that the following minimum requirements are met in the Hydrological Calculation Presentation. This information may be shown on design plans.

SC6.2.4.4.11.8 ***Overall development calculations***

(1) The minimum standard of documentation for calculations shall be the catchment plan, for both minor and major storms, at a suitable scale that clearly shows:

(a) subcatchments
(b) areas of subcatchments
(c) slopes of subcatchments
(d) pit location complete with labelling to clearly identify pits/access chambers to allow the drainage system to be understood.

(2) Calculations shall include minor system design and major system design. Minor system design shall include the following elements:

(a) minor system ARI
(b) subcatchment area contributing
(c) subcatchment time of concentration
(d) fraction impervious
(e) discharge coefficient
(f) rainfall intensity for the design ARI
(g) subcatchment discharge
(h) road flow width and road flow depth immediately upstream of the proposed stormwater inlet
(i) velocity/depth product immediately upstream of the proposed stormwater inlet
(j) flow captured by gully inlet
(k) volume of flow and width of flow bypassed at stormwater inlet.

(3) Major system design shall include the following elements:

(a) major system ARI

(b) subcatchment area contributing
(c) subcatchment time of concentration
(d) fraction impervious
(e) discharge coefficient
(f) rainfall intensity for the design ARI
(g) subcatchment discharge
(h) roadway capacity check for containment of a major storm at stormwater inlets and other critical locations
(i) velocity/depth product at the location of the roadway capacity check.

(4) These calculations must be logically ordered and legible, and may be presented in a tabulated format or in hand-written calculation sheet format (see QUDM 2008 Appendix 5).

SC6.2.4.4.11.9 ***Rear of allotment drainage calculations***

(1) The minimum standard of documentation for calculations shall be the development layout plan at a suitable scale to clearly show:

(a) allotment and roadway layout
(b) set-out of the rear-of-allotment drainage line
(c) location of the underground stormwater drainage line
(d) locations of inspection access chambers on the rear-of-allotment drainage lines and on the underground-stormwater drainage lines
(e) connection stub locations
(f) allotment areas
(g) direction of contributing fall of each allotment
(h) design flow discharge from each allotment
(i) pipe size and type of rear of allotment drainage lines
(j) pipe size and type of underground stormwater drainage lines
(k) existing natural surface levels at every corner of the allotments
(l) finished surface levels at relevant locations to demonstrate proposed drainage paths
(m) other information as may be necessary to identify the development's stormwater drainage system.

(2) The Standard Drawings contain a sample drawing showing this information.

(3) Calculations shall include:

(a) design storm ARI
(b) pipe size
(c) pipe type and class
(d) grade of pipe
(e) flow volume in each section of pipe between the inspection access chambers
(f) average allotment levels
(g) cover from future cut/fill platform to rear-of-allotment drainage lines.

(4) This information could be included on a longitudinal section. The Standard Drawings show a sample drawing.

SC6.2.4.4.11.10 ***Hydraulic calculations (see QUDM 2008 7.16)***

(1) Hydraulic calculations for stormwater drainage are to be undertaken in accordance with Section 7.16 of QUDM 2008, subject to the following comments:

(a) Council wishes to reinforce that Manning's Formula is to be used in the calculation of pipe full flow discharge.
(b) The use of the Colebrook White Formula for this purpose is not approved.

SC6.2.4.4.11.11 ***Overall development calculations***

(1) Calculations for the underground stormwater drainage system design of each reach are the minimum standard of documentation required. These shall be presented in tabulated format (see QUDM 2008 Appendix 5) and shall include:

(a) design flow in reach (L/s)
(b) pipe diameter
(c) reach (pipe) length
(d) grate/surface level at gully pit/access chamber
(e) invert level of gully pit/access chamber
(f) Manning's 'n' for type of pipe
(g) full-flow velocity
(h) velocity head
(i) friction loss in pipe
(j) hydraulic grade line slope
(k) pit/access chamber type, as nominated in QUDM 2008 charts
(l) pit loss coefficients and pit velocity head losses
(m) hydraulic grade line at the upstream side of the pit/access chamber
(n) hydraulic grade line at the downstream side of the pit/access chamber
(o) water surface elevation in the pit/access chamber
(p) freeboard in the pit/access chamber.

SC6.2.4.4.11.12 ***Longitudinal sections***

(1) Longitudinal sections shall be presented in a similar fashion to those as shown in the Standard Drawings. See also the example drawings in QUDM 2008 Appendix 6.

(2) Specific items to be shown are:

(a) minimum acceptable horizontal and vertical scales; these shall be 1:1000 and 1:100 (at A1 size) respectively, unless otherwise approved by Council
(b) service size, elevation and location of existing and proposed services from within the development and from other authorities
(c) length of pipe/culvert in each reach
(d) grate levels/finished surface levels at each pit/access chamber
(e) invert levels of pipes.
(f) hydraulic grade line levels
(g) depth to invert of pipes
(h) slope (grade) of pipe
(i) pipe size, pipe type, pipe class, pipe joint type
(j) velocity in pipe
(k) flow in pipe
(l) plot of natural surface/finished surface as applicable
(m) plot of hydraulic grade line or indication of Water Surface Elevation (WSE)
(n) plot of pipe invert and obvert
(o) proposed access chambers, shown as a blocked-in line with the access chamber number in a circle
(p) existing access chambers, shown as a double line with the access chamber number in a double circle
(q) sections drawn so that the underground stormwater system drains to the right.

SC6.2.4.4.11.13 ***Stormwater outlets (see QUDM 2008 8.0)***

(1) Design of stormwater outlets shall be undertaken in accordance with Section 8.0 of QUDM 2008, subject to the following comments:

(a) It should be noted that virtually no data are currently available for design outlet water levels to creeks throughout the region. Designers should make appropriate allowances where flood data are not available or of uncertain accuracy, and be aware of the sensitivity of designs to outlet water level assumptions, particularly in flat terrain.
(b) Designers are to give careful consideration to the management of velocity of discharge flows on the receiving environment (e.g. outlet protection works and stilling basins) (see QUDM 2008 8.06).

(c) Safety at all free-drainage outlets shall be taken into account in the design. See QUDM 2008 Section 12.04: Inlet and Outlet Screens for details of acceptable safety treatments at free drainage outlets.

(2) For further guidance on the design of stormwater outlets, refer to the Department of Transport and Main Roads Road Drainage Design Manual.

SC6.2.4.4.11.14 *Waterway crossings (see QUDM 2008 10.0)*

(1) Design of waterway crossings shall be undertaken in accordance with Section 10.0 of QUDM 2008, subject to the following comments:

(a) Ford crossings are not to the used (see QUDM 2008 10.03).
(b) For further guidance on the design of culvert crossings (see QUDM 2008 10.04), refer to QUDM 2008 10.04 and the Department of Transport and Main Roads Road Drainage Manual.

SC6.2.4.4.11.15 *Safety aspects (see QUDM 2008 12.0)*

(1) Design for safety associated with stormwater drainage shall be undertaken in accordance with Section 12.0 of QUDM 2008. However, recommendations detailed in this section will be reviewed for relevance and practicality on a case-by-case basis and will depend on conditions relevant to the local area.

SC6.2.4.4.11.16 *Miscellaneous matters (see QUDM 2008 13.0)*

(1) The clause on 'as constructed' plans in QUDM 2008 13.02.3 has not been adopted. Instead, the following applies:

(a) Accurate 'as constructed' plans shall be prepared to record any changes or departures from the design that may have occurred during the construction phase. The 'as constructed' information is required by Council so that a correct database is available for record purposes, asset management and maintenance. It is important as a reference source for other services authorities, future designers, and police and emergency services.

(2) 'As constructed' plans shall be submitted for:
(a) underground stormwater drainage
(b) rear-of-allotment drainage.

SC6.2.4.4.11.17 *Underground stormwater drainage*

(1) 'As constructed' plans shall record the following minimum standard of information, as well as other details particular to the project:

(a) pipe sizes, types, classes and lengths of sections of drainage lines
(b) location of drainage lines
(c) invert levels and grades of pipes
(d) finished surface levels for structures
(e) location of structures
(f) structure types and dimensions
(g) location of subsoil drains and clean-out points
(h) details of relocated services, if applicable.

(2) Refer to the Standard Drawings showing this information.

SC6.2.4.4.11.18 *Rear-of-allotment drainage*

(1) 'As constructed' plans shall record the following minimum standard of information, as well as other details particular to the project:

(a) pipe sizes, types, classes and lengths of sections of drainage lines

(b) location of pipes relative to property boundaries
(c) invert levels and grades of pipes
(d) finished surface levels for structures
(e) location of structures relative to property boundaries
(f) structure types and dimensions
(g) location of connection stubs relative to property boundaries
(h) depth to connection stub from finished surface level
(i) finished surface levels at every corner of allotments
(j) details of relocated services, if applicable.

(2) Refer to Standard Drawings for a sample drawing showing this information.

SC6.2.4.5 Stormwater quality/water-sensitive urban design

(1) Water-sensitive urban design (WSUD) applies the sustainability principles of water conservation, waste minimisation and environmental protection to the management of the urban water cycle. At various points along the drainage system, controls or combinations of controls are used to manage the quality and quantity of stormwater so that the impact on the environment and existing drainage systems is managed.

(2) WSUD aims to minimise the impact of urban development on the natural water cycle, and its principles can be applied to single allotments or to whole subdivisions.

(3) With regard to stormwater management, the core principles of WSUD include:

(a) Protect natural ecosystems.
(b) Integrate stormwater treatment into the urban landscape.
(c) Protect water quality.
(d) Reduce run-off and peak flows.
(e) Add value while minimising development costs.

(4) These principles require a considered approach to urban development in which sustainable land and water management decisions underpin all development proposals.

(5) For stormwater quality management, WSUD promotes an ‘at source’ philosophy that is based on the premise that it is easier and more cost-effective to control pollution at its source rather than remove it once it has made its way into a formal stormwater drainage system.

(6) An ‘at source’ approach also allows for greater integration between stormwater management function and public realm landscape elements. Garden beds within building forecourt areas, street trees and other ‘soft’ streetscape elements can all be used as part of an integrated stormwater management system. Landscape elements can be designed to filter stormwater run-off from hard surfaces, the added benefit being the use of stormwater runoff to water the landscaped areas.

SC6.2.4.5.1 Introduction

(1) The application of WSUD requires significant input from a range of professions. It is essential that a logical process is followed that considers not only the implementation of WSUD practices, but integrates these within the overall urban design framework.

(2) This section addresses the recommended planning and design process, and site-planning concepts and practices that should be incorporated into the design of greenfield and infill development. The practices presented are central to effective site planning and design of stormwater management facilities and the protection of receiving waters throughout the region. The main focus of these guidelines is the consideration of stormwater management in the initial layout and design of a development rather than as an ad hoc development requirement or one that is left until all other elements (such as lot layouts, street design, hydraulics etc.) have been completed.

SC6.2.4.5.2 WSUD planning process

(1) To achieve the an optimum outcome in the application of WSUD principles and measures within a development, integration of detailed planning, engineering, landscaping and ecology is an absolute necessity. For this to occur, a process that addresses the relevant tasks in a logical manner is required.

(2) The process set out below highlights key steps in the overall conceptual design process. In the majority of cases, the WSUD professional will lead a team through the required tasks, or at least seek to facilitate the team through it. This process cannot be conducted separately to other processes, such as the overall urban, engineering or landscape design, and may require several iterations through the overall urban development project.

SC6.2.4.5.2.1 *Step 1: Site analysis*

(1) Understanding the location where WSUD is to be applied is fundamental to the overall success of implementation. This task is about gathering a broad overview of the subject site and identifying those issues that may assist or hamper the delivery of WSUD practices.

(2) This task should involve initial data collection, such as land use zonings, terrain information, aerial imagery and previous studies, and reviewing the data in conjunction with planning scheme maps. A site visit is considered essential. The following items will need to be identified and considered:

(a) terrain — areas of high and low gradients, flatter areas that may allow larger WSUD measures such as wetlands, level areas which may present difficulties in terms of hydraulic head and high groundwater table
(b) catchment boundaries internal to the site and catchment areas external to the site
(c) natural features, especially creek lines, permanent water bodies, existing vegetation
(d) planning constraints — environmental corridors, waterway corridors, flood lines, open space or recreational nodes
(e) receiving environment — waterways or drainage lines where discharge off site is likely to occur
(f) strategic catchment planning — catchment or subcatchment plans (in the Council region this will include catchment management plans, stormwater management plans and master drainage strategies) to identify any regional or catchment-scale strategies applicable to the site
(g) existing hydrological patterns and features
(h) extent of the floodplain for the 100-year ARI; this will also be mapped
(i) topography and slope stability
(j) geology and soil characteristics
(k) existing water quality
(l) waterways, wetlands and floodplains
(m) minor drainage features
(n) existing known stormwater or drainage ‘problem’ areas
(o) vegetation
(p) erosion-prone areas
(q) groundwater and recharge areas
(r) existing infrastructure and services (potholing to obtain levels is considered a mandatory requirement in most cases)
(s) planned infrastructure and services
(t) existing easements and drainage reserves on the site and the possible need to secure additional areas at downstream locations.

(3) From this, a list of opportunities and constraints as they apply to WSUD at the subject site should be prepared to assist in the remaining tasks.

(4) The information layers compiled during the resource mapping then need to be overlaid to provide a composite site analysis that:

(a) identifies the developable area of the site
(b) shows the relationship between constraints and opportunities at the site

(c) guides lot and road layout
(d) identifies the areas best used for stormwater treatment, storage and conveyance.

SC6.2.4.5.2.2 *Step 2: Identification of objectives*

(1) The implementation of WSUD in a development seeks to achieve a range of outcomes relating to water quality, hydrology, conservation and amenity, as shown in Figure SC6.2.3.

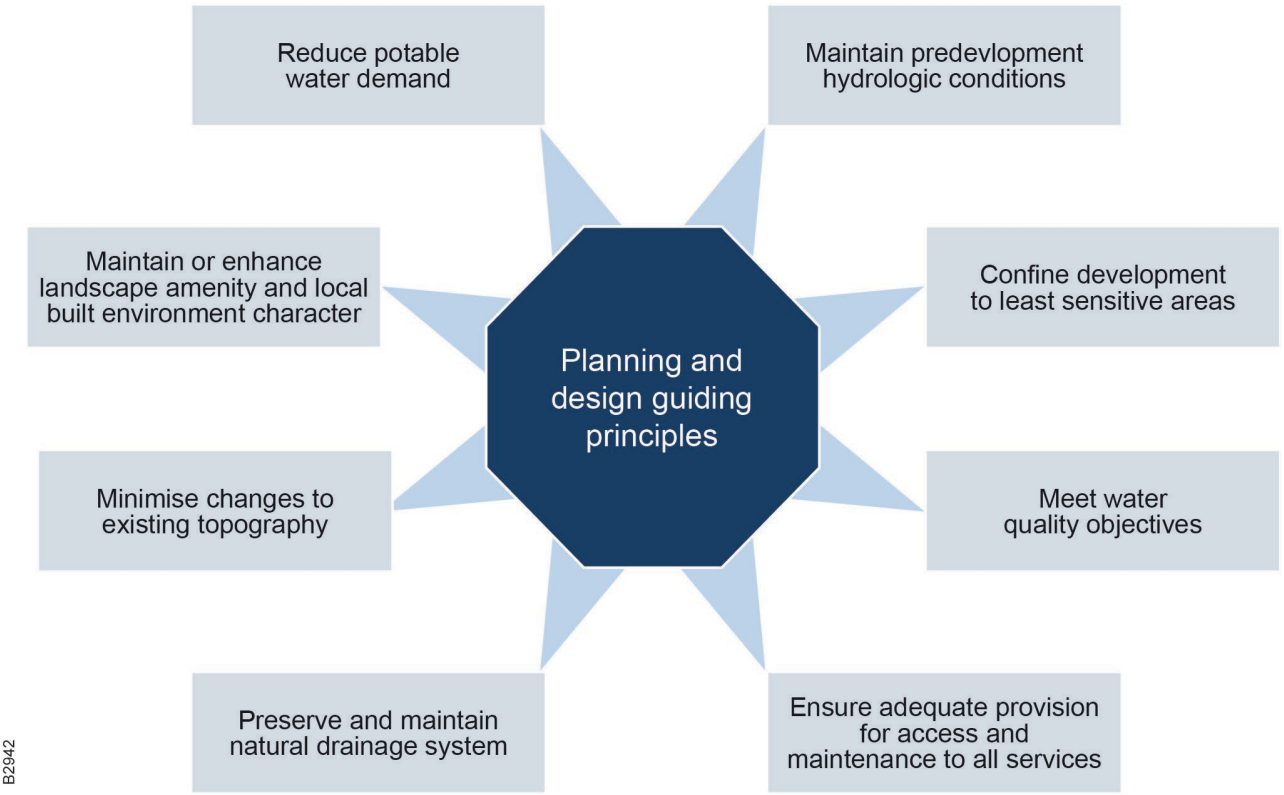


Figure SC6.2.3 WSUD conceptual design outcomes

Source: Gold Coast City Council WSUD Conceptual Design Guidelines

(2) Each of these outcomes is met by ensuring development complies with the appropriate objectives identified for the site. Before any other activities are undertaken with respect to site planning, the objectives must be clearly established using the information provided in the sections below.

(3) In most cases, site-specific objectives will be available and need to be identified clearly so that they can be referred to during the remaining tasks in the concept design process.

A. Water quality objectives

(1) One of the primary roles of WSUD is to reduce the impacts of urban development on receiving environments. As part of the design process, relevant environmental values and water quality objectives of receiving waters or other water quality targets relevant to the site must be identified, where available, and documented.

(2) These may include:
(a) concentration-based water quality objectives for receiving waters
(b) concentration-based discharge standard from a site
(c) load-based criteria (mass per unit of time) or reduction in load.

(3) The relevant water quality objectives should be used as the primary performance criteria on which a development is assessed for its ability to ensure protection of receiving water quality. Tables 2.1 and 2.2 of the Urban Stormwater Quality Planning Guidelines (Department of Environment and Resource Management) identify appropriate water quality objectives for the construction and operational phases of development, and where they will apply.

B. Water quantity objectives

(1) Another key principal of WSUD is to reduce the impact of urban development on the natural hydrologic conditions of a site. The Council's planning scheme clearly outlines the requirements of all development:

(a) Predicted peak flows are not increased for all ARIs from 2 years to 100 years, unless approved by Council to accord with a regional drainage master plan.
(b) Predicted peak volumes for three-month and 2-year ARIs are maintained
(c) Frequency of bank-full flows compared to the pre-developed scenario is maintained to the post-development scenario.
(d) Developments must comply with Table 2.4 of the Urban Stormwater Quality Planning Guidelines (Department of Environment and Resource Management).

(2) Other water quantity objectives may also be relevant. Inundation times should be considered as part of the setting of water quantity objectives. This will be particularly relevant where inundation times may be increased for downstream properties.

(3) Further discussions should be held with Council development assessment officers during Step 3 to ensure appropriate quantity targets have been identified.

(4) It should be recognised that WSUD elements in isolation will not be sufficient to address all flooding or hydraulic requirements, but may be integrated within the overall hydraulic design of the development.

C. Integrated water cycle management objectives

(1) One of the major benefits of WSUD is the ability to incorporate measures that can benefit all parts of the water cycle. WSUD elements such as rainwater tanks, aquifer storage and recovery, bioretention basis and sediment control ponds can all be useful elements in an integrated water management plan.

D. Landscape and amenity objectives

(1) While deterministic objectives may not be available, broad objectives for the integration of landscape elements into WSUD may include the following:

(a) Ensure the integration of landscapes, recreational amenity and WSUD functionality facilitates creative expression and solutions, meets standards of service for recreation and landscape amenity, can be comprehended by the community, and is sensitive to the environment and the local setting.
(b) Provide appropriate buffers to open-space areas or environmental corridors.
(c) In most circumstances, the functionality of open-space areas should not be compromised by the WSUD elements.
(d) Provide a desirable community amenity and integrate WSUD into the overall design of the urban framework.
(e) Ensure the sustainability of landscape amenity through a design that accounts for longevity of the system by considering maintenance and community use aspects (e.g. vandalism, litter protection).
(f) Provide 'green' elements and visual breaks in the urban landscape.

E. Vegetation and natural features

(1) The objectives of WSUD relating to vegetation and natural features include:

(a) protection and enhancement of waterways, wetlands and their buffers

(b) appropriate development setbacks from waterways and wetlands
(c) protection of remnant vegetation communities
(d) retention and reinstatement of native vegetation
(e) natural channel design responses for natural gullies and waterways.

(2) Each of these objectives should be developed in conjunction with Step 6 to ensure natural features of the site are identified and their protection or enhancement is listed as an objective for that development.

F. Social outcomes

(1) Increasingly, developers are recognising the benefits of incorporating social design into the delivery of new urban areas. Objectives relating to public safety, community enhancement and recreational opportunities may be identified through other processes; however, it is important that they are considered as a specific outcome.

SC6.2.4.5.2.3 *Step 3: Conceptual site design*

(1) Based on the outcomes of Steps 1 and 2, an initial conceptual site design based on broad development outcomes should be undertaken.

(2) This may simply be a sketch using intended land uses (e.g. residential areas, local open space, regional open space, protected zones), but should identify areas for possible implementation of lot-, local- and regional-scale WSUD measures. The objectives identified previously may provide guidance, but key to this conceptual design will be addressing the opportunities and constraints identified in Step 1 in a whole-of-development context. This conceptual site design becomes the overall vision for more detailed design in later steps.

(3) There will be occasions when the above process will generate the apparent need for stormwater treatment devices that are out of proportion or inappropriate for the proposed development. In these special circumstances, Council is prepared to consider alternative 'best practice/best fit' solutions that may not deliver the targeted, desired standards of service. Council will require compelling justification to vary its position on achieving these targets against the following criteria:

(a) Cost of construction and whole-of-life cost is prohibitive.
(b) Land area required is excessive against the scale of the development.
(c) Environmental constraints prohibit the full implementation of the required facility.
(d) Topographical constraints prohibit the full implementation of the required facility.
(e) Hydraulic constraints prohibit the full implementation of the required facility.
(f) Other matters prohibit the full implementation of the required treatment measures.

SC6.2.4.5.2.4 *Step 4: Pre-lodgement meeting*

(1) In the majority of applications, it will be beneficial to the overall development application process to meet with Council officers to discuss the existing site, proposed development and likely Council requirements. Typically, this would form part of a pre-lodgement meeting in which informal discussions are held between the developer (and its consultants) and Council.

(2) A draft concept design of the proposed development (including potential WSUD locations) should be prepared and form the basis of discussion at the pre-lodgement meeting.

(3) This meeting should also be used to discuss the implications, if any, of Council catchment and stormwater management plans, particularly in relation to the opportunity or requirement for larger catchment-scale regional detention or water quality treatment devices that account for upstream catchment areas.

SC6.2.4.5.2.5 *Step 5: Identification of suitable WSUD measures*

(1) WSUD best management practices (BMPs) are best provided as a series of 'fit for purpose' treatment measures placed sequentially to form a 'treatment train'. One individual measure

will generally not adequately address the full range of pollutants generated from a typical urban development. Therefore, an appropriate collection of individual treatment measures in series within a treatment train must be developed. This shall consider the best operating environment for each treatment measure, taking into account:

(a) contributing catchment area
(b) hydraulic and pollutant loading
(c) treatment processes employed
(d) soil type and groundwater
(e) maintenance and public health and safety issues.

(2) The treatment train should provide an integrated drainage system suitable for the site that includes a graduated level of treatment, from primary through to tertiary treatment, with a specific aim of treating stormwater for the target pollutants (see Figure SC6.2.4).

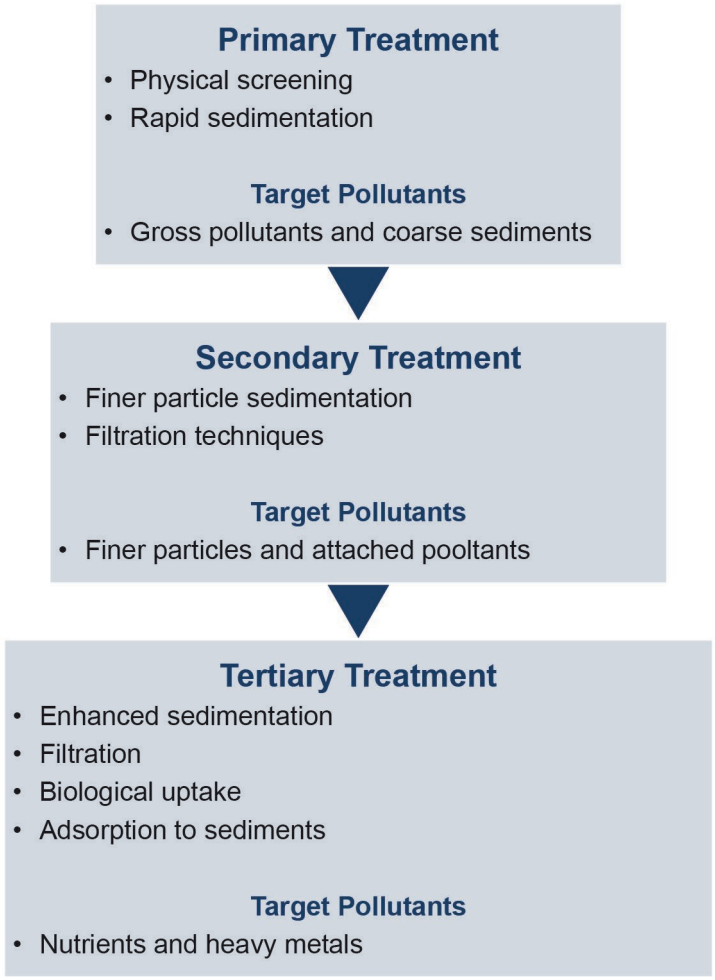


Figure SC6.2.4 Stormwater treatment train categories

Source: Gold Coast City Council WSUD Concept Design Guidelines

(3) The Healthy Waterways (Waterbydesign) Water Sensitive Urban Design Technical Design Guidelines advises on the alternative treatment measures that are available to support the treatment train and provides information on their application and performance.

(4) Subject to the risk assessment describe at SC6.2.4.1.1 of the Toowoomba Regional Planning Scheme, 'deemed to comply' solutions may be implemented to meet the stormwater quality objectives. The designer is referred to Deemed to Comply Solutions – Stormwater Quality Management (South East Queensland), prepared by Waterbydesign

for Healthy Waterways. The use of wetlands is not acceptable to the Council as a 'deemed to comply' solution.

(5) The list of possible WSUD devices should be used to develop a series of potential treatment trains for the proposed development, based on the interpreted site conditions and site opportunities and constraints. Other issues that should also be taken into consideration in selecting appropriate treatment measures include:

(a)
(b) cost–benefit ratio of the number of treatment devices (capital and maintenance costs) against the water quality achieved
(c) workplace health and safety issues (for maintenance crews)
(d) general public amenity and safety
(e) whether a distributed or 'bottom-of-catchment' approach will be used
(f) integration with urban design, including road and lot layouts
(g) life cycle costs and ongoing maintenance requirements and resources.

(6) A number of factors must be considered in the selection of the final treatment train for the site. These factors should be considered alongside the opportunities and constraints identified at the site and the opportunities to lay out the development to respond to WSUD requirements.

(7) The following factors should be considered in the selection of the treatment train:

(a) maintenance
(b) life cycle costs
(c) location
(d) public safety
(e) establishment
(f) access
(g) erosion and sedimentation control.

A. Maintenance

(1) The devices selected should represent a reasonable maintenance burden, particularly where the asset will be handed over to Council at some time in the future.

(2) The maintenance requirements must be within Council's capacity in terms of skills, resources and equipment.

(3) There should be enough resources to undertake maintenance at the required frequency.

(4) The treatment devices should be safe to maintain and should not require maintenance staff to have direct contact with pollutants and other trapped materials.

(5) Maintenance procedures should be simple and should not require specialised equipment.

(6) Disposal of waste (e.g. gross pollutants, vegetation etc.) should be considered.

B. Life cycle costs

(1) A life cycle cost assessment may be undertaken in the process of selecting the best devices (e.g. many smaller devices rather than larger treatment devices).

C. Location

(1) The device must be able to integrate with the local character and built environment and must be suitably located to treat the maximum amount of run-off from the site.

D. Public safety

(1) The safety of the general public adjacent to the WSUD device is a priority. Consideration should be given to the risks associated with open water bodies, ponded water etc. Risks should be appropriately managed through selection of devices and subsequent detailed design.

E. Establishment

(1) The establishment period will be dictated by the period required for the measure to become fully functional. For vegetated systems, this may take two or three growing seasons.

F. Access

(1) The devices and their locations must be accessible for ongoing maintenance. Maintenance access must be ensured for all equipment required for ongoing maintenance (including any heavy machinery).

G. Erosion and sedimentation control

(1) Construction phase performance criteria are limited to those parameters that are directly linked to construction site management practices. Typical parameters include turbidity/suspended solids, pH, dissolved oxygen, litter and hydrocarbons.

(2) Unless otherwise stated in a Council-endorsed catchment management plan or study, the construction phase performance criteria for discharges from development sites are those listed in Table 2.1 of the Urban Stormwater Quality Planning Guidelines. These criteria are discharge standards, so they apply to run-off events or pumped discharges from development sites.

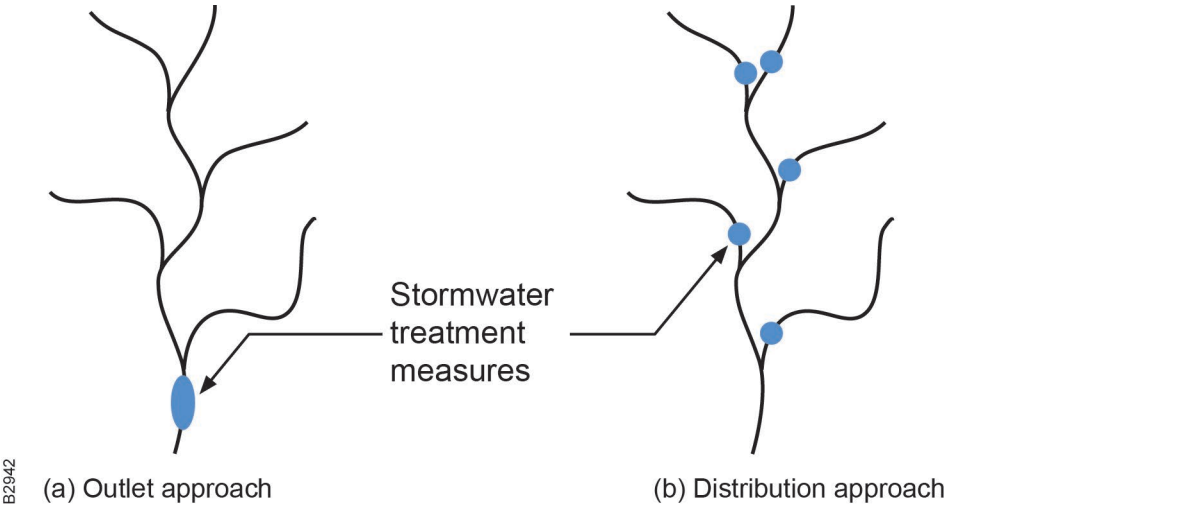
(3) It is highly recommended that a site-specific relationship be developed between turbidity and suspended solids on high-risk development sites. This will enable the rapid feedback of turbidity monitoring into site management actions (such as flocculation and timing of discharge from a sedimentation basin).

(4) Setting concentration-based criteria allows for compliance checks through water quality monitoring. Construction phase water quality monitoring will be required for sites where dewatering is required.

(5) The designer is referred to Section 6.3 of the Urban Stormwater Quality Planning Guidelines for hazard assessment, design criteria and monitoring requirements associated with the preparation and implementation of the sedimentation and erosion control plans for all development sites.

SC6.2.4.5.2.6 *Step 6: Location of WSUD elements*

(1) When determining the best WSUD measures for a site, some consideration should be given to the site analysis, the opportunities available, and the 'natural' or obvious areas for WSUD devices (e.g. overland flow paths). The site analysis may provide information on whether a bottom-of-catchment, regional approach or a distributed, treatment-at-source approach to WSUD is best for the site. These two options are shown in Figure SC6.2.5.



Source: NSW EPA 1997

Figure SC6.2.5 Location of stormwater treatment measures

Source: Gold Coast City Council WSUD conceptual design guidelines

(2) WSUD principles are most effective and economical when integrated into development design at the concept design stage. Subdivision patterns for different development types may vary significantly and present different WSUD opportunities. Different development types and suitable WSUD can include:

(a) low-density subdivisions (e.g. park residential). These developments generally have larger allotments and may incorporate a large range of WSUD initiatives. These sites may have sufficient space to incorporate significant landscape WSUD elements, such as swales and buffer strips in road reserves, bioretention in natural depressions etc.

(b) low- to medium-density subdivisions. These generally contain a range of low-rise dwelling types on smaller allotments and afford less opportunity for landscape WSUD elements. In this instance bioretention devices may be incorporated into street design or through more effective lot layout design

(c) high-density development. This contains several dwellings in strata or community title. Private open space will generally be hard-paved with limited pervious area. Open-space areas will be generally multifunction areas acting as treatment measures and recreational areas. WSUD opportunities may include common open-space areas, courtyards and roof areas.

A. Public open space

(1) The open-space system should be developed with the aim of establishing a network of natural features and compatible land uses that will act as a green network throughout the development.

(2) The integration of stormwater management initiatives as components of the open-space system contributes to open-space outcomes by increasing the physical area of general open-space and green elements within a community, enhancing terrestrial and aquatic habitat diversity and enhancing recreational and educational opportunities. The following are examples of techniques that can be used to integrate stormwater management and the open-space network:

(a) incorporation of waterways and bioretention systems within parks as ecological and/or recreational features

(b) integration of playfields within dry detention basins

(c) design of subsurface storage and/or infiltration systems beneath playfields within parks or school yards

(d) development of gardens within open-space areas as bioretention systems.

B. Road configuration and layout

(1) Most impervious hard surfaces in urban developments are roads. Road designs can change the way water is transported through a development. Roads also generate water-borne stormwater contaminants including fine sediments, metals and hydrocarbons. Road alignments and streetscapes should be carefully planned to incorporate some degree of treatment. Appropriate WSUD drainage elements include:

(a) bioretention system
(b) bioretention swales
(c) buffer strips.

(2) These devices collect, attenuate, convey and treat run-off before it is discharged to receiving waterways. Opportunities exist for incorporating stormwater elements in roadways by diverting flow paths to a treatment system. Traditional road features (medians, roundabouts, street trees and car parking nodes) can be configured to collect and treat run-off as part of a stormwater conveyance system.

C. Lot layout

(1) The requirements of the Reconfiguring a Lot code in the planning scheme will be the key document to be used in overall lot layout. However, some general principles that can be followed in lot layout to maximise WSUD opportunities and reduce stormwater impacts are:

(a) Minimise site disturbance.
(b) Locate lots in a way that stormwater can be discharged via open space (and not concentrated in one location).
(c) Maximise opportunities for on-lot treatment or for conveyance via WSUD devices.

(2) Lot layout options that may be considered (see Figure SC6.2.6) include:

(a) clustering houses to use central stormwater treatment measures
(b) using open space and existing vegetation as buffers
(c) reducing the impervious area per lot (e.g. driveway length and width).

Figure SC6.2.6 Integration of housing with waterway corridor

Source: Gold Coast City Council WSUD Conceptual Design Guidelines

D. Natural channel design

(1) The basic principle of natural channel design is to maintain the hydraulic conveyance requirements of engineered or affected channels, while improving environmental values. Natural channel design is important in all waterways (whether natural in formation or constructed to appear and operate as natural channels), especially where the waterway

provides a link with bushland reserves or forms an important part of an aquatic or terrestrial movement corridor. An extended maintenance period may be required until the channel has sufficiently stabilised and vegetative cover is well established.

(2) Where rock armour is required to control erosion, partially embedded or grouted natural rocks/boulders should be used. Planting between rocks can soften visual impacts.

(3) Boulders placed on the bed of the watercourse can promote habitat diversity. Boulders recessed into the low-flow channel or the pools can increase the total submerged surface area, thus increasing the available food supply for aquatic life. Concrete lining is generally unacceptable to Council as this solution does not protect or enhance environmental values.

E. Rainwater tanks

(1) Council actively supports the use of rainwater tanks as they provide a simple and effective means for property owners to manage stormwater at the source, while providing a major benefit to the management of the urban water cycle through reduced water demand and improved water quality. The application of rainwater tanks is particularly suited to new and existing houses, and small-scale residential developments of four dwelling units or less. The Queensland Development Code provides minimum water tank requirements.

(2) Overflows from rainwater tanks are usually connected to soakage or rubble pits. The proposed stormwater disposal method should mitigate any potential impacts worsening the existing conditions either by ponding, concentrating or increasing the flow onto adjoining properties. The acceptable solution may include soakage trenches or a combination of gravity-feed pipe via a drowned outlet to the kerb and channel and/or rainwater tank under the house. The soakage pit should be located at least 3 m from any building or boundary, and should provide every opportunity for the stormwater flow to broadsheet across the lawn. The removal of stormwater by adsorption or infiltration into permeable soils should be designed to suit the topography and soil type.

SC6.2.4.5.2.7 ***Step 7: Model base case***

(1) At this stage, sufficient information would have been collected to allow modelling of both the existing site and the 'untreated' developed site; the model would form the base case against which to compare future modelling of the WSUD development.

(2) In the majority of developments, water quality modelling should focus on total suspended solids, total nitrogen, total phosphorus and gross pollutants as the key pollutants of interest, as well as on the hydraulic outcomes. Further guidance on water quality modelling is provided in the Healthy Waterways Waterbydesign MUSIC Modelling Guidelines.

(3) Some characterisation of the natural hydrology and an assessment of the peak flow rates and volumes for the pre-development condition must be undertaken for the full range of ARIs from 2 to 100 years. For smaller catchments, preliminary assessments can be made using simple catchment calculations based on the Rational Method. For larger catchments, characterisation of the site hydrology may require use of hydrologic models (e.g. XP-RAFTS, RORB, URBS) to adequately represent the hydrologic conditions of the site. These pre-development conditions will be used as the reference point for which the WSUD strategy should aim. Note that this will usually be conducted through an overall hydraulic assessment of the site to meet flood management requirements. Refer to the Queensland Urban Drainage Manual for guidance on hydrological and hydraulic assessment.

SC6.2.4.5.2.8 ***Step 8: Model treated case***

(1) Evaluation and assessment of alternative stormwater strategies are based on predictions made by forecasting tools. Modelling tools such as MUSIC and hydrologic models such as XP-RAFTS, URBS etc. should be used to demonstrate that the proposed strategy:

(a) achieves the load reduction targets adopted by Council

(b) results in no change to the hydrology of the site, as per Council's water quantity objectives.

(2) Other tools may include water balance modelling and flood/hydraulic modelling where this is appropriate to the site. Refer to the MUSIC Modelling Guidelines (Waterbydesign) for further guidance on the use of MUSIC to assess stormwater treatment trains. The Queensland Urban Drainage Manual should be referred to for hydrologic and hydraulic assessments.

A. Life cycle costing

(1) The life cycle costing of a WSUD practice or treatment train is a process to determine the sum of all expenses associated with a product or project, including acquisition, installation, operation, maintenance, refurbishment, discarding and disposal costs. It aims to calculate a single dollar value that can be used in the overall decision-making process.

(2) The MUSIC software includes a life cycle costing module that should be used to calculate the overall life cycle cost of the WSUD treatment train. Guidance on the life cycle costing module is provided in the MUSIC user guide and MUSIC modelling guidelines. Modellers will need to be familiar with the caveats within that document with regard to using the module.

B. Objectives check

(1) Several iterations may be required to ensure that the majority of objectives set out in Step 2 are achieved. It may not be possible to meet all objectives and compromise may be needed in some areas to achieve the best outcome.

(2) If particular objectives are essential, it may be appropriate to revise the conceptual site design and/or the type of WSUD practices used.

SC6.2.4.5.2.9 *Step 9: Finalisation of design*

(1) In the development of the WSUD conceptual design, it will be necessary to confirm sizing and locations of measures before entering the detailed design process. Of key importance at this stage will be identifying services and completed design elements (e.g. roads, open-space areas, final lot layouts, hydraulic design) within which WSUD elements may need to be integrated.

(2) A conceptual design should be developed that shows:
(a) location of the WSUD device/devices within the development
(b) proposed layout of the device in its specific location (and locations of key features such as roads and other services). The proposed layout should also provide detail about proposed access to the WSUD device for maintenance and monitoring and, where relevant, any associated recreational infrastructure around the device. This is to ensure that adequate consideration has been given to ongoing maintenance and prevent future impacts on the functionality of open space or other recreational space.

(3) At this stage, it will also be appropriate to document operation and maintenance plans, including all ongoing requirements of the treatment train. This information will form the basis for the concept stormwater management plan, to be lodged with Council for approval with the Material Change of Use (MCU) or Reconfiguration Of Lot (ROL) application.

(4) An implementation plan should also be developed for the WSUD devices, particularly where they will be used as interim erosion and sediment control measures, and when the final setting of the system will take place some time after initial functional installation of the device.

(5) The plan should identify:
(a) when structural elements of the device are to be constructed in relation to development staging and subdivisional works
(b) if devices are to be used as temporary sediment basins, and for what period
(c) how the final setting of the WSUD device is to be undertaken.

(6) Where it is envisaged that the final setting of the WSUD device will take place some time after the functional installation of the device (e.g. after the building phase of the contributing catchment area has been completed), discussions should be held with Council to determine the process by which the WSUD device will be completed. Options for the developer are to either provide a contribution to Council to allow it to complete the WSUD asset(s) or to return and complete the asset as designed at a later time. These options should be discussed at the pre-lodgement meeting with Council outlined in Step 3.

(7) Following approval of the development and the conceptual stormwater management plan, the detailed design should be undertaken in accordance with these guidelines for submission to Council with the detailed stormwater management plan.

SC6.2.4.5.3 Water quality monitoring

(1) The monitoring parameters included in the program will depend on the agreed performance criteria, which in turn will depend on the environmental values of the receiving waters and the key pollutants generated by the development. For construction phase monitoring, a typical list of minimum parameters would include pH, dissolved oxygen, turbidity/suspended solids and hydrocarbons.

SC6.2.4.5.3.1 *Monitoring frequency*

(1) Monitoring should be undertaken at least once a month following rainfall of at least 25 mm in a 24-hour period. Rainfall should be based on data from an on-site rain gauge if available or from the nearest Bureau of Meteorology rainfall station. In the case of sedimentation basins requiring flocculation, monitoring must be undertaken and documented before all pumped discharges.

SC6.2.4.5.3.2 *Monitoring locations*

(1) The location of monitoring sites will depend on the topographical site constraints and nature of the development. Potential monitoring locations that should be considered for inclusion in the monitoring program include:

(a) pumped discharges from sedimentation basins; a representative sample is required from within the basin prior to discharge
(b) upstream and downstream of the development if a creek or permanently flowing watercourse borders the site; this may be beneficial in detecting any changes in receiving water quality associated with the development
(c) at the discharge points from the development site if pumped discharges will not occur and the development is remote from any watercourse.

(2) In practice the sampling and interpretation of discharges from sites can be very difficult. Devices such as stage-height samplers should be used to capture samples from sites with a short time of concentration.

SC6.2.4.5.3.3 *Water quality monitoring and analysis standards*

(1) The water quality monitoring program should be designed in accordance with the ANZECC Monitoring and Sampling Manual, and with reference to AS/NZS5667 Water Quality-Sampling Part 1: Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples.

SC6.2.4.6 Preparation of stormwater management plans

(1) This section outlines Council's requirements for the preparation of a ***stormwater management plan*** (SWMP) and is applicable to all types of land development and redevelopment.

(2) An SWMP must be prepared for all development applications made to Council unless the application falls within the category noted as 'deemed to comply' (see SC6.2.4.1.1: Risk Assessment).

(3) Council requires two SWMPs to be submitted at two different stages of a development. The first SWMP is to be identified as a conceptual SWMP (CSWMP) and is to be submitted with the initial lodgement of a development application (i.e. MCU and ROL stages). Following the approval of the CSWMP, a detailed SWMP (DSWMP) is to be submitted prior to lodgement of any operational works (OPW) application to justify and support all detailed design considerations in accordance with the approved requirements of the CSWMP.

SC6.2.4.6.1 Preparation of a conceptual stormwater management plan

(1) The purpose of a CSWMP is to identify all potential environmental impacts, performance criteria and mitigation strategies, together with relevant monitoring, reporting and, where necessary, appropriate corrective actions. A CSWMP contains clear commitments framed in a way that enables later assessment of the extent to which the commitments have been met. A CSWMP is structured to address the major issues, risks and key pollutants for the life of the development.

(2) The level of detail required in a CSWMP may vary between developments, based on the level of impact the proposed development is likely to have on the receiving waterways/water bodies. The level of detail required in a CSWMP is at all times the decision of Council, and therefore early consultation between the proponent and Council's development assessment officers will be important to establish the required level of detail. In most cases, the CSWMP will need to provide sufficient documented evidence to indicate satisfactory completion of each of the following steps.

SC6.2.4.6.1.1 *Step 1: Determining the level of detail required for the CSWMP*

(1) Council's development assessment officers will advise the level of detail required based on:

(a) requirements under state legislation
(b) requirements under the Council planning scheme.

SC6.2.4.6.1.2 *Step 2: Site analysis and data collection*

(1) Refer to Step 1: Site Analysis and Step 2: Identification of Objectives in SC6.2.4.1.4.2.

SC6.2.4.6.1.3 *Step 3: Development of stormwater treatment train*

(1) Refer to Step 3: Conceptual Site Design, Step 5: Identification of Suitable WSUD Measures, Step 6: Location of WSUD Elements, and Step 7: Model Base and Treated Cases in SC6.2.4.1.4.2.

SC6.2.4.6.1.4 *Step 4: Documenting the CSWMP*

(1) Documenting the CSWMP involves documenting:

(a) all information and findings from steps 1 to 3.
(b) a water quality monitoring program (if required).
(c) an asset management/maintenance schedule outlining roles and responsibilities before and after asset handover.

(2) Documenting information and findings from steps 1 and 2 is self-evident. Therefore, the following SWMP documentation requirements relate specifically to documenting the stormwater treatment train development, the water quality monitoring program (if required), and the asset management/maintenance schedules.

(3) For ease of interpretation and auditing, the proposed stormwater treatment trains and associated water quality monitoring program(s) and management/maintenance schedules

for the proposed development must be reported in the SWMP under the headings Construction Phase and Operational Phase. The specific documentation requirements for each of these phases of development are outlined below.

A. Construction phase

(1) Description of the proposed staging and programming of the proposed development to minimise the area of disturbance and the duration during which the disturbed areas are exposed, including details of proposed stabilisation works

(2) Description of the proposed permanent/temporary sediment and erosion controls designed, installed and maintained in accordance with the Sediment and Erosion Control Guidelines (Institution of Engineers Queensland 1996) and Section 6.3 of the Urban Stormwater Quality Planning Guidelines, indicating the locations and sizing of sediment basins

(3) Description of the performance criteria to be met by the proposed stormwater treatment train

(4) Description of the screening process and quantitative modelling (or other computational method agreed by Council) undertaken to select the proposed stormwater treatment train and to demonstrate its performance against the performance criteria

(5) Concept layout plan showing the location, size and key functional elements of each part of the proposed treatment train

(6) Description of the proposed performance-monitoring program, assessment and reporting provisions. Information required for inclusion in the submitted monitoring program includes:

(a) agreed performance criteria
(b) monitoring and reporting frequency
(c) monitoring locations
(d) monitoring parameters

(7) Regular visual inspections or monitoring must be carried out on all developments during the construction phase. Additional quantitative water quality monitoring is required for developments disturbing >2,500 m² at any one point in time; the monitoring must be carried out for the duration of construction activities. Also, for developments involving constructed water bodies, monitoring is required for the duration of construction activities as well as for the agreed on-maintenance period prior to handover of the asset

(8) Outline of the management/maintenance requirements, including predicted frequency and responsibility for all treatment elements and the overall treatment train during the construction phase of the development

(9) Implementation schedule of the proposed treatment train elements

(10) Contingency plan if the treatment train, or particular elements of the treatment train, do not meet the performance criteria

B. Operational phase

(1) Description of the performance criteria to be met by the proposed system

(2) Description of the screening process and quantitative modelling (or other computational method agreed by Council) undertaken to select the proposed stormwater treatment train and to demonstrate its performance against the performance criteria

(3) Description of the life cycle cost analysis undertaken to determine the least life cycle cost treatment train for the development

(4) Description of quantitative modelling (or other computational method agreed by Council) undertaken to demonstrate the performance of the proposed system against performance criteria)

(5) Description of the proposed implementation schedule of the treatment elements comprising the proposed treatment train, and the performance of the treatment train under its varying stages of implementation

(6) Concept layout plan showing the location, size and the key functional elements of each part of the proposed treatment train

(7) Description of the proposed performance-monitoring program, assessment and reporting provisions. Information required for inclusion in the submitted monitoring program includes:

(a) agreed performance criteria
(b) monitoring and reporting frequency
(c) monitoring locations
(d) monitoring parameters

(8) Outline of the management/maintenance requirements, including predicted frequency and responsibility for all treatment elements and the overall treatment train before and after handover of the operational phase of the development

(9) Contingency plan if the treatment train, or particular elements of the treatment train, do not meet the performance criteria

SC6.2.4.6.2 Preparation of a detailed stormwater management plan

(1) A DSWMP is to be used as a stand-alone document for site managers, engineers, landscape professionals and others constructing stormwater treatment devices. The DSWMP provides details of various elements within the approved treatment train. It allows Council to assess whether the submitted information follows best practice design and has considered all potential design issues based on further knowledge of site constraints (approved lot layout, final earthworks levels, pipe locations etc.).

(2) The DSWMP is to be submitted in conjunction with the detailed documentation as part of the operational works or building works applications (whichever is submitted first). It identifies the required level of maintenance by the developer during the 'on maintenance' period and by Council after asset handover, and provides maintenance schedules and forecasted maintenance costs for the life of the stormwater system.

(3) A DSWMP can be prepared using the following four steps.

SC6.2.4.6.2.1 *Step 1: Treatment train*

(1) Identify the approved treatment train from the CSWMP as approved and/or amended by Council.

(2) Identify the location of the conceptual devices and sizes as determined using the MUSIC package.

(3) Identify any potential issues of the approved treatment train, based on site constraints, from further engineering details. If the approved treatment train is not feasible, proposed amendments to the treatment train are required, along with detailed justification as to why the approved treatment train cannot function appropriately and with MUSIC modelling to support the proposed amendments.

SC6.2.4.6.2.2 *Step 2: Detailed calculations*

(1) Review the detailed calculations and summaries provided with the submission of the CSWMP and WSUD design.

SC6.2.4.6.2.3 *Step 3: Detailed engineering designs*

(1) Include detailed cross-sections and long-sections of the proposed devices, along with a plan view depicting the exact surface area of the device(s). These drawings must be clearly dimensioned and labelled, and must include an appropriate scale.

(2) Include the relevant detailed engineering drawings that have been submitted within the OPW/building works application. This will ensure the officer can assess the submitted drawings in conjunction with the report, as well as determine if any discrepancies have

occurred due to the amendment of drawings after the stormwater consultant had completed the DSWMP.

SC6.2.4.6.2.4 *Step 4: Verification check*

(1) Ensure that the vegetation will be protected from scour during flood events and that the final design will achieve the treatment performance identified in the CSWMP. If any aspects of the designed treatment devices (areas, depths, filter media etc.) need to be modified, an amended revised modelling may be required to ensure the treatment performance meets the performance standard approved in the CSWMP.

SC6.2.4.7 References

(1) Urban Stormwater Quality Planning Guidelines, Department of Environment and Resource Management.
(2) Environmental Planning (Water) Policy.
(3) Water Sensitive Urban Design Technical Design Guidelines for South East Queensland, Healthy Waterways.
(4) Queensland Urban Drainage Manual (QUDM 2008).
(5) Best Practice Erosion and Sedimentation Control, International Erosion Control Association.
(6) Water Sensitive Urban Design Guidelines, Gold Coast City Council.
(7) Department of Transport and Main Roads Road Drainage Manual.
(8) State Planning Policy 1/03: Mitigating the Adverse Impacts of Flood, Bushfire and Landslide.
(9) State Planning Policy 4/10: Healthy Waterway.

SC6.2.5 Earthworks

SC6.2.5.1 General

(1) These guidelines provide Toowoomba Regional Council's minimum standards for developments encompassing clearing, contaminated soils, filling, batters and earth-retaining structures, earthworks, topsoil and grassing. The developer shall, with the first application for development that includes earthworks, provide a bulk earthworks plan for approval. The plan shall describe the proposed changes to level, height and slope of batters and retaining structures, and slope and means of access to public roads. The submitted bulk earthworks plan will demonstrate compliance with the principles of this guideline.

(2) The standards for the provision of earthworks are to be in accordance with Australian Standard AS 3798 Guidelines on Earthworks for Commercial and Residential Developments, modified to suit local conditions and practices. These modifications include the following requirements:

(a) Level 1 supervision is required, but Council may accept a proposal for level 2 supervision where Council considers the risk assessment is satisfactory.

(b) When Level 1 supervision and major earthworks are undertaken, certification and a geotechnical report are to be issued for each allotment. A copy of this information is to be provided to Council.

SC6.2.5.2 Contaminated soils

(1) Areas that have been identified as contaminated soils should be treated as the Environmental Protection Agency requires. The design shall accommodate these requirements.

SC6.2.5.3 Clearing

(1) Clearing shall be executed in accordance with Council's current Standard Specification for Clearing and Grubbing for Infrastructure, Roadways and Designated Areas, and generally be kept to a minimum to comply with current Regulations, by-laws and Council's conditions of approval. Indicative minimum environmental considerations are detailed in Section 11.00 of the Queensland Urban Drainage Manual (QUDM 2008).

(2) Before the design phase, trees and vegetation of significance (as nominated by Council) should be identified by the developer so that damage or disturbance can be minimised by appropriate design and practices. Trees and vegetation that form part of riparian and/or dual buffer zones along rivers, creeks or waterways are of special significance, and should be clearly identified and planned for by the developer.

(3) Where areas of development are to be dedicated as under Council control (e.g. parks), no trees or vegetation shall be damaged or removed without the prior written permission of Council. However, subject to specific written direction from Council, dead, dying or dangerous trees should be removed from these areas. Trees on existing roads shall not be damaged or removed without the approval of Council. All such trees affected by the works are to be shown and detailed on a layout plan. The plan, together with proposed protection measures, is to be submitted to Council for approval.

(4) On slopes steeper than 10%, special consideration should be given to the retention of groundcover. The cost penalty for the removal of the existing groundcover should involve increased use of erosion control blankets, mulch and/or other suitable erosion control measures. Similarly, special consideration should be given to the retention of vegetation on shaded areas or steep slopes with a southern aspect.

SC6.2.5.4 Topsoil and grassing

(1) Topsoil to all disturbed areas, including allotments and verges, should be a minimum 75 mm compacted thickness and comply with Council's Standard Specification.

(2) The minimum Council requirement, following the placing and spreading of topsoil to disturbed areas, should be seeding with grass/grasses approved by Council. Where stormwater drainage overland flowpaths, swales etc. are constructed, the minimum grassing requirement shall be cover turf or an equivalent treatment approved by Council.

SC6.2.5.5 Fill materials

(1) The following materials are considered unsuitable as structural fill:

(a) organic soils
(b) silts
(c) materials prone to dissolving or that undergo physical or chemical changes on exposure to moisture
(d) contaminated soil.

(2) Such material, except for contaminated soil, should be confined to non-critical areas, such as parkland.

(3) Structural fill is any filling that will or may be required to support structures or pavements, or for which it is intended the time-dependent settlement will be restricted.

Most naturally occurring earth, soil and rock, with the exceptions noted above, are capable of being compacted to form a homogeneous mass to support commercial and residential developments and associated infrastructure.

(4) Special measures will need to be undertaken if the following materials are proposed to be used for structural fill:

(a) natural material:

(i) clays of high plasticity that may be reactive and need to be selectively placed within the filling and under strict moisture and density control

(ii) material that, after compaction, contains large particles and may cause difficulties for the excavation of trenches for footings or services or for driving piles or drilling piers, if this is necessary

(iii) over wet materials, as may be encountered in low-lying areas

(iv) single-sized or gap-graded gravels or rock fill that will not break down upon compaction, leaving voids into which finer material may subsequently migrate

(v) saline, chemically aggressive or polluted soils

(vi) carbonate soils where acid dispersal may occur

(b) waste material:

(i) for example, building and demolition material; may be accepted as structural fill if the supply, placement and compaction is fully specified and supervised by a Registered Professional Engineer of Queensland (RPEQ).

Note: Level 1 supervision, as set out in Section 8 of AS 3798, will be required if waste material is to be used as structural fill.

SC6.2.5.6 Erosion and sedimentation control

(1) Controls are required to avoid the siltation or erosion of adjoining lands, streams, watercourses and downstream piped drainage systems during the construction phase and the maintenance phase of a development. An erosion hazard risk assessment and consequent erosion and sedimentation control plans are to be prepared in accordance with

the recommendations contained in the Best Practice Sediment and Erosion Control, International Erosion Control Association, November 2008 and the State Planning Policy 4/10: Healthy Waters. Adopted measures are to be captured on plans and engineering drawings and implemented during construction.

(2) It may not be possible to identify beforehand all the situations where and when erosion will occur, especially during the construction phase.

(3) When any erosion or siltation does occur, immediate action is necessary to rectify the situation and repair any damage, including to remove silt.

(4) During the construction phase, temporary measures that may be accepted include:

(a) contour banks
(b) hay bales
(c) sandbags
(d) sedimentation basins and traps
(e) channel lining such as riprap
(f) energy dissipaters
(g) geotextile or matting on slopes
(h) proprietary methods.

(5) During construction:

(a) vegetation above and below the cut-and-fill areas is to be retained to stop run-off water coming onto the site and into the excavation, and to prevent soil from leaving the site
(b) all excess material is to be removed immediately after excavation to prevent bogging and soil from washing away
(c) soil stockpiles are to be stored within areas of the site nominated on the approved erosion and sediment control plans
(d) cut-off drains are to be provided, where necessary, above and below the cut-and-fill area to minimise the volume of water entering the excavation.

(6) To limit the amount of excavation and clearing at any one time:

(a) the staging of works should be considered
(b) trenches are to be backfilled within 24 hours of inspection and approval
(c) soil erosion control measures are to be placed above and below the excavated site to prevent soil movement during periods of rainfall
(d) the erosion control measures are to be maintained throughout the progress of the work.

(7) All unpaved areas where earthworks have been undertaken are to be grass-seeded to achieve a good grass cover.

(8) Following the placing and spreading of topsoil, either from the site or imported to the site, to a minimum depth of 75 mm, the footpaths, parks, allotments and other disturbed areas are to be seeded with an approved seed mixture that includes a nursery grass (e.g. millet).

(9) The type of nursery grass and the rate of application will depend on the season.

(10) Immediately before the seed mixture is spread, the areas are to be thoroughly watered to promote seed germination.

(11) After seeding, the seeded areas are to be kept moist by watering until the grass is established. Grass is deemed to be established when vigorous green growth is in evidence from the planted seeds.

(12) Such watering is to be continued throughout the maintenance period to ensure the continued growth of the grass.

(13) Turf is to be placed behind all kerb and channel, kerbing etc. for a minimum distance of 0.6 m. Other areas to be turfed shall be shown on approved erosion and sediment control plans.

SC6.2.5.7 Batters and earth-retaining structures

(1) Batters and earth-retaining structures should conform to the requirements set out in Building Regulation 2006, the current edition of the Building Code of Australia. For example, fill batters steeper than 1V:4H and retaining walls greater than 1 m in height will require the lodgement of building applications.

(2) Batters and earth-retaining structures (including footings) should be wholly contained within the allotments (subdivision) or development site.

(3) The locations of batters and earth-retaining structures should be shown on plans certified by a Registered Surveyor before the development is accepted as 'on maintenance' or before a Certificate of Classification is issued. Note that the term 'on maintenance' applies mainly to subdivisions and developments with significant portions of donated assets.

(4) All retaining walls are to be designed and certified by a suitably qualified RPEQ, having due regard for foundation conditions and all loads.

(5) Earthworks abutting public spaces should be treated as follows:

(a) Earthwork batters rather retaining walls are preferred adjacent to existing or future public spaces (e.g. road reserves, parks). Where the slope of the batter is steeper than 1V:6H, the toe of fill batter or the top of cut batter should be provided with a minimum setback distance of 1 m from the property boundary.

(b) Where a retaining structure cannot be avoided, the preferred design solution is a retaining wall that does not exceed 1 m in height. Where the change of level exceeds 1 m, terraced retaining walls in accordance with Figure SC6.2.7 are acceptable.

SC6.2.5.7.1 Batters

(1) It is desirable that fill batters no steeper than 1V:4H be provided adjacent to residential properties, although steeper landscaped embankments up to 1V:2H will be considered.

(2) If any proposed fill or cut is likely to have a damaging effect on the visual amenity of the adjoining property, or if 1V:4H batters are impracticable, consideration should be given to providing a low retaining wall and associated landscaping of the reduced embankment.

(3) The minimum treatment required for batters is topsoiling and grassing where the slope is no steeper than 1V:4H. Irrespective of the treatment, a cross-section showing the interface between the proposed development and the existing properties should be shown on the engineering drawings. The effects on the drainage of adjoining properties of any cut or fill operation should be considered and details shown on the engineering drawings. No ponding or nuisance from stormwater run-off will be accepted. Typical acceptable treatment alternatives are illustrated in Figures SC6.2.8 to SC6.2.11.

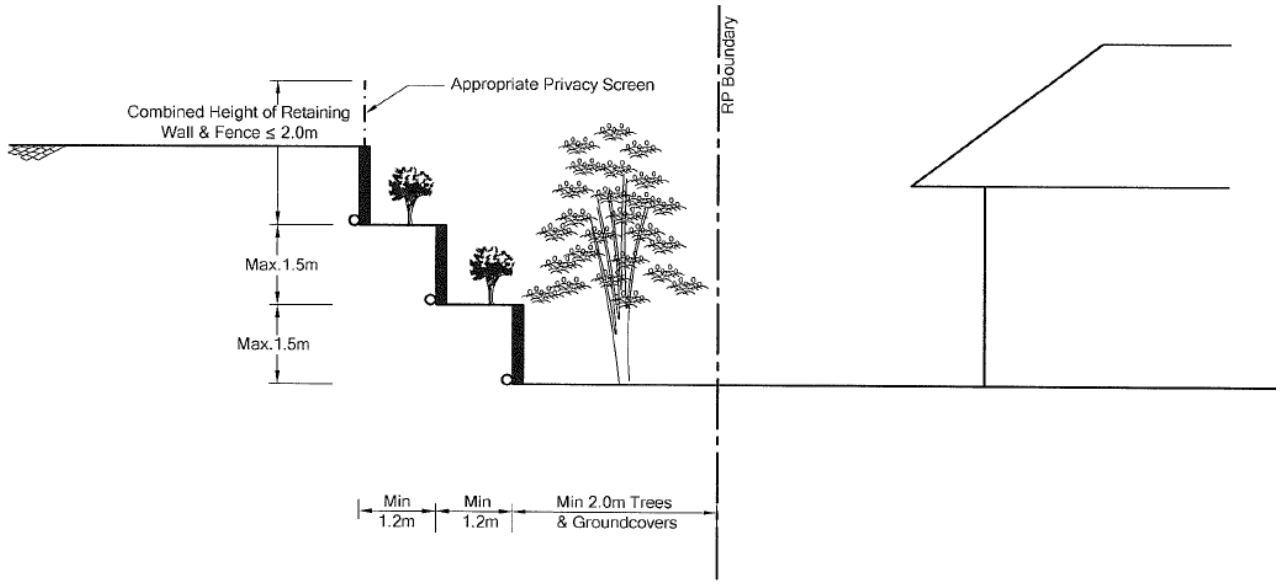


Figure SC6.2.7 Typical acceptable treatment

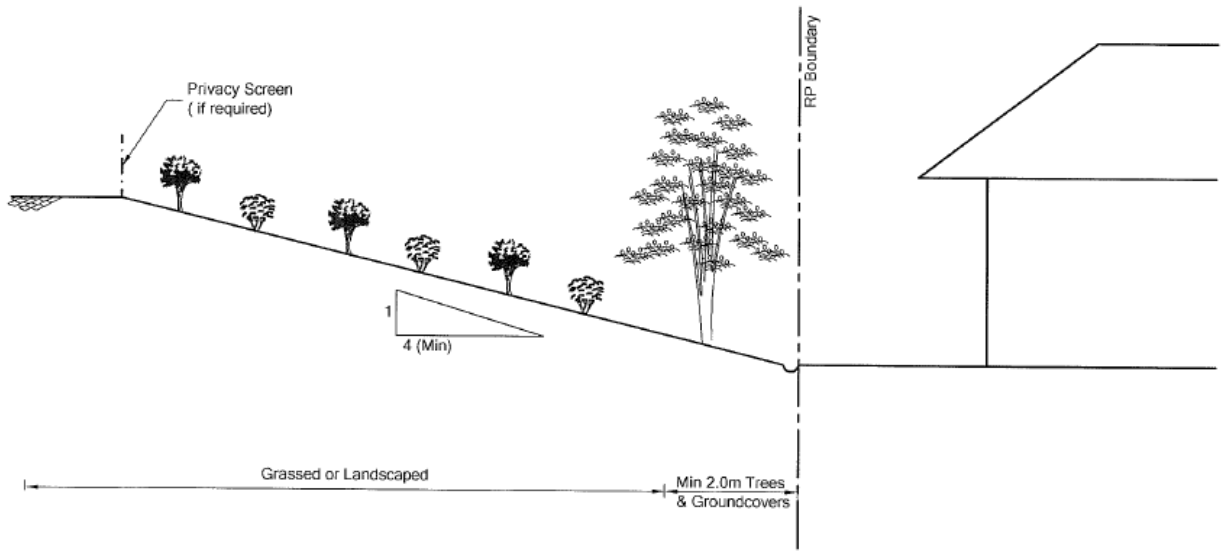


Figure SC6.2.8 Fill embankment: landscaped batter with 1V:4H slope

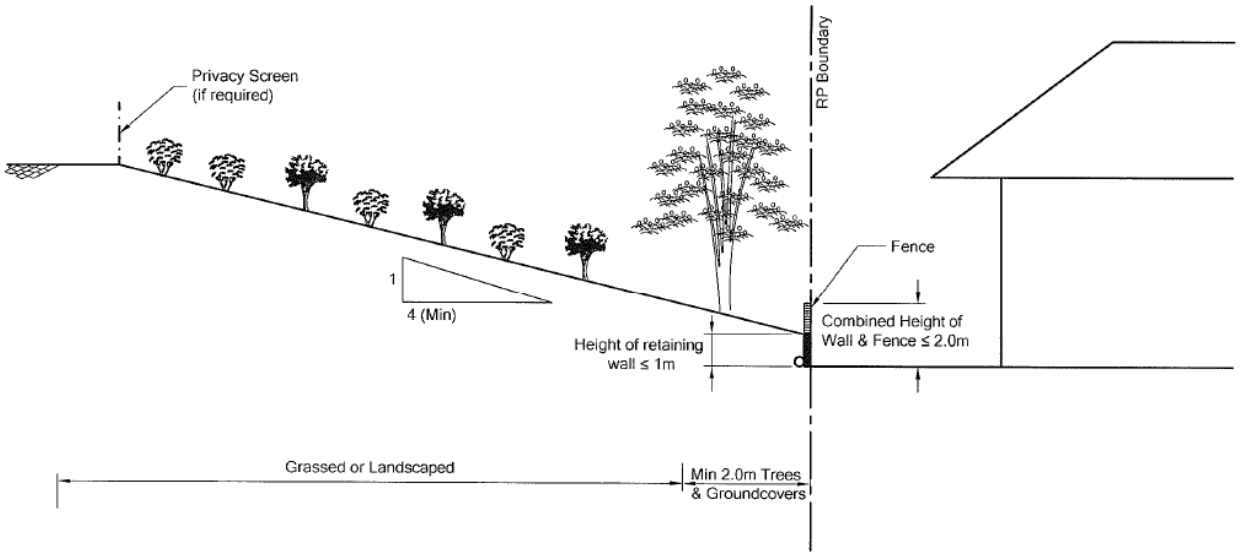


Figure SC6.2.9 Fill embankment: landscaped batter with low retaining wall

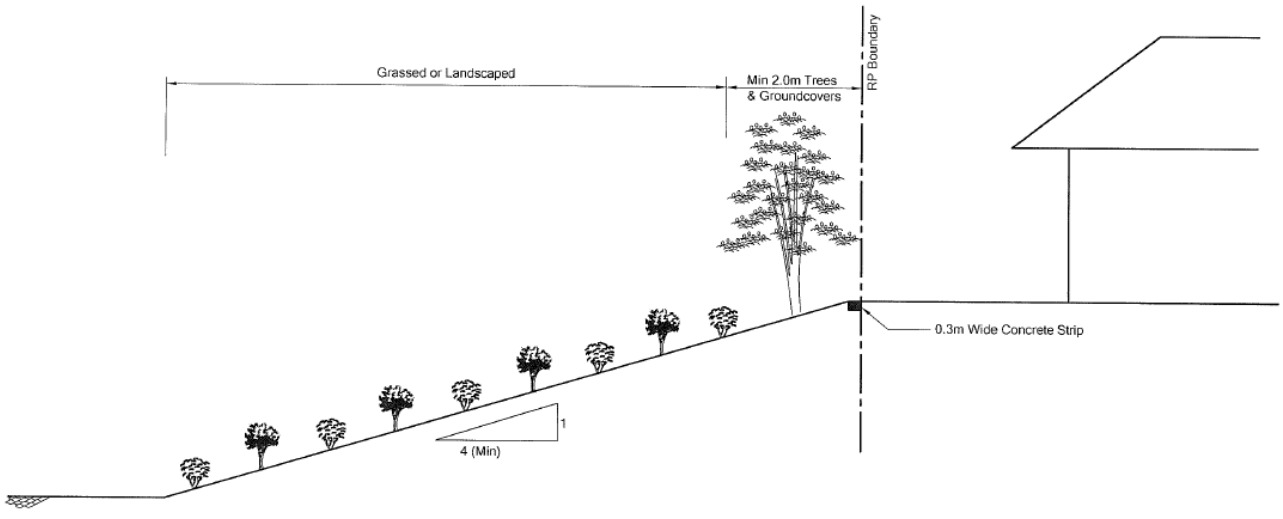


Figure SC6.2.10 Fill embankment: landscaped batter adjacent to a concrete strip

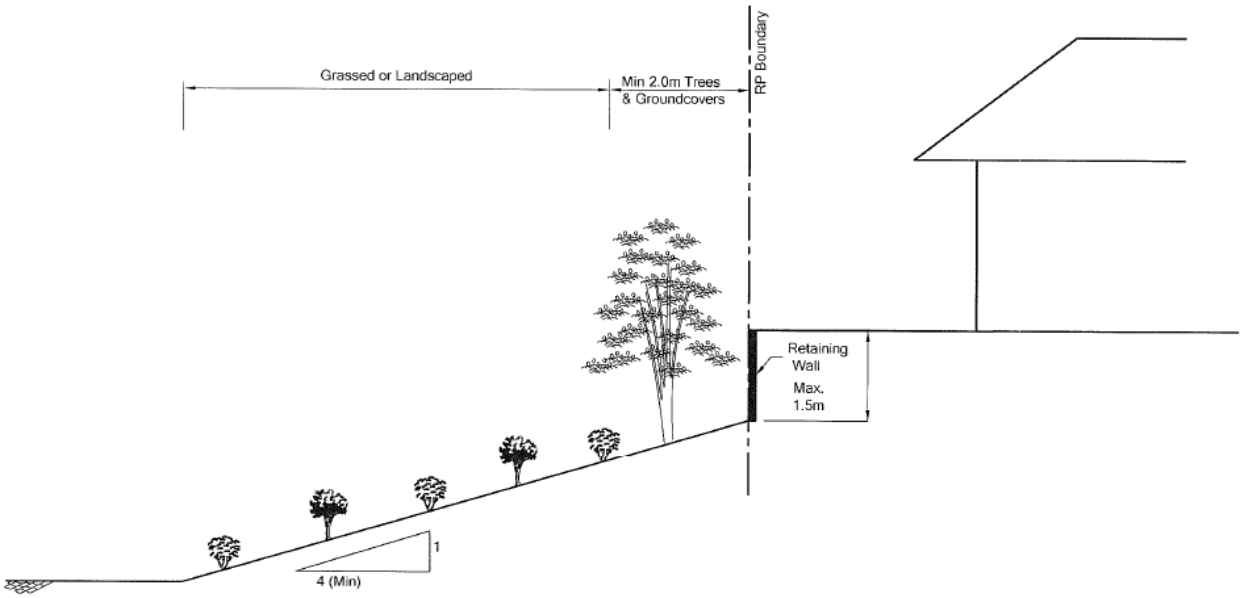


Figure SC6.2.11 Excavation: combined batter and retaining wall

SC6.2.5.8 Retaining walls

(1) An earth-retaining structure is built to protect land, buildings and structures in the vicinity of proposed excavation or filling. Retaining walls are broadly classified into the following two categories:

(a) Category A: Council-built, Council-owned. Council builds the retaining-wall structure, and the maintenance responsibility lies with Council. Section 1122(3) of the *Local Government Act 1993* states, 'If a local government, in exercise of the jurisdiction of local government, constructs a roadway or other structure or performs any works on someone else's land, the materials in the roadway, structure or works are the local government's property.' The wall is usually characterised by the use of a consistent construction material over a lengthy stretch across several properties. The wall may be located on Council land or private property. The private property may be subject to an easement (in favour of Council) to provide unimpeded maintenance access. This category is most commonly associated with transport infrastructure upgrade projects.

(b) Category B: privately built, privately owned. The developer or property owner builds the retaining-wall structure. The ownership and maintenance responsibilities remain private. This category is usually characterised by the use of different construction material or discontinuity in retaining-wall structure past the subject property boundaries. The category is most commonly associated with development applications pertaining to a material change of use and/or operational work for filling and excavation exceeding one vertical metre in relation to the natural ground.

(2) All retaining structures should be shown and detailed on engineering plans for approval by Council. Timber (which has a limited life span) and bush rocks (which have stability and vermin problems) are not permitted on land adjoining public space or road reserves. Construction materials acceptable to Council include grouted rock, reinforced concrete and masonry (bricks and blocks).

(3) Timber retaining walls (permitted at proposed lot boundaries of a subdivision) should be preservative-treated to Hazard Class 5 in accordance with AS 1604 for protection against decay, insect or borer attack.

(4) Generally, all walls should be:

(a) aesthetically pleasing when viewed from the adjoining property (i.e. the retaining wall finishes have a high-quality appearance and are compatible with the surrounding development)
(b) contained wholly within the property (Consideration for access for maintenance to retaining walls is to be given at the design stage.)
(c) terraced and landscaped to mitigate any adverse visual impacts. Plant species should be appropriately selected to preserve the structural integrity of the wall. The minimum bench width must be 1.2 m to allow for plantings and maintenance access. Where planting is not practical in the area between the retaining wall and boundary fence (e.g. because it is too narrow or less than 0.5 m wide), this area should be paved with concrete or other approved materials to avoid future maintenance problems
(d) designed with catch drains along the toe of the wall to catch any overland flow that may overtop the wall
(e) designed for catch drains along the top of the walls
(f) designed with subsoil drainage.

(5) Walls exceeding 1 m in height will require a building application and structural certification. When the combined height of a retaining wall and fence exceeds 2 m, the aforementioned requirements plus the written authorisation from the low-side neighbour will need to be provided to Council with the engineering drawings. Typical acceptable treatment alternatives are illustrated in Figure 5.1.

(6) Earthworks within the front 4 m of a site do not result in retaining walls facing towards the street that are greater than 1 m in height.

(7) Earthworks beyond the front 4 m of a site do not result in retaining walls greater than 2 m in height within 1.5 m of a side or rear boundary.

SC6.2.5.9 Ground anchors

(1) A ground anchor is a tie back to the soil behind the face requiring support. Ground anchors are generally used to stabilise the excavated face of railway or road cuttings and basements of buildings, and to provide local support in underground excavations and mines. The ground anchor transfers forces into the ground by means of a steel tendon inserted into a borehole and grouted to the surrounding material. The anchor spacings, sizes and angles of inclination depend on the type of soil, the loads to be resisted and the physical limitations used to install the anchors.

(2) Council approval is required for ground anchor systems (permanent or temporary) proposed within 2 m of Council infrastructure, such as sewer pipes, water mains, stormwater lines or associated structures. The application will form part of the filling and excavation/bulk earthworks plans submitted at the operational works stage.

(3) The ground-anchoring system should be designed and certified by a suitably qualified RPEQ. Anchors should not be located closer than 1.2 m vertically above or 1 m below or 1 m horizontally from the existing Council infrastructure. The following information should accompany the operational works application:

(a) payable fees
(b) site plan (layout, elevation and sections) depicting details of the anchoring system (position, length, inclination angle and lock-off load) and surveyed locations of Council infrastructure and other services, such as telecommunications, electricity and gas
(c) approval from the Department of Environment and Resource Management if the anchoring system extends into the road reserve
(d) approval from the providers of affected services — for example, telecommunications, electricity and gas
(e) pre- and post-construction closed-circuit television camera (CCTV) inspections of the pipe. CCTV surveys should be carried out in colour using a camera with the capacity to pan and tilt. The applicant should submit both the hard copy report and a video

display of the CCTV inspection. The CCTV inspection of sewer pipes should be carried out by accredited Australian Water Association operators, in accordance with the guidelines of the Australian National Manual for Conduit Condition Evaluation (ANMCCE) and the Sewrat data capture software.

SC6.2.5.10 Surface water

(1) Plans submitted for approval need to indicate effects on surface water created by filling.

(2) No ponding or nuisance from stormwater is to occur. In redeveloped areas, shallow concrete spoon drains may need to be constructed along the toe of the embankment to permit the drainage of an adjoining property. In low areas, subsoil drainage may also be required along the toe of the fill batters as the compaction of fill may affect subsoil drainage of the area. Drainage may also be required where seepage is likely from irrigated lawns and gardens.

SC6.2.5.11 Fences

(1) Unless all survey pegs are obvious, the developer should submit a certification by a Registered Surveyor that the fences are contained entirely within the development prior to the acceptance of works as' 'off maintenance'. Under the Building Regulation 2006, fences higher than 2 m above the natural ground surface would require a building application.

(2) The following requirements will apply to fencing:

(a) The minimum standard of pedestrian safety fence is the galvanised tubular handrail, as shown in the Standard Drawings. However, powder-coated galvanised steel or aluminium pool fencing to AS 1926 of minimum 1.2 m height is the preferred barrier installation at traffic islands, signalised crossings and refuge islands.

(b) A galvanised tubular handrail with chain wire or galvanised weld mesh fencing should be provided where there is a danger of children gaining access to high-risk areas or where the drop height exceeds 1 m. Where the drop height exceeds 1.5 m, a powder-coated steel fence (hunter rod top or approved equivalent, capable of sustaining the imposed actions specified in AS 1170) should be installed.

(c) Where required, a log barrier fence including a lock rail for access should be provided in accordance with the Standard Drawings.

(d) A site-specific attenuation solution for each development should be determined in accordance with the attenuation criteria and methodologies set out in the current relevant legislation.

(e) The fencing should not hinder general maintenance, otherwise the fencing should incorporate vehicular access gates or the fencing panels are designed for easy removal. Pedestrian gates should be provided along road frontages.

(f) A concrete (extruded or cast in situ) mowing strip should be provided under all fences (including acoustic barriers) that abut lawn and landscaped areas. A minimum 140 mm wide x 100 mm deep strip, flush with the surrounding ground, will need to be installed under timber fences/walls or galvanised steel fences. Mowing strips are generally not required under masonry or concrete fences/walls as the footings are usually sufficient for this purpose.

SC6.2.5.12 Hydraulic constraints

(1) It is desirable that fencing not be erected inside any drainage easement or overland flow path or flood regulation line or waterway corridor. Council recommends against the construction of debris-retaining or solid fences, as these structures will inhibit the conveyance of floodwaters. However, in instances where the overland flow between private allotments is shallow (i.e. generally less than 200 mm deep), solid fences can be constructed provided openings are installed at ground level to accommodate overland flows.

(2) Council approval is required where fencing is proposed inside any drainage easement or overland flowpath or flood regulation line or waterway corridor. Some suggested fencing styles include:

(a) open post and rail, where no panels of fencing are incorporated between the post and rail structure to provide minimum resistance to flood flows. Examples include log barrier fencing and galvanised tubular handrail

(b) collapsible fencing, where sections of the fence are designed to collapse under flood loading so as not to increase flood levels, but are also anchored to avoid being washed away. Low-strength ties may be used to hold the fence in place during non-flood times

(c) swing fencing, where sections of the fence are designed to yield under the pressure of flood flows so as not to increase flood levels, but are also anchored to avoid being washed away. Usually fence panels are fitted with hinges or pivot points to allow opening during floods. Low-strength ties may be used to hold the fence in place during non-flood times

(d) lifting fencing, where sections of the fence may be temporarily raised to not obstruct flood flows.

SC6.2.6 Road and public space lighting

SC6.2.6.1 General

(1) These guidelines have been prepared for the guidance of developers and their consultants to ensure that Toowoomba Regional Council's requirements for Ergon Standard Street Lighting Lamps and Luminaires are achieved.

(2) Sustainable developments must be provided with adequate utility services that will:
- (a) operate safely and efficiently
- (b) perform to the required standard of service appropriate to the development
- (c) meet the future servicing requirements that support its intended use.

(3) This policy sets out the requirements for the provision of street-lighting infrastructure.

(4) Except where specifically varied hereafter, all electricity reticulation shall be constructed in accordance with the Toowoomba Regional Council Standard Drawings and this planning scheme policy.

(5) Council's standard requirement for the provision of electricity to new development requires underground reticulation.

(6) Unless stated otherwise, it is the applicant's responsibility to provide Ergon Standard Street Lighting Lamps and Luminaires; this is a condition of development.

(7) The design shall take into account the Department of Transport and Main Roads' (DTMR's) and Council's future planning proposals.

(8) At the time of approval, Council and/or DTMR will nominate the category and extent of Ergon Standard Street Lighting Lamps and Luminaires required.

(9) As a general rule, Ergon Standard Street Lighting Lamps and Luminaires is to be installed in association with the installation of all new traffic islands, new roads, pathways and existing road frontages.

(10) Unless otherwise approved by the DTMR or Council, all road lighting installed as a condition of development shall be Rate 2 lighting.

(11) The developer must meet the cost of any alterations to the existing electricity and street-lighting networks required in connection with the development.

(12) If road widening is required along the frontage of the development, the developer must arrange the undergrounding or, if approved, the relocation of the services onto the correct alignment within the new verge. In some instances this may require lowering of services to provide sufficient cover where the footpath is regraded to the design profile. Services may also need to be raised if significant fill is used to raise the level of the verge.

(13) The service corridors and alignments must conform to the relevant Council Standard Drawings and road hierarchy typologies.

(14) All Ergon Standard Street Lighting Lamps and Luminaires associated with a development is to be certified by a Registered Professional Engineer of Queensland.

(15) Ergon Standard Street Lighting Lamps and Luminaires must be provided at the following locations:
- (a) new public streets (including laneways and paths) created as part of the development
- (b) all road frontage(s) to the development, including any road construction required outside the limits of the development.

SC6.2.6.2 Standards

(1) Unless specified otherwise in this policy or as directed by Council, the provision and detailed design of street-lighting and pathway-lighting installations must conform to the following standards:

- (a) Australian Standard AS/NZS 1158 Lighting for Roads and Public Spaces
- (b) Australian Standard AS 428 Control of the Obstructive Effects of Outdoor Lighting
- (c) Ergon Energy policies and standards.

SC6.2.6.3 Lighting categories

(1) The lighting categories acceptable to Council are set out in Table SC6.2.10. However, the varying selection criteria as referred to in Tables 2.1 to 2.5 in AS/NZS 1158.3.1:2005 or Table 2.1 in AS/NZS 1158.1.1:2005 may dictate a more stringent lighting category for a particular development. The lighting categories referred to in AS/NZS 1158 are broadly described as follows:

(a) Category V lighting — lighting that is applicable to roads on which the visual requirements of motorists are dominant (e.g. major traffic routes)
(b) Category P lighting — lighting that is applicable to roads on which the visual requirements of pedestrians are dominant (e.g. on local roads, pathways and bikeways). This category includes lighting that is applicable to outdoor public areas such as outdoor shopping precincts, car parks and stairways.

Table SC6.2.10 Lighting categories

Road hierarchy	AS/NZS 1158 lighting category
Laneway and cul-de-sac	P4, P5
Local access	P4, P5
Collector	P3, P4
Collector (trunk)	P3, P4
Bikeway or pathway	P1 to P4
Cycleway	P1 to P4
Distributor	P3, V4
Industrial access	P3, V4
Industrial collector	P3, V4
Subarterial	V4
Regional arterial	V1 to V3
Rural residential <4,000 m²	P5
Rural residential >4,000 m² and rural	See note (c)

Notes:
(a) Category V4 is the minimum subcategory acceptable for V category roads within Toowoomba.
(b) Category P4 is the minimum subcategory acceptable for P category roads within Toowoomba City. Category P5 is acceptable in areas outside the Toowoomba City boundary at Council's discretion.
(c) Rural and rural/residential road developments are subject to case-by-case assessment.

(2) Council may vary the required Ergon Standard Street Lighting Lamps and Luminaires category for any street or road in consideration of special circumstances, or require additional lighting in the following situations:

(a) intersections
(b) roundabouts
(c) sharp bends
(d) speed control devices (including local area traffic management)
(e) pedestrian crossings
(f) cul-de-sacs
(g) channelisation
(h) bridges and culverts

(i) night-time accident locations
(j) frequently used night-time bus stops
(k) areas that may generate pedestrian traffic or vehicle night traffic.

SC6.2.6.4 Design principles

SC6.2.6.4.1 Objectives

(1) The lighting design must be cost-effective, minimising the annual operating costs to Council and, where possible, the installation capital costs.

SC6.2.6.4.1.1 *Costs*

(1) The developer is responsible for all capital costs associated with the design and installation of the Ergon Standard Street Lighting Lamps and Luminaires and any loss-of-asset charges required by Ergon Energy or any other electricity supplier for removal/relocation of existing street-lighting equipment. Where it may be advantageous for the developer to install works outside the specified limits at the time of development, Council may contribute towards some of the capital costs, but this arrangement must be specifically agreed between the Council and the developer before any work begins.

(2) Once the lighting has been installed in accordance with the approved plans and accepted by Ergon Energy or other supplier, Council will pay the supplier the necessary annual costs under the Public Lighting Tariff. In accordance with the standard Rate 2 lighting requirements, Ergon Energy will also assume ownership and maintenance of the installation.

SC6.2.6.4.1.2 *Underground electricity services*

(1) Underground electricity services must be provided to all new Ergon Standard Street Lighting Lamps and Luminaires unless the new lights are attached to existing electricity distribution poles.

SC6.2.6.4.1.3 *Partial road construction*

(1) Where the development requires partial road construction (typically, when the development adjoins an undeveloped site), the lighting is to be designed for the ultimate road width. However, the lights on the development side only, assuming a staggered or opposites arrangement, need to be installed.

(2) A street light will be required opposite any new intersection created; the balance of the lighting is required on the development side only.

SC6.2.6.4.1.4 *Frangible-type poles*

(1) Street light poles should not be placed in locations where they are vulnerable to damage from vehicles (e.g. narrow medians). Where this is unavoidable, suitable protection must be provided to minimise the risk of injury and/or the pole must be of a frangible (slip base) type.

(2) Risk for street-lightning poles placed in clear zones is to be assessed in accordance with the DTMR RISC program. Both quantitative evaluation and qualitative evaluation are to be undertaken (refer to Chapter 8 of the DTMR Road Planning and Design Manual). The RISC program and latest accident costs are available from the DTMR web site (http://www.tmr.qld.gov.au/Business-and-industry/Road-systems-and-engineering/Software/RISC.aspx).

SC6.2.6.4.1.5 *Airport obstacle limitation surface*

(1) All lighting within the outer limit of the obstacle limitation surface (OLS) for the Toowoomba Airport and the associated flight paths shall be aeroscreen fittings. Any departure from the use of aeroscreens within these areas must have prior written approval from Council.

SC6.2.6.4.1.6 *Pedestrian facilities*

(1) Lighting of pedestrian zebra crossings must comply with AS/NZS 1158.4. Where the crossing is located on a P category road, the requirement for three spans of category V lighting on each approach does not apply.

(2) Internal pathways connecting adjoining streets are to be lit using either:
- (a) vandal-resistant bollard lights, with the aim to minimise obtrusive lighting where adjacent to residential properties.
- (b) pole-mounted luminaires — may be used in situations where obtrusive lighting is not a concern.

(3) Lights are located at both ends of the paths and at intervals along the path in accordance with the approved design.

(4) The lighting must be located in a way that maintains access for people with disability and for maintenance vehicles (if required).

SC6.2.6.4.1.7 *Subdivisions in rural/rural residential areas*

(1) For low-density rural and rural residential development, the lighting design and all associated conduit installations (if required) must be installed at intersections and hazardous locations only. In rural areas, this requirement may be subject to the availability of electrical reticulation.

SC6.2.6.4.1.8 *Curved horizontal alignment*

(1) The spacing between lights on the curved sections must not exceed that for a straight section with a similar road reserve width. A straight line drawn between successive luminaires must lie within the road reserve.

SC6.2.6.5 Standard street light fittings

(1) In accordance with the current equipment available from Ergon Energy, high-pressure sodium (HPS) luminaires are to be generally used on residential streets and along traffic routes.

(2) Within P category roads, 80 W HPS luminaires are the preferred lighting for residential streets; however, 70 W HPS may be permitted if considered practical by Council (typically, in industrial developments and category P3 roads).

(3) Within V category roads, 150 W HPS and 250 W HPS luminaires are the preferred lighting for traffic routes.

(4) Other wattage HPS luminaires will only be considered if acceptable to Ergon Energy as a Rate 2 installation and if they are proven to be cost-effective to Council.

(5) Metal halide and fluorescent lighting are currently not acceptable to Ergon Energy as a Rate 2 installation and therefore will not be accepted by Council.

SC6.2.6.6 Poles

(1) Council's preferred street-lighting column for category P roads is a 7.5 m mounting height, base-plate-mounted (BPM) column.

(2) Unless specified otherwise in this policy, the luminaire support pole must be the BPM steel type.

(3) While Ergon Energy does currently provide heritage (Nostalgia) style poles in its Lighting Construction Manual, the use of these light columns is discouraged by Council due to some minor compliance problems with glare and the reduced light spacings that are achieved due to the lower mounting heights available. Heritage (Nostalgia) lighting will only be supported where it can be demonstrated to form an integral part of an agreed urban design concept or where it integrates with an existing urban design.

(4) Heritage (Nostalgia) style lights and columns are listed in the lighting combinations shown in Table SC6.2.11; however, use of such lights and columns will require prior Council approval. The use of heritage (Nostalgia) style poles and lights (or similar) would need to be acceptable to Ergon Energy as a Rate 2 installation and to be cost-effective to Council, and will require prior approval from Council before installation.

Table SC6.2.11 Pole/outreach*/luminaire combinations

Luminaire	Lighting category	Pole length (out of ground)	Outreach arm	Mounting height
50 W MV Nostalgia	P	4.5 m	Curved	5.1 m
50 W MV	P	5.5 m	1.5 m*	7.5 m
80 W MV Nostalgia	P	4.5 m	Curved	5.1 m
80 W MV	P	5.5 m	1.5 m*	7.5 m
70 W HPS Nostalgia	P	4.5 m	Curved	5.1 m
70 W HPS	P	5.5 m	1.5 m*	7.5 m
100 W HPS	V	7.0 m/8.5 m	1.5 m/3.0 m	9.0 m/10.5 m
150 W HPS	V	7.0 m/8.5 m	3.0 m/4.5 m	9.0 m/10.5 m
250 W HPS	V	7.0 m/8.5 m	3.0 m/4.5 m	9.0 m/10.5 m

Notes:
** Outreach has an inbuilt 2.0 m uplift.*
While a 12.0 m mounting height is available from Ergon Energy, it is not Council's preferred mounting height for Ergon Standard Street Lighting Lamps and Luminaires. Council approval is required for 12.0 m mounting heights.
Twin outreach arms are available for installations requiring lighting from a central median.
50 W MV and 125 W MV (standard) street lights are available from Ergon Energy for minor road (P category) lighting; however, these are not Council's preferred lights for these roads.
400 W HPS (standard and aeroscreen) street lights are available from Ergon Energy for major road (V category) lighting; however, these are not Council's preferred lights for these roads.

SC6.2.6.7 Aeroscreen luminaires

(1) Aeroscreen fittings are to be used within the outer limit of the OLS and the associated flight paths for the Toowoomba Airport.

(2) Street-lighting design outside the limitations of the OLS should use standard fittings. Consideration to the use of aeroscreens in other areas should be limited to retrofitting to existing residential areas and other areas where aeroscreens already exist (i.e. previous stages of a development).

(3) Consideration should be given to the use of aeroscreen fittings on V category roads outside the limitations of the OLS.

SC6.2.6.8 Decorative lighting

(1) Decorative lighting cannot be used on category V roads as the primary method to illuminate the roadway. Council will not accept any decorative light or supportive pole for the lighting of public roads and pathways unless it is a current standard stock item with Ergon Energy (i.e. available as a Rate 2 installation).

(2) As mentioned in SC6.2.6.6: Poles, while decorative (Nostalgia) style poles are currently available from Ergon Energy, these are not Council's preferred light column due to the reduced spacings required as a result of the lower mounting heights.

SC6.2.6.9 Alignment

(1) To achieve a balanced streetscape, it is desirable that lights be installed alternatively on opposite sides of the street (i.e. a staggered arrangement). Installation of lights in a single-sided arrangement is unacceptable unless this is temporary or the existing lighting in the street is single-sided. Development layouts may require some short spans of single-sided lighting subject to the location of traffic-calming devices and side streets.

(2) The location of light poles must avoid any likely vehicle conflict points, and must minimise the risk of damage to poles and vehicles, injury to road users, glare complaints and conflict with driveway locations. The following factors must be considered when determining the Ergon Standard Street Lighting Lamps and Luminaires alignment:

(a) Locating street lights in line with abutting property boundaries or on the truncation points at intersections is acceptable. Placing street lights midblock (clear of proposed driveways) is also acceptable.
(b) Lighting poles should be located sufficiently clear of existing features. A 1.2 m clearance from the edge of driveways and pathways is required. Where this is not achievable, prior agreement with Council is required.
(c) Locating lighting poles within cul-de-sacs adjacent to narrow property frontages is undesirable and should be avoided due to possible conflict with driveways.
(d) Lighting poles in new roads must be located generally in accordance with the relevant Council Standard Drawings and road hierarchy typologies. Poles in existing roads would typically need to match the existing alignments, unless future road widening is proposed.
(e) Lighting poles should be located nominally 0.4 m to centre of pole behind the back of kerb. The design of other services (e.g. stormwater) should ensure that other infrastructure does not encroach into this area behind the kerb.
(f) New light poles must not be positioned closer than 5 m to any street tree. Conversely, trees are not to be planted closer than 5 m to any existing light pole. Lesser distances may be approved subject to consideration of the specific circumstances and the particular tree species.
(g) The preferred configuration of lighting at small roundabouts on category P roads is for a light pole to be located on the approach side of each intersecting street. Poles are not to be installed in the central median as this area is often landscaped, thus impeding maintenance access. On category V roads, Council may consider the installation of lighting in the central median if a single pole is used and maintenance issues can be resolved with Ergon Energy.
(h) For channelisation or splitter islands at intersections on P category roads only, a light shall be located adjacent to the island and on the nearest common property boundary, where possible avoiding the departure side of the channelisation or splitter island.

SC6.2.7 General construction issues, procedures and standards

SC6.2.7.1 General approach to the construction of public (municipal) works

(1) This section provides Toowoomba Regional Council's requirements for the inspection and certification of works that will become part of its infrastructure (i.e. roadworks and stormwater drainage).

(2) Because Council inherits the maintenance and ecological responsibility for the contributed assets associated with a development, the cost burden of this maintenance ultimately falls on ratepayers. Therefore, strict compliance with Council's requirements is necessary to ensure that the inherited facilities perform adequately for their design lives. The works ultimately accepted by Council should become a public asset, not a public liability.

(3) Council requires that both short- and long-term ecological values be considered during the construction and maintenance phases of the development.

(4) Compliance with the requirements of this guideline needs to be assured through a process of testing, inspection and certification before work may be accepted 'off maintenance' and full responsibility for the works transferred to the Council.

(5) The Registered Professional Engineer of Queensland (RPEQ) who designs and supervises municipal works must be independent and, although engaged by the developer, must not be an employee or associate of the developer or the contractor carrying out the works.

SC6.2.7.2 Inconsistencies

(1) Where any provision of codes of practice, manuals or other technical documentation (e.g. Complete Streets, Queensland Urban Drainage Manual, Austroads guidelines, Department of Transport and Main Roads manuals etc.) does not accord with this planning scheme policy (including its Standard Drawings and Schedules), the provisions of the planning scheme policy are to take precedence.

SC6.2.7.3 Alteration to public utilities

(1) The cost of any alterations to public utility mains, services or installations necessitated by a development are the responsibility of the developer.

SC6.2.7.4 Construction hours

(1) Working hours of construction are to be in accordance with the Environmental Protection Act default noise standards for building work.

(2) From March 2011, the hours of work are:

(a) between 6.30 am and 6.30 pm on business days or Saturday
(b) no construction on Sundays or public holidays.

(3) Changes to the legislation are to be complied with.

SC6.2.7.5 Disposal of cleared vegetation

(1) Cleared vegetation is not burnt on the site. It is either:

(a) mulched and used on site
(b) removed to an approved off-site location.

(2) Specific regard should also be given to the clearing-of-vegetation provisions for the zone in which the site is located to ensure compliance. All approvals are to be obtained before vegetation removal.

SC6.2.7.6 Specification

(1) All works, and materials supplied and fabricated shall comply with the approved detailed design and associated specifications. The engineer who designs and supervises the subject works shall supply all necessary documents, test results and certification to demonstrate compliance with this policy.

SC6.2.7.7 Requirements for the construction of public (municipal) works

SC6.2.7.7.1 General

(1) The engineer who designs and supervises municipal works is to be an RPEQ, and is obliged to perform these duties as set out in the Queensland *Professional Engineers Act 2002*.

(2) The works are to be undertaken by a nominated principal contractor experienced in the construction of public (municipal) works.

(3) Council may request evidence of the principal contractor's competency in the construction of public (municipal) works.

(4) Certification of such works is to include the submission of copies of all relevant test results and certificates as may be required by this planning scheme policy.

SC6.2.7.7.2 Prerequisites

(1) Following operational works approval, but before construction work may commence, Council requires the following:

(a) notification, at least three working days before the date the works commence, by the RPEQ of the:

(i) contractor's (or contractors') on-site and after-hours telephone number

(ii) supervising engineer's (or engineers') office and after-hours telephone number

(iii) date the works will commence

(iv) program of works showing the major components

(b) an invitation to attend the pre-start conference

(c) for any public (municipal) works associated with developments other than the reconfiguration of land, the provision of a bank guarantee, or bond equivalent, in accordance with Council's current fees and charges, as security for the performance of the various construction obligations (including the provision of engineering certification and 'as constructed' information)

(d) consent of property owners affected by the approved works, as required by any development approval conditions.

SC6.2.7.7.3 Inspections

(1) During construction, joint inspections are to be made as required by this planning scheme policy.

(2) Council requires notice of all such joint inspections.

(3) Test results, application rates and other relevant information are to be made available as required at or before the relevant inspection.

(4) Audit inspections of the works may be undertaken at all reasonable times during the construction period.

SC6.2.7.7.4 Alteration to approved design

(1) All changes to the approved design effected during construction are to be approved by Council before they are implemented.

(2) If design inadequacies are discovered during construction, the RPEQ must resubmit amended plans to Council and rectify any works according to the approved amendments.

(3) Where a non-approved discrepancy occurs between the design and Council's standards, the Council's standards apply.

(4) If there are errors, omissions or insufficient detail on the plans for the purpose of construction, these deficiencies are to be made good during construction.

SC6.2.7.7.5 Indemnity

(1) The owner or contractor must indemnify Council for the full construction period against any claim, action or process for damage or injury that might arise during the progress of the works.

(2) No work is to commence unless the developer has in place:

(a) public liability insurance to a limit of indemnity of not less than $10,000,000 with a notation naming the Toowoomba Regional Council as an insured party

(b) workers' compensation insurance.

(3) The developer must ensure that all contractors it employs have the above insurances and must ensure that all its contractors ensure that all their subcontractors employed on the job are covered by the above insurances.

SC6.2.7.7.6 Traffic safety

(1) The contractor must provide all signage and delineation as required by the Manual of Uniform Traffic Control Devices.

(2) Where required, a Permit to Open a Road or Temporarily Close a Road to Traffic is to be obtained from the Council and Queensland Police Service before works commence. The developer may be required to prepare a traffic management plan, for approval by the relevant authorities, where the proposed works impact on the movement and safety of existing traffic.

(3) A permit under SLL1.15 issued by Council's Road Operations Branch may also be required (e.g. for road/footpath closures, hoardings and speed reductions).

SC6.2.7.7.7 Water required for works

(1) Where required, a permit to draw water from a Council water main is to be obtained from Council before water is drawn from the main.

SC6.2.7.7.8 Inconvenience/nuisance to local residents

(1) The contractor must ensure that works never inconvenience or cause nuisance to adjacent residents.

(2) Dust- or smoke-associated problems are not to occur when earthworks are being carried out.

SC6.2.7.7.9 Subsurface drainage

(1) Council requires subsurface drains to be constructed in accordance with Council's Standard Drawings and to be located under all kerb and channel, and median kerbs. Flushing points are to be located as detailed on the Standard Drawings.

(2) Subsurface drainage at locations other than those indicated above is to be approved by Council before kerb and channel and pavement construction commence.

(3) If the subgrade consists of free-draining sand, Council may consider deleting subsurface drainage.

SC6.2.7.8 Compliance procedures

SC6.2.7.8.1 General

(1) Developers and their RPEQ or agents remain at all times responsible for ensuring that all works are executed in accordance with principles of sound engineering design and construction, and that all works are in accordance with this planning scheme policy.

(2) It is the responsibility of the developer or RPEQ to arrange for all testing, inspections and certifications.

SC6.2.7.8.2 Testing

(1) The testing requirements detailed in SC6.2.7: General Construction are summarised for ready reference in SC6.2.9.3: Compliance requirements for public (municipal) works.

(2) SC6.2.9.3 states when the test results are to be supplied to Council.

SC6.2.7.8.3 Certification

(1) To enable formal acceptance of the works as 'on maintenance', the RPEQ engaged to supervise the works is generally required to supply the following certificates, certified drawings or other items:

(a) pre-inspection checklist (see SC6.2.9.4)
(b) engineering certification (see SC6.2.9.1)
(c) geotechnical and structural certificates (where applicable)
(d) 'as constructed' plans
(e) copies of all relevant test results
(f) maintenance security deposit (see Council's current fees and charges)
(g) payment of any outstanding private works accounts
(h) written clearances for works carried out on land under other ownership (obtained on completion of the works)
(i) any other documentation that may be required by Council
(j) payment of any outstanding fees and permits.

(2) To enable formal acceptance of the works as 'off maintenance', items must be provided as agreed by Council at the time of formal acceptance of the works as 'on maintenance'.

SC6.2.7.8.4 Inspections

(1) The Council will carry out scheduled and random inspections, which are to be attended by the RPEQ.

(2) The scheduled inspection requirements for developments involving public (municipal) works are:

(a) pre-start meeting — inspection frequency for large earthwork sites, including open-space reserves is to be determined at this meeting
(b) pavement subgrade
(c) pavement sub-base
(d) pre-pouring of kerb and channel
(e) pre-seal (base course) inspection
(f) final inspection 'on maintenance' (see SC6.2.7.17: Maintenance)
(g) final inspection 'off maintenance' (see SC6.2.7.17: Maintenance)

(h) when specific engineering problems arise.

(3) In addition to the scheduled inspections, random audit inspections are to be undertaken at the following times to ensure adequate quality control is being employed:

(a) pavement construction
(b) allotment fill compaction
(c) water and sewer reticulation installation
(d) conduit installation
(e) asphalt/bitumen surfacing.

(4) Council officers will not deal directly with contractors.

(5) The RPEQ is expected to undertake all other inspections (e.g. of drainage, roadworks, earthworks, sewer reticulation and water reticulation works) that are necessary to ensure that the finished product conforms to standards and is fit for its intended purpose.

(6) Council officers will undertake random/audit inspections to ensure quality control is adequate.

(7) The notice required for any inspection or meeting to be attended by Council officers is as follows:

(a) pre-start meeting — 3 working days
(b) drainage elements — 24 hours
(c) subgrade — 24 hours
(d) pavement lower sub-base before pouring kerb and channel — 24 hours
(e) pavement — 24 hours
(f) pre-seal inspection — 24 hours
(g) 'on maintenance' (provided all documentation is available) — 5 working days
(h) 'off maintenance' — 10 working days.

(8) The inspection or meeting lead times should not be an imposition on the RPEQ if a reasonable level of job control is in place.

(9) These lead times may be reduced by Council wherever possible.

(10) The Council will not normally carry out inspections of civil works associated with community title schemes, multiple residential or similar developments (i.e. works that are to remain the property of the owner). The RPEQ is expected to undertake inspections as necessary to ensure the finished product conforms to standards and is fit for its intended use.

SC6.2.7.9 Pre-start meeting

SC6.2.7.9.1 General

(1) Before construction work commences, the Council's representative must attend the pre-start meeting.

(2) Before arranging the pre-start meeting, Council must have received approved plans and construction specifications (including a priced schedule of quantities).

(3) The following information, where relevant, is to be presented before or at the pre-start meeting:

(a) confirmation that a bond has been provided, where applicable
(b) tree retention and other environmental aspects
(c) Permit to Close a Road, including any permit from the Queensland Police Service and provision of adequate traffic safety measures and an approved traffic management plan
(d) permit under SLL1.15 issued by the Council Road Operations Branch, if applicable
(e) permit to draw water for construction purposes
(f) fire permit, if burning off (required from the Queensland Fire and Rescue Service and Council)
(g) arrangements for private works in relation to Council connections (e.g. water reticulation, sewer reticulation, reinstatement of a road crossing)

(h) obligation to obtain consent letters before entry into private property (A clearance letter is required on completion of works.)
(i) any coordination required with service authorities, Council, Department of Transport and Main Roads etc.
(j) any anticipated changes to the approved design that are to be effected during construction
(k) Council inspection requirements; for roadworks, the California Bearing Ratio (CBR) results and proposed pavement type must be submitted for approval by Council before the subgrade inspection.

SC6.2.7.10 Subgrade inspections

SC6.2.7.10.1 Pavement thickness

(1) Following acceptance of the engineering drawings by Council, the RPEQ will arrange for soil testing and submit a proposed pavement design to Council for approval, in accordance with SC6.2.3: Pavement of this planning scheme policy.

(2) Subgrade CBR tests as required in SC6.2.3: Pavement must be submitted to enable the pavement design to be assessed.
(3) The Council will advise in writing its acceptance or otherwise of pavement designs and subgrade tests.
(4) Approval of pavement designs is based on the tests being representative of the subgrade over the various lengths of road at the box depth.
(5) This is subject to confirmation by load testing upon inspection, as described in the load test requirements below.
(6) Before requesting a box inspection by Council representatives, the RPEQ must verify on site that the subgrade tests are representative of the material on which the pavement approval is based.
(7) The subgrade inspection is to be limited to a visual and load test. The load test will use machinery/plant provided by the developer's contractor.

SC6.2.7.10.2 Visual test

(1) The visual test is used to:

(a) confirm that the pavement excavation depth is in accordance with the approved depth
(b) ensure that the base of the box is even, with correct crown and cross-fall, and that the sides are vertical
(c) check that the subgrade material is consistent in type and colour with the tested material on which the design was based, and that the subgrade material is uniform throughout the exposed section
(d) ensure that the base is free from wet spots or any other visually defective areas (e.g. tree stumps and other organic/inorganic matter).

(2) The RPEQ must provide string lines and tape, and all necessary personnel.

SC6.2.7.10.3 Load test

(1) A truck loaded to the legal limit (e.g. a full water cart, pipe-laden truck, or other acceptable rolling load) must pass along the subgrade at a speed equivalent to a slow walk — about 2 km/h.

(2) The minimum load on the rear-single-axle truck is to be 8 t.
(3) The material should contain as near as practicable to the optimum moisture content.
(4) Proof loading is normally required to check for any area of the subgrade that might show signs of deflection.

(5) Deflections detected in the subgrade indicating a weakness in the substrata will require remedial treatment under the RPEQ's direction.

SC6.2.7.10.4 Subgrade compaction testing

(1) Field density testing is to be carried out at the frequency nominated in SC6.2.8.3.5 : Pavement construction Compaction Testing.

(2) All test results are to be available at the inspection.

(3) Advice of remedial treatment is to be included with any failed test results.

(4) The minimum acceptable density is 100% standard maximum dry density; this is to be achieved at or near to the optimum moisture content.

SC6.2.7.10.5 Remedial treatments

(1) Subgrades that are deemed to have failed any of the tests as outlined in SC6.2.7.10: Subgrade Inspections may require remedial treatments.

(2) These remedial treatments may include the following:

(a) additional excavation to reach a sound subgrade stratum
(b) installation of side or mitre drains, if their installation is not already required
(c) placing free-draining crushed rock (e.g. spalls, 75–100 mm clean rock, with or without geofabric)
(d) stabilising the subgrade with cement or lime
(e) stabilising the pavement material with cement or lime.

(3) The RPEQ must provide details of the remedial treatment, and confirmation of its success, with all other pavement test results before the pre-seal inspection.

SC6.2.7.11 Pre-seal inspections

SC6.2.7.11.1 Pavement compliance testing

(1) Pre-seal inspections are conducted to ensure that the pavement material has been placed and compacted in accordance with the pavement design, and that sufficient depth has been allowed for the placement of the required seal thickness and to a profile enabling the correct cross-fall to be achieved.

(2) The pre-seal inspection by Council is limited to a visual and load test; the load test uses machinery/plant supplied by the developer's contractor.

(3) The RPEQ must arrange for the appropriate compliance testing of the compacted pavement material in accordance with the requirements of this section.

(4) Compaction and pavement material property test results must be provided before the pre-seal inspection.

(5) Advice of any remedial treatment directed by the RPEQ is to be included with any failed test results for any pavement layers or pavement materials.

SC6.2.7.11.2 Material quality compliance tests

(1) One complete set of pavement material quality compliance tests is to be made for each project, unless there is a change in source of supply or additional testing is required by Council and provided prior to the pre-seal inspection.

(2) Quality compliance testing is to be carried out by an authorised registered laboratory.

(3) Testing for quality compliance is to be carried out in accordance with the applicable standard test procedures of the Department of Transport and Main Roads.

(4) A certificate is to be prepared showing results of all material quality compliance tests.

SC6.2.7.11.3 Quality assurance testing

(1) The date and time of the sampling is to be recorded.

(2) The four-day soaked CBR, fines quality and particle size distribution test is to be carried out at the rate of one test per 500 m^3 of material of each class for each parameter.

(3) Additional testing of fines quality and tests of dry density and of moisture content from material in place in the pavement may be requested by Council at any time.

(4) Grading analysis is to be submitted in graphical or tabulated form.

SC6.2.7.11.4 Non-compliance with material requirements

(1) The responsibility for maintaining acceptable material standards rests with the RPEQ and the nominated contractor.

(2) Compliance of the pavement materials is to be covered by the engineer's certification for the adequacy of the works.

(3) Materials submitted for approval, but not complying in full with the relevant specification requirements, may be accepted or rejected at the discretion of Council.

SC6.2.7.11.5 Pavement depth verification

(1) Pavement depth verification is to be carried out in accordance with SC6.2.8.3.5: Pavement Depth Verification.

SC6.2.7.11.6 Pavement moisture content

(1) It is important that the pavement moisture content be satisfactory before bitumen priming is carried out. The following methods may be used:

(a) Degree of saturation (DOS)

The following maximum degree-of-saturation characteristics values are to be used:
(i) *sub-base — 70% maximum*
(ii) *base — 60% maximum.*

(b) Dry back period

A minimum period of four days must be allowed from the final trimming of the pavement to the application of the bitumen priming. In addition, the pavement must have an in situ moisture content of 75% (maximum) of optimum moisture content.

SC6.2.7.11.7 Degree of saturation

(1) The following maximum degree-of-saturation characteristics values are to be used:

(a) sub-base — 70% maximum
(b) base — 60% maximum.

SC6.2.7.11.8 Dry back period

(1) A minimum period of four days must be allowed from the final trimming of the pavement to the application of the bitumen priming. In addition, the pavement must have an in situ moisture content of 75% (maximum) of optimum moisture content.

SC6.2.7.11.9 Visual test

(1) The visual test requires that:

(a) the pavement surface be even and have an acceptable cross-fall (nominally 3%)

(b) sufficient depth is available to place the required thickness of seal
(c) the surface be clean, coarse, tight and stony
(d) the surface be power-broomed beforehand so that the true surface is visible
(e) the surface not be excessively wet
(f) stringlines, tape and necessary personnel be arranged by the RPEQ.

SC6.2.7.11.10 Load test

(1) Proof loading is normally required to check for any areas of the pavement that might show signs of excessive deflection. It uses the same procedure as subgrade inspections.

(2) Deflections detected in this test may indicate a weakness in the underlying pavement materials or a weak sub-base, and the RPEQ must ensure appropriate remedial works are undertaken.

SC6.2.7.11.11 Pavement compaction testing

(1) Field density testing is to be carried out at the frequency nominated in SC6.2.3: Pavements.

(2) The minimum acceptable density is 100% modified maximum dry density, which must be achieved at or near the optimum moisture content.

SC6.2.7.11.12 Remedial works

(1) Pavements that are deemed to have failed any of the tests outlined in SC6.2.8.3.5: Pavement Construction will require remedial treatments.

(2) These remedial treatments may include:
(a) excavation of pavement (and subgrade) to remove soft material and replace it with suitable material
(b) tyne up and recompaction of materials
(c) adjusting the moisture content.

(3) The RPEQ must provide details of remedial treatment, and confirmation of its success, together with any outstanding pavement test results, before the 'on maintenance' inspection.

SC6.2.7.12 Concrete testing

SC6.2.7.12.1 General

(1) Before the 'on maintenance' inspection is carried out, all available concrete test results must be submitted to Council.

(2) All outstanding test results (28-day tests) are to be submitted within 21 days of works being accepted 'on maintenance'.

(3) Testing, inspections and certification are to be carried out as set out in Table SC6.2.12.

(4) For structural elements, such as bridges, retaining walls and cast-in-situ box culverts, full design strength is to be obtained before 'on maintenance', as the structures will be expected to be put into service following acceptance of the works.

Table SC6.2.12 Inspection and certification

Item	Target strength (28 days)	Frequency	Submit to TRC	When required
Kerb and channel	32 MPa	1 per 100 m	Yes	'On maintenance'[2]

[2] 28-day test required.

Item	Target strength (28 days)	Frequency	Submit to TRC	When required
Vehicular crossings	32 MPa	1 per crossing	Yes	'On maintenance'[3]
Bikeways	25 MPa	1 per 150 m	Yes	'On maintenance'[4]
Footpaths	25 MPa	1 per 150 m	Yes	'On maintenance'[5]
Concrete channels	25 MPa	1 per 150 m	Yes	'On maintenance'[6]
Structures[7]	Per design: min. 32 MPa	As directed	Yes	'On maintenance'[8]
Manholes/gully pits[9]	Per design: min. 32 MPa	As directed	Yes	'On maintenance'[10]

SC6.2.7.13 'On maintenance' inspection procedures

SC6.2.7.13.1 General

(1) The purpose of the 'on maintenance' inspection is to ensure that the development works have been completed in accordance with the approved engineering plans and the conditions of development approval, and that the appropriate standards of construction methods and materials have been used.

(2) The inspected works are put on trial for the minimum periods specified in this planning scheme policy.

(3) Longer maintenance periods may be required for specific items, where problems have been encountered or where non-standard methods or materials have been used.

(4) The RPEQ must:

(a) complete a checklist to confirm that critical aspects of the work have been inspected and completed to a standard appropriate for acceptance by Council

(b) provide Closed Circuit Television (CCTV) verification that all underground infrastructure is in a satisfactory condition to be placed "On Maintenance". Refer Closed Circuit Television (CCTV) Inspection for requirements.

(5) The need for a detailed 'on maintenance' inspection by the Council representatives will be at the discretion of the Council.

(6) In most cases only an 'audit' inspection by the Council representatives should be necessary.

(7) In addition to the pre-inspection checklist, the RPEQ must furnish a formal RPEQ's certificate (on the consultant's letterhead) for the works. The certificate is to be in a form similar to that shown in SC6.2.9.1.

SC6.2.7.13.2 Pre-inspection checklist

(1) The pre-inspection checklist is to be in the form given in SC6.2.9.2, advising that all works on the checklist have been completed and inspected to the RPEQ's satisfaction.

[3] 28-day test required.

[4] Tests may be submitted after 'on maintenance' only if bonded.

[5] Tests may be submitted after 'on maintenance' only if bonded.

[6] Minimum requirement is for the seven-day tests to be provided at 'on maintenance'.

[7] Bridges, retaining walls, cast-in-situ box culverts etc.

[8] 28-day test required.

[9] Major structures other than standard manholes and gully pits.

[10] 28-day test required.

(2) The checklist is to be forwarded to the Council before the requested 'on maintenance' inspection date.

(3) The Council inspection will not be carried out if this checklist has not been received from the RPEQ.

(4) If more than two items on the checklist (items not of a minor nature) are found to be incorrect and the site is not ready, the inspection may be immediately cancelled at the discretion of Council's representative.

SC6.2.7.13.3 Inspection

(1) The need for a detailed inspection is to be at the discretion of the Council.

(2) In the majority of cases, it is intended that only an 'audit' inspection be necessary.

(3) The on-site inspection is to be attended by the RPEQ, the civil contractor(s) and the Council representative(s). The Council representatives are to cover all areas of Council infrastructure.

(4) Each person will be required to provide their own safety equipment (e.g. helmet, boots) for the inspection of subsurface structures.

(5) Any need for specialised equipment should be pre-arranged by the RPEQ with the contractor in accordance with the requirements of the Workplace Health and Safety Act.

(6) The RPEQ's attention is drawn to the requirements of the Workplace Health and Safety Act — in particular, where the pipe drainage system or sewer reticulation system is to be subjected to a detailed inspection (i.e. entry into confined spaces, such as gully pits and manholes).

(7) It is the principal contractor's responsibility to ensure the requirements of the Workplace Health and Safety Act are satisfied.

SC6.2.7.13.4 Non-conforming inspection

(1) If the development fails to satisfy the requirements of the inspection as outlined in the Pre-Inspection Checklist section above, other than for minor defects, the RPEQ must be so advised.

(2) When the defects have been remedied, the RPEQ must arrange another inspection.

SC6.2.7.13.5 Post-compliance action

(1) Before formal acceptance of the works as 'on maintenance', the RPEQ must forward to the Council a letter confirming satisfactory completion of the 'on maintenance inspection and requesting that the maintenance period commence from the date of inspection. The letter must include:

(a) a list of items recorded at the 'on maintenance inspection for further attention
(b) certification by the RPEQ that the works have been completed in accordance with the approved design and specifications
(c) all outstanding test data and measurements of asphalt quality (with the exception of 28-day concrete tests in specific circumstances and AC core tests
(d) 'as constructed' information submitted in accordance with this policy
(e) notification of the contract amount and maintenance security amount (refer to Council's fees and charges), and how it is to be handled (i.e. reduction of existing bond, cash payments or bank guarantee lodged with the Council)
(f) payment of all outstanding monies pertaining to private works for live sewer connections, live water connections, and any other works undertaken by the Council on the developer's behalf
(g) payment of any outstanding fees and permits (e.g. Road Opening Permit, Permit to Draw Water)
(h) copies of written clearance for works carried out on land under other ownership, if applicable

(i) other relevant documentation as may be required by the Council.

(2) Formal acceptance of the works 'on maintenance' will be in the form of a letter from the Council to the manager of the consulting firm. The letter will confirm the 'on maintenance' date, list the defects requiring rectification during the maintenance period, and confirm how the maintenance security is to be handled.

SC6.2.7.13.6 Closed-circuit television inspection

(1) Closed-circuit television (CCTV) acceptance inspection of conduits shall be conducted in accordance with the requirements of the Water Services Association's (WSA's) Conduit Inspection Reporting Code WSA 05.

(2) The operator shall investigate, describe, identify and report on the defects or features in accordance with the criteria in Appendix F of the WSA code. Where required, specialised instruments, apparatus and/or software shall be used to facilitate measurement of parameters to determine acceptance.

(3) CCTV operators shall hold a Statement of Attainment in NWP331A: *Perform conduit condition evaluation based on WSA 05*.

SC6.2.7.14 Maintenance period

SC6.2.7.14.1 General

(1) During the maintenance period, responsibility and liability for the maintenance and rectification of defects of materials and works lies with the developer or consultant, not the Council (unless the work may be directly related to Council activities).

(2) AC core tests and 28-day concrete cylinder tests not available at the 'on maintenance' inspection are to be supplied within 20 days of acceptance on maintenance period.

SC6.2.7.15 'Off maintenance' inspection

SC6.2.7.15.1 General

(1) The purpose of the 'off maintenance' inspection is to ensure that the constructed works have performed satisfactorily during the maintenance period, and that omissions, defects and damage have been rectified. This includes the assessment that trees, plantings, grassing and other vegetation works have been satisfactory established.

(2) It provides CCTV verification that all underground infrastructure is in a satisfactory condition to be handed over as a Council asset. See 'On maintenance' Inspection above for requirements.

(3) If this has been achieved, the RPEQ and developer may be relieved of any further responsibility regarding future maintenance of the works, and the works are accepted by Council.

(4) The RPEQ remains liable for all works in relation to certificates the RPEQ attests to.

(5) The Council retains the right to call on the RPEQ to rectify any works that have been found not to comply with the certificates Council received.

SC6.2.7.15.2 Inspection

(1) When requested by the RPEQ, an inspection will generally be undertaken within 10 working days at a mutually agreed time.

(2) All areas inspected at the 'on maintenance' stage are to be re-inspected, with special emphasis placed on any unsatisfactory points noted during the 'on maintenance' inspection

or any points that have been brought to the Council's attention during the maintenance period.

(3) Any matters outstanding at the time of this inspection will constitute an incomplete work, and such works will not be accepted by the Council.

(4) The on-site inspection is to be attended by the RPEQ, the civil contractor(s) and the Council representative(s). The Council representatives are to represent all areas of Council infrastructure.

SC6.2.7.15.3 Non-compliance inspection

(1) All unsatisfactory or outstanding work must be rectified before the consultant arranges a second inspection.

SC6.2.7.15.4 Post-compliance action

(1) The RPEQ forwards a letter to Council requesting that the:

(a) development be taken 'off maintenance'
(b) maintenance security and any other bond monies be released.

(2) Formal acceptance 'off maintenance' will be by a letter from Council to the manager of the consulting firm confirming that the relevant works have been accepted by Council.

(3) The letter will also indicate that the maintenance security deposit is to be released (unless specified to the contrary by the consultant).

(4) At this time, the relevant works formally become a Council asset.

SC6.2.7.16 'As constructed' information

(1) Certification of the constructed works also includes the submission of 'as constructed' information surveyed by a Registered Surveyor.

(2) 'As constructed' asset plans must be submitted electronically in two formats:

(a) .dxf (data exchange) format
(b) .pdf (scalable portable document format) format.

(3) Council will not accept other electronic file formats.

(4) Prepare your .dxf file in accordance with the Asset Design 'As Constructed' (ADAC) standards. These standards are available on the ADAC web site. The ADAC standards are a regional asset information standard developed by Brisbane City Council, Moreton Bay Regional Council and Sunshine Coast Regional Council.

(5) An ADAC v3 AutoCAD plug-in tool can be downloaded from the ADAC web site to help prepare the electronic subdivisional plan in ADAC-compliant format. The plug-in tool is free to download.

(6) The latest version of the ADAC tool available on the web site must be used. The ADAC tool supports AutoCAD 2000 and all later AutoCAD versions.

SC6.2.7.17 Maintenance

SC6.2.7.17.1 Introduction

(1) The purpose of this section is:

(a) To outline the obligations of persons who develop land within the Region to maintain Public (Municipal) Works carried out by them in connection with such development.
(b) To ensure that Public (Municipal) Works are constructed in a good and workmanlike manner with good quality materials and in accordance with the approved design before such works become the full responsibility of the Toowoomba Regional Council and, thus, the ratepayers of the Region.

SC6.2.7.17.2 Definitions

(1) For the purpose of this section, all definitions used are those contained in the planning scheme, with the following additions:

(a) **'Accept on maintenance'** means the issue of a letter of acceptance by the Council in respect of any public (municipal) works associated with this planning scheme policy.

(b) **'Codes'** means the various planning scheme codes that provide the specific outcomes, criteria, probable solutions and standards for various land uses and development types.

(c) **'Defects'** means any deficiencies or flaws in the quality or performance of the infrastructure as a result of construction operation or the material used. The developer may provide evidence that a defect is the result of a third-party damage, in which case Council may excuse the developer from liability for rectification and repairs.

(d) **'Maintain'** means keeping and preserving of public (municipal) works to the standard set out in this policy and other codes.

(e) **'Maintenance period'** means the following periods for each of the categories of public (municipal) works specified:

(i) landscaped (including tree planting) or grassed areas within road reserves and areas dedicated as open space — 18 months commencing from the date the relevant public (municipal) works are accepted 'on maintenance'.

(ii) dry/wet detention basins, swales, bioretention basins, constructed wetlands, waterbodies, gross pollutant traps, and associated works — 24 months, commencing from the date the relevant public (municipal) works are 'accepted on maintenance'.

(iii) all other public (municipal) works — 12 months, commencing from the date the relevant public (municipal) works are accepted 'on maintenance':

AND

(A) For the purpose of clarity, it is recorded that longer maintenance periods may be required for specific items, where problems have been encountered during construction, where non-standard methods or materials have been used, where temporary works are required after construction is completed, or where public (municipal) works have been constructed in accordance with an Accelerated Trunk Infrastructure Agreement, Connecting Works Trunk Infrastructure Agreement or Trunk Infrastructure Agreement.

(B) Where development is done in stages, the developer may submit an 'asset handover plan' that will facilitate on/off maintenance of assets in stages. This plan may include strategies for by-pass systems to ensure the integrity of the stormwater infrastructure.

(iv) **'Public (municipal) works'** means all works, services, land, buildings, structures, roads, park structures, fencing, irrigation, landscape features (hard and soft), grassed or turfed areas, paved areas, footpaths, pathways, cycleways, natural features, park and street furniture including light poles and associated structures that are to pass to or come under the control of the Council.

SC6.2.7.17.3 'Acceptance on maintenance'

(1) Once the Council is satisfied that any public (municipal) works have been properly completed, a letter of acceptance to that effect is to be issued.

(2) The public (municipal) works are deemed to be 'accepted on maintenance' from the date of that letter.

(3) Before accepting on maintenance any public (municipal) works, a bank guarantee or bond equivalent to not less than the amount detailed in Council's fees and charges is to be lodged with the Council as security for the performance of the maintenance obligations.

(4) Before any public (municipal) works are passed as practically complete and accepted on maintenance, the requirements of this planning scheme policy and any relevant development approval conditions are to be complied with.

(5) The following advice is a guide for consultants to help facilitate acceptance of public (municipal) works 'on maintenance' by the Council:

(a) The RPEQ carries out preliminary inspections of roadworks, sewer reticulation, water reticulation, stormwater drainage systems and, if relevant, parkland at or near practical completion, and the pre-inspection checklist as required by this planning scheme policy is completed and forwarded to Council before the requested 'on maintenance' inspection date.

(b) Council's representative and the RPEQ carry out a formal 'on maintenance' inspection.

(c) A date of practical completion is nominated and any further items requiring rectification are listed.

(d) The works will be 'accepted on maintenance' for the required period from the date a letter of acceptance has been issued following the receipt by Council of the information contained in SC6.2.9.6.

SC6.2.7.17.4 Bonding incomplete works associated with the reconfiguring of land

(1) The Council may approve plans of subdivision, before accepting works 'on maintenance', subject to the following prerequisites:

(a) The bulk earthworks are completed.
(b) Kerbing and channelling and carriageway works are completed.
(c) Roads are certified by an authorised surveyor to be within the correct alignment.
(d) Stormwater works have achieved practical completion.
(e) Where a bond is accepted, the amount to be bonded is the value as set out in Council's current fees and charges schedule.
(f) The RPEQ has provided a certified schedule of quantities and rates for the outstanding works as the basis for Council's determining the appropriate amount of the bond.
(g) The developer has undertaken, in writing to Council, that unless all outstanding development (operational) works are completed and 'accepted on maintenance' within three months of the date of the approval of the plans of subdivision (or such longer time as Council may approve), the Council may call up the bond and undertake all works to complete the approved development, including all testing and compilation of 'as constructed' information.
(h) Bonding is to be in the form of a bank guarantee in form acceptable to Council, except for very minor works where Council may agree to accept a cash bond. Among other matters, the bank guarantee must:

(i) comply with Council's policies in relation to credit risk

(ii) detail the name of the customer/applicant

(iii) detail the real property description of the property for which the security bond is held

(iv) where applicable, detail the different types of bonds, detail the relative amounts covered by the guarantee and contain a statement describing the specific purpose of the bond

(v) detail the development permit and date.

(2) At all times, the Council reserves the right not to accept the bonding of incomplete works if it considers that satisfactory security has not been given to ensure compliance with the requirements of the Act or this planning scheme.

(3) Bulk earthworks include any proposed cutting and filling of dwellings.

(4) Road works that may be bonded include:

(a) streetlighting and other electrical infrastructure
(b) landscaping
(c) verge works
(d) footpaths
(e) turfing.

(5) For stormwater works (excluding water quality devices or systems), practical completion means that infrastructure is deemed acceptable and only minor rectification works are required.

(6) For stormwater water quality devices or systems, practical completion means that only the landscaping component is incomplete.

(7) The schedule of quantities must include the provision of all required testing, compilation of 'as constructed' information and any outstanding park or streetscaping works.

(8) Subdivisional (operational) works and 'as constructed' information are to be completed, and a Registered Surveyor's certificate stating that all survey marks (including reinstated survey marks) are in their correct position in accordance with the plan of subdivision is to be lodged within three months of the approval of the plan of subdivision (or such longer time as the Council may approve).

(9) The approval of the plan of subdivision is also subject to the developer's meeting all the conditions of the permit(s) that do not involve bonded works.

(10) Bonding will only be considered by Council when all works including other authorities (e.g., Ergon Energy and Telstra) are expected to be completed in a reasonable timeframe.

(11) Generally, an incomplete works bond shall be as set out in the Council's current fees and charges schedule.

SC6.2.7.17.5 Maintenance of public works

(1) Each item of public (municipal) works must, at no cost to Council:

(a) be maintained during its maintenance period
(b) have any latent defects, of which the Council gives notice prior to the formal acceptance 'off maintenance', promptly rectified.

(2) Failure to perform the obligations under this part entitles the Council to call up the whole or any part of a bank guarantee, or bond, it holds as security for those public (municipal) works, and to apply all monies to meet the cost of Council's performing those obligations.

(3) The RPEQ is to arrange a joint 'off maintenance' inspection with the Council's representatives.

(4) Following the inspection and approval by the Council's representatives of the rectification of any listed items, the RPEQ must forward to Council a letter requesting that:

(a) the development be taken 'off maintenance'
(b) the maintenance security and any other bond monies be released.

(5) The Council must send a letter to the owner/RPEQ formally accepting the works 'off maintenance' and confirming release of the maintenance security bond.

SC6.2.7.17.6 Liability

(1) Nothing in this part operates so that any duty of care relating to the design and construction of any public (municipal) works owed to the Council is limited, released or waived in any respect.

SC6.2.7.17.7 Agreements

(1) Where an agreement is required, details to be assessed and covered by the agreement are to include the following matters (as applicable):

(a) maintenance period
(b) maintenance standard to be applied to the various public (municipal) works
(c) nature and amount of security to be lodged, and details of the use and release of such security
(d) other details deemed appropriate by the Council.

(2) Any agreement required under this section is to be in writing and prepared by the Council at the developer's cost or by the developer at the developer's cost (subject to such agreement being acceptable to the Council).

SC6.2.8 Specifications

SC6.2.8.1 General

(1) Toowoomba Regional Council is in the process of developing a new and complete set of construction specifications. The new specification s will be prepared through Natspec in collaboration with other member Council Authorities in the south-east Queensland region. It is considered that a single set of standards will ensure certainty and consistency in the quality of constructed assets provided across the broader region.

(2) While the new standards are in preparation, the following specifications will apply. These specifications may be augmented with specifications drawn from the current suit of Natspec specifications.

SC6.2.8.2 Standard for construction of earthworks

(1) Earthworks are to be carried out in accordance with Australian Standard AS 3798 Section 6.

(2) A Registered Professional Engineer of Queensland (RPEQ) must certify that all fill over 500 mm in depth has been placed in accordance with the level of supervision required under AS 3798.

(3) For normal types of compaction equipment, the fill is to be compacted in layers not exceeding 150 mm.

(4) Dust generated from the site and from earthworks is to be controlled so it does not adversely affect adjoining properties.

(5) Water carts should be provided on non-working days where it is necessary to control dust problems.

(6) During and immediately following periods of rain, measures are to be taken to ensure that construction traffic does not deposit mud from the development site onto existing roads.

(7) Mud deposited onto existing roads is to be removed immediately so it does not affect the safety of traffic.

SC6.2.8.2.1 Testing

(1) The Council will not give blanket approvals to any consulting body to carry out geotechnical testing at a particular level (i.e. levels 1 or 2 as set out in Section 8 of AS 3798).

(2) The level of testing will vary with the nature of the project and the locality. Table SC6.2.13 details the frequency of field density testing for earthworks.

Table SC6.2.13 Earthworks: frequency of field density test

Scope of earthworks	Minimum frequency of tests
Large-scale operations (e.g. subdivisions, large industrial dwellings, road embankments)	Greatest of: (a) 1 test per 500 m^3 distributed reasonably evenly throughout full depth and area (b) 1 test per layer per material type per 2,500 m^2 (c) 1 test per 200 mm thickness per material type per 2,500m^2 (d) 2 tests per lot.
Small-scale operations (e.g. residential dwellings)	Greatest of: (a) 1 test per 200 m^3 distributed evenly through full depth and area (b) 1 test per layer per 1,000 m^2 (c) 1 test per 200 mm thickness per 1,000 m^2 (d) 2 tests per lot.

Scope of earthworks	Minimum frequency of tests
Concentrated operations (e.g. filling of gullies, farm dams etc.)	Greatest of: (a) 1 test per 100 m^3 distributed reasonably evenly throughout full depth and area (b) 1 test per layer per 500 m^2 (c) 1 test per 200 mm thickness per 500 m^2.
Confined operations filling behind structures (see Note (4))	1 test per 2 layers per 50 m^2 (i.e. test every second layer once per 50 m^2)
Trenches under pavements and structures	1 test per 2 layers per 40 linear metres (i.e. test every second layer once per 40 m)

Notes
Notes (1), (2), (3) and (5) are general notes applying to the whole table.)
These guidelines refer to the determination of relative compaction using a direct method.
1 Tests in visually doubtful areas, and retests of failed areas should be carried out, and are additional to the testing recommended in this table.
2 Where the geotechnical testing authority has been engaged at Level 2 or Level 3 as set out in Appendix B of AS 3798, it may be acceptable to test more than one layer per site visit by excavating to the test level.
3 Implies hand-operated or small equipment.
4 All test locations are to be shown on a sketch plan.

SC6.2.8.2.2 Compaction

(1) For areas of structural filling, the minimum relative compaction values are those outlined in Table SC6.2.14.

Table SC6.2.14 Earthworks: guidelines for minimum relative compaction

Item	Application	Minimum relative compaction %	
		Minimum density ratio (at standard compactive effort) (cohesive soils) (see Note 1)	Minimum density index (cohesionless soils) (see Note 2)
1	Residential — lot, fill, house, sites	95 (see Note 3)	70
2	Commercial —fills to support minor loadings, including floor loadings of up to 20 kPa and isolated pad or strip footings to 100 kPa	98 (see Note 4)	75
3	Fill to support pavements (see Note 5): (a) general fill (b) subgrade (to a depth of 0.3 m)	 95 98	 70 75

Source: Adapted from Table 5.1, AS 3798 - 2007
Notes:
Density ratio may be either dry density ratio (see AS 1289.5.4.1) or Hilf density ratio (see AS 1289.5.7.1) as applicable. These test methods require reporting to the nearest 0.5% and this is assumed in these values.
1 Density index as a means for control of achieved relative compaction may be difficult to use and interpret. Local correlations with other methods may exist and can be used where these are well established.
2 Development on this fill will be restricted to single and some double-storey houses, with floor slab average imposed bearing pressure not exceeding 20 kPa, and strip or pad footings not exceeding imposed bearing pressures of 100 kPa. Residential developments imposing higher pressures other than these are considered as commercial. A minimum dry density ratio of 98% or higher may need to be considered if collapse on saturation or excessive settlement is likely to occur.
3 Commercial developments are likely to impose loads on fills that will have a more severe effect than those of houses, even where contact pressures are limited to those stated. The designer, in association with a geotechnical professional, should assess the load-carrying capacity and expected deformations associated with proposed filling, and be satisfied that the fill can perform its required function. Where highly loaded fills are proposed, the minimum relative compaction may need to be increased.

4 Where pavements will be required to carry a significant volume of heavy vehicles, the minimum compaction criteria for the upper levels of the fill may need to be reviewed. For all pavements, it is essential that the specification for compaction of subgrade materials reflect the condition under which tests carried out for pavement thickness design are conducted.
5 Local practice in some areas for well-known materials may rely on acceptance criteria based on other parameters — e.g. penetrometers as described in AS 1289.6.3.2 and AS 1289.6.3.3.
6 The ground surface exposed after stripping should also be compacted in accordance with Table SC6.2.14 above, to a depth of not less than 150 mm. If this is not carried out or not possible (e.g. due to presence of soft ground), the consequences should be taken into account by the designer.
7 The above criteria should be applied in conjunction with visual appraisal of the standard of compaction by the superintendent or as otherwise provided in the contract. The specification should define the circumstances where visual appraisal (including test rolling, if appropriate) may override test results for relative compaction.

SC6.2.8.3 Standards for construction of roadworks

SC6.2.8.3.1 Standards

(1) All work is to be supervised by a RPEQ or their authorised representative competent in roadworks and undertaken by a nominated principal contractor experienced in the construction of public (municipal) works.

(2) The Council may request evidence of the principal contractor's competency.

(3) On the completion of the works, the supervising engineer is to submit a certificate to the Council certifying that the works have been completed in accordance with the approved plans and specifications.

(4) Certification is to include the submission of 'as constructed' plans and copies of all relevant test results.

(5) Works involving state controlled roads must be referred to the Department of Transport and Main Roads (DTMR) for approval.

(6) Road construction methods and practices must accord with those specified in:
- (a) DTMR's Standard Specifications Roads and Standard Drawings Roads
- (b) Austroads guidelines
- (c) DTMR's Manual of Uniform Traffic Control Devices
- (d) Council's Roads and Drainage Policy
- (e) Council's Standard Drawings.

(7) Where there is an inconsistency between the specified manuals and the Council's Standard Drawings, the Standard Drawings are to take precedence to the extent of the inconsistency.

SC6.2.8.3.2 Rural roadworks and access

(1) Road standards in the rural zone are as follows:

- (a) During the assessment stage of a development, Council is to consider such matters as access, public utility services, drainage, road junctions and electricity.
- (b) Council requires a developer to construct roads to access created and realigned rural lots where necessary, with these roads connecting to Council's existing public road network. Council may also require roads to be upgraded where traffic-generating development will impact on the road network.
- (c) Owners of land without formal access are required to provide access at their own expense to the satisfaction of Council and in accordance with these standards.
- (d) The rural zone contains a number of lots less than 5 ha in area. Where these lots are realigned or sold to individual purchasers, Council requires that the provision of access to these lots meet certain standards.
- (e) Refer to Standard Drawing No. 101386-001 Rural Roads — Typical Cross-sections for surface treatments required for rural roads within the road hierarchy.
- (f) All grades over 12% are to be bitumen-sealed.

(2) The objectives of rural development are:

(a) to ensure that rural development within the region is carried out in a manner that provides for road access commensurate with the size and location of the proposed development and in accordance with acceptable design standards

(b) to ensure roads provided in new developments are of a sufficiently high standards that Council does not need to spend public funds to bring the roads to an acceptable operating standard

(c) to provide for:

(i) efficiency in maintaining movements of vehicles including buses, service and emergency vehicles

(ii) safety for residents and others who enjoy the use of the road, as well as for the protection of adjoining property

(iii) economy by minimising construction and maintenance costs and avoiding the need for future property acquisition

(iv) protection of the environment by minimising visual impact and reducing the risk result and soil erosion

(v) maintenance of flexibility to allow for future changes in use patterns.

(3) For rural zone lots larger than 5 ha, construction is to be in accordance with the road hierarchy 'local access road'. Refer to rural roads typologies for details.

SC6.2.8.3.3 Pavement design: gravel roads

(1) To be based on Flexible Pavement Design (SC6.2.3) plus 50 mm wearing course. Minimum depth — 200 mm.

(2) Gravel quality to be in accordance with DTMR specification:

(a) Fines components properties — Type 3, Subtype 3.5
(b) Weighted plasticity index (PI x % passing 0.425) — maximum 500
(c) Particle size distribution envelope — Grading B or C
(d) California Bearing Ratio (CBR) — minimum 30
(e) Local gravel may be used if quality is acceptable by Council (may require testing at applicant's expense)
(f) Natural surface may be used where all weather access can be sustained.
(g) Reference: Austroads Part 6: Unsealed Pavements

(3) Pavement design: bitumen-sealed roads:

(a) To be designed in accordance with Flexible Pavement Design (SC6.2.3)
(b) Details of connection to Council's existing road network are to be provided.
(c) Bitumen seal may be required where the external road is bitumen-sealed or a dust nuisance may occur in relation to adjoining dwellings. Seal may also be required where a proposed development generates traffic in excess of that associated with a residential use.
(d) Special requirements may apply for construction in black soil/floodplain situations.

(4) Level of documentation:

(a) Rural road to service up to five lots or dwellings — level of survey and design work required will be determined in line with the topography of the road. Special requirements may apply to drainage structures
(b) Rural road to service over five lots or dwellings — full engineering plans required for all works
(c) Rural zone lot size <5 ha — The following requirements apply where development occurs in relation to lots 5 ha or less in area. This includes the realignment of boundaries involving lots of 5 ha or less.

(5) Realignment:

(a) Where the realignment of lot boundaries involves two or more lots of less than 5 ha, Council requires access roads to be sealed to connect to Council's existing sealed road network. Where there is potential for multiple titles to be realigned, Council will require a plan of the proposed subdivision in its entirety and for the sealing of access roads to occur from the initial stages of the realignment.
(b) The standard of construction is to be in accordance with 8.4.2 (Rural zone lot size >5ha).

(6) Sale of existing titles:
(a) Where more than two existing titles of less than 5 ha adjoin each other and are required to access the same road, land owners are required to construct the access road to the standard specified in this policy for the length of the frontage of the lot such that it forms a continuous access to link in with Council's road network.
(b) This requirement will be applied at the time an application is lodged for the construction of a residence.

(7) Physical access to lot:
(a) Physical access is defined as the entry from the lot onto a Council-maintained road from the property boundary to the road shoulder.
(b) Access onto a gravel road requires:
(i) a gravel invert crossing, if situated on the crest of a road; or
(ii) the installation of a concrete stormwater pipe/s placed within the invert of the table drain with concrete headwalls, wingwalls and apron in accordance with the Standard Drawings.
(c) A road base material with a minimum CBR 45 is to be used as cover pavement material and is to comply with those pavement material properties specified in this division.

(8) Roadworks pavement:
(a) The developer is to submit to the Council a certificate from a NATA-registered laboratory indicating conformity with the pavement requirements.
(b) The pavement material may be supplied ex-quarry or delivered to site, and the supplier is to have in place a quality system ensuring the quality of the material.
(c) A certificate indicating conformity with the pavement requirements is to accompany the pavement material.

(9) Pre-start meeting/inspections:
(a) Before any gravel road construction occurs, the developer is to contact the Council for an on-site meeting to discuss the intended road construction process.
(b) Before the developer organises the meeting with the Council, the developer is to have submitted the Certificate of Material Conformity and received confirmation from Council that any material to be used in the construction process has been approved.
(c) The following inspections/meetings are to be undertaken as a minimum by the Council:
(i) pre-start meeting
(ii) subgrade inspection
(iii) pavement inspection
(iv) final inspection.
(d) On completion of all roadworks, a final inspection will be undertaken to determine whether the Council will accept the road into the gravel road maintenance program.

(10) Roadworks construction:
(a) Construction of works is to be undertaken in accordance with approved drawings and specifications.

(11) Table drains:

(a) Table drains are to constructed in accordance with road typologies and:

(i) drain to cross-road drainage points or natural watercourses

(ii) must not pond water.

(12) Cross-road drainage

(a) Culvert discharge is to be determined in accordance with the DTMR Road Drainage Design Manual, including Planners and Designers Instruction No. 3 for rural catchments and the following:

(i) Time of concentration shall be determined using the Bransby-Williams Formula.

(ii) Designs shall be certified by a RPEQ.

(b) The cross-road drainage is to be constructed with the obvert of the pipe culvert a minimum of 300 mm below the finished road level, and the pipe is to have concrete or stone pitched concrete headwalls, wingwalls and aprons on both the inlet and outlet of the culvert.

(c) The minimum pipe size to be used for any cross-road culvert is 375 mm diameter and minimum length 9.76 m. The class of pipe is to be determined by the static and traffic load.

(d) Culverts are to be laid with a minimum fall of 1% across the width of the road.

(e) The inlets and outlets to the culverts are to be clear, flat and unobstructed for a distance of 1.5 m.

(f) The grade of any earth batters leading into or out of the culvert is to have a maximum slope of 1 in 6.

(g) Two timber or tubular-steel delineator posts are to be installed on either side of the culvert structure on both sides of the road in accordance with DTMR Standard Drawing for Roadworks No. 856.

(h) All proposed cross-road drainage treatments are to be approved by the Council before any roadworks are undertaken by the developer.

SC6.2.8.3.4 Urban roadworks and access

(1) Vehicular crossings

(a) Where applicable, all vehicular footpath crossings (together with any necessary adjustments to the kerb and channel) are to be constructed in accordance with Standard Drawings.

(2) Traffic islands

(a) Traffic islands are to be indicated by raised kerb islands.

(b) Islands may include channelling (or directional) islands, roundabouts, median islands, medians, separators and pedestrian refuge islands, and are to be classified in accordance with the DTMR Manual of Uniform Traffic Control Devices (Qld).

(c) Raised kerbed islands less than 12 m² or less than 2 m in width between kerb faces are to be constructed with a minimum 100 mm thickness N32 MPa reinforced-concrete on a compacted sand base.

(d) The surface treatment for these islands is to be brushed or stencilled concrete.

(e) Raised kerb islands greater than 12 m² and wider than 2 m are to be grassed or landscaped in accordance with the approved landscape drawings.

(f) A water service conduit is to be installed approximately every 80 m, with a minimum of one service per median.

(g) Where the fall across an island is greater than 1 in 4, the island is to be surfaced with brushed or stencilled concrete.

(h) Subsoil drainage (connected to an underground drainage system) is required in all islands where the surface treatment is other than concrete.

(i) Whenever the centre island or part of a roundabout or traffic island is landscaped, a water service conduit and perimeter subsoil drainage are to be provided.

(j) An irrigation system may be required if specified by the Council.

(k) A minimum carriageway width as follows shall be maintained through traffic-calming devices:

(i) on collector, local access 75 to 175 dwellings — 3.5 m

(ii) on local access <75 dwellings — 3.2 m.

(3) Verges:

(a) Verges are to be covered full width with suitable topsoil free of stones and deleterious matter, to a depth of not less than 75 mm, lightly compacted and seeded with grass.

(4) Bus stops:

(a) Bus stops (including indented bus bays) are to be located on arterial, subarterial, distributor and collector roads, as outlined in SC6.2.2 of this policy.

(b) Where bus bays front any lot on a collector road, a driveway is to be constructed for each affected lot — not within the bus set-down area, but within the tapers of the bus bay or outside the bus bay area.

SC6.2.8.3.5 Pavement construction

(1) General:

(a) Each pavement course is not to be commenced until the previous course (i.e. subgrade, sub-base, base or existing pavement) has been inspected, approved and certified by the RPEQ with respect to compaction, finished levels and texture of finish.

(b) Compaction tests of each layer are required, and the RPEQ is to ensure that all tests meet specification before proceeding to the next layer.

(c) All test results are to be provided to the Council prior to asphalt surfacing.

(d) Subgrade affected by rainfall after final trimming is not to be accepted until appropriate drying out, testing and proof-rolling treatment has been effected.

(e) Unbound pavement course material is to be kept at optimum moisture content at all times.

(f) Minimum compacted layer thickness is to be 125 mm, with the maximum compacted thickness not exceeding 150 mm.

(2) Compaction testing:

(a) Determination of the compaction performance of the earthworks, subgrade and pavement gravel materials (i.e. laboratory reference density, field density, optimum moisture content, field moisture content) is to be carried out in accordance with AS 1289 Methods of Testing Soils for Engineering Purposes, in particular the E series tests.

(b) The laboratory reference density is to be as follows:

(i) earthworks — 97% standard maximum dry density (MDD)

(ii) subgrade — 100% standard maximum dry density (MDD)

(iii) pavement — 100% standard maximum dry density (MDD).

(c) The minimum frequency of testing is to be as follows:

(i) roads <120 m — 3 tests

(ii) roads >120 m — 1 test every 50 m.

(d) A minimum of 3 tests per project are to be undertaken.

(e) A lot layout plan showing the location of the tests is to be submitted to the Council with the test results.

(f) All tests are to be distributed reasonably evenly through the full depth and area of pavement.

(g) The testing frequencies are to be based on a ‘not one to fail’ basis.

(h) Failure of material quality tests will require removal of the material or further in situ testing.

(i) Failure of compaction tests will require:

(i) retesting at the same depth and location if the failure is minor (e.g. localised single failure by 1%–3%)

(ii) removal or reworking of material if the failure is significant or widespread.

(j) Subgrade and base courses are to be compacted to the following densities:

(i) earthworks up to 300 mm below subgrade — 95% MDD, then 97%

(ii) natural surface and subgrade — 97% MDD

(iii) pavement courses — 100% MDD.

(k) Any failed test results on any layer, together with the remedial treatment undertaken at the direction of the RPEQ, is to be submitted with other test results prior to the preseal inspection.

(l) Testing for material quality compliance and allowable tolerances for pavement construction are to be as set out in SC6.2.8.

(3) Pavement depth verification:

(a) Pavement depths are to be verified by the provision of 'as constructed' levels of the subgrade and top of asphalt surfacing at a frequency of three levels (right-hand side, centre and left-hand side) every 10 m.

(b) The surveyed information is to be provided in a tabulated format and is to be certified by both the surveyor and RPEQ.

(c) A copy of the certified results is to be submitted with the engineer's certification of the works.

SC6.2.8.3.6 Pavement surfacing

(1) Asphaltic concrete surfacing:

(a) Asphaltic concrete surfacing of the road pavement is to be carried out to the width specified in the Standard Drawings for the appropriate road type and in accordance with the construction requirements outlined in the DTMR Standard Specifications Roads.

(b) Asphaltic concrete surfacing is not to be commenced until the RPEQ and the Council have inspected the substrata (either as a base course or existing surface) and the RPEQ has certified that it is suitable for the laying of Asphalt Concrete (AC) surfacing.

(c) Before issuing the required certification the RPEQ is to consider the quality of the finished levels, compaction and texture finish.

(d) The surface of all asphaltic concrete is to be finished true to grade and profile with smooth joints and a neat finish around manholes and other road surface fittings.

(e) The finished compacted thickness of asphaltic concrete is to be as specified in the Deemed to Comply tables for the appropriate road type.

(f) Prior to the asphalt concrete surfacing being placed, the surface is to be bitumen primed with AMC4 with 10 mm cover aggregate.

(g) Where finished levels have been outlined in the engineering plans, the final asphalt surfacing is not to deviate from these levels by more than –5 mm or +10 mm.

(2) Spray surfacing:

(a) Bitumen surfacing is to be hot-sprayed bitumen.

(b) Bitumen surfacing of the road pavement is to comprise the construction of a bitumen surface coat to the width specified in the typologies for the appropriate road type and in accordance with the construction requirements outlined in the DTMR Standard Specifications Roads.

(c) Bitumen surfacing is not to commence until the Council approves the proposed roadworks.

(d) All necessary precautions are to be taken to prevent binder, aggregate or other material used on the work from entering or adhering to kerb and channelling,

gratings, hydrant or valve boxes, manhole covers, bridge or culvert decks, or similar road fixtures.

SC6.2.8.3.7 Traffic control devices and provision for traffic

(1) General:

(a) Street signs, road line-marking and road furniture shall be designed, located, constructed and erected in accordance with the DTMR Manual of Uniform Traffic Control Devices (MUTCD) and the relevant Standard Drawings.
(b) All permanent signs in concrete paved areas are to be sleeved and bolted.
(c) Kerb-side posts are to be installed using v-locks and spears.
(d) Vandal-proof bolts and fittings are to be used on all permanent signing.
(e) Concrete used in traffic calming is to have a minimum strength of 32 mPA.
(f) Raised retro-reflective pavement markers (RRPMs) are to be installed in accordance with the MUTCD.

(2) Traffic control devices:

(a) Traffic control devices (including temporary or construction signing and road marking) are to conform to, and be placed according to, the requirements of the DTMR Manual of Uniform Traffic Control Devices.

(3) Detouring of traffic:

(a) If traffic is to be detoured away from the roadworks via existing roads, the contractor is to liaise with and make all necessary arrangements with the Council and make appropriate arrangements with other stakeholders (e.g. Department of Transport and Main Roads).
(b) The arrangements are to include making provision for the issuing of public notices in respect of the detour, any repair or upgrading work on the roads concerned that may be required prior to the detouring of traffic, maintenance of the roads concerned during the detour period and any restoration work that may be necessary following cessation of the detour period.
(c) The RPEQ is to provide the Council with details of the arrangements made for detouring traffic.
(d) Such details are to be approved by the Council and other affected stakeholders prior to commencement of detouring.
(e) Should existing traffic flow be affected, all necessary arrangements to adequately control traffic affected by the works are to be provided.

(4) Entrances to private properties:

(a) Roadworks are to be carried out in a manner so that either:

(i) existing entrances to private properties affected by the roadworks operations are maintained in a useable condition during the period of construction of the roadworks, or

(ii) alternative entrance arrangements are made with the property owners concerned.

(b) The contractor is to make good any damage to entrances to private properties that result from the contractor's operations during construction of the roadworks.

(5) Dust control:

(a) The contractor is to minimise any dust problems that may occur during the construction of the roadworks and that may affect the safety and general comfort of the travelling public and surrounding residences.
(b) As a minimum, the contractor is to carry out regular applications of water or other palliative measures along the sections of the roadworks and side-tracks traversed by the travelling public.

(6) Protection of traffic, cyclists and pedestrians adjacent to works:

(a) Works are not to be commenced without the prior approval of the Council and the procurement of a Road Opening Permit from the Council in accordance with the Local Government Act and a permit from the Queensland Police Service in accordance with the Traffic Act.

(b) Prior to commencement of construction, a traffic management plan in accordance with the current version of the DTMR Manual of Uniform Traffic Control Devices, setting out the safety measures, signs and personnel involved in maintaining the protection of traffic, cyclists and pedestrians for the duration of the works, is to be supplied to the Council.

(7) Urgent repairs and protective works:

(a) If by reason of any circumstances arising in connection with the work, any urgent remedial, protective, repair or other work is necessary to prevent damage to the work or to provide protection for pedestrians and traffic and the contractor is unable or unwilling to do such work, the Council may do such remedial work.

(b) The Council is to determine the reasonable costs incurred in carrying out the works, and the amount so determined is to be paid by the contractor to the Council, no later than prior to acceptance of the works 'on maintenance'.

SC6.2.8.3.8 Subsoil drainage of pavements

(1) Location of subsoil drains:

(a) Where kerb and channel has been or is to be constructed, the subsoil drains are to be constructed immediately below the back of the kerb, as outlined in the Standard Drawings.

(b) Subsoil drains shall be extended to interface and connect with existing subsoil system and lawful point of discharge.

(c) Where the road shoulders are unsealed, the subsoil drains are to be placed as outlined in the approved engineering plans, except where kerb and channel is to be constructed in the future, in which case the subsoil drain is to be located as outlined in subsection (a) above.

(2) Order of construction:

(a) Subsoil drains are to be constructed after placement of the lower sub-base material (CBRI5) or after preparation of the pavement box on minimum depth pavements.

(b) The Council may, when conditions are suitable, approve the construction of the subsoil drains prior to placement of subgrade replacement material or lower sub-base material, subject to the bedding/filter material being brought to the underside of upper sub-base level.

(3) Excavation of drains:

(a) Trenches for pipe drains are to be excavated to the required line to a depth of at least 900 mm below the finished pavement surface level and to the gradients as outlined on the approved engineering plans (minimum 1%).

(b) Trenches are to be a minimum 100 mm wider than the nominated pipe outside diameter.

(4) Type of pipe:

(a) All subsoil drainage pipes are to be socked Humes 'Draincoil' or similar socked perforated plastic drainage pipe complying with AS 2439 Part 1 1981 Perforated Plastics Drainage Pipe and Fittings.

(b) Perforations shall not exceed 0.7 mm diameter or width.

(c) Joints are to be constructed in accordance with the manufacturer's recommendations.

(d) Where approved by the Council, strip drains may be used.

(e) Strip drains are to be a proprietary product comprising a regular patterned cusp-shaped plastic core, of nominal thickness not less than 40 mm, encased by a nonwoven geotextile.

(f) The plastic core is to permit the passage of high-volume water flows and have a crush strength not less than 100 kPa.

(5) Pipe size:

(a) The minimum pipe size is 100 mm outside diameter:
(b) The pipe is to be bedded on a minimum of 50 mm of graded filter material in accordance with the Standard Drawings.

(6) Pipe laying:

(a) All subsoil drainage pipes are to be laid on a prepared filter or sand bed to ensure a uniform grade.

(7) Outlets:

(a) All subsoil drainage pipes are to be connected to gully pits, as outlined in the Standard Drawings, or to open channels below the edge of the road shoulder or at the edge of an embankment.
(b) For outlets not connected into gully pits, a concrete headwall is to be provided to the outlet.
(c) Where provided, the headwall is to be at least 100 mm thick and is to extend for a minimum of 150 mm on all sides of the pipe.
(d) The outlets to the pipes are to be fully enclosed by vermin-proof flaps.

(8) Clean-outs:

(a) Clean-outs as outlined in the Standard Drawings are to be located at the head of the subsoil drain and at subsequent spacings not exceeding 90 m.
(b) Clean-outs located at gully pits are to be constructed with caps or plugs, as outlined in the Standard Drawings.
(c) A marker is to be installed in the kerb adjacent to clean-out points.

(9) Joining:

(a) Subsoil drains are to be joined in accordance with the manufacturer's recommendations.
(b) Clean-out pipes are to be joined to the subsoil drains using oblique T connections.

(10) Flushing:

(a) After the drains are constructed, they are to be flushed out.
(b) Flushing is to continue until the outlet water is clean and flows consistently.
(c) Treatment of islands and speed control devices:

(i) for islands and speed control devices, a mitre drain is to be constructed to drain subsurface water from these structures into the nearest gully box or access chamber.

(ii) Landscaped islands are to have perimeter subsoil drainage discharging into the nearest gully box or access chamber.

SC6.2.8.3.9 Standards for construction of stormwater drainage works

(1) General:

(a) All work is to be supervised by a RPEQ competent in stormwater drainage works.
(b) The works are to be undertaken by a nominated principal contractor experienced in the construction of public (municipal) works.
(c) The Council may request evidence of the principal contractor’s competency in the construction of stormwater drainage works.
(d) On the completion of the works, a certificate is to be submitted to the Council from the RPEQ to the effect that the works have been completed in accordance with the approved plans and specifications.
(e) Certification is to include the submission of ‘as constructed’ plans and copies of all relevant test results.

(f) Removal of all sand, silt and debris in the pipelines is the responsibility of the contractor, and all sand, silt and debris is to be removed before the works will be accepted 'on' and 'off maintenance'.

SC6.2.8.3.10 Construction requirements

(1) Pipework:

(a) Pipes damaged as an apparent result of handling and pipes cracked in one or more places so as to show clearly visible cracks (exceeding 0.10 mm) inside or outside are to be rejected.
(b) Pipes showing clearly visible shrinkage cracks inside or outside, with openings more than 1.25 mm for a length of 300 mm or more on either inside or outside, are to be rejected.
(c) Pipes showing only internal cracks or only external cracks may be accepted, provided such cracks do not visibly penetrate the full thickness or do not exceed 0.10 mm opening for 300 mm or more of length.

(2) Pipe laying:

(a) Pipes are to be laid true to line, grade and level to the following tolerances and are to be free draining and firmly bedded:

(i) invert levels +15 mm, -15 mm

(ii) structure locations within 50 mm of the approved engineering design.

(b) The minimum vertical and horizontal clearance between a stormwater pipe and any other pipe or service conduit is to be 300 mm.
(c) Pipe laying is to be in accordance with the recommended pipe-laying practice as set out in the current Australian Standard Specification and the Standard Drawings.

(3) Jointing pipes:

(a) Spigot and socket pipes are to be joined by rubber ring joints:

(i) When flush-jointed pipes are used, the first pipe (downstream) is to be bedded to establish line and grade with the groove upstream.

(ii) The external band is to be installed after the joint is made, in accordance with manufacturer's recommendations.

(4) Laying and jointing of box culverts:

(a) Box culverts are to conform to AS 1597.
(b) All precast box culverts are to consist of a separate invert slab or a cast-in-situ slab and a single invert u-shaped section forming the deck and the two walls.
(c) Base slabs and culvert units are to be installed in accordance with DTMR Standard Drawings and Specifications.
(d) When the length of the base slab along the road centreline is greater than 10 m, and in areas of reactive soil (linear shrinkage >8%), a full structural design of the base slab is to be undertaken.

(5) Backfilling:

(a) Backfill is not to be placed until the pipe drain or box culvert has been inspected and approved by the Council.
(b) Refer to Standard Drawings.

(6) Drainage structures — access chambers and inlet pits:

(a) Inlet pits and access chambers are to be constructed to the form and dimensions shown on the approved plans or the Standard Drawings.
(b) The thickness of walls of inlet pits and manholes shown on the approved plan or on the Standard Drawings is to be the minimum adopted when inner and outer forms are used.
(c) Formwork shall remain in position for at least 24 hours prior to stripping.

(d) Provision is to be made in the walls of pits and access chambers for weep holes to drain the pipe bedding and surrounds.
(e) Provision is to be made, where required, in the walls of manholes and pits for the entry of subsoil drainage lines.
(f) Concrete surfaces are to be protected from drying out for at least seven days after placing.
(g) The concrete used in the construction of the floors and walls of the unreinforced access chambers and inlet pits is to be grade N32 in accordance with Australian Standards.
(h) 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.
(i) Cement rendering is to be undertaken on all construction joints and rough surfaces.
(j) Benching is to be provided on all chambers to minimum height of half the pipe diameter:

(i) Special benching may need to be undertaken using N32 concrete in large access chambers and at angle junctions in pipe lines.

(7) Drainage structures — access chamber covers and frames:

(a) Approved cast iron access chamber covers and frames are to be of the best quality cast iron, free from cracks, flaws and porous spots.
(b) All cast iron surfaces are to be coated with hot bitumen before being placed in the works.
(c) Covers and frames are to comply with the details shown on the Standard Drawings.
(d) The initials SW are to be clearly visible on all access chamber covers.
(e) The covers are to be cast iron where access chambers are situated within the road boundaries or other trafficable areas, and concrete-infilled elsewhere.
(f) Frames are to be cast in the reinforced-concrete access chamber topslabs.
(g) The topslabs are to be bedded on a maximum of 12 mm cement mortar on top of the concrete collar of the manhole so that the top of the cover is flush with the finished pavement or ground surface.
(h) The concrete used in the construction of the access chamber lid is to be grade N32/10 in accordance with AS 879 and AS 3600.

(8) Drainage structures — inlet pit grates and backstone:

(a) One-piece grates and backstones are preferred.
(b) The grate and frame for the standard inlet pit is to be Class D to AS 3996, and is to be hot-dip galvanised to AS 1650.
(c) The precast backstone is to be of an approved type as shown on the Standard Drawings or approved engineering plans.

(9) Drainage structures — inlet and outlet structures:

(a) Headwalls, embankment walls and aprons are to be constructed to the form and dimensions shown on the approved engineering drawings.
(b) Headwall slopes are to align with the adjacent batter slopes. Where precast headwalls are used with steeper wingwall slopes, the transition area is to be cement-grouted stone pitching or concrete.
(c) The inlet and outlet headwalls, embankment walls and aprons are to be constructed to produce a smooth transition of stormwater flowing in the open drain into the pipe and culvert inlet, or out of the pipe or culvert into the open drain, in order to reduce energy loss and reduce upstream backwater.
(d) Energy dissipaters and scour protection, where required, are to be constructed in the locations as shown on the approved engineering plans.
(e) The final form of all inlet and outlet structures is to be subject to on-site determinations with the Council and in accordance with any water quality management plan.

(f) Precast headwalls may be used provided they are constructed to the following criteria and conform to (1)(a):

(i) Precast headwalls are to be laid on a clean stable foundation and bedded in a minimum 200 mm deep layer of 3% cement-stabilised road base.

(ii) Apron cut-off walls extend below the edge of the apron by a minimum of 600 mm and are constructed of minimum grade N25 concrete.

(iii) The headwalls are backfilled with approved free-draining material.

(g) All headwalls are to be constructed with adequate protection so as to prevent scouring occurring behind or around the headwall.

(h) 'Stone pitching' or the use of 'no fines' concrete, where used, is to be a minimum depth of 150 mm.

(i) Weepholes are provided to drain the bedding material.

SC6.2.8.3.11 Kerb and channel construction

(1) Kerb and channel foundation:

(a) The foundation is to comply with the requirements of the approved engineering plans.

(b) Where no requirements are set out in the approved engineering plans, the depth of approved foundation material will be at least 100 mm thickness of material with a minimum soaked CBR of 45%, which is to be compacted by watering and rolling or tamping until 95% of the maximum dry density (as determined by the modified AASHO test method) has been obtained.

(c) The foundation is to extend at least 300 mm behind the back of the kerb.

(d) No concrete is to be placed until the foundations have been approved by the Council.

(2) Concrete works:

(a) The concrete used in kerb and channelling work and vehicle crossings is to be Grade N32 concrete and conform in all respects with the standard drawings and approved engineering plans.

(b) Industrial kerbing shall have an additional 50 mm concrete base thickness over standard profiles as a minimum.

(c) Concrete is to be placed true to line and grade to the depths, thicknesses and dimensions as shown on the engineering plans and Standard Drawings.

(d) Any kerb and channel not true to line or with noticeable kinks, bends or other faults or not of the required dimensions is to be condemned and is to be broken out and removed from the site.

(e) The channel is to be shaped in true conformity with the Standard Drawings.

(f) The invert of the channelling is to be finished in true grade and alignment.

(g) No channelling will be accepted by the Council in which water is found to pond.

(h) Channelling that ponds water and surfaces that are chipped, cracked or otherwise damaged are to be cut away to a clear surface and rendered 12 mm minimum thickness.

(i) The concrete kerbing and channelling is to join neatly and transition smoothly with existing kerb and channel or be finished so that it will join neatly with channelling to be constructed.

(j) Where kerbing and channelling joins inlet pits, the width of channel is to be uniformly widened, as shown on the Standard Drawings, to join neatly with the pit.

(k) Kerb ramps are to be constructed at all street intersections as shown on the Standard Drawing and as required to connect cycleways and footpaths.

(3) Kerb and channelling — hand-formed and finished:

(a) Forms are to conform to the profile specified in the Standard Drawings, and be rigid, true to line and grade, and well braced.

(b) Back forms are to be used on the footpath side of the full depth of the kerb back.

(c) In the carrying out of this work, the whole of the water channel is to be cast simultaneously.

(d) The casting of invert and kerb at different times is not acceptable to the Council.
(e) Concrete is to be well rodded and sliced or vibrated during placing to ensure maximum density and a dense surface finish.
(f) Immediately following the casting of the kerb and channel, the top of the kerb and channel is to be finished with an approved steel finishing tool.
(g) The 'arris' and 'invert' are to be formed with approved steel finishing tools.
(h) The front board of the kerb is to be stripped within 24 hours of casting and the kerb face immediately bagged using a damp hessian bag and cement mortar.
(i) The concrete kerb and channel is to be placed in 3 m sections and provision made at the joints to prevent the binding of the concrete at the joint.
(j) Joints are to be finished square and at right angles to the section of the water channel, and show a neat joint line on the kerb face and top truly at right angles to the length.

(4) Kerb and channelling — machine formed and finished:

(a) Kerb and channelling may be cast by approved slip form machines, provided that the kerb and channelling conforms to the profile specified in the Standard Drawings and the following additional requirements:

(i) The minimum slump is to be 12 mm.

(ii) Concrete is to be thoroughly compacted.

(iii) Exposed faces and edges of kerbs are to be finished with a steel tool to the true shape of the kerb.

(iv) Grooves are to be cut with a suitable grooving tool to a depth of at least 100 mm in the channels and inverts at equal intervals of 3 m. Grooves are to be at right angles to the length and perpendicular.

(v) Adjacent concrete is to be finished to a smooth, level surface.

(vi) Concrete is to be supplied ready-mixed and placed within 30 minutes of delivery on site. Any concrete not placed within this time is to be removed from the site.

(5) Curing of concrete:

(a) When curing compounds are used on concrete work, they are not to be detrimental to the quality or appearance of the finished concrete.

SC6.2.8.3.12 Roofwater and inter-allotment drainage systems

(1) Pipe size:

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

(2) Pipe types:

(a) The following pipe types are to be used:

(i) uPVC, sewer Class SH solvent-welded AS 1260

(ii) FRC, Class 2 rubber ring jointed AS 489

(iii) RC Class 2 rubber ring jointed AS 842.

(b) Standard manufacturer's fittings are to be used in all cases.
(c) Site-fitted saddles are not acceptable to the Council.

(3) Flexible joints:

(a) Flexible joints in the form of a short pipe 600 mm maximum at the junction of all stormwater drainage structures are to be provided.
(b) For uPVC systems:

(i) flexible joints are not necessary; however, rubber ring jointed connections are to be provided at all drainage structures to accommodate expansion or contraction

(ii) all pipes are to have sanded ends suitable for bonding to concrete.

(4) Access chambers:

(a) Access chambers are to be Type 1 — Cast In Situ in accordance with the Standard Drawings.

(b) Access chamber dimensions are to be as follows:

(i) 600 mm diameter pit for a maximum depth to 750 mm

(ii) 900 mm diameter pit for a depth ranging between 750 mm and 1,500 mm

(iii) 1,050 mm diameter manhole where depths exceed 1,500 mm.

(c) Access chambers are to be provided at the following locations:

(i) change of grade

(ii) change of pipe size

(iii) change of direction

(iv) end of line.

(d) Covers to cast-in-situ access chambers are to:

(i) be a standard concrete infilled access chamber cover and frame

(ii) be embossed roofwater

(iii) have infill concrete at grade N25

(iv) match the finished surface ground slope and sit 50 mm proud.

(e) Grate installations may be permissible in certain instances where surface flows are to be directed into the system and the system has been designed for these additional flows.

(f) Access chambers are to be benched in a similar manner to that required for sewer installations.

(5) Branch connections:

(a) At least one connection point is to be provided on the main line for each property.

(b) The connection is to be in the form of a slope junction installed in the line with the property branch line, its diameter being a minimum of 100 mm (ID).

(c) An inspection opening is to be located at the end of the property branch line similar to a sewer house connection branch.

(d) The connection point is to terminate 0.5 m past any adjacent sewer.

(e) Stormwater marking tape is to be tied to the cap of the inspection opening, to extend vertically to be tied to a wooden peg at finished surface level, and to be marked with a 50 mm by 25 mm wooden peg painted blue and extending a minimum of 1 m above the ground.

(6) Outlets:

(a) All inter-allotment roofwater drainage systems are to discharge into a suitably located stormwater pit or access chamber in the street.

OR

(b) Where the approved engineering plan permits discharge into the kerb and channel, such discharge is to be via an appropriate number (but not less than two) of galvanised steel rectangular hollow sections (75 mm maximum height) exiting from

an access chamber located 0.5 m inside the property across the footpath into the kerb and channel.

AND

(c) The rectangular hollow sections are to be cut to match the profile of the kerb and channel.

(d) A minimum of two roofwater kerb adaptors shall be provided for each allotment that drains predominately to street drainage.

(e) A kerb adaptor shall be located:

(i) 0.5 m from the property side boundary
(ii) If the allotment drains predominately to one side boundary, then locate both kerb adaptors (0.5 m apart) 0.5 m in from the lower side boundary.

(7) Minimum cover:

(a) In private property, the minimum cover is to be 450 mm.

(b) Where discharge into kerb and channel is allowed, it may be necessary to vary this requirement over the last section (i.e. from the last access chamber to the property boundary).

(8) Where concrete footpaths are provided:

(a) For dwellings discharging to kerb and channel where a concrete footpath/cycleway is provided in the verge, a roofwater drainage connection point is to be provided at the lowest corner of the lot (i.e. a minimum of 2x100mmØ (or RHS) lines discharging to kerb and channel via approved kerb adaptors).

SC6.2.8.3.13 Water quality control

(1) Permanent methods of water quality control:

(a) The construction of permanent erosion and sediment control structures is to be in accordance with QUDM 2008 2007 Best Practice Erosion and Sediment Control, International Erosion Control Association, November 2008, for Queensland Construction sites.

(2) Temporary methods of water quality control:

(a) Temporary erosion control devices (excluding devices which divert or concentrate run-off) are to be constructed in accordance with the Best Practice Erosion and Sediment Control, Erosion and Sediment Control Association, November 2008 for Queensland Construction Sites.
(b) The contractor is to maintain all sediment control measures outlined on the approved erosion and sediment control plan.
(c) It is emphasised that, no matter which measures are selected and implemented, they are to be properly maintained by the contractor to ensure that they adequately fulfil their function.
(d) Where the development involves trenching or other ground disturbance within 10 m of existing downstream or downhill properties, turfing of the disturbed areas is required for protection of the downstream properties.
(e) Gully inlet protection works are to be maintained until contributing catchments have stabilised.
(f) Construction works should, wherever possible, be programmed to minimise the areas exposed to erosion at any one time and to stabilise the disturbed areas before moving to fresh areas.
(g) To stabilise batters, drains and swales, vegetative treatments may be used.

(h) Maintenance is to include inspection after any storm event to:

(i) repair breaches

(ii) remove accumulated silt/debris when 50% of the design capacity of the measures is lost.

(i) The removal of the sediment is to be done in such a manner so as not to damage the sedimentation structure.

(j) Any damage to either permanent or temporary water quality control structures or devices is to be immediately rectified at the contractor's expense.

SC6.2.8.3.14 Standards for construction of water-sensitive urban design works

(1) Construction of infrastructure for water-sensitive urban design will be undertaken in accordance with Water by Design guidelines and good engineering practice.

(a) The Water by Design publication 'Construction and Establishment Guidelines – Swales, Bioretention Systems and Wetlands' provides guidance to deliver vegetated stormwater management systems.

(b) The construction and establishment specifications outlined in the guidelines are to be used giving attention to the following:

(i) sequencing of work

(ii) materials, in particular the filter material

(iii) plant selection

(iv) plant establishment, the measure for successful establishment, is detailed in the 'sign off' form (refer Water By Design publication 'Construction and Establishment Guidelines – Swales, Bioretention Systems and Wetlands' for swales, bioretention basins and constructed wetlands

(v) Works will not be accepted 'on maintenance' until:

(A) the works are certified by an RPEQ as being constructed satisfactorily in accordance with the approved stormwater quality management plan for this phase

(B) completion of 'sign off' forms for each swale, bioretention basin and constructed wetland that is built to completion of an alternative checklist prescribed in the approved stormwater quality management plan.

SC6.2.9 Appendices

SC6.2.9.1 Registered Professional Engineer of Queensland Certificate

Example Only

Engineering Design Certificate

Project:

Project No:

Client:

Site Address:

RP Description: Local Authority:

I/We,
under the *Professional Engineers Act 2002 (Qld) Reprint 2 01/07/08* certify that the engineering drawings, specification and supporting calculations as listed in The Schedule have been prepared in accordance with:

(List standards etc)

Description of project components covered by this certificate:

Clearly describe components (e.g. Confirmation of Sub-grade CBR and Pavement Design).

Basis of Certification: (Clearly describe all design criteria, assumptions and relevant Australian Standards, specifications and references relied upon in the design)

- *(List)*

Reference Documents: (Clearly describe all supporting documentation such as drawings, reports, etc. referenced)

- *(List)*

Exclusions: (Clearly describe all project components or criteria not covered by this certificate which may otherwise be inferred to be included)

Person signing on behalf of *(Company Name)*:

Full Name:

Position:

Professional Qualifications:

RPEQ No.:

Business Address:

Phone: Fax: Email:

Signature:_____ Date:_____

SC6.2.9.2 Pre-On Maintenance Inspection Checklist of Works

SC6.2.9.2.1 Screen shots of actual form (1 of 4)

DEVELOPMENT .....

TRC FILE NO. .....

Item	Work Passed (Yes/No/N.A)	Comment
Roofwater Drainage System The works have been finally inspected and—		
(a) Roofwater drainage system is constructed to plan.		
(b) Roofwater pits have been constructed to a satisfactory standard, i.e.— – benching; – correct cover, embossed RWD; – location relative to lot boundaries; – 50-75mm proud of finished surface level.		
(c) Pipework has been visually inspected and is satisfactory, i.e.— – alignment and grade; – free of debris and siltation; – sanded end connector, for uPVC pipework; – no visual sign of trench subsidence.		
(d) Outlets (especially to kerb and channel) are satisfactory.		
(e) Lots not provided with roofwater drainage system can be drained to kerb and channel.		
Stormwater Drainage System The works have been finally inspected and—		
(a) Pipe layout is as per plan or approved amendments with respect to pipe size, levels and location.		
(b) Pipework has been visually inspected and is satisfactory, i.e.— – alignment and grade; – free of debris and siltation; – pipe joints satisfactory; – lifting plug holes sealed; – no visible sign of trench subsidence		
(c) Gully pits and manholes have been constructed to the correct standards, i.e.— – correct type of grate or cover; – backstones; – side entry slots; – benching; – pipe connections are not constructed to the corner of two walls such that the pipe capacity is reduced; – grates are satisfactorily seated in frames; – weepholes provided to bedding material.		
(d) All density tests of backfill are available and satisfactory.		

SC6.2.9.2.2 Screen shots of actual form (2 of 4)

Item	Work Passed (Yes/No/N.A)	Comment
Roofwater Drainage System The works have been finally inspected and—		
(a) Roofwater drainage system is constructed to plan.		
(b) Roofwater pits have been constructed to a satisfactory standard, i.e.— – benching; – correct cover, embossed RWD; – location relative to lot boundaries; – 50-75mm proud of finished surface level.		
(c) Pipework has been visually inspected and is satisfactory, i.e.— – alignment and grade; – free of debris and siltation; – sanded end connector, for uPVC pipework; – no visual sign of trench subsidence.		
(d) Outlets (especially to kerb and channel) are satisfactory.		
(e) Lots not provided with roofwater drainage system can be drained to kerb and channel.		
(f) CCTV has been submitted and works conform to specifications.		
Stormwater Drainage System The works have been finally inspected and—		
(a) Pipe layout is as per plan or approved amendments with respect to pipe size, levels and location.		
(b) Pipework has been visually inspected and is satisfactory, i.e.— – alignment and grade; – free of debris and siltation; – pipe joints satisfactory; – lifting plug holes sealed; – no visible sign of trench subsidence		
(c) Gully pits and manholes have been constructed to the correct standards, i.e.— – correct type of grate or cover; – backstones; – side entry slots; – benching; – pipe connections are not constructed to the corner of two walls such that the pipe capacity is reduced; – grates are satisfactorily seated in frames; – weepholes provided to bedding material.		
(d) All density tests of backfill are available and satisfactory.		
(e) PSD's have been submitted or are available for bedding material.		
(f) Outlet/inlet structures are satisfactorily constructed and are free from scour or siltation.		
(g) All manhole and gully pit pipe connections are mortared flush with the walls and no pipe reinforcement is exposed.		

SC6.2.9.2.3 Screen shots of actual form (3 of 4)

Item	Work Passed (Yes/No/N.A)	Comment
Concrete Kerb and Channel Medians The works have been finally inspected and—		
(a) The correct type has been used at all locations (including medians) in accordance with standards.		
(b) Ponding of stormwater does not occur.		
(c) Transitions and connections to existing construction are smooth and to a satisfactory standard of workmanship.		
(d) Service markers have been placed to kerb face.		
(e) Lip and back of kerb are flush with the roadway and footpath respectively.		
(f) All channelisation works and medians have been satisfactorily completed.		
(g) Infill treatment of medians has been inspected and found satisfactory.		
(h) Medians planted/turfed as per approved plans.		
(i) Backing strips have been provided to median kerbs where required.		
(j) Side drains have been provided under medians.		
Street Trees The works have been finally inspected and—		
(a) Location and interval as per approved plan.		
(b) Species selection as specified in approved plan.		
(c) Size of tree as specified.		
(d) General health and vigor satisfactory. (A full assessment of all trees, plantings, grassing and other vegetation works will be undertaken at "Off Maintenance" to ensure that they have been satisfactorily established.)		
(e) Planting methods and mulching to acceptable standard.		
Footpaths The works have been finally inspected and—		
(a) Profiles are as per plan.		
(b) Footpath has been topsoiled to Local Government's requirements.		
(c) Footpaths have been grass seeded and fertilised or turfed to Local Government's requirements.		
(d) All service fixtures (such as valves etc) are flush with the surrounding footpath.		
(e) Concrete footpaths have been constructed to Local Government's requirements.		
(f) Kerb ramps constructed as required.		
Pathways, Driveways and Bikeways The works have been finally inspected and—		
(a) Location and width are as per the plan.		
(b) Kerb ramps and crossings are constructed.		
(c) Safety rails and signs have been installed.		

SC6.2.9.2.4 Screen shots of actual form (4 of 4)

Item	Work Passed (Yes/No/N.A)	Comment
Other The works have been finally inspected and—		
(a) Street name signs, traffic signs and pavement marking have been installed.		
(b) Works have not resulted in problems on neighbouring properties. Clearance letters as may be applicable have been submitted or are available.		
(c) All boundaries of Reconfiguration/Development have been inspected to ensure works as constructed will not affect adjoining properties.		
(d) All necessary testing to ensure the quality of the work has been carried out and results are available and have been provided to the Local Government.		
(e) Engineer's Certificate of completion is available and has been provided to the Local Government.		
(f) Private works accounts for live sewer and water connections etc have been paid.		
(g) "As Constructed" details are available and have been provided to the Local Government including pavement depth details.		
(h) All lot boundaries, easements etc, have been pegged.		
(i) Any outstanding fees and charges have been paid, i.e. Design Review, Works Inspection, Road Opening Permit, Permit to Draw Water.		

NOTE: Construction is within stated tolerances or otherwise within normally accepted engineering standard tolerances.

Person signing on behalf of *(Company Name)*:_____

Full Name:_____

Position: _____

Professional Qualifications:_____

RPEQ No.:_____

Business Address:_____

Phone:_____ Fax:_____

Email:_____

Signature:_____ Date:_____

SC6.2.9.3 Compliance Requirements for Public (Municipal) Works

DEVELOPMENT ……..

TRC FILE NO. …….. ……..

Tests and Certificates	Provide Prior To	Comment
Earthworks		
(a) Density Tests (b) Retaining walls and Batters, Structural and Geotechnical Certification	On Maintenance	RPEQ Responsible for submission of all relevant test results.
Roadworks		
– Subgrade CBR/OMC	Pavement Construction	
– Pavement Design	Pavement Construction	
– Subgrade, Field Density	Subgrade Inspection	
– Pavement		
☐ Field Density		
☐ CBR's/PSD	Preseal Inspection	RPEQ Responsible for submission of all relevant test results.
☐ Material Quality		
☐ As Constructed Levels	On Maintenance	
– AC Surfacing—		
☐ Marshall Tests	On Maintenance	
☐ Delivery Dockets	On Maintenance	
☐ Compaction Tests	Within 21 Days of Acceptance On Maintenance	
Stormwater Drainage		
– Trench and backfill compaction		
☐ under road	Subgrade Inspection	RPEQ Responsible for submission of all relevant test results.
☐ other	On Maintenance	
– PSD's for bedding material	On Maintenance	
Concrete Tests		
– CKC – Footpaths – Bikeways – Crossings – Other	Refer Appendix 3	RPEQ Responsible for submission of all relevant test results.
Other		
– Pre-Inspection Certificate /Checklist	On Maintenance	
– Engineers Certificate	On Maintenance	
– As Constructed Information	On Maintenance	
– Bonding Arrangement	On Maintenance	
– Private Works Accounts	On Maintenance	RPEQ Responsible for submission of all relevant information and actions before "On Maintenance" inspection will proceed.
– Clearance letters if applicable	On Maintenance	
– Outstanding fees and charges	On Maintenance	
– Request for works to go On Maintenance	On Maintenance	
– As Constructed pavement depth details	On Maintenance	
Maintenance Period		
– Rectify all defects – Provide any additional "As Constructed" details as may be required by the Local Government as a result of any rectification work. – Submit any outstanding test results or certificates	To be provided within 28 days of completing rectification work or at "Off Maintenance" whichever is the earlier.	RPEQ Responsible for submission of all relevant information.
Off Maintenance		
- CCTV has been submitted and works conform to specification	Off Maintenance	RPEQ to formally request release of maintenance security bond
– Request to take works off maintenance	Off Maintenance	
– All works rectified	Off Maintenance	
– Maintenance security bond	Post Off Maintenance	

SC6.2.9.4 Engineering Certification Checklist – On Maintenance

SC6.2.9.4.1 Screen shot of actual form

Application No: ……../ …….

Development Name: …….

Item	Received (Yes/No/N.A)
General	
Engineer's Certificate of Construction	
Pre-On Maintenance Inspection Checklist	
Geotechnical and Structural Certification where applicable i.e. retaining walls, cut and fill batters etc	
"As Constructed" plans received. Date Received: …. / ……/ …..	
"As Constructed" Certification	
Earthworks	
Roadworks fill compaction test results	
Lot fill compaction test results	
As required by Development Approval conditions	
Roadworks	
CBR test results	
Subgrade compaction test results	
Pavement gravel materials compaction test results	
Pavement gravel quality compliance test results	
Asphalt quality test results	
Asphalt compaction test results	
Pavement depth verification test results – signed by Registered Professional Engineer Queensland and Surveyor	
Stormwater	
Trench backfill compaction test results	
PDS's for bedding material	
Concrete	
As required by A.S. Specification and Manufacture of Concrete	
Miscellaneous	
Clearance letters	
Outstanding design documentation	
Matters listed during construction	

SC6.2.9.5 Road Hierarchy Typologies and Standard Drawings

SC6.2.9.5.1 Road Hierarchy Typologies

Drawing Number	Title
101384-001	Urban Streets – Typical Cross Sections
101385-001	Urban Roads – Typical Cross Sections & Typical Service Locations
101386-001	Rural Roads – Typical Cross Sections
101387-001	Industrial Streets – Typical Cross Sections

SC6.2.9.5.2 Standard Drawings

Drawing Number	Title
TRC Standard Drawings	
101388-001	Residential Streets - Intersection of Access Street with Collector Street.
101389-001	Layback Kerb and Channel Details and Edge Restraint Details
101390-001	Underground Stormwater Drainage Typical Layout Plan
101391-001	Underground Stormwater Drainage Typical Longitudinal Section
101392-001	Underground Stormwater Drainage Typical Layout Plan As Constructed
101393-001	Underground Stormwater Drainage Typical Longitudinal Section As Constructed
101394-001	Bedding and Backfill to Pipes Suggested Treatment
101395-001	Overland Flow in Drainage Reserves Suggested Treatment
101396-001	Allotment & Rear of Allotment Drainage Alternative Levels and Drainage Requirements
101397-001	Rear of Allotment Drainage Layout Plan for Design Approval
101398-001	Rear of Allotment Drainage Longitudinal Section For Design Approval
101450-001	Rear of Allotment Drainage Alternatives And Miscellaneous Details
101451-001	Rear of Allotment Drainage Layout Plan For Design Approval 'As Constructed'
18389-001B*	Urban Residential Driveway: Slab & Tracks

* TRC Standard Drawing 18389-001 Rev B

Disclaimer

1. Council shall have no responsibility to the user or any other person or entity with respect to any liability, loss or damage caused or alleged to be caused, directly or indirectly, by the adaption and use of these Standard Drawings including, but not limited to, any interruption of service, loss of business or

anticipatory profits, or consequential damages resulting from the use of these Standard Drawings. Persons must not rely on these Standard Drawings are the equivalent of, or a substitute for, project-specific design and assessment by an appropriately qualified professional.

2. No liability or warranty is implied or expressed by any inspection or the absence of any inspection or by a Council decision relating thereto.

Standard conditions

1. The proposed crossover shall conform to existing footpath levels where possible. At no stage should a change of grade exceed 10% without checking for adequate vehicle clearance. Particular note should be taken of conditions 2 and 3 below.

2. Where the typical section cannot be achieved and the property is higher than the roadway, the footpath crossover grade shall not excel 5% for at least 2.5 m behind the kerb (ie. Rise 125 mm above top of kerb from a point 2.5 m behind the kerb).

3. Where the typical section cannot be achieved and the property is lower than the roadway, the footpath crossover shall have a positive 5% grade for at least 2.5 m behind the kerb (ie. Rise 75 mm above top of kerb from a point 1.5 m behind the kerb). Then a negative 5% grade for the next 1.5 m (ie a fall of 75 mm below that level). This may prevent the ingress of stormwater onto the property from the roadway.

4. The proposed crossover/crossing shall be constructed at least to the minimum requirements detailed.

5. All services are to be relocated clear of any proposed crossover/crossing at the expense of the property owner. The relevant authority in charge of any service is to be contacted so that services (telecommunication pits, fire hydrants, personnel access chambers etc.) can be relocated clear of the proposed crossover/crossing.

6. The proposed crossover shall be flared to at least 4.0 m in width of the kerb from 1.0 m behind the kerb, alternatively to the full width of any existing crossing from 1.0 m behind the kerb. Any proposed footpath crossover/crossing shall not exceed 4.0 m in width without separate Council approval.

7. Existing street trees shall be protected from damage during the construction of any footpath crossover/crossing. No work is to be undertaken on any street tree without Council approval.

8. Existing bitumen or concrete footpaths at and in the vicinity of the driveway shall be neatly saw cut and replaced. The driveway is to be graded at no steeper than 2.5% for the width of the footpath. Where there is an existing footpath, a matching cross fall must be provided. It should be noted that Council footpaths are not designed to cater for vehicular movement.

9. The property owner/applicant/contractor is to take all measures necessary to ensure pedestrian safety including but not limited to barricades, safety lights, warning devices, or other means of protecting ‘Public Risk’.

10. Any damage to a roadway is to be reinstated with compacted hotmix asphaltic concrete (10 mm mix). The damaged area is to be neatly saw cut and removed prior to reinstatement to provide a neat finish.

11. All work is to be confined within the projected side boundaries of the property for which the footpath crossover/crossing will serve unless agreed to by the affected adjoining property owner and approved by Council.

12. Council takes no responsibility for a vehicle scraping when using a footpath crossover or invert crossing. The property owner/applicant/contractor is to ensure adequate vehicle clearance is provided.

13. The property owner/applicant/contractor is responsible for the reinstatement of the footpath area or roadway during the course of works and following the completion of work. No trip hazards are to be left following the completion of building works. It may be necessary for further earthworks either side of a footpath crossover/crossing to provide a profile of not more than 5%.

Notes

Any problems associated with footpath profiles or council’s requirements should be referred to development assessment.

Drawing Number	Title
IPWEAQ Standard Drawings	
SEQ R-001	Index of Standard Drawings
SEQ R-050	Driveways - Residential Driveway Breakout Type
SEQ R-051	Driveways – Heavy Duty Vehicle Crossing
SEQ R-053	Driveways – Residential Driveway Abutting Type
SEQ R-056	Driveways – Rural Driveway Refer Note 1
SEQ R-065	Concrete Pathway Construction Details
SEQ R-080	Kerb and Channel Profiles and Dimensions including Edge Restraints, Median & Invert
SEQ R-081	Kerb and Channel – Residential Drainage Connections
SEQ R-090	Kerb Ramp – Ramped Pedestrian Crossings
SEQ R-091	Kerb Ramp – Ramped and Cut Through Treatments for Pedestrian Crossings Slip Lanes and Medians
SEQ R-092	Installation of TGSI's on Ramped Kerb Crossings
SEQ R-093	Installation of TGSI's on Ramped Kerb Crossings Application Examples
SEQ R-094	Kerb Ramp – Locations and Configurations
SEQ R-100	Public Utilities – Typical Service Corridors and Alignments
SEQ R-101	Public Utilities – Typical Service Conduit Sections
SEQ R-103	Public Utilities – Optic Fibre Pit
SEQ R-130	Street Name Sign (Finger Board)
SEQ R-131	Traffic Sign Installation Details
SEQ R-140	Subsoil Drains - Details
SEQ R-141	Subsoil Drains – Typical Median Locations
SEQ R-142	Subsoil Drains – Access Points
SEQ R-170	Pavement Extension – Trenching and Widening
SEQ R-180	Typical Bus Stop Layout
SEQ R-181	Indented Busbay Bus Stop Layout – Guidelines for the Layout of a Rural Bus Stop
SEQ D-001	Index of Standard Drawings – Drainage
SEQ D-010	Stormwater Access Chamber Detail – 1050 to 2100 Diameter
SEQ D-014	Manhole Frame (Roadway and Non-Roadway – 1050 to 2100
SEQ D-018	Manhole Riser Details (Roadway)
SEQ D-019	Manhole Cover (Roadway) – 1050 to 2100 Diameter
SEQ D-020	Manhole Cover (Non Roadway) – 1050 to 2100 Diameter
SEQ D-021	Manhole Cover Concrete Infill (Pedestrian Traffic) – 1050 to 2100 Diameter
SEQ D-050	Drainage Pits – Field Inlet Type 1 and Type 2
SEQ D-060	Drainage Pits – Kerb Inlet – Kerb in Line General Arrangement
SEQ D-061	Drainage Pits – Kerb Inlet Precast Lintel Details
SEQ D-062	Drainage Pits – Kerb Inlet Grate and Frame
SEQ D-063	Drainage Pits – Kerb Inlet – Lip in Line General Arrangement

Drawing Number	Title
SEQ D-068	Drainage Pits – Kerb Inlet – Kerb in Line Anti-Ponding
SEQ D-082	Drainage Details – Culvert Inlet Screen
WSUD-001	Bioretention Standard Profile – Overflow Pit
WSUD-002	Bioretention Saturated Zone – Overflow Pit
WSUD-003	Bioretention Standard Profile – Underdrain Cleanout
WSUD-004	Bioretention Saturated Zone – Underdrain Cleanout
WSUD-005	Bioretention – Large Coarse Sediment Forebay
WSUD-006	Bioretention Basin – Weir Details
WSUD-007	Bioretention Pod – Kerb Cutout
WSUD-008	Bioretention Swales – Flush Kerb Setdown
WSUD-009	Constructed Wetland – Outlet Riser Pit Option A
WSUD-010	Constructed Wetland – Outlet Riser Pit
WSUD-011	Constructed Wetland – Outlet Riser Pit (For Very Flat Sites)
WSUD-012	Constructed Wetland Inlet Zone – Weir Details

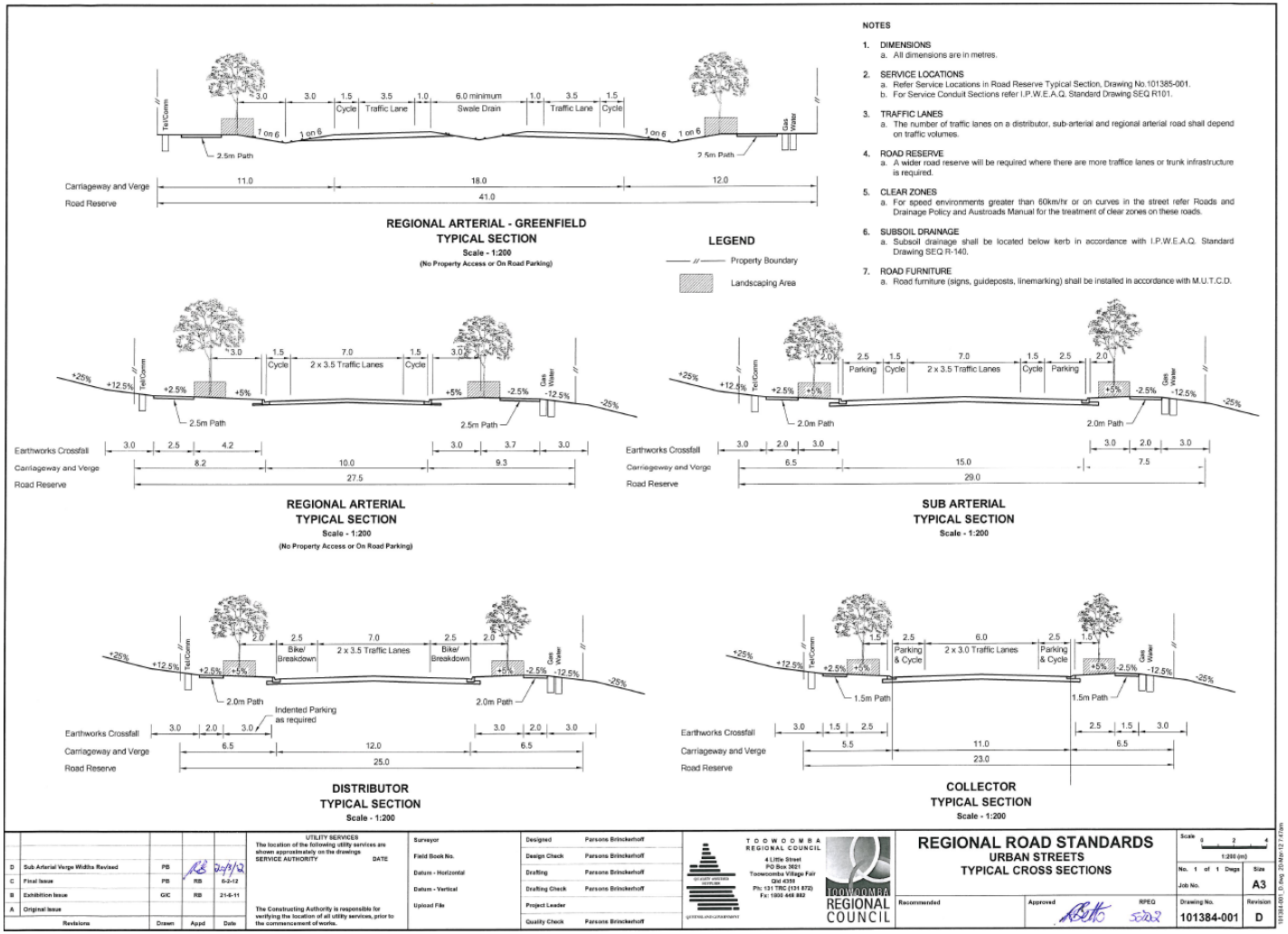
SC6.2.9.5.3 SEQ R-056 Driveways – Rural Driveway – TRC Amendments

Functional Element Road Category)	Bitumen Sealing Requirements for Access	Minimum Standard Pavement Type
Regional Arterial	To property boundary	Type 3.1
Sub-Arterial, Distributor	To TP of turnout	Type 3.2
Collector, Local Access Bitumen Sealed	1m outside shoulder point	Type 3.3
Local Access Gravel	Not required	Type 4

1 *Proprietary precast headwalls including sloping headwalls are acceptable. A reinforced concrete cutoff wall, (minimum: depth 600mm, thickness 100mm) is to be constructed to the invert of the headwall to ensure the headwall stays in place.*
2 *Driveway long section grades are minimum standard and may be adjusted in accordance with the AUSTROADS template.*
3 *Gate to be located to ensure vehicle entering property (including heavy vehicles) do not have to stop on road while gate is being opened.*
4 *Reinforced Concrete Box Culverts (RCBC) may be used where site conditions are not satisfactory to install circular pipes. Culvert size to have equivalent cross sectional area as shown in the pipe size table. Minimum size of RCBC is to be 450mm *300mm.*
5 *Minimum culvert grade to be 1%.*
6 *Rock protection to be used in scour prone material and on steep grades.*
7 *All infrastructure are to be relocated clear of all works in accordance with the requirements of the owner of the infrastructure.*
8 *Council takes no responsibility for any vehicle scraping when using a driveway. The property owner should ensure that adequate clearance is provided prior to the placement of concrete or bitumen surfacing.*

Please Note: the following drawings are not to scale

Diagram 101384-001



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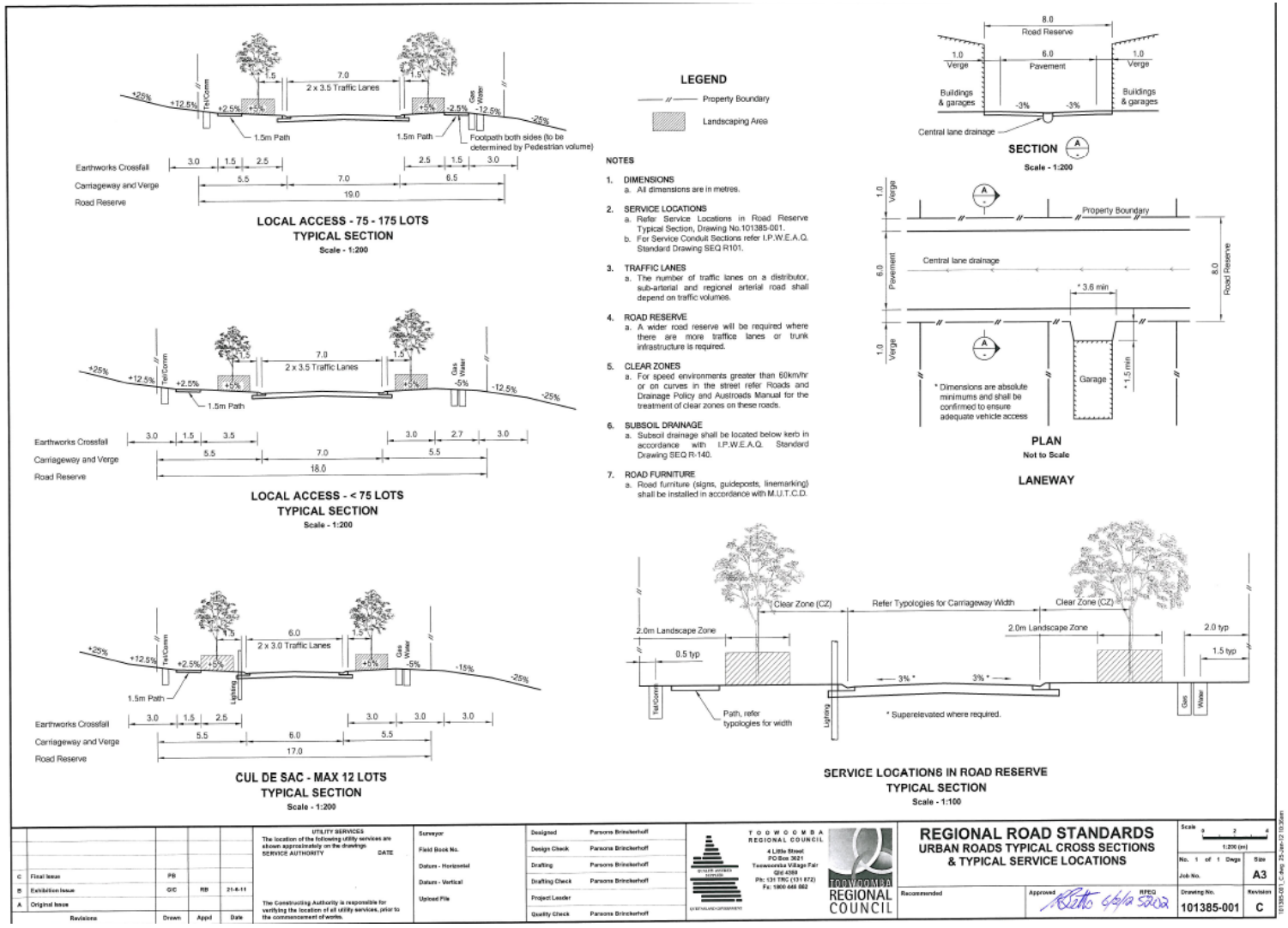
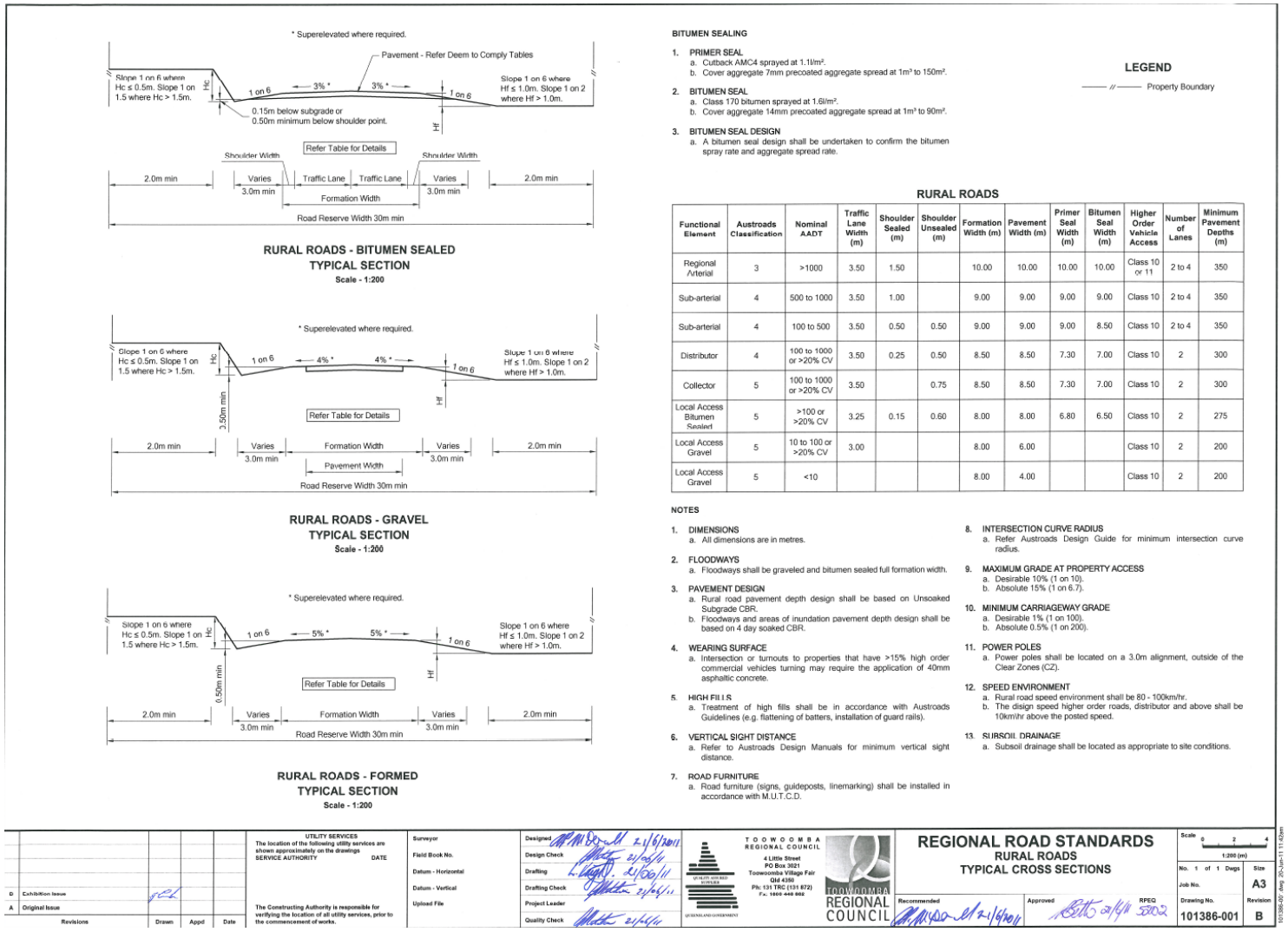


Diagram 101386-001 (not to scale)



BITUMEN SEALING

1. **PRIMER SEAL**
   a. Cutback AMC4 sprayed at 1.1l/m².
   b. Cover aggregate 7mm precoated aggregate spread at 1m³ to 150m².
2. **BITUMEN SEAL**
   a. Class 170 bitumen sprayed at 1.6l/m².
   b. Cover aggregate 14mm precoated aggregate spread at 1m³ to 90m².
3. **BITUMEN SEAL DESIGN**
   a. A bitumen seal design shall be undertaken to confirm the bitumen spray rate and aggregate spread rate.

LEGEND

—— // —— Property Boundary

RURAL ROADS

Functional Element	Austroads Classification	Nominal AADT	Traffic Lane Width (m)	Shoulder Sealed (m)	Shoulder Unsealed (m)	Formation Width (m)	Pavement Width (m)	Primer Seal Width (m)	Bitumen Seal Width (m)	Higher Order Vehicle Access	Number of Lanes	Minimum Pavement Depths (m)
Regional Arterial	3	>1000	3.50	1.50		10.00	10.00	10.00	10.00	Class 10 or 11	2 to 4	350
Sub-arterial	4	500 to 1000	3.50	1.00		9.00	9.00	9.00	9.00	Class 10	2 to 4	350
Sub-arterial	4	100 to 500	3.50	0.50	0.50	9.00	9.00	9.00	8.50	Class 10	2 to 4	350
Distributor	4	100 to 1000 or >20% CV	3.50	0.25	0.50	8.50	8.50	7.30	7.00	Class 10	2	300
Collector	5	100 to 1000 or >20% CV	3.50		0.75	8.50	8.50	7.30	7.00	Class 10	2	300
Local Access Bitumen Sealed	5	>100 or >20% CV	3.25	0.15	0.60	8.00	8.00	6.80	6.50	Class 10	2	275
Local Access Gravel	5	10 to 100 or >20% CV	3.00			8.00	6.00			Class 10	2	200
Local Access Gravel	5	<10				8.00	4.00			Class 10	2	200

NOTES

1. **DIMENSIONS**
   a. All dimensions are in metres.
2. **FLOODWAYS**
   a. Floodways shall be graveled and bitumen sealed full formation width.
3. **PAVEMENT DESIGN**
   a. Rural road pavement depth design shall be based on Unsoaked Subgrade CBR.
   b. Floodways and areas of inundation pavement depth design shall be based on 4 day soaked CBR.
4. **WEARING SURFACE**
   a. Intersection or turnouts to properties that have >15% high order commercial vehicles turning may require the application of 40mm asphaltic concrete.
5. **HIGH FILLS**
   a. Treatment of high fills shall be in accordance with Austroads Guidelines (e.g. flattening of batters, installation of guard rails).
6. **VERTICAL SIGHT DISTANCE**
   a. Refer to Austroads Design Manuals for minimum vertical sight distance.
7. **ROAD FURNITURE**
   a. Road furniture (signs, guideposts, linemarking) shall be installed in accordance with M.U.T.C.D.
8. **INTERSECTION CURVE RADIUS**
   a. Refer Austroads Design Guide for minimum intersection curve radius.
9. **MAXIMUM GRADE AT PROPERTY ACCESS**
   a. Desirable 10% (1 on 10).
   b. Absolute 15% (1 on 6.7).
10. **MINIMUM CARRIAGEWAY GRADE**
    a. Desirable 1% (1 on 100).
    b. Absolute 0.5% (1 on 200).
11. **POWER POLES**
    a. Power poles shall be located on a 3.0m alignment, outside of the Clear Zones (CZ).
12. **SPEED ENVIRONMENT**
    a. Rural road speed environment shall be 80 - 100km/hr.
    b. The disign speed higher order roads, distributor and above shall be 10km\hr above the posted speed.
13. **SUBSOIL DRAINAGE**
    a. Subsoil drainage shall be located as appropriate to site conditions.

D Exhibition Issue
A Original Issue
Revisions | Drawn | Appd | Date

UTILITY SERVICES
The location of the following utility services are shown approximately on the drawings
SERVICE AUTHORITY DATE
The Constructing Authority is responsible for verifying the location of all utility services, prior to the commencement of works.

Surveyor
Field Book No.
Datum - Horizontal
Datum - Vertical
Upload File
Designed 21/6/2011
Design Check
Drafting 21/06/11
Drafting Check
Project Leader
Quality Check

TOOWOOMBA REGIONAL COUNCIL
4 Little Street
PO Box 3021
Toowoomba Village Fair
Qld 4350
Ph: 131 TRC (131 872)
Fx: 1800 466 882

REGIONAL ROAD STANDARDS
RURAL ROADS
TYPICAL CROSS SECTIONS

Recommended
Approved 21/6/11
RPEQ 5802

Scale 0 2 4 1:200 (m)
No. 1 of 1 Dwgs
Job No.
Size A3
Drawing No. 101386-001
Revision B

101386-001.dwg 20-Jun-11 11:43am

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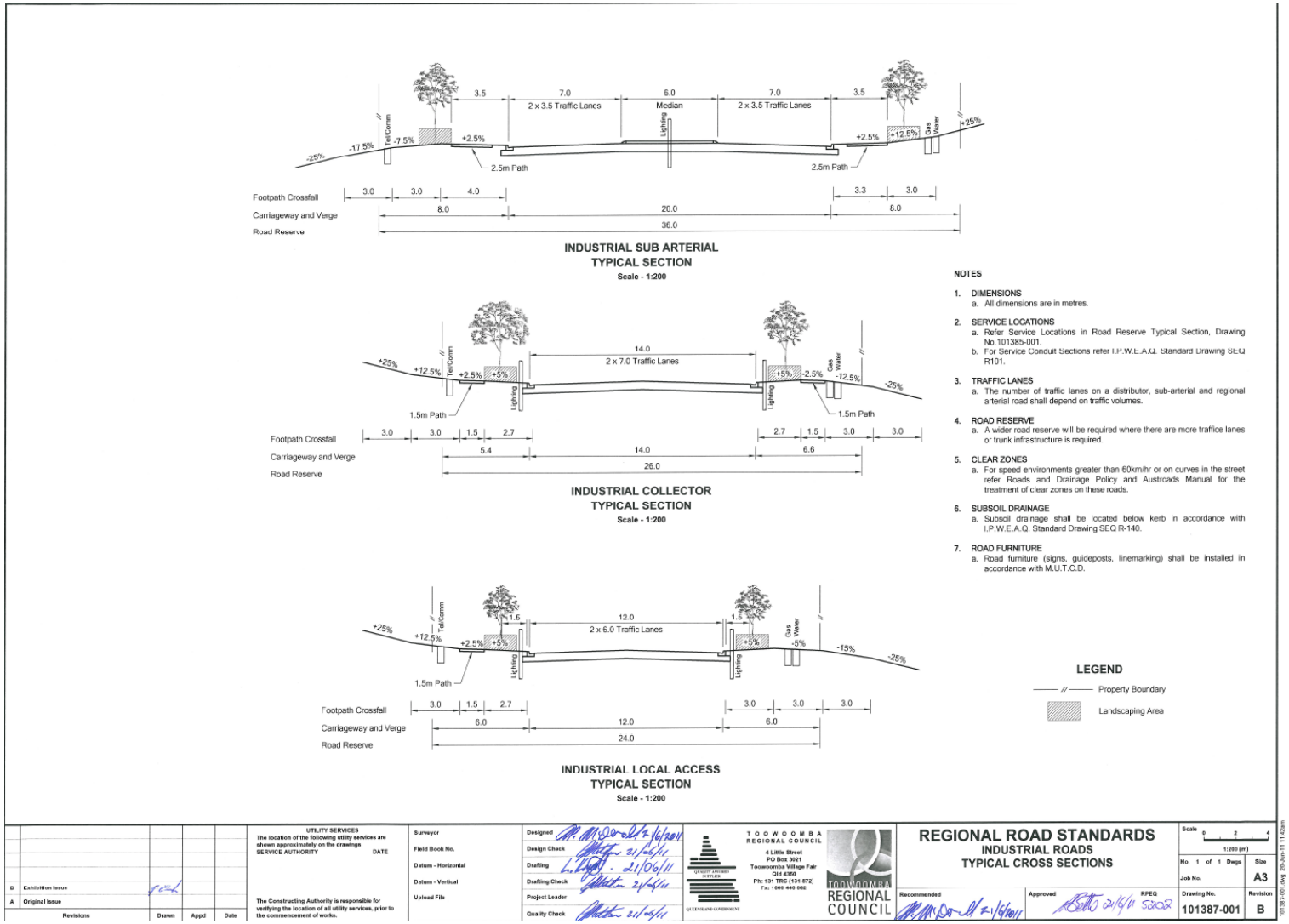

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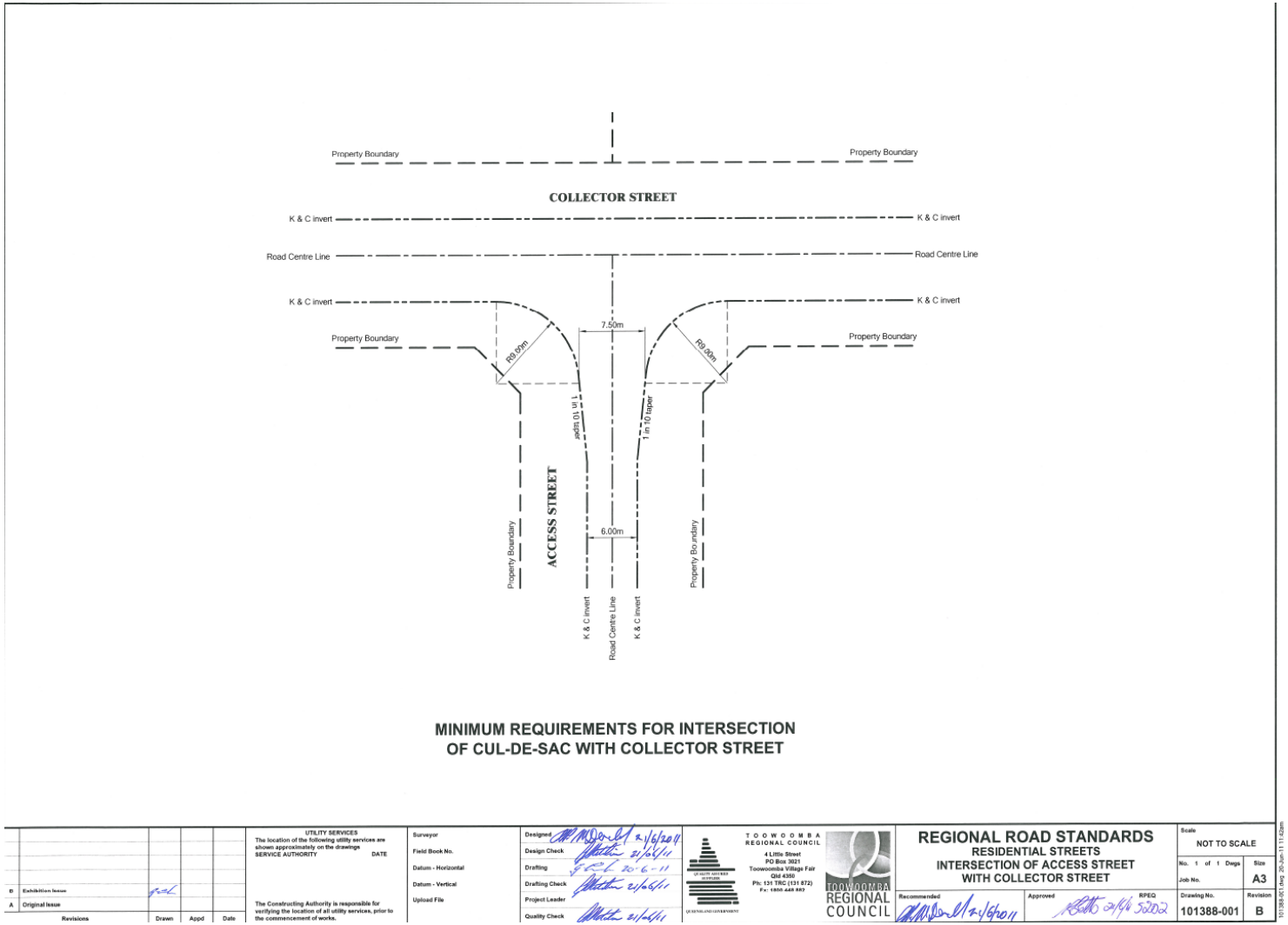

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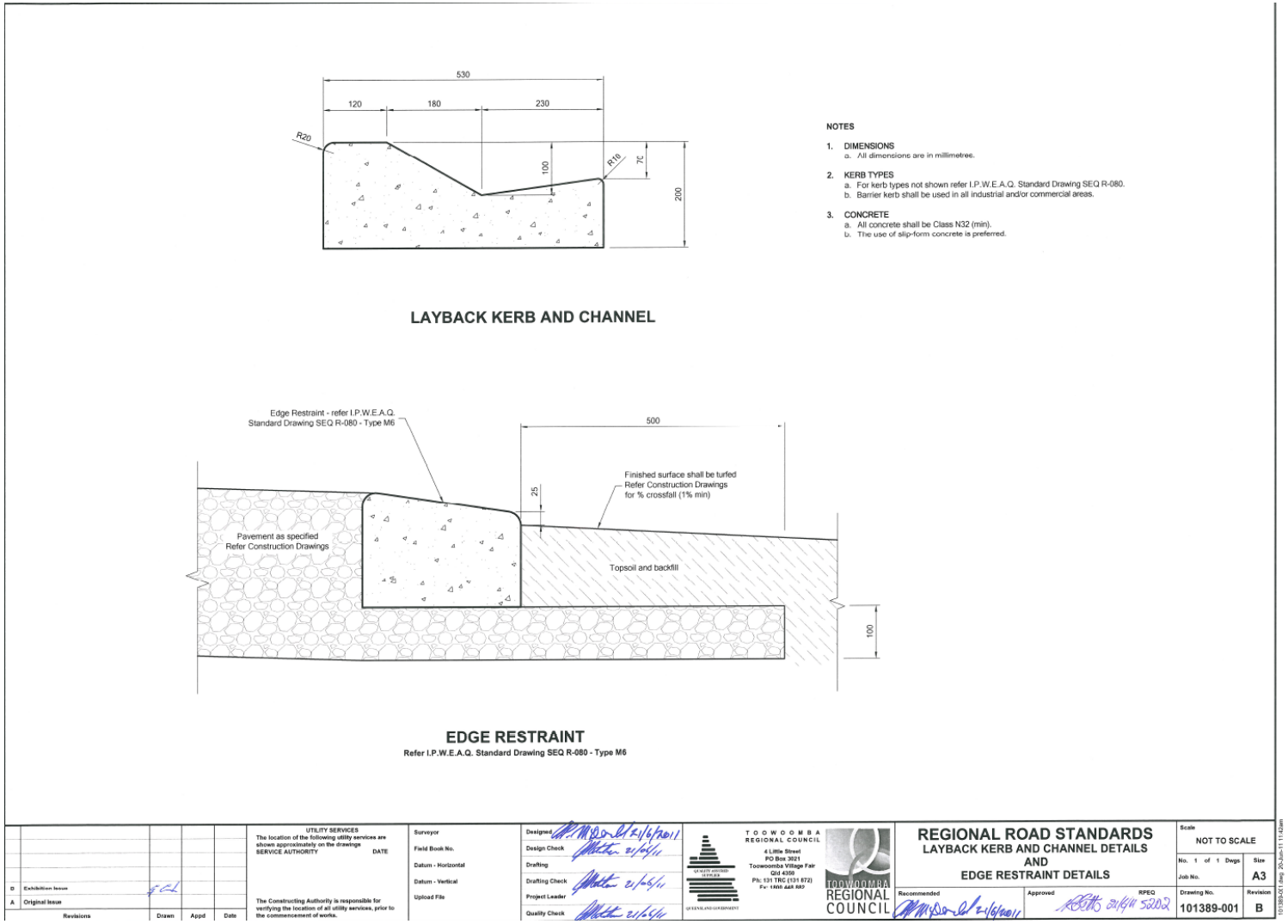

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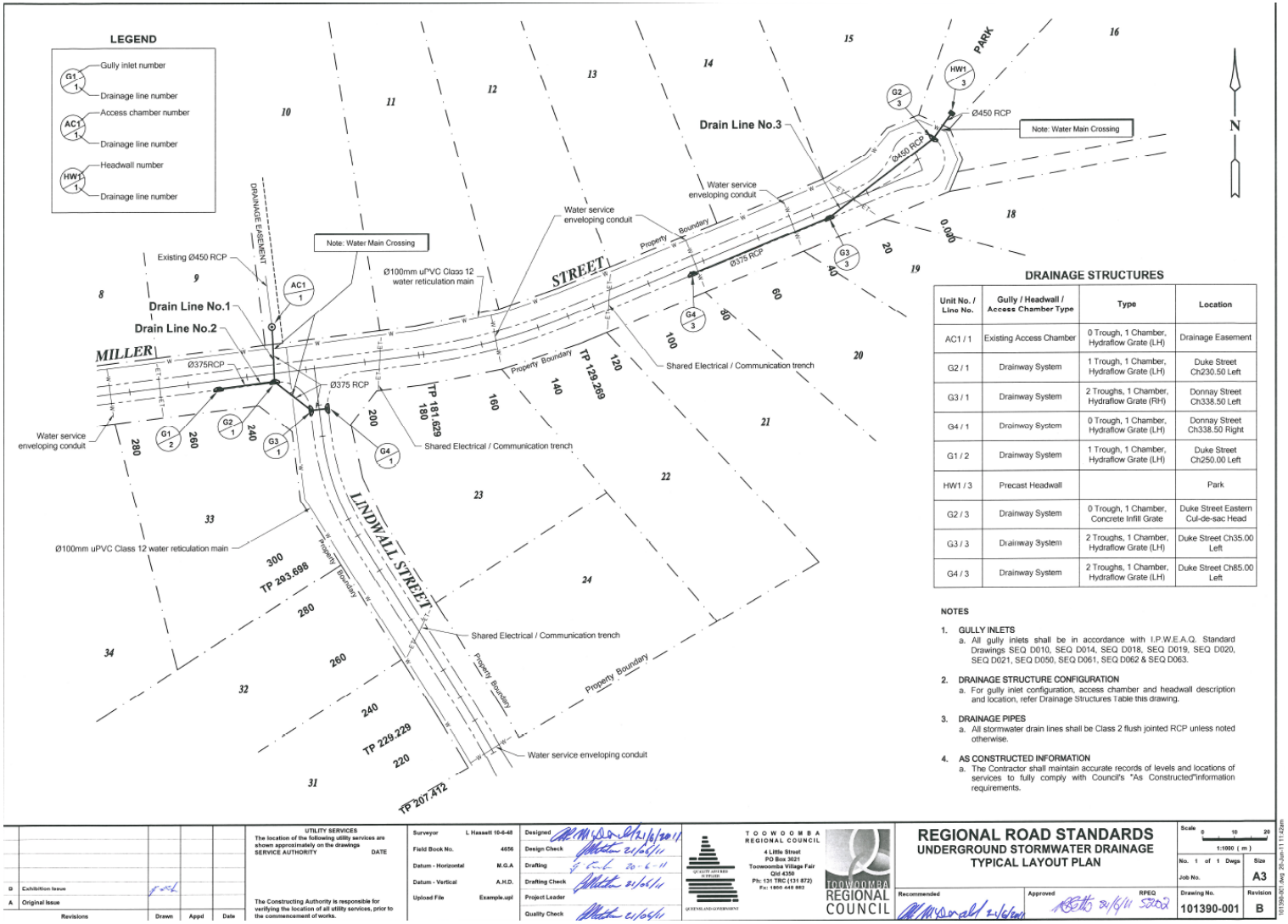
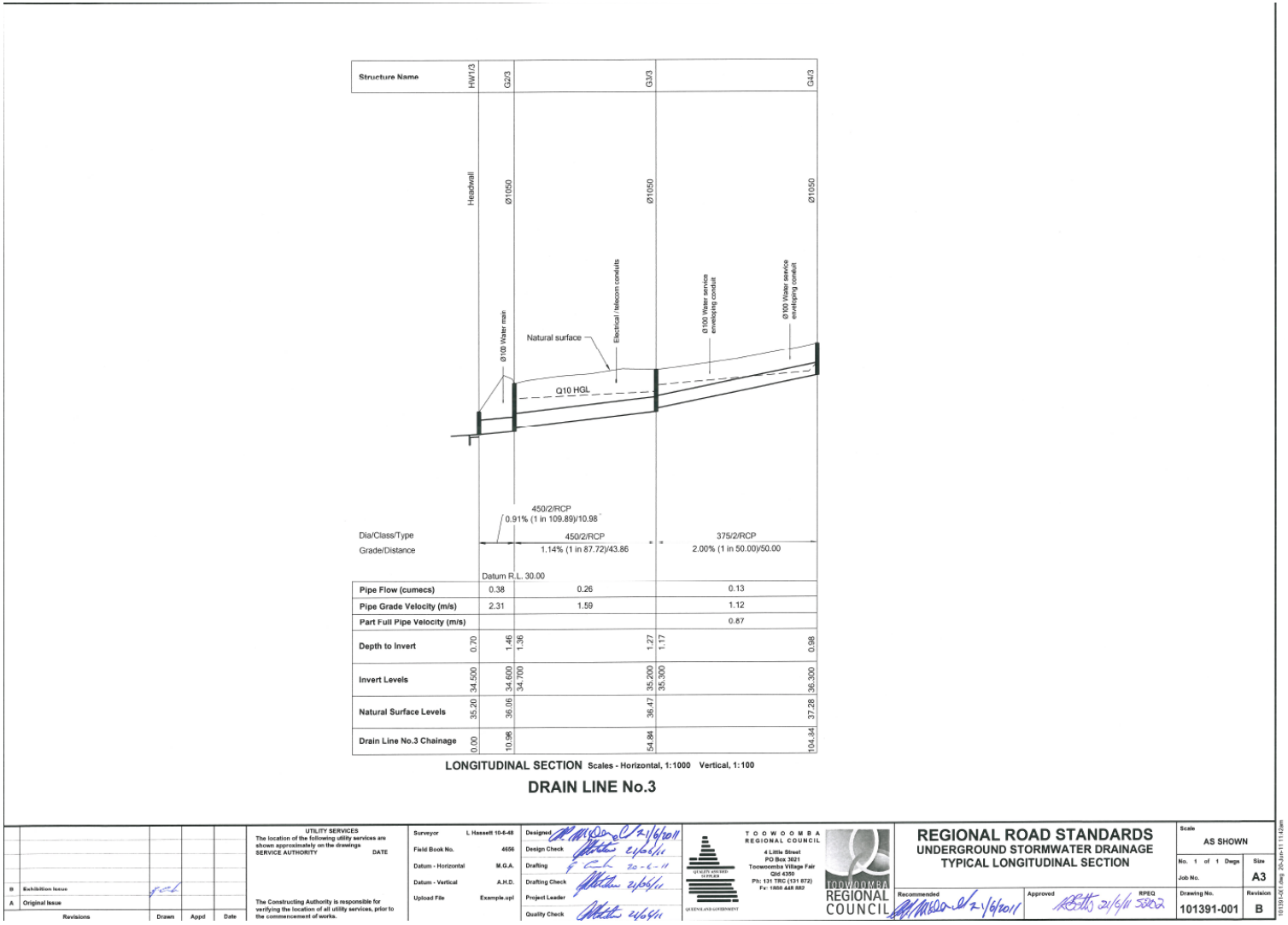


Unit No. / Line No.	Gully / Headwall / Access Chamber Type	Type	Location
AC1 / 1	Existing Access Chamber	0 Trough, 1 Chamber, Hydraflow Grate (LH)	Drainage Easement
G2 / 1	Drainway System	1 Trough, 1 Chamber, Hydraflow Grate (LH)	Duke Street Ch230.50 Left
G3 / 1	Drainway System	2 Troughs, 1 Chamber, Hydraflow Grate (RH)	Donnay Street Ch338.50 Left
G4 / 1	Drainway System	0 Trough, 1 Chamber, Hydraflow Grate (LH)	Donnay Street Ch338.50 Right
G1 / 2	Drainway System	1 Trough, 1 Chamber, Hydraflow Grate (LH)	Duke Street Ch250.00 Left
HW1 / 3	Precast Headwall		Park
G2 / 3	Drainway System	0 Trough, 1 Chamber, Concrete Infill Grate	Duke Street Eastern Cul-de-sac Head
G3 / 3	Drainway System	2 Troughs, 1 Chamber, Hydraflow Grate (LH)	Duke Street Ch35.00 Left
G4 / 3	Drainway System	2 Troughs, 1 Chamber, Hydraflow Grate (LH)	Duke Street Ch85.00 Left

Diagram 101391-001 (not to scale)



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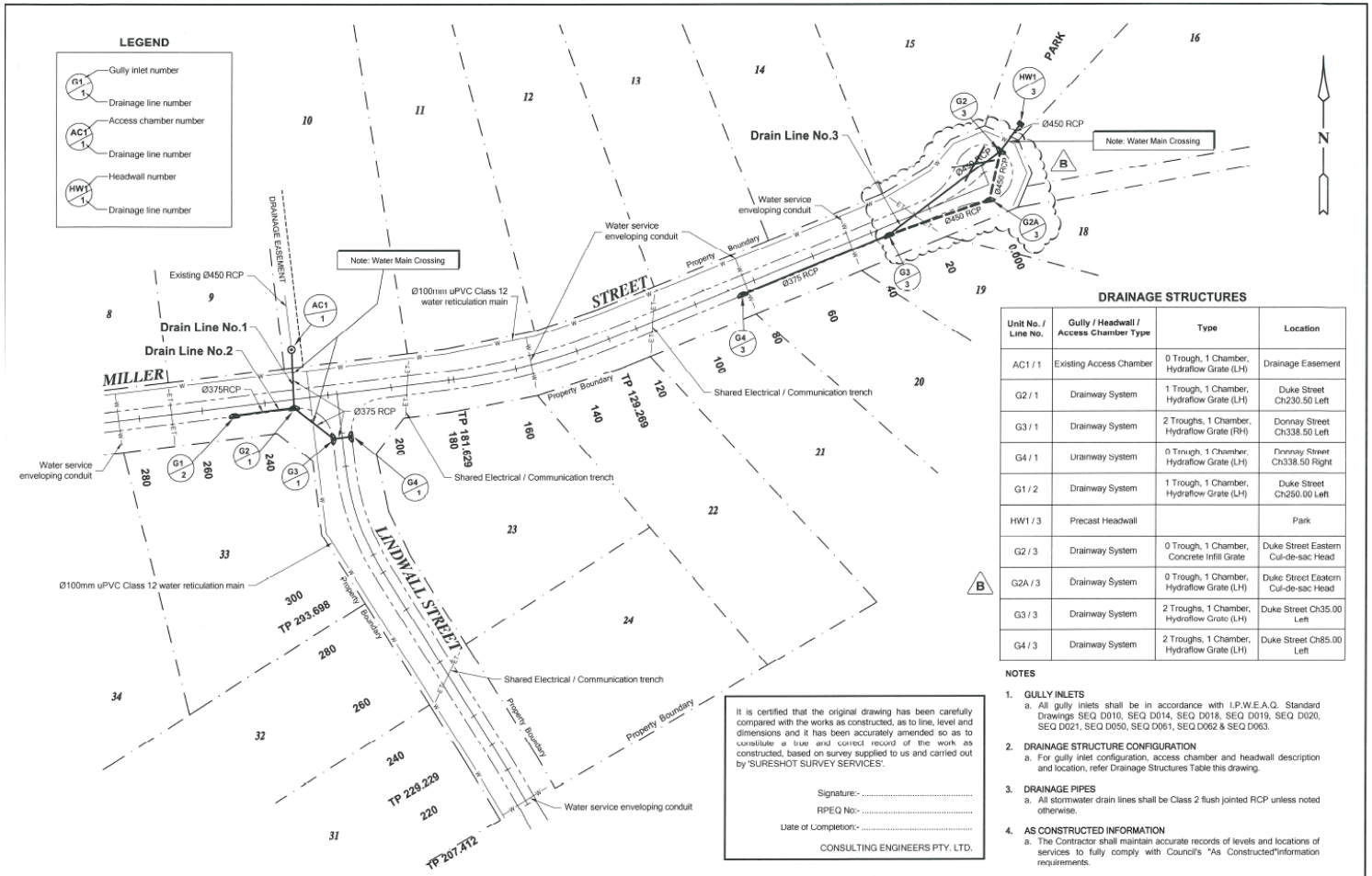

Unit No. / Line No.	Gully / Headwall / Access Chamber Type	Type	Location
AC1 / 1	Existing Access Chamber	0 Trough, 1 Chamber, Hydraflow Grate (LH)	Drainage Easement
G2 / 1	Drainway System	1 Trough, 1 Chamber, Hydraflow Grate (LH)	Duke Street Ch230.50 Left
G3 / 1	Drainway System	2 Troughs, 1 Chamber, Hydraflow Grate (RH)	Donnay Street Ch338.50 Left
G4 / 1	Drainway System	0 Trough, 1 Chamber, Hydraflow Grate (LH)	Donnay Street Ch338.50 Right
G1 / 2	Drainway System	1 Trough, 1 Chamber, Hydraflow Grate (LH)	Duke Street Ch260.00 Left
HW1 / 3	Precast Headwall		Park
G2 / 3	Drainway System	0 Trough, 1 Chamber, Concrete Infill Grate	Duke Street Eastern Cul-de-sac Head
G2A / 3	Drainway System	0 Trough, 1 Chamber, Hydraflow Grate (LH)	Duke Street Eastern Cul-de-sac Head
G3 / 3	Drainway System	2 Troughs, 1 Chamber, Hydraflow Grate (LH)	Duke Street Ch35.00 Left
G4 / 3	Drainway System	2 Troughs, 1 Chamber, Hydraflow Grate (LH)	Duke Street Ch85.00 Left

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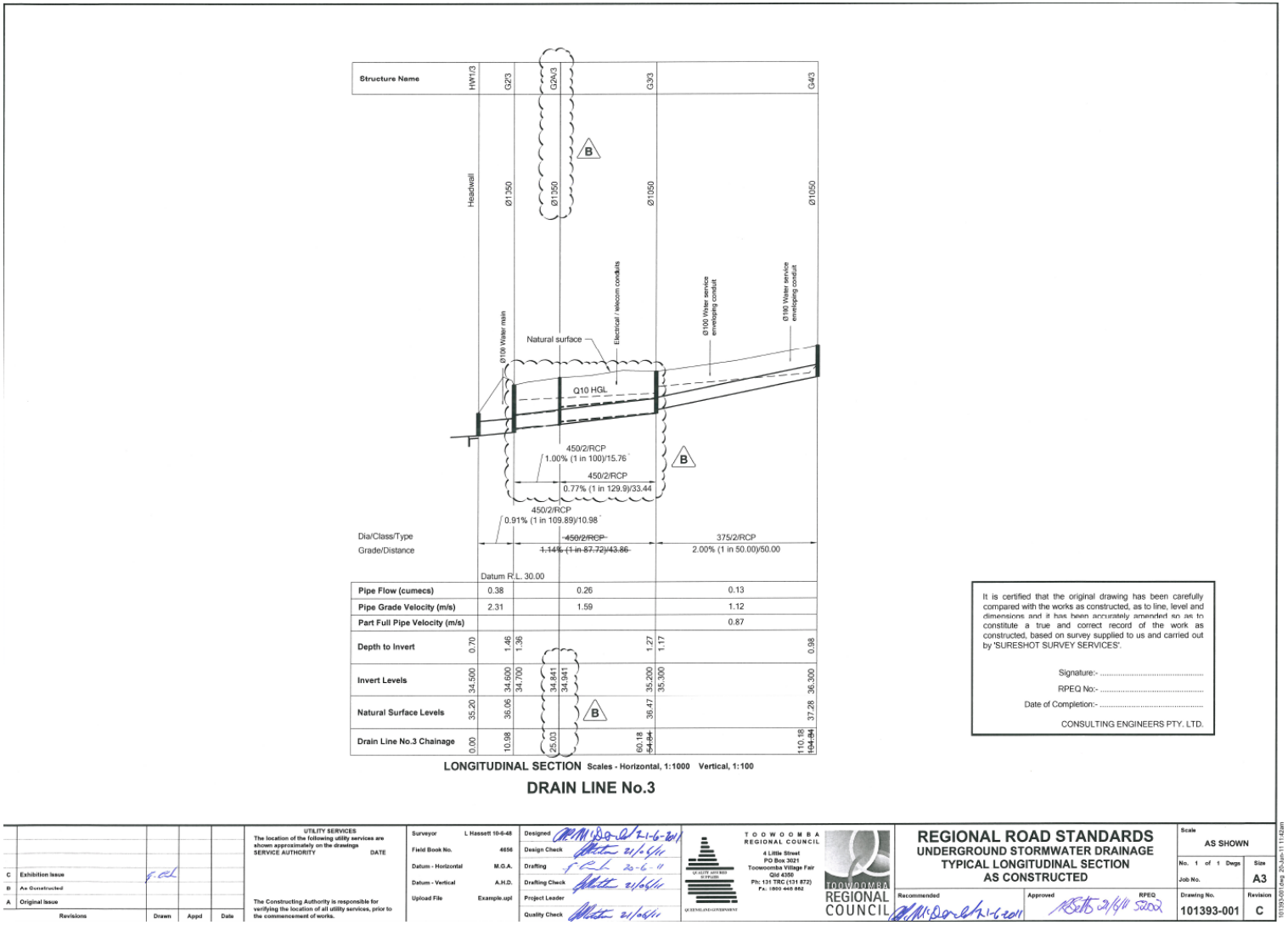

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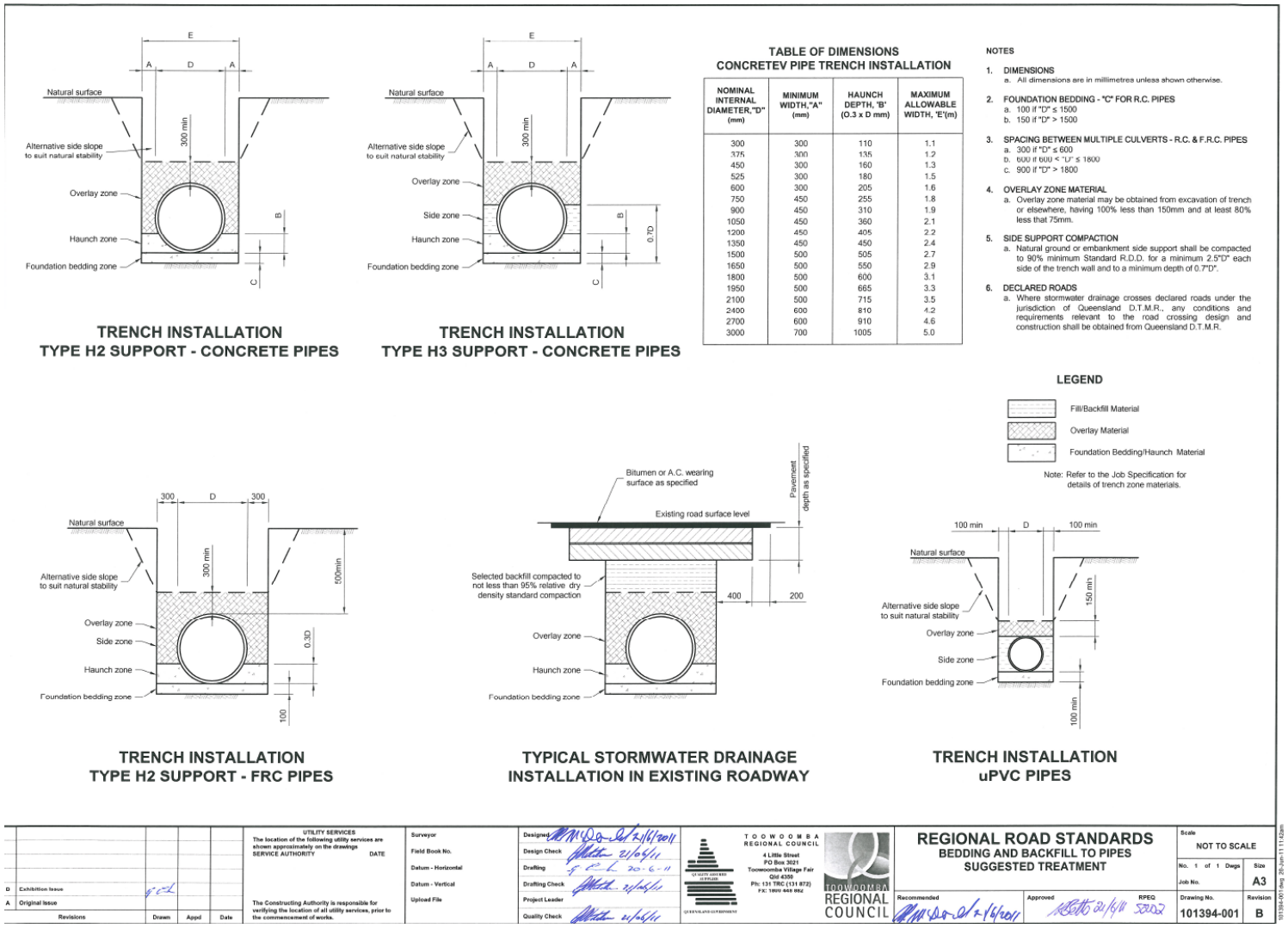

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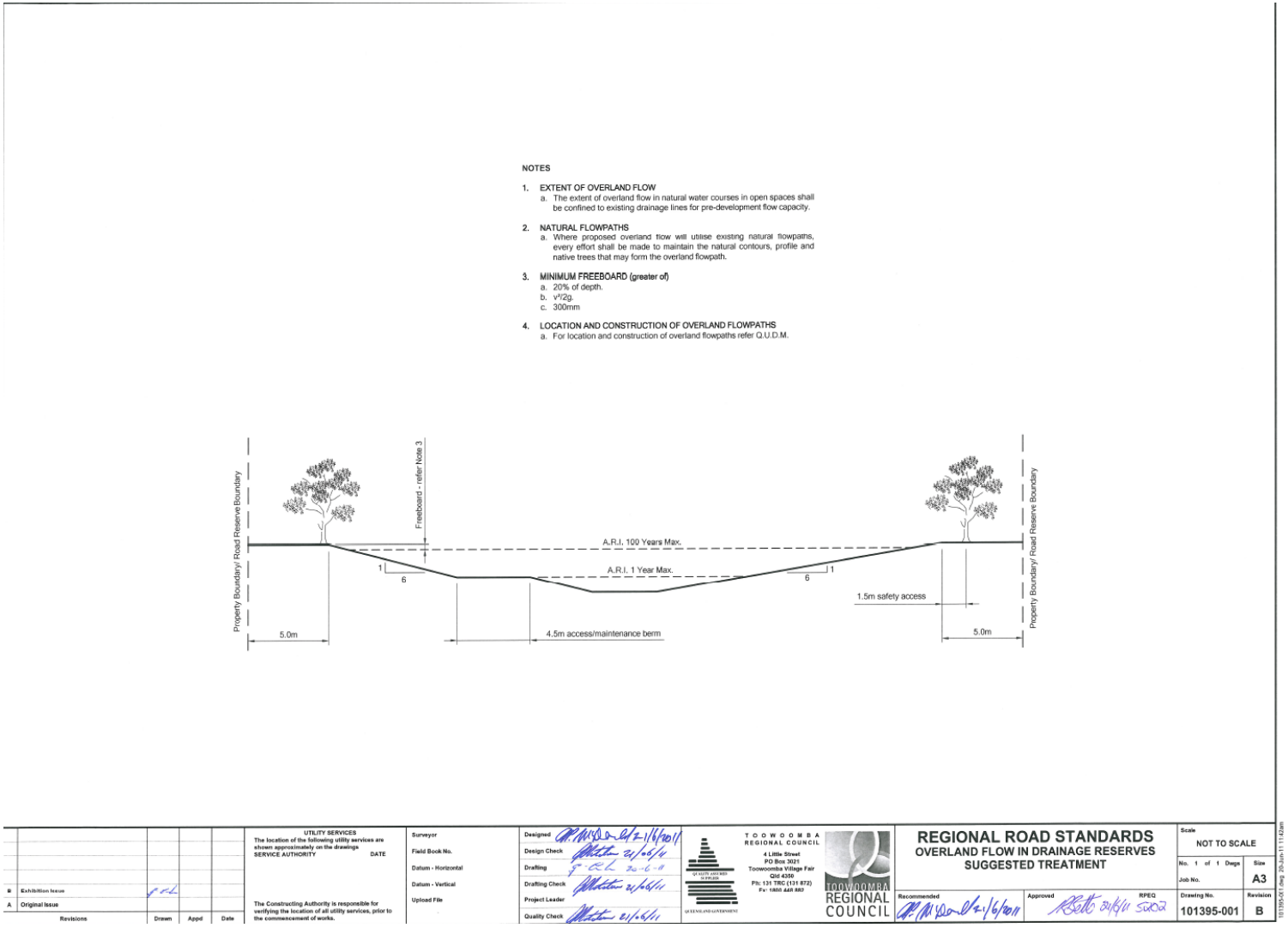

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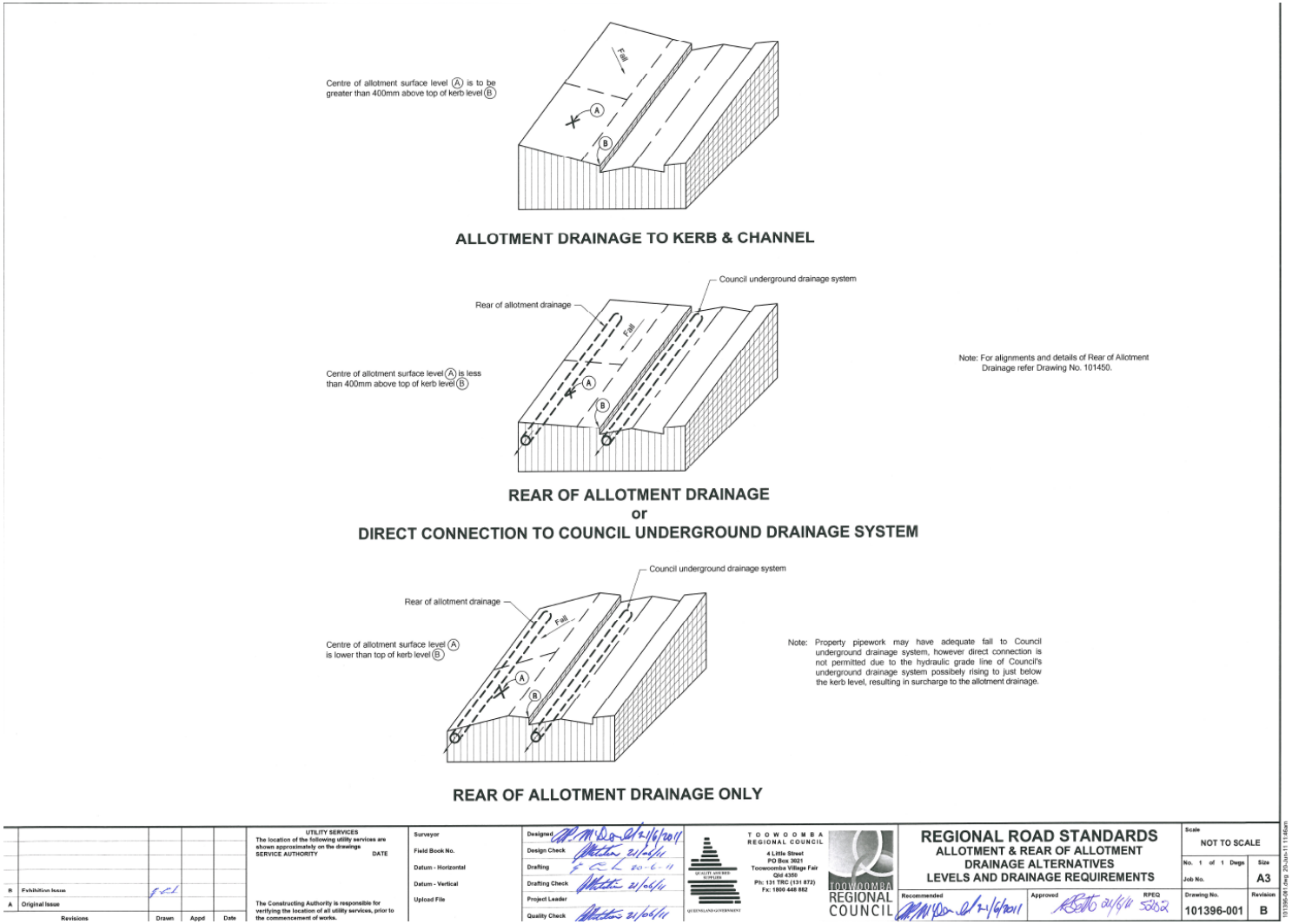

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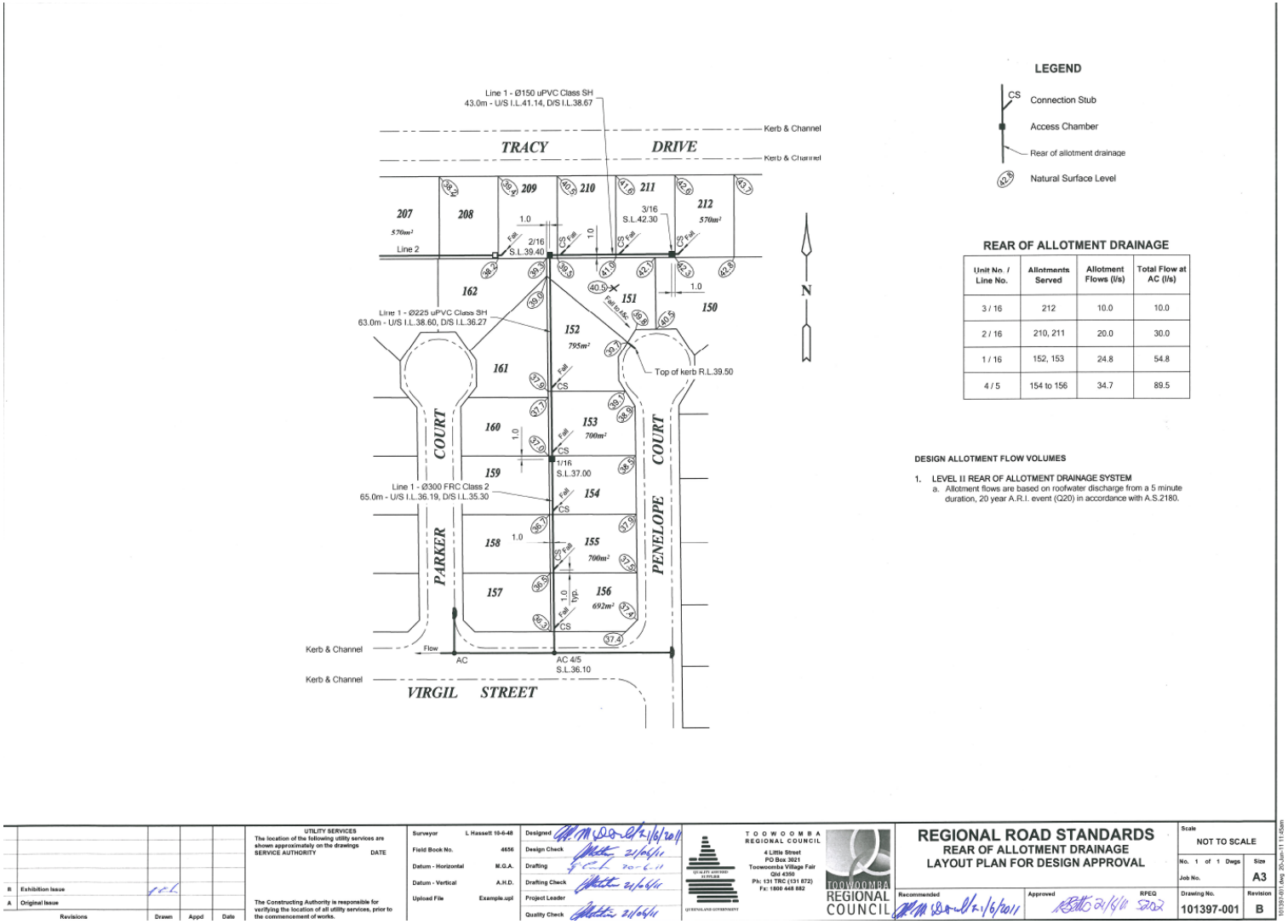
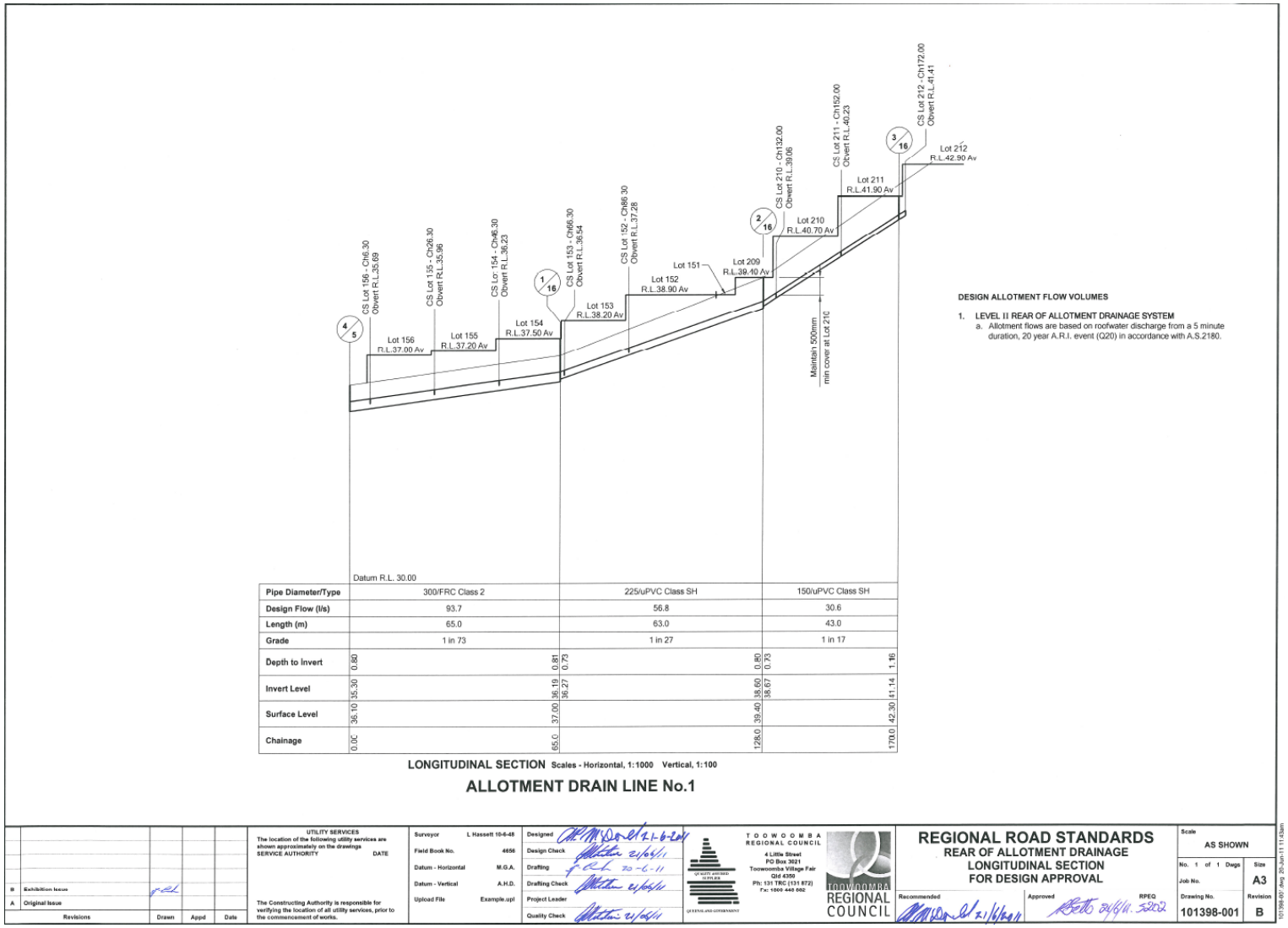


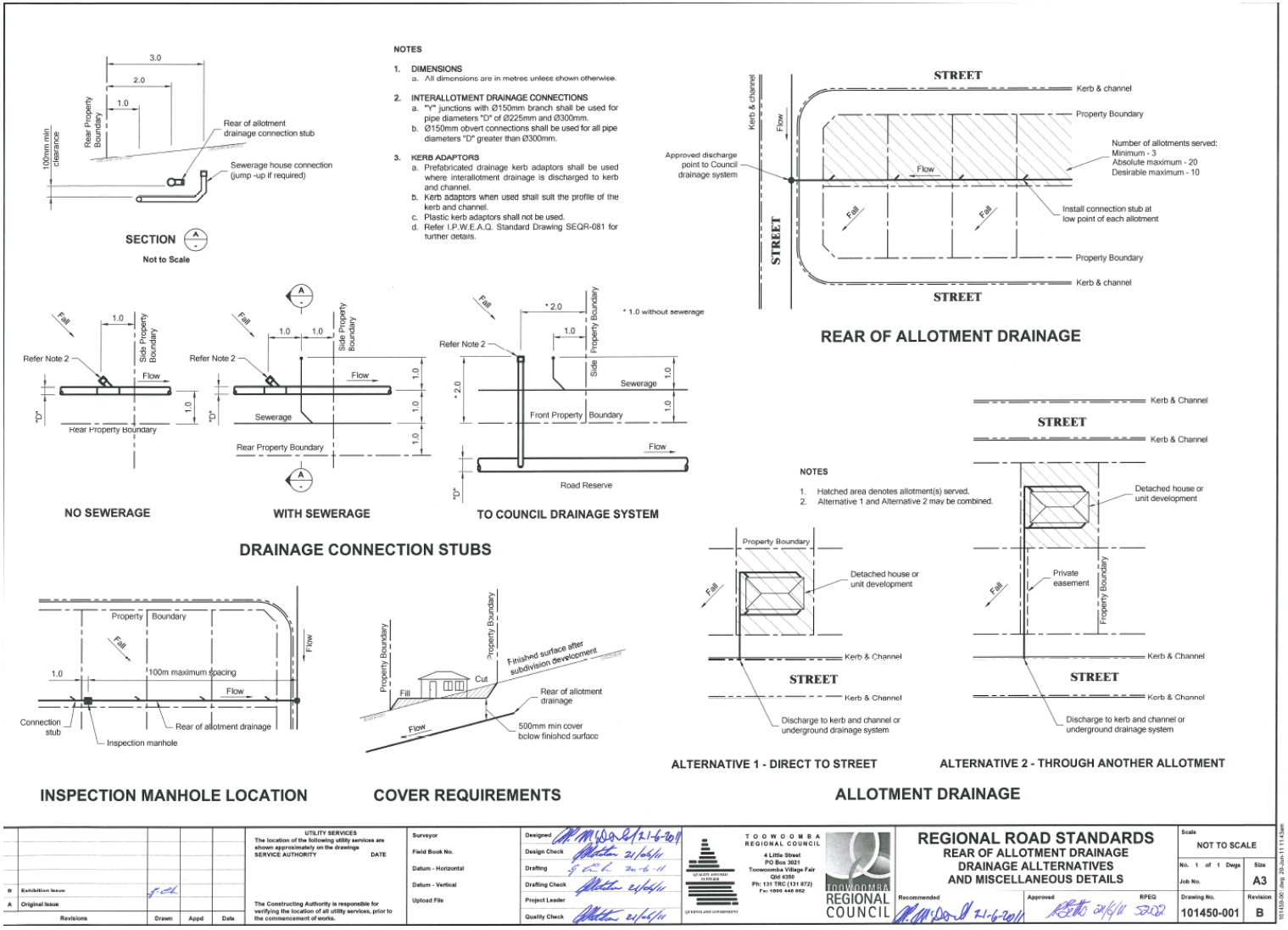
Unit No. / Line No.	Allotments Served	Allotment Flows (l/s)	Total Flow at AC (l/s)
3 / 16	212	10.0	10.0
2 / 16	210, 211	20.0	30.0
1 / 16	152, 153	24.8	54.8
4 / 5	154 to 156	34.7	89.5

Diagram 101398-001 (not to scale)



Pipe Diameter/Type	300/FRC Class 2		225/uPVC Class SH		150/uPVC Class SH	
Design Flow (l/s)	93.7		56.8		30.6	
Length (m)	65.0		63.0		43.0	
Grade	1 in 73		1 in 27		1 in 17	
Depth to Invert	0.80	0.81	0.73	0.80	0.73	1.16
Invert Level	35.30	36.19	36.27	38.60	38.67	41.14
Surface Level	36.10	37.00	39.40	42.30		
Chainage	0.00	65.0	126.0	170.0		

Diagram 101450-001 (not to scale)



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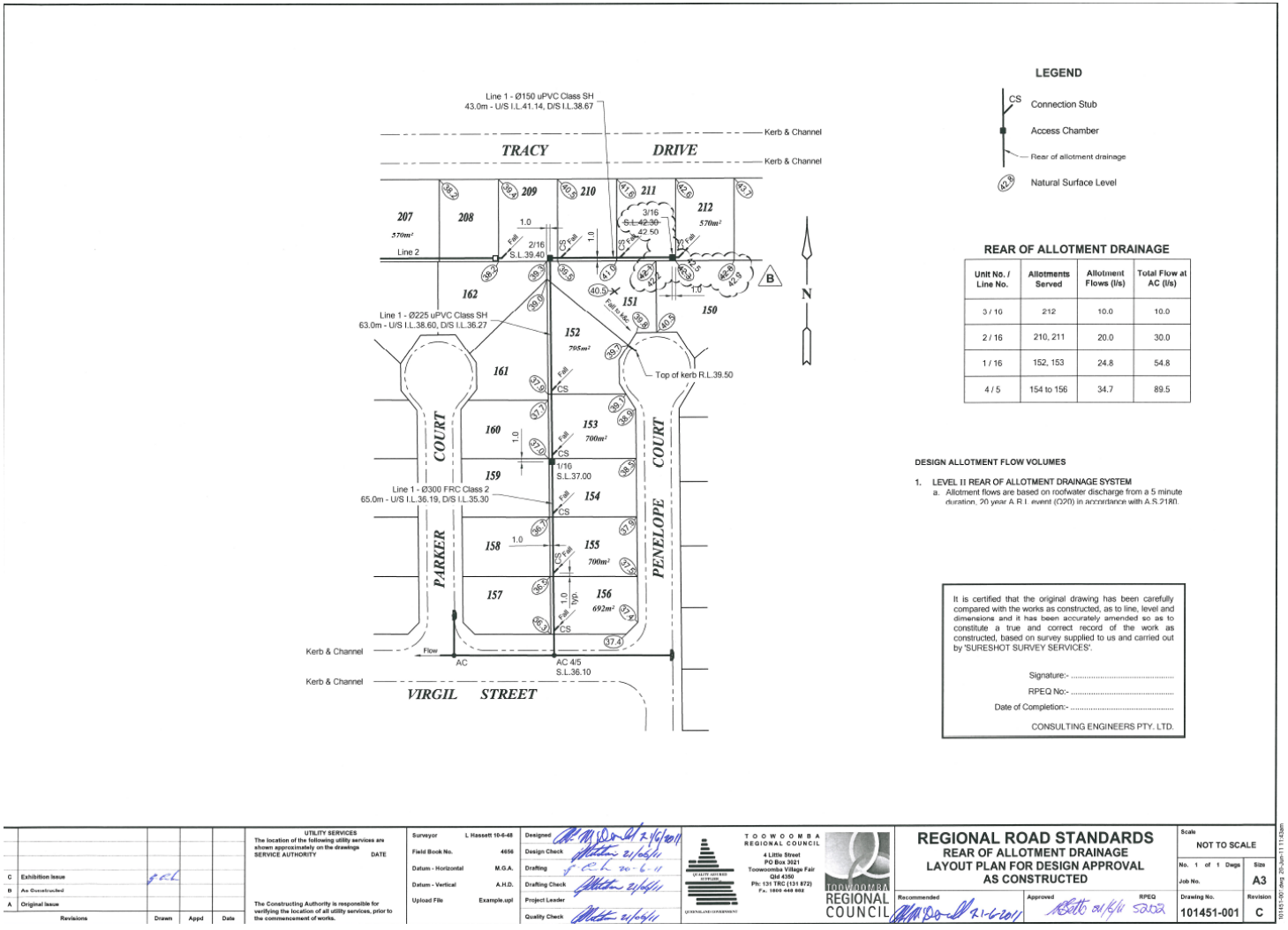


LEGEND

- CS — Connection Stub
- Access Chamber
- Rear of allotment drainage
- Natural Surface Level

REAR OF ALLOTMENT DRAINAGE

Unit No. / Line No.	Allotments Served	Allotment Flows (l/s)	Total Flow at AC (l/s)
3 / 16	212	10.0	10.0
2 / 16	210, 211	20.0	30.0
1 / 16	152, 153	24.8	54.8
4 / 5	154 to 156	34.7	89.5

DESIGN ALLOTMENT FLOW VOLUMES

1. LEVEL II REAR OF ALLOTMENT DRAINAGE SYSTEM
   a. Allotment flows are based on roofwater discharge from a 5 minute duration, 20 year A.R.I. event (Q20) in accordance with A.S.2180.

It is certified that the original drawing has been carefully compared with the works as constructed, as to line, level and dimensions and it has been accurately amended so as to constitute a true and correct record of the work as constructed, based on survey supplied to us and carried out by 'SURESHOT SURVEY SERVICES'.

Signature:- .....
RPEQ No:- .....
Date of Completion:- .....
CONSULTING ENGINEERS PTY. LTD.

C	Exhibition Issue			
B	As Constructed			
A	Original Issue			
Revisions		Drawn	Appd	Date

UTILITY SERVICES
The location of the following utility services are shown approximately on the drawings
SERVICE AUTHORITY DATE

The Constructing Authority is responsible for verifying the location of all utility services, prior to the commencement of works.

Surveyor	L Hassett 10-6-48
Field Book No.	4656
Datum - Horizontal	M.G.A.
Datum - Vertical	A.H.D.
Upload File	Example.upl

Designed	21/6/11
Design Check	21/6/11
Drafting	20-6-11
Drafting Check	21/6/11
Project Leader	
Quality Check	21/6/11

TOOWOOMBA REGIONAL COUNCIL
4 Little Street
PO Box 3021
Toowoomba Village Fair
Qld 4350
Ph: 131 872 (131 872)
Fx. 1800 648 882

TOOWOOMBA REGIONAL COUNCIL

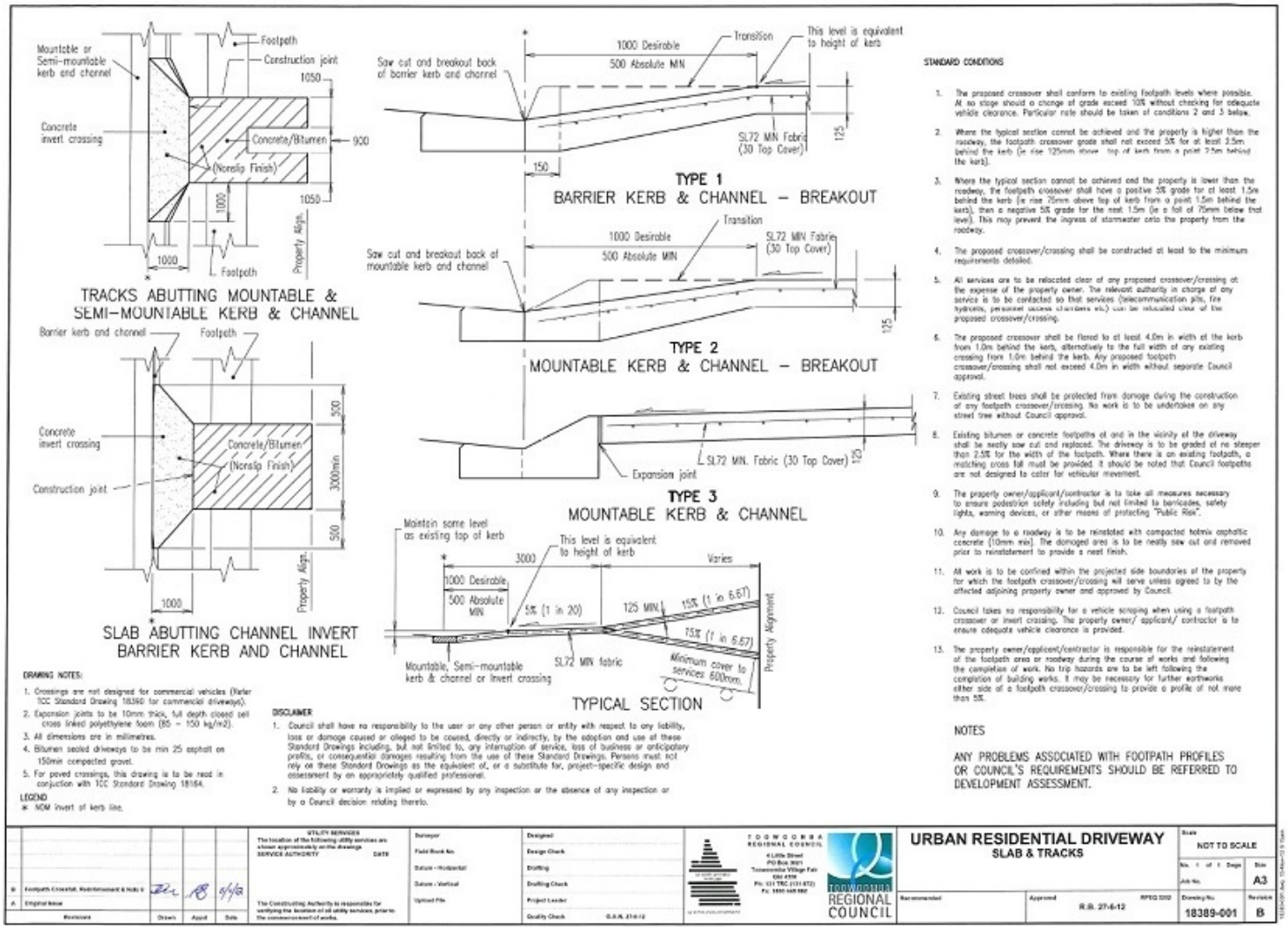
REGIONAL ROAD STANDARDS
REAR OF ALLOTMENT DRAINAGE
LAYOUT PLAN FOR DESIGN APPROVAL
AS CONSTRUCTED

Recommended 21-6-2011 Approved 21/6/11 RPEQ

Scale	NOT TO SCALE
No. 1 of 1 Dwgs	Size A3
Job No.	
Drawing No.	101451-001
Revision	C

101451-001.dwg 20-Jun-11 11:43am

Diagram 18389-001B (not to scale)



SC6.2.9.6 Development Project Quality Plans (Examples)

SC6.2.9.6.1 Development Works Project Quality Plan – Roadworks (Works by Contractors)

Location of Work: _____

Developer: _____

Contractor: _____

Reference: _____ Lot No.: _____

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		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

No.	Activity	Method	Frequency	Quality Requirements	Test Confirmation				Remarks by Contractor or Engineer
					Contractor		Engineer		
					Sign	Date	Sign	Date	
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	Fill to 300mm below Subgrade	Cart in approved fill material	Each Lot	Maximum of 300mm layers					
9	Perform compaction tests on embankment material	Soil tester	As required by specification Minimum 1 test per 250m^3 or part thereof	Testing by NATA approved laboratory - 95% MDD					HOLD POINT
10	Excavate to Subgrade	Excavate to required pavement box depth	Each Lot	Avoid over excavation, Stormwater drainage to be diverted from box					
11	Perform CBR tests on subgrade material to confirm pavement depth	Soil tester	Roads <120m – 3 tests Roads > 120m 1 test every 50m	Testing by NATA approved laboratory. Refer to Policy – Roads and Drainage.					HOLD POINT
Confirmation of pavement design by Toowoomba Regional Council prior to proceeding to activity 12. **COUNCIL REP. SIGN _____ DATE _____**									

No.	Activity	Method	Frequency	Quality Requirements	Test Confirmation				Remarks by Contractor or Engineer
					Contractor		Engineer		
					Sign	Date	Sign	Date	
12	Check box depth and width	Check at key grid points with level	10m intervals and change of road profiles	Tolerances: Vertical +0mm, -25mm Horizontal +150mm, -50mm					HOLD POINT
13	Perform compaction tests on Subgrade	Soil tester	Roads <120m – 3 tests Roads >120m - 1 test every 50m	Testing by NATA approved laboratory - 97% MDD					HOLD POINT
Subgrade proof roll of Insitu material to be certified PASSED by Toowoomba Regional Council prior to proceeding to activity 14. **COUNCIL REP. SIGN _____ DATE _____**									
14	Add subgrade replacement and compact (if applicable)	Approved material and compaction equipment	As required	Tolerances: Vertical +0mm, -25mm Horizontal +150mm,-50mm					
15	Compaction of Subgrade Replacement material	Compaction Equipment as required	Following excavation or subgrade replacement	Minor vertical & horizontal displacement and rebound					
16	Subgrade Replacement Proof Roll by Contractor	Fully loaded 8t truck or equivalent	Following compaction	No vertical or horizontal displacement or rebound					
17	Subgrade Replacement 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
18	Subgrade Replacement Compaction Tests	In accordance with AS 1289	Roads <120m – 3 tests Roads >120m - 1 test every 50m	Minimum of 97% RDD MRS 11.04					HOLD POINT
Subgrade replacement proof roll to be certified 'passed' by Toowoomba Regional Council prior to proceeding to activity 19. **COUNCIL REP. SIGN _____ DATE _____**									

No.	Activity	Method	Frequency	Quality Requirements	Test Confirmation				Remarks by Contractor or Engineer
					Contractor		Engineer		
					Sign	Date	Sign	Date	
19	Mix, place, compact & trim lower subbase material and proof roll	In accordance with AS 1289	As detailed in Specification	No vertical or horizontal displacement or rebound					WITNESS POINT - COUNCIL TO BE NOTIFIED OF PROOF ROLL
20	Lower Subbase Compaction Tests	In accordance with AS 1289	Roads <120m – 3 tests Roads >120m - 1 test every 50m	Minimum of 100% RDD MRS 11.05					HOLD POINT
Council to be notified of proof roll. COUNCIL REP. SIGN _____ DATE _____ **Lower subbase compaction results and proof roll to be certified passed by Engineer prior to proceeding to activity 21.**									
21	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					WITNESS POINT - COUNCIL TO BE NOTIFIED OF PROOF ROLL
22	Subbase Compaction Tests	In accordance with AS 1289	Roads <120m – 3 tests Roads >120m 1 test every 50m	Minimum of 100% RDD MRS 11.05					HOLD POINT
Council to be notified of proof roll COUNCIL REP. SIGN _____ DATE _____ **Subbase compaction results and proof roll to be certified passed by Engineer prior to proceeding to activity 23.**									
23	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					

No.	Activity	Method	Frequency	Quality Requirements	Test Confirmation				Remarks by Contractor or Engineer
					Contractor		Engineer		
					Sign	Date	Sign	Date	
24	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					WITNESS POINT - COUNCIL TO BE NOTIFIED AT COMPLETION OF STRINGLINING
25	Extrude or pour kerb & Channel	As per specification	As required	Contraction joints to be formed within 30mins of pour, smooth finish					
26	Concrete strength cylinder testing	As per specification	1x 2 cylider test every 100m or part thereof	Results 20 MPA after 7 days and 32 MPA after 28days					WITNESS POINT- COUNCIL TO BE NOTIFIED WITHIN 5 DAYS OF RECEIVING 7 DAY TEST RESULTS
27	Check finished levels of kerb & channel	Survey, Visual	After each section pour	Tolerances: Vertical +10mm, -10mm Horizontal +10mm,-10mm					
28	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 Tolerances: Vertical +10mm, -5mm Horizontal- Crown +- 20mm Edge -25 +250					Note: Pavement Depth to be design depth.
29	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
30	Base course Compaction Tests	In accordance with AS 1289	Roads <120m – 3 tests Roads >120m 1 test every 50m	Minimum of 100% RDD MRS 11.05					HOLD POINT

No.	Activity	Method	Frequency	Quality Requirements	Test Confirmation				Remarks by Contractor or Engineer
					Contractor		Engineer		
					Sign	Date	Sign	Date	
31	Survey Checks for Road Cross Section	Survey	3 points/ 10m and profile changes	Vertical -5mm +10mm Horizontal- Crown +- 20mm Edge -25 +250					HOLD POINT
Basecourse compaction results, pavement depths, kerb and channel strength and quality and proof roll to be certified passed by Engineer prior to proceeding to activity 32. COUNCIL REP. SIGN _____ DATE _____ **Basecourse proof roll to be certified passed by Toowoomba Regional Council prior to proceeding to activity 32.**									
32	Broom and Prime finished pavement surface, or primer seal if directed by Engineer	Tractor Broom	As detailed in Specification	All loose & flaky 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 33.									
33	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.					
34	Asphalt Testing	Insitu Density Testing of A.C surface to Specification	As per Specification	91% of maximum density MRS 11.09 and minimum thickness					

Note: Satisfactory load testing or proof rolling shall be taken as no discernible movement under a load applied with a fully loaded single drive water truck or a multi-tyred roller of not less than 8 tonnes per axle

_____ _____

CONTRACTOR ENGINEERING SUPERVISOR

_____ _____

PRINTED NAME

_____

DATE

PRINTED NAME

_____

DATE

SC6.2.9.6.2 Development Works Project Quality Plan – Stormwater Drainage

Location of Work: _____ Developer: _____

Contractor/Job Foreman: _____ Lot No: _____

No.	Activity	Method	Frequency	Quality Requirement	Test Confirmation				Remarks by Council design Engineer or Engineering Supervisor
					Contractor		Engineer		
					Sign	Date	Sign	Date	
1	Peg line Location	Check setout pegs via survey	Each Installation	Check by Contractor to be approved by Engineer					**Hold Point**. Verification by Consulting Engineer and Council Engineering Supervisor.
2	Cut Existing Pavement Surfaces (if any)	Concrete saw or cutting wheel	Existing pavement areas	Depth of cut to exceed depth of seal or asphalt					
3	Excavation of Trench Assessment for shoring/benching	Visual check by Contractor/Job Foreman	Each Section	As per Standard drawings Shored or benched if necessary					Ensure trenching is undertaken in accordance with Workplace Health & Safety Act.
4	Depth of Cover at road & footpaths	Level Check by Contractor/Job Foreman	As required	As per Specification (Standard drawings)					
5	Backfill & Bedding Materials Stockpile	Visual check by Contractor	Each stockpile	As per Specification (Standard drawings)					

No.	Activity	Method	Frequency	Quality Requirement	Test Confirmation				Remarks by Council design Engineer or Engineering Supervisor
					Contractor		Engineer		
					Sign	Date	Sign	Date	
6	Bed, Lay & Joint	Engineer & Contractor or Job Foreman, Manhole & Gully Pit Depths, Geometrics	Each Line	As per Specification (Standard drawings)					HOLD POINT
Engineer and Council to certify pipework 'passed' prior to commencement of backfilling. **COUNCIL REP. SIGN _____ DATE _____**									
7	Backfill Trench	As per Specification Visual, Probe, Field Density (if specified)	Each Line	As per Specification Engineer to check 1/2 height compaction					HOLD POINT
Engineer to certify trench compaction as 'passed' prior to backfilling more than ½ full trench depth. **COUNCIL REP. SIGN _____ DATE _____**									
8	Manholes and Benching	Visual check by Engineer/Job Foreman or Contractor	All Drainage	As per Specification As per Planning Scheme Policy - Roads and Drainage					
9	Manhole Covers	Visual check by Engineer/Job Foreman or Contractor	All Drainage	As per Specification As per Planning Scheme Policy - Roads and Drainage					

Note: All work to be CCTV. CCTV results to be submitted two weeks prior to works being placed 'on maintenance'.

_____ _____

NAME & SIGNATURE OF CONTRACTOR/JOB FOREMAN NAME & SIGNATURE ENGINEERING SUPERVISOR (RPEQ)

_____ _____

DATE DATE

SC6.2.9.6.3 Development Works Project Quality Plan – Culvert Installation

PROJECT INFORMATION	LOT No.:
PROJECT NAME:	
Date Commenced:	Control Line:
Underlying Lots:	Chainages:
	Side (if applicable):

1. PRE-CONSTRUCTION	CHECKED BY: (Initials)
Date Commenced ____/____/____ Culvert Size _____mm Length _____m Culvert Type—RCP/RCBC/CSHP _____ Class _____ Location Chainage _____	

2. SERVICES	CONTRACTOR SIGN	CONTRACTOR DATE	ENGINEER SIGN	ENGINEER DATE
Checked or Relocated YES/NO				

3. SET OUT				
Location Correct Minimum Cover Checked Distance from C/L L_____ R_____ Invert Levels L_____ R_____				

4. EXCAVATION				
Excavated to R.L Inlet _____ R.L Outlet _____				
Selected Backfill under Culvert YES/NO Depth _mm Compaction Result (Standard 95%) _% HOLD POINT (If applicable)				
Trench Base Compacted YES/NO Compaction Result (Standard 97%) _____% HOLD POINT (If applicable)				

5. BASE OR CONCRETE BASE SLAB				
Box - Bedding Placed Depth _____mm - Formwork Placed and Checked. - Reinforcement placed and checked (HOLD POINT)				
-Concrete poured DATE ____/____/____ Concrete Strength _____ MPa Slump _____mm Supplier _____ Cylinder Numbers If Any _____ Pipes - Bedding placed Compaction Results/Cylinder test Result _____%/MPA _____%/MPA _____%/MPA (HOLD POINT)				

6. PLACING CELLS/PIPES				
Place Cells/Pipes to plan Yes / NO Cell/Pipe Alignment correct (e.g. Butted together neatly) Yes / NO (HOLD POINT)				

7. END WALL INLET	CONTRACTOR SIGN	CONTRACTOR DATE	ENGINEER SIGN	ENGINEER DATE
Formwork Placed and Checked Approved / Notapproved (HOLD POINT)				
Concrete Poured DATE ___/___/___ Concrete Strength ___ MPa Slump ___ mm Supplier ___ Cylinder Numbers ITAN ___ Cylinder TestResults ___ MPA ___ MPA ___ MPA				

8. END WALL OUTLET				
Formwork Placed and Checked Approved / Notapproved (HOLD POINT)				
Concrete Poured DATE ___/___/___ Concrete Strength ___ MPa Slump ___ mm Supplier ___ Cylinder Numbers ITAN ___ Cylinder TestResults ___ MPA ___ MPA ___ MPA				

9. DRAINAGE	
Levels of Inlet and Outlet Drain Correct Yes / No If No list reason why and new Invert levels Inlet ___ Outlet ___	Approved / NotApproved (TRC) Sign Date

CONTRACTOR

PRINTED NAME

DATE

ENGINEERING SUPERVISOR (RPEQ)

PRINTED NAME

DATE