

# Whitsunday Regional Council Development Manual



Version No. 4.7

Issued 24/11/2022

This document is the property of Whitsunday Regional Council and is issued to developers, consultants, contractors and Council officers responsible for the development process from inception to completion.

No unauthorised changes are to be made to this manual. Suggested changes are to be forwarded to the Manager Strategic Planning for consideration.

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#### Definitions and Acronyms

AASHTO	American Association of State Highway & Transportation Officials
AC	Asphaltic Concrete
ADWF	Average Dry Weather Flows
AHD	Australian Height Datum
AMCORD	Australian Model Code for Residential Development
ARI	Average Recurrence Interval
AEP	Annual Exceedance probability
ASD	Approach Sight Distances
ASS	Acid Sulphate Soils
AV	As Values
BBQ	Barbecue
CBR	California Bearing Ratio
Consulting Engineer	An RPEQ certified engineer
CPESC	Certified Professional in Erosion and Sediment Control
CPTED	Crime Prevention through Environmental Design
Days	Business days



Defects Liability	Means the obligation upon the developer/applicant to repair any defects (latent or patent) in the development.
Defects Liability Period	Means the period commencing on the date stated in Council's Defects Liability Letter and ending on the date stated in that letter. For the avoidance of doubt, Council may impose a different period for defects liability and 'on maintenance' periods.
DICL	Ductile Iron Cement Lined
DTMR	Department of Transport and Main Roads
EP	Equivalent Persons
ESA	Equivalent Standard Axles
ESC	Erosion and Sediment Control
ESCP	Erosion and Sediment Control Plan
ESCS	Erosion and Sediment Control Strategy
ESD	Entering Site Distance
FRC	Fibre Reinforced Pipe
HDPE	High Density Polyethylene
IDF	Intensity Frequency Duration
IEAust	Institute of Engineering Australia
IPWEA	Institute of Public Works Engineering Australia
IPWEAQ	Institute of Public Works Engineering Australasia, Queensland
ITP	Inspection and Test Plan
K	Potassium
LATM	Local Area Traffic Management
MUTCD	Manual of Uniform Traffic Control Devices
N	Nitrogen
NATA	National Association of Testing Authorities
Off Maintenance	Means that the ownership and the maintenance obligations have transferred to Council upon completion of the "Off Maintenance" inspection occurring at the end of the "On Maintenance" period.
On Maintenance	Means that ownership of the asset has passed to Council but the maintenance responsibility and obligation remains with the developer/applicant for the On Maintenance Period. Maintenance includes but is not limited to mowing, whippersnipping, watering, cleaning and general upkeep, as well as the rectification of any defects and shall be at the sole cost of the developer (unless caused by Council activities).
On Maintenance	Means the period of time commencing on the date of issue of the "On

Period	Maintenance “letter from Council and ending on the date stated in that letter.
P	Phosphorus
PASS	Possible Acid Sulphate Soils
PE	Polyethylene
PVC-M	PVC modified
QLD	Queensland
QUDM	Queensland Urban Drainage Manual
RM	Rising Main
RPEQ	Registered Professional Engineer Queensland
RPZD	Reduced Pressure Zone Device
SCADA	Supervisory Control and Data Acquisition
SISD	Safe Intersection Site Distance
SQID	Stormwater Quality Improvement Devices
Surveyor	Registered Surveyor with the Surveyor’s Board of Queensland
SV	Scour Valves
U PVC	Unplasticised PVC
Vpd	Vehicles per day
Wet Sediment Basin	<p>A wet sediment basin has the capacity to contain all run-off expected from the y percentile, X – day rainfall depth where, depending on the sensitivity of the receiving waters and/or the duration that the structure is in use: x varies between 2 and 20 days and y varies between 75<sup>th</sup> and 90<sup>th</sup> percentile.</p> <p>Refer to IECA best practice erosion and sediment control.</p>

# A1 – APPLICATION PROCEDURES

## General

### AP 1.01 Introduction

- 1.01.1 This manual sets out procedures involved in applying for an Operational Works permit for works that will ultimately be in the ownership and maintenance responsibility of Council or other service authorities or works which are subject to approval by Council;
- 1.01.2 It should be read in conjunction with the relevant approvals and/or what development permit conditions;
- 1.01.3 Conditions of a development permit (including reconfiguration) may require the Applicant to construct, bond and/or submit, various works or documentation before survey plans can be approved and sealed by Local Authority or before a development may be occupied or a land-use commenced;
- 1.01.4 Preliminary approvals/development permits requiring the construction of operational works generally involve the applicant and/or a designer applying for an operational works permit and request in Council approval of designs and specifications;
- 1.01.5 Plans for roadworks, drainage works, water supply, sewerage works, bridges, retaining walls, miscellaneous structures, buildings, pumping stations and flood control structures are to be prepared under the direction of and certified by an RPEQ;
- 1.01.6 Plans for landscape works by a person of professional standing and competence in the field of landscape architecture or landscape design, and a standard acceptable to the Council. Where irrigation plans are required for public parks, traffic islands or roundabouts, they are to be prepared by an irrigation designer with a proven track record of successful irrigation design;
- 1.01.7 Designs, models, calculations, drawings and specifications are to be submitted as supporting information to an application for a Development Permit for Operational Works;
- 1.01.8 Where the works are to be constructed over or nearby to existing infrastructure the RPEQ responsible for the works shall take into consideration the protection of existing asset and the ability to replace or realign the asset at a future point in time.
- 1.01.9 Operational Works permits will not be issued until evidence of payment of the Portable Long Service Leave and Occupational Health & Safety fees is provided.

## Design Approval

### AP 1.02 Pre-lodgement discussions

- 1.02.1 Prior to lodgement of an Operational Works application for approval of detailed designs, the designer is encouraged to meet with Council officers to discuss the following matters in the event that the following issues have not been addressed at reconfiguration of a lot approval including:
  - 1.02.1.1 Stormwater design approach including:
    - 1.02.1.1.1 Lawful Point of discharge as per DG 4.6. Any design intent to change flow characteristics on adjoining land, natural overland flow paths or waterways requires the developer/ applicant to provide in-kind written consent to discharge by land owners. Ensuring all effected landowners are notified and consent prior to detailed design and later easement agreements where required.
    - 1.02.1.1.2 Provide initial stormwater due diligence assessment as per Section DG4.7.
  - 1.02.1.2 Identify environmentally significant areas and heritage features;
  - 1.02.1.3 Internal and external stormwater catchment boundaries;
  - 1.02.1.4 Tail water conditions including water quality requirements and determination of tail water level;
  - 1.02.1.5 Existing infrastructure and the protection of the affected assets (water and sewer mains).
  - 1.02.1.6 Connection points for water supply and available pressure and discharge capacities;
  - 1.02.1.7 Discharge points for sewerage;
  - 1.02.1.8 setback distances from watercourses for on-site wastewater treatment and disposal;
  - 1.02.1.9 future planning for the provision of services, e.g., water supply, sewerage, drainage and road networks, stream management and stormwater quality management, structures, power, communications and gas. In special circumstances, the Council may require the installation of large water mains to serve areas beyond the development;
  - 1.02.1.10 Site Conditions;
  - 1.02.1.11 Development Permit Conditions for the particular development;
  - 1.02.1.12 landscaping works for on street works and public open space.
- 1.02.2 Approval of designs can be expedited where the above issues have been resolved in advance;
- 1.02.3 The designer may obtain as constructed information in relation to existing roads, stormwater drainage, water and sewer reticulation if available from Council, on application and payment of a prescribed fee (where applicable);
- 1.02.4 In addition to the above, it is advisable that the designer discuss and obtain Council's agreement to the following issues (where required) prior to submission of designs:
  - 1.02.4.1 Request for Council to contribute towards some aspects of the work.
  - 1.02.4.2 Build over permits were necessary. If a build over permit is permitted the designer must take into consideration replacement or realignment of the asset in the future.
- 1.02.5 Resolution of these issues, particularly those requiring a decision of Council (i.e. amendments to conditions of approval, diversion from Standards or request for Council contributions) is essential to avoid protracted approval periods and wasted design effort.

### AP 1.03 Design Requirements

- 1.03.1 The design of operational works must comply with the relevant development permit conditions, Council's local laws, policies, planning scheme and the provisions of this manual. The developer shall meet all costs associated with the compliance with these minimum requirements.
- 1.03.2 Design is to demonstrate a non-worsening affect to surrounding infrastructure, where upgrades are required, the developer must bear all costs associated with the required upgrade.
- 1.03.3 It is Council's requirement that the design of all operational works must be prepared by or under the direction of, and certified by, an RPEQ. The RPEQ must bear full responsibility for all aspects of the design of the operational works, which they certify.
- 1.03.4 Road safety audit to be undertaken by a suitably experienced RPEQ as per the requirements and Austroad's Guide to Road Safety to verify designs and signage prior to submission to Council.

### AP 1.04 Consent of Adjoining Landowners

- 1.04.1 Written approval is required from adjoining property owners authorising any operational works on their property (if under an easement authorisation must come from the easement owners).
- 1.04.2 Approvals to discharge and/or easements over downstream drainage paths from the respective property owners are required from the development site to the approved point of discharge.

### AP1.05 Documentation

- 1.05.1 Associated with the lodgement of the "Application for Operational Works Development Permit", engineering plans and specifications for the works are to be submitted to Council for approval (the specific requirements for the submission).
- 1.05.2 Submissions with a full complement of all supporting documentation as per AP1.08 shall be provided prior to Council approval.
- 1.05.3 Following the issue of an operational works permit, any plans that are required to be amended must be resubmitted with an accompanying letter outlining the amendments and including any necessary models, calculations or documentation as supporting information.
- 1.05.4 One complete submission must be issued to Council incorporating any required amendments following the issue of an operational works permit.

### AP 1.06 Local Authority Approval

- 1.06.1 The “[Statement of Compliance – Operational Works Design](#)” (refer Form 1) has been introduced to expedite the approval process.
- 1.06.2 Any non-compliant aspects are to be re-designed by the certifying RPEQ and relodged to Council for approval.
- 1.06.3 If the Council review reveals the Statement of Compliance to be inaccurate or incomplete, the submission may be returned to the applicant for resubmission.
- 1.06.4 It is the RPEQ’s responsibility to ensure the design as submitted considers all site conditions and complies with Council’s approval conditions, local laws, policies, the provisions of this Development Manual and other relevant authorities.
- 1.06.5 Council’s review and stamp approval process does not warrant that an approved design complies with the above in every respect, and Council reserves its right to order the rectification of non-complying or unsafe works at the cost of the developer, despite its prior approval.
- 1.06.6 Within five (5) days of Council’s approval, the designer shall submit an electronic copy of the requirements of 1.08 below.
- 1.06.7 Three (3) street names for each new street (in line with any Council naming policy and Australian Standards) must be lodged for consideration and approved by Council before construction is complete.

#### AP 1.07 Approval of Other Authorities and Referral Agencies

- 1.07.1 The applicant is responsible for gaining the approvals of any other authorities having jurisdiction over any part of the works.
- 1.07.2 All works on state-controlled roads will be subject to DTMR approval and is to be carried out in accordance with the Department’s policies, standards and guides.
- 1.07.3 All referral agency conditions are to be included in design documents and must be approved by each agency (if required), prior to submission to Council.

#### AP 1.08 Supporting Information

##### General

- 1.08.1 Supporting information for operational works shall include the following:
  - 1.08.1.1 Design Plans (in DWG and PDF Format)
  - 1.08.1.2 Job specification (one copy)
  - 1.08.1.3 Design report (one copy)
  - 1.08.1.4 Design checklist
  - 1.08.1.5 DA form 1 and/or relevant application forms from the *Planning Act 2016*
  - 1.08.1.6 Evidence that the prescribed application fee as stated in Council’s fees and charges schedule, has been paid.
  - 1.08.1.7 Evidence of payment of the Portable Long Service Leave Levy and Occupational Health & Safety fee.
  - 1.08.1.8 ‘Permit to Enter & Construct’ letters and easement documents relevant to the application.

## Design Plans

- 1.08.2 Design plans shall be definitive and clearly set out to present the design concepts in such a way that the project can be understood, specified for construction and satisfactorily built, generally in accordance with AS1100.101.
- 1.08.3 All design plans should be clearly numbered with separate sheets numbered as part of a set.
- 1.08.4 Sheets of drawings should not be overcrowded with information and should not rely on colour printing or colour wash to impart information. Drawing should be true to scale A1 size sheets and be suitable for black and white copying and photo reduction.
- 1.08.5 Design plans must be certified by an RPEQ (refer 1.03.2).

## Job Specification

- 1.08.6 A job specification must be prepared by the designer specifying site-specific requirements not covered in standard specifications.
- 1.08.7 All work shall be in accordance with Council standard specifications where available. Where Council standard specifications exist for a particular type of work, the designer may use the Department of Transport and Main Road specification or their own standard specification. Both options will be subject to approval by Council.

## Design Report

- 1.08.8 The designer shall submit a design report with all plans lodged. Report to include all the necessary design assumptions and calculations, correspondence, and all other relevant information to allow Council to check the design submission.
- 1.08.9 The engineering design and materials used must be selected to minimise the whole of life Cost to Council. The designer must demonstrate how the design complies with this requirement.
- 1.08.10 The Design Report must be on company letterhead and shall contain the following minimum details:
  - 1.08.10.1 The project details and list of plans including all sheet names and numbers associated with the project.
  - 1.08.10.2 A completed '[Statement of Compliance – Operational Works Design](#)' (Form 1) endorsed by the designer and RPEQ engineer.
  - 1.08.10.3 A copy of the development approval conditions on which the design is based including a summary of the design submission referencing each of the development approval conditions.
  - 1.08.10.4 A copy of all separate approvals given by Council for variations to the minimum standard in relevant Guidelines.
  - 1.08.10.5 Design details of alternative design proposed which depart from the development manual/development conditions with supporting arguments for how the alternative meets Council's objectives.
  - 1.08.10.6 Records of pre-submission discussions with Council including confirming correspondence.
  - 1.08.10.7 Copies of letters of approved consent from adjoining property owners for any works or stormwater discharge on the properties.

- 1.08.10.8 Evidence that negotiations have been entered into regarding provision of supply with service authorities such as Ergon Energy and Telstra (including approved reticulation/service plans, if available).
- 1.08.10.9 Site photographic report confirming the designer has visited the site and all constraints have been considered and addresses.
- 1.08.10.10 Stormwater drainage calculations spreadsheet and modelling to be provided in accordance with QUDM as per Section DG 4.
- 1.08.10.11 Stormwater Drainage Catchment Plan detailing external catchments and internal sub catchments.
- 1.08.10.12 Design calculations for detention basins, dissipaters, scour protection and water quality control structures.
- 1.08.10.13 Design criteria and parameters operating regimes and calculations for permanent water quality works such as stormwater quality improvement devices (SQIDs), sediment basins, trash racks, etc and demonstrated consistency with catchment Stormwater Quality Management Plan and water quality report which accompanies the development application.
- 1.08.10.14 The street lighting design prepared by a suitably qualified professional engineer including evidence of both horizontal and vertical lighting requirements are compliant. To include any impacts to existing street lighting where lighting is removed include measures to ensure existing illumination levels are not reduced during and after construction.
- 1.08.10.15 An Erosion and Sediment Control Strategy (ESCS) addressing erosion and sediment management during construction.
- 1.08.10.16 Traffic Management Plan in accordance with the Austroads Guide to Temporary Traffic Management, Queensland Guide to Traffic Management, AS1742 Manual of Uniform Traffic Control Devices prepared by a traffic management designer holding the relevant qualifications.
- 1.08.10.17 Traffic Impact Assessment to justify road layouts, intersection treatments and use of traffic calming devices.
- 1.08.10.18 Water and sewerage reticulation networks analysis shall be supplied in a format compatible with Council's network systems, including the location and relative levels of existing infrastructure impacted by the development.
- 1.08.10.19 If the water supply is from a newly developed source, provide information on quality, quantity, disinfection and infrastructure proposed.
- 1.08.10.20 Pavement and wearing surface design, assumptions, and calculations. Include records of geotechnical tests indicating subgrade CBRs in cuts where the design has been based, adopted traffic load, requirements for subsoil drainage and subsoil drainage design by geotechnical engineer. Copies of the geotechnical reports are to be included in the design report.
- 1.08.10.21 Where additional subsoil drainage is required above Council's minimum requirements, pavement design shall include details for pavement drainage prepared by a Geotechnical engineer.
- 1.08.10.22 Geotechnical reports, where relevant, relating to slope and batter stability, in situ materials etc.



- 1.08.10.23 Structural and geotechnical certification of design of miscellaneous structures including retaining walls, non-standard headwalls, drainage structures, reservoirs etc.
- 1.08.10.24 Design parameters and operating regimes for water supply and sewerage pump stations.
- 1.08.10.25 Full design drawings and pre-commissioning plan for water and sewerage pump stations.
- 1.08.10.26 Landscaping design drawings for development involving open space to become a Council asset, showing details of Park/reserve planting, Street tree planting, buffer zone planting, and any hill slope development works if applicable.
- 1.08.10.27 For staged development, master plans showing the overall design concept shall be submitted at Stage 1 and updated copies provided with subsequent stages. Subsequent development plans will show the “as constructed” information of all the earlier stages. Master plans to include the following as a minimum;
  - 1.08.10.27.1 Water including pump stations.
  - 1.08.10.27.2 Sewer including pump stations.
  - 1.08.10.27.3 Stormwater.
  - 1.08.10.27.4 Stormwater Management Plans.
  - 1.08.10.27.5 Road works.
  - 1.08.10.27.6 Earthworks.
  - 1.08.10.27.7 Road hierarchy.
  - 1.08.10.27.8 Pathways.
  - 1.08.10.27.9 Public transport.
  - 1.08.10.27.10 Lighting and other services.
  - 1.08.10.27.11 Easements, freehold lots and land to be deeded to Council for accommodating the works.
  - 1.08.10.27.12 Open space areas.
  - 1.08.10.27.13 Erosion and sediment control strategy and location of permanent survey marks.
- 1.08.10.28 Selection of materials and components to be transferred to Council ownership must comply with service standards specified by Council (e.g. minimised whole of life Costa, reliability etc).
- 1.08.10.29 Bill of quantities completed by suitably qualified engineer and estimate of construction costs.
- 1.08.10.30 All necessary supporting details for any request by a developer for Council to financially contribute towards the development.
- 1.08.10.31 Any other relevant information sought by Council.
- 1.08.10.32 Completed Design Certification Report by RPEQ – refer to Annexure A.

## AP 1.09 General Requirements

## Plan Presentation

- 1.09.1 These presentation minimum standards will apply to engineering and landscape plans submitted for approval for operational works associated with approved developments.
- 1.09.2 Standardisation of the presentation of operational Works plans submitted for approval is necessary for consistency in Council’s records and desirable for expedient review and approval.
- 1.09.3 Scaled engineering drawings in accordance with this manual are required for plan review.

### AP 1.10 Title Block

- 1.10.1 Each sheet of the design drawings shall have a title block containing the following information:
  - 1.10.1.1 Development/estate name (if any)
  - 1.10.1.2 Locality/approved street name.
  - 1.10.1.3 Developers name.
  - 1.10.1.4 Bar scales as a minimum (alternatively numerical scale with original sheets I stated).
  - 1.10.1.5 Plan number and sheet number.
  - 1.10.1.6 Schedule and date of amendments.
  - 1.10.1.7 Certification by RPEQ (for engineering drawings).

### AP 1.11 Sheet Sizes

- 1.11.1 Preferred sheet sizes (overall dimensions) are A1 (841mm x 593mm) and A3 (420mm x 297mm).

### AP 1.12 Scales

- 1.12.1 scales used for plan should preferably be those recommended by the standards Association. Generally, the following scale should be used 1:1, 1:2, 1:5 in multiples of 10 of these. All scales should be bar scales.
- 1.12.2 The following scales are also acceptable:

Description	Urban	Rural
<b>Plans</b>	1:500*	1:1000
<b>Longitudinal Section:</b>		
<b>Horizontal</b>	1:500	1:1000
<b>Vertical</b>	1:50	1:100
<b>Intersection Details</b>	1:100, 1:200	1:500
<b>Cross Sections</b>	1:100	1:100
<b>Engineering Details</b>	1:1, 1:2, 1:5 and multiples of 10 of these scales.	

\*Sewerage Reticulation should be 1:500.

### AP 1.13 Dimensions

### **Dimensioning on Plans**

- 1.12.1 Linear dimensions on all roadworks plans will be in metres, with the exception of some detailed plans of small structures (e.g. manholes) and some standard plans (e.g. kerb and channel) which may be in millimetres.
- 1.12.2 Details of methods of dimensioning shall be in accordance with AS1155 – Metric Units in Construction.

### **Standard Cross-Section Intervals**

- 1.12.3 Urban and rural cross sections should be provided to roads at 20 m intervals and tangent points, with further reduction to 10 m or 5 m intervals when necessary due to horizontal or vertical curvature.

### **Chainage and Offset Dimensions**

- 1.12.4 Chainage and offset dimensions on plans shall be expressed to 0.01 m (0.005 may be used as the order of accuracy requires).

### **AP 1.14 Levels**

- 1.14.1 All levels must be reduced to Australian Height Datum, unless otherwise approved by Council.
- 1.14.2 Reduced levels of benchmarks and reference pegs including Permanent Survey Marks shall be expressed to 3 decimal places i.e. 0.001m. the location of the origin of the survey must be on the plan.
- 1.14.3 Reduced levels of roadworks and stormwater drainage must be expressed to 3 decimal places i.e. 0.001m.
- 1.14.4 Reduced levels of sewerage reticulation shall be expressed to 3 decimal places i.e. 0.001m.

### **AP 1.15 Grades**

- 1.15.1 Road grade must be shown as a percentage to 2 decimal places.
- 1.15.2 Pipe grade must be shown either as a percentage to 2 decimal places or as a gradient to one decimal place

### **AP 1.16 Drawings Required**

#### **Design Drawings**

- 1.16.1 Operational Works drawings will generally consist of the following:
  - 1.16.1.1 locality plan.
  - 1.16.1.2 Subdivision layout/staging plan (if applicable).
  - 1.16.1.3 Earthworks plan.
  - 1.16.1.4 Roadworks and drainage plan.
  - 1.16.1.5 Longitudinal section of each road.
  - 1.16.1.6 Type cross sections for each Road.
  - 1.16.1.7 Cross sections of each Road.
  - 1.16.1.8 Detailed plan of each intersection and cul-de-sac.

- 1.16.1.9 Longitudinal section of each stormwater drainage line.
- 1.16.1.10 Sewerage reticulation plan, long section and pump station details.
- 1.16.1.11 Water reticulation plan and pump station plans and details.
- 1.16.1.12 Landscape plan.
- 1.16.1.13 Erosion and sediment control strategy.
- 1.16.1.14 Service provider's conduit plan, including street lighting.
- 1.16.1.15 Stormwater catchment plans/drainage calculation table.
- 1.16.1.16 Miscellaneous details.
- 1.16.2 The minimum requirements for each drawing a detailed in the following sections.

#### AP 1.17 Locality Plan

- 1.17.1 Locate the subdivision/development in relation to adjacent towns, major roads, major streets, etc.
- 1.17.2 Northpoint.
- 1.17.3 May be included on layout/staging plan for large jobs or roadworks and drainage plan for smaller jobs.

#### AP 1.18 Subdivision Layout/Staging Plan

- 1.18.1 For stage subdivisions, the layout plan should show the relationship of all new roads and infrastructure to each other, and to existing roads and infrastructure adjoining the subdivision. All adjacent structures and services are to be shown also.
- 1.18.2 Where development is to be carried out by stages, the boundaries of proposed stages should be shown on this plan, and the stages identified by numbering.

#### AP 1.19 Earthworks Plan

- 1.19.1 The earthworks plan may be included with the roadworks and drainage plan for smaller subdivisions and shall include:
  - 1.19.1.1 Legend.
  - 1.19.1.2 Existing site contours and finished surface contours (spot levels should be used to complement contours)
  - 1.19.1.3 limits and levels of all major allotment cut and fill – distinguished by hatching.
  - 1.19.1.4 Locations of cut and fill batter relative to allotment boundaries.
  - 1.19.1.5 Location and levels of retaining walls (if required).
  - 1.19.1.6 Batter slopes and treatment.
  - 1.19.1.7 Existing water and sewer infrastructure.
  - 1.19.1.8 Appropriate flood levels in accordance with Council's policies.
  - 1.19.1.9 Northpoint.
  - 1.19.1.10 Locations and levels of permanent survey Marks, reference stations etc used as datum for the works.

- 1.19.1.11 Vegetation including trees proposed to be removed in days to be retained.
- 1.19.1.12 The smaller subdivisions, the earthworks details may be included on the roadworks and drainage plan.

## AP 1.20 Roadworks and Drainage Plan

- 1.20.1 The plan of each Road shall include:
  - 1.20.1.1 Legend.
  - 1.20.1.2 Road reserve boundaries.
  - 1.20.1.3 Allotment numbers and boundaries, both existing and proposed (including existing and proposed easements).
  - 1.20.1.4 Chainages of all tangent points on curves.
  - 1.20.1.5 All horizontal curve details including radius and arc length, tangent length of each curve. Maximum superelevation and design speed of road curves and include labelling to identify relevant curve.
  - 1.20.1.6 Road centrelines or other construction lines, including bearings and chainages at intersecting points. Set out co-ordinates table to be shown on a separate drawing.
  - 1.20.1.7 Kerb lines including kerb type, kerb radii, and chainage of all tangent points of the kerb line.
  - 1.20.1.8 Footpaths/bikeways and pram ramp locations.
  - 1.20.1.9 Proposed street tree schedule, plant key for species identification and root barrier locations
  - 1.20.1.10 Fencing.
  - 1.20.1.11 Access road extents where required to be constructed.
  - 1.20.1.12 Edge of pavement, where no kerb is to be constructed.
  - 1.20.1.13 Dimensioned road reserve, footpath and pavement widths, where these differ from the standard cross-section.
  - 1.20.1.14 Existing and finished surface contours, highlighting cut and fill areas.
  - 1.20.1.15 Drainage line locations, pipe diameters and type
  - 1.20.1.16 Boundary extents of drainage easements, where required
  - 1.20.1.17 Drainage structures and pit details including pit benching details where required and open channel design details.
  - 1.20.1.18 Label all drainage structures and lines e.g ½ structure 1 on line 2.
  - 1.20.1.19 Subsoil drain locations and flush points.
  - 1.20.1.20 Overland drainage paths including levels.
  - 1.20.1.21 Riverine and Coastal areas erosion protection works.
  - 1.20.1.22 Location of existing utilities and other existing works within the site.
  - 1.20.1.23 Location of all service clashes including levels of services and clearance distance.
  - 1.20.1.24 Location and levels of PSM's, benchmarks and reference pegs.
  - 1.20.1.25 Northpoint.
  - 1.20.1.26 Line marking and signing\*.
  - 1.20.1.27 Guideposts and guardrails
  - 1.20.1.28 All other traffic control devices\*.
  - 1.20.1.29 Creek protection works and the like.
  - 1.20.1.30 Street name signs\*.
  - 1.20.1.31 Property boundaries, street number and lot numbers including existing and proposed.

- 1.20.1.32 Property accesses where required to be constructed.
- 1.20.1.33 Dimensions of road reserves where they are not able to meet the standard minimum requirements otherwise shown on the type cross section plans.
- 1.20.1.34 Public Transport Infrastructure meeting the Public Transport Infrastructure Manual

\*may be shown on separate plan(s).

#### AP 1.21 Longitudinal Sections of Roads.

- 1.21.1 The longitudinal section of each road shall include:
  - 1.21.1.1 Chainages.
  - 1.21.1.2 Existing surface levels.
  - 1.21.1.3 Design Road centreline levels.
  - 1.21.1.4 Cut and fill depths at each chainage.
  - 1.21.1.5 Design road grades.
  - 1.21.1.6 Chainages and levels of grade intersection points.
  - 1.21.1.7 Vertical curve details including location, length, radius and all crest and sag locations.
  - 1.21.1.8 Sections on control lines or superelevated curves (i.e. pavement edges, kerb or lane edges), curve widening and superelevation details.
  - 1.21.1.9 Location of services where they cross the centre of the road.

#### AP 1.22 Standard Type Cross-Sections

- 1.22.1 A type cross-section shall be shown for each new or reconstructed road, including:
  - 1.22.1.1 Road reserve with.
  - 1.22.1.2 Pavement widths including medians (as applicable).
  - 1.22.1.3 Footpath and Cycleway widths.
  - 1.22.1.4 Cross falls of pavement and verge including footpaths.
  - 1.22.1.5 Pavement depth and material type for roadway, footpath and/or cycleway.
  - 1.22.1.6 Type of kerb and channel.
  - 1.22.1.7 Sub – soil drainage.
  - 1.22.1.8 Table drain details for rural roads.
  - 1.22.1.9 Batter slopes.
  - 1.22.1.10 Standard type cross section intervals for urban roads at 20m intervals and rural roads at 50m intervals and all tangent points and reduce interval to 5m or 10m where necessary due to horizontal or vertical curvature.

#### AP 1.23 Cross-Sections of Roads

- 1.23.1 A cross-section shall be shown for each new or reconstructed road at the intervals defined in this manual for each Road and shall show:
  - 1.23.1.1 Road reserve boundaries.
  - 1.23.1.2 Pavement centreline and/or other construction line.

- 1.23.1.3 Natural surface profile.
- 1.23.1.4 Design cross-section.
- 1.23.1.5 Crossfall of pavement/verges and footpaths, widths of pavement/verges and footpaths, depth of pavement/ verge and footpath wherever these differ from the standard cross-section.
- 1.23.1.6 Chainage of cross-section.
- 1.23.1.7 Control Line
- 1.23.1.8 Location of services in any aspect of the pavement, verge, footpath, or cycleway where it varies from the standard details.

#### AP 1.24 Detail Plans of Intersections and Cul-De-Sacs

- 1.24.1 Intersection detailed plans shall include all the relevant information required for roadworks and drainage plans, as listed above together with additional details such as kerb levels on kerb returns, pavement contours, channelisation works, line marking, signing and pram ramps.

#### AP 1.25 Longitudinal Sections of Stormwater Drainage Lines

- 1.25.1 For each new or reconstructed drainage line (including open channel), a longitudinal section shall be provided, showing;
  - 1.25.1.1 Chainages.
  - 1.25.1.2 Existing surface levels.
  - 1.25.1.3 Longitudinal grade of each drainage line.
  - 1.25.1.4 Design finished surface level and invert levels.
  - 1.25.1.5 Chainage of drainage structures including and any offsets.
  - 1.25.1.6 Pipe diameter/size, material type and grade.
  - 1.25.1.7 Hydraulic grade line and water surface level.
  - 1.20.1.35 Label each drainage structure including line and structure number. E.g. ½ structure 1 on line 2. Include reference to separate detailed drawing where relevant.
  - 1.25.1.8 Crossing of any services including location, service type, invert level, details of pipe material type and size.

#### AP 1.26 Sewer Concept Plan

- 1.26.1 Where development incorporates multiple stages, sewer concept plan must be prepared by the consultant.
- 1.26.2 This concept plan must be submitted prior to proceeding with detailed design and should include the following:
  - 1.26.2.1 location, size, approximate depth, and alignment of gravity sewers.
  - 1.26.2.2 Location, size and alignment of rising mains.
  - 1.26.2.3 Location of pump stations and lift stations including justification for the use.
  - 1.26.2.4 Contour information at 1 m intervals maximum or to suit the topography of the land for both natural surface and finished surface contours.

- 1.26.2.5 Contributing catchments (internal and external) showing the equivalent persons (EP).
- 1.26.2.6 Justification for redirecting flows between sewerage districts were proposed.
- 1.26.2.7 Details of the influence on downstream catchments and systems.
- 1.26.2.8 The flow contributing to each section of main including the estimated design capacity, e.g.:

EP300	
PWWF	14.3 L/s
Pipe Size	225 diameter
Max Pipe Cap	26.2L/s

- 1.26.3 Access for maintenance of the system should be considered when locating manholes etc (refer section D7.07).
- 1.26.4 During the preparation of the concept plan consideration must be given to the integration of other infrastructure design, overall site earthworks and the impacts on existing upstream and downstream developments and potential developments.
- 1.26.5 As part of the preparation of the concept plan, the requirements of section 2 – concept designs in WSA 04 – 2005 Sewerage Pumping Code of Australia should also be included.

#### AP 1.27 Sewerage Reticulation Plan Longitudinal Section

- 1.27.1 The sewerage reticulation plan shall include:
  - 1.27.1.1 Legend.
  - 1.27.1.2 All allotments and allotment numbers.
  - 1.27.1.3 Boundary of the subdivision.
  - 1.27.1.4 North Point.
  - 1.27.1.5 Location and size of existing sewers.
  - 1.27.1.6 Invert levels of existing lines.
  - 1.27.1.7 Location of other services which cross sewer lines.
  - 1.27.1.8 Location of manholes with manhole numbers (including dimensions where not shown on alignment).
  - 1.27.1.9 Identification of allotments, which are currently sewered.
  - 1.27.1.10 Finished surface contours sufficient to enable verification of property connection design.
  - 1.27.1.11 Details of permanent survey marks including AHD from which levels are to be transferred.
  - 1.27.1.12 Grading information for new sewer lines including distance between manholes, pipe grades, pipe diameter, pipe material and class of each pipe length.
  - 1.27.1.13 Manhole cover type and class.
  - 1.27.1.14 Manhole inlet types.
  - 1.27.1.15 Locations and level of sewer property connections and type.



- 1.27.1.16 Details of pumping stations including location, inlet/outlet levels, overflow, cut-off levels, electrical switchboard layout and water supply, size of pumping plant.
  - 1.27.1.17 Diameter, material class and route of pressure main(s); indicating air valve and scour valve locations.
  - 1.27.1.18 Clear identification of any alterations/connections to existing sewers to be completed by Council at developer's cost.
  - 1.27.1.19 Finished surface contours with spot levels to compliment contours.
  - 1.27.1.20 Ultimate sewer design flows including catchment plan for staged development if applicable.
  - 1.27.1.21 Gravity sewer pipe capacities.
  - 1.27.1.22 Structural design of pipes for pipes with more than 3m of cover.
  - 1.27.1.23 Thrust block calculation where required.
  - 1.27.1.24 Diagram showing all allotment controls.
  - 1.27.1.25 Flow velocities under different flow conditions.
  - 1.27.1.26 Rising main hydraulic grade line.
  - 1.27.1.27 System resistance and pump curves showing static and friction head and duty points.
  - 1.27.1.28 Demonstration of pipeline capacity to resist cyclical pressure effects over a 100-year lifespan of the systems.
  - 1.27.1.29 Estimation of pump start, stop, alarm, overflow and other control levels.
  - 1.27.1.30 Calculations supporting the provision of wet well storage.
  - 1.27.1.31 Calculations showing that floatation forces are counteracted for all buried or all partially buried structures.
  - 1.27.1.32 Estimation of electrical loads – Mains Supply proposed; and Radio Frequency interference screening measures.
  - 1.27.1.33 Structural calculations where necessary for the pump well and associated works.
  - 1.27.1.34 Calculations supporting the hydraulic design of emergency relief structures.
- 1.27.2 The longitudinal section of each sewerage line should include:
- 1.27.2.1 Existing surface levels.
  - 1.27.2.2 Design finished surface.
  - 1.27.2.3 Manhole number.
  - 1.27.2.4 Distance between manholes.
  - 1.27.2.5 Grade of each pipe length.
  - 1.27.2.6 Diameter, material and class of each pipe length.
  - 1.27.2.7 Manhole diameter and cover type.
  - 1.27.2.8 Manhole inlet types review.
  - 1.27.2.9 Invert levels of existing lines.
  - 1.27.2.10 Crossings with any other services (including location, size, invert levels and clearance of pipe crossing).

## AP 1.28 Water Reticulation Concept Plan

- 1.28.1 Where development incorporates a large number of lots with multiple stages, the consultant shall submit a water reticulation concept plan of the water reticulation showing proposed mains sizes, connections to existing mains and

valve positions. The concept plan is to be supported by computer network analysis.

- 1.28.2 This concept plan shall be submitted prior to detailed design and should include the following:
- 1.28.2.1 layout of mains, together with the development layout.
  - 1.28.2.2 Key to network analysis i.e. node points, elevation, demand.
  - 1.28.2.3 Size and type of mains, indicated graphically and distinguished by colour and/or line type.
  - 1.28.2.4 Design parameters – number of lots, number of EP's design flows.
  - 1.28.2.5 Legend of land uses (i.e. residential, industrial precincts etc).
  - 1.28.2.6 Supply points and pressure or hydraulic grade lines (HGL) as supplied by Council.
  - 1.28.2.7 Location of pumps, pressure reducing valves and reservoir top water level (TWL) and volume where applicable.
  - 1.28.2.8 Limit of water district serviced by the reticulation mains.
  - 1.28.2.9 Contours for the entire development, at minimum 1 m intervals.
  - 1.28.2.10 Consideration for connection to adjoining and/or future developments as directed.

#### AP 1.29 Water Reticulation Plan

- 1.29.1 The water reticulation plan shall include:
- 1.29.1.1 Legend.
  - 1.29.1.2 The services for the development.
  - 1.29.1.3 All allotments and allotment numbers.
  - 1.29.1.4 Boundary of subdivision.
  - 1.29.1.5 North point.
  - 1.29.1.6 Location and size of existing mains.
  - 1.29.1.7 Location, size, material and class of new mains.
  - 1.29.1.8 Location of other services which cross the mains.
  - 1.29.1.9 Details of connection to existing mains.
  - 1.29.1.10 Location of each bend.
  - 1.29.1.11 Location of valves, hydrants, scours and caps, T's, reducers etc.
  - 1.29.1.12 Road crossing conduit locations, size and class.
  - 1.29.1.13 Water service connection details.
  - 1.29.1.14 Pump stations and reservoirs (if required).
  - 1.29.1.15 Network analysis (if required).
  - 1.29.1.16 Type and class of pipes for the pressure and cyclical loading regime.
  - 1.29.1.17 Thrust block calculation where required.
  - 1.29.1.18 Operating conditions for pressure reducing valves.
  - 1.29.1.19 Structural calculations were necessary for valve pits and associated work.

## AP 1.30 Landscape Plan

1.30.1 The landscape plan shall contain the following details:

### Site and Layout

- 1.30.1.1 Proposed and existing contours at 5 m intervals.
- 1.30.1.2 Extent of existing vegetation including type and location.
- 1.30.1.3 Significant tree showing level at base and proposed levels, indicating which trees/vegetation is to be removed.
- 1.30.1.4 Proposed layout of roadways including:
  - 1.30.1.4.1 kerb and channel.
  - 1.30.1.4.2 Stormwater drainage pits and manholes.
  - 1.30.1.4.3 Street lighting.
  - 1.30.1.4.4 Property boundaries.
  - 1.30.1.4.5 Traffic islands, roundabouts, traffic calming devices etc.
  - 1.30.1.4.6 Existing and proposed water supply, sewerage services and easements.
  - 1.30.1.4.7 Proposed freehold lots covering water supply and sewerage infrastructure.
- 1.30.1.5 Proposed street tree schedule and plant key for species identification
- 1.30.1.6 Existing tree schedule and plant key for species identification Layout and numbering of individual lots, including street names.
- 1.30.1.7 Layout and numbering of individual lots, including street names.
- 1.30.1.8 Existing parks, reserves etc.
- 1.30.1.9 adjoining land uses, access corridors.
- 1.30.1.10 Existing watercourses, watersheds, gullies, with a buffer zone to either side of creeks, where required.
- 1.30.1.11 Revegetation areas including extent, type, technique and erosion prevention proposals.
- 1.30.1.12 North point

### On-Street Works

- 1.30.1.13 Alignment and location of proposed concrete foot paths and bike paths.
- 1.30.1.14 Grass establishment areas.
- 1.30.1.15 Lighting proposals and street furniture, if appropriate

### Traffic Islands and Roundabouts

- 1.30.1.16 Alignment of kerb and channel and concrete backing to roadside kerb.
- 1.30.1.17 Soil mixed type and depth.
- 1.30.1.18 Proposed planting layout and plant schedule, including species, number, size, set out and staking.
- 1.30.1.19 Mulch types and depth.
- 1.30.1.20 Irrigation proposals.

### Public Open Space

- 1.30.1.21 Dimensions and landscape treatment to buffer zones.

- 1.30.1.22 Location and dimension of all off-road bikeways and pedestrian pathways, with trees at 15 m intervals, showing size and species.
  - 1.30.1.23 Location of boundaries to parkland, reserves and easements, including fencing proposals and details of removable vehicle barriers.
  - 1.30.1.24 Location and type of play equipment, if applicable, including type, extent and edge treatment to satisfy surfacing.
  - 1.30.1.25 Proposed lighting.
  - 1.30.1.26 Mounding, showing base, Crown, levels and gradients.
  - 1.30.1.27 Proposed furniture including benches, bins, BBQ's, shade structures, signage.
  - 1.30.1.28 Tabs, drinking fountains, irrigation couplings.
  - 1.30.1.29 Proposed planting and mulched garden beds.
  - 1.30.1.30 Irrigation plan at 1:200 scale.
- 1.30.2 Detailed specifications will be required to cover all proposed works including the following:
- 1.30.2.1 play equipment and safety surfacing.
  - 1.30.2.2 planting schedule showing key, botanical name, common name, quantity, pot size, minimum height, comments
  - 1.30.2.3 Exercise equipment
  - 1.30.2.4 Universal access to key recreational infrastructure and picnic areas
  - 1.30.2.5 The plant schedule.
  - 1.30.2.6 Revegetation requirements.
  - 1.30.2.7 Grass establishment.
  - 1.30.2.8 Mulch.
  - 1.30.2.9 Hard landscaping.
  - 1.30.2.10 Hard / soft shading i.e. shelters or vegetation
  - 1.30.2.11 Furniture and lighting.
  - 1.30.2.12 Irrigation, if applicable, including mainline and lateral pipes, type and size of pipe, BPD position, and details, valve and sprinkler positions, type, controller cables, hydraulic data and watering programs

## AP 1.31 Erosion and Sediment Control Strategy

- 1.31.1 Erosion and Sediment Control planning and reporting should be commensurate to the scale and complexity of development or disturbance, undertaken by suitably qualified person, in accordance with **Table AP 1.1** below:

**Table AP 1.1 Training levels for the design and implementation of an Erosion and Sediment Control Strategy, Plan and control measures.**

Development / Sediment control	ESC Plan	ESC Strategy	Site Water Quality objectives	Soil testing	ESC report with modelling and calculations	Minimum training level (Definition below table)
Land disturbance 400m <sup>2</sup> to 1000m <sup>2</sup> – slope <15%	✓					Level 1
Land disturbance 400m <sup>2</sup> to 1000m <sup>2</sup> – slope >15%	✓					Level 4
Land disturbance 1000m <sup>2</sup> to 2500m <sup>2</sup> – slope <15%	✓	✓				Level 2
Land disturbance 1000m <sup>2</sup> to 2500m <sup>2</sup> – slope >15%	✓	✓				Level 4
Land disturbance >2500m <sup>2</sup> and <15% slope	✓	✓	✓	✓	✓	* Level 4 – RPEQ
Land disturbance >2500m <sup>2</sup> and >15% slope	✓	✓	✓	✓	✓	CPESC ** and/or RPEQ with level 4
Type 1 – Sediment basin	Identified within above reporting, as necessary					RPEQ with level 4
Type 2 – Rock filter dams, sediment weirs	Identified within above reporting, as necessary					Level 4 and/or CPSS
Type 3 – Sediment fence and sediment traps	Identified within above reporting, as necessary					Level 1** or Level 2

Notes:

- \* RPEQ with Erosion & Sediment Control training
- \*\* qualification acceptable if low risk i.e. presence of watercourses and slope over 15%
- Land disturbance* means area subject to clearing, grubbing, engineering work or earthworks associated with a development, until they are suitably rehabilitated and stabilised to Council's satisfaction.
- CPESC* means Certified Professional in Erosion and Sediment Control
- CPSS* means Certified Professional Soil Scientist
- Level 1, 2, 3 or 4 means IPWEAQ or AUSTIECA recognised Erosion & Sediment Control training.
- Construction phase water quality objectives are in accordance with *Whitsunday Planning Scheme 2017 – Construction Management Code*

1.31.2 As required, an Erosion and Sediment Control Strategy (ESCS) must be submitted for review and approval by Council at operational works stage. An ESCS provides a wholistic overview of erosion and sediment control over the lifetime of the construction phase.

1.31.3 The ESCS informs detailed *Erosion and sediment control plans* in accordance with CP1.05, that may be created for each stage, phase or weather condition. The Erosion and Sediment Control Strategy needs to be communicated to all involved – sub-contractors, private certifiers, homeowners and Council – how stormwater pollution is to be controlled on the site and who is responsible for its control at each phase of construction.

1.31.4 The Erosion and Sediment Control Strategy shall include:

<b>Erosion and Sediment Control Strategy</b>	<b>Supplied (✓)</b>
<b>Overview Map (s)</b>	
A plan of development showing the road, allotment boundaries,	
Existing and finished surface contours at an interval close enough to define terrain.	
Contours shall extend beyond the limits of the development site to fully define the limits of external catchments and identify all areas over 15% slope.	
Existing drainage paths, watercourses and drainage infrastructure.	
Extent of clearing and trees to be removed or retained.	
Line diagram of drain lines and drainage structures.	
<b>Works Overview / Analysis</b>	
Description of construction methodology and staging program. Description must describe construction phases and triggers for altering or installing new erosion and sediment controls to inform detailed <i>CP1.05 Erosion and sediment control plans</i> . A detailed Erosion and sediment control plan may be required for each stage.	
Location of underground services, permanent site stabilisation (i.e. retaining wall, channels, cut & fill) and neighbouring adjoining structures that may channel, re-direct or be impacted by run-off.	
Soil testing and description of soil type if disturbing more than >2500m <sup>2</sup> .	
Location of stabilised entry/exit (rumble pad).	
Location of stockpile areas.	
Location of sensitive and restricted access areas.	
If development directly discharging into an on-site or adjoining watercourse, pre-development baseline water quality measure of total suspended solids in Nephelometric units (NTU) and description of weather conditions or surrounding development preceding test.	
Existing significant vegetation to be retained and vegetation buffer strips.	
Location of re-vegetation works (as required)	
<b>Stormwater Quality Management</b>	
Calculations are to be submitted in accordance with QUDM and based on soil type(s) of the site in accordance with IECA calculations.	
Calculations identify compliance with stormwater management design objectives – construction phase, within the <i>Whitsunday Planning Scheme 2017</i> for nominated design events.	
<b>Erosion &amp; Sediment Control Plan inputs</b>	
Overview of ESCP to be employed for each stage of the construction process. As a minimum this is to include stripping/earthworks, trenching/services installation and when stormwater and roadways are completed.	
Consideration for construction during the wet season (typically Nov – Mar) with regard given to increased storm intensity and minimising disturbed areas and for construction during the dry season with regard given to dust suppression.	

The identification and location of all Erosion and Sediment control measures (i.e. catch drains, diversion drains, sediment traps, sediment basins etc.) that are proposed for each ESCP or construction stage when the site is disturbed, including who is responsible for establishing and maintaining all erosion and sediment measures.	
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#### AP 1.32 Service Providers/Conduit Plan including Street Lighting.

- 1.32.1 This plan shall include:
  - 1.32.1.1 Legend.
  - 1.32.1.2 Road Reserve Boundaries.
  - 1.32.1.3 Allotment Numbers and Boundaries.
  - 1.32.1.4 North Point.
  - 1.32.1.5 Kerb and channel or edge of pavement where no kerb is to be constructed;
  - 1.32.1.6 Road Crossings Conduits Type and size.
  - 1.32.1.7 Location of Pad Mount Transformers.
  - 1.32.1.8 Location of Telecommunications Authority's Roadside Cabinets & Shelters and Cables;
  - 1.32.1.9 Location of Street Lighting including designation of hierarchy of all roads.
  - 1.32.1.10 Lux contours and street light pole details for intersection designs
  - 1.32.1.11 Essential details of all roads, traffic facilities or public open space areas to be lit.
  - 1.32.1.12 Location of Electricity Authority's Cables and Facilities paying particular attention to connection to existing power supply.
  - 1.32.1.13 Electrical reticulation plans.
  - 1.32.1.14 Gas pipes, valve, syphon points and storage facilities.
  - 1.32.1.15 Mandatory requirements to be provided and demonstrated compliance of the design as specified in Appendix D of AS/NZS 1158.1.1 and Appendix E of AS/NZS 1158.3.1

#### AP 1.33 Stormwater Catchment Plan/Drainage Calculations Tabulation.

- 1.33.1 The catchment plan shall include the following:
  - 1.33.1.1 North point.
  - 1.33.1.2 A plan of the development showing the road and allotment boundaries.
  - 1.33.1.3 Existing and finished surface contours/ levels (in different line types and at interval close enough to define the terrain) and clearly define the sub- Catchments.
  - 1.33.1.4 Contours shall extend beyond the Limits of the Development Site to fully define the limits of all external catchments, existing and future.
  - 1.33.1.5 Catchment and Sub- catchment boundary labels and areas.
  - 1.33.1.6 Line diagram of drainage line, manhole, gully and outlet locations.
  - 1.33.1.7 Labelling of stormwater structures.
  - 1.33.1.8 Adjacent to each stormwater pit tabulation is to be provided illustrating the roadway approach flow, the width of approach flow, and the bypass flow.
  - 1.33.1.9 Overland flow paths.

1.33.1.10 Proposed easement boundary extents.

1.33.1.11 Stormwater calculation table shall be in a format in accordance with QUDM. This tabulation to include flow width in roadway to each pit, depth of ponding at sag points and a bypass flow value at all pits.

#### AP 1.34 Pest Plant Management

1.34.1 In accordance with the *Land Protection (Pest and Stock Route Management) Act 2002* the applicant must not remove soil or any matter containing reproductive pest plant material and transport such matter to another location. Appropriate measures must be put in place to ensure that soil and other organic materials are not inadvertently (or otherwise) transported to other locations.

1.34.2 Prior to the issue of a development permit for operational works, the applicant must:

1.34.2.1 Clearly state if there is an excess amount of soil on the development site.

1.34.2.2 Provide appropriate documentation to show where any excess soil is to be used or placed on the site.

1.34.2.3 Provide a plan which indicates where a shakedown or wash down area will be placed to ensure that all vehicles entering and exiting the development site are subject to a cleansing procedure to remove soil and any other organic materials.

1.34.2.4 Construct a shakedown or wash down area during the first stage of development. This is not to be in the vicinity of a creek, or a waterway or drain which leads to a creek or other water body.

1.34.2.5 Permanently contain material within the site inclusive of shakedown area.

1.34.2.6 Maintain the site to a point of sale so that declared weeds are eradicated or controlled.

1.34.3 Soil or other matter contaminated with weed seed or organic material should not be used in landscaping e.g. buffer mounds.

1.34.4 Reference should be made to Council pest management unit to obtain advice.

1.34.5 These conditions relate to all class 1, 2 and 3 plants identified in the *Land Protection (Pest and Stock Route Management) Act 2002*.

#### AP 1.35 Miscellaneous Details

1.35.1 Detailed are required for the following either on separate drawings or appropriate service plan:

1.35.1.1 Stormwater inlet and outlet structures, other than standard headwinds.

1.35.1.2 Manhole details where pipe alignments are critical for clearances or flow considerations.

1.35.1.3 Water quality permanent works structures (SQIDs, sediment basins, trash racks etc).

1.35.1.4 Details of erosion control and stormwater management structures.



- 1.35.1.5 Surcharge structures.
- 1.35.1.6 Overland drainage paths
- 1.35.1.7 Sewer and water pump stations showing all relevant levels and dimensions for pumps etc (where not provided elsewhere).
- 1.35.1.8 Footbridges.
- 1.35.1.9 Reservoirs.
- 1.35.1.10 Water source treatment/disinfection works.
- 1.35.1.11 Entry structures.
- 1.35.1.12 Retaining walls.
- 1.35.1.13 Buildings.
- 1.35.1.14 Unique signage, placemaking or artwork installations
- 1.35.1.15 And any details or variations from standard drawings.

## AP 1.36 Design Records

- 1.36.1 The designer shall provide Council with appropriate design records in a format such that design staff with no prior knowledge of the particular design can understand them readily.
- 1.36.2 A design file shall be maintained by the developer or the developers designer containing records of calculations, approvals and decisions, geotechnical data and other design data which could be relevant in reviewing aspects of the design or planning future maintenance responsibilities.
- 1.36.3 The developer is to provide a detailed submission for all structures being built as part of the development, for separate building approval and inspection. Submission is to include detailed design plans and a structural certificate from RPEQ.

## CP1 – Construction Procedures

### General

#### CP 1.01 Introduction

- 1.01.1 This section of this Development Manual details the minimum requirements acceptable to the Council associated with developments involving operational works defined as any works to be constructed that are subject to Council approval. Typically, this involves the construction of water supply, sewerage, stormwater, roadworks and public open space associated with development, reconfiguration or other approvals.
- 1.01.2 This manual does not apply to works of services under the control of other authorities (i.e. works within state-controlled road corridors). Separate approvals may be required from the other relevant authorities.
- 1.01.3 This section has been divided into four subsections as follows:
  - 1.01.3.1 Requirements prior to construction.
  - 1.01.3.2 Requirements during construction.

- 1.01.3.3 Acceptance of works.
- 1.01.3.4 Final acceptance of works.

## Requirements Prior to Construction

### CP 1.02 General Requirements

- 1.02.1 Prior to the construction of any works associated with the development approval which requires operational works approval by Council, the designer responsible for the design of the works must first obtain an approval of the design, construction drawings and specifications from Council. The procedures to be undertaken in order to achieve approvals are outlined in detail in section AP1 of this manual.

### CP 1.03 Construction Inspections

- 1.03.1 Prior to construction of the works the consulting engineer who is an RPEQ is to be engaged to be responsible for the provision of inspection services in accordance with a Council approved Inspection and Test Plan (ITP) and to exercise reasonable skill and diligence in order to ensure that the operational works requiring approval are executed in accordance with:
  - 1.03.1.1 Council's development permit conditions;
  - 1.03.1.2 Council's relevant policies and local laws;
  - 1.03.1.3 This manual, Council approved drawings, specifications and relevant Australian Standards;
  - 1.03.1.4 Good engineering practice; and
  - 1.03.1.5 Records compatible with Council's asset management information recording system are provided.
- 1.03.2 Inspections may be carried out by the consulting engineer or a delegate who shall be suitably qualified/experienced person approved by the consulting engineer.
- 1.03.3 The consulting engineers required to certify that all works have been carried out in accordance with the development approval and to WRC minimum standards prior to works acceptance.

### CP 1.04 Inspection and Test Plan

- 1.04.1 The Contractor is to prepare an ITP (endorsed by the RPEQ) identifying the following items:
  - 1.04.1.1 Element of work;
  - 1.04.1.2 tests and checks required;
  - 1.04.1.3 standard required to meet;
  - 1.04.1.4 frequency of testing;
  - 1.04.1.5 contractor's responsibility;

- 1.04.1.6 consulting engineer’s responsibility;
- 1.04.1.7 Council’s responsibility; and
- 1.04.1.8 asset data recording requirements.

Refer to CP 1.16 and the following Forms:

[Form 1 – Statement of compliance Operational works design](#)

- 1.04.1.9 allocate competent and experienced after site inspection and testing;
- 1.04.1.10 provide sufficient site presence, dependent on the contractor's progress and workmanship, and in accordance with the ITP, to be reasonably satisfied that the works meet the design, specification and performance requirements; and inspect and confirm acceptability of works is complying with the design intent and in accordance with the Council's requirements trying to request a Council inspection.

#### CP 1.05 Contractor's Erosion & Sediment Control Plan

- 1.05.1 The contractor shall prepare an Erosion and Sediment Control Plan (ESCP) for review and approval by Council at operational works stage. The ESCP must manage the site during construction and the defects liability period.
- 1.05.2 The plan shall be consistent with the approved Erosion and Sediment Control Strategy (ESCS) (as required) and shall take into consideration the contractor's proposed construction methodology and program. Note, if land disturbance is between 400m<sup>2</sup> to 1000m<sup>2</sup> and slope <15%, an ESCS may not be required.
- 1.05.3 The contractor may propose an alternative construction methodology that differs from the approved ESCS. In this instance the contractor shall discuss and obtain approval from the relevant suitably qualified person for the alternative strategy prior to submitting to Council for approval.
- 1.05.4 The contractor's ESCP must be prepared by a suitably qualified person in accordance with **Table AP 1.1**.
- 1.05.5 A copy of the contractor's current approved ESCS and ESCP is to be retained on site by the contractor's representative.
- 1.05.6 The relevant suitably qualified person is to review the ESCP for compliance with the approved ESC S (as relevant), ensuring compliance with stormwater management design objectives – construction phase for nominated design events within the *Whitsunday Planning Scheme 2017 – Construction management code*.
- 1.05.7 Any amendments required to ensure ESCS compliance are to be incorporated by the contractor prior to approval. The relevant suitably qualified person will issue a copy of the approved ESCP to the Council prior to the pre-start meeting.
- 1.05.8 It is the contractor's responsibility to ensure that the ESCP is updated and amended to reflect any changes in the construction methodology and program.
- 1.05.9 All amendments to the contractors ESCP shall be approved by the relevant suitably qualified person and a copy of the revised approved ESC P issued to Council for approval prior to implementation.
- 1.05.10 On larger sites where works are to be progressively constructed a plan shall be provided for each stage of works in accordance with the ESC S
- 1.05.11 Erosion and Sediment Control Plan implementation is a Hold Point if involving development:
  - (a) Land disturbance more than 400m<sup>2</sup> over >15% slope; or
  - (b) All land disturbance more than 1000m<sup>2</sup>
- 1.05.12 Hold Point is required to review implemented erosion and sediment control measures prior to commencing work. Hold point will review on-ground measures in accordance with the approved ESC S and ESCP. Works may not

proceed until the meeting is held and any further requirements identified during the conduct of the meeting are satisfied.

1.05.13 The contractors ESC P shall consist of the following:

Erosion and Sediment Control Plan	Completed (✓)
<b>Works Overview / Analysis</b>	
Written description of the sequencing of works or construction program, in accordance with the ESCS.	
General soil description	
Details of all erosion and sediment control measures to be used. The contractor may adopt standard details developed by others e.g. the IECA Best Practice Erosion and Sediment Control manual. Details should respond to items listed within CP 1.05.14, including: <ul style="list-style-type: none"> <li>- Minimising disturbance, sediment loss and erosion</li> <li>- Control of run-off and stormwater</li> <li>- Erosion control</li> <li>- Sediment control</li> <li>- Re-vegetation</li> </ul>	
An inspection, maintenance and test plan for monitoring erosion and sediment control measures during the construction and the defects liability period.	
Demonstrated compliance with stormwater management design objectives – construction phase for nominated design events, within the <i>Whitsunday Planning Scheme 2017 – Construction management code</i> , in accordance with the ESCS.	
The name of the person within the contractor’s organisation who has the authority and responsibility for implementing, monitoring, updating or amending the plan, in accordance with <b>Table AP 1.1</b>	
<b>Overview Map (s)</b>	
Property boundaries	
Existing and final contours – including location of cut and fill banks	
Existing and final overland flow drainage paths	
Limits of clearing where applicable e.g. on large properties	
Location of vegetated buffer strips	
Stabilised entry/exit point (rumble pad)	
Location of soil and sand stockpiles	
Location of all proposed temporary drainage control measures	
Location of all proposed erosion control measures (alternatively, use notes to describe locations)	
Installation sequence and maintenance requirements	
Location of measure(s) to remain in place from the commencement of the defect’s liability period.	

Note – ESC P should have regard to [Whitsunday Regional Council Erosion and Sediment Daily Site Checklist \(Fact Sheet 9\)](#) and [Controlling stormwater pollution \(Fact Sheet 10\)](#).

1.05.14 The contractors ESCP shall address the following issues:

1.05.14.1 Minimising Disturbance, sediment loss and erosion:

1.05.14.1.1 limiting the exposure time and size of disturbed areas to a minimum;

1.05.14.1.2 allow for the use of existing vegetation has buffer zones.

1.05.14.2 Control of runoff and stormwater quality:

- 1.05.14.2.1 sizing of structures, channels, catch strain and diversion drains for appropriate storm events in accordance stormwater management design objectives – construction phase, within the *Whitsunday Planning Scheme 2017 – Construction Management Code* for nominated design events;
- 1.05.14.2.2 Diverting clean water run-off around disturbed areas;
- 1.05.14.2.3 dividing the site into smaller more manageable drainage areas;
- 1.05.14.2.4 early installation of temporary drainage works;
- 1.05.14.2.5 early installation of permanent drainage system and protection works.
- 1.05.14.3 Erosion Control:
  - 1.05.14.3.1 protecting service changes and hard engineering structures (e.g. driveways, curbs, etc) from erosion caused by run-off;
  - 1.05.14.3.2 prompt revegetation of disturbed areas;
  - 1.05.14.3.3 installing structures and drainage channels to flow velocity and encourage settlement of soil particles;
  - 1.05.14.3.4 protection of disturbed areas from wind erosion (dust suppression).
- 1.05.14.4 Sediment Control:
  - 1.05.14.4.1 locating stockpiles clear of drainage paths and protecting stockpiles from traffic, run-off and wind erosion;
  - 1.05.14.4.2 minimising number of site access points;
  - 1.05.14.4.3 stabilising site access points to prevent vehicles transporting materials off-site;
  - 1.05.14.4.4 intercepting drainage from disturbed areas and installing sediment barriers to slow the velocity of flow and allow fine particles to settle;
  - 1.05.14.4.5 diverting larger contaminated flows to sediment traps to allow soil particles to settle or to be treated prior to release into receiving waters; and
  - 1.05.14.4.6 protecting partially constructed drainage structures from sediment infiltration.
- 1.05.14.5 Revegetation:
  - 1.05.14.5.1 Progressive stabilisation and rehabilitation of completed works; and
  - 1.05.14.5.2 providing protection to revegetation works on steep batters during establishment period.
- 1.05.14.6 Inspection, cleanout and maintenance:
  - 1.05.14.6.1 the inspection, cleanout and maintenance regime are to take into account the duration that the site will be disturbed and the timing of construction. If the site is disturbed (i.e. rehabilitation works are not complete) during the period December to May (wet season) a more rigorous inspection, cleanout and maintenance regime will be required then for a site which is disturbed during the period June to November.
  - 1.05.14.6.2 The following references/guidance it may assist in preparing the ESCP:

- [Whitsunday Regional Council Erosion and Sediment Control Guidelines and online Fact Sheets](#);
- Best Practice Erosion and Sediment Control, International Erosion Control Association (Australiasia) 2008;
- Queensland Urban Drainage Manual;
- Guidelines for the Preparation of Erosion and Sediment Control Plans for Building Sites, Cairns City Council, July 2003;
- Erosion and Sediment Control Standard Version 9, Brisbane City Council, 2000

#### CP 1.06 Construction Security Bond.

- 1.06.1 Prior to construction of the works commencing the developer is required to lodge a security bond in cash or unconditional bank guarantee to the value of 5% of the estimated cost of the construction of the works prepared and certified by the consulting engineer.
- 1.06.2 A bank guarantee should:
- 1.06.2.1 Be a binding contractual relationship between Council and the guaranteeing bank;
  - 1.06.2.2 Include specific requirements for renunciation of the guarantee;
  - 1.06.2.3 require adequate notice of renunciation;
  - 1.06.2.4 not have an expiry date.
- 1.06.3 The bond is to be accompanied by [Council's Security Lodgement Form \(Form 2\)](#) clearly identifying the purpose of the bond together with the consulting engineer's certification of the value of the works.
- 1.06.4 The bond is required to provide security to Council in the event that costs are incurred as a result the following:
- 1.06.4.1 protection of on street works from damage by contractors, subcontractors and suppliers;
  - 1.06.4.2 repairs to on street works or adjoining Council parkland resulting from damage caused by contractors, subcontractors and suppliers;
  - 1.06.4.3 protection and repair of existing Council services (i.e. sewerage connections, water connections et cetera);
  - 1.06.4.4 non-compliance with the approved Erosion and Sediment Control Plan during construction;
  - 1.06.4.5 failure to provide adequately for traffic; and
  - 1.06.4.6 urgent action required by Council to resolve unsafe construction or emergency repairs required to protect persons and/or property from consequential damages.
- 1.06.5 Any costs incurred by Council in responding to the above circumstances will be recovered from the security bond.
- 1.06.6 At the completion of the works and the commencement of the defects liability period, the construction security bond shall be returned to the developer or may be substituted for the defects liability bond.

#### CP 1.07 Notice of Commencement of Work

- 1.07.1 A notice of intention to commence works is to be issued to Council in writing seven days prior to the intended date for commencement of the works. No works will be permitted to commence until the following information is provided:
- 1.07.1.1 name, address and telephone number (including after-hours contact) of the consulting engineer for the works;
  - 1.07.1.2 name, address and telephone number (including after-hours contact) of the contractor and major subcontractors for the work;
  - 1.07.1.3 name and telephone number of the person to be contacted in regard to any matter arising from the construction of the works;
  - 1.07.1.4 intended date of commencement of works, and contract period;
  - 1.07.1.5 an invitation to the relevant Council representative to attend the pre-start meeting and confirmed by phone or email and minimum of 24 hours prior;
  - 1.07.1.6 a request to Council to confirm that environmentally significant areas and/or trees which are to be preserved in accordance with any tree preservation declaration, have been identified and adequately protected;
  - 1.07.1.7 A request to Council to utilise adjoining public open space during construction (as required), including, pre-construction photos of adjoining public open space that may be utilised, to inform appropriate rehabilitation.
  - 1.07.1.8 location of project sign (if required);
  - 1.07.1.9 and inspection and test plan (refer CP 1.16).
- 1.07.2 This submission will form notification of the date of the “pre-start” meeting.

#### CP 1.08 Documentation to Be Provided Prior to Pre-Start Meeting.

- 1.08.1 The following documents (to a standard acceptable to Council) are required to be submitted and accepted by Council prior to the pre-start meetings:
- 1.08.1.1 evidence of public liability insurance.
  - 1.08.1.2 Proof of payment of Portable Long Service Leave Levy (PLSL);
  - 1.08.1.3 contractor’s erosion and sediment control plan;
  - 1.08.1.4 traffic management plan;
  - 1.08.1.5 construction security bond;
  - 1.08.1.6 safety plan;
  - 1.08.1.7 evidence that all fees and charges have been paid; and
  - 1.08.1.8 cultural heritage management plan (if applicable).
- 1.08.2 The site safety induction is to be undertaken for each Council representative at initial attendance on site (prior to initial inspection);
- 1.08.3 evidence of Concurrence Agency, Service Authority or adjoining land owner consents/approvals is to be provided to Council prior to commencing any elements of work affecting/involving those parties;
- 1.08.4 the project specific Inspection and Test plan endorsed by the RPEQ.

#### CP 1.09 Pre-Start Meeting



- 1.09.1 A pre-start meeting is to be held prior to the commencement of works. The meeting is to be attended by consulting engineer, the contractor's representative, any relevant specialist consultants and Council's representative.
- 1.09.2 Items to be considered at this meeting will include but not be limited to the following:
  - 1.09.2.1 review of relevant conditions of development approval and discussion of any issues including conditions of the development permit and operational works approvals that are considered important and relevant to the attending parties;
  - 1.09.2.2 review of Council's construction requirements;
  - 1.09.2.3 discuss the Contractor's ESCP approved by the consulting engineer;
  - 1.09.2.4 a review of the processes for monitoring, compliance assessment and auditing of the ESCP;
  - 1.09.2.5 inspection and identification of parks and environmentally significant areas and/or trees for preservation;
  - 1.09.2.6 site access conditions;
  - 1.09.2.7 identification of areas to be left undisturbed;
  - 1.09.2.8 evidence of compliance with the Workplace Health and Safety Act, including site safety inductions, site safety plans, notifications;
  - 1.09.2.9 review of ITP including a notice of nominated hold/witness point;
  - 1.09.2.10 relevant provisions of any other Acts;
  - 1.09.2.11 Traffic Management Plan;
  - 1.09.2.12 location of project sign (if required);
  - 1.09.2.13 sewerage and water pump station commissioning plan (if applicable to the project); and issue plans for construction are the latest approved plans.
- 1.09.3 The pre-start meeting is a Hold Point and works may not proceed until the meeting is held and any further requirements identified during the conduct of the meeting are satisfied.
- 1.09.4 Council may require that subdivisions in difficult terrain or environmentally sensitive areas to have all road centre lines pegged prior to the pre-start meeting. This is to occur at least two weeks prior to any construction activity taking place so Council can visit the site with Engineers and Contractors representatives to view first had ramifications of such construction activities as stormwater drainage points, proposed earthworks areas, clearing etc. Council reserves the right to amend the design in consultation with engineers should any problems arise as a result of the inspection. This preliminary site visit should be arranged prior to or in conjunction with the pre-start meeting.

## Requirements During Construction

### CP 1.10 General Requirements

- 1.10.1 The general requirements during construction of the project are as follows:
  - 1.10.1.1 work may only proceed subsequent Council being issued with all the relevant documentation set out in CP 1.09;
  - 1.10.1.2 no work shall commence on any existing open Road to the public unless specifically approved by Council;

- 1.10.1.3 no work may be carried out nor machinery driven above or near existing water and sewerage pipes without a work method statement being submitted by the contractor and approved by Council;
  - 1.10.1.4 any damage to existing services under the control of Council or another authority must be notified immediately and made good by the relevant authority at the contractor/developer's expense prior to acceptance of the works;
  - 1.10.1.5 use of Council services (e.g. water from existing mains) is subject to approval by Council and payment of appropriate fees;
  - 1.10.1.6 work involving the use of machinery of any description shall only be carried out on the site 6:30 AM to 6:30 PM Monday to Saturday, with no work to be carried out on Sundays or public holidays. (In certain circumstances Council may approve works outside these hours. All applications for changes to working hours must be in writing). For emergent or complaint response issues, dust suppression and sedimentation control may occur outside these hours. Council is to be notified as soon as possible in this instance; and
  - 1.10.1.7 pumping stations, electrical switchboards, access covers, compounds and associated equipment installed during construction shall be padlocked when left unattended.
- 1.10.2 The developer, contractor and consulting engineer shall take all necessary steps, in accordance with the provisions of the workplace health and safety act, to ensure safety of the public in regard to construction activities. In particular, work on roadways shall be signed in accordance with the MUTCD. Council will require submission of plans indicating traffic control proposals and a program of work for sites involving the travelling public.
- 1.10.3 No public road may be closed, traffic diverted from public roads, or traffic diverted elsewhere without the prior approval of Council, Police and public advertising of the proposed diversion must be carried out. Proposals to divert traffic shall include full details of the alternative route and proposed signage.
- 1.10.4 Works shall not be undertaken on any adjoining private properties without the prior written consent of the relevant registered proprietor. A written acceptance (by the registered proprietor) of the completed work shall be submitted to Council upon finalisation of the work.
- 1.10.5 If connections or alterations to Council mains are required, the Council engineer shall be given a minimum of 10 working days' notice of the contractor's requirements (Council's notification requirements are to be noted on the project drawings/specifications).

## CP 1.11 Public Notices/Project Signage

- 1.11.1 Where is a condition of approval, Council requires a project sign(s) to be erected on the sites frontages to constructed roads and any other location as required, the sign shall contain the following information:
- 1.11.1.1 An overall concept plan of the development showing the stage or works about to commence construction;
  - 1.11.1.2 name of the developer;
  - 1.11.1.3 name of the project;
  - 1.11.1.4 Street address of the site;

- 1.11.1.5 project manager's name and contact number;
  - 1.11.1.6 consulting engineer's name and contact number;
  - 1.11.1.7 contractor's name and contractors number; and
  - 1.11.1.8 other specialist consultants (geotechnical, landscaping, architects, hydraulics et cetera) names and contact numbers.
- 1.11.2 Material and size of the sign shall be as follows:
- 1.11.2.1 Made of weatherproof material; and
  - 1.11.2.2 Not less than 1200mm x 900mm.
- 1.11.3 Position of the sign on the land:
- 1.11.3.1 the sign must be placed on, or within 1.5 m of, the road frontage of the land;
  - 1.11.3.2 the sign must be mounted to at least 300 mm above ground level; and
  - 1.11.3.3 the sign must be positioned so that it is visible from the road.
- 1.11.4 The lettering on the sign:
- 1.11.4.1 each item listed above must start on a new line; and
  - 1.11.4.2 the minimum lettering height shall be 50 mm in height.

#### CP 1.12 Document Control

- 1.12.1 A copy of the approved project drawings, specification and operational works approval shall be kept on the job site at all times during construction.
- 1.12.2 Should amendments be required to engineering plans and/or specifications during construction, the consulting engineer shall ensure that Council and any other person or organisation who has previously been issued a set of plans that may be affected by this amendment (e.g. registered surveyor, public service authority) is in receipt of a copy of all amended drawings and/or specifications. When approved, Council shall stamp these plans for approval as Operational Works plans. Any amended drawings and/or specifications shall be submitted with an accompanying letter outlining the amendments together with any supporting information.
- 1.12.3 Submissions with a full complement of supporting documentation will expedite Council's approval timeframes.
- 1.12.4 All amendments shall be issued to Council for approval prior to the works being undertaken.

#### CP 1.13 Erosion & Sediment Control

- 1.13.1 The consulting engineer shall ensure that the construction contract contains provisions requiring the contractor to implement the approved ESCS and to prepare and implement an ESCP complying with the approved strategy.
- 1.13.2 The contractor shall ensure that all reasonable measures are taken to protect nearby properties from dust pollution, erosion, siltation or sediment transport.
- 1.13.3 Council reserves the right to order whatever action deem necessary and appropriate at the time to prevent environmental harm, including ordering temporary cessation of work in extreme cases.

- 1.13.4 As erosion and sediment control is also an issue of public amenity and safety, the developer shall be responsible for any costs arising from dust or water pollution generated by its development.

#### CP 1.14 Noise

- 1.14.1 The requirements of the *Environmental Protection Act* 1994 regarding nuisance noise (if applicable) shall apply to the development works.

#### CP 1.15 Parks & Environmentally Significant Areas

- 1.15.1 In cases where the subject land or the adjacent land is an existing or proposed park, bushland conservation reserve or area otherwise declared by Council as environmentally significant, the following general precautions shall be mandatory:
- 1.15.1.1 the areas should be clearly pegged, flagged, (and fenced if ordered by Council) inspected and approved by Council officers;
  - 1.15.1.2 the approved design, or certificate of approval for tree clearing issued pursuant to tree preservation bylaws (if applicable) shall have identified any unavoidable intrusion into such areas and nominated work practices such as maximum widths of disturbances, nominated access routes, methods and timing of rehabilitation, which shall be strictly adhered to.
  - 1.15.1.3 adjoining public open space utilised in construction is rehabilitated to Council's satisfaction, in accordance with pre-construction photos submitted as per CP 1.07.
- 1.15.2 Council should be notified immediately when the consulting engineer is aware of any damage or disturbance beyond the approved limits. Rehabilitation of this damage or disturbance shall be to the satisfaction of Council.

#### CP 1.16 Inspection & Testing

- 1.16.1 During the construction phase, the consulting engineer shall be responsible for undertaking the minimum number of required inspections and tests in accordance with the approved Inspection and Test Plan (ITP).
- 1.16.2 There are a number of major inspections that are mandatory hold points (H) for the consulting engineer and Hold Points or Witness Points for Council. These will be included in the ITP and can be found in [Appendix A](#) which contains inspection and test plan templates. The contractor's ITP is to be based on these templates and updated with project specific testing requirements.
- 1.16.3 Any proposed changes to the ITP must be notified to and accepted by Council prior to the affected works commencing.

- 1.16.4 The submitted ITP is to be implemented by the consulting engineer. The test results and effort certification that the plan has followed are to be submitted with the “as constructed” documentation.
- 1.16.5 Council will, on a random basis, call upon the consulting engineer to provide evidence of conformance with the approved ITP in the form of diary records, site visit reports etc.
- 1.16.6 During construction, Council reserves the right to conduct audit inspections of any or all of the works without prior notification. These inspections do not release the consulting engineer from his responsibility to check the contractor’s work.
- 1.16.7 For the RPEQ’s test inspections and Hold/Witness Points, a “Certificate of Inspection” will record the inspections. If requested, copy is to be provided to Council for each Hold Point/Witness Point inspection.
- 1.16.8 For Council Hold/Witness points, the RPEQ’s information will include as a minimum the details contained within [Form 3](#).

#### CP 1.17 Application for Council to Complete Private Works

- 1.17.1 unless otherwise approved, Council requires any connections and alterations to Council’s live sewer and water mains associated with developments to be completed by the developer at the developer’s expense subject to Council’s approval and supervision.
- 1.17.2 Sewer and water mains are considered to be live once the defects liability period has commenced. All work on live sewers and water mains must be carried out by the contractor with Council approval and subsequent supervision.
- 1.17.3 Alterations and connections to existing Council sewer and water mains, resulting from the development (including cutting in of new sewer property connections) are to be completed prior to commencement of the defects liability period. In these cases, separate applications should be made for the alterations and the connections.
- 1.17.4 Contractors are not permitted to operate Council’s infrastructure unless written approval has been obtained from Council. The placement and removal of plugs within live sewers must be done under direct supervision of Council’s inspector.
- 1.17.5 Council reserves the right, on the advice of its inspector, to stop, or take over a connection being undertaken by a contractor, if in the inspector’s opinion the contractor is incapable of completing the connection work in a reasonable time without causing damage to Council’s infrastructure or undue inconvenience to the public. Any work carried out by Council will be at the contractor’s cost.

#### CP 1.18 Application for Approval to draw water from Council Mains

- 1.18.1 The drawing of construction water from Council’s mains must be approved and the relevant fees paid in advance.
- 1.18.2 Permission to draw water shall be subject to the following conditions:
  - 1.18.2.1 backflow prevention;
  - 1.18.2.2 water mainly be taken between the hours of 8 AM and 4:30 PM;
  - 1.18.2.3 the approval shall be limited to the days and dates nominated in Council’s notice of approval;

- 1.18.2.4 water money be taken from the approved hydrant point;
- 1.18.2.5 a copy of this approval is to be held by the driver of any vehicle taking water covered by this approval;
- 1.18.2.6 Council may withdraw this approval at any time, such notice shall be in writing and will become effective immediately; and
- 1.18.2.7 the applicant is responsible for the cost of reinstatement of damage to Council's property caused by the taking of water covered by this permit.

## Acceptance of Works

### CP 1.19 Introduction

- 1.19.1 Full works requiring Council approval a "Defects Liability" period is a period of 12 months minimum (or other period as Council so shall require in its absolute discretion) after the works have been accepted as complete by Council. During the defects liability period, it is the responsibility of the developer to rectify any works found to be defective due to design faults or found to exhibit faults attributed to the performance of the construction activities in terms of quality and conformance with the design and specifications.
- 1.19.2 The following are required to be completed prior to Council acceptance of works:
  - 1.19.2.1 completed "as constructed" submission lodged with Council a minimum five days prior to the "Works Acceptance" inspection or early plan sealing inspection for bonding or uncompleted works and being to Council satisfaction;
  - 1.19.2.2 satisfactory "Works Acceptance" inspection;
  - 1.19.2.3 all documentation outlined in CP 1.25(2) submitted to and accepted by Council;
  - 1.19.2.4 all appropriate documentation to be completed by the consulting engineer and retained for records purposes. This consists of the ["Works Acceptance Inspection Checklist" \(Form 4\)](#), the certified ITP and all test results and records for the works.
  - 1.19.2.5 Approval has been given by Council or private certifier for construction of any buildings forming part of the operational works approval; and
  - 1.19.2.6 satisfactory commissioning and acceptance of any water pump station, reservoir or sewerage pump station.
- 1.19.3 Following the satisfactory completion of all of the above matters, the consulting engineer shall make a written request for acceptance of the works and commencement of the "Defects Liability" period and lodgement of any uncompleted Works Bonds.
- 1.19.4 The date of the works acceptance shall be the date of issue of the Works Acceptance certificate and shall be taken as the date all documentation outlined in CP 1.25 has been approved and conditions of the operational works and development approval have been met. Works acceptance will not be backdated to the date of the works acceptance inspection. The assets will become Council's at the date on the work acceptance certificate.

- 1.19.5 Prior to making application for works acceptance the consulting engineer must confirm that all non-compliant work is rectified by the contractor. Any non-compliance is found by Council must be rectified prior to Council's issue of a Works Acceptance certificate. It is the responsibility of the consultant to monitor the contractor's work to the extent necessary such that any deviations from the design are approved prior to making application for works acceptance, alternatively the consultant must instruct the contractor to rectify the work.

#### CP 1.20 Defects Liability Bond

- 1.20.1 Council requires a bond equivalent to a minimum of 5% of the value of the works (or such other amount as Council deems appropriate in its sole discretion), which is kept for the Defects Liability period, or until the works are finally accepted.
- 1.20.2 The bond is to be submitted with [Council's Security Lodgement Form \(Form 2\)](#) clearly identifying the purpose of the bond together with the consulting engineers certification of the value of the works.
- 1.20.3 The construction security bond lodged prior to construction may be used for the purposes of the defects liability bond subject to Council's approval.

#### CP 1.21 "As Constructed" Submission

- 1.21.1 "As Constructed" documentation serves two distinct functions:
- 1.21.1.1 Evidence that "As Constructed" works have been checked against the approved design, to support certification by the consulting engineer responsible for the design that design philosophies and criteria have been achieved; and
- 1.21.1.2 to provide an accurate record of the "As Constructed" services.
- 1.21.2 Information required for the checking function must be presented in ADAC format in accordance with Council's "Guidelines for Creation and Submission of ADAC XML Files".
- 1.21.3 The submission of digital "As Constructed" files in accordance with Council's ADAC guideline is mandatory in order to achieve acceptance of development works and commencement of the "Defects Liability" period and is required to be forwarded to Council a minimum of five working days prior to the "Works Acceptance" inspection or early plan sealing inspection for bonding of uncompleted works.
- 1.21.4 The following items must be submitted as part of the "As Constructed" submission:
- 1.21.4.1 electronic copies of the updated management plans, operational and maintenance manuals, and environmental management plans where these have been amended or not previously provided to Council (where applicable);
- 1.21.4.2 asset valuation report (detailed bill of quantities) in a format acceptable to Council and certified by an RPEQ;

- 1.21.4.3 an electronic copy of the Council approved final engineering drawings in both DWG and ADAC format together with electronic PDF copies;
- 1.21.4.4 where applicable, pump station RTU number and pump station identifier to be obtained from Council;
- 1.21.4.5 electronic copy of the Council approved landscaping and parks embellishment drawings;
- 1.21.4.6 electronic copy of Park/landscaping irrigation system drawings;
- 1.21.4.7 electronic copy of design plans for building/structure and copy of structural certificate;
- 1.21.4.8 “As Constructed” digital data and drawings of services and infrastructure including works completed by Council for the contractor under a Private Works agreement;
- 1.21.4.9 digital ground model data to the requirements of Council in an approved format (e.g. DWG or as nominated by Council).
- 1.21.4.10 Any necessary information required for Council’s asset management records;
- 1.21.4.11 certificate of installed playground equipment to relevant Australian standards; and
- 1.21.4.12 details of works carried out on mains, whether or not they are part of the original project design or for a future stage.

#### CP 1.22 Compliance Certifications

- 1.22.1 All “As Constructed” works including the sewerage property connection branches, must be surveyed by a registered surveyor in order to obtain the detail required by Council’s ADAC guideline. The registered surveyor’s certification must accompany the “As Constructed” submission to Council. See [Form 5](#) for an example of an acceptable Registered Surveyor’s (Consulting) Certification.
- 1.22.2 All “As Constructed” works must also be certified by the consulting engineer responsible for the works. The certification must note that the design intent and function of the proposed works have not been compromised by the constructed works. To this extent, the consulting engineer will be responsible for determining whether the “As Constructed” details that exceed the tolerances for construction do not compromise the design intent and/or operational effectiveness of the infrastructure.
- 1.22.3 It is recognised that in some circumstances, the tolerances for construction are exceeded. In these instances, the consulting engineer will be responsible for performing confirmation design calculations to ensure that the original design intent and function are not compromised.
- 1.22.4 Further, should the “as constructed” details indicate a change to the design intent or function of the works, revised design calculations shall be provided by the consulting engineer to indicate the acceptability of the proposed change relative to Council’s requirements. Council’s approval of the change is required prior to the formal acceptance of the works.
- 1.22.5 The consulting engineer shall be responsible for the completion of [Form 6](#) [“Statement of Compliance - As Constructed Works”](#).



## CP 1.23 Management Plans, Operation and Maintenance Manuals

- 1.23.1 Where works comprise pump stations, reservoirs, treatment plants etc, operation and maintenance manuals for all components shall be provided. Operating and maintenance manuals shall include spare parts lists, electrical documentation and any other relevant information. Maintenance manuals and procedures are also required for drainage structures which incorporate Gross pollutant traps, interceptor devices etc. The maintenance procedures should indicate recommended frequencies for maintenance/planning functions in wet and dry seasons.
- 1.23.2 Management plans are necessary for where there is any future maintenance required to ensure sustainability of that feature, i.e. waterways, bio retention basins etc.

## CP 1.24 Project Documentation

- 1.24.1 Development works will not be accepted until construction records have been certified as being completed by the consulting engineer and accepted by Council.
- 1.24.2 A complete copy of the following documents shall be provided to Council for acceptance prior to the “Works Acceptance” inspection:
- 1.24.2.1 ITP certified by the consulting engineer;
  - 1.24.2.2 “Works Acceptance” inspection checklist;
  - 1.24.2.3 “As Constructed” submission (including ADAC files) in accordance with CP1.21;
  - 1.24.2.4 management plans, operation and maintenance manuals in accordance with CP 1.23;
  - 1.24.2.5 water and sewerage inspection certificates including pump station and reservoir commissioning certificate; and
  - 1.24.2.6 digital copy of CCTV survey for sewer and stormwater with engineering report and certification.
- 1.24.3 Copies of all test results required to confirm compliance with Council standard specifications shall be assembled and retained as part of the project documentation within the consulting engineers record storage facilities. Whilst not a complete listing, the following details some major records to be included:
- 1.24.3.1 fill compaction test results;
  - 1.24.3.2 subgrade CBR’s;
  - 1.24.3.3 subgrade replacement material quality, thickness and locations;
  - 1.24.3.4 subgrade replacement material compaction test results;
  - 1.24.3.5 subsoil drain filter media quality statements (or grading is where required);
  - 1.24.3.6 subbase course and base course material quality statements and thicknesses;
  - 1.24.3.7 subbase course and base course compaction test results;
  - 1.24.3.8 prime or primer spray seal and application rates;
  - 1.24.3.9 AC core test results;
  - 1.24.3.10 sewer pressure test records;
  - 1.24.3.11 grading to sewer bedding quality statements;

- 1.24.3.12 grading to water main bedding quality statements;
  - 1.24.3.13 water main pressure test records;
  - 1.24.3.14 pump station commissioning and test certification by Council (sewer and water) including wet-well, pumps and switchboard;
  - 1.24.3.15 any concrete testing required by the technical specifications;
  - 1.24.3.16 pipework material quality statements for all pipework material (water, sewer, stormwater et cetera);
  - 1.24.3.17 Geo fabric material quality statements;
  - 1.24.3.18 digital copy of CCTV survey for sewer and stormwater with engineering report and certification;
  - 1.24.3.19 any other testing results or statements required to conform with this manual;
  - 1.24.3.20 any other job specific testing carried out ordered by the consulting engineer, if used.
- 1.24.4 The consultant should prepare a letter to Council requesting acceptance of a pump station for the purpose of achieving “Works Acceptance” for the subdivision. The letter should include/enclose:
- 1.24.4.1 the pump station allotment number, as it appears on the survey plan;
  - 1.24.4.2 the name of the pump station and RTU number;
  - 1.24.4.3 copy of approved design drawings;
  - 1.24.4.4 copy of as – constructed drawings (can be preliminary);
  - 1.24.4.5 copy of completed pre-commissioning checklist;
  - 1.24.4.6 details of any nonconformances and uncompleted works;
  - 1.24.4.7 rectification plan if required;
  - 1.24.4.8 copy of ITP;
  - 1.24.4.9 certification by the consultant for structural design, buoyancy and compliance with design drawings and this manual;
  - 1.24.4.10 request that Council make application to Ergon for connection of power accompanied with a locality plan with street names showing the pump station location to attach to the application; and
  - 1.24.4.11 evidence that an application for commissioning a sewerage pump station has been lodged.
- 1.24.5 The information to be provided to Council shall include as a minimum the requirements of the pump station commissioning checklist ([Appendix H](#)). The following pump station information shall also be provided to Council:
- 1.24.5.1 pump manufacturer, model, type, and impeller diameter (as a cut sheet);
  - 1.24.5.2 rating of the motor;
  - 1.24.5.3 weight of the pump and motor;
  - 1.24.5.4 Manufacturers performance curve (as a cut sheet);
  - 1.24.5.5 curves with at least four points plotted of the actual performance established in the field, or similar supervised work certificate plotted with the manufacturers pump curve;
  - 1.24.5.6 KWH/1000 L pumped;
  - 1.24.5.7 complete wiring diagrams and details (if not Council standard);
  - 1.24.5.8 mechanical details and parts list of pump and motor;
  - 1.24.5.9 maintenance catalogue showing also daily, weekly, monthly and annual maintenance requirements; and
  - 1.24.5.10 a complete set of the manufacturers recommended spares delivered to Council.

- 1.24.6 Should any of the above test results fail to meet specification the consulting engineer shall include in the record, details of retesting/rectification carried out.
- 1.24.7 The construction record should be retained analogically assembled and bound document including a table of contents confirming completeness and presented to Council on completion of the works.
- 1.24.8 Site-specific as constructed drawings for pump stations and reservoirs. The drawings must be prepared in accordance with the requirements set out in Council's ADAC and Survey guidelines.

#### CP 1.25 “Works Acceptance” Inspection

- 1.25.1 The “Works Acceptance” inspection requires attendance by:
  - 1.25.1.1 The consulting engineer for the project;
  - 1.25.1.2 The contractor; and
  - 1.25.1.3 Council's nominees.
- 1.25.2 It is the responsibility of the contractor and the consulting engineer to ensure any necessary requirements of the works are to an acceptable standard (as defined in approved design and construction documentation) prior to the conduct of a “Works Acceptance” inspection.
- 1.25.3 The general requirements to be met prior to Council's “Works Acceptance” inspection of the works are as follows:
  - 1.25.3.1 the site is clean, tidy, free of rubbish, rocks, sticks, unauthorised stockpiles, etc.
  - 1.25.3.2 allotment earthworks and site grading to be free draining and in accordance with the approved design;
  - 1.25.3.3 integrity of environmentally significant areas is maintained;
  - 1.25.3.4 all sewers flushed and gravity sewers inspected by CCTV; and
  - 1.25.3.5 valve boxes and manhole tops visually located and not covered.
- 1.25.4 Prior to requesting a “Works Acceptance” inspection, the consulting engineer is responsible for confirming:
  - 1.25.4.1 that the approved works have been completed;
  - 1.25.4.2 any non-compliant issues or defects noted during the construction process, have been rectified to Council satisfaction;
  - 1.25.4.3 the above listed items are in accordance with the approved drawings, Council's technical specifications and accepted engineering and landscaping practice; and
  - 1.25.4.4 project documentation listed in CP 1.25 have been submitted. Failure to do so may result in cancellation of the inspection and/or the incurring of a reinspection fee.
- 1.25.5 Further to the above, and prior to the “Works Acceptance” inspection, the consulting engineer shall be responsible for the completion of the [“Works acceptance” Inspection Checklist \(Form 4\)](#) as appropriate to the works being constructed.
- 1.25.6 The completed checklist shall be presented to the relevant Council officer prior to the “Works Acceptance” inspection. Council officers will not undertake a detailed check of all items raised in the checklist but will examine some aspects of the works on an audit basis. The original of the completed checklist shall be retained with the records for the project upon completion of the works.

## CP 1.26 Bonding of Uncompleted Works

- 1.26.1 For subdivision works council may, at its discretion, approve the bonding of uncompleted works to enable early sealing of survey plans. If Council does consent to the early sealing of survey plans, the developer must disclose to prospective purchasers that all services may not be available until the outstanding works are completed. Council will only consider early plan sealing for the full stage of the development is defined in the Operational Works approval. Parts of a stage will not be considered for early plan sealing.
- 1.26.2 Prior to the submission of any bond or plans for sealing, the following matters must be completed to the satisfaction of Council:
- 1.26.2.1 engineering plans have been approved; and
  - 1.26.2.2 all survey pegs placed;
  - 1.26.2.3 all allotment preparation work and earthworks on allotments have been completed in accordance with the requirements of this manual, with finished surface levels, the degree of compaction achieved and geotechnical assessments required on any of the allotment submitted and approved by Council.
  - 1.26.2.4 Roads have been constructed to subbase level;
  - 1.26.2.5 all stormwater systems including kerb and channel constructed;
  - 1.26.2.6 sewer systems to be installed, tested, operational and “as constructed” plans lodged and accepted;
  - 1.26.2.7 water supply system to be installed, tested, commissioned and “as constructed” plans lodged an accepted;
  - 1.26.2.8 satisfactory evidence is to be provided to Council of a negotiated agreement with service providers for telecommunications, cabling, reticulation of electricity and the provision of street lighting and gas service providers for provision of gas (if applicable);
  - 1.26.2.9 all outstanding rates are paid;
  - 1.26.2.10 all works within allotments are fully completed and no further disturbance required on the allotments;
  - 1.26.2.11 appropriate erosion and sediment control measures are in place for all disturbed areas;
  - 1.26.2.12 all other bonded works (or works under agreement) are included in a bona fide contract between the developer and the contractor to be completed within 90 days;
  - 1.26.2.13 all contributions required by the conditions of approval shall be paid prior to sealing of survey plans (infrastructure charges, contributions to service providers, Department of Main roads contributions, etc).
  - 1.26.2.14 “As constructed” information provided for all completed works and accepted by Council;
  - 1.26.2.15 submission of CCTV survey of completed sewers and stormwater drainage systems; and
  - 1.26.2.16 building approval for all buildings/structures.
- 1.26.3 When the above matters have been completed, the applicant or consulting engineer shall submit the following to Council:
- 1.26.3.1 [Security lodgement Form \(Form 2\)](#) to be completed clearly indicating that the purpose of the bond is for uncompleted works;

- 1.26.3.2 fully priced schedule of outstanding works including the cost of preparation of the “as constructed” submission;
- 1.26.3.3 cash bond or unconditional bank guarantee to the value of 1.5 times the estimated value of the uncompleted works as certified by the consulting engineer. A bank guarantee should include:
  - 1.26.3.3.1 a binding contractual relationship between counsel and the guaranteeing bank;
  - 1.26.3.3.2 specific requirements for renunciation of the guarantee; and
  - 1.26.3.3.3 require adequate notice of renunciation and must not have an expiry date.
- 1.26.3.4 certification from the consulting engineer that the works on each allotment have reached a stage acceptable to Council and that the outstanding works are programmed for completion within 90 days. The outstanding construction works program must be Council approved;
- 1.26.3.5 all bonds submitted shall be clearly identified as to the particulars of the site and the purpose of the bond.
- 1.26.3.6 Council may, at its discretion, require an Uncompleted Works inspection to ensure that the on allotment works and all associated documentation has been completed to Council’s satisfaction. Should an inspection be deemed necessary, Council will require five (5) days’ notice and payment of the required inspection fee in advance of any inspection.

#### CP 1.27 Sealing of Plan of Survey

- 1.27.1 Where operational works are associated with the reconfiguration of land or creation of new titles the Applicant is required to submit plan of survey which accords with the proposal plan approved by Council, suitable for deposit in the office of the Registrar of Titles and duly certified by a Registered Surveyor (Consulting Cadastral), together with 4 copies of the plan, and a completed application form for sealing of survey plans, building units, or group titles plan within 2 years from the date of approval of engineering drawings and specifications for subdivisions involving works.
- 1.27.2 Where the survey plans differ from the approved proposed plan, details of any changes are to be provided with the application.
- 1.27.3 The application form and plans, certificate(s) of compliance for any water, sewer reticulation and stormwater drainage system (including CCTV survey), together with the relevant fee are to be lodged with Council.
- 1.27.4 Upon being satisfied that the Plan of Survey conforms with the approval granted, and all required works have been carried out, or adequate security in accordance with Council's policy for bonding of uncompleted works is provided and all outstanding rates, contributions and charges have been paid, Council will note its approval under seal on the plan of survey and return the plan of survey to the Applicant for lodgement in the Titles Office.
- 1.27.5 The Applicant is required to submit the plan of survey to the Titles Office within 6 months of Council sealing the plan. Failure to do so will require the plan of survey to be resubmitted to Council for resealing.

## Final Acceptance of Works

### CP 1.28 “Final Acceptance” Inspection General Requirements

- 1.28.1 The “Final Acceptance” inspection will generally confirm the matters raised in the [“Final Acceptance” inspection checklist \(Form 4\)](#) and any other matters outstanding relevant to the works. The checklist is to be completed by the consulting engineer prior to the conduct of the “Final Acceptance” inspection. Failure to do so may result in cancellation of the inspection and/or the incurring of a reinspection fee.
- 1.28.2 During the defects liability period, it is the responsibility of the developer to rectify any works found to be defective or found to exhibit faults attributed to the design of the works and/or the performance of the construction activities in terms of quality and conformance with the design and specifications.
- 1.28.3 Once a period of 12 months minimum (or other such period as determined by Council) has elapsed from Council’s acceptance of the works “Works Acceptance”, a “Final Acceptance” inspection is to be arranged with Council. Payment of an appropriate inspection fee may be required.
- 1.28.4 The “Final Acceptance” inspection is to be attended by:
  - 1.28.4.1 Council’s nominees;
  - 1.28.4.2 the consulting engineer for the project; and
  - 1.28.4.3 the contractor.
- 1.28.5 The consulting engineer for the work shall be responsible for ensuring that Council’s requirements for acceptance of the works are satisfied prior to requesting a final acceptance inspection.
- 1.28.6 Council’s requirements for final acceptance of the works are:
  - 1.28.6.1 No outstanding payments are due to Council or other Authorities from the development;
  - 1.28.6.2 completion of the “Final Acceptance” inspection checklist;
  - 1.28.6.3 satisfactory “Final Acceptance” inspection;
  - 1.28.6.4 All conditions of the approvals for as constructed drawings, works acceptance and plan sealing have been completed to the satisfaction of Council.
- 1.28.7 Following a satisfactory Final Acceptance inspection, the consulting engineer shall submit a written request to Council for Final Acceptance of the works and release of the defects liability bond. Council will, upon confirmation that no outstanding payments arising from the development are due to Council, confirm acceptance of the works, and arrange for the release of the defects liability bond.

## DP 1 – DEVELOPMENT PRINCIPLES

### General

#### DP 1.01 Introduction

- 1.01.1 This section of the Development Manual has been prepared to provide guidance on the design principles and issues to be considered by the designer in the preparation of layout plans for new urban developments. It is to be read in conjunction with the relevant planning scheme, and any local laws and policies.

#### DP 1.02 Urban Development Objectives

- 1.02.1 In addition to the requirements of the relevant planning scheme, local laws and policies, urban development layouts should:
- 1.02.1.1 Protect and enhance environmentally significant areas;
  - 1.02.1.2 Be sympathetic to the existing topography and landform;
  - 1.02.1.3 Minimise the impacts on the surrounding environment;
  - 1.02.1.4 Take into consideration existing water and sewerage services;
  - 1.02.1.5 Facilitate the provision of urban services; and
  - 1.02.1.6 Provide a safe urban living environment.

#### DP 1.03 Identification of Site Constraints and Values

- 1.03.1 In preparing an urban development layout, it is important to identify the natural constraints and values of the site and any engineering constraints on the provision of urban services and amenities.
- 1.03.2 Factors that may impose constraints on the development layout include but are not limited to:
- 1.03.2.1 Existing significant vegetation;
  - 1.03.2.2 road and service connections to adjoining properties;
  - 1.03.2.3 public transport networks;
  - 1.03.2.4 railway and cane tram way lines;
  - 1.03.2.5 external stormwater drainage catchments;
  - 1.03.2.6 downstream stormwater drainage and receiving waters;
  - 1.03.2.7 low-lying areas subject to flooding and ponding;
  - 1.03.2.8 constraints and impact on adjoining properties;
  - 1.03.2.9 constraints and limitation of existing utility services and planned augmentation works;
  - 1.03.2.10 Main roads resumption requirements;
  - 1.03.2.11 existing topographical features;
  - 1.03.2.12 Existing sewers, manholes and pump stations;

- 1.03.2.13 water quality issues; and
- 1.03.2.14 geotechnical considerations.

1.03.3 Designers are encouraged to consult with Council and other relevant authorities prior to or during the preparation of the site layout and design concept. Designers should in addition to the requirements of this manual ascertain any specific requirements of these authorities as they relate to the designs in hand.

## DP 1.04 Vegetation Protection and Environmentally Significant Areas

1.04.1 Prior to preparing a development layout, all areas that have significant environmental value should be identified and incorporated into the layout design to enable them to be preserved and protected. Any disturbances within these areas shall be minimised to the satisfaction of Council and other relevant authorities, as may be appropriate.

1.04.2 All existing natural streams, watercourse and riparian vegetation shall be preserved. To minimise the impacts on stream bank vegetation, all streams and watercourses shall be protected by a drainage reserve. The extent of the drainage reserve shall be determined by the following criteria:

- 1.04.2.1 Not less than 3m clear of tree trunks of adjacent trees;
- 1.04.2.2 Not less than 10m clear of the high bank of the adjacent drainage path;
- 1.04.2.3 Not less than 20m clear of the high bank of a perennial stream;
- 1.04.2.4 Clear of the ARI 100 year storm event influence from the adjacent drainage path; and
- 1.04.2.5 Clear of the vertical projection of the tree canopy of the adjacent trees.

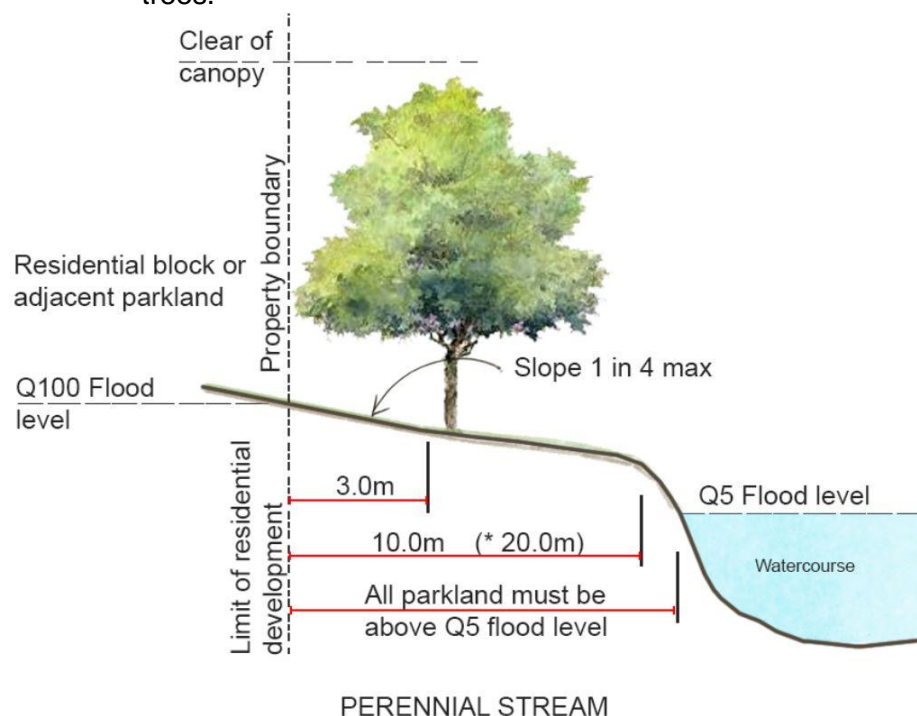


Figure DP1.04: Limits of development adjacent to natural stream banks



- 1.04.3 In order to retain any established landscape character, all trees located within existing road reserves shall be protected and retained unless approved otherwise by Council.
- 1.04.4 Reference should be made to the Vegetation Management Act and any Local Laws and Policies to ascertain any requirements in relation to tree clearing.

#### DP 1.05 Crime Prevention Through Environmental Design

- 1.05.1 It is important when designing development layouts that the principles of crime prevention through environmental design are considered, in particular:
  - 1.05.1.1 Natural surveillance of public open spaces is optimised; and
  - 1.05.1.2 Long pathway or obscured park areas that remain unlit should be avoided.

### Engineering Issues

#### DP 1.06 General

- 1.06.1 The optimum site and road layout needs to be developed through consideration of social, environmental, town planning, traffic and engineering issues.
- 1.06.2 Although the engineering design of roads is the province of the engineer, it is essential that the surveyor and planner preparing the site layout are fully aware of the engineering issues to ensure that the road layouts proposed are satisfactory in this regard. Major alterations to the development layout may otherwise be necessary to accommodate engineering requirements.
- 1.06.3 The factors to be taken into consideration when designing new development layouts include the following:
  - 1.06.3.1 Proposed land use;
  - 1.06.3.2 Road hierarchy, interim and ultimate;
  - 1.06.3.3 Public transport network;
  - 1.06.3.4 Local planning policies, bikeways/paths and open space;
  - 1.06.3.5 Council's drainage management plans;
  - 1.06.3.6 Council's traffic management plans;
  - 1.06.3.7 Connection and protection of existing water and sewer infrastructure;
  - 1.06.3.8 Railway and cane tram way lines;
  - 1.06.3.9 access requirements for service vehicles and emergency vehicles;
  - 1.06.3.10 topography of the area;
  - 1.06.3.11 adequate road frontage to parks and drainage reserves;
  - 1.06.3.12 existing utility services constraints and proposed augmentation works;
  - 1.06.3.13 crime prevention through environmental design;
  - 1.06.3.14 impacts on adjoining properties;
  - 1.06.3.15 existing stormwater drainage;
  - 1.06.3.16 flooding and ponding;
  - 1.06.3.17 preservation of natural watercourses;
  - 1.06.3.18 significant existing vegetation;

- 1.06.3.19 bushfire protection measures;
- 1.06.3.20 impact of earthworks;
- 1.06.3.21 water quality improvement structures and features;
- 1.06.3.22 existing soil conditions; and
- 1.06.3.23 geotechnical considerations.

## DP 1.07 Road Network

- 1.07.1 The provision of a Road network within a subdivision development is to be designed to achieve the aims listed below and others mentioned in the IPWEA Street Design Manual:
  - 1.07.1.1 convenient and safe access to all allotments for pedestrians, vehicles and cyclists;
  - 1.07.1.2 safe, logical and hierarchical transport linkages with existing Street system;
  - 1.07.1.3 appropriate access for buses, emergency and service vehicles;
  - 1.07.1.4 convenient service corridors for public utilities, such as water, sewer, stormwater and telecommunications infrastructure;
  - 1.07.1.5 ecological connectivity
  - 1.07.1.6 opportunity for street landscaping, tree planting, furniture; and
  - 1.07.1.7 convenient parking for visitors.
- 1.07.2 A hierarchical road network is essential to maximise Road safety, residential amenity and legibility. Each class of Road in the network serves a distinct set of functions and is designed accordingly, see **Table D1.1**.
- 1.07.3 The maximum number of turning movements at intersections or junctions that a visitor should be required to undertake to reach a particular address within the development should be minimised.
- 1.07.4 The road network should be designed to ensure that roads connect to next order of road in the hierarchy. Under no circumstances should a road connect to another road, which is more than two levels higher or lower in the hierarchy.
- 1.07.5 Where a Local Access forms part of a pedestrian or cycle network, suitable connectivity with adjoining Local Accesses or open space systems should be provided to ensure such pedestrian and cycle network are functionally efficient.
- 1.07.6 Developments layouts should be designed with a road layout to achieve the desired speed environment. The use of traffic control devices in lieu of a suitable road layout is not preferred.
- 1.07.7 It is important that the road hierarchy adequately caters for buses. The main criteria in determining the location of bus routes is that no more than 10 per cent of residents should have to walk in excess of 500 metres to catch a bus. Roads above the Urban Access in the hierarchy are designed as bus routes.

## DP 1.08 Site Regrading Concept

- 1.08.1 Excessive site regrading should be avoided, wherever possible site layouts should be developed to position roads and drainage networks to take advantage of natural surface grades. Site layouts that minimise the disturbance

of the land will require less erosion and sediment control measures during construction phase and reduce the risk of environmental harm.

- 1.08.2 Where earthworks are proposed on any development site identified in the Whitsunday Regional Council Planning Scheme Landslide Overlay as having a gradient of 15% or greater input should be sought from a qualified geotechnical engineer to ascertain slope stability and potential construction issues.

#### DP 1.09 Stormwater Drainage

- 1.09.1 The design of the drainage system, and earthworks for the proposed development shall be such that the upstream drainage is not adversely affected and that the downstream drainage system is capable of adequately catering for the discharge of the additional flow produced as a result of the development.
- 1.09.2 If the downstream system is not capable of carrying the modified discharge, the designer shall indicate the measures proposed to ensure the downstream system is capable of carrying the modified discharge. This will involve negotiation with adjoining landowners for minor creek systems to produce easements over downstream drainage paths. Written approval from the respective property owners is required for the easement and any engineering works on their property from the development site to the legal point of discharge.
- 1.09.3 The development layout shall be designed to accommodate both existing and future developed flows from upstream catchments based on development in accordance with the relevant Planning Scheme.
- 1.09.4 In preparing a development layout, consideration should be given of the overall site drainage philosophy, and overland flow paths, to ensure that the road network has sufficient drainage capacity to safely convey stormwater runoff to its receiving waters with minimal nuisance or damage to the community.
- 1.09.5 Consideration should be given in the preparation of the layout to ensure that in the event of drainage system failure, adequate emergency relief paths are provided. In particular, downhill sloping cul-de-sac heads should be avoided where a sufficient width pathway or open space cannot be provided to convey the overland flow.

#### DP 1.10 Stormwater Quality Management

- 1.10.1 In recognition of the impacts that development may have on the quality of water within the waterways, the over-riding objective for water quality management is to minimize the potential for development activity to cause harm to the environment / receiving waters.
- 1.10.2 All developments are required to include appropriate SQID's that ensure removal of suspended matter (litter) and treatment of contaminated stormwater prior to crossing the boundary of the development or discharge into downstream roadside gutters, stormwater drainage systems or waterways.
- 1.10.3 The location of the interception devices within the drainage system is to be planned to ensure that the first flush waters from all parts of the site are treated and they can be easily accessed for cleaning and maintenance.

## DP 1.11 Sewerage Reticulation

- 1.11.1 In preparing a development layout, consideration should be given to the provision of sewerage reticulation connections to adjoining properties based on their future development in accordance with Council's Strategic Plan.
- 1.11.2 Where an existing sewerage reticulation line pass through a development site, the development layout should where possible incorporate the sewer with the development layout. Where this is not practical the layout should be prepared to minimise the extent of the sewerage relocation work necessary.
- 1.11.3 Alignment should be at the front / rear or side of lots taking into consideration any possible future subdivision of the lots. Design should minimise the likelihood of needing to build over sewers and allow ease of replacement.
- 1.11.4 An easement is created over the sewer with appropriate width to allow maintenance and replacement.
- 1.11.5 Where it is not possible to relocate or realign an existing sewer main proposed to be built over, the sewer shall be encased in an enveloper / encasement / carrier pipe compliant with Transport and Main Roads Specifications MRTS141 Microtunnelling and Pipe Jacking July 2017 or later.
- 1.11.6 As a minimum the enveloper / encasement / carrier pipe shall be designed to carry sewerage at the design depth and be a minimum or one size larger than the existing pipeline. Council will contribute the used portion of life of the existing pipeline. The developer shall be responsible for the unused portion (remaining life) of the pipeline and full cost of the enveloper / encasement / carrier pipe based on Councils schedule of rates for mains replacement.

Note – DP 1.11.5 and DP 1.11.6 applies to Class 2 – 9 buildings. Building Class 1 or 10 must address QDC MP1.4 for building over or near relevant infrastructure.

## DP 1.12 Electricity Supply and Telecommunication Services

- 1.12.1 In preparing a development layout, the relevant Service Authorities should be consulted to confirm that the provision of services to the proposed development would be provided and if the provision of land for the purpose of siting infrastructure would be necessary.

## DP 1.13 Tramlines through Urban Areas

- 1.13.1 Where cane tramlines run through urban areas a tramway reserve shall be created over tramline and transferred to Council.
- 1.13.2 The width of the tramway reserve for a single line shall be a minimum of twelve (12) metres. The reserve should be centrally located around the tramline except where exceptional circumstances prevent this. (e.g. adjoining tramway easement or reserve is placed off centre).
- 1.13.3 Under certain embankment / cutting conditions it may be necessary to widen the easement to provide a 3.0m wide access to at least one side of the track.

- 1.13.4 Where multiple tracks exist, the tramway reserve shall include all tracks plus a distance of six (6) metres from the centreline of the outermost tracks on each side.
- 1.13.5 This widened section shall be continued past the point of convergence of the tracks (i.e. the point of the switch of the first turnout of single line) a minimum of twenty (20) metres before becoming a standard twelve (12) metre easement again.
- 1.13.6 Residential areas should be sited away from siding locations if at all possible because of major dust and noise pollution problems. For cases where development will adjoin siding locations (closer than one hundred (100) metres from any part of the planned subdivision to the cane unloading point) then each such location would need to be the subject of a special study between the developer, the appointed consultants, representatives of the Mill and Council, in order to identify the unique problems of the location.
- 1.13.7 The number of road crossings should be kept to a minimum. Factors affecting the positioning of road crossings include: sight distances, track grades, proximity of the nearest crossing and the noise problem associated with the use of the train whistle at close successive crossings. Of particular importance is the adjacent grading of the track. The locating of road crossings on or near the base of falling grades should be avoided. Any road crossing proposal must be submitted to the Mill for the assessment of its likely implications on its own operations and on road users and residents.

## DG1 - DESIGN GUIDELINES – ROAD GEOMETRY

### Scope & Aims

#### DG 1.01 Road Geometry

- 1.01.1 This section sets out the minimum standards developed specifically for the design of roadworks using principles of Street design to enable safety and improved amenity and to reduce pedestrian/vehicular conflicts. Road design shall comply with Austroads Guide to Road Design Part 3.
- 1.01.2 The geometry of a road is to be designed to aims below, and others described in the IPWEA Street Design manual:
  - 1.01.2.1 provide convenient and safe access to all allotments for pedestrians, vehicles and cyclists;
  - 1.01.2.2 provide appropriate access for buses, emergency and service vehicles;
  - 1.01.2.3 provide a convenient verge for public utilities;
  - 1.01.2.4 provide an opportunity for street landscaping, trees planting and furniture; and
  - 1.01.2.5 provide convenient parking for visitors.

## DG 1.02 Reference Documents

- 1.02.1 Australian Standards:
  - 1.02.1.1 AS1158 Lighting for Roads and Public Spaces;
  - 1.02.1.2 AS1348 Road and Traffic Engineering – Glossary of Terms, Road Design and Construction;
  - 1.02.1.3 AS1428 Design for Access & Mobility;
  - 1.02.1.4 AS2890.1 Parking Facilities: Off-street parking;
  - 1.02.1.5 AS2890.2 Parking Facilities: Off-street Commercial Vehicle Facilities;
  - 1.02.1.6 AS2890.5 Parking Facilities: On-street Parking;
  - 1.02.1.7 AS/NZS 3845.1 Road Safety Barrier Systems;
  - 1.02.1.8 AS/NZS 3845.2 Road Safety Devices
  - 1.02.1.9 AS 4678 Earth retaining structures
  - 1.02.1.10 AS4282 Obtrusive Effects of Outdoor Lighting.
  - 1.02.1.11 Disability Standards for Accessible Public Transport – IPWEAQ
- 1.02.2 Department of Transport & Main Roads:
  - 1.02.2.1 Road Planning & Design Manual;
  - 1.02.2.2 Manual of Uniform Traffic Control Devices MUTCD;
  - 1.02.2.3 Transport Operations (Road Use Management) Act.
- 1.02.3 Austroads:
  - 1.02.3.1 Guide to Road Design;
  - 1.02.3.2 Guide to Traffic Management
  - 1.02.3.3 Guide to Road Safety;
  - 1.02.3.4 Cycling Guidelines;
- 1.02.4 Other:
  - 1.02.4.1 IPWEAQ Street Design Manual;
  - 1.02.4.2 Australian Model Code for Residential Development.

## DG 1.03 Consultation

- 1.03.1 Designers are encouraged to consult with the Council and other relevant authorities prior to or during the preparation of the design. Designers should in addition to requirements of this manual ascertained specific requirements of these authorities as they relate to the designs in hand.

## Road Design Criteria

### DG 1.04 Design Speed

- 1.04.1 The designer shall ensure that the selected design speed and road layout will result in a speed environment that is likely to comply with that specified in Table 1 – Target Speeds for Streets of IPWEA Street Design Manual . The use of Traffic Control Devices in lieu of a suitable road layout is not preferred.
- 1.04.2 Adoption of a low design speed discourages speeding; therefore, attention should be given to ensuring that potentially hazardous features are visible to

the driver and adopting traffic engineering measures which will help a driver avoid errors of judgement.

- 1.04.3 Design speeds shall be calculated on largest radius track between kerb and centreline unless a physical constraint is incorporated in the design to maintain vehicle tracking in traffic lane.

#### DG 1.05 Longitudinal Gradient

- 1.05.1 A general minimum gradient of 0.5% should be adopted for all roads, which will ultimately include kerb and channel. In very flat conditions, where approved by Council, it may be reduced to 0.3%.
- 1.05.2 A desirable minimum gradient of 1.0% should be adopted for all roads, which will have earth table drains, except where approved otherwise by Council, in exceptional cases.
- 1.05.3 Roads constructed, without kerb and channel, completely in embankment may have zero grade.
- 1.05.4 Maximum grades shall be as nominated in **Table D1.1**.
- 1.05.5 Longitudinal grade 3 intersections should not exceed 4%, the actual gradients being dependent on the type of terrain. Design of the road alignment and the grades used are interrelated. A steep grade on a side street is undesirable if vehicles must stand waiting for traffic on the priority road.
- 1.05.6 Turning circles and cul-de-sacs on steep grades should have grades less than 5%.
- 1.05.7 Where minimum radius crest vertical curves are used local widening is to be provided to facilitate safe ingress/egress from properties.

#### DG 1.06 Horizontal Alignment

- 1.06.1 Horizontal alignment shall generally comply with the requirements of Austroads, Street Design Manual, or Department of Transport and Main Roads manuals, as applicable.
- 1.06.2 Designers should ensure that, for a given design speed, the minimum radius of curvature utilised is such that drivers can safely negotiate the curve. Curves that progressively tighten produce an uncomfortable sense of disorientation and alarm. Sudden reverse curves that drivers cannot anticipate also have a potential to cause similar conditions.
- 1.06.3 The horizontal alignment shall ensure adequate sight distances taking into account construction of solid fencing on property boundaries.

#### DG 1.07 Vertical Curves

- 1.07.1 Vertical curves should be used on all changes of grade where the algebraic change of grade exceeds:
- 1.07.1.1 Urban laneways, Urban Local Access, Access, Urban Collector, and Industrial Access – 1%

- 1.07.1.2 Major Collector and Industrial Collector – 0.6%
- 1.07.2 The length of the crest vertical curve for stopping site distance should conform to Austroads;
- 1.07.3 Every effort should be made to provide vertical curves as long as possible, for improved appearance.
- 1.07.4 Drainage poses a practical limit to the length of sag curves and a maximum length (in metres) 15 times the algebraic sum of the intersection vertical grades should be adopted. This is to avoid water ponding in excessively flat sections of curb and channel. A minimum grade of 0.5% should be maintained in the curb and channel.
- 1.07.5 In general, a minimum 10 m length vertical curve shall be provided with a side road joins the through road at three-way intersections.
- 1.07.6 A tangent point of a vertical curve in the side road shall be located at, or outside of, the kerb line of the through road. Council may approve the use of concrete invert in lieu of a vertical curve with a side road is at Local Access and the algebraic change of grade is less than 6%.
- 1.07.7 The three-dimensional coordination of the horizontal and vertical alignment of a road should be aimed at improving traffic safety and aesthetics. The following principles should be applied:
- 1.07.7.1 Combined horizontal and vertical stopping sight distance and minimum sight distance should be considered three dimensionally;
  - 1.07.7.2 Sharp horizontal curves shall not be introduced at or near the crest of a vertical curve;
  - 1.07.7.3 Horizontal curves should leave the vertical curve and be longer than the vertical curve; and
  - 1.07.7.4 A short vertical curve on a long horizontal curve or a short tangent in the grade line between sag curves may adversely affect the road's symmetry and appearance.

## DG 1.08 Crossfalls

- 1.08.1 Carriageway crossfalls for streets shall conform to the requirements of Austroads and/or IPWEA Street Design Manual.
- 1.08.2 Generally, pavement crossfalls on straight roads shall be:
- 1.08.2.1 Bituminous seal coat - 3%
  - 1.08.2.2 Asphaltic concrete pavement – 3%
  - 1.08.2.3 Cement concrete pavement – 3%
  - 1.08.2.4 Paved Surfaces – 3%
  - 1.08.2.5 Gravel – 5%.
- 1.08.3 Median crossfalls - the maximum crossfall on grassed medians on divided roads shall be desirably 1 in 6 with an absolute maximum of 1 in 4. Refer also Department of Transport and Main Roads Design Manuals. However, at median openings, the pavement crossfall should not exceed 5 per cent.



## DG 1.09 Urban Street and Road Hierarchy

### Table D1.1 Urban Street and Road Hierarchy – Deemed to Comply Requirements

PARAMETER	URBAN LANEWAY	URBAN LOCAL ACCESS	URBAN ACCESS	URBAN COLLECTOR	URBAN MAJOR COLLECTOR	SUB ARTERIAL	ARTERIAL	URBAN INDUSTRIAL ACCESS	URBAN INDUSTRIAL COLLECTOR
Typical max. volume (vpd <sup>1</sup> )	<100	<500	<1,000	<3,000	<6,000	<10,000	>10,000	-	-
Direct residential lot access for vehicles	Yes	Yes	Yes	Yes	Yes <sup>2</sup>	No	No	Yes	Yes
Reserve widths (m) <sup>3,7,8,9</sup>	8.0	16	20	20.0	25.0	The requirements of these categories shall be provided by the Council or relevant authority (DTMR).  Traffic volumes shall be identified in a traffic management report.		20.0	22.0
Carriageway Width (min) <sup>3,4,5</sup>	6.0	6.0	6.0	7.5	10.0			12.0	14.0
Desired max. length (m)	140	250 <sup>10</sup>	250 <sup>10</sup>	n/a	n/a			250	250
Max. Grade (Desirable) %	(8) 10	(12) 16 <sup>6</sup>	(12) 16 <sup>6</sup>	(8) 10	(8) 10			(6) 10	(6) 8
Intersection spacing min. (m)	n/a	40	40	60-100	100			60-100	60-100
Design speed (Km/h)	<20	50	50	60	60			50	60
Verge width. Minimum each side (m)	n/a	4.0	4.5	5.0	5.0			4.0	4.0
Pedestrian paths	Shared	One side	One side <sup>11</sup>	Both sides	Both sides			Both sides	Both sides
Cycle paths, either - Cycle lanes on carriageway - Off carriageway shared paths - Separated cycle track	Shared No No	No <sup>12</sup> No <sup>12</sup> No <sup>12</sup>	No <sup>12</sup> Yes <sup>13</sup>  Possibly <sup>13</sup>	Yes <sup>13</sup> Yes <sup>13</sup> Yes <sup>13</sup>	Yes <sup>13</sup> Yes <sup>13</sup> Yes <sup>13</sup>			No Possibly <sup>13</sup> Possibly <sup>13</sup>	No Possibly <sup>13</sup> Possibly <sup>13</sup>
Bus route	No	No	No	Possibly <sup>4</sup>	Yes			Possibly	Possibly
Street trees	No	Both sides	Both sides	Both sides	Both sides	Both sides	Both sides		

#### Notes

A. The street category should be determined by the function it performs and not just the motor vehicle traffic volume.

B. The determination of the appropriate type of cycle path and its dimensions should be the outcome of an analysis of the types and volumes of cyclist activities and the motor vehicle speeds in the street.

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C. In accordance with *Planning (Walkable Neighbourhoods) Amendment Regulation 2020 - Subordinate Legislation 2020 No. 162*, street trees should be provided at an average spacing of 15m to both sides of every street but not laneways.

D. There are existing laneways in the Whitsunday Regional Council road network, however, no new laneways are deemed necessary. The approval of a new laneway must be assessed by Council according to its definition (see definition below). These are usually applied in central business areas where frontage access to businesses is undesirable or unachievable. They are not to be provided in new residential development areas.

1. For concept planning purposes, a guide for traffic generation is 10 vpd/dwelling.
2. Direct vehicle access from residential lots is typically acceptable up to 6,000vpd. Above this traffic volume, direct access might be acceptable depending on the number of driveways, parking, and moving lane configuration. Usually, no direct access is appropriate where traffic volumes exceed 7,500vpd.
3. Carriageway (and reserve) widening shall be provided on bends in accordance with Austroads.
4. Widening of carriageway to 10m shall be required on all bus routes, and a minimum road reserve of 20m provided.
5. Carriageway widths are measured from the invert of the kerb and channel on one side of the carriageway to the invert of the kerb and channel on the opposite side of the carriageway.
6. The absolute maximum grade shall be 20% for a maximum length of 60m. The maximum length of grades less than 20%, but not less than 16%, shall be 60m plus 25m for each 1% the grade is less than 20%. The maximum length of any grade greater than 16% shall be 160m.
7. Road reserve widths may require widening to accommodate table drains, provision for services, on-street car parking provision and bus bays.
8. Minimum reserve must be provided, irrespective of minimum verge and carriageway widths specified.
9. Where the road is nominated as part of the bikeway network, allowance for bike lanes shall be added to this width (minimum bikeway widths in accordance with Austroads).
10. For Local Access and Access streets, this refers to block length to achieve good pedestrian access.
11. Unless required as part of the pedestrian movement network or in the near vicinity of community facilities, parks, or schools where footpaths both sides are appropriate. Path width in accordance with the latest *Austroads Guide to Road Design Part 6A – Paths for Walking and Cycling*.
12. Unless required as part of the cycling movement network or in the near vicinity of community facilities, parks, or schools where the circumstances indicate this is a preferred solution. Path width in accordance with the latest *Austroads Guide to Road Design Part 6A – Paths for Walking and Cycling*.
13. Dependent upon the desired lines, cycle hierarchy plan, road speed and estimated pedestrian and cyclist demand. Path width in accordance with the latest *Austroads Guide to Road Design Part 6A – Paths for Walking and Cycling*.

### **Major Collector**

A Major Collector generally has restricted or limited direct motor vehicle access to individual properties.

Major Collector streets provide linkage between and within neighbourhoods to facilitate short trips for pedestrians, cyclists and motor vehicles in a calm and low-speed environment. Major Collectors also provide connection between the Collector streets and the external road network (arterial and sub-arterial) and are the preferred location for any public transport route through a neighbourhood.

Development frontage to collector streets is appropriate for residential (and non-residential) development and parking is typically accepted.

Major collector streets are typically provided where the function and/or traffic volume on that street is such that there is a need to achieve higher traffic efficiency and/or to provide improved safety of users. On major collector streets, the following may be necessary:

- restricted or limited vehicular access to property (e.g. consolidated driveways, centre median, turning lanes);
- indented bus stops;
- indented parking lanes;
- separated cycle facilities (i.e. separate from motor vehicle traffic and/or pedestrians); and
- wide verges suitable for landscape/streetscape improvements and pedestrian pathways on both sides of the street.

### **Collector**

A Collector Street provides direct motor vehicle access to individual properties.

Collector streets provide linkage between and within neighbourhoods to facilitate short trips for pedestrians, cyclists, and motor vehicles in a calm and low-speed environment. Collectors also provide connection between the local neighbourhood access streets and the external road network. They may be used as a public transport route through a neighbourhood.

Development frontage to collector streets is appropriate for residential development. Vehicular access and parking are typically encouraged due to relatively low traffic volumes.

Collector streets should make specific provision for cycle movement and should include pedestrian pathways on both sides of the street.

### **Access**

An access street provides direct access to individual properties. An access street also provides a connection to other access streets but is not so significant that it would function as a collector street.

It should facilitate movement by pedestrians and cyclists, without significant constraint by motor vehicle traffic needs. In general, public transport does not utilise an access street.

### **Local Access**

A local access street provides direct access to individual properties. A local access street generally, is one that services only motor vehicle traffic for that street but allows the necessary connections for pedestrians and cyclists from other streets. It is typically a cul-de-sac or a short connecting street between two access streets.

Public transport should not utilise a local access street.

### **Laneway**

A laneway provides a very low volume, very low-speed environment that provides vehicular access to the rear (or side) of individual properties, typically where vehicular access from the front of the lot is undesirable (for improved front street aesthetics or direct access to open space) or not achievable (due to road hierarchy, high traffic volumes or high demand for on-street parking on the frontage street). A laneway services only motor vehicle traffic for that

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street (i.e. it does not serve other streets) but sometimes allows the necessary connections for pedestrians and cyclists from other streets. It typically excludes on-street parking unless in specifically designed parking areas.

## DG 1.10 Carriageway Width

- 1.10.1 Minimum carriageway widths for all streets shall be as nominated in **Table D1.1**.
- 1.10.2 The carriageway widths must allow vehicles to proceed safely at the operating speed intended for that level of road in the network and with only minor delays in the peak period. This must take into consideration the restrictions caused by parked vehicles where it is intended or likely that this will occur on the carriageway. Vehicles include trucks, emergency vehicles and, on some roads, buses.
- 1.10.3 The safety of pedestrians and cyclists must also be assured by providing sufficient width and visibility.
- 1.10.4 The carriageway should also provide for unobstructed access to individual allotments. Motorists should be able to comfortably enter or reverse from an allotment in a single movement, taking into consideration the possibility of a vehicle being parked in the carriageway opposite the driveway.
- 1.10.5 The design of the carriageway should discourage motorists from travelling above the intended speed by reflecting the functions of the road in the network. In particular, the width and horizontal and vertical alignment should not be conducive to excessive speeds.
- 1.10.6 Appropriate road reserve width should be provided to enable the safe location, construction and maintenance of required paths and public utility services (above or below ground) and to accommodate the desired level of streetscape.
- 1.10.7 Where a “split-level” road is proposed, a stable form of retaining structures such as reinforced concrete, crib block, gabion or masonry walling (or other approved alternative) is required between upper and lower road levels.
- 1.10.8 Traffic islands shall be designed in accordance with the current DTMR or AUSTRROADS design manuals.
- 1.10.9 Where upgrades are required, the applicant may undertake a traffic count to confirm the number of vehicle movement per day on the subject road.

## DG 1.11 Verges

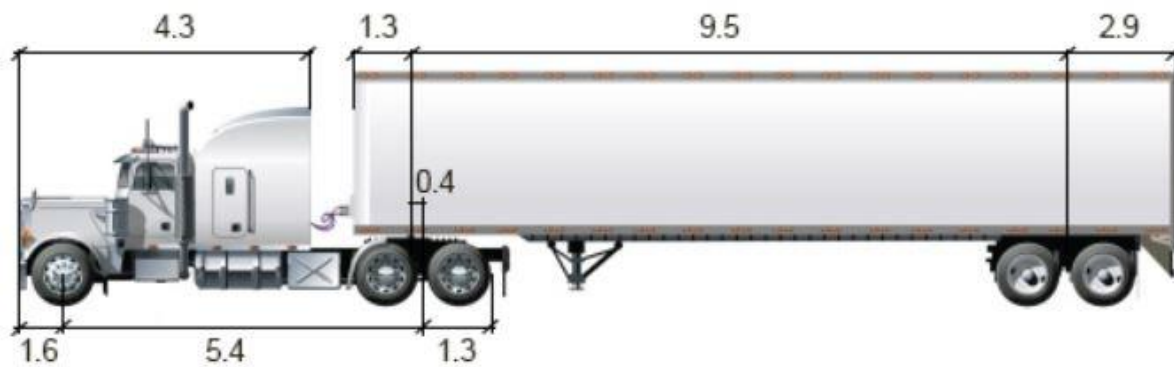
- 1.11.1 Minimum verge width for all streets shall be as nominated in **Table D1.1**.
- 1.11.2 A suitable design of the verge will depend on utility services, access to allotments, pedestrian usage, tree preservation and storm water drainage.
- 1.11.3 All verges shall fall from the frontage property boundary to the adjacent kerb and channel with acceptable Cross falls of between 3% to 5%. In the case where the allotment falls away from the road reserve (i.e. the allotment is lower than the level of the road), the verge shall have a minimum fall from the frontage property boundary to the adjacent kerb of 3%.
- 1.11.4 The maximum slope permissible within a road verge is 1 in 4.
- 1.11.5 The verge when considered in conjunction with the horizontal alignment and permitted fence and property frontage treatments should provide appropriate sight distances, taking into account expected speeds and pedestrian and cyclist movements.
- 1.11.6 Utility service locations shall be in accordance with the relevant authorities' requirements.

- 1.11.7 Verges shall be covered full width with topsoil to a depth of not less than 40 mm and shall be lightly compacted and grassed in accordance with Council's minimum standards and specifications.

## DG 1.12 Intersections

- 1.12.1 All new intersections of Access Places, Access Streets and Collector Streets, shall be three-way intersections designed and located in accordance with Austroads.
- 1.12.2 A roundabout shall be used in the design of four way intersections.
- 1.12.3 Intersections of Collector, Industrial, and Sub Arterial roads shall be designed in accordance with AUSTROADS design manual and shall allow for potential improvement to incorporate other traffic control methods e.g. traffic signals.
- 1.12.4 Intersections with state-controlled roads shall be designed and constructed in accordance with the requirements of DTMR.
- 1.12.5 The design of intersections or junctions should allow all movements to occur safely without undue delay. Projected traffic volumes shall be used in designing all intersections or junctions on trunk collector streets or higher order roads.
- 1.12.6 Truncations shall be provided to real property boundaries in order to maintain minimum verge widths and adequate sight distances taking into account potential for construction of solid fencing on the property boundaries.
- 1.12.7 The turning radii at intersections measured at the kerb invert shall be 9.0m minimum and accommodate the intended movements without allowing desired speeds to be exceeded.
- 1.12.8 All vehicle turning movements are accommodated using AUSTROADS design vehicle and turning templates, as follows:
- 1.12.8.1 For turning movements involving urban major collector streets or urban collector , the “design semitrailer” with turning path radius of 15 m. Industrial Access and Industrial Collector might require the use of the B-Double template.
- 1.12.8.2 For turning movements involving local access and access streets but not involving collector streets, the “design single unit track/bus” with turning path radius of 12.5 m.
- 1.12.8.3 For turning movements involving Urban Laneways and Urban Local Access, but not involving collector streets the garbage collection vehicle with turning path radius of 12.5 m.
- 1.12.8.4 For turning movements at the head of cul-de-sacs for all streets, except access place, have sufficient area provided for the “design single unit track”; and
- 1.12.8.5 Road furniture shall be located to allow for clear manoeuvring of the design semitrailer.
- 1.12.9 Intersection channelisation is to be provided and designed in accordance with the current DTMR or AUSTROADS design manuals.
- 1.12.10 All channelisation shall be designed to accommodate a design vehicle providing a clearance of not less than 0.6 m between the wheel track and the kerbs at all points, unless specified otherwise by Council.

- 1.12.11 Traffic islands or medians of less than 2m width to be hard surfaced in concrete with a patterned broomed finish incorporating a coloured pigment in accordance with Council's requirements. This colour should generally be terracotta unless otherwise approved by Council.
- 1.12.12 Traffic islands, which are to be grassed or landscaped, shall be provided with a water service conduit and a perimeter subsoil drainage line connected to the underground drainage system or an open drainage channel.
- 1.12.13 On Urban Major Collectors, Sub-Arterial and Arterial roads, median breaks will only be permitted at approved intersections.
- 1.12.14 Pavement markings associated with channelisation and signs shall be provided in accordance with the MUTCD.



### Semi-trailer

Tractor width	:	2.50	Trailer width	:	2.50
Tractor track	:	2.50	Trailer track	:	2.50
Turning radius (outside):		15.00			

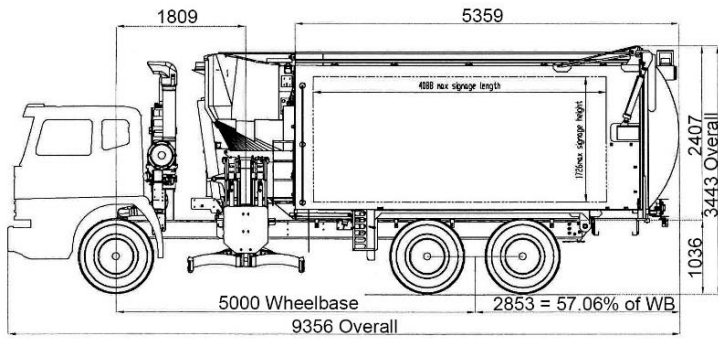


### Single unit truck/bus

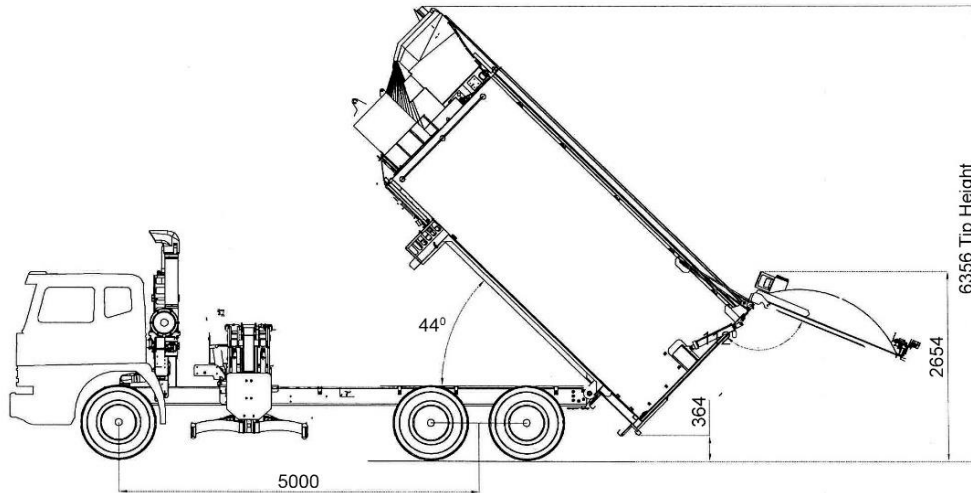
Width	:	2.50
Track	:	2.50
Turning radius (outside):		13.00

Figure 1.3 Standard Vehicles

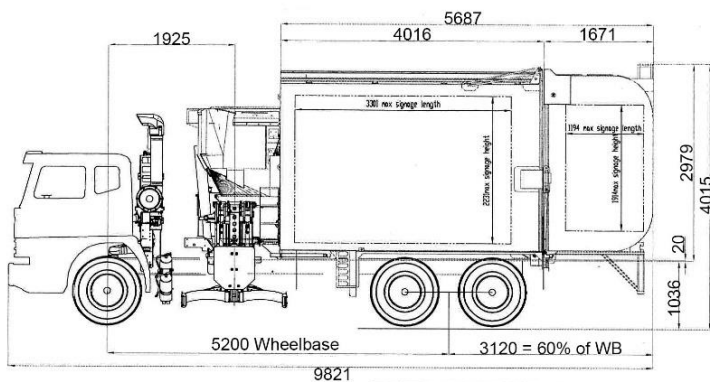
### 25m<sup>3</sup> TTT Side Loader



ACCO 2350G 6X4 5000mm EURO 5	
BODY	JJEP/25/DC/G
CAPACITY	25 CUBIC METRES
LIFTER	J.J.R.E. LONG THROW GRAB LIFTER
TARE WEIGHT	12 600 KG
G.V.M. (QLD. & N.S.W.)	23 000 KG
G.V.M. (VIC.)	23 500 KG (WITH ROAD FRIENDLY REAR SUSPENSION)
TURNING RADII :-	
KERB TO KERB	9.033 M
WALL TO WALL	9.903 M
WHEEL BASE	5.00 M
OVERALL LENGTH	9.356 M
OVERALL WIDTH	2.49 M
OVERALL HEIGHT	3.433 M



### 35m<sup>3</sup> TTT Side Loader



ACCO 2350G 6X4 5200mm EURO 5	
BODY	JJEP/35/DC/G
CAPACITY	35 CUBIC METRES
LIFTER	J.J.R.E. LONG THROW GRAB LIFTER
TARE WEIGHT	13 400 KG
G.V.M. (QLD. & N.S.W.)	23 000 KG
G.V.M. (VIC.)	23 500 KG (WITH ROAD FRIENDLY REAR SUSPENSION)
TURNING RADII :-	
KERB TO KERB	9.322 M
WALL TO WALL	10.192 M
WHEEL BASE	5.20 M
OVERALL LENGTH	9.821 M
OVERALL WIDTH	2.49 M
OVERALL HEIGHT	4.015 M

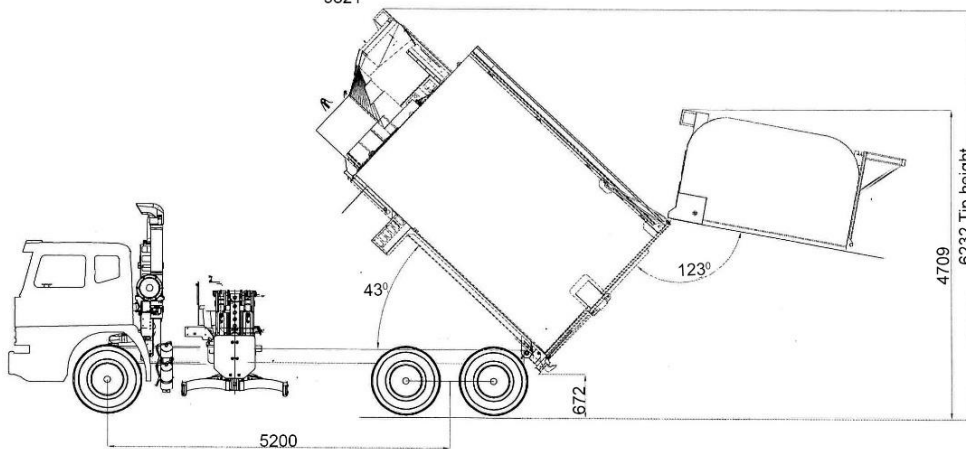


Figure 2.3 Standard Vehicles – Rubbish Trucks (Source: JJ Richards 2021)



## DG 1.12 Roundabouts

- 1.12.1 Design of roundabouts shall be in accordance with current Department of Transport and Main Roads Design Manuals and AUSTRROADS Guide to Road Design.
- 1.12.2 Roundabout shall only be used at intersection of Urban Collector Streets and Urban Access Streets or higher order roads only. All roundabouts shall have a minimum inscribed circle diameter of 30.0m.
- 1.12.3 Centre islands which are to be grassed or landscaped shall be provided with a water service conduit and a perimeter subsoil drainage line connected to the underground drainage system or an open drainage channel.
- 1.12.4 Landscaping to centre islands to be in accordance with Council minimum standards and Specifications.
- 1.12.5 Roundabouts shall include provision for on road cycle lanes unless alternate cycle paths are provided.

## DG 1.13 Cul-De-Sac Turning Areas

- 1.13.1 The turning areas at the ends of the cul-de-sac in streets is to be designed in accordance with Austroads and/or IPWEA Street Design manual, excepting as follows:
  - 1.13.1.1 Three-point turns (T-Heads) will not be permitted without the prior consent of Council. Council may review site specific alternatives where topography and site constraints exist.
  - 1.13.1.2 Where a full turning circle is not provided to the minimum radius below, provision for turning within kerbs for Council's design garbage truck must be demonstrated.
- 1.13.2 Where a full turning circle is provided the minimum kerb radii shall be:
  - 1.13.2.1 Approach and departure curves – 15m
  - 1.13.2.2 The turning circle – 10m.
- 1.13.3 Turning areas at the ends of cul-de-sac in industrial developments shall be full turning circles based on criteria for the specific application, with the following minimum kerb radii:
  - 1.13.3.1 Approach and departure curves – 30m
  - 1.13.3.2 The turning circle – 15m.
- 1.13.4 All turning heads shall have adequate provision for on-street parking at cul-de-sacs in accordance with Austroads and/or IPWEA Street Design Manual. Provision of parking areas within the verge must not compromise the future connection of services to the allotments.
- 1.13.5 Reference should be made to **Table D3.2** for rural cul-de-sac requirements.

## DG 1.14 Local Area Traffic Management

- 1.15.1 The road network should be designed to manage the movement and speed of traffic in local areas. In this regard, any traffic management devices such as thresholds, slow points, speed humps, chicanes and splitter islands

- should be designed in accordance with the requirements of AUSTRROADS and are to be approved by Council.
- 1.15.2 Devices other than at intersections should be located to be generally consistent with streetscape requirements, existing street lighting, drainage pits, driveways, and services may decide the exact location of devices.
- 1.15.3 Emergency vehicles must be able to reach all residences and properties.
- 1.15.4 Where bus routes are involved, buses should be able to pass without mounting kerbs and with minimised discomfort to passengers.
- 1.15.5 Traffic management devices and associated road furniture must not prevent the passage of larger vehicles (i.e. semi-trailers) however their principle function is not to be compromised.
- 1.15.6 In newly developing areas where street systems are being developed in line with LATM principles, building construction traffic must be catered for.
- 1.15.7 Maximum vehicle speeds can only be reduced by deviation of the travelled path. Pavement narrowings have only minor effects on average speeds, and usually little or no effect on maximum speeds.
- 1.15.8 Speed reduction can be achieved using devices, which shift vehicle paths laterally (slow points, roundabouts, corners). The use of vertical devices (i.e. humps, platform intersections, platform pedestrian/school/bicycle crossings) is not desirable and shall only be used where specifically approved by Council.
- 1.15.9 Speed reduction can be helped by creating a visual environment conducive to lower speeds. This can be achieved by 'segmenting' streets into relatively short lengths (less than 200-300m), using appropriate devices, streetscapes, or street alignment to create short sight lines.
- 1.15.10 Adequate critical sight distances should be provided such that either party in a potential conflict situation may take evasive action. Sight distances should relate to likely operating speeds.
- 1.15.11 Sight distances to be considered include those of and for pedestrians, cyclists and property accesses, as well as for drivers.
- 1.15.12 Night time visibility of street features and LATM devices must be adequate and in accordance with the MUTCD.
- 1.15.13 Many devices will be designed for their normal use by cars, but with provision (such as mountable kerbs) for larger vehicles. Some typical dimensions include:
- 1.15.13.1 Pavement narrowing:
    - 1.15.13.1.1 Single lane 3.5m between kerbs;
    - 1.15.13.1.2 Between obstructions - 3.75m; and
    - 1.15.13.1.3 Two lane 6.0m minimum between kerbs.
  - 1.15.13.2 Bicycle lanes (including adjacent to pavement narrowings) – 1.5m minimum;
  - 1.15.13.3 Plateau or platform areas;
  - 1.15.13.4 75mm to 150mm height maximum, with 1 in 15 ramp slope;
  - 1.15.13.5 Dimensions of mountable areas required for the passage of large vehicles to be determined by appropriate turning templates.

## DG 1.16 Bus Stops

- 1.16.1 Bus stops should be provided on all bus routes so no more than 10 per cent of residents should have to walk in excess of 500 metres to catch a bus. Normally roads above the access street in the hierarchy are designed as bus routes. **Table D1.2** details minimum criteria for bus stops.
- 1.16.2 Unless otherwise approved, bus stops shall be constructed in accordance with AUSTRROADS Guide to Road Design, MUTCD and Disability Standards for Accessible Public Transport.
- 1.16.3 Tactile Ground Surface Indicators (TGSi) are to be installed at all bus stops and shelters in accordance with AS/NZS 1428.4:2009.

**Table D1.2 Bus Stop Criteria**

Road	Stops (Spacing)	Description
Collector Streets	400 metres <sup>1</sup>	Single Bay and shelter <sup>2</sup>
Urban major collector or higher order road	400 metres	Single Bay and shelter <sup>2</sup>

Notes:

1. Loop roads with single entry/exits only require stops and bays on one side of the road.
2. Shelters are subject to Council's requirements.

## DG 1.17 Access to Allotments

- 1.17.1 Criteria for acceptable access to allotments are to be in accordance with Council's Standard Drawings.
- 1.17.2 Criteria for acceptable access to steep allotments are to be in accordance with Section DG 2.12.
- 1.17.3 Criteria for acceptable access to lots in the Rural, Rural residential & Emerging communities zones are to be in accordance with Section DG 1.30.
- 1.17.4 All rear allotment access (hatchet or battleaxe lots), shall be provided with a reinforced concrete driveway (unless in a Rural, Rural residential or Emerging communities zone, where Council may approve another surface), have a minimum width of 3.0m and extend the full length of the access handle.
- 1.17.5 All rear allotment access driveways shall commence at the adjacent kerb and channel with a standard kerb crossover or at the existing edge of pavement. Conduits for internal allotment services are to be provided adjacent to the concrete driveway for the full length of the access unless otherwise approved.
- 1.17.6 All rear allotment access via an easement to more than one lot, shall be provided with a reinforced concrete driveway (unless in a Rural, Rural residential or Emerging communities zone, where Council may approve another surface) and have a minimum width of 5.5m to allow two-way access.

- 1.17.7 Where lots are accessed via an access easement, a 10.0m transition to singular (3.0m wide) access may be provided from the second last lot's crossover extending the full length of the access handle to the last lot.
- 1.17.8 All lots associated with an access easement must only gain access through the access easement.

Note – Applicants must get a Road Work Permit from Council's Roads and Drainage Branch for a [driveway crossover](#) prior to undertaking any works in the road reserve.

## DG 1.18 Parking Provisions

- 1.18.1 Parking provisions in accordance with the relevant sections of Austroads and/or Street Design Manual shall be accorded with on all roads, except that for Urban Major Collector Street.
- 1.18.2 Streets which cannot comply with the on-street parking provisions of Austroads and/or Street Design Manual, due to reduced allotment frontage widths or carriageway widths, shall make provision for indented or verge parking bays at a minimum frequency of 1 parking bay per 2 allotments. Particular attention should be made to providing adequate provision for on-street parking at cul-de-sacs, turning heads and elbow bends.
- 1.18.3 Verge widths are to be maintained alongside indented or verge parking areas. Where necessary, property boundaries shall be adjusted to meet this requirement.
- 1.18.4 Off-street parking facilities are sealed and designed in accordance with AS 2890.1:2004. If outside of the Urban area, off street parking may be unsealed only if impacts on neighbouring properties from dust, noise and traffic from vehicular movement to and from the development are managed.

## DG 1.19 Pathways

- 1.19.1 Unless otherwise approved, pathways will be constructed taking into consideration the Disability Discrimination Act and Disability Standards for Accessible Public Transport.
- 1.19.2 Where a pathways link is located between allotments, the minimum width of land dedicated to Council shall be 5.0m. Concrete paving is to be for the full width of the pathway link. Path width in accordance with the latest Austroads Guide to Road Design Part 6A – Paths for Walking and Cycling, and extend to the adjacent kerb and channel together with a kerb ramp. Vehicular access is to be restricted at the ends of pathways through the installation of bollards at the property line in accordance with the Councils requirements.
- 1.19.3 Maximum cross fall on all access pathways 2.5%.
- 1.19.4 Pathways constructed using alternate material (e.g. Asphalt, Paving blocks) are to be approved by Council.
- 1.19.5 The pathway shall extend to the property boundary remote from the roadway where the path is not connecting two street frontages.
- 1.19.6 Bends shall be provided with a minimum internal radius of 6m.

- 1.19.7 All pathways shall have a non-slip surface, generally, this can be achieved by applying a stiff broom to the wet surface. (Alternate methods shall require Council approval).
- 1.19.8 Where a pathway link is used for stormwater drainage overland flow relief it shall have a one way crossfall and be constructed in full width concrete with a layback kerb and channel or approved equivalent along one edge to contain the required flow within the concrete.
- 1.19.9 Pathways are not to be aligned with stormwater pits where a stormwater pit is required to be located at the end of a pathway for overland flow, the pedestrian path is to be offset and appropriate measures provided to guide pedestrians away from the pit and remove any potential hazards.
- 1.19.10 The requirements for pathways to be constructed longitudinally along roads shall be in accordance with **Table D1.1**, the latest Austroads Guide to Road Design Part 6A – Paths for Walking and Cycling, and Street Design Manual.
- 1.19.11 All pathways shall have appropriate immunity against cross drainage.
- 1.19.12 The maximum gradient shall be 16 per cent with a maximum crossfall of 2.5 per cent. Where the pathway is parallel with a road with a grade greater than 16 per cent footpath gradient shall match that of the road.
- 1.19.13 The finished surface level of concrete work shall be not more than 20mm above the finished surface level of adjoining ground and shall finish flush with adjoining hard surfaces.

#### DG 1.20 Bikeways

- 1.20.1 Bikeways are provided in urban streets and roads in accordance with **Table D1.1**.
- 1.20.2 The minimum width of land dedicated to Council for a bikeway shall be 5.0 metres with a minimum 2.5 metre wide concrete paving in accordance with Cycling Aspects of AUSTRROADS Guides and MUTCD - Part 9, Bicycle Facilities.
- 1.20.3 Bikeways constructed using alternate material (e.g. Asphalt, Paving blocks) are to be approved by Council.
- 1.20.4 Bikeways located in parks shall be constructed above the flow of a storm of 5 year ARI, unless approved otherwise by Council.
- 1.20.5 Where bikeways connect to or crosses over an Urban Access Street or higher order road, a slow point shall be installed as approved by Council.
- 1.20.6 All bikeways shall have a non-slip surface. Generally, this can be achieved by applying a stiff broom to the wet surface. (Alternate methods require Council approval).

#### DG 1.21 Kerb and Channel

- 1.21.1 Concrete kerb and channel, and layback kerb and tray shall be provided on both sides of all roads except as otherwise provided for in Austroads and/or Street Design Manual.
- 1.21.2 Standard kerbs in accordance with Council's Standard Drawing shall be used in the following cases:

- 1.21.2.1 Residential Streets – Layback Kerb and Layback Kerb and Channel;
- 1.21.2.2 Medians – Maintenance Strip Kerb;
- 1.21.2.3 Grassed and Landscaped Traffic Islands – Maintenance Strip Kerb;
- 1.21.2.4 Concrete Traffic Islands - Semi-mountable Kerb; and
- 1.21.2.5 Roundabouts (centre island only), - Maintenance Strip Kerb.
- 1.21.3 Where proposed construction adjoins existing kerb and channel the Designer shall confirm with Council whether the existing profile shall be extended or whether the new construction will be tapered smoothly to the existing kerb and channel. The grading of kerb and channel will normally 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 following shall apply.
- 1.21.4 Minimum channel grade should be 0.5 percent unless approved other approved by Council.
- 1.21.5 Every effort should be made to provide vertical curves as long as possible, for improved appearance.
- 1.21.6 At all changes in horizontal alignment, kerbs and kerb and channel shall be constructed with horizontal curves.
- 1.21.7 To improve appearance where small deflections occur (e.g. on tapers), horizontal curves shall be as long as possible. Refer also to current Department of Main Roads or AUSTRROADS.
- 1.21.8 Kerb ramps shall be provided at all tangent points of intersection kerb returns, at park entrances and at any other locations where required by Council.
- 1.21.9 Access crossovers for Industrial, Commercial and Multi Residential site shall be installed in accordance with Council's Standard Drawings.

## DG 1.22 Signs and Road Markings

- 1.22.1 Permanent signing and road marking shall be in accordance with the current edition of the MUTCD. Where there is a choice of line marking colour, then only white or yellow paint is to be used.
- 1.22.2 Temporary or construction signing and road marking shall be in accordance with current edition of the MUTCD.
- 1.22.3 The relevant sign reference number from the MUTCD shall be included on the construction drawings.
- 1.22.4 All signs and pavement markings shall be adequately dimensioned to ensure accurate setting out.
- 1.22.5 Signs located in grassed areas shall have a surrounding 500mm x 100mm thick concrete mowing strip.
- 1.22.6 Signs located in concrete islands or medians shall be installed with the "V Loc" socket system and fitted with anti-theft bolts.
- 1.22.7 The bottom of all un-sleeved posts shall be flattened prior to placing in concrete footing.
- 1.22.8 Vandal proof bolts and fittings shall be used on all permanent signing.
- 1.22.9 Street Name signs shall be installed in accordance with Council's Standard Drawing.

### DG 1.23 Road Edge Guide Posts & Guardrails

- 1.23.1 Road edge guide posts shall be provided at all locations where concrete kerb and channel is not constructed e.g. half road construction, tapers, ends of roads etc.
- 1.23.2 Guide posts shall conform to and be installed in accordance with Department of Main Roads 'Manual of Uniform Traffic Control Devices'.
- 1.23.3 Guardrails shall be installed in accordance with the Department of Main Roads Road Planning and Design Manual.

### DG 1.24 Pedestrian Foot Bridges

- 1.24.1 Pedestrian foot bridges are to be provided where necessary and are to be constructed from concrete, recycled plastic product (replas) or steel (all steelwork is to be hot dipped galvanised) and shall be provided with handrails / fences for pedestrian safety.
- 1.24.2 Pedestrian footbridges must be approved by an RPEQ for structural stability.
- 1.24.3 The clear width of all pedestrian bridges shall match the width of the approaching pathway / bikeway unless otherwise approved by Council and shall have squeeze points to control access.
- 1.24.4 Designers shall consult with Council at concept stage to confirm location, widths, flood immunity and material etc.

### DG 1.25 Tram Line Crossings

- 1.25.1 Road crossings are to be constructed in accordance with Department of Transport and Main Roads Standard Drawings.
- 1.25.2 Flashing lights and crossing warning signs to the Department of Transport and Main Roads standards are to be erected on all new road crossings or crossings where the traffic density will increase because of the development.
- 1.25.3 Prior to commissioning of flashing lights and warning lights appropriate temporary controls including warning signage shall be installed and maintained at all road crossings.

### DG 1.26 Fencing

- 1.26.1 All fencing located inside the road reserve shall have a minimum height of 1.2m and shall be of a type that discourages climbing and constructed in accordance with Council's Standard Drawing.
- 1.26.2 A continuous chain wire mesh fence shall be constructed along all interfaces between the development and the tramway reserve and shall be constructed in accordance with Council's Standard Drawing.

## Rural Design Criteria

### DG 1.27 General

- 1.27.1 In addition to the foregoing sections this section specifically applies to all those sites identified as being suited to rural and rural residential subdivisions inclusive of rural home sites and hobby farms types of developments. For roads within the Rural Living Areas reference should be made to **Table D1.1**. **Table D1.3** details specific road demands for rural roads.

**Table D1.3 Rural Road Hierarchy – Deemed to Comply Requirements**

PARAMETER	RURAL LOCAL ACCESS	RURAL ACCESS	RURAL COLLECTOR	RURAL SUB ARTERIAL	RURAL ARTERIAL
Traffic volumes or Road Class (vpd)	<100	100-199	200-999	1,000-7,999	>8,000
Road Reserve (flat terrain < 5%)	20m	20m	20m	25m	25m
Road Reserve (undulating/Hilly > 5%) <sup>2</sup>	25m	25m	25m	30m	30m
Formation	8m	8m	10m	10m	12m
Pavement Width	6m	6m	6.5m	8m	10m
Seal Width	Optional	6m (min)	6.5m	8m	10m
Shoulders <sup>3</sup>	1.0m	1.0m gravel	1.75m gravel	As collector Incl. 0.5m sealed on each side	As collector Incl. 1.5m sealed on each side
Desirable Speed Environment (Km/h)	100 <sup>5</sup>	80	100	100	100
Design speed for individual elements (Minimum - Km/h) <sup>4</sup>	110	90	110	110	110

1. Sealing 4.0m wide shall be required for longitudinal grades in excess of 10% and may be required at sites where existing adjacent roads are sealed.
2. In undulating terrain, this width shall be increased to enable services to be constructed on accessible flatter land on top or below batters.
3. Where the road is a designed on-road bicycle route (signposted and pavement marked) the shoulder provision needs to confirm to AUSTRROADS Part 14-Bicycles
4. **In accordance with Austroads Guide to Road Design Part 3: Geometric Design, the design speed should not be less than the expected operating (85th percentile) speed for the road. The Department of Transport and Main Roads' Manual of Uniform Traffic Control Devices Part 4: Speed Controls (MUTCD Part 4) defines the approach used within Queensland to review and revise speed limits on existing roads within the Queensland road network.**
5. Default speed limit for unsealed roads.

- 1.27.2 Design speed is to be generally used as the basic parameter of design standards and the determination of the minimum design value for other elements in rural subdivisions is to be based on the concept of a "speed environment" as outlined in AUSTRROADS Guide to Road Design.



- 1.27.3 Where appropriate superelevation, widening and centreline shift and their associated transitions are to comply with AUSTRROADS Guidelines.
- 1.27.4 Where the table drain will have a flow velocity greater than 2.5m/s or is likely to scour, a stone pitched, or suitably lined dish drain is to be constructed along the invert. (Generally, table drains steeper than 6 % will require scour protection).

## DG 1.28 Horizontal and Vertical Alignment

- 1.28.1 Horizontal and vertical curves are to be designed generally to the requirements of AUSTRROADS Guide to Road Design. These requirements are essential to satisfy the safety and performance of proper road design. Roads having both horizontal and vertical curvature should be designed to conform to the terrain to achieve desirable aesthetic quality and being in harmony with the landform.

## DG 1.29 Intersections

- 1.29.1 Intersections should generally be in accordance with AUSTRROADS.
- 1.29.2 Adequate sight distance should be provided at intersections both horizontally and vertically. Each intersection location shall be examined for conformance with the criteria for Approach Sight Distance (ASD), Entering Sight Distance (ESD) and Safe Intersection Sight Distance (SISD).

## DG 1.30 Access to Allotments

- 1.30.1 All accesses onto sealed roads are to be sealed as per RS-0056. Accesses off gravel roads do not have to be sealed, unless access has a grade of more than 10%, falling to the road. Access over 10% grade falling to the road must be sealed from the property boundary to the road edge or distance otherwise agreed to by Council.
- 1.30.2 Drainage under accesses shall be designed and constructed to a size and length as determined by RPEQ. Minimum pipe size – 375mm diameter, Minimum length – 4.8m long.
- 1.30.3 All pipe and box culverts under accesses shall have headwalls to protect and retain gravel fill.
- 1.30.4 Precast vertical headwalls with wings are preferred, but insitu cast concrete or grouted stone may be used subject to Council Approval.
- 1.30.5 Precast sloping headwalls to be used on all access where the road design speed is 100km/h or where the culvert is within 4.5m of the traffic lane and the road speed is 80 km/h.
- 1.30.6 Accesses are to be designed to ensure that stormwater runoff from the road and the access discharge to the table drain.
- 1.30.7 Accesses shall be constructed in accordance with Council's Standard Drawing unless otherwise approved by Council.

## DG 2 – DESIGN GUIDELINES - Site Regrading

### General

#### DG 2.1 Scope

- 2.1.1 This section sets out the minimum standard specifically designed for site regrading involved land development and subdivision.
- 2.1.2 The designer needs to make reference to the associated design manual related to DG 1 – Road Geometry, DG 4 – Stormwater Drainage and DG 5 – Stormwater Quality Management.

#### DG 2.2 Objectives

- 2.2.1 This Manual aims to assist the Designer in achieving:
  - 2.2.1.1 Efficient and economical design;
  - 2.2.1.2 Enhancement of the environmental character and maintenance of natural features of the site; and
  - 2.2.1.3 Minimal impact on adjoining properties and developments.

#### DG 2.3 Reference Documents

- 2.3.1 AS3798 Guidelines on Earthworks for Commercial and Residential Development
- 2.3.2 AS4373 Pruning of Amenity Trees
- 2.3.3 AS4970 Protection of Trees on Development Sites
- 2.3.4 State Planning Policy

#### DG 2.4 Site Regrading Concept

- 2.4.1 Areas of a site proposed for building or recreational purposes may not be suitable in their natural state for their intended function without improvement works, the designer shall review the natural surface contours and where necessary shall design finished surface levels that ensure the land is suitably prepared.
- 2.4.2 Excessive site regrading should be avoided, wherever possible site layouts should be developed to position roads and drainage networks to take advantage of natural surface grades. Site layouts that minimise the disturbance of the land will require less erosion and sediment control measures during construction phase and reduce the risk of environmental harm.

- 2.4.3 The designer shall consider the implications of site regrading in relation to the existing natural environment. Generally, site regrading shall be minimised in heavily treed areas.
- 2.4.4 The design of site regrading areas preferably should aim to achieve a balanced cut to fill to minimising haulage of imported fill or spoil to and from the development site.
- 2.4.5 Where practical, areas should be regraded to minimise the necessity for underground drainage systems with surface inlet pits, and allow surface water to flow naturally to roads or drainage reserves without excessive concentration.

## DG 2.5 Clearing

- 2.5.1 Unless otherwise approved by Council any pruning and/or protection of trees shall be carried out in accordance with AS 4970 and AS 4373.
- 2.5.2 Clearing must be kept to a minimum. Trees and vegetation of significance shall be identified prior to design in order that the amount of disturbance may be minimised through appropriate design.
- 2.5.3 Reference should be made to the Vegetation Management Act and any relevant Local Laws and Policies prior to any tree clearing.
- 2.5.4 Generally, in areas with significant trees and vegetation:
  - 2.5.4.1 Roadways clearing shall be limited to the limits of approved earthworks plus a sufficient lateral clearance to ensure that the works are not interfered by the trees or vegetation; and
  - 2.5.4.2 Allotment clearing shall be limited to the minimum areas required to safely construct services such as sewers and catchment drains, and the limits of approved earthworks to allotments plus a sufficient lateral clearance to ensure the works are not interfered by the trees or vegetation.
- 2.5.5 No trees shall be damaged or removed from areas to be dedicated under the control of Council without prior written approval of Council.
- 2.5.6 Trees on existing roads shall not be damaged or removed without the approval of Council. All trees on existing roads affected by the works shall be shown and details given of proposed protection or relocation methods.
- 2.5.7 Prior to any clearing, all existing and future parkland shall be delineated to ensure its protection from unauthorised clearing.

## DG 2.6 General Standard of Lot Preparation

- 2.6.1 Special requirements will apply where necessary but generally lots are to be cleared of low scrub, fallen timber, debris, stumps, large rocks and any trees which in the opinion of Council are approaching the end of their functional life or are dangerous or will be hazardous to normal use of the development. Prior consultation with Council is necessary. Such requirements shall be shown on the design plan.

- 2.6.2 Class 1, 2 and 3 Pest Plants are to be removed and disposed of in accordance with Land, pest and Stock Route Management Act and Regulation.
- 2.6.3 All timber and other materials cleared from lots shall be removed from the site. All roots, loose timber, etc which may contribute to drain blockage shall be removed.
- 2.6.4 All trees nominated by Council in its conditions of approval shall be preserved by approved means to prevent destruction normally caused by placement of conventional filling or other action within the tree drip zone. Details of the proposed protection measures shall be detailed on the design plans.

## DG 2.7 Filling

- 2.7.1 If any land is to be filled all practices must ensure compliance with AS 3798 "Guidelines on Earthworks for Commercial and Residential Developments" and State Planning Policy 2/02.
- 2.7.2 Fill comprising industrial wastes or by-products is not permitted.
- 2.7.3 No person shall be permitted to fill any land where, in the opinion of Council, such filling will detrimentally affect the area available in any natural or artificial watercourse for either present or estimated future flood flows, or will detrimentally reduce the volume within a flood plain available for the storage of flood waters.
- 2.7.4 No person shall be permitted to fill any land if such filling may detrimentally affect natural drainage of any of the surrounding land.
- 2.7.5 All new allotments are to be flood free. Immunity levels shall be in accordance with relevant Council Policies and Planning Scheme requirements.
- 2.7.6 Every allotment shall be filled and drained to achieve Council's performance criteria, such that an area is available above the adopted flood line, or stipulated flood level, in accordance with the following documents:
  - 2.7.6.1 Queensland Urban Drainage Manual (QUDM);
  - 2.7.6.2 Council's Local Laws & Policies; and
  - 2.7.6.3 Council's Flooding and Drainage Policies

## DG 2.8 Compaction

- 2.8.1 Compaction of earthworks shall be in accordance with AS 3798 "Guidelines on Earthworks for Commercial and Residential Developments".

## DG 2.9 Cartage of Soil

- 2.9.1 The designer shall nominate in their design submission whether excess spoil is generated by the proposed earthworks and in these cases shall nominate the proposed spoil dump site and external haul route which shall be subject to the written approval of the Council.

- 2.9.2 In cases where the spoil is generated from works within existing declared roads, Council may nominate that the spoil be placed on Council controlled land within 5 km of the project site.
- 2.9.3 Where rock is disposed of on site, the position of the rock is to be approved by Council and shown on the 'as constructed' drawings.
- 2.9.4 Unless otherwise approved by Council all topsoil shall be retained on the development site and utilised effectively to encourage appropriate revegetation.

#### DG 2.10 Allotment Earthworks

- 2.10.1 Allotments shall be provided with a minimum finished surface gradient of 0.5%, including catch drains, to facilitate drainage.

#### DG 2.11 Batter Treatments

- 2.11.1 Cut and fill batters shall not straddle allotment boundaries unless otherwise approved by the Council.
- 2.11.2 Cut batters shall not extend into existing or proposed parks or bushland reserves unless specifically approved by Council. Fill batters may extend into proposed parks or bushland reserves with a maximum slope of 1 in 10 unless otherwise approved by Council.
- 2.11.3 In general, cut and fill batters shall be limited to a maximum slope of 1 in 4 (1 in 10 in parks), such that stabilisation is achieved by topsoiling and grassing which can be maintained by conventional tractor slasher.
- 2.11.4 All embankments and cuttings must be outside the road reserve. The toe of any cut batter is to be 300mm inside the property boundary; the top of any fill batter is to be 300mm inside the property boundary.
- 2.11.5 In environmentally sensitive areas or steep terrain, consideration may be given to relaxation of clause 4 subject to council approval.
- 2.11.6 Where subdivision roads are constructed in fill and the batter slope exceeds 1 in 2, Council may require an easement over the batter and to a nominated distance past the toe of the batter.
- 2.11.7 Batters in road reserves but outside the verge steeper than 1 in 4 may be retained by a retaining structure subject to approval by the Council.
- 2.11.8 On private land, batters should preferably be 1 in 4 or flatter for batters fronting the road reserve and 1 in 2 elsewhere. Batters steeper than 1 in 2 may be approved subject to the submission of an acceptable landscape treatment.
- 2.11.9 All batters steeper than 1 in 2 and higher than 1.5m shall require certification as to stability by a Registered Professional Geotechnical Engineer (RPEQ).

#### DG 2.12 Allotment Accesses

- 2.12.1 The slope of the natural surface can result in difficulty in providing vehicular access to allotments fronting the road. Driveway grades within the property should be limited for safety and amenity. Refer **Table 2.1** for Maximum Driveway Grades

**Table D2.1 Maximum Driveway Grades**

Location	Desirable	Maximum
Residential	16.6% (1 in 6)	20% (1 in 5) for 6m in every 12m
Industrial	10% (1 in 10)	16.6% (1 in 6)
Maximum change in driveway grades – all areas <sup>1</sup>	8%	10%

Notes:

1. Change of grade is expressed algebraically as the change in gradient between the two roadway grades.

- 2.12.2 Steep allotment access (10% or greater) and drainage shall be designed and constructed to include the following (unless otherwise approved by Council):
- 2.12.2.1 The driveway must be a minimum of three (3) metre wide concrete slab, with barrier kerb and channel provided on one side for vehicular safety and drainage purposes;
  - 2.12.2.2 The driveway shall be constructed in such a manner as to ensure that the crossfall of the driveway be one-way and directed into the hill, for vehicle safety and drainage purposes;
  - 2.12.2.3 A turn around shall be provided adjacent to each of the proposed dwellings sufficient to allow turning movements for an emergency services vehicle;
  - 2.12.2.4 The driveway shall be located to minimise the visual impact, and minimise the amount of earthworks required; and
  - 2.12.2.5 Both sides of the areas adjacent to the driveway shall be re-vegetated to minimise visual impact. This information is to be included in the application for engineering approval.

## DG 2.13 Retaining Walls

- 2.13.1 All retaining walls are to be 150mm from the property boundary or back for the footing to be wholly contained within the allotments that the retaining wall sits.
- 2.13.2 Council will allow retaining walls to be constructed up to a maximum height of 1.0m without structural certification provided they are constructed fully in accordance with the technical literature provided by the manufacturer and are designed to maximise life expectancy (i.e. replas plastic, Keystone or similar, timber generally not supported due to low life expectancy).
- 2.13.3 All retaining walls greater than 1.0m high must be designed, detailed and certified by a structural RPEQ. Structural certification and geotechnical

assessment if required shall be submitted to Council with design submission.

- 2.13.4 Retaining walls shall be designed to consider the location of any adjacent services (e.g. sewer). The minimum horizontal clearance between any adjacent services and the outermost edge of the retaining wall structure shall 800mm and outside the zone of influence whichever is the greater. Retaining walls must be designed to ensure that no imposed loads are applied directly to service infrastructure. Retaining walls adjacent to services shall be subject to Council approval.
- 2.13.5 Retaining walls associated with residential allotments or stormwater drainage must have a design life of 60 years.
- 2.13.6 All retaining walls must comply with the requirements of AS 4678 – Earth retaining structures.

#### DG 2.14 Earthworks on Hillslopes

- 2.14.1 Where earthworks are proposed in any development where the slope of the land exceeds 15% (unless otherwise agreed), Council requires a report from a qualified Geotechnical RPEQ addressing slope stability and construction issues.
- 2.14.2 The designer shall incorporate the specific measures and recommendation contained within the geotechnical report to control soil and rock movements into the design of roads and house bench pads.
- 2.14.3 Where batters are 2.0 meters or higher a risk assessment is to be undertaken by the Engineer to determine if fencing is required to be undertaken in accordance with the relevant Australian Standard.

#### DG 2.15 Earthworks to Parks

- 2.15.1 All earthworks within proposed or existing parkland shall:
- 2.15.1.1 Be adequately drained;
  - 2.15.1.2 Have no batters exceeding 1 in 10; and
  - 2.15.1.3 Have acceptable landscaping in accordance with Council's minimum standards.

#### DG 2.16 Footpaths/Verge Crossfall

- 2.16.1 All footpaths / verges shall fall from the frontage property boundary to the adjacent kerb and Whitsunday Regional Council Planning Scheme 2017– Schedule 6 –June 2017 (V3.5) 77 channel with acceptable crossfalls of between 2.5% - 5%. In the case where the allotment falls away from the road reserve (i.e. the allotment is lower than the level of the road), the footpath / verge shall have a minimum fall from the frontage property boundary to the adjacent kerb of 3%.

## DG 2.17 Topsoiling and Grassing

- 2.17.1 Topsoil is defined as surface soils high in organic matter and contaminated by residual grass seeds and grass roots.
- 2.17.2 The area under paved areas, footpaths, batters and areas of fill shall be stripped of topsoil and any other organic matter.
- 2.17.3 On the completion of the works, topsoil shall be re-spread to allotments, batters and footpaths and fill areas to a minimum depth of 75mm - 100mm.
- 2.17.4 The footpath areas, batters and all disturbed areas including allotments are to be trimmed and drill seeded with an approved grass species.
- 2.17.5 All cut and fill batters shall be hydro-mulched or approved equivalent.

## DG 2.18 Inspection Requirements

- 2.18.1 Inspections and testing requirements for all allotments and roads shall be to Level 1 in accordance with AS 3798 “Guidelines on Earthworks for Commercial and Residential Developments”.
- 2.18.2 A higher level of inspection and testing may be required for more significant works as determined by Council.
- 2.18.3 Council may approve a lower level of inspection and testing for minor works and drainage works.



## DG 3 - DESIGN GUIDELINES – Road Pavements

### General

#### DG 3.1 Scope

- 1.1.1 This section sets out the minimum standards for the design of the road pavement to meet the required design life, based on the subgrade strength, traffic loading and environmental factors, and including the selection of appropriate materials for select subgrade, subbase, base and wearing surface.
- 1.1.2 The Manual contains procedures for the design of the following forms of road pavement construction:
  - 1.1.2.1 Flexible pavements; and
  - 1.1.2.2 Rigid pavements (i.e. concrete pavements).
- 1.1.3 Generally flexible pavements designed in accordance with this manual are preferred for road pavement construction in North Queensland. Council may examine pavement designs for rigid pavements subject to detailed engineering submissions of any such proposals. Council reserves the right to refuse any alternate proposal for pavement design.

#### DG 3.2 Objectives

- 1.2.1 The objective in the design of the road pavement is to select appropriate pavement and surfacing materials, types, layer thicknesses and configurations to ensure that the pavement performs adequately and requires minimal maintenance under the anticipated traffic loading for the design life adopted.

#### DG 3.3 Reference Documents

- 3.3.1 Department of Transport and Main Roads
  - 3.3.1.1 Pavement Design Supplement
  - 3.3.1.2 MRTS 30 Asphalt Pavements
  - 3.3.1.3 Road Planning and Design Manual Chapter 3 Appendix A 1st Edition
- 3.3.2 AUSTROADS / ARRB Publications
  - 3.3.2.1 Guide to Pavement Technology
  - 3.3.2.2 Guide to Road Design
  - 3.3.2.3 Design of Sprayed Seals
  - 3.3.2.4 ARRB-SR35 - Special Report No. 35 - Subsurface Drainage of Road Structures
  - 3.3.2.5 APRG 21 - Report No. 21 - A guide to the design of new pavements for light traffic
  - 3.3.2.6 Special Report No. 35 Subsurface Drainage of Road Structures

- 3.3.2.7 Guide to Pavement Structural Design
- 3.3.2.8 Technical Report – Pavement Design for Light Traffic – A supplement to Austroads Pavement Design Guide AP-T36/06
- 3.3.3 Cement and Concrete Association of Australia.
  - 3.3.3.1 T51 Concrete Pavement Design for Residential Streets and Paths
- 3.3.4 Concrete Masonry Association of Australia.
  - 3.3.4.1 T44 Concrete Segmental Pavements - Guide to Specifying
  - 3.3.4.2 T45 Concrete Segmental Pavements - Design Guide for Residential Access Ways and Roads
  - 3.3.4.3 T46 Concrete Segmental Pavements - Detailing Guide

## Pavement Design Criteria

### DG 3.4 Design Variables

- 3.4.1 Regardless of the type of road pavement proposed, the design of the pavement shall involve consideration of the following five input variables:
  - 3.4.1.1 Design Traffic;
  - 3.4.1.2 Subgrade Evaluation;
  - 3.4.1.3 Environment Factors;
  - 3.4.1.4 Pavement and Surfacing Materials; and
  - 3.4.1.5 Construction and Maintenance Considerations

### DG 3.5 Design Traffic

- 3.5.1 The design traffic shall be calculated based on the following minimum design lives of pavement:
  - 3.5.1.1 Flexible – 20 years;
  - 3.5.1.2 Rigid - 40 years;
- 3.5.2 Traffic loadings can be obtained from Austroads *Guide to Pavement Technology Part 2: Pavement Structural Design*
- 3.5.3 The pavement design shall include all traffic data and/or assumptions made in the calculation of the design traffic.

### DG 3.6 Subgrade Evaluation

- 3.6.1 Subgrade evaluation shall be carried out by a NATA registered materials test authority on each different natural sub-grade material evident and shall be by the conduct of soaked 4 day CBR laboratory testing.
- 3.6.2 Design CBR for each subgrade area shall be determined in accordance with the method outlined in AUSTROADS publications *Guide to Pavement Technology* and *ARRG Report 21 - A guide to the design of new pavements for light traffic*. The design parameter for

- 3.6.3 The following factors must be considered in determining the design strength/stiffness of the subgrade:
  - 3.6.3.1 Sequence of earthworks construction;
  - 3.6.3.2 The compaction moisture content and field density specified for construction;
  - 3.6.3.3 Moisture changes during service life;
  - 3.6.3.4 Subgrade variability; and
  - 3.6.3.5 The presence or otherwise of weak layers below the design subgrade level.
- 3.6.4 The subgrade Design CBR adopted for the pavement design must consider the effect of moisture changes in the pavement and subgrade during the service life, and hence consideration must be given to the provision of subsurface drainage in the estimation of equilibrium in-situ CBRs, and hence in the design of the pavement structure.
- 3.6.5 If the in situ subgrade test results in a CBR of 3 or less, the pavement is to be designed with input from RPEQ engineer experienced in the design of road pavements.

### DG 3.7 Environment Factors

- 3.7.1 The environmental factors, which significantly affect pavement performance, are moisture and temperature. Both of these factors must be considered at the design stage of the pavement. Reference should be made to AUSTRROADS publications Guide to road Design and Special Report No. 35 Subsurface Drainage of Road Structures.
- 3.7.2 The following factors relating to moisture environment must be considered in determining the design subgrade strength/stiffness and in the choice of pavement and surfacing materials:
  - 3.7.2.1 Rainfall/evaporation pattern;
  - 3.7.2.2 Permeability of wearing surface;
  - 3.7.2.3 Depth of water table;
  - 3.7.2.4 Relative permeability of pavement layers;
  - 3.7.2.5 Whether shoulders are sealed or not;
  - 3.7.2.6 Pavement type (boxed or full width); and
  - 3.7.2.7 Subject to flooding (e.g. Causeways and Floodways).
- 3.7.3 The effect of changes in moisture content on the strength/stiffness of the subgrade shall be taken into account by evaluating the design subgrade strength parameters (i.e. CBR or modulus) at the highest moisture content likely to occur during the design life, i.e. the Design Moisture Content. The provision of subsurface drainage may, under certain circumstances, allow a lower Design Moisture Content, and hence generally higher Design CBR.
- 3.7.4 The pavement design shall include all considerations for environmental factors, and any assumptions made that would reduce or increase design subgrade strength or affect the choice of pavement and surfacing materials.

## DG 3.8 Materials Testing

- 3.8.1 All materials testing shall be carried out by a NATA registered materials testing authority using the procedures described in the manuals or codes of practice as appropriate to Department of Transport and Main Roads and Standards Association of Australia.

## Pavement Thickness Design

### DG 3.9 Pavement Structure – General

- 3.9.1 The minimum pavement provided shall be as detailed in **Table D3.2**

**Table D3.2 Minimum Pavement Design Criteria**

Street Type	Minimum Pavement (mm) <sup>1</sup>	Surface Treatment	Minimum Base Course CBR	Minimum Subbase Course CBR
Laneway/Local Access / Access Street / Residential Street	200	Minimum 30mm AC	80	45
Collector Streets			80	45
- Minor	250	Minimum 30mm AC	80	60
- Major	250	Minimum 30mm AC		
Sub Arterial	300	50mm AC	80	60
Rural & Rural Residential	150	Gravel	60	45
<100vpd	200	Two Coat Seal	80	45
100-999vpd	200	Two Coat Seal	80	60
>1000vpd				
Industrial	250	50mm AC	80	60
Notes:				
1. Minimum pavement thickness does not include the depth of surfacing.				
2. All cul-de-sac heads and intersection turnouts in Rural and Rural Residential developments are required to have a 30mm asphalt surface treatment or concrete as a minimum.				

- 3.9.2 Notwithstanding subgrade testing and subsequent pavement thickness design, the thickness of subbase and base layers shall not be less than the following:
- 3.9.2.1 Flexible pavement: Subbase 100mm, Base 100mm
- 3.9.2.2 Rigid pavement: Subbase 100mm, Base 150mm
- 3.9.3 The subbase layer shall extend a minimum of 150mm behind the rear face of any kerbing.
- 3.9.4 The base and surfacing shall extend to the face of any kerbing. Where the top surface of the subbase layer is below the level of the underside of the kerbing and/or guttering, the base layer shall also extend a minimum of

- 150mm behind the rear face of the kerbing. Regardless of pavement design, all kerbing to be constructed on a minimum of 100mm pavement material.
- 3.9.5 For un-kerbed roads, the subbase and base layers shall extend at least to the nominated width of shoulder.
- 3.9.6 A change of pavement types may be considered for intersection thresholds and traffic control features.

### DG 3.10 Flexible Pavements

- 3.10.1 Flexible pavements with a design traffic up to  $5 \times 10^5$  ESA's shall be designed in accordance with AUSTRROADS publications Guide to Pavement Technology and ARRG Report 21 - A guide to the design of new pavements for light traffic.
- 3.10.2 Flexible pavement with a design traffic above  $5 \times 10^5$  ESA's shall be designed in accordance with Department of Transport and Main Roads' Pavement Design Manual.
- 3.10.3 In areas of high water table (within 300mm of subgrade level). Base course should be cement modified (1% by weight)
- 3.10.4 Concrete segmental pavements with design traffic up to  $5 \times 10^5$  and estimated commercial vehicles exceeding 3T gross shall be designed in accordance with CMAA-T45.
- 3.10.5 For design traffic above  $5 \times 10^5$  estimated commercial vehicles exceeding 3T gross the design shall be in accordance with AUSTRROADS Guide to Pavement Technology with the calculation of design traffic in terms of ESA's.

### DG 3.11 Rigid Pavements

- 3.11.1 Rigid (concrete) pavements, with design traffic up to  $5 \times 10^5$  ESA's shall be designed in accordance with either CCAA -T51 or AUSTRROADS Guide to Pavement Technology.
- 3.11.2 Rigid (concrete) pavements for design traffic above  $5 \times 10^5$  ESA's, the design shall be in accordance with AUSTRROADS Guide to Pavement Technology.

## Surfacing Design

### DG 3.12 Bitumen Wearing Surface

- 3.12.1 Except where the pavement is designed for asphaltic concrete or segmental paver surfacing or where a gravel pavement is permitted, the wearing surface shall be a bituminous as follows:
- 3.12.1.1 Urban Residential, Low Density Residential – Primer or primer seal, plus 2 seal coats of sprayed bitumen) Seal (14mm / 7mm Aggregate) (only permitted where widening existing bituminous seals)

- 3.12.1.2 Rural & Rural Residential - Primer or primer seal, plus 2 seal coats of sprayed bitumen Seal (16mm / 10mm Aggregate).

### DG 3.13 Segmental Pavers

- 3.13.1 Segmental pavers shall be concrete segmental pavers 80mm thick, shape Type A, and designed to be paved in a herringbone pattern unless otherwise approved by Council. Concrete segmental pavements are only to be used for pathways and local pavement 'highlight' features (e.g. 'threshold' treatments). The use of clay pavers on road wearing surfaces is not permitted.
- 3.13.2 The edges of all paving shall be constrained by either kerbing and/or guttering, or by concrete edge strips.
- 3.13.3 Sand bedding layers are to be provided with adequate drainage.

### DG 3.14 Asphaltic Concrete

- 3.14.1 All roadworks shall be surfaced with an appropriate thickness of Asphaltic Concrete in accordance with **Table D3.2**.
- 3.14.2 Council requires the use of dense graded asphalt on all roads.
- 3.14.3 All roads greater than 10% in grade shall have a 10mm primer seal or other Council approved measure applied to the base course prior to the placement of the AC.
- 3.14.4 Asphalt Surfacing:
  - 3.14.4.1 Where asphalt surfacing is required to be between 30mm and 50mm, it is considered to function as a wearing surface only;
  - 3.14.4.2 Asphalt 40mm or thicker is required to be a dense graded asphalt (AC14) in accordance with Department of Transport and Main Roads' MRTS 30;
  - 3.14.4.3 Asphalt of 30 – 40 mm thickness must be a dense graded asphalt (AC10) in accordance with Austroads; and
  - 3.14.4.4 A tack coat is to be applied over the pavement material prior to the asphalt being laid. Tack coat is only not necessary when asphalt is placed over a new, undriven layer of asphalt.

### DG 3.15 Subsoil Drains

- 3.15.1 Subsoil or sub-pavement drains shall be provided on both sides of the formation, unless the geotechnical report indicates the absence of subsurface moisture at the time of investigation and the likelihood that changes in the subsurface moisture environment will not occur within the design life of the pavement and/or the pavement has been specifically designed to allow for likely variations in subgrade and pavement moisture contents:

- 3.15.1.1 Cut formations where the depth to finished subgrade level is equal to or greater than 400mm below the natural surface level;
- 3.15.1.2 Locations of known hillside seepage, high water table or isolated springs;
- 3.15.1.3 Irrigated, flood-prone or other wasterly drained areas;
- 3.15.1.4 Subgrades, which are highly susceptible to moisture, (i.e. commonly displaying high plasticity or low soaked CBRs);
- 3.15.1.5 Pavement materials, which are susceptible to moisture;
- 3.15.1.6 Existing pavements displaying signs of distress due to excess subsurface moisture; and
- 3.15.1.7 At cut to fill transitions.
- 3.15.2 Subsoil drains shall always be installed to all grassed/landscaped central medians and islands, unless otherwise approved by Council.
- 3.15.3 Where only one side of the formation is in cut, and the other side in fill, it may be sufficient to provide subsoil or sub-pavement drains only along the edge of the formation in cut.
- 3.15.4 In some circumstances it may be necessary to note on the engineering design the need for additional subsoil and sub-pavement drains that may become apparent during the construction process, due to changes in site moisture conditions or to areas of wasterer subgrade being uncovered that were not identified in the geotechnical investigation.
- 3.15.5 The requirements for subsoil drains should be assessed and designed by a registered geotechnical engineer or specialist pavement engineer.
- 3.15.6 Subsoil drains shall be constructed in accordance with Council's Standard Drawing.
- 3.15.7 In kerbed roads, the preferred location for the line of the trench is directly behind the kerb.
- 3.15.8 In un-kerbed roads, subsoil and sub-pavement drains shall be located within the shoulder, preferably at the edge of the pavement layers.
- 3.15.9 At the time of sub-soil drainage installation tree root barriers are to be installed in the appropriate locations and the kerb suitably marked (temporarily) to indicate where the tree is to be planted.
- 3.15.10 The minimum desirable longitudinal design grade shall be 1.0 - 1.5%. (Absolute minimum grade of 0.5%).
- 3.15.11 Trench widths shall be a minimum of 300mm, with a minimum depth below finished subgrade level of 300mm in earth and 200mm in rock. All subsoil drain trenches shall be wrapped in an appropriate geotextile fabric.
- 3.15.12 Outlets shall be spaced at maximum intervals of 150 metres. Where possible, subsoil and subpavement drainage pipes shall discharge into gully pits or other stormwater drainage structures. Where not possible, outlets shall be provided through fill batters.
- 3.15.13 Flushing Points are to be provided at the commencement of each run of drain, and at intervals not exceeding 50 metres. Flushing points shall generally be located directly at the rear of kerb or at the edge of shoulder, as applicable.
- 3.15.14 Flushing Points and Outlets shall be constructed in accordance with Council's Standard Drawing.

## DG 3.16 Drainage Mat (Blankets)

- 3.16.1 Drainage mats are designed where there is a need to ensure continuity of a sheet flow of water under fills, to intercept and control seepage water and springs in the floors of cuttings, to intercept water which would otherwise enter pavements by capillary action or for protection of vegetation or habitat downstream of the road reserve where a fill would otherwise cut the flow of water.
- 3.16.2 In embankments drainage mats are constructed after the site has been cleared and grubbed and before commencement of embankment construction.
- 3.16.3 In excavations drainage mats are constructed after completion of the subgrade construction and before construction of the pavement.
- 3.16.4 The minimum thickness of compacted filter material shall be 300mm plus an allowance for the expected consolidation or 500mm if the amount of consolidation of embankment foundation is not known.
- 3.16.5 The requirements for and design of drainage mats shall be undertaken by a geotechnical engineer experienced in the design of road pavements.
- 3.16.6 All drainage mats shall be wrapped in appropriate geotextile.

## DG 4 – DESIGN GUIDELINES – Stormwater

### General

#### DG 4.1 Scope

- 4.1.1 The Queensland Urban Drainage Manual (QUDM) shall be the basis for design of stormwater drainage, except where amended by this guideline.
- 4.1.2 For the design of stormwater drainage (quantity) this section sets out the design guidelines for urban and rural area.
- 4.1.3 For the design of stormwater drainage (quality) systems for urban and rural areas refer to the requirements set out in the Stormwater Quality Guideline. <https://www.whitsundayrc.qld.gov.au/downloads/file/368/storm-water-quality-guideline-wrc-sw-qity-guide-final>
- 4.1.4 A suitably qualified and experienced Professional Engineer who is certified as a Registered Professional Engineer Queensland (RPEQ) and is competent to perform stormwater drainage design shall undertake or oversee all aspects of the design. The design shall comply with all relevant requirements of:
  - 4.1.4.1 this development manual
  - 4.1.4.2 all Reference documents listed in Section DG 4.3
  - 4.1.4.3 any development approval conditions relevant to the design
  - 4.1.4.4 any relevant request provided by Council in writing



## DG 4.2 Objectives

- 4.2.1 The objectives are to ensure the proposed stormwater drainage system and earthworks is designed to:
- 4.2.1.1 adequately collect and convey stormwater from a catchment to its receiving waters with minimal nuisance, danger or damage and at a development and environmental cost which is acceptable to the community as a whole; and
  - 4.2.1.2 limit flooding of public and private property, both within the catchment and downstream, to acceptable levels; and
  - 4.2.1.3 provide convenience and safety for pedestrians and traffic in frequent stormwater flows by controlling those flows within prescribed velocity/depth limits; and
  - 4.2.1.4 be in accordance with Council's flood and stormwater drainage studies and modelling formats.

## DG 4.3 Reference Documents

The planning and design of the developments within Whitsunday Regional Council local government area must be undertaken in accordance with the current edition of the following key reference documents, unless specified in this Section.

- 4.3.1 Queensland Government -
  - (i) State Planning Policy - state interest guideline Water quality,
  - (ii) Urban Stormwater Quality – Planning Guidelines (2010),
  - (iii) Environmental Protection (Water) Policy 2009
- 4.3.2 IPWEAQ - Queensland Urban Drainage Manual (QUDM)
- 4.3.3 Engineers Australia –
  - (i) Australian Rainfall and Runoff (ARR) – 1987 and 2016,
  - (ii) Australian Runoff Quality – A guide to water sensitive urban design.
- 4.3.4 Water by Design -
  - (i) Music Modelling Guidelines (2010),
  - (ii) Construction and Establishment Guidelines – Swales, Bioretention Systems and Wetlands.
- 4.3.5 WRC –
  - (i) [Flood and stormwater drainage studies](#) –
  - (ii) [WRC ADAC Guideline](#)
  - (iii) [Standard Drawings](#)
  - (iv) [WRC Stormwater Quality Guideline](#)
- 4.3.6 Australian Standards -
  - (i) AS/NZS 1597 Precast Reinforced Concrete Box Culverts
  - (ii) AS/NZS 4058 Precast Concrete Pipes
  - (iii) AS/NZS 3725 Design for Installation of Buried Concrete Pipes
  - (iv) AS/NZS 4139 Fibre Reinforced Concrete Pipes and Fittings
  - (v) AS/NZS 1254 PVC-U Pipes and Fittings
  - (vi) AS/NZS 2032 Installation of PVC pipe systems

- (vii) AS/NZS 2566 Buried Flexible Pipelines, structural design
  - (viii) AS/NZS 2041 Buried Corrugated Metal Structures
  - (ix) AS/NZS 1554 Structural Steel Welding
  - (x) AS/NZS 4671 Steel Reinforcing Materials
- 4.3.7 Department of Energy and Water Supply - Queensland Urban Drainage Manual Institute of Engineers Australia.
- 4.3.8 Department of Transport and Main Roads (TMR) Specifications:
- (xi) MRTS03 Drainage, Retaining Structures and Protective Treatments
  - (xii) MRTS04 General Earthworks
  - (xiii) MRTS06 Reinforced Soil Structures
  - (xiv) MRTS14 Road Furniture
  - (xv) MRTS15 Noise Fences
  - (xvi) MRTS16 Landscape and Revegetation Works
  - (xvii) MRTS24 Manufacture of Precast Concrete Culverts
  - (xviii) MRTS25 Steel Reinforced Precast Concrete Pipes
  - (xix) MRTS26 Manufacture of Fibre Reinforced Concrete Drainage Pipes
  - (xx) MRTS27 Geotextiles (Separation and Filtration)
  - (xxi) MRTS28 Contractor's Site Facilities and Camp
  - (xxii) MRTS45 Road Surface Delineation
  - (xxiii) MRTS46 Skid Resistant Friction Coating for Steel Road Plates
  - (xxiv) MRTS51 Environmental Management
  - (xxv) MRTS52 Erosion and Sediment Control
  - (xxvi) MRTS55 Use of Explosives in Roadworks
  - (xxvii) MRTS100 High Strength Geosynthetic Reinforcement in Road Embankments
  - (xxviii) MRTS140 Horizontal Directional Drilling (HDD)
  - (xxix) MRTS141 Micro-tunnelling and Pipe Jacking
  - (xxx) MRTS142 Thrust Boring and Auger Boring
- 4.3.9 Austroads –
- (i) Waterway Design – A Guide to the Hydraulic Design of Bridges, Culverts and Floodways
  - (ii) Guide to Pavement Technology – at the time of writing this document, part relating to development was AGPT10-09 - Part 10: Subsurface Drainage
- 4.3.10 Australian Institute for Disaster Resilience – Managing the floodplain – a guide to best practice in flood risk management in Australia – Handbook 7 - Floodplain Management in Australia: Best Practice Principles and Guidelines
- 4.3.11 John Argue – Storm Drainage Design in Small Urban Catchments – A handbook for Australian Practice – Special Report 34 Australian Road Research Board
- 4.3.12 Lewis Rossman – Stormwater management model User's Manual Version 5 – United States Environmental Protection Agency
- 4.3.13 Brisbane City Council. 2000. Natural channel design guidelines. Document produced in co-operation with Grant Witheridge, Catchment and Creeks Pty Ltd
- 4.3.14 Chow, Ven Te. 1959. Open channel hydraulics
- 4.3.15 Concrete Pipe Association of Australia, Concrete Pipe Guide, charts for the selection of concrete pipe to suit varying conditions
- 4.3.16 Henderson F.M.. 1966. Open channel flow

## DG 4.4 Flood Studies

- 4.4.1 Councils have or are in the process of producing, flood and stormwater drainage studies and hydrologic and hydraulic models for several catchments. Where a study and modelling do not exist, the designer shall be required to prepare this study and modelling as part of a development application. This is to be discussed at pre-lodgement meeting.
- 4.7.1 Councils studies can be found [online](#): The developer/engineer shall refer to QUDM Section 3 when assessing damage and/or nuisance
- 4.7.2 The developer/engineer shall refer to QUDM Section 3 when assessing damage and/or nuisance criteria. Further, as per QUDM any assessment of the potential adverse impacts of stormwater changes on other properties should consider the current and future use of land and also the value and potential development use.
- 4.7.3 The engineer must submit to Council a Due Diligence Assessment in accordance with Section 3.5 of QUDM. Including:
  - 4.7.3.1 Pre-development evaluation
  - 4.7.3.2 Demonstrate proposed drainage system/ works
  - 4.7.3.3 Determine the changes to volume, rate, frequency, duration, velocity, location and quality of stormwater run-off
- 4.7.4 The engineer is to notify Council in writing where the pre-development drainage system analysis identified deficiencies in the existing drainage system. Historical drainage design standards and changes to modelling may have resulted in parts of Councils drainage network not able to cater for the design storm flows. These issues will be considered with respect to Section 13.1 of QUDM.

## DG 4.8 Easements

- 4.8.1 Any potential easements to mitigate actionable nuisance on surrounding properties are to be determined early in the development process and shall be brought to Council's attention in a pre-submission meeting to advise Council on the likelihood of damage and/or nuisance.
- 4.8.2 Where stormwater drainage line that pass through property other than a road reserve an easement shall be provided over the property in favour of the Council. The width of this easement is determined by the depth at which the stormwater pipe is laid and based on twice the depth to the pipe obvert plus the pipe diameter (with a minimum width of three (3) metres and located centrally over the pipe. Further, if a drainage line passes adjacent to a property, an easement over that portion shall be required and dimensions as per above formula.
- 4.8.3 The width of easement for overland flow paths shall contain the 1% AEP storm flow from the upstream catchment or be three (3) metres wide, whichever is greater.
- 4.8.4 Easement required over inter-allotment drainage systems must be have extents as defined in QUDM.
- 4.8.5 Easement document to include the responsibility for all routine above ground maintenance within inter-allotment drainage easements to the grantor/ property owner. Council shall be responsible for repairs of a

capital nature. For example, the property owner must ensure that drainage paths are clear and kept unblocked at all times, such as removing leaves and debris.

- 4.8.6 Easement extents shall be designed to allow for necessary vehicle/machinery access for on-going Council maintenance and/or future repair and upgrade works to the drainage system.

#### DG 4.9 General

- 4.9.1 The RPEQ shall sign all relevant documents associated with the drainage design, certifying the design complies with this section.
- 4.9.2 Minor system flows (as defined by QUDM) are to be conveyed underground to a legal point of discharge unless otherwise approved by Council.
- 4.9.3 For new developments, the designer shall provide a stormwater drainage system designed in accordance with the "major/minor" system concept in accordance with QUDM and TMR standards. That is, the "major" system shall provide safe, well-defined overland flow paths for rare and extreme storm runoff events while the "minor" system shall be capable of carrying and controlling flows from frequent runoff events.
- 4.9.4 For redevelopment areas or where the proposed development transfers external catchment flows, the on-site drainage system is to be designed in such a way that the estimated peak flow rate from the site for the design Average Exceedance Probability (AEP) of the receiving minor system is no greater than that which would be expected from the existing area. Further, the design does not concentrate flows in such a way as to cause nuisance or damage to downstream properties.
- 4.9.5 The stormwater design shall meet all requirements relating to stormwater quality management, erosion and sediment control and acid sulphate soils. Refer to detailed requirements in [WRC Stormwater Quality Guideline](#).
- 4.9.6 The design of the stormwater drainage system, for the development shall be such that the upstream drainage is not adversely affected and that the downstream drainage system is capable of adequately catering for the discharge of the modified flow produced as a result of the development.
- 4.9.7 The design must be consistent with any relevant Council drainage study or catchment and waterway management plans.
- 4.9.8 The design must be based on the premise of peak load reduction by using methods of suitable detention or infiltration.
- 4.9.9 If the downstream system is not capable of carrying the modified discharge, the designer shall indicate the measures proposed to ensure the downstream system is capable of carrying the modified discharge. This will involve negotiation with adjoining property owners to produce easements over downstream drainage paths from the development to the legal point of discharge as per QUDM. Written approval for consent to discharge from the respective property owners

- is required for the easement and any engineering works on their property from the development site to the legal point of discharge.
- 4.9.10 Alternatively, where a development will result in increased runoff the stormwater drainage system may include on-site measures to such as detention basins, to ensure that the peak discharge from the development area is restricted to a level no greater than that discharging prior to the development.
- 4.9.11 The legal point of discharge will be assessed against the test and principles of QUDM to determine if a legal point of discharge has been achieved. If no lawful point of discharge or no discharge agreement has been provided, then the design cannot be accepted or approved.
- 4.9.12 All works proposed within creeks and natural watercourse, or lands under the control of other Authorities must have the approval of all relevant authority prior to commencing the work and evidence of such approvals shall be provided with the design submission.
- 4.9.13 The engineer of the stormwater drainage system shall accommodate the future developed peak flows from upstream catchments on the basis of development in accordance with the Planning Scheme.
- 4.9.14 The engineer shall be responsible for assessing the existing and future developed flow regime entering the development site from upstream catchments and shall provide detailed calculations with the design submission.
- 4.9.15 Unless approved otherwise by the Council, piped drainage systems shall extend to the boundaries of the subject land, with inlet and discharge works within the subject property.
- 4.9.16 All Material and components of the Stormwater Drainage system shall be durable and fit for purpose, with a minimum lifespan 60 years.
- 4.9.17 The designer needs to make reference to the associated design manuals related to DG 1 Road Geometry, DG 5 Stormwater Quality Management and DG 11 Parks and Open Space.
- 4.9.18 If a lawful point of discharge and tailwater conditions have not been provided by Council as development conditions, they shall be confirmed with Council prior to proceeding with detailed design.
- 4.9.19 Hydraulic calculations shall generally be carried out in accordance with QUDM. The calculations shall substantiate the hydraulic grade line adopted for design of the system. A sample of a summary sheet for hydraulic calculations is given in QUDM.
- 4.9.20 Catchment plans and hydraulic calculations including any additional calculations in support of overland flow path capacities, weir flows over kerbs, culvert designs etc. shall be provided to Council with the design submission. Where a hydraulic modelling programme is used, calculations to be provided with the design including listings of all programme input parameters.

A suitably qualified and experienced professional engineer (who must be a RPEQ), using the approach outlined in this section shall undertake or oversee all hydrologic designs.

#### 4.10.1 Design Storms

Table DG4.10.1 provides the design storms for developments within the Whitsunday Regional Council local government area.

The probability terms are the terminology preferences as adopted in Australian Rainfall and Runoff (ARR) – reference Figure 1.2.1.

**Table DG 4.10.1 Design Storms for Major and Minor Drainage Systems**

Design Type		Design Storm
<b>Major System Design</b>		1% AEP (100 Year ARI) Plus Climate Change Factor
<b>Minor System Design</b>		<b>Design Storm</b>
<b>Development Category (QUDM)</b>		
Central Business & Commercial		10% AEP (10 Year ARI)
Industrial		18% AEP (5 Year ARI)
Urban Residential High Density (greater than 20 dwelling units/ha)		10% AEP (10 Year ARI)
Urban Residential Low Density (greater than 5 and up to 20 dwelling units/ha)		18% AEP (5 Year ARI)
Rural Residential (2 to 5 dwelling units/ha)		39% AEP (2 Year ARI)
Open Space (Parks etc)		63% AEP (1 Year ARI)
<b>Roadway Criteria</b>		<b>Design Storm</b>
<b>Major Road</b>	Kerb & Channel Flow	10% AEP (10 Year ARI) <sup>1</sup>
	Cross Drainage (Culverts)	2% AEP (50 Year ARI) <sup>2</sup>
<b>Minor Road</b>	Kerb & Channel Flow	Use relevant Development Category above
	Cross Drainage (Culverts)	10% AEP (10 Year ARI) <sup>2</sup>
Notes-		
<ol style="list-style-type: none"> <li>1. The design storm for a Major Road overrides the Development category design storm.</li> <li>2. Design storm may change if the roadway is deemed by Council to be an emergency evacuation route.</li> <li>3. For cross-drainage requirements, refer to QUDM Section 7.3.7 &amp; Table 7.3.1.</li> </ol>		

#### 4.10.2 Hydrology - Design Rainfall Data

The rainfall intensities for design are to be obtained in accordance with ARR and BOM recommendations.

The Intensity Frequency Duration (IFD) data is to be generated for the specific site location at the BOM website. The link is <http://www.bom.gov.au/water/designRainfalls/ifd/>.

#### 4.10.3 Hydrology - Catchment Area

- 4.10.3.1 The catchment area of any point is defined by the limits from where surface runoff will make its way, either by natural or man-made paths, to this point. Consideration shall be given to likely changes to individual catchment areas due to the full development of the catchment.
- 4.10.3.2 The catchment boundary shall be determined by using the most accurate information available and details of catchments shall be provided to Council with the design submission.
- 4.10.3.3 Catchment plans shall include both major and minor event catchment extents.
- 4.10.3.4 Catchment land use shall be based on the current, proposed, and future available zoning information, where relevant.

#### 4.10.4 Hydrology - Rational Method Calculations

A suitably qualified and experienced professional engineer (who must be a RPEQ), shall undertake and oversee all hydrologic calculations as per the approach outlined in this section.

For small and rural catchments up to 25km<sup>2</sup> and urban catchments up to 1km<sup>2</sup>, Rational Method calculations shall be used to determine peak flows and must be carried out in accordance with QUDM

#### 4.10.5 Coefficient of Runoff

The impervious values for various development types must be in accordance with QUDM Table 4.5.1.

#### 4.10.6 Time of Concentration

- 4.10.6.1 The maximum time of concentration, to the first inlet pit in urban areas must be less 20minutes. If this is not met, sufficient evidence must be provided to justify a greater time.
- 4.10.6.2 For overland flow paths with differing flow characteristic, then the flow time of concentration of each segment must be calculated separately. Including flow paths across property and roadways.
- 4.10.6.3 Where calculating time of concentration for a specific area, the flow paths to pits shall be provided to service the fully development catchment. The designer must consider the likely fully developmental impacts of the catchment including any fence or building impacts on the flow path.

#### 4.10.7 Hydrology - Models

- 4.10.7.1 The use of hydrological models shall be used in accordance with the requirements of ARR and QUDM. Where computer analysis programs

are used, all relevant information (copies of the final data files, details of all calculations and stated relevant assumptions) must be provided on submission of the design to Council along with the final drawings.

- 4.10.7.2 Where a new flood model is required the 10 ensemble temporal patterns from ARR 2016 are to be analysed as per ARR 2016, Book 2, Chapter 5, Section 5. The median temporal pattern; the 6th highest flow rate out of 10 ensemble temporal patterns is to be used for the design.

#### DG 4.11 Hydraulics

A suitably qualified and experienced professional engineer (who must be a RPEQ), using the approach outlined in this section shall undertake or oversee all hydraulic designs.

#### DG 4.12 Hydraulic Grade Line

- 4.12.1 The design calculations shall validate the hydraulic grade line of the system as shown in the drawings.
- 4.12.2 The criteria for determining the downstream water surface level include:
- 4.12.2.1 known hydraulic grade line level from downstream calculations including pit losses at the starting pit in the design event;
  - 4.12.2.2 where the downstream starting point is a pit and the hydraulic grade line is unknown, a level of 0.15m below the invert of the downstream pit inlet is to be adopted;
  - 4.12.2.3 where the outlet is tidal or into other waterways the engineer shall refer to section 8.0 of QUDM;
  - 4.12.2.4 where the outlet is an open channel or natural waterway and the design storm is the major event and the downstream flood levels are not known the top of the outlet pipe shall be the downstream control; and
  - 4.12.2.5 where the outlet is an open channel or natural watercourse, the design storm is the major event and downstream flood levels are known, the downstream control shall be the major event flood level.
- 4.12.3 The Designer shall take into consideration the following requirements during major flood events with regard to the road inundation depth:
- 4.12.3.1 maximum depth of inundation at the kerb & channel lip to be limited to 300mm, based on the local catchment; and
  - 4.12.3.2 where the road reserve is adjacent to a trunk drain (as advised by Council) the road shall be graded such that the maximum water level from a 1% AEP including climate change event is to be less than 75mm at the kerb and channel lip.
  - 4.12.3.3 the water surface in drainage pits shall be limited to 150mm below the kerb and channel invert for inlet pits and 150mm below the underside of the lid for junction pits.
- 4.12.4 In addition, detailed calculations shall be provided to substantiate compliance in relation to:
- 4.12.4.1 depth of flow criteria in relation to surcharging of major system flows;



- 4.12.4.2 flow velocities to ensure vehicle / pedestrian safety; and
- 4.12.4.3 road reserve inundation depths.

#### DG 4.13 Minor System Requirements

The acceptable channel flow widths shall be in accordance with section 5.09 of QUDM unless otherwise agreed by Council. Minimum and maximum velocity of flow in stormwater pipelines shall be in accordance with section 5.16 of QUDM

Minimum conduit sizes shall be as follows:

- (i) pipes – 375mm diameter (under roads/streets); and
- (ii) box culverts – 450mm wide x 300mm high

#### DG 4.14 Pits

- 4.14.1 Inlet Pits shall be spaced so that the channel flow width is limited in accordance with QUDM sub-clause 5.09.1 and so that the inlet efficiency is not affected by adjacent inlet openings.
- 4.14.2 Preference is to be given to the location of drainage pits being centred opposite the side boundaries or centre of an allotment.
- 4.14.3 The engineer is to assume that Whitsunday Regional Council (WRC) Standard gully pit has the same inlet capacity as a Bro Pit, with no trough.
- 4.14.4 Kerb inlet sections to gully pits are to be a preferred maximum of 2 number.
- 4.14.5 Lip in Line lintel type pits are preferred. Back inlet pits are not preferred due to conflicts with services within road verge.
- 4.14.6 Kerb Inlet pits shall be in accordance with Council's Standard Drawings. All pits are to be recessed sufficiently to maintain a continuous lip line in accordance with these drawings.
- 4.14.7 Where alternate kerb inlets systems have been approved for use by a Council, a copy of certified inlet capacity design charts for the alternate inlets shall be provided to Council with the design submission.
- 4.14.8 Information on pit capacities is available in the following sources:
  - 4.14.8.1 Queensland Urban Drainage Manual (QUDM);
  - 4.14.8.2 pit relationships given in Volume 1, Chapter 14 or ARR; and
  - 4.14.8.3 pit manufacturer's charts.
- 4.14.9 Other pits shall be provided:
  - 4.14.9.1 to enable access for maintenance;
  - 4.14.9.2 at changes in direction, grade, level or class of pipe; and
  - 4.14.9.3 at junctions.
- 4.14.10 The kerb inlet capacity design charts shall be used in accordance with the following:
  - 4.14.10.1 Curves indicated on the charts that are shown in full are considered "Reliable" curves;
  - 4.14.10.2 Curves indicated on the charts that are shown dashed up to an Approach Flow of 250 l/sec are considered "Satisfactory" for use;

- 4.14.10.3 Curves indicated on the charts that are shown dashed with an Approach Flow in the range 250 l/sec to 500 l/sec are "Estimates Only" and are to be used with caution in critical locations; and
- 4.14.10.4 No extrapolation beyond the limits of these charts shall be permitted.
- 4.14.11 Side entry pits with grates are preferred. Grated inlet pits with no side entry shall only be used in areas with a low risk of consequential damage from blockage and shall be subject to Council approval.
- 4.14.12 Manholes shall be provided on stormwater drainage lines in accordance with the requirements of QUDM. Manholes for pipes up to 1200mm dia shall be constructed in accordance with the Council's Standard Drawings. Council may examine proposals for the use of proprietary manufactured directional changes for stormwater systems and the acceptance of these will be subject to the satisfaction of the Council.
- 4.14.13 Other factors to be considered in the design are as follows:
  - 4.14.13.1 Pits to be free draining;
  - 4.14.13.2 Kerb inlet pits at intersections generally are to be located at the tangent point taking into account the position of pedestrian paths and kerb ramps. Inlets shall not be placed on kerb return unless specifically approved by Council;
  - 4.14.13.3 Reductions in pipe sizes shall not be permitted; and
  - 4.14.13.4 Pipework openings are to be located within a single wall. i.e. pipes shall not be permitted to enter through the corner of the pit structure.
- 4.14.14 The desirable maximum inlet pit depth should be limited to 1.5m to enable maintenance.
- 4.14.15 The desirable minimum and maximum stormwater manhole depth is to be limited to 1.2m and 3.0m respectively.
- 4.14.16 Inlet pits should be located at the mid-point of allotment frontages to reduce the likelihood of conflict with service conduits and future driveways.

#### DG 4.15 Hydraulic Losses

- 4.15.1 The pressure change coefficient 'Ke' shall be determined by the appropriate chart in QUDM.
- 4.15.2 Where designs change from larger upstream to small downstream conduits, the design shall be in accordance with QUDM Section 5.11.4.
- 4.15.3 Where relevant, refer to QUDM for allowable reduction in "Ke" due to benching.
- 4.15.4 Junctions without a structure should be avoided. Justification and prior approval is required by Council before the detailed design stage. Where unavoidable, the pressure change coefficient "Ku", for the upstream pipe and "Kl" for lateral pipe, shall be determined from relevant charts in QUDM.

#### DG 4.16 Pipes/Box Culverts

Stormwater drainage pipes and boxes shall be generally of reinforced concrete (including FRC) construction and in accordance with the following:

- 4.16.1 Minimum pipe size 375mm diameter, minimum box culvert size 450mm x 300mm;
- 4.16.2 Minimum clear cover shall be 600mm in general or in accordance with manufacturers specification, otherwise approved by the Council;
- 4.16.3 The minimum vertical and horizontal clearances between a stormwater pipe and any other pipe or service conduit shall be 150mm;
- 4.16.4 In areas of high water table, the designer must consider buoyancy uplift in relation to pipe/culvert joints; and
- 4.16.5 In aggressive environments or where any part of the pipe / box culvert is below the Highest Astronomical Tide (refer to Queensland Tide Table for local conditions), pipes / box culverts will have cover to reinforcement in accordance with the exposure classification requirements of AS 3600.

#### DG 4.17 Major System Requirements

- 4.17.1 Major storm flows in developments shall be in accordance with Section 5.09 of QUDM. Where allotments do not drain towards the road frontage, the depth of the major storm flows shall not extend above the top of the roadway kerb.
- 4.17.2 Roadway flow capacities shall be determined in accordance with Section 5.09.2 of QUDM.
- 4.17.3 Surcharging of the drainage system which provides a water depth in excess of the top of kerb will not be permitted or approved, except where the requirements of QUDM Table 5.07.1 are met.
- 4.17.4 The velocity x depth product of flow across a footpath/ cycleway and likely within the road reserve shall especially consider the safety of children and vehicles. The maximum allowable depth of water within the road reserve, at the lip of kerb and channel is not greater than 0.3 meters. The maximum velocity x depth product is not greater than 0.4m<sup>2</sup>/s. Where the safety impacts are to vehicles only, the maximum velocity x depth shall not greater than 0.6m<sup>2</sup>/s.
- 4.17.5 In open channels and overland flow paths, the above velocity x depth product criteria will be required, except where the engineer shall address the requirements of safety in relation to children by providing other appropriate safety methods.

#### DG 4.18 Overland Flow

Overland flow paths or emergency relief paths shall be formed and located in accordance with the requirements of QUDM.

The following overland flow path requirements are:

- 4.18.1 Shall be provided at all sag points
- 4.18.2 Where the underground drainage system has a design capacity which caters for less than the 1% AEP storm flows, then the remaining surface flow up to the 1% AEP storm event is to be conveyed within a designated drainage reserve or easement. Further, where a concrete invert is required it shall

commence from the back of the kerb and be a minimum of 1.2m wide and the concrete section across the footpath shall be graded away from the kerb at 1:50. The remaining of the drainage reserve/ easement shall be turfed with a maximum slope of 1:4.

- 4.18.3 Where the underground drainage has a design flow of 1% AEP, the system must consider any blockage affects in accordance with QUDM and provide extents of overland flow as a result of blockage and subsequent drainage reserve and/or easements over these flow paths.
- 4.18.4 Allotments adjacent to overland flow paths are to have the floor levels above the Q100 clearly shown on the relevant design drawings.
- 4.18.5 The engineer shall provide weir calculations at locations where overland flows cross any footpath, cycleways adjacent to private allotments.
- 4.18.6 Where a pathway link is used for overland flow the pathway shall be concrete for its full width, shall have a maximum crossfall of 2.5 % and be constructed with a layback kerb and channel or approved equivalent along one edge. The 1% AEP flow shall be contained completely within the pathway;
- 4.18.7 The footpath profile at the overland flow tip out point shall be designed to provide a fall from the kerb at the road edge towards the pathway / park;
- 4.18.8 Flows through parks and open space shall have non-erosive velocity or adequate protection against scouring to the satisfaction of Council, designed to minimise maintenance requirements, in accordance with DG 11 Parks and open space.;
- 4.18.9 Where a stormwater pit is required to be aligned with a pathway for overland flow, the pedestrian path is to be offset and appropriate measures provided to guide pedestrians away from the pit and remove any potential hazards; and
- 4.18.10 Where flows discharge into receiving waters or drainage reserves, adequate protection against scouring of the batter slope shall be provided to the satisfaction of Council.

#### DG 4.19 Open Channels

- 4.19.1 Generally, open channels will only be permitted where they form part of the trunk drainage system and shall be designed to have smooth transitions with adequate access provisions for maintenance and cleaning. Where Council permits the use of an open channel to convey flows from a development site to the receiving water, such a channel shall be designed in accordance with Section 9 of QUDM and this planning scheme policy.
- 4.19.2 Maximum side slopes not greater than 1 in 6 unless approved by Council.
- 4.19.3 Low flow provisions in open channels to prevent scouring from trickle flows shall be provided to all grass lined channels. Trickle flow protection shall be contained within a pipe or hard lined channel and shall be designed to cater for the 3 month ARI storm event (60 per cent of the 1 Year ARI storm event flow).
- 4.19.4 Have depth x velocity not greater than 0.4m<sup>2</sup>/s in areas of access to general public, especially children and vehicles or 0.6m<sup>2</sup>/s only accessible to vehicles. Safety exposure to be determined by the engineer.
- 4.19.5 Subsurface drainage shall be provided in grass-lined channels to prevent waterlogging of the channel bed.

- 4.19.6 Profiles of all grass lined channels ensure that mowing may be undertaken by a tractor and slasher to the satisfaction of Council.
- 4.19.7 Open channels involving natural waterways or formed grass swales in parks and open space are designed to minimise maintenance requirements, in accordance with DG 11 Parks and open space.
- 4.19.8 Where the flow velocity and / or depth within an open channel pose a safety hazard, barrier fencing and / or appropriate hazard warning signs shall be provided to discourage access to the channel. The extent of precautions should be determined following consultation with Council.
- 4.19.9 The depth velocity product and the gutter flow widths are to be included in the submitted drainage calculations.

#### DG 4.20 Inter-allotment Drainage

- 4.20.1 Inter-allotment drainage systems must be designed in accordance with QUDM Section 7.13. The minimum standard shall be Level 3 as defined in QUDM table 7.13.4, however the Engineer may direct a higher level for specific developments or parts thereof.
- 4.20.2 Inter-allotment drainage system must be provided to all allotments where:
  - 4.20.2.1 Any part of the allotment falls away from the frontage roadway; or the mid-block finished surface level is less than 600 mm above the lowest invert level along the frontage kerb and channel.
- 4.20.3 Inter-allotment pipes shall generally be:
  - 4.20.3.1 R.C. Pipe (minimum class 2) rubber ring jointed;
  - 4.20.3.2 F.R.C pipe rubber ring jointed; and
  - 4.20.3.3 uPVC pipes to be rubber ring jointed. Standard manufactures fittings shall be used in all cases: site fitted saddles are not permitted.
- 4.20.4 Inter-allotment drainage system shall be discharged into an underground drainage system or approved open channel. Discharge of inter-allotment systems to kerbs and channel shall not be permitted.
- 4.20.5 The depth of the house connection shall be determined as follows (subject to the above minimum);
  - 4.20.5.1 Determine the longest run of house drain to the connection point possible within the allotment;
  - 4.20.5.2 Allow 0.3 metres cover to the house drain at the head of the line; and
  - 4.20.5.3 Allow minimum grade of 1 in 100 for the house drain.
- 4.20.6 Inter-allotment drainage or catch drains which have a change in horizontal alignment greater than 45 degrees shall be provided with concrete or wire-reinforced rock mattresses at such change points which shall be designed to cater for flows in accordance with QUDM.
- 4.20.7 Inspection manholes may be precast or cast insitu concrete boxes or precast FRC or RC pipe systems to the dimensions shown in **Table D4.4**.

#### **Table D4.4 Inspection Manholes**

Maximum Depth to invert (mm)	Boxes – internal dimensions (mm)	FRC or RCP Systems
900	600 x 600	600mm diameter
>900	600 x 900	750mm diameter
Minimum wall thickness	100 <sup>1</sup>	N/A
Notes:		
1. Precast boxes shall be approved prior to installation, wall thickness may vary according to manufacturer.		

4.20.8 Manholes shall be provided in the following locations:

- 4.20.8.1 One per lot;
- 4.20.8.2 Changes in grade;
- 4.20.8.3 Changes in direction;
- 4.20.8.4 Changes in pipe diameter; and
- 4.20.8.5 End of lines.

#### DG 4.21 Retaining Walls

- 4.21.1 Where retaining walls are incorporated in the retention of earth batters, adequate drainage shall be incorporated behind the top of the wall to ensure surface stormwater flows do not flow over the top of the wall but are contained in a designed system to pass the wall.
- 4.21.2 Appropriate scour protection is to be provided to the base of the wall.
- 4.21.3 Retaining walls within drainage lines must be block and concrete core filled, with weepholes, Design drawings to be provided to Council.

#### DG 4.22 Detention Basins

- 4.22.1 Detention basins in public land are not a preferred drainage solution and may not be used in any design without prior approval by Council.
- 4.22.2 Where approved detention basins shall be designed in accordance with Section 5 of QUDM and other criteria nominated by Development Approval.

#### DG 4.23 Headwalls

- 4.23.1 Pipe / Box culvert headwalls shall be in accordance with the Department of Transport and Main Roads (TMR) Standard Drawings 1303 – 1306 and 1318 Proprietary precast headwall may also be used as an alternative to cast insitu structures.
- 4.23.2 The designer shall ensure that in addition to standard aprons and cut-off walls adequate protection works commensurate with design velocities and flows shall be provided to prevent downstream scouring and erosion.

- 4.23.3 Where floodgates are to be used, headwalls and aprons shall be specifically designed to accommodate the floodgate and minimise the potential for debris and siltation to impede the operation of the floodgate. Most precast headwalls are not suitable for use with floodgates.

#### DG 4.24 Table Drains

- 4.24.1 Table drains shall generally be constructed with a minimum depth of 600mm or to a depth of 300mm below the pavement subgrade, whichever is greater.
- 4.24.2 Table drain profiles may be either v-shaped or trapezoidal. Reference should be made to the Local Authority Specific Requirements for each Councils preferred profile.

#### DG 4.25 Outlets

- 4.25.1 The engineer should not assume that drainage channels, overland flow paths, drainage outlets, energy dissipators or stormwater detention basins will automatically be permitted in public space, either existing or newly created.
- 4.25.2 The engineer is to consult with Council at the concept design stage prior to any detailed design which facilitated any stormwater discharge onto Council controlled land.
- 4.25.3 Outlets into natural watercourse, open channels and tidal areas shall be designed in accordance with the requirements of QUDM.
- 4.25.4 Protection works to outlet shall be designed to meet the following criteria:
- 4.25.4.1 Dissipate the outflow velocity to minimise scouring;
  - 4.25.4.2 Provide protection from stream flows in receiving waters;
  - 4.25.4.3 Provide protection from overland (Major Storm) flows into receiving waters; and
  - 4.25.4.4 Provide protection from local scouring or undermining of the outlet structure.
- 4.25.5 Where a headwall is located within the tidal splash zone, it will be designed to comply with the exposure classification requirements of AS 3600.
- 4.25.6 An energy dissipating outfall shall be provided where the velocity of the outflow or nature of the discharge from the pipe system into the receiving water could cause scouring in the receiving channel.
- 4.25.7 Outlets with floodgates shall be designed to ensure that they can operate freely at all times, and are protected from siltation, excessive vegetation growth, debris and the impacts of stream flows in the receiving waters.
- 4.25.8 The designer shall provide calculations to show that they have accounted for losses due to floodgates or other water control devices in the hydraulic design.

4.25.9 All outlets shall be located to facilitate inspection and maintenance access.

4.25.10 Tidal outlet levels must be in accordance with Council's storm tide modelling and QUDM. Further, All tidal outlets shall be fitted with floodgates to prevent the intrusion of salt water into the system.

## DG 5 – DESIGN GUIDELINES – Water Reticulation

### General

#### DG 5.1 Scope

- 5.1.1 This document sets out the acceptable solutions for the planning, design and construction of water reticulation systems that are to be constructed by a Developer and handed to Council to operate. This section also covers certain service connection issues relating to development approvals and private infrastructure that needs to be to Council standards.
- 5.1.2 The water reticulation system shall be defined as mains less than 300mm diameter. Design of mains 300mm diameter and greater shall be subject to the specific criteria nominated by Council. All mains less than 300mm diameter shall be designed in accordance with this manual.
- 5.1.3 No connections will be permitted to bulk water supply mains that are used for the sole purpose of bulk water transfer of water to water reservoirs.
- 5.1.4 The planning, design, construction and certification of water reticulation infrastructure is to be carried out in accordance with the following provisions:
  - 5.1.4.1 Council's general criteria as set out in these manuals and Council's Standard Specifications and Drawings that are based on the Desired Standards of Service;
  - 5.1.4.2 The criteria contained within the Water Services Association of Australia WSA 03 – 2011 – Water Supply Code of Australia;
  - 5.1.4.3 The designer shall note the Queensland Workplace Health and Safety – Guide to the Workplace Health and Safety Obligations of Designers of Structures and the design shall include the required Safety Design Report; and
  - 5.1.4.4 For general guidance on infrastructure elements not contained within council's documents, the criteria contained within the Department of Energy and Water Supply Planning Guidelines for Water Supply and Sewerage may be used for guidance.
- 5.1.5 Aspects of modification or clarification of the Water Supply Code of Australia WSA 03 – 2011 are detailed in [Appendix B](#) of this document.
- 5.1.6 Council's Land Development Guidelines and Standard Specification and Drawings shall take precedence over the Water Services Association of Australia Codes and the Department of Energy and Water Supply Planning Guidelines for Water Supply and Sewerage.

#### DG 5.2 General



- 5.2.1 It is the Consulting Engineer’s responsibility to ensure that the current version of this section is used and that all infrastructure is constructed in accordance with this section.
- 5.2.2 It is the Consulting Engineer’s responsibility to ensure that all work is undertaken to council’s requirements. Responsibility for supervision, testing, inspection, commissioning and remedial work rests with the Consulting Engineer.
- 5.2.3 Where a water supply source is being developed to service the development, the source shall either meet or exceed the Australian Drinking Water Guidelines 2011 (ADWG), or the developer shall provide the necessary infrastructure to treat the source to the ADWG, including disinfection before storage and/or distribution.

#### DG 5.3 Objective

- 5.3.1 The objective of a water supply system is to provide to the consumer a reticulated portable water supply to meet the demands imposed upon it by both the consumers and fire-fighting requirements.

#### DG 5.4 Reference Documents

- 5.4.1 Australian Standards:
  - 5.4.1.1 AS/NZS 2566 Buried Flexible Pipelines
  - 5.4.1.2 AS 2368 Test Pumping of Water Wells
  - 5.4.1.3 AS 3952 Water Supply – Spring Hydrant Valve for Waterworks Purposes
- 5.4.2 National Health and Medical Research Council
- 5.4.3 Australian Drinking Water Guidelines
- 5.4.4 QLD Government Legislation
  - 5.4.4.1 Water Act
  - 5.4.4.2 Water Supply (Safety and Reliability) Act
  - 5.4.4.3 Water Services Association of Australia
  - 5.4.4.4 WSA 03 – 2011 – Water Supply Code of Australia
  - 5.4.4.5 WSA 01 –2004- Polyethylene Pipeline Code Information and Guidance Note
  - 5.4.4.6 WSA-TN4 Guidelines for design of pressure pipeline systems for water supply using PVC-M and PVC-O pipes
- 5.4.5 Department of Energy and Water Supply
  - 5.4.5.1 Planning Guidelines for Water Supply and Sewerage National Uniform Drillers Licensing Committee 2012
  - 5.4.5.2 Minimum Construction Requirements for Water Bores in Australia

#### DG 5.5 General

- 5.5.1 All connections or alterations to Council water reticulation mains shall be made by the Developer at the Developers cost and subject to appropriate conditions agreed with Council.
- 5.5.2 The design of the water reticulation will take into consideration all external demands that are presently acting on the system or are likely to do so in the future. Council shall be consulted to ascertain these external demands, points of connection to existing reticulation and operating parameters.
- 5.5.3 Council approval of water reticulation does not relieve the Consulting Engineer of responsibility for the design.
- 5.5.4 In staged developments, to ensure an efficient distribution system is established, the designers are required to submit to the Council an overall layout of the proposed subdivision, including all stages demonstrating that each stage of the development achieves minimum pressures and showing the sizing of mains to be incorporated. This proposal shall be submitted to the Council for approval in principle before the submission of any construction plans and specifications will be accepted for review.
- 5.5.5 Prior to proceeding with detailed design, the Consultant shall liaise with Council to ascertain whether a network analysis (to determine the optimum size of the internal mains) is required by Council as part of the design submission for the development. For the design of water reticulation schemes and where Council requires a network analysis, it shall be completed by the Consultant at the Developers cost following discussions with Council and be based on the design criteria detailed in Section DG5.7 below.
- 5.5.6 If a network analysis is required, the designer will be required to provide digital data compatible with Councils software, with the design submission, to enable the reticulation network to be input into Council's network model for checking. The network analysis shall be undertaken for the total development using Bentley WaterCAD compatible software and available for handover to Council for incorporation into the Council network program.
- 5.5.7 The network analysis shall be based on the design drawings and be spatially accurate.
- 5.5.8 In sloping development sites, the water reticulation network is to be designed in pressure zones to allow Council to control maximum and minimum pressures within the development.
- 5.5.9 The network design shall be planned to satisfy the requirements of this manual and to meet Council Customer Service Standards, which are published pursuant to the requirements of the Water Supply (Safety and Reliability) Act 2008, at a minimum whole-of-life cost (capital cost, operational and maintenance cost) for an environmentally acceptable solution and not simply a least capital cost solution. 8. Refer to [Appendix D](#) Whitsunday Regional Council Standard Conditions for Water Supply Above RL40.

## DG 5.6 Existing Mains

- 5.6.1 Council should be contacted to obtain copies of any "As Constructed" plans and details of any planned augmentation works.

- 5.6.2 Where, as a result of the development, existing mains are located on non-standard alignments or have less than minimum cover, the developer shall bear the cost of relocation, replacement or lowering, subject to the approval of the Council.
- 5.6.3 Pavement widening associated with some developments can place existing mains under the new pavement. In such cases, where the existing main has inadequate cover, the developer shall bear the cost of its replacement in a material approved by the Council, or reconstruction at an adequate cover depth or reconstruction on a standard alignment in the new verge.

## DG 5.7 Design Criteria

- 5.7.1 Flow Parameters - unless advised otherwise by Council, the Average Daily consumption and peaking factors for the design of Water Supply Schemes shall be as follows:
- 5.7.1.1 Average Daily Consumption (AD) 500 litre/person/day
- 5.7.1.2 Mean Day max Month (MDMM) 1.50 x AD Peak Day (PD) 2.25 x AD
- 5.7.1.3 Peak Hour (PH) 1/12 x PD
- 5.7.2 In the absence of specific flow consumption data, the Average Daily Consumption shall be calculated using the equivalent demands shown in **Table 6.1**.

**Table 6.1 Equivalent Demands**

Description	Equivalent Persons/Connection
Single Family Dwelling	
Lots > 1500m <sup>2</sup>	3.7
Lots 1101 – 1499m <sup>2</sup>	3.4
Lots 901 – 1100m <sup>2</sup>	3.1
Lots 401 – 900m <sup>2</sup>	2.8
Lots <400m <sup>2</sup>	2.5
Multi Unit Accommodation	
Units > 3 bedrooms	0.4 + 0.6/bedroom
Units = 3 bedrooms	2.2
Units = 2 bedrooms	1.6
Units < 2 bedrooms	1.0
Caravan Parks	
Van Site / Camping Site	1.2
Shops/Offices	
Per 90m <sup>2</sup>	1.0
Notes:	
1. Based on 2.8 Equivalent Persons/Equivalent Domestic Connection (EP/EDC), with 1 EDC equivalent to a single residential dwelling on a standard size allotment (401m <sup>2</sup> to 900m <sup>2</sup> ).	
2. For undeveloped land equivalent populations shall be calculated in accordance with the maximum allowable population density in the Planning Scheme, or estimation of maximum allowable density agreed with Council prior to design.	

- 5.7.3 Pressure Parameters – minimum and maximum service Pressures (excluding fire-fighting) – see **Table 6.2**.

**Table 6.2 – Pressure Parameters**

<b>Requirement</b>	<b>Details</b>
Minimum Pressure	22 metres head at peak hourly consumption
Minimum Pressure Location	At the property boundary for all lots
Minimum Pressure Network Condition (for modelling from a reservoir).	Based on the reservoir level for Peak Hour of the third day of three consecutive Peak Day events (for dynamic models). In the absence of dynamic model results the minimum reservoir level shall be assumed at 15% of storage height. Liaise with Council to confirm minimum pressure constraints available at the connection to the existing system.
Maximum Pressure	80 metres head. Where the pressure in a main exceeds 800 kPa, Council may require the installation of Pressure Reducing Valves (PRV) that may (at Council’s discretion) include telemetry control. Prior to proceeding with any design, Council shall be provided with details of the area affected and the number of lots involved.
Maximum pressure location	At the lot boundary
Maximum Pressure Network Condition (for modelling from a reservoir).	Based on reservoir level at 95 percent of top water level.

5.7.4 Fire Fighting Parameters

**Table 6.3 – Fire Fighting Parameters**

<b>Category</b>	<b>Fire Flow Requirement</b>	<b>Number &amp; Duration</b>
Residential (i.e. An area comprising of predominantly residential dwellings of a maximum of 3 storeys)	15 L/s for 2 hours	1 @ 2 hours
Commercial (i.e. An area comprising of shop and office accommodation of a maximum of 3 storeys) and Industrial	30 L/s for 4 hours  For schemes serving a population of less than 1000 a fire flow of 15 L/s for 2 hours should be satisfactory except where a special hazard or risk development exists	1 @ 4 hours
High Risk (i.e. A development where there is a probability of a fire occurring or there is a high cost of resultant damage (personal injury or property))	To be determined	Adopt a special hazard or risk fire
Note - Residual pressure plan is to be 12m minimum at hydrant at all times, assuming that the elevation of the supply point is equal to the ground elevation at the hydrant. Positive residual pressures must exist within the reticulation during the fire event.		

5.7.5 Background Demand - the following minimum criteria should be adopted for background demand during a fire event:

- 5.7.5.1 Predominantly Residential Areas:
  - 5.7.5.1.1 The minimum residual pressure specified should be exceeded with a background demand of 2/3 Peak Hour demand;
  - 5.7.5.1.2 A check should be undertaken at Peak Hour demand to ensure that pressures in the network remain positive; and
  - 5.7.5.1.3 The calculated background demand should not be less than Average Day demand.
- 5.7.5.2 Predominantly Commercial / Industrial Areas – In this case, the following scenarios should be investigated with the worst case being adopted:
  - 5.7.5.2.1 At Peak Hour demand of the Commercial / Industrial area (e.g. between 10am to 4pm). The intent of this scenario is to assess the local reticulation performance; and
  - 5.7.5.2.2 At 2/3 Peak Hour demand of the water supply zone (e.g. around 6pm). The intent of this scenario is to assess the zone trunk performance.
- 5.7.5.3 Mixed Residential / Commercial / Industrial Areas – In such cases a combination of background demand conditions similar to the Predominantly Commercial / Industrial Areas above should be examined.

5.7.6 Storage Parameters – refer **Table 6.4**.

**Table 6.4 – Storage Parameters**

Component	Sizing
Reservoirs (Ground Level)	3 (PD-MDMM) + (greater of Emergency Storage/Firefighting Storage)
Reservoirs (Elevated)	$6 \frac{(PH - MDMM)}{12}$ + firefighting reserve

5.7.7 Pump Parameters – refer **Table 6.5**.

**Table 6.5 – Pump Parameters**

Design type	Parameters
Treated water pumps feeding a ground level reservoir	MDMM over 20 hours
Treated water pumps feeding an elevated reservoir	Capacity (L/s) = $\frac{6PH - \text{reservoir operating volume}}{6}$ 3600 (Volume in litres)
Standby Pumps	Standby pump capacity to match the largest single unit pump capacity
Reticulation booster pump station	PH + fireflow
Pumped System	Peak Instantaneous flow + fireflow This situation may exist in smaller systems if variable

		speed pumps would replace any elevated storage. In these instances, it would be necessary to calculate instantaneous flow based on concurrent demand. This would exceed PH by a significant margin
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5.7.8 Pipeline Parameters

**Table 6.6 Pipeline Parameters**

Parameter	
<b>Pipe Capacity – trunk &amp; reticulated mains</b>	Size for PH + Fire Flow
<b>Friction Equation</b>	Hazen-Williams
<b>Maximum Velocity</b>	2.5m/s velocities up to 4.0m/s may be acceptable during fire flows
<b>Minimum Velocity</b>	N/A

5.7.9 Headloss Calculations - For headloss calculations, the Hazen-Williams formula is generally used. Values of the Hazen Williams friction co-efficient (C) to be adopted are as per **Table 6.7**.

**Table 6.7 Headloss Calculations**

Pipe Diameter (D)	C Value
<b>D ≤ 150mm</b>	100
<b>150mm &lt; D ≤ 300mm</b>	110
<b>300mm &lt; D ≤ 300mm</b>	120
<b>D &gt; 600mm</b>	125
<b>Note: The above values take into account losses for pipe fittings such as bends, valves, tees, crosses etc and the effect of pipeline ageing.</b>	

5.7.10 Road Crossing

- 5.7.10.1 all road crossings shall be minimum 100mm diameter;
- 5.7.10.2 all road crossings under Council controlled roads shall be constructed in Ductile Iron; and
- 5.7.10.3 all Road crossings under Industrial Roads, Major Collectors or higher order roads shall be constructed with an isolation valve each side of the road.

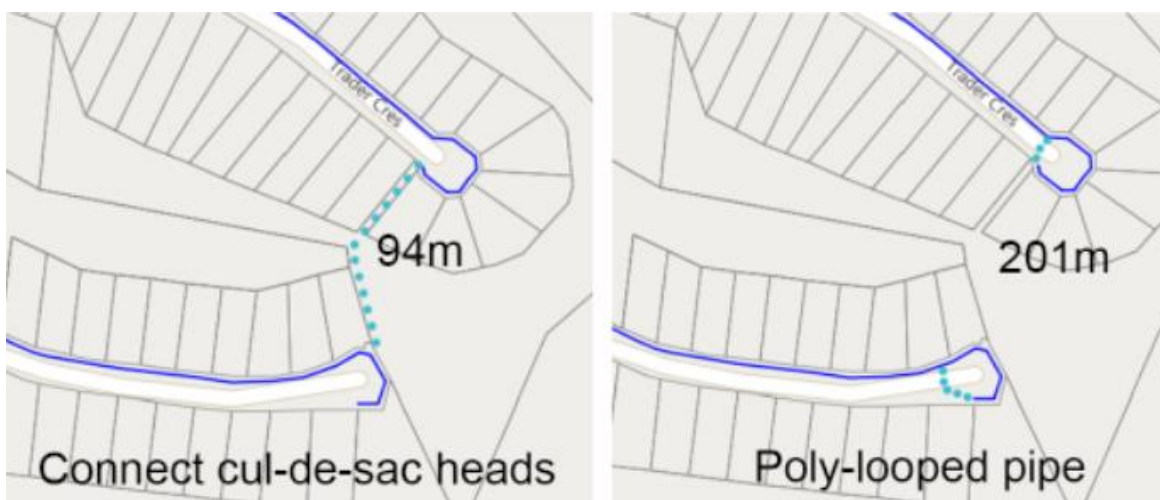
**DG 5.8 Dedication of Land Easements & Permits to Enter**

5.8.1 General Infrastructure - All pumping stations, booster stations, storage tanks, reservoirs, water towers and the like are to be located on freehold land that is owned by or will be dedicated to Council at the time of plan sealing, except that small pumping stations may, with State Government's approval, be located in land that is or will become road reserve. This land shall be provided to Council at no cost as freehold and zoned for water infrastructure purposes; and

- 5.8.2 Pumping Stations not sited beside a road reserve are to be provided with a 5-metre wide access transferred to Council as freehold.
- 5.8.3 When pipelines and appurtenances relating to pipelines are constructed in land other than in what is or will become, a dedicated road reserve or property owned by Council, Council requires easements to be registered in its favour over all such pipelines and appurtenances;
- 5.8.4 Easements shall be a minimum of 3 metres wide and located centrally over the pipeline. Mains are to be no closer than 1 m from an easement boundary; and
- 5.8.5 In the event that works are to be constructed through properties not under the control of the Developer, the Developer shall submit with the Operational Works Application:
  - 5.8.5.1 A 'Permit to Enter & Construct' letter, signed by each property owner through whose property the infrastructure is to be constructed, consenting to the construction of the works;
  - 5.8.5.2 Where the property is owned or to be dedicated to Council approval of the relevant section of Council that will manage the property; and
  - 5.8.5.3 Proof of the registration of easements in favour of Council as specified above.

#### DG 5.10 Reticulation Network

- 5.10.1 All water mains shall be laid on a standard alignment and unless directed otherwise alignments shall be as follows:
  - 5.10.1.1 Urban – 2.5m
  - 5.10.1.2 Rural – 2.5m
- 5.10.2 To promote network security and function, any development that can avoid a dead-end loop or dead end by the construction of less than 200m of main, shall do so where possible. Where this is not possible, Cul-de-sacs shall have a minimum DN63 HDPE-looped main;
- 5.10.3 Bending of pipes is not permitted notwithstanding any clause to the contrary in the WSA Code.



## DG 5.11 Cover

- 5.11.1 Unless noted otherwise on the approved Project Drawings the minimum depth of cover to be provided for mains shall be in accordance with WSA 03 – 2011 Table 7.2 Minimum Depths of Pipe Cover and shall have a pipe structural assessment to demonstrate suitability of the design.
- 5.11.2 The maximum depth of cover to be provided for mains shall be 1500mm.

## DG 5.12 Hydrants

- 5.12.1 Hydrants shall be installed for fire-fighting purposes on all potable water mains unless approved otherwise by Council.
- 5.12.2 Generally, hydrants shall be at 80m maximum centres for all urban areas and wherever possible located opposite allotment boundaries, and at every second allotment boundary for Rural, Park Residential and Low Density Residential allotments.
- 5.12.3 Hydrants shall be located at ends of lines in cul-de-sacs opposite the nearest allotment boundary.
- 5.12.4 Hydrants shall be located near access legs of battle-axe or hatchet shaped allotments.
- 5.12.5 Staged developments resulting in temporary dead ends shall have a hydrant located within close proximity to the end of line to enable maintenance flushing.
- 5.12.6 In undulating areas, hydrants should also be positioned at all high and low points of the main.
- 5.12.7 Hydrants shall be constructed in accordance with Council's Standard Drawings.

## DG 5.13 Valves

- 5.13.1 Valves shall be located opposite the first truncation point at a three-way intersection; or opposite the nearest allotment boundary.
- 5.13.2 All valves shall be located within the verge. Valves shall only be located within the road carriageway where specifically approved by Council.
- 5.13.3 Valves shall be installed where necessary to isolate sections of the system for maintenance purposes such that maintenance can be carried out causing minimum inconvenience and disturbance to the consumers. Generally, the design is to ensure that no more than 4 valves are required to be turned off to isolate a section with the maximum number of houses inconvenienced should be no greater than 20. All undeveloped urban zoned land shall be assumed to have the average density defined by Schedule 3 of the Whitsunday Planning Scheme 2017 and shall be modelled and designed where supply is most efficient as assessed by WRC Engineers to come through the proponent's development.
- 5.13.4 Cul-de-sacs shall have an isolation valve if more than 4 lots are served.



- 5.13.5 At tee junctions a valve shall be located on the leg of the tee. Where necessary to achieve maintenance isolation requirements, additional valves shall be installed to one or both sides of the tee junction.
- 5.13.6 The maximum spacing between isolation valves shall be 200m.
- 5.13.7 In higher density areas the spacing of isolation valves may be reduced to the requirement of the Council.
- 5.13.8 Valves shall be constructed in accordance with Council's Standard Drawings.

#### DG 5.14 Irrigation

- 5.14.1 All irrigation systems connected to Council's water supply shall be installed to satisfaction of Council. The installation of water meters, RPZ backflow prevention device and isolation valves are mandatory in all irrigation system. Refer Design Manual D9 Landscaping for design of irrigation systems.
- 5.14.2 A hydraulic design certificate is required for the irrigation system and to ascertain the required service size.
- 5.14.3 All connections to Council's existing system shall be completed by the Developer at the Developer's cost and subject to appropriate conditions agreed with Council.

#### Pump Stations

##### DG 5.15 General

- 5.15.1 Pump stations shall be subject to specific requirements of the local authority. Council should be consulted prior to design to confirm the specific requirements for pumps, electrical, switchboards, telemetry, etc.
- 5.15.2 Council acceptance of pump station design does not relieve the Consulting Engineer of responsibility for the correctness of the design.

##### DG 5.16 Pump Stations

- 5.16.1 Pump stations are to be contained in an above ground structure. The structure is to be constructed from reinforced masonry block and/or reinforced concrete. The structure is to be sized to allow for adequate internal access to all items for operational control but particularly for maintenance works. Openings will allow the easy reach and replacement of the largest item contained in the pump station. The use of multistage/centrifugal pumps is preferred.
- 5.16.2 A back-up power supply is to be provided either by a generator or diesel pump unless a five (5) day reservoir capacity is provided. Suitable arrangements for ducting airflow to the generator / diesel pump and the disposal of exhaust gases so as not to create a nuisance is required.

- Sufficient fuel is to be stored to operate for 12 hours at rated load (at AD demand).
- 5.16.3 Noise suppression is to be addressed and incorporated into the pumps station design. The pump station design is to comply with the Environmental Protection Act during normal use.
  - 5.16.4 The tenure of property on which pump stations and access roads are situated are to be transferred to Council as freehold title. Pump station sites are not to encroach upon gazetted road areas unless otherwise approved by Council.
  - 5.16.5 Access to the pump station site is to be via an appropriate standard sealed access and the pump station site is to accommodate maintenance vehicles and their manoeuvring.
  - 5.16.6 Internal and external pump station surfaces are to be painted as directed.

### DG 5.17 Telemetry Systems

- 5.17.1 Where required by the Local Authority, pump station control panel shall incorporate SCADA equipment for transmission of monitoring data and control to Council's existing master system. Council should be contacted to obtain a copy of their Technical Specification for Telemetry Systems.
- 5.17.2 It should be noted that where amalgamated Councils have varying telemetry systems, left over from pre-amalgamation Councils, pump station telemetry systems and requirements may vary within that Council and requirements must therefore be reconfirmed as a part of the design.

### DG 5.18 Alternative Water Pumping Systems

- 5.18.1 Alternative water pumping systems to provide increased pressures and flows to individual developments in lieu of a water storage reservoir may be considered by Council if sufficient justification can be provided. Such systems should generally include a number of centrifugal pumps installed in parallel and coordinated by a pump controller, which senses, and responds to water demand. The controller shall also regulate the pump speed to give a graduated increase or decrease in the volume of water being supplied and evenly shares the work between pump units.
- 5.18.2 In general, Council will only permit the use of such booster pump stations where all of the following conditions apply:
  - 5.18.2.1 Where Council considers it impractical to build a storage reservoir for topographical, geotechnical, or aesthetic reasons;
  - 5.18.2.2 Where a reservoir would service only that particular development;
  - 5.18.2.3 Where the number of lots to be serviced by the booster pump station is less than 25; and
  - 5.18.2.4 Where the booster pump station building can be blended with the architectural style of residences within the development.
- 5.18.3 The consultant should submit an initial report and associated recommendations for consideration by Council prior to any detailed design. As a minimum the report should include:

- 5.18.3.1 Reason for and benefits to the community based on the total life cycle costs of an alternative water pumping system;
- 5.18.3.2 Connection points to the existing system;
- 5.18.3.3 Water supply schematic plan;
- 5.18.3.4 Maintenance issues; and
- 5.18.3.5 Environmental reasons.

## DG 5.19 Dual Water Supply Systems

- 5.19.1 The Dual Water Supply System comprises Water Supply Code WSA 03-2011 and the Whitsunday Regional Council Amendments ([Appendix B](#)) to the above supplement.
- 5.19.2 [Appendix C](#) describes Whitsunday Regional Council's specific requirements for Dual Water Supply System works up to and including DN 300 that vary from or are additional to those detailed in the Water Supply Code WSA 03-2011.

## DG 5.20 Private Boosters

- 5.20.1 Written approval for the use of private boosters must be obtained from Council.

## DG 5.21 Conduits

- 5.21.1 A conduit shall be provided to all landscaped or grassed Medians, Traffic Islands and Roundabout islands to facilitate a future water service connection for landscaping purposes.
- 5.21.2 Where the length of a median exceeds 50m, conduits shall be provided at 50m centres. At roundabouts and channelised intersections the conduit layout should enable all landscape islands to be connected to a single water service connection.
- 5.21.3 Conduits under roadways shall be a minimum 100mm dia. uPVC Class 9 sealed each end with push-on caps.
- 5.21.4 Cover to conduits under roads shall be 600mm minimum or 100mm below subgrade, whichever is the greater.
- 5.21.5 The position of all conduits under roadways shall be clearly marked by the casting a nonferrous cuphead bolt into of the top of the kerb.
- 5.21.6 Where concrete footpaths are constructed on the road verge and the future water service connections are not being provided, a conduit shall be provided under the footpath opposite the allotment boundary to facilitate the future installation of water services by Council. Generally, water services shall be located at an alternate boundary to Ergon Energy's pillar box. Exceptions may be considered in individual circumstances were unusual

conditions or lot layouts exist and where approved by Council and Ergon Energy.

- 5.21.7 Conduits under footpaths shall be a minimum 100mm dia. uPVC Class 6 with 300mm cover and are to extend 300mm past the edge of the footpath. The position of all conduits under footpaths shall be clearly marked by casting a non-ferrous cuphead bolt into the property side of the footpath while the concrete is wet.

## DG 6 – DESIGN GUIDELINE – Sewerage System

### General

#### DG 6.1 Scope

- 6.1.1 This document sets out the minimum standards for the planning and design of sewer reticulation systems that are to be constructed by a Developer and handed to Council to operate. This section also covers certain service connection issues relating to development approvals and private infrastructure that need to be to Council standards.
- 6.1.2 The sewer reticulation system shall be defined as sewers of 150mm and 225mm diameter, used to collect and convey sewage from properties. Designs for sewers larger than 225mm diameter shall be subject to specific criteria nominated by the Council. All sewers 225mm diameter or less shall be in accordance with this manual. This definition of sewer reticulation systems applies only to these Whitsunday Regional Council Sewerage Design Manual and Specifications and is independent of the definition of trunk infrastructure as relates to trunk infrastructure charges.
- 6.1.3 Wherever possible, development should avoid the use of sewerage pump stations when a gravity solution is available. If a pump station is the only option, a buffer zone and screening should be given to the nearest private property.
- 6.1.4 The planning, design, construction and certification of infrastructure is to be carried out in accordance with following provisions:
- 6.1.4.1 Council's general criteria as set out in this manual and Council's Standard Specifications and Drawings that are based on the Desired Standards of Service;
  - 6.1.4.2 The criteria contain within the Water Services Association of Australia (WSAA) publications identified in D7.4. While vacuum and pressure sewer scheme WSA codes are listed, they are still considered unconventional infrastructure –refer D7.7;
  - 6.1.4.3 The designer shall note the Queensland Workplace Health and Safety – Guide to Workplace Health and Safety Obligations of Designers of Structures and the design shall include the required Safety Design Report; and
  - 6.1.4.4 For general guidance on infrastructure elements not contained within council's documentation, the criteria contained with the Department of Energy and Water Supply Planning Guidelines for Water Supply and Sewerage may be used for guidance.
- 6.1.5 Aspects of modification or clarification of the Water Services Association of Australia codes are detailed in [Appendix E](#) of this manual.
- 6.1.6 Council's Land Development Guidelines and Standard Specification and Drawings shall take precedence over the Water Services Association of Australia Codes and the Department of Energy and Water Supply Planning Guidelines for Water Supply and Sewerage.
- 6.1.7 Smart Sewers are considered Unconventional Infrastructure. Smart Sewer planning, design, construction and certification may be carried out in

accordance with Queensland Urban Utilities Sewerage Standards – Nu Sewer – Design and Construction Specification Version 6 and aspects of modification or clarification within the manual and approved by Council.

- 6.1.8 For construction standards for Electrical Switchboards for Sewage Pumping Stations, refer [Appendix J](#) – Addendum to Sewer Pumping Code.

## DG 6.2 General

- 6.2.1 It is the Consulting Engineer’s responsibility to ensure that the current version of Whitsunday Regional Council Development Manual is used and that all infrastructure is constructed in accordance with this section as a minimum standard.
- 6.2.2 It is the Consulting Engineer’s responsibility to ensure that all work is undertaken to council’s requirements. Responsibility for supervision, testing, inspection, commissioning and remedial work rests with the Consulting Engineer.

## DG 6.3 Objective

- 6.3.1 The objective of the sewerage system is to transport sewage from domestic, commercial and industrial properties using gravity flow pipes and, where gravity system is not possible by pumping to the treatment plant.
- 6.3.2 While various options can be determined that meet the minimum technical requirements, the selected option should meet least community cost for whole lifecycle. To achieve the optimum solution will require sewerage reticulation issues to be considered at the commencement of the planning process and to integrate with other planning issues, and not be considered an end of process infrastructure provision exercise.

## DG 6.4 Reference Documents

- 6.4.1 Australian Standards:
- 6.4.1.1 AS/NZS 1547-2012 On-site domestic wastewater management.
  - 6.4.1.2 AS/NZS 3500-2018 Plumbing and drainage set
- 6.4.2 Council Approved Products Register
- 6.4.3 QLD Government Legislation:
- 6.4.3.1 Water Act 2000
  - 6.4.3.2 Water Supply (Safety and Reliability) Act 2008
  - 6.4.3.3 Plumbing and Drainage Act 2002
  - 6.4.3.4 Queensland Plumbing and Wastewater Code
- 6.4.4 Water Services Association of Australia:
- 6.4.4.1 WSA 02-2014 Gravity Sewerage Code of Australia
  - 6.4.4.2 WSA 04-2005 Sewerage Pumping Station Code of Australia
  - 6.4.4.3 WSA 05-2013 Conduit inspection Reporting Code of Australia
  - 6.4.4.4 WSA 06-2008 Vacuum Sewerage Code of Australia
  - 6.4.4.5 WSA 07-2007 Pressure Sewerage Code of Australia
  - 6.4.4.6 WSA 01-2004 Polyethylene Pipeline Code

6.4.5 Department of Energy and Water Supply's - Planning Guidelines for Water Supply and Sewerage

## Design Criteria

### DG 6.5 General

- 6.5.1 Sewers shall be designed to accommodate flows from upstream catchments, calculated on the basis of their future development in accordance with Council's Strategic Plan, and accordingly, shall be extended to the upstream boundary(ies) of the proposed development (where required) to service upstream properties with the least whole of life cost. Designers should consult with Council to confirm location of any future connections points, details of any planned augmentation works and sewerage catchment areas.
- 6.5.2 Council approval of sewerage reticulation does not relieve the Consulting Engineer of responsibility for the correctness of the design.
- 6.5.3 In staged developments, to ensure an efficient distribution system is established, the designers are required to submit to the Council an overall layout of the proposed subdivision, including all stages, showing the sizing of mains to be incorporated. This proposal shall be submitted to the Council for approval in principle before the submission of any construction plans and specifications will be accepted for review. Refer to Application Procedures.

### DG 6.6 Existing Sewers

- 6.6.1 Prior to proceeding with the design, the designer shall obtain from Council "As Constructed" sewer information relevant to the proposed development and confirm point(s) for connection.
- 6.6.2 Works associated with some developments can impact on existing mains. Where as a result of the development an existing main has inadequate cover, it shall be reconstructed with a material approved by the Council or such other alternate protection measures deemed necessary by Council. Subsequent to construction, CCTV and/or ovality Testing is to be undertaken as determined by Council after the completion of works in accordance with this Manual and supervised by a Council Representative.
- 6.6.3 Where finished surface levels around existing manhole covers are altered, the manhole shall be reconstructed to conform with the requirements of this manual.
- 6.6.4 All connections or alterations to Council sewerage network, shall be made by the Developer at the Developers cost and subject to appropriate conditions agreed with Council.

## DG 6.7 Unconventional Infrastructure

- 6.7.1 Conventional infrastructure includes gravity sewers, lift stations, area pumping stations and pressure (rising) mains. Unconventional infrastructure includes smart sewers, small bore systems of any kind, including vacuum systems, hybrid low pressure systems, common effluent drainage systems, grinder pumps serving small clusters of properties and the like, and any other unconventional or unusual systems.
- 6.7.2 The use of unconventional infrastructure shall require special approval by Council and may require extended maintenance periods and a higher value for performance bonds.
- 6.7.3 In unconventional systems, Council may not have approved design criteria. Accordingly, proposals will be considered on the basis of best engineering practice and are to be subject to a lifetime benefit cost analysis.
- 6.7.4 If unconventional infrastructure is proposed the Consultant shall submit an initial report and associated recommendations for consideration by Council prior to any detailed design. The report should include as a minimum:
- 6.7.4.1 Description of proposed infrastructure;
  - 6.7.4.2 Reasons for departing from Conventional systems;
  - 6.7.4.3 Reasons for and cost benefits to Council;
  - 6.7.4.4 Connection points to existing system;
  - 6.7.4.5 Schematic layout plan; and
  - 6.7.4.6 Maintenance and operational issues.
- 6.7.5 Subject to Council's assessment of the Consultant's initial report and prior to any detailed design, Council may engage an independent Consultant to act for Council in assessing the initial report and to recommend suitable system parameters.
- 6.7.6 All costs associated with the engagement of the independent Consultant shall be at the Developers expense.
- 6.7.7 Any subsequent designs of infrastructure shall be planned to satisfy the requirements to meet Council Customer Service Standards, which are published pursuant to the requirements of the Water Supply (Safety and reliability) Act, at a minimum whole-of-life cost (capital cost, operational and maintenance cost) for an environmentally acceptable solution and not simply a least capital cost solution.

## DG 6.8 Design Criteria

- 6.8.1 Capacity – population estimates shall be based on those equivalent demands detailed in **Table 6.1**; and
- 6.8.2 The minimum pipe capacity shall be based on the criteria detailed in **Table 6.2**.



Table 6.1 Equivalent Demands

Description	Equivalent Persons/Connection
<b>Single Family Dwelling</b>	
Lot > 1500m <sup>2</sup>	3.7
Lot 1101m <sup>2</sup> to 1500m <sup>2</sup>	3.4
Lot 901m <sup>2</sup> to 1100m <sup>2</sup>	3.1
Lot 401m <sup>2</sup> to 900m <sup>2</sup>	2.8
Lot <400m <sup>2</sup>	2.5
<b>Multi-Unit Accommodation</b>	
Units > 3 bedrooms	0.4 + 0.6/bedroom
Units = 3 bedrooms	2.2
Units = 2 bedrooms	1.6
Units < 2 bedrooms	1.0
<b>Caravan Parks</b>	
Van Site / Camping Site	1.2
<b>Shops/Offices</b>	
Per 90m <sup>2</sup> GFA	1.0
<b>Notes:</b>	
<ol style="list-style-type: none"> <li>1. Based on 2.8 Equivalent Persons / Equivalent Domestic Connection (EP/EDC) with 1 EDC equivalent to a single residential dwelling on a standard size allotment (401m<sup>2</sup> to 900m<sup>2</sup>)</li> <li>2. For undeveloped land equivalent populations shall be calculated in accordance with the maximum allowable population density in the Planning Scheme for that land use, or estimation of maximum allowable density agreed with Council prior to design.</li> </ol>	

Table 6.2 Sewerage Loading

Average Dry Weather Flow (ADWF)	270/EP/d	Based upon analysis of pump station flows and STP inflow records during dry weather
<b>Peak Wet Weather Flow (PWWF)</b>	5 x ADWF or C <sup>1</sup> x ADWF whichever is greater	C <sup>1</sup> Peaking Factor = 15 x (EP) <sup>(^-0.1587)</sup> Note - Minimum value C <sup>1</sup> to be 5
<b>Peak Dry Weather Flow (PDWF)</b>	C <sup>2</sup> x ADWF	C <sup>2</sup> Peaking Factor = 4.7 x (EP) <sup>-0.105</sup>
<b>Vacuum Sewer Peak Wet Weather Flow (PWWF)</b>	4 x ADWF	Peaking Factor of 4
<b>Smart Sewer Peak Wet Weather Flow (PWWF)</b>	4 x ADWF	Peaking Factor of 4

6.8.3 Pipe velocity shall be based on the details show in **Table 6.3**

**Table 6.3 Pipe Velocities**

<b>Design Criteria</b>	<b>Recommended Value</b>
<b>Mannings ‘n’ (PVC)</b>	0.013
<b>Mannings ‘n’ (Poly)</b>	0.013
<b>Minimum Velocity @ PWWF</b>	0.6m/s
<b>Minimum Velocity @ PDWF</b>	0.3m/s
<b>Depth of Flow @ PWWF – Proposed Sewers</b>	Max Flow depth shall not exceed $\frac{3}{4}$ pipe full

6.8.4 Minimum grades for sewer reticulation mains are to be as summarised in **Table 6.4**

**Table 6.4 Minimum Grades for Gravity Sewers**

<b>Diameter</b>	<b>Minimum Grade</b>	<b>Minimum Grade Percentage</b>
<b>100mm – Property Connection Branches</b>	1 in 60	1.66%
<b>150mm – Property Connection Branches</b>	1 in 80	1.25%
<b>150mm – First MH Length, head of sewer</b>	1 in 100	1.00%
<b>Second MH Length</b>	1 in 150	0.67%
<b>Remaining MH Lengths</b>	1 in 150	0.67%
<b>225mm</b>	1 in 290	0.34%
<b>300mm</b>	1 in 420	0.24%
<b>375mm</b>	1 in 570	0.18%
<b>450mm</b>	1 in 730	0.14%
<b>525mm</b>	1 in 900	0.11%
<b>600mm</b>	1 in 1000	0.10%
<b>675mm</b>	1 in 1200	0.08%
<b>≥ 750mm</b>	1 in 1500	0.07%

6.8.5 The maximum allowable Equivalent Domestic Connections for various gravity sewer pipeline grades and diameters is listed in **Table 6.5** below.

Grade	150 diameter	225 diameter	300 diameter	375 diameter
570				1530
550				1557
500				1633
450				1721
420			983	1782
400			1007	1826
350			1076	1952
300			1163	2108
290		549	1183	2144
250		591	1274	2310
200		661	1424	2582
180	236	697	1501	2722
150	259	763	1644	2982
125	284	836	1801	3266
100	317	935	2014	3652
75	366	1080	2325	4217
50	448	1322	2848	5164

6.8.6 Sewer Depths – sewers shall not be greater than 3m deep unless approved by Council.

6.8.7 Where sewers are greater than 3m deep, the consultant engineer must submit calculations demonstrating sufficiency of the strength of the proposed pipe type and trenching condition.

#### DG 6.9 Sewer Alignment

6.9.1 The preferred, or standard, alignment of sewer lines in relation to property boundaries is presented in **Table 6.6**.

**Table 6.6 Preferred Alignment of Sewers**

Location	Alignment
Carriageway	Not Permitted, crossings only
Verge	Not usually permitted, subject to Council approval
Private Property (other than Commercial property)	
Side Boundary	0.8m inside allotment
Front and Rear Boundary	1.5 inside allotment
Commercial Boundary	
Front Boundary	1.5m inside front of allotment

6.9.2 Where sewer lines are located along the road frontage of allotments, the preferred alignment is 1.5m inside the allotment. However, to reduce the number of manholes on curved roads and where truncations occur, the sewer alignment may be varied slightly subject to Council approval.

- 6.9.3 Where the allotment is located adjacent to a designated Council Park or Drainage Reserve, and the sewer is proposed to be constructed adjacent to the Park or Drainage Reserve boundary, the sewer shall be constructed on a 0.8m alignment and wholly within the Park or Drainage Reserve. Where the sewer is proposed to be located elsewhere in the park, approval for the location must be obtained from Council.
- 6.9.4 Where sewers are to be located within existing road reserves, the designer shall check that the sewers do not conflict with other utility services and locate the sewers to the satisfaction of Council and in accordance with the services clearances as set out in WSA 02-2014 5.4.
- 6.9.5 Where retaining walls are located on or near the boundary of allotments, sewers, property connection points, manholes etc. must not be constructed under or within the zone of influence of the retaining wall foundations. Consideration is to be given to the difficulty of maintenance excavation on the lower side of retaining walls.
- 6.9.6 Where access for persons is required, adequate clearance must be provided around access structures and property connection points. For access structures, an area within a 1.5 metre radius (on three sides to permit the set up and use of confined space equipment and other maintenance equipment such as jet rodders and remote cameras) must be provided around the central point of the facility.
- 6.9.7 Stubs must be extended a minimum of 0.5m past the property boundary.

#### DG 6.10 Manholes

- 6.10.1 Manholes shall be placed on gravity sewers at the following locations:
  - 6.10.1.1 At changes of pipe diameter;
  - 6.10.1.2 At ends of lines where ends are more than 30m from previous manhole;
  - 6.10.1.3 At ends of lines where the line depth is greater than 1.5m;
  - 6.10.1.4 At end of lines servicing greater than one Property Connection Branches; and
  - 6.10.1.5 At council approved connections to trunk sewer.
- 6.10.2 Manhole shall not be constructed across property boundaries. Minimum clearance from the edge of manhole to the property boundary shall be 400mm.
- 6.10.3 The maximum change of angle through a manhole shall be 90° unless specifically approved otherwise by Council.
- 6.10.4 Manholes shall be constructed in accordance with the Standard Drawings S-0020 – S-0026.
- 6.10.5 Rectangular covers shall be provided to manholes less than 1500mm deep measured from the top of the manhole cover to the obvert level of the outlet. This has been derived so that a minimum 1.0m high clear working space is available within the manhole.
- 6.10.6 End of line treatments/alternatives may be acceptable as determined by Council.

#### DG 6.11 Covers and Surrounds

- 6.11.1 Manhole covers shall be finished flush with the surface in roadways, footpaths and paved surfaces. Elsewhere, unless noted otherwise on the approved Project Drawings, covers shall be finished 50mm above the surface of the ground, in a manner designed to avoid as far as possible, the entry of surface water.
- 6.11.2 Manhole covers are to be gas tight.
- 6.11.3 Manhole covers are to be located such that the position of the access opening is directly over the outlet pipe.
- 6.11.4 The installation of all precast manhole covers shall be in accordance with the manufacturers' recommended procedures and requirements and subject to appropriate conditions agreed with Council.

#### DG 6.12 Dedication of Land, Easements and Permits to Enter

- 6.12.1 General Infrastructure –
  - 6.12.1.1 All pumping stations, lift stations, storage tanks and the like are to be located on freehold land that is held by or will be transferred to Council at the time of plan sealing, except that lift stations, and small pumping stations may, with State Government's approval, be located in land that is or will become road reserve. This land shall be provided to Council at no cost as freehold and noted for sewerage purposes;
  - 6.12.1.2 Pumping Stations and lift stations that are not sited beside a road reserve are to be provided with a 5-metre wide access transferred to Council as freehold; and
  - 6.12.1.3 Dedicated or freehold land requirements shall include provision for the pump station offset as indicated in D7.16 Pump Stations.
- 6.12.2 Pipelines –
  - 6.12.2.1 When pipelines and appurtenances relating to pipelines are constructed in land other than in what is or will become, a dedicated road reserve or property owned by Council, Council requires easements to be registered in its favour for all sewage rising (pressure) mains and all gravity sewers.
  - 6.12.2.2 Easements shall be a minimum of 3m wide and located centrally over the pipeline, where no property boundary is common to any easement boundary. In the case where a pipeline is laid on a standard alignment from a proposed property boundary, the boundary of the lot and one boundary of the easement must be coincident and where the property boundary is to be created in the future, the boundary must be coincident to the easement boundary. Where possible, easements for pipelines shall not be installed diagonally through properties.
  - 6.12.2.3 Sewers are to be no closer than 1m from an easement boundary except where the sewer is on a preferred alignment; and
  - 6.12.2.4 In the event that works are to be constructed through properties not under the control of the Developer, the Developer shall submit with the Operational Works Application a 'Permit to Enter & Construct' letter, signed by each property owner through whose property the infrastructure is to be constructed, consenting to the construction of the works;

- 6.12.2.5 Where the property is owned or to be dedicated to Council approval of the relevant section of Council that will manage the property; and
- 6.12.2.6 Proof of the registration of easements in favour of Council as specified above.

## DG 6.13 Property Connections

- 6.13.1 Property connections shall be installed in accordance with Council's Standard Drawing.
- 6.13.2 Property connections should generally be located at the lowest corner of the allotment between 0.5 and 1.5m upstream of the allotment boundary or manhole.
- 6.13.3 Property connections will not be accepted within 0.5m of a lot boundary.
- 6.13.4 Property connections into manholes will be permitted at ends of line manholes only. Elsewhere, property connections are required "on line" and not into manholes.
- 6.13.5 Property connections into maintenance shafts require Council approval.
- 6.13.6 Combined Property Drains are not permitted in any development works.
- 6.13.7 For commercial / industrial premises, where the PCB is to be built over, a manhole is to be constructed at the point of connection.
- 6.13.8 Where a sewer main lies within an adjoining allotment, the property connection is to extend a distance of 1.0m into the allotment. For battle-axe allotments with the property connection located within the access, the Property drain shall extend from the property connection along the access to a point 1.0m within the main part of the allotment or, where a sealed driveway is required for the full length of the hatchet 'handle' then 1m past the extents of the driveway to allow a suitable future point of connection. Where a sewer is contained within a stormwater drainage easement, then the property connection should extend a minimum of 1m past the easement boundary and into the lot it is serving. All property connections should be finished a minimum of 1m clear of any infrastructure.
- 6.13.9 Property connections sizes shall be as follows:
  - 6.13.9.1 Residential (single Dwelling) – 100mm dia; and
  - 6.13.9.2 Others (i.e. Commercial, Industrial, Multi Residential) – 150mm dia.
- 6.13.10 Property connections to existing sewer mains shall only be permitted when the construction of a new main to service the proposed properties is not possible.
- 6.13.11 All Property connections shall be deep enough to service the entire lot using the following property drain design criteria:
  - 6.13.11.1 300mm minimum cover at the start of the drain or at any other control point on the allotment, (where property drains are subject to vehicular traffic, cover shall be increased to 600mm);
  - 6.13.11.2 1 in 60 minimum grade from the most distant corner where any Property or structure can be located on the allotment, on an alignment parallel to the property boundary; and

- 6.13.11.3 Consideration will be given to the finished level of the lot after all earthworks are complete including likely benching for building platforms.

## DG 6.14 On-Site Sewerage Facilities – Treatment and Disposal

- 6.14.1 The Consultant shall submit a report containing a detailed assessment of site and soil factors as per AS1547 2000 Appendix 4.1B. The report shall consider all major constraints and opportunities relating to the management of wastewater in relation to the development. The report must include all site and soil evaluation (SSE) findings and recommendations so that the most appropriate on-site sewerage facility can be chosen for the development and, in particular, be of sufficient quality and size to receive, treat and absorb all wastewater outputs that is likely to be produced on a property. It is not necessary at this stage to indicate a location for the land application area (LAA) but the report must include a site plan for each lot which indicates all unfavourable land due to site restraints, required setbacks and site features thus leaving the final location of the land application area (LAA) flexible until the detailed report is carried out at building stage and final building location is determined.
- 6.14.2 The minimum requirements for the wastewater disposal report:
  - 6.14.2.1 Site plan showing dams, creeks, bores and water courses over the whole development site;
  - 6.14.2.2 Flood overlay for entire development if applicable (available on Councils website)
  - 6.14.2.3 Contour plan maximum of 1 metre intervals;
  - 6.14.2.4 Areas of each block with proposed Lot No's and property boundaries;
  - 6.14.2.5 Proposed use of the land to be developed;
  - 6.14.2.6 Soil survey, including indicative permeability of soil by either a percolation test or textural classification of soil (minimum of one test site per proposed lot);
  - 6.14.2.7 Depth of ground water, if any encountered during testing;
  - 6.14.2.8 Estimated daily flows of 300 litres per bedroom per day to be utilised in calculations for daily flows;
  - 6.14.2.9 Method of disposal, e.g. Irrigation, ETA, Absorption;
  - 6.14.2.10 Minimum level of treatment of wastewater for each proposed lot;
  - 6.14.2.11 Size of estimated disposal area to suit system;
  - 6.14.2.12 Calculations to justify disposal site; and
  - 6.14.2.13 Assessment of any additional accumulative nutrient loadings of the area caused by onsite waste water disposal from the proposed development.

## Pumping Stations and Pressure Mains

### DG 6.15 General

- 6.15.1 Council should be consulted prior to design to determine specific requirements for pumps, electrical, switchboard and telemetry etc. Outlined below are Council's minimum requirements unless specified otherwise.
- 6.15.2 Council prefers that sewage be conveyed by gravity. Pump station will only be accepted if all other options have been considered and rejected.
- 6.15.3 Council requires documentary evidence that life cycle costs of all options have been analysed before approving a pumping station.
- 6.15.4 When the use of a pumping station has been approved it must be designed and constructed in accordance with this Manual and WSA 04-2005 and WRC Standard Drawings.
- 6.15.5 A submersible sewage pumping station built to Council requirements and incorporating two submersible sewage pumps with motor sizes up to 22 kW each will be regarded as a "standard" installation. Any station with pumps larger than 22kW will be regarded as a "non-standard" installation and will need to be specifically designed to suit the design flows. The design of a "non- standard" station must be carried out in consultation with Council.
- 6.15.6 Wet well washers are required in all sewage pumping stations unless otherwise approved by council.

#### DG 6.16 Pump Stations

- 6.16.1 Pump stations shall be designed as detailed on Standard Drawings S0050 – S-0052 and S-0057 – S-0060. Project specific design drawings are to be provided with the operational works submission which include the following: Relative levels (A through G) as denoted on these drawings as well as all pump start, stop and alarm levels appropriate to operating conditions shall be provided with the pump station design.
- 6.16.2 Operation levels for pump stations to be controlled by ultra-sonic level controllers or hydrostatic probes and not by float switches. Major pump stations as determined by the Council shall be controlled by ultra-sonic level controllers.
- 6.16.3 The pump stations overflow pipe shall be designed to cater for the maximum possible flow. Council and the Department of Environment and Heritage Protection should be consulted to determine emergency storage and overflow requirements.
- 6.16.4 The designer shall be responsible for obtaining all necessary licenses and approvals associated with the provision of pump station emergency overflow.
- 6.16.5 Pump stations shall be located as far as possible away from existing or proposed habitable dwellings. A 100m setback is desirable with absolute minimum of 30m unless otherwise approved by Council for standard pump stations only. New developments are to comply with the setback conditions from existing pump stations.
- 6.16.6 The tenure of property on which pump stations and access roads are situated shall be transferred to Council as freehold title. Pump station sites shall not encroach upon gazetted road areas unless otherwise approved by State Government and Council
- 6.16.7 Access to the pump station site shall be via an appropriate standard sealed 3.5m wide road (within the 5m access reserve) and the pump station site



shall accommodate maintenance vehicles and their manoeuvring. An acceptable layout and hard standing area will need to be determined in consultation with council.

- 6.16.8 The sealed access can be either of the following construction:
- 6.16.8.1 2 coat seal on 100mm sub-base and 100mm base course, subject to the sub grade strength indicated by the CBR;
  - 6.16.8.2 30mm asphalt on minimum 100mm base course; and
  - 6.16.8.3 125mm thick reinforced concrete.
- 6.16.9 Pump stations will be located a minimum 300mm above the 1%AEP flood and/or storm event whichever is greater. The finished ground level around the pump station will be shaped to fall away from the pump station. 10. Detailed calculations of the pump station, Sewerage Pump Station Commissioning Plan and pressure main sizing shall be submitted to Council with the design and/or Operational Works submission in the format required by Council.
- 6.16.10 The Sewerage Pump Station Commissioning Plan shall be completed in accordance with WSA 04- 2005 2.17.
- 6.16.11 Pump Station switchboards are to be painted with a graffiti resistant paint prior to application.
- 6.16.12 New or upgraded pump stations which are or will be part of the trunk main reticulation network or have less than 6 hours emergency storage capacity will be required to have a standby generator as part of the sewer scheme. The standby generator will be located a minimum of 300mm's above the 1%AEP flood and/or storm event whichever is greater.

## DG 6.17 Sewage Pumping Systems

- 6.17.1 Sewage Pumping Station Design Criteria - Sewage pumping stations shall be designed in accordance with the minimum specific design criteria shown in **Table 6.7** and WSA 04-2005.

**Table 6.7 Sewage Pumping Station Design Criteria**

Description	Adopted Design Parameter	Comments
<b>Pump Motor Drives</b>	<ul style="list-style-type: none"> <li>- &lt;15kW – Soft Start</li> <li>- &gt;15 to 22kW – VFD</li> <li>- &gt;22kW – special design – refer to Council</li> </ul>	Where VFD's are used, cables are to be shielded. Where VFD's are used, a magnetic flow meter must be provided with the pump station.
<b>Number of Pumps</b>	Two (2)	Pump station controls must allow for automatic alternating duty pumps.
<b>Wet Well Operating Volume (kL) - Fixed Speed Pumps</b>	$\frac{0.9 \times Q}{N}$	Where 'Q' is the flow rate (l/s) if a single pump operating and 'N' is the allowable number of pump

		starts, the number of pump starts (N) should be not more than 10 for pumps less than 50kW rating. For pumps greater than 50kW rating, according to manufactures recommendations
<b>Wet Well Operating Volume (kL) – Variable Speed Pumps</b>	$\frac{0.9 \times Q}{N}$	Q = Discharge of a single pump (L/s) at 50 Hz. N = Maximum number of starts per hour recommendation by the motor manufacturer.
<b>Bottom Water Level (duty pump cutout)</b>	<ul style="list-style-type: none"> <li>- For fixed speed pumps: 100mm above minimum submergence level of pumps.</li> <li>- For variable speed pumps: minimum of 100mm above top of motor casing.</li> </ul>	In case of variable speed drives a permanent water level must be maintained above the motor casing to ensure continuous cooling of the motor.
<b>Well Diameter</b>	Minimum internal well diameter 2100mm internal well diameter may be increased in increments of 300mm depending upon considerations such as: <ul style="list-style-type: none"> <li>- Clearance around pumps and pipework;</li> <li>- Depth of pump station; and</li> <li>- Geotechnical conditions.</li> </ul>	
<b>Top Water Level (TWL) (standby start)</b>	Must be set no higher than 300mm below invert level of inlet sewer. Must be no lower than 100mm above duty start but confirmed by project specific design.	
<b>Operating Range (TWL – BWL)</b>	This shall be in accordance with WSA 04, Clause 5.4. Generally this range should be between 1000mm and 2800mm.	
<b>Duty Point</b>	With static head corresponding to top water level and pipe friction factors as follows determine Duty Point 1 and 2: <ul style="list-style-type: none"> <li>- Duty Point 1 – Single Pump operation:</li> <li>- <math>C1 \times ADWF</math> (L/s) vs. Static Head = Friction Head (m)</li> <li>- Duty Point 2 – Duty Pump operating in parallel with Standby Pump:</li> <li>- <math>5 \times ADWF</math> (L/s) vs. Static Head + Friction Head (m).</li> </ul>	Where: Static Head = Highest Point in Pressure (Rising) Main – Water Level in Wet Well.  Friction Head = is a derived from the Hazen Williams formula.  C1 = Peaking Factor from Table 6.2 of this Manual.
<b>Pump Selection</b>	Select a pump that is capable of operating at both duty points and which operates within the range of the system resistance curves that are	The friction factors used in pump selection depend on Top and Bottom Water Level so as to ensure the

	<p>determined by the Conditions detailed below:</p> <ul style="list-style-type: none"> <li>- Where pressure sewers are allowed to interconnect with existing sewers (refer Table 6.8), pumps are to be designed to operate against the ultimate pressure in the receiving main unless otherwise approved by Council;</li> <li>- Condition 1 – Normal Operating Condition lower limit system resistance curve:</li> <li>- Static Head corresponding to Top Water Level with pressure (rising) main friction factors as follows: C = 120 (dia. 300mm)</li> <li>- Condition 2 – Normal Operating Condition Upper limit system resistance curve:</li> <li>- Static Head corresponding to Bottom Water Level with pressure (rising) main friction factors as follows: C = 100 (dia. &lt;300mm)</li> </ul>	<p>fullest possible range of heads are taken into account in the selection of the pumps.</p>
<b>Emergency Storage</b>	6 hours ADWF	May vary dependent on location of the overflow. Emergency storage may include gravity sewers, manholes and pump station we well volume above TWL.
<b>Duty Pump Capacity</b>	Refer DNRM Guidelines (or subsequent department)	Refer DNRM Guidelines (or subsequent department)
<b>Standby Pump Capacity</b>	Refer DNRM Guidelines (or subsequent department)	Refer DNRM Guidelines (or subsequent department)
<b>Total Pump Station Capacity</b>	Refer DERM Guidelines (or subsequent department)	Refer DERM Guidelines (or subsequent department)

6.17.2 Pump Information - The following information shall be provided when the plans are submitted for approval:

- 6.17.2.1 Preliminary pump selection;
- 6.17.2.2 Rating of the motor;
- 6.17.2.3 Weight of the motor;
- 6.17.2.4 Duty Point;
- 6.17.2.5 Estimate of KWh/1000 litres pumped; and
- 6.17.2.6 Performance, power and efficiency curve.

## DG 6.18 Pressure Mains

- 6.18.1 For detailed design of sewer pressure mains (rising mains) the requirements of Design Manual D6 Water Reticulation should be noted and the mains shall be designed as per the procedures relevant to Water Supply Mains with the exception of the following:
- 6.18.1.1 Air release valving should be provided to high points as required;
  - 6.18.1.2 Scour valving should be provided to low points as required. Scouring must be to a scour manhole or adjacent gravity sewer system;
  - 6.18.1.3 Thrust Block and Trenching Details shall be as per the Standard Drawings W-0040 and W-0041; and
  - 6.18.1.4 Line valves, scours and air valves are to be provided as required to reduce scour volume.
- 6.18.2 Consideration needs to be given to the potential for sulphide generation in pressure mains.
- 6.18.3 Sewer rising mains shall be a minimum 125mm DN HDPE PN16 unless approved otherwise by Council. Sewer rising mains shall be ‘cream’ in colour.
- 6.18.4 Sewer pressure mains shall be ‘cream’ in colour.
- 6.18.5 All Discharge manholes shall be fitted with a HDPE or wound PVC manhole liner suitable for exposure to sewerage. Where the discharge manhole is an existing manhole, the manhole internal surfaces shall be adequately dried and then coated with an approved epoxy coating.
- 6.18.6 Sewer pressure mains shall be designed in accordance with the minimum specific design criteria shown in **Table 6.8** and WSA 04- 2005.

**Table 6.8 Pressure Main Design**

Description	Adopted Design Parameter	Comments
Flow equation	Hazen-Williams	
Minimum Diameter	100mm – unless otherwise approved by Council	
Friction Factors	Refer Item 10 in <b>Table 6.7</b>	
Minimum Velocity (on a daily basis)	0.75m/s	To prevent the deposit of solid materials such as grit
Preferred Minimum Velocity (on a daily basis)	1.5m/s	To provide for slime stripping on a regular basis
Maximum Velocity	2.5m/s	To prevent damage to pipe lining
Configuration	Pressure Mains should be sized to optimise the balance between reduction of detention times and life cycle cost. Factors to be considered include but not be limited to: <ul style="list-style-type: none"> <li>- Population growth;</li> <li>- Staging;</li> <li>- Operational features to provide for maintenance and replacement activities;</li> </ul>	

	<ul style="list-style-type: none"> <li>- Minimisation of energy costs; and</li> <li>- Detention times (reduction of odours)</li> </ul>	
<b>Interconnection of Pressure (rising) Mains from different Pump Stations</b>	Only with the approval of Council. Generally interconnection of pressure (rising) mains from different pump stations will not be approved unless there are substantial economic and operational benefits	Selection of the class of mains shall be for the maximum condition, refer pump selection, <b>Table 6.7</b>

## Private Pump Station and Pressure Mains

### DG 6.19 General

- 6.19.1 Sewage pumping stations serving more than one “Titled” property shall meet the requirements of this Manual and WSA 04–2005.
- 6.19.2 Where a gravity sewer connection is not directly available to a development, Council may approve a private sewage pumping station, which will discharge via a private pressure (rising main) to the property line, after which, it shall be a Council main, and then connected to Council’s reticulation infrastructure. The Developer shall prepare and provide to Council “As Constructed” drawings. A private pressure main is not acceptable within a Council controlled road reserve.
- 6.19.3 All costs associated with connection of a private pressure main to an existing gravity sewer system (system analysis, design and upgrades to provide capacity) shall be met by the Developer.

### DG 6.20 Connection to Existing Gravity Main

- 6.20.1 The approved connection point for a private pressure (rising) main shall be a discharge manhole that is connected to an existing gravity sewer manhole. Discharge manholes shall conform to Council’s Standard Drawing.
- 6.20.2 Council may require the provision of a non-corrosive pipe installed for the length of sewer to the next downstream manhole and will require the provision of an inert lining to all internal surfaces of the pressure main discharge manhole.

### DG 6.21 Alternative Connection Points

- 6.21.1 Council may consider an alternative connection point. Where an alternative is proposed, the Consultant shall request written approval from Council. The request shall outline the reasons for the alternative connection point and the connection methodology proposed.
- 6.21.2 A private pressure main is not permitted to inject into another private pressure main.

- 6.21.3 If Council approves the alternative connection to be a Council rising main, the conditions outlined in **Table 6.8** shall apply.

#### DG 6.22 Private Pump Station Sizing and Operation

- 6.22.1 Pumping stations shall be designed with sufficient in-system storage (in the well, upstream sewers or a dedicated self-draining high level storage) so that in the event of pump or power failure, 6 hours' emergency storage is provided with inflow at average dry weather flow, provided the scheme is not a low pressure sewer scheme or vacuum system. In system storage shall be measured from duty start level to the level of the lowest relief point. Low pressure sewer or vacuum schemes shall be looked at separately by Council.
- 6.22.2 Less than 6 hours of storage may be provided, as long as a standby generator is part of the sewer scheme.
- 6.22.3 The pumps are to be set up to operate automatically as Duty / Standby and should be of the positive displacement electric type.
- 6.22.4 An alarm shall be provided in the form of a prominently positioned flashing red light set to activate at the invert level of the incoming Property drain.

#### DG 6.23 Private Pressure Mains

- 6.23.1 Medium density polyethylene pressure main class PN16 is approved for use with cream colouring.
- 6.23.2 If the pressure main is not readily available in cream colour, the pressure main shall be wrapped in cream coloured tape.

#### DG 6.24 Specific Requirements

- 6.24.1 As the private sewage pumping station is a component of the internal plumbing and drainage, Council's Plumbing and Drainage Services Section shall check the design drawings for compliance with current legislation and relevant standards.
- 6.24.2 Owners of private pumping stations are responsible for all costs and charges associated with the installation, operation and maintenance. Council may consider entering into a service agreement with the owner of the pump station for the ongoing operation and maintenance of the pump station.
- 6.24.3 As constructed details and the location of the pressure main shall be submitted to Council.
- 6.24.4 Where Council accepts a Maintenance Service Agreement with the owner of a private pump station, the following conditions will apply:
- 6.24.4.1 The pump station control panel should incorporate SCADA equipment for transmission of monitoring data and control of Council's existing master system;

- 6.24.4.2 Council requirements for integrating the SCADA equipment will not relieve the owner of the responsibility for the operation and maintenance of the pump station during the agreed defect liability period;
- 6.24.4.3 Council will not accept responsibility under the Service Agreement until the pump station has been accepted “off maintenance” with all defects rectified and the pump station is operating to the satisfaction of Council;
- 6.24.4.4 Notwithstanding the above, Council may monitor the operation and performance of the pump station during the defects liability period; and
- 6.24.4.5 The following information shall be provided when the plans are submitted for approval:
  - 6.24.4.5.1 Place of Manufacture of all components;
  - 6.24.4.5.2 Pump Manufacturer, Model, Type, and Impeller diameter (as a cut sheet)
  - 6.24.4.5.3 Rating of the motor;
  - 6.24.4.5.4 Weight of the pump and motor;
  - 6.24.4.5.5 Duty Points;
  - 6.24.4.5.6 KWh/1000 litres pumped;
  - 6.24.4.5.7 Performance curves; and
  - 6.24.4.5.8 Guarantee.
- 6.24.5 Upon commissioning, the following information shall be provided to the Council for checking prior to survey plans being endorsed by Council:
  - 6.24.5.1 Curves with at least four points plotted of the actual performance established in the field, or similar supervised works certificate;
  - 6.24.5.2 Actual KWh/1000 litres pumped;
  - 6.24.5.3 Complete wiring diagrams and details;
  - 6.24.5.4 Mechanical details and parts list of pump and motor;
  - 6.24.5.5 Maintenance catalogue showing daily, weekly, monthly and annual requirements;
  - 6.24.5.6 A complete set of the manufacturers recommended spares delivered to Council; and
  - 6.24.5.7 A set of cover lifters delivered to Council.

## Telemetry Systems and Management Plan

### DG 6.25 Telemetry Systems

- 6.25.1 All pump stations must be fitted with telemetry system in accordance with Council’s Specification for Telemetry Systems. Council should be contacted to obtain a copy of their Technical Specification for Telemetry Systems.
- 6.25.2 It should be noted that where amalgamated Councils have varying telemetry systems, left over from pre-amalgamation Councils, pump station telemetry systems and requirements may vary within that Council and requirements must therefore be reconfirmed as a part of the design.

## DG 6.26 Management Plan

- 6.26.1 Where required, a facility management plan is to be provided which will detail procedures and arrangements in place for routine operation and management of the facility (eg. Service Agreement) The Facility Management Plan shall include:
- 6.26.1.1 Details of proposed regular maintenance of private sewer systems; and
  - 6.26.1.2 A bi-annual report of sewerage flows to Council's sewer and details of maintenance activities.



## DG 7 – DESIGN GUIDELINES – Maintenance Shafts

### DG 7.1 General

- 7.1.1 The use of maintenance shafts is permitted in reticulation sewers subject to the design parameters detailed in this Manual and WSA 02-2014.

### DG 7.2 Design Parameters for MS's and TMS's

- 7.2.1 The following design parameters apply to maintenance shafts and terminal maintenance shafts in addition to or instead of those detailed in WSA 02-2002:
- 7.2.1.1 Sizing and installation of maintenance shafts to generally comply with the manufacturers recommendations;
  - 7.2.1.2 Maintenance shafts shall be graded to the intersection point of the sewer main and maintenance shaft coupling / fitting;
  - 7.2.1.3 Maintenance shafts may be used on 100mm, 150mm and 225mm diameter sewer mains and Property connection branches only;
  - 7.2.1.4 Maintenance shafts shall be used to a maximum depth of 3.0m;
  - 7.2.1.5 Testing of maintenance shafts shall generally be carried out in conjunction with the testing of the sewer main;
  - 7.2.1.6 Property connection branch inspection tees shall be 2000mm clear of the centre of the Maintenance Shaft;
  - 7.2.1.7 Property connections must not be made into maintenance shafts;
  - 7.2.1.8 Maintenance shafts must be provided with a Council approved 600mm dia. Ductile Iron Class B cover located within a precast surround. The trench bedding material shall extend below the shaft inspection opening surround;
  - 7.2.1.9 A maximum of five (5) Maintenance Shafts will be permitted between two conventional maintenance holes with a total length of sewer of not more than 300m between maintenance holes;
  - 7.2.1.10 Maintenance Shafts are to be located with a maximum spacing of 60 metres to a maintenance hole or shaft;
  - 7.2.1.11 The combined flow entering a MS will not exceed 22 L/s;
  - 7.2.1.12 The flow to be redirected at an angle greater than 45 degrees will not exceed 12 L/s; and
  - 7.2.1.13 The vertical distance a sewer connection entering the riser and the invert of a MS will be a minimum of 1100mm. Where this distance is less then 1100mm the incoming sewer will enter at the invert of the MS.
- 7.2.2 Maintenance shafts and terminal maintenance shafts are not permitted in the following locations:
- 7.2.2.1 As the receiving manhole at a pumping / lift station;
  - 7.2.2.2 As a discharge manhole for a pressure (rising) main;
  - 7.2.2.3 Within roadway central medians, roundabouts or within kerb and channel;
  - 7.2.2.4 As the connection structure for future development stages; and

7.2.2.5 In an area zoned Industrial, Commercial, or Multi-unit.

## DG 8 – DESIGN GUIDELINES – Water Seals, Boundary Traps and Water-sealed MH's and Gas Check MH's

### DG 8.1 General

- 8.1.1 Water seals - Water seals are not required.
- 8.1.2 Gas Check MH's - Gas check MH's are not required.
- 8.1.3 Vertical and Near Vertical Sewers - Prior approval must be obtained from Council for the use of vertical or near vertical sewers.
- 8.1.4 Vortex Inlets and Water Cushions - Prior approval must be obtained from Council for the use of water inlets and water cushions.
- 8.1.5 Inverted Syphons – The use of inverted syphons is not permitted.
- 8.1.6 Flow measuring devices – flow measuring devices are not required to be installed. Notwithstanding, provision shall be made in the design of the valve chamber to allow the future installation of an electromagnetic flow meter.
- 8.1.7 Wet weather storage - Prior approval must be obtained from Council for using wet weather storage as a means of reducing downstream infrastructure.

## DG 9 – DESIGN GUIDELINES – Utilities

### General

#### DG 9.1 Scope

- 9.1.1 This section sets out the minimum standards for the provision of utility services within new subdivisions and developments.
- 9.1.2 The designer needs to coordinate the provision of services within the confines of the road verge in consultation with and to the requirements of the Service Authorities / Providers.

#### DG 9.2 Objective

- 9.2.1 The objective of the Manual is to assist the designer in making provision for the following utility services within the design of new subdivisions and developments:
  - 9.2.1.1 Telecommunications;
  - 9.2.1.2 Electricity Supply;
  - 9.2.1.3 Road Lighting; and
  - 9.2.1.4 Gas.

#### DG 9.3 Reference Documents

- 9.3.1 AS/NZS 1158-2010 Lighting for Roads and Public Spaces
- 9.3.2 Ergon Energy Standard Drawings
  - 9.3.2.1 Standard Drawing 5162/1 - Joint Electricity, Gas and Telecommunications; and
  - 9.3.2.2 Standard Drawing 5162/2 - Joint Electricity, Gas and Multiple Telecommunications.
- 9.3.3 Civil Aviation Safety Authority Australia – Manual of Standards Part 139 Aerodromes;
- 9.3.4 Ergon Energy Lighting Construction Manual;
- 9.3.5 Ergon Energy Underground Construction Manual
- 9.3.6 G645:2011 Fibre Ready Pit and Pipe Specification for Real Estate Development Projects / NBN Co Installing Pit and Conduit Infrastructure – Guidelines for Developers

#### DG 9.4 Service Authority's General Requirements

- 9.4.1 Prior to an application to reconfigure a lot, the Service Authorities should be consulted to confirm that the provision of services to the proposed development would be provided. E.g. Telstra, Ergon and NBN Co.

- 9.4.2 Following receipt of Development Approval from Council the designer shall make application to both Authorities for “Offer of Connection Services” for electricity and telecommunication services.
- 9.4.3 Approved proposal plans shall be supplied to both Authorities, for staged developments, this shall include an overall concept layout outlining stages and expected timing for each stage.
- 9.4.4 Should any amendment occur in the design, both Authorities are to be notified immediately together with an amended plan.
- 9.4.5 Where a development includes lots that may have higher service demands (i.e. Industrial, Commercial, Multi Residential etc.), details of the expected yields and the maximum permissible development yield for each lot in accordance with its current zoning shall also be provided to both Authorities.
- 9.4.6 Underground telecommunication services shall be provided to all new developments.
- 9.4.7 Unless otherwise approved by Council, an underground electricity supply is to be provided to all new developments and all new consumer mains connections to developments to be supplied from a pillar.
- 9.4.8 The designer shall be responsible for coordinating and checking the locations of all telecommunication and electrical services to avoid conflicts with other services (i.e. Stormwater pits etc).
- 9.4.9 Layout plans for telecommunication and electrical services including the road lighting design shall be submitted to Council with the design submission.
- 9.4.10 Evidence of the agreement to provide an electricity supply and telecommunication services must be given to Council prior to the sealing of plans of survey.

## DG 9.5 Telecommunication Services

- 9.5.1 Installing of underground telecommunication conduits shall be in accordance with the Service Authority’s requirements.
- 9.5.2 Consideration shall be given to the location of any roadside cabinets, pillars and pits within the subdivision design.
- 9.5.3 Where an underground telecommunication service is to be provided, telecommunication conduits shall be placed in a shared trenching arrangement, refer Ergon Energy Standard Drawings 5162/1 and 5162/2 for shared trench arrangement that incorporates telecommunication, electrical and gas services.
- 9.5.4 Unless approved otherwise by Council, all telecommunication services shall be located within the road reserve at a distance of 0.3m – 1.2m from the property boundary.
- 9.5.5 The developer is responsible for the provision of telecommunication conduits across roads, existing roads are to be bored.
- 9.5.6 Permanent non-ferrous cable markers are to be installed in the kerb to mark the location of all road crossings,

## DG 9.6 Electricity Supply

- 9.6.1 Unless otherwise approved by Council, electricity reticulation is to be placed underground.
- 9.6.2 Where an underground electrical service is to be provided it shall be placed in a shared trench arrangement. Refer relevant Ergon Energy Standard Drawings for shared trenching arrangements that incorporates telecommunication, electrical and gas services.
- 9.6.3 Sharing of trenches with sewerage and water mains shall not be permitted. Where existing or proposed services are likely to impede on standard electricity alignments, Council and the Ergon Energy are to be consulted to confirm service alignments and clearances.
- 9.6.4 Unless approved otherwise by Council, all electrical services shall be located within the road reserve at a distance of 0.3m – 1.2m from the property boundary.
- 9.6.5 The developer is to liaise with the Ergon Energy in relation to any requirement for an electrical substation with a view to providing sufficient suitable land on which to site the infrastructure.
- 9.6.6 Where a pad-mount substation is to be located within the frontage of a proposed or existing parkland, the location shall be subject to Council's approval.
- 9.6.7 No other services shall pass beneath the Ergon Energy pillars or substations.
- 9.6.8 The developer is responsible for the provision of electrical conduits across roads, existing roads are to be bored.
- 9.6.9 Permanent non-ferrous cable markers are to be installed in the kerb to mark the location of all road crossings.
- 9.6.10 Electrical pillars shall generally be located at an alternate boundary to water meters and gas service crossings. Exceptions may be considered in individual circumstances where unusual conditions or lot layouts exist and where approved by Council and the Ergon Energy.
- 9.6.11 Pillars shall be located at property boundaries exceptions can occur where there are stormwater easements or other constraints. The Ergon Energy should be consulted to determine alternate locations in these cases.
- 9.6.12 The Ergon Energy conditions of connection including contributions for initial cable installation works shall be met prior to the acceptance of the works "On Maintenance" by Council.
- 9.6.13 Where advised by the Ergon Energy an additional communication conduit supplied by the service provider shall be laid to Ergon Energy requirements.

## Overhead Supply

### DG 9.7 General

- 9.7.1 The overhead electrical reticulation shall be designed in accordance with the Ergon Energy requirements.

- 9.7.2 Power poles shall be placed on an appropriate alignment as approved by Council and the Ergon Energy.

## DG 9.8 Road Lighting

- 9.8.1 All road lighting designs shall be prepared by an RPEQ Engineer shall be included in the design submission for acceptance by Council.
- 9.8.2 Road lighting design must be in accordance with this manual and AS/NZS 1158 and the Ergon Energy Lighting Construction Manual and Underground Construction Manual. Specific consideration must be given to identification and lighting of Local Area Traffic Management devices (LATM's) and intersections.
- 9.8.3 All light columns, luminaries and lamps are to be specified from the Ergon Energy Lighting Construction Manual and Underground Construction Manual.
- 9.8.4 All installation works shall be in accordance with the Ergon Energy Lighting Construction Manual.
- 9.8.5 Lighting on declared roads shall be designed and installed to the requirements of the Department of Transport and Main Roads.
- 9.8.6 It is a Council requirement that road lighting be installed under Rate 2 conditions of Tariff 71 - Public Lamps at all new subdivisions and developments.
- 9.8.7 The required lighting category for a particular road hierarchy shall be determined from **Table D9.1**.

**Table D9.1 Lighting Categories**

Category	Application <sup>1</sup>	Luminaire Type	Lamp Type	Rate <sup>2</sup>
<b>V3</b>	Sub Arterial Road	Aeroscreen	150 – 400 watt HPS	2
<b>V5</b>	Urban Major Collector Road	Aeroscreen	150 – 400 watt HPS	2
<b>P3</b>	Urban Collector Road	Normal	80 Watt MV <sup>4</sup>	2
<b>P4</b>	Residential Street Urban Access Street Urban Local Access Urban Laneway	Normal <sup>3</sup>	50 Watt MV <sup>4</sup>	2
<b>P4</b>	Urban Industrial Collector Street Urban Industrial Access Street	Normal	80 Watt MV <sup>4</sup>	2
<b>P1 – P3</b>	Pathway and Cycleway	Normal <sup>5</sup> OR Council Specific	80 Watt MV Council Specified	2 3
<b>P3</b>	Bus Stop	Aeroscreen	Wattage as	2

		OR Normal	required HPS – Cat V lighting MV – Cat P Lighting	
1.	<b>Roadway Classifications are contained in Table D1.1 “Street and Road Hierarchy – Deemed to Comply Requirements” of Design Manual “D1 Road Geometry”. Where discrepancies exist between No. of Dwellings, Traffic Generation and Roadway Classification, lighting design shall be based on the Council designated Roadway</b>			
2.	<b>Rate 2 – Lighting owned and maintained by the Ergon Energy. Rate 3 – Lighting owned and maintained by Council.</b>			
3.	<b>Where “Nostalgia” luminaires are used, the lamp type is to be an 80 Watt MV. The “Nostalgia” luminaire must meet the glare control requirement stipulated in AS/NZS 1158.3.1:2005, design is to be based on “I” table 201262.CIE and the luminaire sourced directly from Sylvania.</b>			
4.	<b>Once permitted by the Electricity Authority, T5 fluorescent or compact fluorescent lamps shall be used where they offer a lower energy consumption or lower cost solution than the lamps nominated.</b>			
5.	<b>Where lighting is located next to residences (on a pathway or cycleway) then a Type 4 – Aeroscreen luminaire is required.</b>			
6.	<b>In general, street lighting poles are to be located opposite common allotment boundaries, to minimise potential interference with vehicle access, access to services (i.e. hydrants) and glare complaints from residents. It is desirable that poles not be located opposite boundaries of “battle axe” allotments due to a higher potential for vehicle collision.</b>			
7.	<b>Council may consider a lesser standard for subdivisions with lots greater than 4000m<sup>2</sup> and outside the designated urban footprint. e.g. Category P5 or lighting at intersections, cul-de-sac’s and other hazardous locations.</b>			

- 9.8.8 Lighting shall be provided at the following locations in accordance with the development approval conditions and AS/NZS 1158:
- 9.8.8.1 Straight Sections;
  - 9.8.8.2 Curves;
  - 9.8.8.3 Intersections and Junctions;
  - 9.8.8.4 Pedestrian Refuges;
  - 9.8.8.5 Cul-de-sacs; and
  - 9.8.8.6 Local Area Traffic Management Devices including Roundabouts.  
(The maintained horizontal illuminance is not to be less than 3.5 lux).
- 9.8.9 Where a pedestrian crossing has been installed it shall be lit in accordance with AS 1158.4 – 2009, Lighting of Pedestrian Crossings.
- 9.8.10 Lighting of entry points to pathways and cycleways shall be achieved by the selected placement of a road light nearby.
- 9.8.11 Additional lighting shall be provided at a designated bus stop facility; the design shall include the entry and exit lengths of the bus stop.
- 9.8.12 Lighting columns are to be offset a minimum of 820mm (+/- 20mm) from the invert of kerb and channel to centre of the pole. For a road with a flush kerb or a low density residential road that has a table drain instead of layback kerb and channel, the lighting column is to be offset 1300mm (+/- 20mm) from the outer edge of traffic lane to centre of the pole.
- 9.8.13 Where required to clear conflicts e.g. stormwater, sub-soil drain flushing points, water supply infrastructure, sewerage infrastructure, lighting columns can be located up to 0.5m in either direction from boundary prolongation along the roadway and at an alignment up to 1.1m from the invert of the kerb and channel.
- 9.8.14 The placement of lighting columns shall not occur within 1m of any water main that crosses the road.

- 9.8.15 Lighting columns that are to be installed at all new subdivisions and developments are to be a four hole base plate mounted steel pole as specified in the Ergon Energy Lighting Construction Manual.
- 9.8.16 When joining to an existing installation or extending a subdivision in stages, lighting columns and luminaires shall match as near as possible with the existing infrastructure.
- 9.8.17 The use of aeroscreen luminaires may be required when road lighting is installed near airports, refer to the Civil Aviation Safety Authority Australia – Manual of Standards Part 139.
- 9.8.18 Documentation shall be submitted to Council with the design submission demonstrating compliance with the AS/NZS 1158.
- 9.8.19 Foundation footing for minor road lighting must be cast in situ, a precast concrete foundation is not permitted without prior approval of council.
- 9.8.20 Existing timber street light poles are to be replaced with a steel lighting column when overhead powerlines are augmented underground.
- 9.8.21 Where adjoining Beaches utilised by sea turtles, lighting avoids direct illumination of the beach, ocean and sky at night utilising fittings, shields or low bollard lighting.

Note – Applicants should adhere to the [State Governments Sea Turtle Sensitive Area Code](#) and the [Department of Environment and Energy: National Light Pollution Guidelines for Wildlife](#) when developing lighting adjoining beaches that may be utilised by Sea Turtles. Contact Council to determine what Beaches may be turtle habitat.



Figure 9.8.21: Turtle sensitive lighting (Department of Environment and Energy)

## DG 9.9 Park Lighting

- 9.9.1 Lighting requirements in parks are provided in accordance with DG 11 Parks and open space or advised by Council in accordance with the classification of the park
- 9.9.2 A point of supply is required to all parks location will be advised by Council in consultation with Ergon Energy



- 9.9.3 Pathways or cycle ways within parks that require lighting shall be lit to the minimum lighting category P3 or above as deemed appropriate from the selection criteria tabled in AS/NZS 1158.3 Pedestrian area (Category P) lighting.

## DG 9.10 Gas

- 9.10.1 Gas reticulation within a new subdivision or development may be installed subject to Council's approval.
- 9.10.2 Where reticulated gas is approved by Council, the gas service shall be located in the shared trench arrangement. Refer Ergon Energy Standard Drawings 5162/1 and 5162/2 for shared trenching arrangements that incorporates telecommunications, electrical and gas services.
- 9.10.3 The location of a central storage facility shall be on a separate freehold parcel of land with appropriate security to the satisfaction of the Council.
- 9.10.4 The Developer shall be responsible for obtaining all relevant approvals and licences necessary for installation.

## DG 10 – DESIGN GUIDELINES – Landscaping

### General

#### DG 10.1 Scope

- 10.1.1 This section sets out the minimum standards for landscaping within new subdivisions and on-street works for private developments.
- 10.1.2 This manual contains procedures for the design of:
- 10.1.2.1 On-street landscaping works, including buffers mounds, traffic islands and roundabouts; and
  - 10.1.2.2 Public Open Spaces including, signage, furniture and playgrounds in accordance with DG 11.5 Open space model design guides, DG 11.6 Public open space components, DG 10 Landscaping and [Council's Parks Embellishments Guide](#).

#### DG 10.2 Objective

- 10.2.1 The objective of this manual is to define Councils minimum landscaping requirements and to assist the designer in achieving the following:
- 10.2.1.1 Visually enhancement of the streetscapes;
  - 10.2.1.2 Enlargement of the habitat and plant diversity in order to provide a food source for indigenous fauna;
  - 10.2.1.3 Enhanced living environments by reducing the impacts of noise, fumes and car headlights;

- 10.2.1.4 Provision of shade trees; and
- 10.2.1.5 Crime prevention through environmental design (CPTED).

## DG 10.3 Reference Documents

- 10.3.1 Whitsunday Regional Council:
  - 10.3.1.1 Planning Scheme – Landscaping Code;
  - 10.3.1.2 Local Laws and Policies;
  - 10.3.1.3 Levels of Service/Operations Plan – Parks & Gardens
- 10.3.2 Australian Standards:
  - 10.3.2.1 AS/NZS 1158.3-2005 Pedestrian area (Category P) lighting
  - 10.3.2.2 AS 3500 National Plumbing and Drainage, Part 1.2 Water Supply – Acceptable Solutions
  - 10.3.2.3 AS/NZS 4486 Playgrounds and playground equipment - Development, installation, inspection, maintenance and operation.
  - 10.3.2.4 AS 3798 Guideline on Earthworks for Commercial and Residential Developments
  - 10.3.2.5 AS 4419-2018 Soils for Landscaping and Garden Use
  - 10.3.2.6 AS 4454-2012 Composts, soil conditioners and mulches
  - 10.3.2.7 AS 4678 - Earth Retaining Structures
  - 10.3.2.8 AS 3000-2018 – Electrical Irrigation Wiring
  - 10.3.2.9 AS/NZS 3008.1.1:2017 – Cable selection for different voltage
- 10.3.3 [Wet Tropics Weed Pocket Guide](#)

## DG 10.4 General

- 10.4.1 At the time of development, the developer shall provide all on-street landscaping, this shall include street tree planting, grass establishment to road verges, and landscaping of traffic islands, roundabouts and buffer mounds.
- 10.4.2 Council should be consulted prior to commencement of the design to ascertain whether there are any site specific design requirements.
- 10.4.3 Some Local Authorities have plant selection guidelines and suburban planting themes designers are encouraged to consult with Council in the preparation of the landscaping design.
- 10.4.4 Landscaping plans shall be prepared by a person of professional standing in the field of Landscape architecture or landscape design, at a standard acceptable to Council.
- 10.4.5 CCA treated timber is not to be used for the construction of Council assets.
- 10.4.6 ACQ, Copper Azole, LOSP, or another alternative timber treatment is not preferred and subject to Council approval.

## DG 10.5 Existing Vegetation

- 10.5.1 In order to retain any established landscape character, all trees located within existing road reserves shall be protected and retained unless approved otherwise by Council.
- 10.5.2 Significant trees located within the verge of new road reserves shall be protected wherever possible and where advised by Council. This may require the adoption of non-standard utility service alignments therefore designers are encouraged to discuss proposed solutions with Council.

## DG 10.6 Verges

- 10.6.1 All verges shall be covered full width with topsoil to a depth of 75mm - 100mm and shall be lightly compacted and grassed in accordance with Councils minimum standards and Specifications.
- 10.6.2 In order to guarantee a high standard of maintenance all verges are to be in a mowable condition, free from rocks and loose stones, and graded to even-running contours.
- 10.6.3 Aside from grass establishment and tree planting, landscaping of the verge between the property boundary and kerb is not a Council requirement. However, additional landscaping within the verge may be considered subject to Council approval. Generally, any additional landscaping shall be clear of underground services or alternatively limited to ground covers or small shrubs less than in 500mm height.
- 10.6.4 Planting of trees, groundcovers or native grasses on road verges are selected with respect to their growing size and adequately setback 500mm by a paved edge to avoid maintenance of vegetation spilling onto the road.
- 10.6.5 Suitable vegetation selection and landscape design to maintain sight lines and minimise maintenance requirements in road verges or round-a-bouts are developed in accordance with best practice set out within [Department of Transport and Main Road - Road Landscape Manual, Edition 2, 2013](#) and guidance within DG 11.5.15 Model design guide.
- 10.6.6 Should any excavation of the underground services in this vicinity of the additional verge landscaping be required, thus destroying the vegetation, Council will not be held responsible for plant replacement. Maintenance of planting in this vicinity will be the sole responsibility of the adjacent property owner/occupier.
- 10.6.7 Densely planted low maintenance ground covers that suppress weed growth are promoted along garden edges and in isolated locations, unless more exotic ground covers are approved by Council for a high-profile area;

## DG 10.7 Street Tree Planting

- 10.7.1 The ultimate aim of street tree planting is to provide:
  - 10.7.1.1 An attractive streetscape with character and charm. An individual character may be obtained by using a specific tree species for each street;

- 10.7.1.2 Shade, and the reduction of heat and glare from the road pavement. Parked cars may remain cool during the summer months; and
- 10.7.1.3 Habitat provision and enhancement. Native flowering trees provide a source of food and shelter for insects, birds and animals.
- 10.7.2 An avenue of trees of identical species and size planted at regular intervals has far greater visual and aesthetic impact than a mis-matched selection of incompatible trees. In order to promote continuity in new streetscapes, a single species should be nominated for each street.
- 10.7.3 Where a development is occurring in an established street setting, an assessment of the existing trees should be made, and the most prevalent and healthy species chosen for verge planting.
- 10.7.4 Tree species shall be selected for their suitability to the site conditions (e.g. shrubs under power lines not more than 4m height at maturity, drought resistance, soil suitability) and shall be in accordance with any relevant Council plant selection guidelines and suburban planting themes.
- 10.7.5 To ensure consistency in growth rate and form all trees shall be no less than two (2) metres in height and shall be well established in their root and branch formation. A minimum 45 litre container should ensure a good survival factor.
- 10.7.6 The alignment and placement of street trees measured from the tree at the estimated ultimate size shall be in accordance with the following:
  - 10.7.6.1 Greater than 4.0 metres from electricity or telecommunication poles or pillars;
  - 10.7.6.2 Greater than 7.5 metres from streetlights to ensure effective street lighting;
  - 10.7.6.3 Greater than 4.0 metre radius from high voltage transmission lines;
  - 10.7.6.4 Greater than 2.0 metres from stormwater drainage pits;
  - 10.7.6.5 Trees are to be planted in the front of properties at the centre of the lot at a rate of one per lot, or at the necessary rate to provide a maximum 20 metre spacing;
  - 10.7.6.6 Trees are to be placed a minimum 1000mm from the back of kerb where achievable;
  - 10.7.6.7 Trees are to be placed a minimum of three (3) metres from driveway;
  - 10.7.6.8 At intersections trees are to be placed a minimum of ten (10) metres back from the face of the kerb of the adjoining street;
  - 10.7.6.9 Trees are to be located so as not to obstruct access to any services or signage;
  - 10.7.6.10 Trees are to be located so as not to obstruct pedestrian or vehicular traffic, nor create traffic hazard or cause damage to existing trees;
- 10.7.7 Street trees shall be planted in accordance with Standard Drawings SEQ G-010 – SEQ G-012 and installed in accordance with Council Specifications; and
- 10.7.8 Street trees should not be a plant listed in:
  - 10.7.8.1 Land Protection (Pest and Stock Route Management) Regulation;
  - 10.7.8.2 Pest Management Plan; or

10.7.8.3 Wet Tropics Management Authority Publication Agricultural and Environmental Weeds

DG 10.8 Buffer Zones

- 10.8.1 Mounds / Buffers adjacent to major roads controlled by the Department of Main Roads must comply with the requirements as specified by the Department of Main Roads and as detailed within DG11.5.14 Conservation, sloped and buffer area model design guide. Generally, these buffers are ten (10) metres wide along the full frontage of the major road.
- 10.8.2 The aim of the Buffer Mound landscaping is to:
- 10.8.2.1 Reduce the visual impact of adjacent development by screening rooflines;
  - 10.8.2.2 Reduce the visual impact of proposed noise attenuation barriers, which may be constructed at some time in the future on the mound crest;
  - 10.8.2.3 Reduce the visual impact of the mound's severe geometric landform by screening with foliage to ground level;
  - 10.8.2.4 Introduce a "natural" vegetated landscape appearance by replacing open agricultural land with a facade of dense planting;
  - 10.8.2.5 Reinforce the local character by indigenous tree and shrub species; and
  - 10.8.2.6 Provide additional functions, i.e.. shade over adjacent bikeways.
- 10.8.3 In order to accomplish the above aims, the species mix of plant selection should incorporate a range of species to provide variation in form, colour and texture, to contribute to a natural appearance. The front line of planting should have foliage down to ground level.
- 10.8.4 To ensure that buffer mounds are given the best possible chance of successful establishment and prolonged survival, a temporary irrigation system is required to be installed to the mounding. The preferred system is with a drip-style irrigation system or similar below the surface of the mulch, which reduces the chances of vandalism and reduces excess water loss as a result of runoff and evaporation.
- 10.8.5 Strong recognisable character is further reinforced by repetition of some suitable species as street and park trees in the adjacent subdivision
- 10.8.6 Use of disciplined plant selection based on themes such as colour, texture, or natural species associations, in addition to site suitability, creates higher quality landscapes than random assortments of nursery stock chosen solely for short notice availability and growth suitability.
- 10.8.7 Advance ordering and growing on contracts are desirable to ensure availability of desired species in the large quantities required.
- 10.8.8 Local rainforest species, which typify and reinforce the regions image, are preferred. Most are hardy, long-lived and have dense growth, which suppress weeds and reduce long-term maintenance.
- 10.8.9 The landscaping shall be designed so as not to create a safety risk to people using the mound and adjacent areas (i.e. no thorns, heavy nuts or poisonous fruits or berries).
- 10.8.10 No tree planting shall be done higher than 1/3 from the base of mound i.e. no trees on top of the mound.

## DG 11 – DESIGN GUIDELINES – Parks and Open Space

### DG 11.1 Scope

This Guideline applies to developments that provide or are required to provide public open space that will be owned or controlled by Council.

11.1.1 The purpose of this Guideline is to:

11.1.1.1 Ensure sufficient supply of high quality and functional open space to meet the recreational and sporting needs of the community in line with Desired standards of service within DG 11.4 Desired standards of service and the Local Government Infrastructure Plan;

11.1.1.2 Define park hierarchy and function of each park; and

11.1.1.3 Define design principles for open space to ensure high quality amenity, function and minimal maintenance cost.

11.1.2 New open space must be developed in accordance with this Guidelines overarching design principles, relevant Open space model design guides, Public open space components, DG 10 Landscaping, [Council's Parks Embellishments Guide](#) and applicable assessment benchmarks specified within the *Whitsunday Planning Scheme 2017*.

### DG 11.2 Types of Open Space

Open space is land provided as recreational or non-recreational open space. Types of open spaces, hierarchy in the network and their associated characteristics are defined below.

**Table 11.2: Open space categories within the Whitsunday Region.**

Recreation Park category	Hierarchy Classification**	Characteristics
Linear Park	Medium profile	Long and narrow park containing walking, cycling paths and basic infrastructure to connect residential neighbourhoods to trunk parks or employment nodes.
Local park	Medium profile	Small park containing limited recreational infrastructure to service the immediate residential neighbourhood.
District Park*	High profile – Trunk infrastructure	Medium – large park containing recreational infrastructure for 2 or more age groups servicing a part of a Towns catchment.
Regional Park*	High profile – Trunk infrastructure	Large park containing recreational infrastructure for all age groups servicing a whole Town catchment.
Cemetery	High profile	Well landscaped open space to provide solitude for visitors recognising past friends and family.
Nature Park	Low profile	Walking tracks & conservation parks within scenic natural environments including bushwalks, lookouts, Beaches or swimming holes.  Note – Nature parks may require planning approval, defined as an Environment facility or Outdoor sport and recreation, pending the characteristics of the use.
<b>Sportpark category</b>	<b>Characteristics</b>	

Local sporting facilities	Facilities not associated with a traditional large sportspark, that may include aquatic facilities, lawn bowls, surf lifesaving or tennis courts.
District Sportspark*	Traditional medium-large sportspark, that may support facilities for at least 3 clubs.
Regional Sportspark*	Traditional large sportspark, that may support facilities for at least 5 clubs.
<b>Non-recreational open space category</b>	<b>Characteristics</b>
Conservation area	Naturally forested areas or areas undergoing afforestation.
Drainage corridor or water sensitive urban design	Areas dedicated to facilitating drainage and water sensitive urban design.
Road verge or entrance statement gardens	Areas adjoining the road or landscaping at estate entrances.
Buffer areas	Land dedicated to forming a landscaped buffer between uses that share amenity conflicts.

\* Infrastructure defined as trunk infrastructure within the *Local Government Infrastructure Plan*.

\*\* Hierarchy classification defined by the Whitsunday *Technical Levels of Service/Operations Plan – Parks & Gardens*.

DG 11.3 Design principles

The following open space design principles inform model design guides within DG 11.5 Open space model design guides and must be considered in all open space design.

**Table 11.3: Overarching design principles that must be considered in all open space design.**

Objective	Implementation
1. <u>Access and connectivity</u>	<ul style="list-style-type: none"> <li>• Parks are adequately distributed throughout a Township, encourage access by walk/cycle and are designed to ensure universal accessibility for all ages and abilities;</li> <li>• Parks are located in an area that is easily accessible to the community by public transport, road networks, cycle ways, footpaths and linear parks;</li> <li>• Higher density residential developments are designed to facilitate strong connectivity to trunk parks or if outside of park catchments, are adequately serviced by a local park.</li> </ul>
2. <u>Multi-function</u>	<ul style="list-style-type: none"> <li>• Parks are designed to provide multiple environmental, social and economic functions, such as biodiverse ecosystems, drainage, stormwater treatment, wayfinding, passive and active recreation and organised events;</li> <li>• Drainage corridors, where possible also facilitate pedestrian connectivity between residential areas and parkland;</li> </ul>
3. <u>Amenity</u>	<ul style="list-style-type: none"> <li>• Parks are located in areas of high natural amenity and are designed to enhance vistas, activation of waterbodies and support the enjoyment of the natural environment;</li> <li>• Open space areas utilise high quality landscaping to provide shade of walkways, resting areas, provide stormwater treatment and habitat for local wildlife;</li> <li>• The siting and design of recreational infrastructure is sympathetic to the amenity of surrounding sensitive uses;</li> </ul>
4. <u>Co-location</u>	<ul style="list-style-type: none"> <li>• Where possible, Parks are co-located with community facilities, such as schools, community centres and libraries;</li> <li>• Trunk parks consider co-location or integration with retail and service hubs;</li> </ul>
5. <u>Safety</u>	<ul style="list-style-type: none"> <li>• The principles of Crime Prevention through Environmental Design (CPTED) are used in the design of open space to promote personal safety and discourage anti-social behaviour and vandalism of open space assets;</li> <li>• Siting and design promote park boundaries with direct road frontage or adjoining active retail or service hubs, to maximise visual surveillance and community access to open space;</li> <li>• Non-recreational open space is designed to ensure safety and avoid worsening of natural hazards;</li> </ul>
6. <u>Sense of place</u>	<ul style="list-style-type: none"> <li>• The location and design of open space retains and creates spaces to enjoy natural systems, landscape elements, significant trees or culturally significant features;</li> <li>• Parks utilise placemaking initiatives such as lighting, artworks or interpretive signage to cultivate interest in the community about history or natural systems, and capture the 'sense of place' of the neighbourhood;</li> </ul>
7. <u>Non-recreational open space</u>	<ul style="list-style-type: none"> <li>• Non-recreational open space should be planned to compliment recreational open space and may provide use benefits, such as providing connectivity, scenic amenity, habitat or buffering</li> </ul>



	between different land uses;
8. <u>Lifecycle cost</u>	<ul style="list-style-type: none"> <li>Recreational infrastructure is designed to reduce the lifecycle cost through selection of embellishments, materials, treatment of play surfaces that meet community needs and promote maintenance efficiency;</li> <li>Siting and design of recreational infrastructure has regard to natural hazards and climate change impacts;</li> <li>The focus on lifecycle cost does not detract from the requirement that a park should be designed and constructed to be fit for purpose for the type of recreational park; and</li> <li>Landscaping and plant selection are designed to enable easy maintenance with machinery and provide suitable groundcover that mitigates the rise of weeds.</li> </ul>

#### DG11.4 Desired Standards of Service

Desired Standards of Service (DSS) for recreational and sportparks seek to ensure adequate open space is provided across the Region to meet the needs of the community.

##### 11.4.1 Recreational Parks

11.4.1.1 Public recreation parks are provided in accordance with the below desired standards of service:

**Table 11.4.1.1: Rate of land provision for public parks.**

Park type	Rate of provision (Ha/1000 people)		
	Local	District (trunk)	Regional (trunk)
Recreation park	0.4	0.5	0.6

**Table 11.4.1.2: Accessibility standards for public parks.**

Recreational Park type	Accessibility standard to urban residential areas			
	Local	District (trunk)	Regional (trunk)	All parks
Desired standard	400m	1.6km	3km	As defined *
% residents within proximity	50%		75%	90% *







\* Editor's note – 90% of residents are either within 400m of a Local park, 1.6km of a District park or 3km of a Regional recreation park.

**Table 11.4.1.2: Size and design of public parks.**

Characteristic	Recreation park			
	Linear	Local	District (trunk)	Regional (trunk)
Minimum (desired) size (Ha)	N/A	.08	2	4
Shape of land	No portion narrower than 10m	No portion narrower than 20m	Fits at least one 20m x 20m grassed area within, above Q50.	
Embellishments for needs of each age group as defined by <b>Table 11.4.1.3</b>	N/A	Minimum 1 of 3 age groups	Minimum 2 of 3 age groups	All age groups
Minimum embellishments	Embellishments provided as per <b>DG 11.5 – Open space model design guides.</b>			
Minimum desired flood/Storm tide immunity (area)	N/A	70% > Q50	50% > Q50 20% > Q100	
Minimum desired grade	Max grade 1:8	Max grade 1:10 for 80% of park, 1:14 where possible	Max grade 1:10 for 80% of park, 1:14 where possible	Average grade 1:20, 1:50 for active play areas
Road frontage	N/A	At least 20m of direct road frontage, fronting multiple roads where possible	30%-50% of park perimeter to have direct road frontage, preferably on a collector road	

**Table 11.4.1.3: Recreational Infrastructure for various age groups.**

Demographic	Examples of desired recreational activities	
Children and parents	Natural playgrounds Rocky boulders Safe and accessible creeks	
	Playgrounds Swings Waterparks	
	Shaded paths and shaded seating in view of children play areas	

<p>Adolescents &amp; young adults (12 – 30)</p>	<p>Informal open space/sport fields</p>	
	<p>Climbing equipment Pyramid net Major playgrounds Large slides</p>	
	<p>Basketball rings Skateparks Pump track/mountain bike tracks Volleyball nets Goal posts Cricket nets</p>	
<p>Older adults (30+)</p>	<p>Designs that promote safety, security, contact with nature Opportunities for socializing, such as BBQ's and picnic facilities.</p>	
	<p>Fitness equipment</p>	
	<p>Shaded walking tracks Mountain bike tracks</p>	

## 11.4.2 Sportspark

11.4.2.1 Public sportspark are provided in accordance with the below desired standards of service:

**Table 11.4.2.1 Rate of land provision for public sportspark.**

Infrastructure item	Rate of provision (Ha/1000 people)		
	District	Regional	All sportspark
Sportspark	0.6	1	1.7

**Table 11.4.2.2: Accessibility standards for public sportspark.**

Infrastructure item	Accessibility standard (km) <sup>1</sup>	
	District	Regional
Sportspark	10	25
% residents within proximity	90% of residents are either within 10km of a District sportspark or 25km of a Regional sportspark.	

**Table 11.4.2.2 Size and design of public sportspark**

Characteristic	Sportspark	
	District	Regional
Minimum desired size (Ha)	6	18
Diversity of clubs/facilities	3	5
Shape of land	Preferred square to rectangular aspect	
Minimum desired flood immunity (area)	Shelters, grandstands, fields and courts > Q50 All other built structures > Q100	
Minimum desired grade	Max grade of 1:80 for all playing surfaces.	
Road frontage	Minimum 25% or 100m of the park perimeter, to have direct road frontage with an urban collector, sub-arterial road or arterial road.	
<b>Minimum embellishments</b>	<b>Embellishments provided as per DG 11.5 – Open space model design guides.</b>	

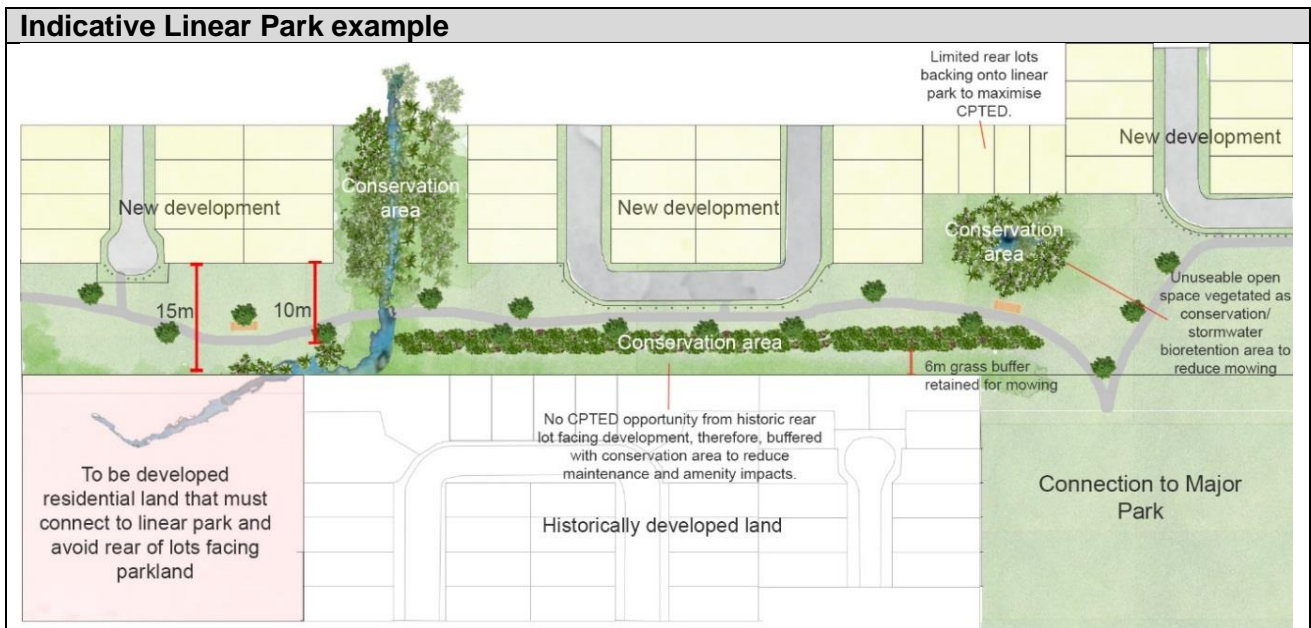
## DG11.5 Open Space model design guides

- 11.5.1 Open space should be designed in response to individual site conditions, surrounding areas, park hierarchy and function, *DG 11.3 Design principles*, *DG 11.4 Desired Standards of Service*, specific open space model design guidance set out herein and other relevant sections of the *Whitsunday Development Manual 2017*.
- 11.5.2 The following benchmarks apply to all open space. Development must align with these benchmarks and the respective model design guide in this section (as applicable).
- 11.5.2.1 Recreation park or sportspark is not suitable in areas:
- i. containing contaminated land;
  - ii. within 100m of High voltage power lines, as mapped by the Infrastructure overlay;
  - iii. adjacent to noxious industries or potentially hazardous industrial activity;
  - iv. that has been stripped of topsoil and vegetation or used for construction staging that has not been remediated; or
  - v. constrained by easements that preclude the use of the land for recreational use.
- 11.5.3 All recreational park or sportspark must have electricity supply, water, sewer and, where possible, connection to Council's recycled water network. Where connection to reticulated networks is not possible, on-site solutions must be demonstrated to the satisfaction of Council.
- 11.5.4 Recreational infrastructure and sportspark ensure hazard resilience in accordance with the following:
- 11.5.4.1 Clubhouses, storage structures or picnic infrastructure including electrics, such as BBQs or charging points are located above a 1% AEP flood or storm tide event at 2100 and outside of the High or Very High Bushfire risk area;
- 11.5.4.2 Playground rubber matting, sand or bark pits beneath playgrounds is located above a 10% AEP flood or storm tide event and outside of the Medium, High or Very High Bushfire risk area;
- 11.5.4.3 Sport fields and Recreational park's active play areas are located above a 50% AEP flood or storm tide event at 2100; and
- 11.5.4.4 Recreational infrastructure, including shelters and seating is located above a 20% AEP flood event at 2100 and outside of the High or Very High Bushfire risk area;
- 11.5.5 The location of non-recreational open space within or adjoining recreation park or sportparks may occur where:
- 11.5.5.1 The design of the non-recreational open space compliments the landscaping and aesthetics of the park and does not pose any risk to users;
- 11.5.5.2 Providing biodiversity corridors to connect habitats through the site;

- 11.5.5.3 Does not create CPTED issues or create a split through the centre of the park; and
- 11.5.5.4 Drainage corridors or slopes greater than 1:4 are designed in accordance with *DG 11.5.13 Parks and open space drainage corridor* or *DG 11.5.14 - Conservation, sloped and buffer area model design guide*, to be safe and avoid the need for regular mowing.

DG 11.5.6 Linear Park model design guide

Minimum width	Provision rate
(a) 15m; or (b) 10m if adjoining drainage corridor, measured from top of the bank to adjoining boundary or road verge.	Provided opportunistically to connect residential areas with parkland
<b>Siting and design performance benchmarks for Linear parks</b>	
<p>The following benchmarks applying to Linear Parks are to be read in conjunction with <i>DG 10 – Design Guidelines - Landscaping</i>, <i>DG 11.3 Design principles</i>, <i>DG 11.4 - Desired standards of service</i> and <i>DG 11.6 Public open space components</i>. Where not complying with these benchmarks, approval may be sought from Council’s Parks and Gardens team where solutions demonstrate low maintenance outcomes, safety and amenity that is desired for the area.</p> <p><i>General</i></p> <ul style="list-style-type: none"> <li>(a) Has a minimum width of 15m (can include adjoining road verge), or 10m from top of bank if located adjacent to a drainage corridor;</li> <li>(b) Direct street frontage along a minimum of 30% of any linear boundary to promote casual visual surveillance and provide public access via a shared concrete path with kerbside ramp;</li> <li>(c) Provides shared path connectivity between residential areas and key community nodes, such as commercial centres and recreational or sportspark;</li> <li>(d) Lighting to delineate park entrances and along pathways, sited and orientated to not spill into adjoining residential premises;</li> <li>(e) Promotes public and casual surveillance of the linear corridor by maximising number of allotments or road frontages facing the park;</li> <li>(f) Linear parks and associated subdivisions are sited and designed to minimise the number of rear residential allotments that directly abut;</li> </ul> <p><i>Vegetation and maintenance</i></p> <ul style="list-style-type: none"> <li>(g) Existing vegetation is retained where possible and shade trees are planted at least every 15m along the length of the internal footpath, in accordance with <i>DG 11.10 Planting</i>;</li> <li>(h) Minimises maintenance requirements and areas for mowing by creating re-vegetated conservation areas or gardens over spaces with limited recreation function and slopes over 1:4, in a manner that doesn’t compromise casual surveillance; and</li> <li>(i) Mowing widths of 1.6m are retained between barriers such as, trees, bollards, fencing, recreational infrastructure, garden beds and park boundaries for maintenance efficiency.</li> <li>(j) Park access from adjoining road network, including removable locked bollards, 4m in width, for maintenance vehicles;</li> </ul> <p>Note – Re-vegetated areas, garden beds or slopes over 1:4 within a linear park are designed in accordance with <i>DG 11.5.14 Conservation area, sloped and buffer area model design guide</i> or <i>DG 11.5.15 Garden beds and Entrance statements model design guide</i>, as relevant.</p>	
<b>Embellishments</b>	
<p>The following are the minimum requirements, to be provided in accordance with <a href="#">Council’s Parks Embellishments Guide</a>, <a href="#">Council or IPWEAQ standard drawings</a>:</p> <ul style="list-style-type: none"> <li>(a) Bollards preventing vehicular access into the park, except via removable locked bollards, 4m in width, provided for maintenance vehicles;</li> <li>(b) Lighting in accordance with <i>DG 11.15 Lighting</i>;</li> <li>(c) Dog waste bag dispensers at key park entrances, located at least 200m apart;</li> <li>(d) Concrete shared footpath in accordance with <i>IPWEAQ - RS-065</i>, along the length of the park that are at least 3m wide, setback 5m from the top of creek banks or residential boundaries, avoid easily saturated areas and connect into adjoining street pathway networks;</li> <li>(e) Wayfinding finger signage and lighting is utilised at pathway junctions and entrances to identify connecting streets and community nodes, such as commercial centres or parks; and</li> <li>(f) Seat benches predominately shaded by vegetation are provided maximum 200m apart, located at access points or overlooking high amenity natural features, where possible.</li> </ul>	





DG 11.5.7 Local Park model design guide

Minimum size	Service catchment	Provision rate
800m <sup>2</sup>	400m	Local Parks are only provided where: (a) density exceeds 30 dwellings per ha, across a total of 100 dwelling units; and (b) 50% of dwelling units in a reconfiguring a lot are located in an area that is outside of the accessibility catchment of existing or future recreational parks defined within the Local Government Infrastructure Plan.

**Siting and design performance benchmarks for a Local park**

The following benchmarks applying to Local Parks are to be read in conjunction with the with *DG 10 – Design Guidelines - Landscaping*, *DG 11.3 Design principles*, *DG 11.4 - Desired standards of service* and *DG 11.6 Public open space components*. Where not complying with these benchmarks, approval may be sought from Council’s Parks and Gardens team where solutions demonstrate low maintenance outcomes and amenity that is desired for the area.

*General*

- (a) Minimum street frontage of 40m, adjoining two or more road frontages where possible;
- (b) Minimum area of 800m<sup>2</sup>;
- (c) Minimum 250m<sup>2</sup> open grassed area, at least 15m wide, for informal recreation activities;
- (d) Lighting to delineate park entrances, illuminate picnic infrastructure and along pathways, sited and orientated to not spill into adjoining residential premises; and
- (e) Noisy activities, such as playgrounds are located as far as practically possible from adjoining residential lots;
- (f) Shared footpaths through the park, connecting to special needs or adult’s recreational infrastructure, such as shelters and picnic areas from adjoining street footpaths or linear parks;
- (g) Picnic areas and shaded seating located within proximity to and with visibility of children play areas;

*Vegetation and maintenance*

- (h) Existing vegetation is retained where possible and shade trees are planted at least every 15m along the length of internal footpaths, in accordance with *DG 11.11 Planting*;
- (i) 40% coverage of shade across the park, provided by shade sails, canopy coverage at maturity or shelters, predominately around walking paths and recreational infrastructure.
- (j) Minimises maintenance requirements and grassed areas for mowing by creating re-vegetated conservation areas or gardens over spaces with limited recreation function and slopes over 1:4 in a manner that does not compromise casual surveillance from street frontages or adjoining residential premises if no direct street frontage;
- (k) Mulched garden beds located in proximity to picnic areas, sited to create noise buffers or in locations not utilised for recreational activity;
- (l) Mowing widths of 1.6m are retained between barriers such as, trees, bollards, fencing, recreational infrastructure, garden beds, slopes greater than 1:4 and park boundaries for maintenance efficiency; and
- (m) Park access from adjoining road network, including removable locked bollards, 4m in width, for maintenance vehicles.

Note – Re-vegetated areas, garden beds or slopes over 1:4 within a local park are designed in accordance with *DG 11.5.14 Conservation area, sloped and buffer area model design guide* or *DG 11.5.15 Garden beds and Entrance statements model design guide*, as relevant.

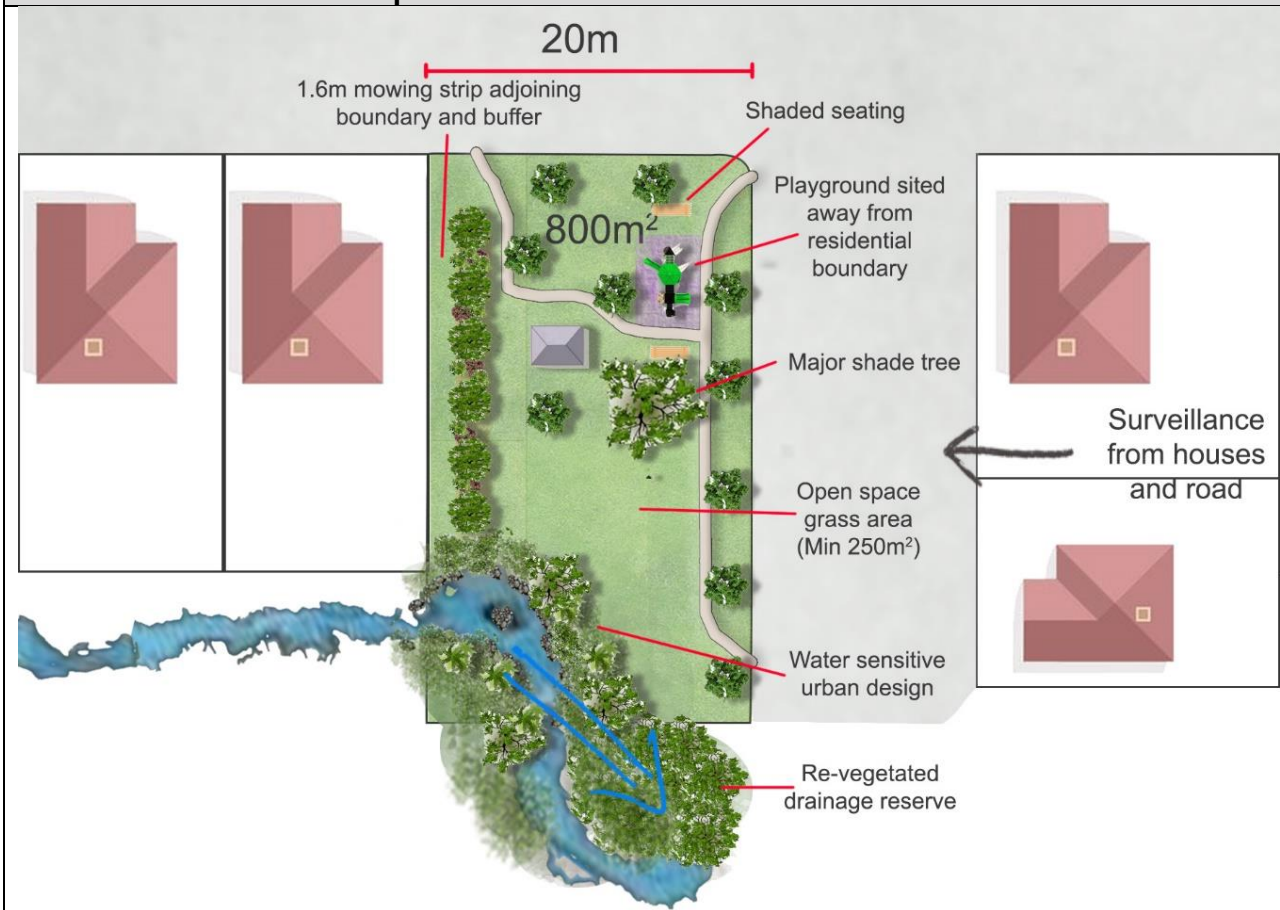
**Embellishments**

The following are the minimum requirements, to be provided in accordance with [Council’s Parks Embellishments Guide](#), [Council or IPWEAQ standard drawings](#):

- (a) Bollards preventing vehicular access into the park, except via removable locked bollards, 4m in width, provided for maintenance vehicles;

- (b) Lighting in accordance with *DG 11.15 Lighting*;
  - (c) Concrete internal shared footpath in accordance with *IPWEAQ - RS-065*, that are at least 3m wide, setback 5m from the top of creek banks or residential boundaries and avoiding easily saturated areas;
  - (d) Open grassed space for active play with a minimum width of 15m
  - (e) Minimum embellishments:
    - 2x park seating in a shady area overlooking playground or area of high natural amenity;
    - 1x picnic setting and shelter;
    - 1x drinking fountain, waste bin and bin enclosure nearby picnic setting;
    - Recreation infrastructure servicing at least one age group that meets the anticipated needs of the surrounding community, landscape context and broader open space network. Discussion should be had with Council to determine suitable infrastructure.
- Example:
- 1x Climbing equipment / goal posts (youth); or
  - 1x Minor playground / natural playground (children).

**Indicative Local Park example**



## DG 11.5.8 District Park model design guide

Minimum size	Service catchment	Provision rate
2ha	1.6km	0.5 ha / 1,000 people
<b>Siting and design performance benchmarks</b>		
<p>The following benchmarks applying to District Parks are to be read in conjunction with the with <i>DG 10 – Design Guidelines - Landscaping</i>, <i>DG 11.3 Design principles</i>, <i>DG 11.4 - Desired standards of service</i> and <i>DG 11.6 Public open space components</i>. Where not complying with these benchmarks, approval may be sought from Council’s Parks and Gardens team where solutions demonstrate low maintenance outcomes and amenity that is desired for the area.</p> <p><i>General</i></p> <ul style="list-style-type: none"> <li>(a) Minimum street frontage of 80m, adjoining two or more road frontages where possible;</li> <li>(b) Minimum area of 2ha;</li> <li>(c) Minimum 1,000m<sup>2</sup> open grassed area, at least 20m wide for informal recreation (includes dog park areas);</li> <li>(d) Recreation infrastructure servicing at least 2 of 3 age groups;</li> <li>(e) 20 sealed car parks are provided off-street or on-street if directly adjoining the park boundary, of which minimum 70% is located on the primary frontage and maximum 30% on any secondary frontage;</li> <li>(f) Noisy activities, such as playgrounds are located as far as practically possible from adjoining residential lots;</li> <li>(g) Shared footpaths through the park, connecting to special needs or adult’s recreational infrastructure, such as shelters and picnic areas from adjoining street footpaths or linear parks;</li> <li>(h) Lighting to delineate park entrances, illuminating picnic infrastructure and along pathways, sited and orientated to not spill into adjoining residential premises;</li> <li>(i) Picnic areas and shaded seating is located within proximity of and has visibility of children play areas;</li> </ul> <p><i>Vegetation and maintenance</i></p> <ul style="list-style-type: none"> <li>(j) Existing vegetation is retained where possible and shade trees are planted at least every 15m along the length of internal footpaths, in accordance with <i>DG 11.10 Planting</i>;</li> <li>(k) 40% coverage of shade across the park, provided by shade sails, canopy coverage at maturity or shelters, predominately around walking paths and recreational infrastructure;</li> <li>(l) Minimises maintenance requirements and grassed areas for mowing by creating re-vegetated conservation areas or gardens over spaces with limited recreation function and slopes over 1:4 in a manner that does not compromise casual surveillance from street frontages or adjoining residential premises if no direct street frontage;</li> <li>(m) Irrigated and mulched garden beds located in proximity to picnic areas, sited to create noise buffers or in locations not utilised for recreational activity; and</li> <li>(n) Mowing widths of 1.6m are retained between barriers such as, trees, bollards, fencing, recreational infrastructure, garden beds, slopes greater than 1:4 and park boundaries for maintenance efficiency; and</li> <li>(o) Park access from adjoining road network, including removable locked bollards, 4m in width, for maintenance vehicles.</li> </ul> <p>Note – Re-vegetated areas, garden beds or slopes over 1:4 within a district park are designed in accordance with <i>DG 11.5.14 Conservation area, sloped and buffer area model design guide</i> or <i>DG 11.5.15 Garden beds and Entrance statements model design guide</i>, as relevant.</p>		
<b>Embellishments</b>		
<p>The following are the minimum requirements, to be provided in accordance with <a href="#">Council’s Parks Embellishments Guide</a>, <a href="#">Council or IPWEAQ standard drawings</a>:</p> <ul style="list-style-type: none"> <li>(a) Signage at primary park entrances delineating a map of amenities in the park and any pathway linkages to nearby community facilities or commercial nodes;</li> <li>(b) Bollards preventing vehicular access into the park, except via removable locked bollards, 4m in width, provided for maintenance vehicles;</li> </ul>		

- (c) Lighting in accordance with *DG 11.15 Lighting*.
- (d) Concrete internal shared footpath in accordance with *IPWEAQ - RS-065*, that are at least 3m wide, setback 5m from the top of creek banks or residential boundaries and avoiding easily saturated areas;
- (e) Open grassed space for active play approximately 50m x 20m, including goal post sited to avoid impact on adjoining residents; and
- (f) Minimum embellishments:
  - 1x major playground or key recreational infrastructure;
  - 2x minor playground or climbing equipment;
  - Park furniture seating within shaded sections overlooking recreational equipment;
  - Minimum 2x BBQ/s and 4x shelters with picnic seating;
  - Public amenities in proximity to picnic areas;
  - Minimum 4x exercise equipment along walking paths;
  - Dog waste bag dispenser at key park entrances;
  - Dog park area, where park size exceeds 3ha; and
  - Drinking fountains, waste bins and bin enclosures located evenly distributed within vicinity of picnic seating, shelters and alongside pathways throughout the park.

**Indicative District park example**



## DG11.5.9 Regional Park model design guide

Minimum size	Service catchment	Provision rate
4ha	3km	0.6ha / 1,000 people
<b>Siting and design performance benchmarks</b>		
<p>The following benchmarks applying to Regional Parks are to be read in conjunction with <i>DG 10 – Design Guidelines - Landscaping</i>, <i>DG 11.3 Design principles</i>, <i>DG 11.4 - Desired standards of service</i> and <i>DG 11.6 Public open space components</i>. Where not complying with these benchmarks, approval may be sought from Council’s Parks and Gardens team where solutions demonstrate low maintenance outcomes and amenity that is desired for the area.</p> <p><i>General</i></p> <ul style="list-style-type: none"> <li>(a) Minimum street frontage of 80m, adjoining two or more road frontages where possible;</li> <li>(b) Minimum area of 2ha;</li> <li>(c) Minimum 1,000m<sup>2</sup> open grassed area, at least 20m wide for informal recreation (includes dog park areas);</li> <li>(d) Recreation infrastructure servicing all age groups;</li> <li>(e) 30 sealed car parks are provided off-street or on-street if directly adjoining the park boundary, of which minimum 70% is located on the primary frontage and maximum 30% on any secondary frontage;</li> <li>(f) Noisy activities, such as playgrounds are located as far as practically possible from adjoining residential lots;</li> <li>(g) Shared footpaths through the park, connecting to special needs or adult’s recreational infrastructure, such as shelters and picnic areas from adjoining street footpaths or linear parks;</li> <li>(h) Lighting to delineate park entrances, illuminating picnic infrastructure and along pathways, sited and orientated to not spill into adjoining residential premises;</li> <li>(i) Picnic areas and shaded seating is located within proximity of and has visibility of children play areas;</li> </ul> <p><i>Vegetation and maintenance</i></p> <ul style="list-style-type: none"> <li>(j) Existing vegetation is retained where possible and shade trees are planted at least every 15m along the length of the internal footpath, in accordance with <i>DG 11.10 Planting</i>;</li> <li>(k) 40% coverage of shade across the park, provided by shade sails, canopy coverage at maturity or shelters, predominately around walking paths and recreational infrastructure;</li> <li>(l) Minimises maintenance requirements and grassed areas for mowing by creating re-vegetated conservation areas or gardens over spaces with limited recreation function and slopes over 1:4 in a manner that does not compromise casual surveillance from street frontages or adjoining residential premises if no direct street frontage;</li> <li>(m) Irrigated and mulched garden beds located in proximity to picnic areas, sited to create noise buffers or in locations not utilised for recreational activity; and</li> <li>(n) Mowing widths of 1.6m are retained between barriers such as, trees, bollards, fencing, recreational infrastructure, garden beds slope greater than 1:4 and park boundaries for maintenance efficiency.</li> <li>(o) Park access from adjoining road network, including removable locked bollards, 4m in width, for maintenance vehicles;</li> </ul> <p>Note – Re-vegetated areas, garden beds or slopes over 1:4 within a regional park are designed in accordance with <i>DG 11.5.14 Conservation area, sloped and buffer area model design guide</i> or <i>DG 11.5.15 Garden beds and Entrance statements model design guide</i>, as relevant.</p>		
<b>Embellishments</b>		
<p>The following are the minimum requirements, to be provided in accordance with <a href="#">Council’s Parks Embellishments Guide</a>, <a href="#">Council or IPWEAQ standard drawings</a>:</p> <ul style="list-style-type: none"> <li>(a) Signage at primary park entrances delineating a map of amenities in the park and any pathway linkages to nearby community facilities or commercial nodes;</li> <li>(b) Bollards preventing vehicular access into the park, except via a minimum 4m wide locked gate provided for maintenance vehicles; and</li> </ul>		

- (c) Lighting in accordance with *DG 11.15 Lighting*.
- (d) An events space, including earthworks or utilisation of the natural contours of the land to create an atrium and focal point functioning as a stage. The stage may be multi-purpose, also functioning as open grassed active play area or basketball court as example;
- (e) Open grassed space for active play approximately 50m x 20m, including goal posts; and
- (f) Minimum embellishments:
  - 1x key recreational infrastructure - Major attraction playground;
  - Minimum 2x major playground, climbing equipment or other key recreational infrastructure;
  - Park furniture seating within shaded sections overlooking recreational equipment and within dog park area;
  - 1x special needs playground;
  - Minimum 3x BBQ/s and 6x shelters with picnic seating;
  - Public amenities in proximity to picnic areas;
  - Minimum 6x exercise equipment along walking paths;
  - Dog waste bag dispenser at key park entrances;
  - Dog park area; and
  - Drinking fountains, waste bins and bin enclosures located within vicinity of picnic seating, shelters and evenly distributed alongside pathways throughout the park.

**Indicative Regional park example**



DG 11.5.10 Cemetery model design guide

**Siting and design performance benchmarks**

Future land for cemeteries will be identified by Council. If Cemetery is to be provided by developer, close collaboration must be had with Council to select the site, design and construct. No specific siting and design benchmarks are defined, Cemetery development will be undertaken on a case-by-case basis.

**Embellishments**

The following are the minimum requirements for a Cemetery:

- (a) Bollards preventing vehicular access into the park, except via removable locked bollards, 4m in width, provided for maintenance vehicles;
- (b) Mowing widths of 1.6m are retained between barriers such as, trees, bollards, fencing, recreational infrastructure, garden beds, slopes greater than 1:4 and park boundaries for maintenance efficiency;
- (c) Finger signage at key internal pathway junctions and map of the area showing key features and amenities at Cemetery entrance;
- (d) Lighting to delineate pedestrian entrances and safety lighting adjoining internal pathways;
- (e) Shade trees at entrances and throughout the site to achieve 30% shade coverage at maturity;
- (f) Embellishments provided in accordance with [Council's Parks Embellishments Guide](#), including a minimum of:
  - Bollards preventing vehicular access into the park, except via removable locked bollards, 4m in width, provided for maintenance vehicles;
  - Benches and seating distributed at entrances and through internal pathways;
  - Car parking commensurate to the anticipated size and traffic demands of the cemetery; and
  - Public amenities.

### DG11.5.11 Nature Park model design guide

Note – Nature parks may require planning approval, defined as an Environment facility or Outdoor sport and recreation, pending the nature of the use and infrastructure.

#### **Siting and design performance benchmarks**

Nature Parks to be managed by Council are generally not supported unless integrated with a trunk park or providing a functional recreational benefit that links to areas of high natural amenity. Discussion with Council should be undertaken to determine if a premise should be designed as a Conservation area or a Nature Park including recreational components.

The following benchmarks applying to Nature Parks are to be read in conjunction with *DG 10 – Design Guidelines - Landscaping*, *DG 11.3 Design principles*, *DG 11.4 - Desired standards of service* and *DG 11.6 Public open space components*. Where not complying with these benchmarks, approval may be sought from Council's Parks and Gardens Branch where solutions demonstrate low maintenance outcomes.

#### *General*

- (a) Nature Parks are designed in accordance with *DG 11.5.14 Conservation, sloped and buffer area model design guide*, but include the provision of a pathway providing a pedestrian connection through the site or to a desirable natural destination, such as a water source, waterfall or viewpoint;
- (b) cleared grass areas are avoided, unless located at access points adjoining the road network, not exceeding 200m<sup>2</sup> for persons to congregate;
- (c) Sufficient on or off-street car parking to cater for anticipated demand for the nature park, demonstrated by a suitably qualified professional;
- (d) Design and construction that is sensitive to natural hazard risks, natural features and ecosystems;
- (e) Design, landscaping and operational measures that minimises ongoing maintenance requirements and avoids the risk of weed growth or invasive seed spread into a natural ecosystem; and

Note – An Operational maintenance plan detailing necessary works required to maintain the nature park over the projects life cycle may be requested by Council prior to issuing an approval.

- (f) Recreational infrastructure is not located under fruit or seed trees that may impact upon maintenance.

#### **Embellishments**

The following are the minimum requirements to be provided in accordance with [Council's Parks Embellishments Guide](#):

- (a) Bollards preventing vehicular access into the park, except via removable locked bollards, 4m in width, provided for maintenance vehicles;
- (b) Signage at park entrance providing a map of the area, trails, key natural features, and interpretive signage about key features/wildlife (as required);
- (c) Bushwalks are composed appropriately graded dirt paths designed and constructed by a suitably qualified professional;
- (d) Embellishments are provided in accordance with [Council's Parks Embellishments Guide](#), including a minimum of:
  - Picnic or seating area shaded by vegetation at entrance;
  - bench or log seating at start, rest points and overlooking key vistas;



## DG11.5.12 District &amp; Regional Sportspark model design guide

Sportspark type	Minimum size	Service catchment	Provision rate
District	6ha	5km	0.6ha / 1,000 people
Regional	18ha	25km	1.0ha / 1,000 people
<b>Siting and design performance benchmarks</b>			
<p>The following benchmarks applying to District or Regional Sportspark are to be read in conjunction with the <i>DG 10 – Design Guidelines - Landscaping</i>, <i>DG 11.3 Design principles</i>, <i>DG 11.4 - Desired standards of service</i> and <i>DG 11.6 Public open space components</i>. Where not complying with these benchmarks, approval may be sought from Council’s Parks and Gardens team where solutions demonstrate low maintenance outcomes and amenity that is desired for the area.</p> <p><i>General</i></p> <p>(a) Has at least a 100m street frontage, being an urban collector, sub-arterial or arterial road;</p> <p>(b) Utilises earthworks to maximise drainage of sporting fields by creating stormwater gullies and grading of fields;</p> <p>(c) Where possible, located adjoining two or more road frontages, with trees along each road frontage;</p> <p>(d) Sporting facilities are designed to relevant field/court regulation standards, including orientation, dimensions, installations/facilities, safety buffers and lighting;</p> <p>(e) Design of sportspark considers the impact of traffic, noise and light impacts of sporting activity on sensitive land uses and provide vegetation and open space buffers to minimise impacts;</p> <p>(f) All fields or courts provide shade trees and adequately distributed shaded benches for spectators, with primary field/courts facilities featuring grandstand style seating as defined within <a href="#">Council’s Parks Embellishments Guide</a>;</p> <p>(g) Provides suitable support facilities, including storage, amenities for spectators and adequate change rooms, commensurate to the number of sport clubs;</p> <p>(h) Shade trees are provided around the circumference of fields to provide shading to spectators;</p> <p>(i) Car parking is provided in accordance with the <i>Whitsunday Planning Scheme 2017</i>. Parking is sited with equal access to each sporting facility, or is adequately distributed in vicinity to each sporting facility; and</p> <p>(j) Encourages the co-location of community facilities or utilities infrastructure.</p>			
<b>Embellishments</b>			
<p>The following are the minimum requirements, to be provided in accordance with <a href="#">Council’s Parks Embellishments Guide</a>, <a href="#">Council or IPWEAQ standard drawings</a>:</p> <p>(a) Park name signage, field/court signage and internal wayfinding finger signage;</p> <p>(b) Bollards preventing vehicular access from internal and external road network, except via removable locked bollards, 4m in width, for maintenance vehicles; and</p> <p>(c) Embellishments are provided, including a minimum of:</p> <ul style="list-style-type: none"> <li>○ entrance statement garden bed and Park name signage at primary frontage;</li> <li>○ shaded benches and seating around all fields or courts;</li> <li>○ minimum 50 grandstand seats around primary field or court;</li> <li>○ 1x Minor playground, located in a position that is viewable from main grandstand;</li> <li>○ Lighting of entrances, car parking and key internal pathways, in accordance with <i>DG 11.15 Lighting</i>;</li> <li>○ Lighting in accordance with relevant Australian Standards for sports fields and courts;</li> <li>○ Sufficient amenities to service scale of sportpark;</li> <li>○ Concrete internal pathways connecting car parking, facilities and amenities;</li> <li>○ Drinking fountains, bins and bin enclosures adequately distributed around sport facilities and amenities; and</li> <li>○ Fencing around the circumference of the sportspark.</li> </ul>			
<b>Indicative Regional &amp; District sportspark example</b>			



DG11.5.13 Parks and Open Space drainage corridor model design guide

**Siting and design performance benchmarks**

The following benchmarks applying to drainage corridors that are natural waterways or formed grass drains within parks and open space. Benchmarks provide guidance on low maintenance design for developments that incorporate drainage corridors. Design benchmarks should be read in conjunction with *QUDM, DG 4 – Design Guidelines – Stormwater Drainage, IPWEAQ drawings and the [Whitsunday Stormwater Quality Guideline](#)*. Where not complying with these benchmarks, approval may be sought from Council's Parks and Gardens or Roads and Drainage Branch where solutions demonstrate low maintenance outcomes and amenity that is desired for the area.

Note: *QUDM, DG 4 – Design Guidelines – Stormwater Drainage, IPWEAQ drawings and the [Whitsunday Stormwater Quality Guideline](#)* prevail to the extent of any inconsistency.

*General*

Where pathways or cycleways are included alongside drainage corridors, the following benchmarks apply:

- bollards preventing vehicular access and removable locked bollards, 4m in width for access to the street by maintenance vehicles;
- Lighting to delineate park entrances and along pathways, sited and orientated to not spill into adjoining residential premises, as per *DG 11.15 Lighting*; and
- footpaths avoid overland flow paths ground and are setback 5m from the top of creek banks or residential boundaries; or
- footpaths are raised above overland flow paths.

*Watercourse or open drain within parks and open space:*

- The following are re-vegetated in accordance with this model design guide to become densely planted ecosystems with low maintenance requirements:
  - Watercourse defined under the *Vegetation Management Act 1999*,
  - Overland flow paths or formed grass drains exceeding 10m in width<sup>1</sup> or with grade greater than 1:4
- Works within a watercourse occur between April and October, unless approved by Council;
- Endemic native plantings and layout defined by a *suitably qualified professional* include predominately fast-growing pioneer species, with some edge and climax species, in accordance with:
  - density and design set out within *indicative drainage corridor design* below, or
  - [Whitsunday Stormwater Quality Guideline](#) where function is for stormwater quality;
- For watercourse, re-vegetation occurs to a minimum width defined by *Whitsunday Planning Scheme 2017 Table 0.1 - Minimum riparian buffers and setbacks for biodiversity, waterways and wetlands* for the respective stream order. Re-vegetation occurs to the adjoining boundary if within this riparian buffer.
- Outside of re-vegetated riparian buffer, a 6m wide grass buffer area adjoins freehold boundaries, unless slope exceeds 1:4, then re-vegetation occurs to the boundary line, and
  - only pioneer and edge species that grow to a maximum of 5m in height are planted within this 6m buffer;
  - Maintenance track access is provided to the grass buffer adjoining freehold boundaries is provided and connected to the road network via a minimum 4m wide locked bollards;
- For grass drain, exceeding 10m in width, re-vegetation occurs to the adjoining boundary. Where exceeding 30m in width, a 6m wide grass buffer area adjoins freehold boundaries unless slope exceeds 1:4, then re-vegetation occurs to the boundary line, and
  - only pioneer and edge species that grow to a maximum of 5m in height are planted

<sup>1</sup> *Drainage corridor width* - measured between top of each bank

within this 6m buffer;

- Maintenance track access is provided to the grass buffer adjoining freehold boundaries is provided and connected to the road network via a minimum 4m wide locked bollards;
- Bollards preventing vehicle access into the drainage corridor;
- Bank stabilisation, such as geofabric or rock defences, are utilised as necessary to ensure native vegetation can establish, developed in accordance with best practice set out within [Catchments and Creeks – Use of Rock in Waterway Engineering Version 4 2020](#);
- Alternate treatments to naturally vegetated flow paths, such as formed concrete/rock drains may be permitted in urban areas where limited width, safety, maintenance or erosion issues are demonstrated by an RPEQ;
- A low flow pipe is considered where pooling may occur to mitigate pests and scouring, as per Standard drawing DS-079 and DG 4 – *Design Guideline – Stormwater Drainage*;

*Rock lined watercourses within parks and open space:*

- Natural or re-vegetated waterways requiring rocks to strengthen banks, reduce scouring or manage velocities, are designed in a manner that reduce weed growth as shown within *indicative drainage corridor design* below and best practice set out within [Catchments and Creeks – Use of Rock in Waterway Engineering Version 4 2020](#);
- Where possible, rock lined banks are covered with soil, geofabric and endemic native vegetation, in accordance with planting density and design set out within *indicative drainage corridor design* below;
- Where necessary, concrete pipes (min. 900mm) placed within the rock wall are utilised to allow trees to establish and provide canopy coverage, as shown by *indicative drainage corridor design* below;
- Rock lined watercourses unable to accommodate vegetation on account of high slope, high scouring or high velocities are grouted with concrete to avoid weed growth between rocks. It is acknowledged grouting may not be possible in all circumstances on account of managing velocities in accordance with QUDM.

*Grass drain within parks or open space:*

- Drainage areas that are not *watercourses*, less than 10m in width<sup>1</sup> and of a grade less than 1:4, is grassed, unless required for stormwater quality treatments to achieve MUSIC modelling requirements, designed in accordance with the [Whitsunday Stormwater Quality Guideline](#);

Editor's note – *Watercourse* is defined by the *Vegetation Management Act 1999*.

- Grassed drainage areas between residential premises are a minimum of 4m width and include 4m wide locked bollards for service vehicle and bollards to prevent vehicular movement through the corridor that may damage drainage contouring;
- Includes a low flow pipe as per Standard drawing DS-079 and DG 4 – *Design guidelines – Stormwater drainage* to allow more frequent mowing during wet season.

### **Embellishments**

Where identified by *Siting and design performance benchmarks*, the following are the minimum requirements, to be provided in accordance with [Council's Parks Embellishments Guide, Council or IPWEAQ standard drawings](#):

- (a) Bollards preventing vehicular access into a parks and open space drainage corridor, except via removable locked bollards, 4m in width, adjoining the street for maintenance vehicles;
- (b) native plantings endemic to the local habitat as defined by a suitably qualified person, generally in accordance with planting density of 1 per 1m<sup>2</sup> and species type within *Indicative drainage corridor design*;
- (c) Planting densities and species may vary where an RPEQ identifies need to prioritise stormwater flows or bushfire assessment recommends an alternate outcome;
- (d) Irrigation is provided in accordance with *DG 11.19 Irrigation* or designed by a suitably qualified professional to achieve at least a 90% survival rate to maturity;
- (e) Minimum mulch depth 200mm or erosion matting as necessary to suppress weed growth and manage erosion impacts from flooding. Note mulch may not be suitable in some drainage

corridors where flood velocities may wash it away; and

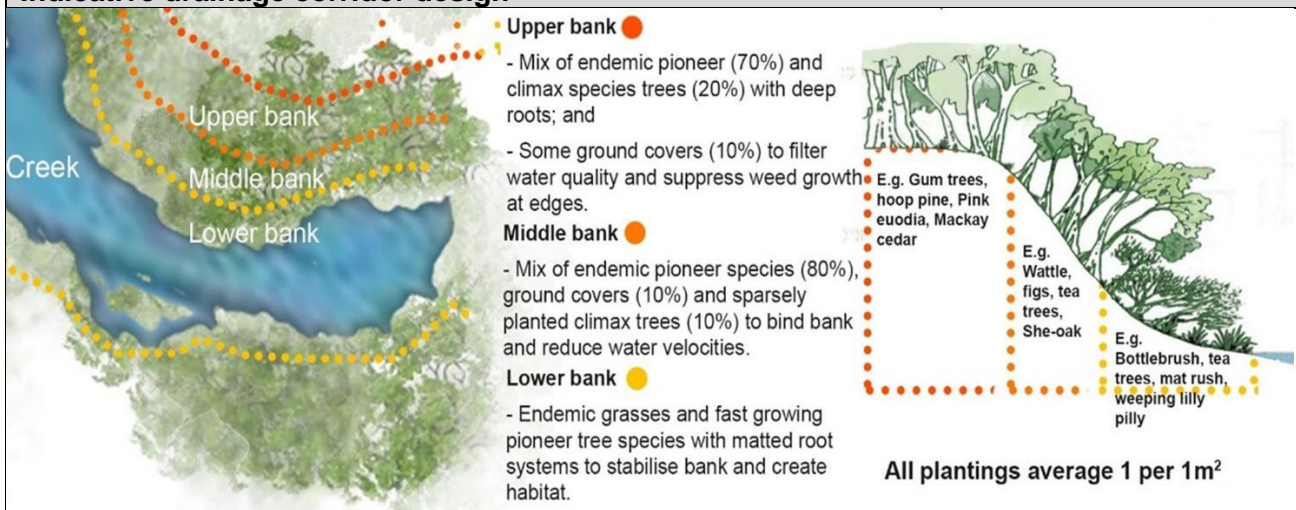
Editor's note – *Suitably qualified person* planning re-vegetation must have a degree in Environmental management, science or demonstrated experience in waterway management.

### Handover and Bonding

Handover and bonding of drainage corridors involving re-vegetation or watercourse stabilisation within parks and open space shall occur in accordance with the following:

- (a) Developer shall install and manage the drainage corridor in accordance with this model design guide;
- (b) The developer shall lodge with Council a maintenance security bond for 5% of the total value of re-vegetation or watercourse stabilisation in accordance with CP 1.06 Construction security bond;
- (c) The developer and Council shall attend an on-maintenance inspection. Should the asset be in accordance with this model design guide and approved plans, it shall be placed on maintenance for a period of 24 months. Should the asset not be in acceptable condition the defects shall be rectified and another on-maintenance inspection arranged;
- (d) The developer shall maintain the asset for 24 months after establishment, ensuring irrigation, erosion management and weeding, that allows vegetation canopy coverage to establish appropriately. Council inspections may be undertaken at 6 monthly intervals to assess vegetation growth and management;
- (e) The developer and Council shall attend an off-maintenance inspection. Should the asset be in accordance with this model design guide and approved plans, it shall be accepted off maintenance and the remainder of the maintenance security deposit returned. Should the asset not be in acceptable condition the defects will be rectified. If the defects were minor in nature, the asset shall be accepted off maintenance and the security deposit returned. If the defects were major in nature, the 12-month maintenance period shall be served in full again.

### Indicative drainage corridor design





DG11.5.14 Conservation, Sloped and Buffer area model design guide

**Siting and design performance benchmarks**

The following benchmarks applying to re-vegetation projects involving conservation areas, sloped areas exceeding 1:4 and buffers areas in parks and open space. Benchmarks are to be read in conjunction with *DG 10 – Design Guidelines - Landscaping*, *DG 11.3 Design principles*, *DG 11.4 - Desired standards of service* and *DG 11.6 Public open space components*. Where not complying with these benchmarks, approval may be sought from Council’s Parks and Gardens Branch where solutions demonstrate low maintenance outcomes and amenity that is desired for the area.

- (a) Conservation areas, slopes exceeding 1:4 and buffer areas in parks and open space minimise maintenance requirements through re-vegetation that creates a densely planted ecosystem, in accordance with planting density and layout within *Indicative Conservation, Buffer or Sloped area design*;
- (b) Re-vegetation includes a diversity of species that are endemic to the local area as defined by a suitably qualified person;
- (c) Re-vegetation is not supported if it will create CPTED issues or worsen natural hazard impacts;
- (d) Where possible, re-vegetation is established early in the development process to allow time to become established;
- (e) Where adjoining medium, high or very high bushfire hazard area, access easement, fire maintenance trails and firebreaks are created to ensure compliance with *QFES Bushfire resilient communities*’ document, accessible by the local road network;
- (f) Where conservation area adjoining freehold boundaries, a 6m wide grassed area with a grade not more than 1:4 (unless required fire break is larger), is provided and accessible by the local road network;
  - o Where 6m grass buffer area adjoining freehold boundaries has a slope greater than 1:4, re-vegetation is completed to the boundary line.
  - o Only pioneer and edge species that grow to a maximum of 5m in height are planted within this 6m buffer. The exception is for necessary fire maintenance trails or fire buffer areas required through sloped land;
- (g) Accesses include removable locked bollards, 4m in width, for access to the street by maintenance vehicles to fire trails or unvegetated buffers; and
- (h) Where area to be re-vegetated is 10m or less in width, it should only consist of edge and pioneer species plantings.

**Embellishments**

Where identified by *Siting and design performance benchmarks*, the following are the minimum requirements, to be provided in accordance with [Council’s Parks Embellishments Guide](#), [Council or IPWEAQ standard drawings](#):

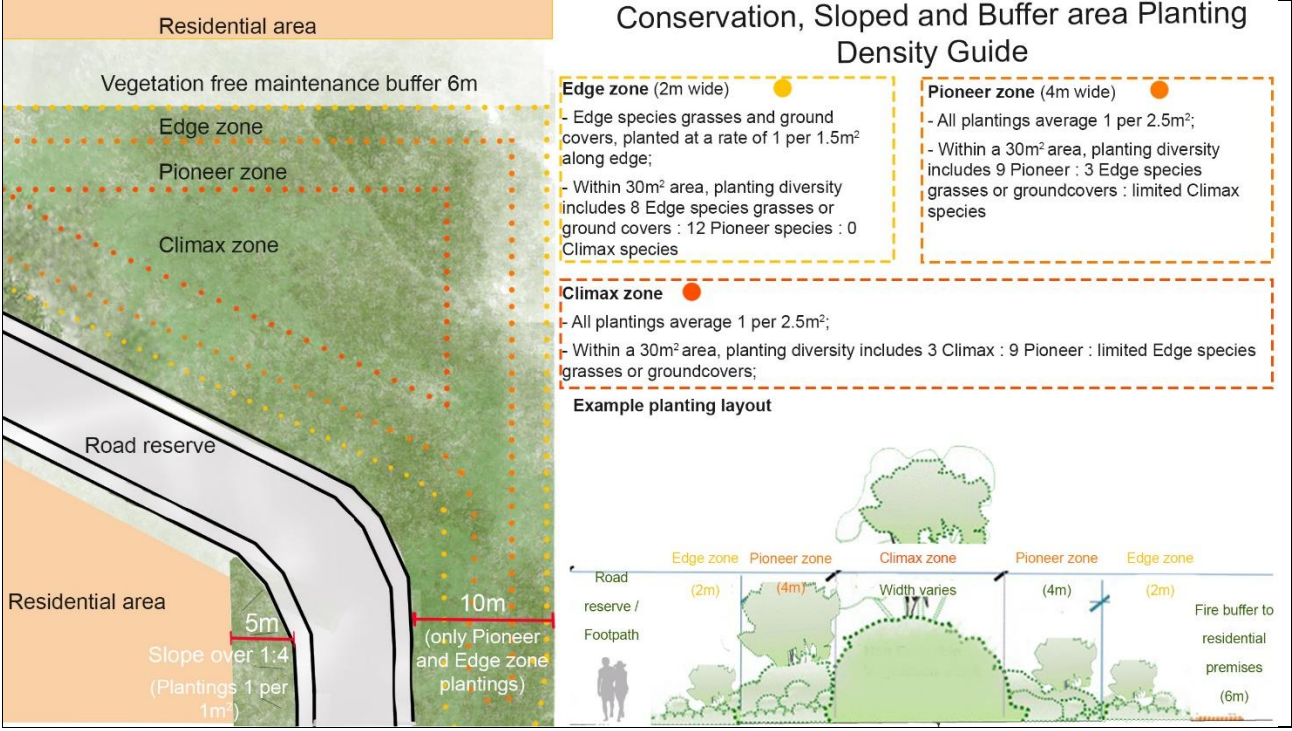
- (a) Bollards preventing vehicular access into a parks and open space drainage corridor, except via removable locked bollards, 4m in width, adjoining the street for maintenance vehicles;
- (b) Native plantings that are endemic to the local habitat determined by a suitably qualified professional, providing a diversity of at least 10 species per re-vegetation area;
- (c) Plant rows 2m apart, with plantings spaced to achieve minimum 1 per 2.5m<sup>2</sup> or a planting density of 4,000 seedlings/ha;
- (d) Where area to be re-vegetated is 5m or less in width, re-vegetation should include a densely planted mix of pioneer and edge species composed of resilient native grasses or ground covers, at a density of 1 per 1m<sup>2</sup> or 10,000 seedlings/ha;
- (e) 200mm of mulch, re-mulched and weeds removed within 1 month prior to handing over the asset to Council;
- (f) Planting densities and species may vary where an RPEQ identifies need to prioritise stormwater flows or bushfire assessment recommends an alternate outcome;
- (g) Irrigation is provided in accordance with *DG 11.19 Irrigation* or designed by a suitably qualified professional to achieve at least a 90% survival rate to maturity.

**Handover and Bonding**

Handover and bonding of conservation, sloped or buffer areas involving re-vegetation within parks and open space shall occur in accordance with the following:

- (f) Developer shall install and manage the re-vegetation in accordance with this model design guide;
- (g) The developer shall lodge with Council a maintenance security bond for 5% of the total value of re-vegetation in accordance with CP 1.06 Construction security bond;
- (h) The developer and Council shall attend an on-maintenance inspection. Should the asset be in accordance with this model design guide and approved plans, it shall be placed on maintenance for a period of 24 months. Should the asset not be in acceptable condition the defects shall be rectified and another on-maintenance inspection arranged;
- (i) The developer shall maintain the asset for 24 months after establishment, ensuring irrigation and weeding, that allows vegetation canopy coverage to establish appropriately. Council inspections may be undertaken at 6 monthly intervals to assess vegetation growth and management;
- (j) The developer and Council shall attend an off-maintenance inspection. Should the asset be in accordance with this model design guide and approved plans, it shall be accepted off maintenance and the remainder of the maintenance security deposit returned. Should the asset not be in acceptable condition the defects will be rectified. If the defects were minor in nature, the asset shall be accepted off maintenance and the security deposit returned. If the defects were major in nature, the 12-month maintenance period shall be served in full again.

**Indicative Conservation, Buffer or Sloped area design**





DG11.5.15 Garden beds and Entrance statement model design guide

**Siting and design performance benchmarks**

The following benchmarks are to be read in conjunction with *DG 10 – Design Guidelines – Landscaping* and *DG 11.6 Public open space components*. Where not complying with these benchmarks, approval may be sought from Council’s Parks and Gardens or Roads and Drainage Branch where solutions demonstrate low maintenance outcomes and amenity that is desired for the area.

*Garden beds in parks, road verges or round-a-bouts*

- (a) All plantings are provided in accordance with *Whitsunday Planning Scheme 2017* Schedule 6.4.5 – Planting species list, with minimum 75% endemic to the local habitat;
- (b) Garden beds provide an amenity function that is commensurate to the area, designed to promote:
  - CPTED safety as per DG 11.7;
  - road / pedestrian safety; and
  - maintenance efficiency through irrigation and plantings of dense native ground covers/grasses along edges and fast-growing trees with canopy coverage that suppress weeds;
- (c) Planting selection and resilience is relevant to location, with isolated areas such as road verges or round-a-bouts utilising lowest maintenance ground covers/grasses;
- (d) Planting of trees, groundcovers or native grasses in road reserves are selected with respect to their growing size and adequately setback from the road by a paved 500mm edge to avoid maintenance of vegetation spilling onto the road. Suitable vegetation selection and landscape design to maintain sight lines and minimise maintenance requirements in road verges or round-a-bouts are developed in accordance with best practice set out within [Department of Transport and Main Road - Road Landscape Manual, Edition 2, 2013](#).

*Entrance statements:*

Proposed entrance statements are subject to approval by Council. Location, structures, materials or placemaking themes to align with Town themes and ongoing maintenance expectations, are set out below:

- (a) Located at:
  - primary entrances for Regional recreation park or Regional sportspark;
  - intersections of arterial, sub-arterial or urban collector roads leading into a new residential estate, outside of road reserve;
- (b) Are compact in design, with structures or signage not exceeding 3m in height and 6m in length;
- (c) Utilise materials and design that are resilient to cyclones and have a low maintenance cost;
- (d) Utilise signage that includes placemaking themes or colours that reflect the ‘sense of place’ and in accordance with Councils style guide;
- (e) Clearly show the name of the destination and avoids landscaping that obscure the name of the destination after growth;
- (f) Are designed and constructed of materials and colours that contribute to the amenity of the streetscape, don’t create a distraction for drivers and don’t obscure pedestrian movement;
- (g) Include signature or exotic native trees that assist wayfinding; and
- (h) Encourage multi-functional use, facilitating stormwater treatment or co-location with recreational open space.

Note - Entrance statements not meeting the benchmarks herein or not approved by Council must be located within a private lot and managed by private organisation or person in accordance with a maintenance statement provided to Council.

**Embellishments**

The following are the minimum requirements for garden beds and entrance statements:

- (a) Native plantings that are endemic to the local habitat, water resilient, cyclone resilient and

- effective in suppressing weeds;
- (b) 200mm of mulch re-mulched and weeds removed within 1 month prior to handing over the asset to Council;
- (c) All garden beds, predominately include resilient native grasses and groundcovers along garden boundary at a minimum planting rate of 2 per metre;
- (d) Where garden beds are greater than 4m in width, the use of densely planted pioneer and climax species trees are utilised alongside ground covers, to provide shade and suppress weed growth at maturity;
- (e) Where possible, new garden beds and open space requiring irrigation is connected to Council's recycled water network; and
- (f) Irrigation is provided in accordance with *DG 11.19 Irrigation*.

**Indicative garden bed, road verge and entrance statement garden examples**

**Garden beds**

Use of shade trees surrounded by native low maintenance, densely planted groundcovers. Allows good visual surveillance and reduces the maintenance cost of grass mowing. It is also effective in channelling pedestrians away from unsafe road crossings.



Hardy and durable ground cover is very effective as a weed suppressant and provides an attractive neat edge, whilst reducing need for mowing.




**Road medians or roundabouts**

Planting of trees, groundcovers or native grasses on road verges are selected with respect to their growing size and adequately setback 500mm by a paved edge to avoid maintenance of vegetation spilling onto the road as shown right. Where inadequate space for vegetation or unsafe to maintain, a paved surface is preferable.

Vegetation must not impede sight lines and is planted densely into a weed mat, overlaid with a mulched bed to avoid weed growth. Multi-purpose uses, such as WSUD and rainwater harvesting via tree pit designs are encouraged, designed in accordance with the WRC Stormwater Guideline.

Roadside vegetation should be designed in accordance with best practice set out by [Department of Transport and Main Road -](#)



<p><a href="#"><i>Road Landscape Manual, Edition 2, 2013.</i></a></p>	
<p><b>Entrance statement</b></p>	
<p>Landscaping that represents the tropical character of the Town, inclusive of signature or unique trees, dense groundcovers to suppress weed growth. Landscape design should ensure the sign cannot be covered by overgrown vegetation.</p>	 A photograph showing a stone sign for 'AIRLIE BEACH' with the text 'WELCOME TO AIRLIE BEACH' and 'THE HEART OF THE REEF' below it. The sign is set in a landscaped area with several tall palm trees and other tropical plants. The background shows a clear blue sky and some buildings in the distance.

## Public open space components

### DG 11.6 General

- 11.6.1 At the time of development, the developer shall landscape all public open spaces to the satisfaction of Council, in accordance with DG 10 – Landscaping, DG 11 Parks and open space and Council’s Levels of Service/Operations Plan.
- 11.6.2 Where a development is proposing to undertake any work within existing or proposed park a landscaping plan shall be prepared for consideration by Council.
- 11.6.3 Developers should have regard to , embellishments siting and design required in each park defined by DG 11.5 Open space model design guides and [Council’s Parks Embellishments Guide](#);
- 11.6.4 Landscaping plans shall be prepared by a person of professional standing in the field of landscape architecture or landscape design, at a standard acceptable to Council.
- 11.6.5 CCA treated timber is not to be used for the construction of Council assets.
- 11.6.6 ACQ, Copper Azole, LOSP, or another alternative timber treatment will be considered for approval by Council, so long as each individual piece of timber is clearly marked to show the treatment type, e.g. 'ACQ, Copper Azole, LOSP' or other similar text as appropriate. In some instances, (e.g. high use public areas), Council will require these markings to be burn branded into exposed timber areas also. In this regard reference should also be made to Council specific standard drawings for additional marking of treated timber elements that are used in the construction of Council assets in high use public areas.

### DG11.7 Crime Prevention through Environmental Design

- 11.7.1 It is important when designing parks that the principles of crime prevention through environmental design are considered, in particular:
  - 11.7.1.1 Dense stands of vegetation should be confined to park peripheries and should not be located alongside paths and play equipment. Vegetation should not block casual surveillance of picnic and play areas from adjacent residences;
  - 11.7.1.2 Landscaping should not restrict sightlines and opportunities for natural surveillance within and of a site therefore all new vegetation around centres of activity should be single clean trunked trees with shrubs which do not grow beyond 500 mm height. This will avoid the problem of concealment and allow a greater area of surveillance from the road;
  - 11.7.1.3 Lighting where required should be sufficient to deter loitering and vandalism; Large shrubs and trees should be planted in such a way as to prevent or reduce illicit access to buildings and neighbouring properties; and
  - 11.7.1.4 Safety in large parks or areas of vegetation within a development may be enhanced by planting trees in thin strips which maximises the number of trees planted but which also restricts the ability of offenders to hide within a “mass” of vegetation.

## DG 11.8 Treatment to Park Boundaries

- 11.8.1 Vehicles should be prevented from driving into parks, drainage reserves and public open spaces by the provision of barriers along the road frontages. These may be fences, bollards or natural features such as existing vegetation or newly planted and staked trees. Access for maintenance vehicles shall be provided through a lockable gate or removable bollard.
- 11.8.2 Definition of the park side boundaries should be indicated by installing replas bollards at approximately 1.6 metre centres, down each side. These should be offset from the surveyed boundary by 250 mm in order to allow future erection of private fencing without having to remove Council's boundary markers or assets. Definition of the park boundary is intended to deter encroachment onto park by adjacent private properties and to define the park limits.
- 11.8.3 Fencing, log barriers and bollards shall be designed and sited in accordance with Council's Standard Drawing and DG 11.5 Open space model design guides and [Council's Parks Embellishments Guide](#), unless otherwise approved by Council.

## DG 11.9 Internal Circulation

- 11.9.1 The park layout should be designed to ensure that internal circulation or movement within the park is:
  - 11.9.1.1 Safe;
  - 11.9.1.2 Unencumbered;
  - 11.9.1.3 Highly visible internally and externally; and
  - 11.9.1.4 Linked to external cycle and pedestrian networks.
- 11.9.2 Design features including access points, street frontages, carparks, pedestrian/bike paths, park equipment and lighting should be located and designed in accordance with the DG 11.5 Open space model design guides and [Council's Parks Embellishments Guide](#).
- 11.9.3 Design of paths, car parking and access points should consider the needs of people with mobility challenges. Pathways shall be in accordance with Design manual D1 and comply with accessibility standards.

## DG 11.10 Planting

- 11.10.1 Council parks seek to provide a range of recreation opportunities and there is scope to utilise planting design to help achieve this objective, options include:
  - 11.10.1.1 Shade trees evenly planted throughout the site to maximise protection from the sun;
  - 11.10.1.2 Shade trees planted along internal pathways within parks at a minimum rate of 1 per 15m;
  - 11.10.1.3 Island or corridor planting to concentrate trees for easy maintenance and encourage bird life for pleasure viewing;

- 11.10.1.4 Grouped planting will also provide shade adjacent to open space to allow unencumbered active play areas; and
- 11.10.1.5 Lines of tree planting to define edges of informal active play areas.
- 11.10.2 Tree plantings are sensitive to underground infrastructure, and if necessary, include root barriers;
- 11.10.3 A minimum 75% of the proposed tree planting should be endemic, and species should be selected on their adaptability to site conditions, and their value to local fauna. Where the proposed park adjoins an area of established native vegetation, an extension of this habitat into the park should be implemented by using compatible species. The designer should also be encouraged to use rare and endangered plant species, or species proven to have excellent bird, butterfly and insect attracting qualities.
- 11.10.4 Development involving re-vegetation to create 'conservation areas', are planted in accordance with design criteria within the DG 11.5 Open space model design guides to minimise maintenance and weed growth.
- 11.10.5 In order to promote the unique landscape characteristics of the region exotic flowering trees and non-native palms should only be used as features or emphasis, where necessary.
- 11.10.6 Plant selection is in accordance with Whitsunday Planning Scheme 2017 - Schedule 6.4.5 Planting Species List and planting layout aligns with DG 11.5 Open space model design guides for each respective open space type. Designers are encouraged to consult with Council in the preparation of the landscaping design.
- 11.10.7 Street trees should not be a plant listed in:
  - 11.10.7.1 Land Protection (Pest and Stock Route Management) Regulation;
  - 11.10.7.2 Local governments Pest Management Plan; and
  - 11.10.7.3 Publication, Agricultural and Environmental Weeds (Wet Tropics Management Authority).

#### DG 11.11 Grassing

- 11.11.1 All parks shall be covered with topsoil to a minimum depth of 75mm - 100mm and shall be lightly compacted and grassed in accordance with Councils' minimum standards and specifications.
- 11.11.2 In order to guarantee a high standard of maintenance all parks shall be in a mowable condition, free from rocks and loose stones, and graded to even running contours.
- 11.11.3 Grass should be established within the proposed park as quickly as possible in order to avoid erosion and sedimentation to the local waterways, and prevent the establishment of weeds in accordance with Council's Manuals and Specifications.

#### DG 11.12 Mounding

- 11.12.1 Mounding may be used within the park design to provide topographical interest, to emphasise views, to help screen adjacent properties or low amenity storage areas, or as part of the internal design. The mounds should not exceed a gradient of 25% (1 in 4) in order to reduce erosion and allow mowing. Where exceeding a gradient of 25%, mound should

be densely planted in accordance with DG 11.5.14 Model design guide to minimise maintenance. Planting of trees and shrubs over the mound will further emphasise height and shape.

- 11.12.2 Care should be given to ensuring that the mound or associated landscaping does not restrict visibility into and out of the park thus threatening the safety of users or provide unwanted visibility into private properties.

## DG 11.13 Furniture

- 11.13.1 Park furniture provided in accordance with DG 11.5 Open space model design guides and [Council's Parks Embellishments Guide](#) should reflect the intended function of the park and compliment any distinguishing features present e.g. seating situated to maximise a view scape. Some preferred features of furniture include:
- 11.13.1.1 Park benches located under a natural or built shade structure to allow day long use. If the shade is built, it should have an impervious roof e.g. colourbond to provide shelter during rain;
  - 11.13.1.2 Well drained ground and hard surfacing below any structure. Surface material could be pavers, coloured or exposed aggregate concrete etc;
  - 11.13.1.3 Shade structures should maximise protection from the sun during the hours of 11 am - 3 pm e.g. skillion shelters or shade sails with Montec 370 material; and
  - 11.13.1.4 Refuse bins should be located for ease of use and pickup by refuse trucks e.g. adjacent to playgrounds or picnic areas, at park exits.
- 11.13.2 Designs of furniture should reflect a strong aesthetic and vandal resistant appearance.
- 11.13.3 Where possible, natural features may be used e.g. mounding for seating, trees or natural rock for bollards to simulate park furniture; and
- 11.13.4 Park furniture themes are set out within the [Council's Parks Embellishments Guide](#). Designers are encouraged to consult with Council in the preparation of the landscaping design.

## DG 11.14 Signage and Interpretation

- 11.14.1 A park name and sign design is to be provided, designed in accordance with Communication Style Guidelines. The park name is to be submitted to Council for approval with the landscaping drawings. The proposed name is to preferably have the same theme as the subdivision's street names. The name is to be creative and imaginative in order to appeal to children for local parks and to adults for district and regional parks.
- 11.14.2 If the park has any historic, cultural or natural value the provision of interpretive signage will provide further interest to local users. Council can provide assistance in developing interpretive concepts.
- 11.14.3 Signage types and themes are designed and sited in accordance with the DG 11.5 Open space model design guides and [Council's Parks Embellishments Guide](#). Note each Town may be subject to a different

signage theme, particularly in high profile Regional or District parks, therefore, designers should collaborate with Council in these instances.

## DG 11.15 Lighting

- 11.15.1 Lighting requirements within parks are in accordance with DG 11.5 Open space model design guides and [Council's Parks Embellishments Guide](#).
- 11.15.2 As a guide, the following lighting is required:
  - 11.15.2.1 Solar pole light to illuminate park entrances
  - 11.15.2.2 Bollard lighting to delineate pathways at 20m centres or pathway divergences
  - 11.15.2.3 adequate lighting of picnic infrastructure with pole or in-built shelter lighting
  - 11.15.2.4 uplighting of significant trees within Linear, District or Regional parks, to promote amenity and safety of areas beyond pathways

Note – Lighting requirements may vary depending upon the shape, park classification alignment of the park, and the presence of existing vegetation, considering CPTED safety principles.

- 11.15.3 Generally, parks should be well lit providing a safe nocturnal environment for local users, illuminating park entrances, picnic infrastructure and along key pathways in a manner that avoids spill into adjoining residential premises.
- 11.15.4 Underground power should be provided to each light. Light fittings should be vandal resistant and provided in accordance with [Council's Parks Embellishments Guide](#).
- 11.15.5 Pathways or cycle ways within parks that require lighting shall be lit to the minimum lighting category P3 or above as deemed appropriate from the selection criteria tabled in AS/NZS 1158.3 Pedestrian area (Category P) lighting.
- 11.15.6 Where adjoining Beaches utilised by sea turtles, lighting avoids direct illumination of the beach, ocean and sky at night utilising fittings, shields or low bollard lighting.

Note – Applicants should adhere to the [State Governments Sea Turtle Sensitive Area Code](#) and the [Department of Environment and Energy: National Light Pollution Guidelines for Wildlife](#) when developing lighting adjoining beaches that may be utilised by Sea Turtles. Contact Council to determine what Beaches may be turtle habitat.



Figure 9.8.21: Turtle sensitive lighting (Department of Environment and Energy)



## DG 11.15 Provision of Water

- 11.15.7 Facilities for drinking, such as drinking tap / bubbler, shall be designed and sited in each park area in accordance with DG 11.5 Open space model design guides and [Council's Parks Embellishments Guide](#).
- 11.15.1 Drinking fountains should be located near active recreational areas, adjacent to a well-used access route, and within an area serviceable from the road frontage. A soak-away trench shall be provided to the base of each tap to prevent ponding and waterlogging.
- 11.15.2 In order to irrigate the park, 1 water meter connection is to be provided, sized appropriately for the size of the park.
- 11.15.3 As an alternative, irrigation may be provided, on condition that the proposed system complies with the Council Standard Specification for Irrigation.

## DG 11.16 Water Features

- 11.16.1 Water features should not be included in infrastructure to be handed to Council.

## DG 11.17 Playgrounds

- 11.17.1 To ensure play equipment is as safe as possible and appropriate for the intended users, it should conform to the current and relevant Australian Standards for playgrounds and play areas and additional standards as may be established by Council.
- 11.17.2 Where playground equipment is required by Council as a condition of the development permit of the subdivision, or proposed to be installed by the developer, the following requirements should be considered and incorporated into the design:
- 11.17.2.1 Type of play equipment proposed should be selected in consultation with Council and in accordance with DG 11.5 Open space model design guides and [Council's Parks Embellishments Guide](#);
- 11.17.2.2 The age range of the users should influence the type of equipment provided, as per with DG 11.5 Open space model design guides and [Council's Parks Embellishments Guide](#); and
- 11.17.2.3 The siting of the playground should not infringe upon adjacent residential properties; a minimum distance of 10 metres between equipment and park boundaries should be provided and suitably landscaped with a minimum of 3 metre of screen planting to reduce noise and visual impact. Such landscaping is to be consistent with CPTED Principles.
- 11.17.3 To conform to safety requirements, impact absorbing surfacing should be installed to the play area, e.g. certified sand softfall or rubber softfall .

- 11.17.4 Shade cover over playgrounds is to be provided, in order to encourage day long use. Preferably this should be a permanent soft sailshade structure approved by Council in accordance with Council's Parks Embellishments Guide, however shade trees planted at maximum 6 metre centres around the safety area are acceptable.
- 11.17.5 The provision of seating overlooking the playground will be required.
- 11.17.6 Bench seating should be replas recycled plastic, as per the [Council's Parks Embellishments Guide](#).

#### DG 11.18 Maintenance

- 11.18.1 The design of a park should carefully consider long-term maintenance requirements and adhere to design performance criteria DG 11.5 Open space model design guides and [Council's Parks Embellishments Guide](#).
- 11.18.2 Mulched garden beds are preferred, rather than numerous small trees and shrubs planted individually throughout the grassed areas.
- 11.18.3 Where single shade trees occur they should be mulched to 100 mm depth in a minimum 1.2 metre diameter circle, thus avoiding damage to trunks by mowers or whipper snippers.
- 11.18.4 Access to the parks, drainage reserves and public open spaces for maintenance vehicles should be via a lockable gate or removable bollards.
- 11.18.5 A maintenance programme is required to be submitted to Council with the submission of the landscape designs. The programme should be prepared by the Landscape Architect / Designer and should detail all proposed maintenance works.

#### DG11.19 Irrigation

- 11.19.1 All irrigation systems connected to Council's water supply shall be designed and installed to satisfaction of Council by a suitably qualified professional. The installation of water meters, backflow prevention device and isolation valves are mandatory in all irrigation system. Refer AS 3500.

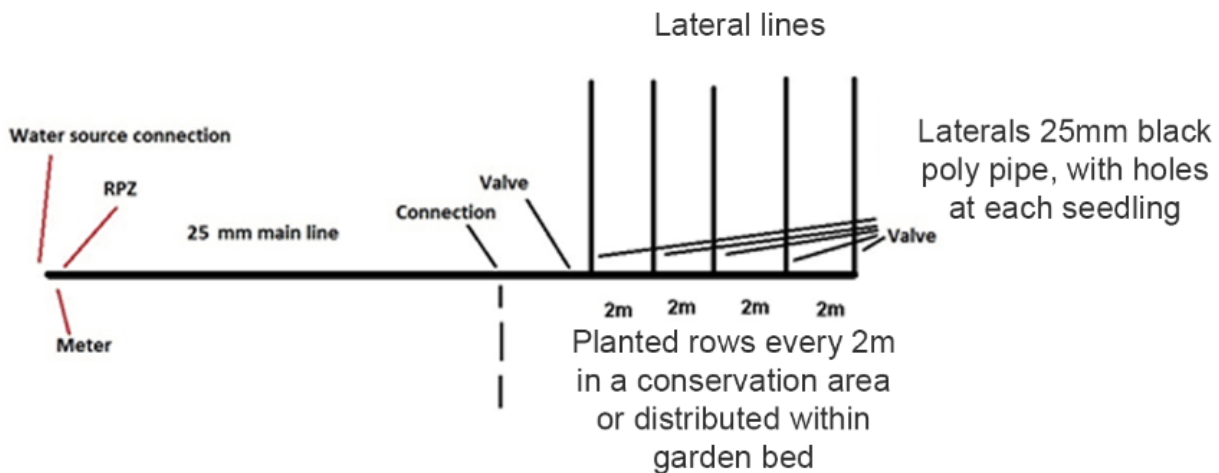
Note – Suitably qualified person to design and install irrigation must be licenced for irrigation by the [QBCC](#). Design may also be completed by an experienced landscape architect.

- 11.19.2 The installation of an irrigation system to all landscaped traffic islands, re-vegetation conservation areas and roundabouts is mandatory.
- 11.19.3 An irrigation plan prepared by an irrigation consultant, shall be submitted to Council for approval together with the landscaping plans, and the proposed planting plans for the traffic islands / roundabouts.
- 11.19.4 The design of all watering systems must ensure an efficient and economical application of water, achieving at least a 90% survival rate of new plantings. Such systems are to be designed to use low water application, and shall run only during Council's nominated times:
  - 11.19.4.1 Irrigation controller box is set to provide water to seedlings for 1hr a day during the dry season (May – December),

and 1hr every 2 days during the wet season (January – March).

- 11.19.5 The irrigation system shall use the following components and shall be installed in accordance with Council Specifications:
- 11.19.5.1 A backflow prevention unit, installed to the requirements of AS 3500;
  - 11.19.5.2 25mm or 32mm or 40mm diameter blue line poly pipework (as required) or PN12 pipe to garden bed areas, laid in a ring around the periphery of each garden bed;
  - 11.19.5.3 For turf, pop up sprinklers located to provide sufficient coverage of grassed areas whilst minimising spray of recreational infrastructure;
  - 11.19.5.4 For garden beds, pop-up sprinklers to periphery of garden, spraying inwards; or
  - 11.19.5.5 For re-vegetated conservation areas designed in accordance with DG 11.5.14 model design code, lateral lines are 2m apart with a small hole placed at/near seedling in polypipe line, as per Figure 11.19.5 below. Sprinklers are generally not supported in densley planted conservation areas, as irrigation spread is blocked by dense vegetation and water efficiency is lower;
  - 11.19.5.6 Automatically operated controller in PVC box laid flush with finished ground level.

Figure 11.19.5: Example re-vegetated conservation area irrigation system.



- 11.19.6 All irrigation pipework installed under roadways shall be laid in minimum 100mm dia. uPVC Class 9 conduit.
- 11.19.7 The water connection and installation of the irrigation system shall be carried out by Council personnel or an approved contractor at the developers / applicants cost. The maintenance period for irrigation works shall be 12 months and shall run concurrently with the "On Maintenance" / establishment period for landscaping works. Thereafter all maintenance and watering will be the responsibility of the Council.
- 11.19.8 The installation of an irrigation system on Council property, other than buffer mounds, traffic islands/verges, re-vegetation areas and roundabouts, will not be permitted unless:

- 11.19.8.1 The system is separate from the development and all pipework is located adjacent to the kerb and channel; and
- 11.19.8.2 Or the verge is irrigated from sprinklers that fall within the development property boundaries.

11.19.9 These requirements have come about in order to prohibit the installation of water lines across the underground services located within the verge. These water lines would not appear in Council records and are therefore at risk of breakage during service repair work/trench excavation.

11.19.10 If a separate irrigation system within the verge is desired, the developer will be required to pay all installation costs, which include:

- 11.19.10.1 Tapping into main;
- 11.19.10.2 Installation of 25mm diameter (typical) backflow prevention device;
- 11.19.10.3 Installation of pipework and pop-up sprinklers; and
- 11.19.10.4 Installation of solenoid valves and automatic controller.

## SG – Specification Guidelines

### SG 1 – Earthworks

#### General

#### SG 1.1 Scope

- 1.1.1 This specification details all requirements pertaining to earthworks operations associated with construction sites. This specification excludes earthworks associated with roadworks construction.
- 1.1.2 Where there is any conflict determined between the requirements specified herein and the requirements of any referenced Australian Standard, Statutory Authority Standards or otherwise, the requirements specified herein shall apply.
- 1.1.3 Where there is any conflict determined between the requirements specified herein and the requirements of any referenced Australian Standard, Statutory Authority Standards or otherwise, the requirements specified herein shall apply.

#### SG 1.2 Reference Documents

- 1.2.1 Australian Standards:
  - 1.2.1.1 AS 3798 Guideline on Earthworks for Commercial and Residential Developments
  - 1.2.1.2 AS 4419-2018 Soils for Landscaping and Garden Use
  - 1.2.1.3 AS 4454-2012 Composts, soil conditioners and mulches
  - 1.2.1.4 AS 4678 - Earth Retaining Structures

#### Materials

#### SG 1.3 Topsoil

- 1.3.1 Topsoil is defined as surface soils normally high in organic matter and contaminated by residual grass seed and grass roots. Topsoil, in accordance with AS 4419-2018 Soils for Landscaping and Garden Use, shall be free from large roots, stones, rocks and unsuitable material as defined below.

## SG 1.4 Unsuitable Material

- 1.4.1 Reference is made to AS 3798 Section 4.2 "Unsuitable Materials" for definitions and guidelines regarding unsuitable materials with regard to earthworks operations.

## SG 1.5 Suitable Material

- 1.5.1 Reference is made to AS 3798 Section 4.3 "Suitable Materials" for the definition and guidelines regarding acceptable materials for earthworks operations.

## Construction

### SG 1.6 General

- 1.6.1 Specific reference is made to AS 3798 in relation all activities pertaining to earthworks operations. Specific construction details are noted in Section 6 of AS 3798 and all appropriate methods of testing, frequency of testing and reporting procedures are to be in accordance with this Australian Standard.

### SG 1.7 Protection of Earthworks

- 1.7.1 The Contractor's responsibility for care of the works shall include the protection of earthworks in accordance with the approved Erosion and Sediment Control Strategy.
- 1.7.2 The Contractor shall install effective erosion and sedimentation control measures, prior to commencing earthworks, and shall maintain these control measures as required.
- 1.7.3 Adequate drainage of all working areas shall be maintained throughout the period of construction to ensure run-off of water without ponding, except where ponding forms part of a planned erosion and sedimentation control system.
- 1.7.4 When rain is likely or when work is not proposed to continue in a working area on the following day, precautions shall be taken to minimise ingress of any excess water into earthworks material. Ripped material remaining in cuttings and material placed on embankments shall be sealed off by adequate compaction to provide a smooth tight surface.
- 1.7.5 Should insitu or stockpiled material become over wet as a result of the Contractor not providing adequate protection of earthworks, the Contractor shall be responsible for replacing and/or drying out the material and for any consequent delays to the operations.

## SG 1.8 Clearing and Grubbing

- 1.8.1 Clearing and grubbing operations shall be in accordance with AS 3798 Section 6.1.4.
- 1.8.2 The extent of clearing and grubbing shall be taken to mean the removal and disposal of:
  - 1.8.2.1 Trees, Shrubs and overhanging branches, both living and dead;
  - 1.8.2.2 Tree stumps and roots to a depth not less than 300mm below ground surface;
  - 1.8.2.3 Rocks, rubbish and other artificial obstructions from the ground surface;
  - 1.8.2.4 Abandoned services to a depth not less than 300mm below ground surface;
  - 1.8.2.5 Old foundations, buildings and structures;
  - 1.8.2.6 Minor made structures (such as fences);
  - 1.8.2.7 Other materials, which are unsuitable for use in the works.
- 1.8.3 Un-grubbed rocks under embankments may be left undisturbed providing there is a depth of at least 600mm of earth covering over them when the filling operations are completed.
- 1.8.4 Unless otherwise specified or directed, the area to be cleared is the minimum width required to construct the works plus a margin of 2m beyond tops of cuts and toes of embankments. The area to be cleared and grubbed should be shown on a plan, preferably the Erosion and Sediment Control Plan.
- 1.8.5 Any trees, shrubs and overhanging branches identified on the Project Drawings to be retained or protected shall be clearly marked by the contractor prior to commencing clearing operations.
- 1.8.6 Beyond the areas to be cleared only those trees, shrubs and over hanging branches which directly interfere with the construction of the works shall be removed or pruned as necessary.

## SG 1.9 Topsoil Operations

- 1.9.1 Stripping of topsoil shall be in accordance with AS 3798 Section 6.1.5.
- 1.9.2 Removal of topsoil shall only commence after erosion and sedimentation controls have been implemented and when clearing, grubbing and disposal of materials have been completed on that section of the Works.
- 1.9.3 Topsoil throughout the extent of the work shall be removed and stockpiled separately clear of the work with care taken to avoid contamination by other materials.
- 1.9.4 Topsoil material stripped from the site shall be stockpiled for later use in spreading on footpaths, allotments and parkland areas.
- 1.9.5 Topsoil stockpiles shall not contain any timber or other rubbish and shall be trimmed to a regular shape.
- 1.9.6 To minimise erosion, stockpiles are to be protected by effective usage of erosion and sediment control devices, which are to be defined within the Erosion and Sediment Control Management Plan.

- 1.9.7 Where seeding of stockpiles to encourage vegetation cover is specified, such work shall be carried out in accordance with the Specification S8 LANDSCAPING.
- 1.9.8 Nominally 75mm depth of topsoil is to be re-spread over such areas with an absolute minimum of 40mm material to be provided in any one location.

### SG 1.10 General Earthworks

- 1.10.1 Placement and Compaction of earthworks shall be in accordance with AS 3798 Sections 5 and 6.
- 1.10.2 The methods of testing and frequency of testing shall be in accordance with AS 3798 Sections 7 and 8.
- 1.10.3 Unless a higher level of testing is specified or directed the minimum level of geotechnical testing services to be accorded earthworks activities shall be as determined by Level 2 in Appendix B of AS 3798.
- 1.10.4 All testing is to be carried out by a NATA registered laboratory with appropriate accreditation and suitably qualified personnel.

### SG 1.11 Excavations

- 1.11.1 Materials encountered in excavation shall be loosened and broken down as required so that they are acceptable for incorporation in the works.
- 1.11.2 All excavations shall be constructed to the shape and slopes shown on the approved Project Documents.
- 1.11.3 Batter shall be trimmed neatly to the shapes specified and shall be free of loose or unstable material.
- 1.11.4 Horizontal tolerances for the excavation of batters, measured at right angles to the batter line, shall be – 50mm +250mm (where the + tolerance is in the direction which increases the width of excavation).
- 1.11.5 Vertical tolerances for all excavation shall be  $\pm 50$ mm.6. When completed all culvert excavations, benches, berms and drains shall be free draining.
- 1.11.6 At all times the requirements of the Workplace Health and Safety Act shall be complied with and all works shall be made safe during the performance of such activities.

### SG 1.12 Embankments/Fill Areas

- 1.12.1 All embankments and fill areas shall be constructed to the shape and slopes shown on the approved Project Documents.
- 1.12.2 When completed, the average planes of the batters of embankments shall conform to those shown on the approved Project Documents.
- 1.12.3 Horizontal tolerances for the embankment batters, measured at right angles to the batter line, shall be – 0mm +250mm (where the + tolerance is in the direction which increases the width of embankment).
- 1.12.4 Vertical tolerances for all embankments / fill areas, shall be  $\pm 50$ mm except where such fill defines the subgrade level for a structure, then the vertical tolerances are to be +15mm – 30mm.



- 1.12.5 When completed all embankments / fill areas shall be free draining.
- 1.12.6 At all times the requirements of the Workplace Health and Safety Act shall be complied with and all works shall be made safe during the performance of such activities.
- 1.12.7 Stabilise final embankment and fill areas with suitable revegetation, landscaping, turf or grass seeding. These areas and works should be shown in the landscape plans.

## SG 1.13 Trenching Operations

- 1.13.1 The excavation for trenches shall be taken out to the exact alignment, width and level as shown on the Project Drawings and associated specifications.
- 1.13.2 Trenches shall not be excavated wider than the dimensions shown on these relevant drawings and the Contractor shall take all precautions as necessary to ensure that the excavation is made in a careful manner and that it is rendered secure and safe by all appropriate means.
- 1.13.3 At all times the requirements of the Workplace Health and Safety Act shall be complied with and all works shall be made safe during the performance of such activities.
- 1.13.4 Suitable drainage shall be accorded to all trenching activities and de-watering of trenches shall be undertaken should infiltration of water occur. All materials excavated from trenches shall be separated by material type for latter inclusion into the works or disposal from the site should these materials be deemed unsuitable in accordance with the requirements of AS 3798.
- 1.13.5 Excavation and trenching operations shall proceed with sufficient resources to ensure uninterrupted progress and continuance of the works with subsequent services. Completion and backfilling are to be undertaken as soon as possible to minimise the extent of site open to the effects of the environment.

## SG 2 – Road Pavements

### General

#### SG 2.1 Scope

- 1.1.1 This specification details all requirements pertaining to the construction of flexible road pavements, including kerbing, subsoil drainage and trimming of verges.
- 1.1.2 Where there is any conflict determined between the requirements specified herein and the requirements of any referenced Australian Standard, Statutory Authority Standards or otherwise, the requirements specified herein shall apply.

## SG 2.2 Reference Documents

- 2.2.1 Australian Standards:
  - 2.2.1.1 AS1289 Methods of Testing Soils for Engineering Purposes
  - 2.2.1.2 AS2439.1 Perforated Drainage Pipe and Associated Fittings
  - 2.2.1.3 AS3706.7 Determination of Pore-sized Distribution – Dry Sieving Methods
- 2.2.2 All Australian Standards referenced in this specification shall be the current edition.
- 2.2.3 Department of Main Roads Standard Specifications
  - 2.2.3.1 MRS 11.03 Drainage, Retaining Structures and Protective Treatments
  - 2.2.3.2 MRS 11.04 General Earthwork
  - 2.2.3.3 MRS 11.05 Unbound Pavements
  - 2.2.3.4 MRS 11.11 Sprayed Bitumen Surfacing (Excluding Emulsions)
  - 2.2.3.5 MRS 11.14 Road Furniture
  - 2.2.3.6 MRS 11.17 Bitumen
  - 2.2.3.7 MRS 11.19 Bitumen Cutter and Flux Oils
  - 2.2.3.8 MRS 11.20 Cutback Bitumen
  - 2.2.3.9 MRS 11.22 Supply of Cover Aggregate
  - 2.2.3.10 MRS 11.30 Dense Graded Asphalt Pavements
  - 2.2.3.11 MRS 11.45 Pavement Marking Department of Main Roads Publications
  - 2.2.3.12 Manual of Uniform Traffic Control Devices)

## SG 2.3 Pavement Material

- 2.3.1 Pavement materials used for pavement construction shall comply with Table S2.1 unless otherwise approved by the relevant authority.

**Table S2.1 Pavement Materials**

<b>Pavement Material</b>	<b>Type of Material Permissible</b>	<b>Grading</b>	<b>CBR (Minimum)</b>
<b>Subgrade Replacement</b>	Type 2.5	B, C or D	15
<b>Sub-base (for Laneway/Local Access/ and Access Streets)</b>	Type 2.3	B, C or D	45
<b>Sub-base (for all roads of Major Collector or higher in the hierarchy)</b>	Type 2.2	B, C or D	60
<b>Base (for Laneway/Local Access and Access Streets)</b>	Type 2.2	B, C or D	60
<b>Base (for all roads of Major Collector or higher in the hierarchy)</b>	Type 2.1	B or C	80

- 2.3.2 All references to material type in the above table refer to the Main Roads Standard Specification MRS11.05 "Unbound Pavements".
- 2.3.3 All materials shall be sourced from a Quality Assured material supplier and the results of the manufacturer's testing to assure the quality of the product shall be incorporated with the Contractor's Quality records.

#### SG 2.4 Asphaltic Concrete Surfacing

- 2.3.4 For surfacing on pavements with nominal depth 30mm, the material quality requirements, material quality compliance testing requirements and all other matters pertaining to Asphaltic Concrete road pavement surfacing shall conform to the requirements as specified in Austroads.
- 2.3.5 For surfacing on pavements with nominal depths greater than 30mm, the material quality requirements, material quality compliance testing requirements and all other matters pertaining to Asphaltic Concrete road pavement surfacing shall conform to the appropriate Main Roads Standard Specification (Main Roads Specification MRS 11.30 "Dense Graded Asphalt Pavements").

#### SG 2.5 Sprayed Bitumen Surfacing

- 2.5.1 For surfacing of pavements with sprayed bitumen. the material quality requirements, material quality compliance testing requirements and all other matters pertaining to hot bitumen road pavement surfacing shall conform to the appropriate Queensland Department of Main Roads Specification:
  - 2.5.1.1 Main Roads Specification MRS 11.11 "Sprayed Bitumen Surfacing (Excluding Emulsions)"
  - 2.5.1.2 Main Roads Specification MRS 11.17 " Bitumen"
  - 2.5.1.3 Main Roads Specification MRS 11.19 " Bitumen Cutter and Flux Oils"
  - 2.5.1.4 Main Roads Specification MRS 11.20 " Cutback Bitumen"
  - 2.5.1.5 Main Roads Specification MRS 11.22 "Supply of Cover Aggregate"

#### SG 2.6 Concrete Interlocking Pavers

- 2.6.1 Concrete interlocking pavers shall be manufactured and supplied in accordance with the requirements of Specification S3 SEGMENTAL PAVING.

#### SG 2.7 Road Furniture

- 2.7.1 The manufacture, supply and material requirements appropriate to the specification for Road Signs and guidepost shall be as per the Main Roads Standard Specification "MRS11.14 Road Furniture".
- 2.7.2 All signs to be Class 1 reflectivity.

- 2.7.3 Signs located in concrete islands or medians shall be supplied with the “V Loc” socket system and fitted with anti-theft bolts.

## SG 2.8 Pavement Marking

- 2.8.1 The manufacture, supply and material requirements appropriate to the specification for Pavement Marking shall be as per the Main Roads Standard Specification "MRS11.45 Pavement Marking".

## Construction

### SG 2.9 Inspection, Sampling & Testing

- 2.9.1 Inspection, sampling and testing of the pavement shall be in accordance with the requirements of this specification before, during and after the construction of the pavement.
- 2.9.2 All testing shall be carried out by a NATA registered laboratory with appropriate accreditation and suitably qualified personnel.

### SG 2.10 Setout

- 2.10.1 The construction set-out for roadworks construction shall be by reference to a datum line established by a Registered Surveyor. The datum line may be either the road centreline, a pegged chainage offset line or any alternative datum suitable for the purposes of accurately setting out the roadworks in accordance with the drawings for the works.

### SG 2.11 Clearing & Grubbing

- 2.11.1 All clearing and grubbing works shall be in accordance with the Specification for SG 1 EARTHWORKS.

### SG 2.12 Topsoil Operations

- 2.12.1 All topsoil operations associated with roadworks construction (topsoil stripping, stockpiling and re-spreading), shall be in accordance with the Specification for SG 1 EARTHWORKS.

## SG 2.13 Earthworks

- 2.13.1 All earthworks operations up to subgrade level shall comply with the requirements detailed in Main Roads Standard Specification MRS11.04 "General Earthworks".

## SG 2.14 Trim and Compact Subgrade

- 2.14.1 The subgrade material is defined as the top 300mm of earthworks profiled and compacted upon which pavement materials are to be placed. The subgrade material shall be compacted in accordance with the requirements detailed in Main Roads Standard Specification MRS11.04 "General Earthworks", with the testing frequency and requirements are detailed herein.
- 2.14.2 The subgrade material shall be compacted to provide a relative compaction determined by AS1289 for a standard compactive effort as follows:
- 2.14.2.1 Minimum Dry Density Ratio (Cohesive soils) - 98%
  - 2.14.2.2 Minimum Density Index (Cohesion less soils) - 80%
- 2.14.3 Testing frequency not less than one (1) test per 1000m<sup>2</sup> with a minimum number of three (3) tests per sample area being tested.
- 2.14.4 At least one (1) sample area shall be tested for type of subgrade material evident on site.
- 2.14.5 The subgrade material shall not include any "Unsuitable Material" as defined in Main Roads Standard Specification MRS 11.04 "General Earthworks" and shall be trimmed to the profile required to conform with the Project Drawings and the tolerances specified herein.
- 2.14.6 Where unsuitable material is encountered in the subgrade, a suitable "Subgrade Replacement Material" in accordance with the requirements of this specification shall be incorporated in the works.
- 2.14.7 In this instance, the unsuitable material shall be excavated to a level sufficient to obtain a sound foundation for the pavement. The compaction requirements and testing frequency noted previously shall apply to all operations involving any subgrade replacement material required for the works.
- 2.14.8 The tolerances appropriate to the construction of subgrade and to subgrade replacement material shall comply with the following:
- 2.14.8.1 Design Level Tolerance +15mm, - 30mm
  - 2.14.8.2 Shape Tolerance of 25mm maximum deviation from a 3m straight edge laid in any direction.
- 2.14.9 Following completion of subgrade compaction, trimming, and satisfactory density testing, the whole of the subgrade area shall be inspected by proof rolling with a fully loaded single rear axle truck with a minimum axle loading of 8 tonne (or acceptable equivalent). Acceptable proof rolling shall be taken to be no visible signs of deformation or instability in the subgrade.

## SG 2.15 Pavement Courses

- 2.15.1 The pavement course materials (Base Course and Sub-base Course) shall be transported from the material supplier to the spreading area without segregation and shall be placed at the correct moisture content.
- 2.15.2 The pavement course materials shall be spread in uniform loose layers on the prepared subgrade, subgrade replacement, or sub-base course and compacted to conform with the grades, profiles and cross sections as indicated on the Project Drawings and to the tolerances and compaction standards specified herein.
- 2.15.3 The thickness of any loose layers shall be such that after compaction it shall not be less than 100mm nor more than 200mm thick. Appropriate compaction equipment shall immediately follow the spreading and shaping of the loose materials and under no circumstances shall the materials be allowed to dry out before compaction.
- 2.15.4 After compaction of each pavement course, the whole of the surface shall be watered and rolled with a steel drum roller to give a hard, dense, tightly packed surface free of lenses, compaction planes and caking, in accordance with the tolerances specified herein.
- 2.15.5 No placement of base course material on the sub-base shall commence until the compaction standards and tolerances for construction of the lower layer have been inspected and confirmed satisfactory. [Hold Point].
- 2.15.6 The pavement course material shall be compacted to provide a relative compaction determined by AS1289 for a standard compactive effort as follows:
  - 2.15.6.1 Base Course - 100%
  - 2.15.6.2 Sub-base Courses - 100%
- 2.15.7 Testing frequency not less than one test per 500m<sup>2</sup> with a minimum of four (4) tests per sample area being tested for sand replacement method and two tests per 500 m<sup>2</sup> with a minimum” of eight (8) tests per sample for nuclear test.
- 2.15.8 The tolerances for the construction of the pavement courses shall comply with Table S2.2.

**Table S2.2 Construction Tolerances**

<b>Course</b>	<b>Design Level Tolerance</b>	<b>Layer Thickness Tolerance</b>	<b>Shape Tolerance</b>
<b>Sub-base</b>	+20mm -20mm	+40mm -20mm	25mm in 3m maximum
<b>Base</b>	+10mm -10mm	+15mm -15mm	15mm in 3m maximum
<b>Overall</b>	+20mm -10mm	+20mm -10mm	

### SG 2.17 Asphaltic Concrete Surfacing

- 2.17.1 For Asphaltic Concrete surfacing with a nominal depth 30mm, the construction requirements, method of construction works, and compliance testing requirements for Asphaltic Concrete surfacing, shall be in accordance with Austroads

- 2.17.2 For Asphaltic Concrete surfacing with a nominal depth greater than 30mm, the construction requirements, method of construction works, and compliance testing requirements for Asphaltic Concrete surfacing, shall be in accordance with Main Roads Specification MRS 11.30 "Dense Graded Asphalt Pavements".
- 2.17.3 All roads greater than 10% gradient shall have a 10mm primer seal or applied to the base course prior to the placement of the Asphaltic Concrete. Alternate methods where approved by Council shall be as noted on the approved Project Drawings.
- 2.17.4 The tolerances appropriate to Asphaltic Concrete surfacing shall comply with the following:
  - 2.17.4.1 Design Level Tolerance - +10mm, - 10mm
  - 2.17.4.2 Layer Thickness Tolerance - +15mm, - 0mm
  - 2.17.4.3 Shape Tolerance - 7mm in 3m Maximum (Any direction).

### SG 2.18 Sprayed Bitumen Surfacing

- 2.18.1 The construction requirements, method of construction works, and compliance testing requirements for Hot Sprayed Bitumen surfacing, shall be in accordance with the following Queensland Department of Main Roads Specifications:
  - 2.18.1.1 Main Roads Specification MRS 11.11 "Sprayed Bitumen Surfacing (Excluding Emulsions)"
  - 2.18.1.2 Main Roads Specification MRS 11.17 "Bitumen"
  - 2.18.1.3 Main Roads Specification MRS 11.19 "Bitumen Cutter and Flux Oils"
  - 2.18.1.4 Main Roads Specification MRS 11.20 "Cutback Bitumen"
  - 2.18.1.5 Main Roads Specification MRS 11.22 "Supply of Cover Aggregate"

### SG 2.19 Concrete Segmental Pavers

- 2.19.1 Concrete interlocking pavers shall be constructed in accordance with the requirements of Specification S3 SEGMENTAL PAVING.

### SG 2.20 Kerbing and Channelling

- 2.20.1 Concrete kerb, kerb and channel shall be constructed by a continuous slip form extrusion machine true to line and grade and to the profile for each kerb type in accordance with the Council's Standard Drawing.
- 2.20.2 Kerbing shall be constructed on sub base material compacted to 100% standard compaction as determined in accordance with the relevant Test Methods contained in AS 1289.
- 2.20.3 The finished kerbing shall be well compacted and shall have exposed surfaces free from voids and honeycombing.

- 2.20.4 Contraction joints shall be made at regular intervals not exceeding 3m. The joints shall be made by forming grooves 40mm deep and not more than 6mm wide in all exposed surfaces of the kerb and kerb and channel. All grooves shall be normal to the top surfaces and square to the alignments of the kerb and kerb and channel.
- 2.20.5 The horizontal and vertical alignments of the kerb and kerb and channel shall not vary from the design level by more than + 10mm, provided that:
  - 2.20.5.1 The difference between the deviations from correct levels at any two points 30m apart shall not exceed 30mm
  - 2.20.5.2 The deviation from a straight edge laid parallel to the centreline shall not exceed 10mm in 3m.
- 2.20.6 The invert of all channels shall be finished true to grade and alignment and no channelling in which water is found to pond will be accepted.
- 2.20.7 Any kerb or kerb and channel not true to line or with noticeable kinks, bends or other faults, or not of the required dimensions (considering the tolerances specified herein), may be condemned and shall be broken out and removed from site.

## SG 2.21 Subsoil Drainage

- 2.21.1 Unless otherwise detailed on the Project Drawings subsoil drainage shall be constructed beneath the kerbing on an alignment as shown on Council's Standard Drawing.
- 2.21.2 Subsoil drainage trenches, drainage pipe, backfill material, geotextile shall be constructed in accordance with the requirements of Main Roads Standard Specification MRS 11.03 "Drainage, Retaining Structures and Protective Treatments".
- 2.21.3 Subsoil Drainage cleanouts shall be constructed in accordance with the requirements of Council's Standard Drawing and shall preferably, be located with the upstream flushing point internally within a stormwater gully pit or manhole.

## SG 2.22 Trim Verges and Batters

- 2.22.1 Following completion of all earthworks operations associated with roadworks construction, all verges and fill batters shall be graded and trimmed to the line and level indicated on the Project Drawings. Allowance shall be made in the final trimming operations for topsoiling and grassing activities.
- 2.22.2 Cut batters shall be lightly tined to a depth of 25 - 50mm prior to resspreading of topsoil material.

## SG2.23 Road Furniture and Pavement Marking

- 2.23.1 The construction of all Road Signs and associated Road Furniture shall comply with the requirements of the following:



- 2.23.1.1 Main Roads Standard Specification MRS 11.14 "Road Furniture"
- 2.23.1.2 Main Roads "Manual of Uniform Traffic Control Devices"
- 2.23.1.3 Council's Standard Drawing for Street Name Signs.
- 2.23.1.4 Council's Standard Drawing for Traffic Control Devices.
- 2.23.2 All Pavement Marking shall comply with the requirements of Main Roads Standard Specification MRS 11.45 "Pavement Marking".

## SG 3 – Segmental Paving

### General

#### SG 3.1 Scope

- 3.1.1 This specification details all matters pertaining to the construction of both clay and concrete segmental paving for road pavements, medians, traffic islands, driveways, cycle ways, footpaths and other pedestrian areas.
- 3.1.2 Segmental paving is not a preferred pavement or footpath in public open space or road reserves. Installation of segmental paving to become a Council asset is subject to Council approval. Where approved by Council, the following standards must be complied with.
- 3.1.3 Where there is any conflict determined between the requirements specified herein and the requirements of any referenced Australian Standard, Statutory Authority Standards or otherwise, the requirements specified herein shall apply.

#### SG 3.2 Reference Documents

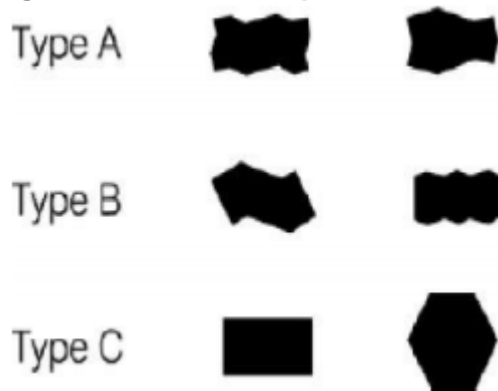
- 3.2.1 Australian Standards
  - 3.2.1.1 AS1012 Method of Testing Concrete
  - 3.2.1.2 AS1141.1 Particle Size Distribution of Dry Sieving
  - 3.2.1.3 AS/NZS4455 Masonry Units and Segmental Pavers
  - 3.2.1.4 AS/NZS4456 Masonry Units and Segmental Pavers – Methods of Test – General Introduction and list of Methods
- 3.2.2 Concrete Masonry Association of Australia Specifications
  - 3.2.2.1 T44 Concrete Segmental Pavements - Guide to Specifying
  - 3.2.2.2 T45 Concrete Segmental Pavements – Design Guide for Residential Access Ways and Roads
  - 3.2.2.3 T46 Concrete Segmental Pavements – Detailing Guide

### Materials

#### SG 3.3 Concrete Segmental Pavers

- 3.3.1 Concrete segmental pavers are units of not more than 0.10 square metres in gross plan area, manufactured from concrete, with plain or dentated sides, with top and bottom faces parallel and with or without chamfered edges.
- 3.3.2 Concrete pavers are identified by shape as being one of the following types:
  - 3.3.2.1 Shape Type A: Dentated chamfered units which key into each other on four sides, are capable of being laid in herringbone bond, and by their plan geometry, when interlocked, resist the spread of joints parallel to both the longitudinal and transverse axes of the units.
  - 3.3.2.2 Shape Type B Dentated units which key into each other on two sides, are not (usually) laid in herringbone bond, and by their plan geometry, when keyed together, resist the spread of joints parallel to the longitudinal axes of the units and rely on their dimensional accuracy and accuracy of laying to interlock on the other faces.
  - 3.3.2.3 Shape Type C Units which do not key together and which rely on their dimensional accuracy and accuracy of laying to develop interlock.
- 3.3.3 Figure S3.1 shows examples of some of the more common shapes.

**Figure S3.1 Paver Shapes**



- 3.3.4 Concrete segmental pavers shall comply with the requirements of T44, T45, T46, and AS/NZS 4455 for each area of application.
- 3.3.5 The material requirements for concrete pavers for each application, derived from T44, are shown in Table S3.1.
- 3.3.6 The pavers shall meet the requirements for the relevant application given in Table S3.1 when tested in accordance with the test methods outlined in AS/NZS 4456.

**Table S3.1 Material Requirement for Concrete Segmental Pavers**

Application	Characteristic breaking load <sup>2</sup> (kN)	Characteristic flexural strength <sup>2</sup> (MPa)	Minimum Thickness (mm)	Shape <sup>3</sup>	Dimensional deviations (Cat AS455)	Abrasion Resistance (mean abrasion]
Residential Driveways	3	2	No Limit	Any	DPA1 or DPB1	7
Light Traffic	5	3	No Limit	Any	DPA1 or DPB1	7
Medium					DPA1 or DPB1	

<b>Traffic<sup>1</sup></b>						
<b>Public Footpaths</b>	5	3	No Limit	Any	DPB2	5
<b>Low Volume High Volume and Pedestrian Malls<sup>1</sup></b>	5	3	No Limit	Any	DPB2	3.5
<b>Roads<sup>3</sup></b>						
<b>All Roads</b>	5	3	80	A	DPB2	5
<b>Notes:</b>						
1. <b>Capable of taking occasional 8.2-t axle loads</b>						
2. <b>At 28 days</b>						
3. <b>Interlocking shapes offer superior performance in road applications</b>						

### SG 3.5 Bedding Sand

- 3.5.1 The bedding sand shall be well graded sand, consisting of clean, hard, uncoated grains uniform in quality, generally passing a 4.75mm sieve and shall conform with the grading limits specified in **Table S3.2**.

**Table S3.2 Bedding Sand Grading Limits**

<b>AS Metric Sieve (mm)</b>	<b>% Passing</b>
9.52	100
4.75	95-100
2.36	80-100
1.18	50-85
0.600	25-60
0.300	10-30
0.150	5-15
0.075	0-10

- 3.5.2 The sand shall be of uniform moisture content when spread. It shall be covered when stored on site to protect it from rain penetration.
- 3.5.3 The bedding sand shall be free of deleterious soluble salts or other contaminants, which may cause, or contribute to, efflorescence.

### SG 3.6 Joint Filling Sand

- 3.6.1 Pavers are compacted in place, prior to applying joint filling sand.
- 3.6.2 The joint filling sand shall be well graded passing a 2.36mm sieve, and shall conform with the grading limits specified in **Table S3.3**.

**Table S3.3 Joint Filling Sand Grading Limits**

<b>AS Metric Sieve (mm)</b>	<b>% Passing</b>
2.36	100
1.18	90-100

0.600	60-90
0.300	30-60
0.150	15-30
0.075	5-10

- 3.6.3 The sand shall be dry when spread. It shall be covered when stored on site to protect it from rain penetration.
- 3.6.4 The sand shall be free of deleterious soluble salts or other contaminants, which may cause, or contribute to, efflorescence.
- 3.6.5 Sand used for bedding is not suitable for joint filling

### SG 3.7 Concrete for Edge Restraints

- 3.7.1 Concrete supplied and placed for the construction of edge strips shall comply with the Specification for SG 7 CONCRETE WORKS.
- 3.7.2 Unless otherwise indicated on the Project Drawings, or where the edge restraint is provided by kerb and / or channel, the concrete used for edge restraints shall have a minimum 28-day characteristic compressive strength of 25MPa for edge restraints to pavers on road pavements and 20MPa for edge restraints to pavers on footpaths, bikeways, and medians.

## Construction

### SG 3.8 Paver Type, Shape, Class and Laying Pattern

- 3.8.1 The choice of concrete pavers shape type, shape name, colour, thickness and laying pattern shall be as shown on the Project Drawings for each area of application.
- 3.8.2 Council will require a minimum stock quantity for future replacements.

### SG 3.9 Subgrade Preparation

- 3.9.1 For road pavements and areas subject to vehicle loads, the subgrade shall be trimmed and compacted to the required depth below finished surface level as shown on the approved Project Drawings and in accordance with Specification SG 2 ROAD PAVEMENTS.
- 3.9.2 Following completion of subgrade compaction and trimming, the whole of the subgrade area shall be inspected by proof rolling with a fully loaded single rear axle truck with a minimum axle load of 8 tonnes (or acceptable equivalent). Acceptable proof rolling shall be taken to be no visible signs of deformation or instability in the subgrade. [Hold Point]
- 3.9.3 For pedestrian and light traffic areas (i.e. footpaths, bikeways and medians) all soft, yielding or other unsuitable material shall be replaced with sound material and the subgrade shall be compacted to provide a minimum of 95

per cent standard compaction as determined by AS 1289.5.4.1 for standard compactive effort. The subgrade shall be trimmed to be  $\pm 30$ mm of the design subgrade level.

### SG 3.10 Subbase/Base

- 3.10.1 Base course for pedestrian and light traffic areas (i.e. footpaths, bikeways, medians) shall be as shown on the Project Drawings, where not otherwise specified the base course shall be a 125mm thick compacted to 95 per cent standard compaction as determined by AS 1289.5.4.1 for standard compactive effort. Base course material shall be minimum of Type 2.3 Pavement Material in accordance with the Specification for SG 2 ROAD PAVEMENTS.
- 3.10.2 For road pavements and areas subject to vehicle loads the subbase and base shall be constructed to the specified thickness and depth below finished surface level, and to the design grade and crossfalls of the finished surface, as shown on the approved Project Drawings in accordance with Specification SG 2 ROAD PAVEMENTS.
- 3.10.3 The base course shall extend in width to at least the rear face of all new edge restraints.
- 3.10.4 Notwithstanding the finished level tolerances contained within Specification SG 2 ROAD PAVEMENTS for base of  $\pm 10$ mm of design levels, the level on the finished surface of the base course for road pavements to be overlain with segmental paving shall be trimmed to within + 10mm or - 0mm of design levels. The deviation from a 3m long straight edge placed anywhere and laid in any direction on the top surface of the base course for all segmental paving shall not exceed 10mm. Sand bedding material shall not be used as a levelling material to compensate for base finishing outside the above tolerances.
- 3.10.5 The finished surface of the base shall drain freely without ponding.

### SG 3.11 Edge Restraints

- 3.11.1 Edge restraints in the form of kerb and / or channel or edge strips shall be constructed along the perimeter of all segmental paving as shown on the approved Project Drawings. Concrete kerb and / or channel and edge strips shall be constructed in accordance with specifications SG 2- ROAD PAVEMENTS and SG 7 CONCRETE WORKS
- 3.11.2 Faces of edge restraints abutting pavers shall be vertical.
- 3.11.3 Edge restraints shall be supported on compacted base and / or subbase of the thickness as shown on the approved Project Drawings. Where not otherwise specified or indicated, the minimum thickness of compacted base beneath the edge restraints shall be 100mm adjacent to road pavements and medians, and 50mm adjacent to footpaths, bikeways and driveways.
- 3.11.4 Unless otherwise shown on the Project Drawings, expansion and contraction joints shall be provided in accordance with Specification SG 7 CONCRETE WORKS.

- 3.11.5 After the concrete has hardened and not earlier than three days after placing, the spaces at the back of the edge restraint shall be backfilled with earth, compacted in layers not greater than 150mm thick, then topsoiled to meet surrounding of design levels.
- 3.11.6 Hidden edge restraints may be used as an alternative for pedestrian and light traffic areas and shall be as detailed on the approved Project Drawings.

### SG 3.12 Sand Bedding Course

- 3.12.1 The sand bedding course shall be spread in a single uniform layer and screeded in a loose condition to the nominated design profile and levels plus that necessary to achieve a uniformly thick nominal 25-35mm layer following final compaction of the segmental paving.
- 3.12.2 Any depressions in the screeding sand exceeding 5mm shall be loosened, raked and rescreeded before laying pavers.
- 3.12.3 Screeded sand left overnight if subject to rain shall be checked for level and rescreeded where necessary before pavers are placed. The sand shall not be screeded more than two metres in advance of the laying face at the completion of work on any day.
- 3.12.4 Drainage of the bedding course shall be as detailed on the approved Project Drawings.

### SG 3.13 LAYING PAVERS

- 3.13.1 Unless otherwise specified, concrete pavers for road pavements shall be placed in herringbone laying pattern.
- 3.13.2 Pavers shall be uniformly placed on the screeded sand bedding to the nominated laying pattern. Pavers shall be placed so that they are not in direct contact with each other and shall have uniform 3mm nominal joint widths.
- 3.13.3 The first row shall be located next to an edge restraint or an established straight line, and laid at a suitable angle to achieve the required orientation of pavers in the completed pavement.
- 3.13.4 In each row, full units shall be laid first. Edge or closer units shall be neatly cut using a paver scour, or mechanical or hydraulic guillotine, and fitted subsequently. Cut pieces of pavers which are smaller in size than one quarter of a full block shall not be used.
- 3.13.5 Manholes, drainage gullies and similar penetrations through the pavement shall be finished against the paving with a concrete surround or apron designed to suit and fit the laying pattern, otherwise complying with the requirements for edge restraints.
- 3.13.6 Any foot or barrow traffic shall use boards overlaying paving to prevent disturbance of units prior to compaction. No other construction traffic shall be allowed on the pavement prior to compaction and provision of joint filling sand.
- 3.13.7 On completion of subsequent bedding compaction and joint filling operations, no more than 10 per cent of joints along any 10 metre line along a major axis of the laying pattern shall have widths outside the range of 2 - 4mm.

### SG 3.14 Bedding Compaction

- 3.14.1 After laying the pavers, the sand bedding shall be fully compacted and the surface brought to design levels and surface profiles by not less than two passes of a high frequency low amplitude plate compactor, which covers at least 12 units. Compaction shall continue until lipping between adjoining units has been eliminated.
- 3.14.2 Any units which are structurally damaged during bedding compaction shall be removed and replaced. The pavement shall then be recompacted for at least one metre surrounding each replacement unit.
- 3.14.3 The paving operations shall be arranged so that the use of the plate compactor proceeds progressively behind the laying face without undue delay, and such that compaction is completed prior to cessation of construction activity on any day. Compaction shall not be attempted within one metre of the laying face except on completion of the pavement against an edge restraint.
- 3.14.4 The finished surface level shall not vary from the design level at any point laid in any direction, by more than 6mm for all road pavements and 8mm for all other areas of segmental paving. Notwithstanding this, the finished surface of the segmental paving, including where the paving abuts an edge restraint other than a drainage inlet, shall not deviate from the bottom of a 3m straight edge laid in any direction, except at grade changes, by more than 6mm for road pavements and 8mm for all other areas of segmental paving.
- 3.14.5 The abutting edges of two adjacent pavers should match, but in no circumstances should they differ by more than 2mm.
- 3.14.6 The surface level of pavers immediately adjacent to surface drainage channels shall finish not less than 5mm nor more than 10mm above the channel edge.
- 3.14.7 All compaction shall be complete and the pavement shall be brought to design profiles before spreading or placing sand filling in the joints.

### SG 3.15 Filling Joints

- 3.15.1 As soon as practicable after bedding compaction, and in any case prior to termination of work on any day, dry sand for joint filling shall be spread over the pavement and the joints filled by brooming.
- 3.15.2 To ensure complete filling of the joints, both the filling sand and pavers shall be as dry as practicable when sand is spread and broomed into the joints.
- 3.15.3 The pavement shall then receive one or more passes of a plate compactor and the joints then refilled with sand, with the process then repeated sufficiently to ensure that the joints are completely filled.

### SG 3.16 Protection of Work

- 3.16.1 Other than wheeled trolleys, forklifts and cluster-clamp vehicles, construction and other traffic shall not use the pavement until bedding compaction and joint filling operations have been completed.

### SG 3.17 Opening to Traffic

- 3.17.1 As soon as practicable after the filling of joints, construction vehicles may use the pavement, and should be encouraged to traverse the greatest possible area of pavement to assist in the development of 'lock-up'.
- 3.17.2 Excess joint filling sand shall be removed prior to opening to traffic.
- 3.17.3 The pavement shall then be inspected by the Contractor at regular intervals up until the expiration of the Defects Liability Period to ensure that all joints remain completely filled.

### SG 3.18 Tolerances

- 3.18.1 Where tolerances for individual components and associated dimensions are not specified on the Project Drawings, deviations from established lines, grades and dimensions in the completed work shall not exceed the values stated herein.
- 3.18.2 The dimensional tolerances as shown in **Table S3.4**

**Table S3.4 Summary of Limits and Tolerances**

Description	Limits/Tolerances
Base	Finished level of base for pavements to be within +10mm or -0mm of design levels.
	Finished level of base other than for road pavements, to be within +/-10mm of design levels.
	Finished level of base other than for road pavements, to be within +/-10mm of design levels
Segmental Paving Units (Joint Widths)	No more than 10% of joints along any 10 metre line of joints along a major axis of the laying pattern shall have widths outside the range 2 – 4mm.
Segmental Paving Units (Surface Level)	Finished surface level of pavers shall not vary from design levels by more than +/- 6mm for road pavements and +/- 8mm for other than road pavements.
	Finished surface of pavers shall not deviate from a 3m straight edge, laid in any direction, by more than 6mm for road pavements and 8mm for other road pavements.
	The abutting edges of two adjacent pavers shall not differ by more than 2mm.
	Finished surface level of pavers adjacent to surface drainage channels shall be no less than 5mm and no more than 10mm above the level of adjacent channel edge.



SG 3.19 Paver Laying Patterns



Stretcher



Zig Zag Running Bond

## SG 4 Stormwater Drainage

### General

#### SG 4.1 Scope

- 4.1.1 The specification details are all the requirements pertaining to the construction of stormwater drainage works.
- 4.1.2 Where there is any conflict determined between the requirements specified herein and the requirements of any referenced Australian Standard, Statutory Authority Standards or otherwise, the requirements specified herein shall apply.

#### SG 4.2 Reference Documents

- 4.2.1 Australian Standards
  - 4.2.1.1 AS1597 Precast Reinforced Concrete Box Culverts
  - 4.2.1.2 AS1650 Hot-Dipped Galvanised Coatings on Ferrous Articles
  - 4.2.1.3 AS1761 Helical Lock-Seam Corrugated Steel Pipes
  - 4.2.1.4 AS2338 Preferred Dimensions of Wrought Metal Products
  - 4.2.1.5 AS2423 Galvanised Wire Fencing Products
  - 4.2.1.6 AS3725 Loads on Buried Concrete Pipes
  - 4.2.1.7 AS4058 Precast Concrete Pipes (pressure and non-pressure)
  - 4.2.1.8 AS4159 Fibre-Reinforced Concrete Pipes and Fittings
  - 4.2.1.9 AS5065 Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications
- 4.2.2 All Australian Standards referenced in this specification shall be the current edition.
- 4.2.3 Department of Main Roads
  - 4.2.3.1 MRS 11.03 Drainage, Retaining Structures and Protective Treatments

### Materials

#### SG 4.3 Steel Reinforced Concrete Pipes (RCP)

- 4.3.1 Pipes shall conform in all respect to AS 4058.
- 4.3.2 Pipes up to and including 600mm diameter can be rubber ring jointed or flush with manufacturer's external bands; pipes larger than 600mm diameter shall be flush jointed with manufacturer's external bands.
- 4.3.3 In locations where the pipes are to be laid in a subgrade of sand or influenced by saltwater, rubber ringed joints shall be used.
- 4.3.4 Pipes laid in areas influenced by saltwater intrusion or acid sulphate soils, or where any part of the pipe is below the Highest Astronomical Tide the pipe

will have cover to reinforcement in accordance with the exposure classification requirements of AS 3600.

- 4.3.5 The class of pipe shall be as specified or shown on the drawings. Minimum of Class "2".

#### SG 4.4 Fibre Reinforced Concrete Pipes (FRC)

- 4.4.1 Pipes shall conform to the AS 4139. Pipes of the same diameter and class can be used in lieu of Steel Reinforced Concrete Pipes.
- 4.4.2 In locations where the pipes are to be laid in a subgrade of sand or influenced by saltwater, rubber ringed joints shall be used.
- 4.4.3 Where rubber ring joints are specified the "V" section rubber ring shall be used and are to be jointed using the manufacturer's lubricant.

#### SG 4.5 Reinforced Concrete Box Culverts (RCBC)

- 4.5.1 Box culverts shall be of the "Inverted U" type unless specified otherwise and shall conform in all respects to the current edition of AS 1597.
- 4.5.2 Box culverts laid in areas influenced by saltwater intrusion or acid sulphate soils, or where any part of the pipe is below the Highest Astronomical Tide the box culvert will have cover to reinforcement in accordance with the exposure classification requirements of AS 3600.

#### SG 4.7 Polypropylene Pipes

- 4.7.1 Pipes shall conform to the AS 5065. Pipes shall only be used within allotments with the prior approval of Council. "As Constructed" drawings shall clearly indicate location of polypropylene pipes. Polypropylene pipes shall not be used within road reserves.

#### SG 4.8 Bedding Materials

- 4.8.1 Concrete and Fibre Reinforced Concrete Pipes:
- 4.8.1.1 Bedding shall consist of clean coarse sand with 100% passing the 19mm AS Sieve and not more than 15% passing the 0.075mm AS Sieve.
- 4.8.2 Reinforced Concrete Box Culverts:
- 4.8.2.1 The bedding material to be used in conjunction with box culverts should conform to the grading specified in the Main Roads Standard Specification MRS11.03.

## SG 4.9 Steel Wire Gabion and Mattress Protection Works

- 4.9.1 Steel wire gabions and mattresses shall be proprietary products manufactured from heavily galvanised hexagonally woven steel-wire mesh and filled with rock conforming to the material requirement specified in Main Roads Specification MRS 11.03.

## SG 4.10 Concrete

- 4.10.1 The concrete and reinforcement used in the construction of gully pits, manholes, headwalls and aprons etc shall comply with Specification SG 7 CONCRETE WORKS.

## SG 4.11 Manhole Covers and Frames

- 4.11.1 Cast iron covers and frames are to be supplied for all stormwater manholes and shall be manufactured and tested in accordance with AS 3996.
- 4.11.2 All openings shall conform to the details on Council's Standard Drawing
- 4.11.3 All covers shall have a raised stud pattern with the letters SW (65mm high) cast into the centre of the lid and "gatic" type lifting holes.
- 4.11.4 Minimum classes of manhole covers shall be as follows:
- 4.11.4.1 Within Residential Properties and Parks - Class B
  - 4.11.4.2 Residential Road Reserves:
    - 4.11.4.2.1 Up to collector street status - Class C
    - 4.11.4.2.2 Trunk Collector or higher - Class D
  - 4.11.4.3 Industrial, Commercial Road Reserves - Class D

## SG 4.12 Grates and Frames

- 4.12.1 Grates and frames of gully pits are to be fabricated from grade 250 steel and shall comply with the requirements of AS 3996 They shall be constructed to the dimensions and details supplied on the Council's Standard Drawing and shall be Hot Dipped Galvanised to the requirements of AS 1650.
- 4.12.2 Grates for structures other than gully pits shall be bicycle safe, and of a classification applicable to its location in accordance with AS 3996.

## SG 4.13 Floodgates

- 4.13.1 Floodgates shall be a proprietary product manufactured from non-corrosive material of a type specified on the approved Project Drawings.

## SG 4.14 Backfill Material

- 4.14.1 Backfill material shall generally be selected fill material, not markedly different in character from the surrounding soil, free from large stones, lumps of clay, topsoil, tree roots and other rubbish. It shall have an even grading free of lumps retained on a 75mm sieve and free of stones retained on a 25mm sieve.
- 4.14.2 Stabilised Backfill material may need to be required when utilising Corrugated Aluminium Alloy Pipes. Where such materials are required, only approved mixes in accordance with the manufacturers recommendations shall be accepted.

## Construction

### SG 4.15 Setout

- 4.15.1 The alignment of the stormwater pipes and position of the gully pits, manholes and headwalls shall be as stated in the approved Project Drawings and set out from a datum line established by a Registered Surveyor. The datum line may be either the road centreline, property boundary, a pegged chainage offset line, or any alternative datum suitable for the purposes of accurately setting out the works.
- 4.15.2 The invert levels of the pipes shall be maintained in strict accordance with site bench marks and only approved and tested equipment shall be used to establish and maintain these levels.

### SG 4.16 Clearing & Grubbing

- 4.16.1 All clearing and grubbing works shall be in accordance with Specification SG 1 EARTHWORKS.
- 4.16.2 Where stormwater lines pass through allotments any trees or obstructions not on the line of the pipes shall be preserved.

### SG 4.17 Trenching

- 4.17.1 All trenching and foundation works necessary for the installation of stormwater drainage works, shall be in accordance with Specification SG 1 EARTHWORKS.
- 4.17.2 Trench or foundation excavation for stormwater drainage works shall be undertaken to the planned level for the bottom of the specified bedding or foundation level. All loose material shall be removed from the bottom of the trench.

- 4.17.3 The width of trenching excavation shall be in accordance with the Council Standard Drawings, the trench base and comply with all regulations of Workplace Health and Safety Act.
- 4.17.4 In undertaking trench excavation, the Contractor shall provide any shoring, sheet piling or other stabilisation of the sides necessary to comply with statutory requirements.
- 4.17.5 Where public utilities exist in the vicinity of stormwater drainage works the Contractor shall obtain the approval of the relevant authority / corporation to the method of excavation before commencing excavation.

#### SG 4.18 Diverting Water and Dewatering

- 4.18.1 During construction all care should be taken to ensure any water, which may interfere with the progress of the works, be diverted to keep the trenches and excavations free from water so as to prevent any damage to the works due to flooding or other causes.
- 4.18.2 The necessary pumping items shall be kept on hand to ensure the excavation is constantly dewatered during the progress of the works.
- 4.18.3 Discharge for dewatering pumps shall be directed to location approved by and to the satisfaction of Council.
- 4.18.4 Care shall be taken to ensure that discharge flows do not cause any flooding, erosion or environmental harm, where necessary appropriate measure shall be put in place to trap and dispose of entrained sediments.
- 4.18.5 In areas where acid sulphate soils are present, discharge flows shall be disposed of and/or treated in accordance with an approved acid sulphates soils management plan.

#### SG 4.19 Bedding

##### General

- 4.19.1 Pipe support and bedding shall be in accordance with AS 3725 for pipe support types shown on the approved Project Drawings. Where the pipe support type is not shown on the Drawings, the minimum pipe support type shall be HS2 within road reserves and H1 elsewhere.
- 4.19.2 The bedding and haunch zone material shall be placed and compacted in accordance with AS 3725, with care be taken around the Haunch zone area to avoid disturbing the position of the pipe. The surface of every pipe should have full and even contact with the bedding material.
- 4.19.3 In trenches with bad ground water conditions and/or unsuitable material the trench should be over excavated to allow a foundation layer of crushed rock material (min. depth 250mm) to be placed to provide an adequate foundation. A geofabric to engineering design should be placed for the full width of the trench and overlapped 450mm prior to placing the bedding material and laying the pipes in this instance.

## Box Culverts

- 4.19.4 Bedding for precast and cast insitu base slabs shall be selected backfill to a compacted depth of 150mm laid to the line and level of the underside of the base slab. The bedding shall be finished to a smooth surface with a tolerance of  $\pm 10\text{mm}$  in level and  $\pm 50\text{mm}$  in line.

## SG 4.20 Lay and Joint Pipes

### Concrete and Fibre Reinforced Concrete Pipes

- 4.20.1 Pipe laying shall begin at the downstream end of the line with the socket or grooved end of the pipe facing upstream. When the pipes are laid, the barrel of each pipe shall be in contact with the bedding material throughout its full length.
- 4.20.2 When elliptical pipes with circular reinforcement or circular pipes with elliptical reinforcement are used, the pipes shall be laid in such a position that the manufacturer's marks, designating the "Top" or "Bottom" of the pipe shall not be more than 5 degrees from a vertical plane through the longitudinal axis of the pipe.
- 4.20.3 External joints shall be taped with the manufacturers supplied tape or rubber external sand bands upon final bedding and alignment.
- 4.20.4 Lifting holes in pipes shall be plugged with mortar, precast tapered concrete / plastic plugs, or other approved means prior to backfill material being placed.
- 4.20.5 Joints shall not be made under water. The trench must be de-watered to facilitate joint making and inspection. Precautions must be taken to prevent erosion of joint material by moving currents of water.
- 4.20.6 Drainage lines shall be constructed with a tolerance of  $\pm 15\text{mm}$  in line or level over any section 30m in length (providing each pipe unit has a fall in the direction of flow) from the alignment and levels shown on the approved Project Drawings.

### Reinforced Concrete Box Culverts

- 4.20.7 The base of the box culvert shall be laid true to line and grade before the crown units of the box culvert segments are laid.
- 4.20.8 All construction methods, tolerances and requirements for box culverts shall conform to the requirements detailed in Main Roads Standard Specification MRS 11.03.

## SG 4.21 Backfill

### Concrete & Reinforced Pipes

4.21.1 Compaction standards for backfill material shall conform to **Table S4.1**.

**Table S4.1 Backfill Compaction**

Location	Minimum Dry Density (Cohesive soils)	Minimum Density Index (Cohesionless soils)
Under Road embankments: >0.3m below pavement subgrade <0.3m below pavement subgrade	95% Standard 98% Standard	65% 80%
Elsewhere	95% Standard	65%

Note: Compaction requirements are with reference to the relevant Test Methods Contained in AS 1289.

- 4.21.2 For trench installations, mechanical compacters shall be used. Where impact tampers are used caution must be exercised not to allow a direct blow on the pipe. The material should be compacted at near optimum moisture content and should be brought up evenly in layers not exceeding 150mm on both sides of the pipe up to 150mm over the pipe. It should not be bulldozed into the trench nor dropped directly on the pipe.
- 4.21.3 Heavy mechanical equipment must not be used for tamping of backfill or be permitted to run over pipelines at shallow depths except at prepared crossing places and where approved.
- 4.21.4 For trenches not contained within the road reserve the trench shall be refilled to natural surface level with fill material placed evenly in 150mm to 300mm layers, tamped thoroughly.
- 4.21.5 The backfilling should be completed as soon as possible after pipe laying, and before the pipeline is charged with water. This will avoid the risk of pipes floating if the trench becomes flooded.

## SG 4.22 Drainage Structures

- 4.22.1 Gullies, manholes and field inlets shall be constructed to the form and dimensions shown on the plans and in accordance with Council's Standard Drawings. Where the ground is solid, back forms need not be used in the construction of drainage structures, the concrete being poured against the earth. Where this is done, the thickness of the wall of such gully or manhole shall be increased to a minimum of 50mm greater than the dimension shown on the plan.
- 4.22.2 The joints between drainage structures and pipes shall be made watertight using cement mortar. The mortar shall be used within one hour of mixing and shall not be retempered. The joints shall be finished to provide smooth surfaces, uniform with the inner surfaces of the structure.



- 4.22.3 Concrete benching shall be shaped as specified and shall have smooth, even surfaces and neat edges. Step irons shall be installed horizontal, vertically in line, and shall project uniformly from the walls, where the depth of the structure is greater than 1.5m.
- 4.22.4 Where step irons are not cast-in-place, they shall be epoxy mortared into drilled holes. The joints between the step irons and the walls shall be completely filled so that the step irons are held rigid and the joints are watertight.
- 4.22.5 Concrete top slabs in Manholes shall be joined to the walls using cement mortar or epoxy mortar. The opening in the top slab shall be closed with temporary covers, after which excavations shall be backfilled. Cast in situ concrete surrounds shall be constructed on the top slabs to encase the frames. Alternatively, precast concrete surrounds may be employed, using epoxy mortared joints. Only approved covers in accordance with this Specification shall be installed in the frames.
- 4.22.6 Temporary covers to Gullies and Manholes may remain in position and installation of the frames and surrounds deferred until pavement construction has reached a stage where the frames and surrounds can be positioned accurately. Where construction is in a staged format, the joint between each pour shall be suitably roughened to ensure an adequate bind and seal is achieved between the successive concrete pours.
- 4.22.7 Compaction of material surrounding drainage structures shall be in accordance with **Table S4.1**.

#### SG 4.23 Steel Wire Gabions and Mattress Protection

- 4.23.1 These proprietary products shall be assembled and installed in accordance with the Main Roads Standard Specification MRS 11.03.

#### SG 4.24 Headwalls, Wingwalls and Aprons

##### **Cast Insitu**

- 4.24.1 Where necessary, localised excavations shall be carried out to allow construction of cast insitu end structures.
- 4.24.2 Cast insitu endwalls, wingwalls and aprons, shall be constructed to the dimensions and other requirements shown on the approved Project Drawings and in accordance with Council's Standard Drawings.
- 4.24.3 Concrete work shall comply with Specification SG 7 CONCRETE WORKS. Construction of endwalls and wingwalls shall include the construction of integral cut-off walls, where required.

##### **Precast**

- 4.24.4 Where necessary, localised excavations shall be carried out to allow installation of precast concrete end structures.

- 4.24.5 End structures shall be laid on foundation bedding, which provides continuous even support to the structures. Foundation bedding material shall be compacted to the relevant standard specified below:
- 4.24.5.1 Cohesive material - to not less than 95% Standard Compaction. □  
Non-cohesive material - to a density index of not less than 65.
  - 4.24.5.2 The joints between end structures and culverts shall be filled with cement mortar. The joint areas shall be thoroughly cleaned and wetted just prior to filling. All points shall be finished smooth and uniform with the surfaces of the end structures.
- 4.24.6 Any holes and recesses provided in end structures to assist installation shall be neatly plugged or filled with cement mortar.
- 4.24.7 Mortared joints and filled holes and recesses shall be cured for a period of not less than 48 hours. Backfill operations against end structures shall not be carried out during this curing period.

#### SG 4.25 Floodgates

- 4.25.1 Floodgates can be sleeved over the end of the pipe, secured with stainless steel bands or fixed to with a flange to headwalls. Installation shall be in accordance with the manufacturers recommendations.

#### SG 4.26 Tolerances

- 4.26.1 Tolerances for the construction of Stormwater Drainage Works shall comply with **Table S4.2**.

**Table 4.2 Construction Tolerances**

Location	Tolerance
Invert Levels	+10mm -10mm
Surface Levels	+50mm - 50mm in Allotments +10mm - 10mm in Roadways
Structure Locations	Within 100mm of design in Allotments or Park Within 50mm of design longitudinally along roadway Within 10mm of design at right angles to road
Crest of Spillway and Detention Basins	Trimmed to +25mm - 10mm

## SG 5 – Water Reticulation

### General

#### SG 5.1 Scope

- 5.1.1 This specification details all matters pertaining to Water Supply Reticulation Construction.
- 5.1.2 Where there is any conflict determined between the requirements specified herein and the requirements of any referenced Australian Standard, Statutory Authority Standards or otherwise, the requirements specified herein shall apply.
- 5.1.3 Aspects of modification or clarification of the Water Supply Code of Australia WSA 03 – 2002 are detailed in Appendix A of Design Guideline – D6.
- 5.1.4 Aspects of modification or clarification of the Water Supply Code of Australia WSA 03 – 2002 – Water Supply Code of Australia – Standard Drawings are detailed in [Appendix A](#) of this document.

#### SG 5.2 Reference Documents

- 5.2.1 Australian Standards:
  - 5.2.1.1 AS1289 Methods of Testing Soils for Engineering Purposes
  - 5.2.1.2 AS1432 Copper Tubes for Plumbing, Gasfitting and Drainage Applications
  - 5.2.1.3 AS/NZS1477 PVC Pipes and Fittings for Pressure Applications
  - 5.2.1.4 AS1646 Elastomatic Seals for Waterworks Purposed
  - 5.2.1.5 AS/NZS1906 Retroreflective Material and Devices for Road Traffic Control Purposes
  - 5.2.1.6 AS2032 Code of Practice for Installation of PVC Pipe Systems
  - 5.2.1.7 AS2033 Installation of Polyethylene Pipe Systems
  - 5.2.1.8 AS2129 Flanges for Pipes, Valves and Fittings
  - 5.2.1.9 AS/NZS2280 Ductile Iron Pressure Pipes and Fittings
  - 5.2.1.10 AS2638 Sluice Values for Waterworks Purposes
  - 5.2.1.11 AS3500 National Plumbing and Drainage Code
  - 5.2.1.12 AS3952 Water Supply – DN80 Spring Hydrant Valve for General Purposes
  - 5.2.1.13 AS/NZS4129 Fittings for Polyethylene (PE) Pipes for Pressure Applications
  - 5.2.1.14 AS/NZS4130 Polyethylene (PE) Pipes for Pressure Applications
  - 5.2.1.15 AS/NZS4765 Modified PVC (PVC-M) Pipe for Pressure Applications
- 5.2.2 Department of Main Roads
  - 5.2.2.1 MRS 11.45 Pavement Marking
- 5.2.3 Water Services Association of Australia
  - 5.2.4 WSA 03 – Water Supply Code of Australia

## Materials

### SG 5.3 Pipes General

- 5.3.1 All pipes used for water main reticulation shall be constructed from the following materials:
  - 5.3.1.1 Polyvinylchloride (PVC) PVC-M Only
  - 5.3.1.2 Polyethylene (PE); or
  - 5.3.1.3 Ductile Iron.

### SG 5.4 Modified PVC (PVC-M)

- 5.4.1 Modified PVC (PVC-M) pipes manufactured in accordance with AS/NZS 4765 by an Australian Standards quality endorsed company may be used as an alternative to PVC-U.
- 5.4.2 PVC pipes 100mm diameter and greater to be Class 16 rubber ring jointed (Ductile iron O.D compatible).
- 5.4.3 Rubber Rings shall be manufactured and tested in accordance with AS 1646. Jointing lubricant in accordance with the manufacturers' specification should be used to facilitate jointing.

### SG 5.5 Polyethylene Pipe

- 5.5.1 Polyethylene pipe shall be manufactured in accordance with AS/NZS 4130 by an Australian Standards quality endorsed company.
- 5.5.2 PE pipes up to 100mm inside diameter to be Class 20
- 5.5.3 Fittings shall comply with AS/NZS 4129.

### SG 5.6 Ductile Iron

- 5.6.1 Ductile Iron pipes shall be manufactured and cement lined in accordance with AS/NZS 2280 by an Australian Standards quality endorsed company.
- 5.6.2 Socketed pipes to be Class K9 suitable for the patented "Tyton" type rubber ring joint. Flanged pipes to be Class K12.
- 5.6.3 Flanges shall comply with AS 2129 Table C. Bolts and nuts for flanged joints shall be in accordance with AS 2129.
- 5.6.4 All pipes and fittings shall be wrapped in a loose polyethylene sleeving 0.25mm thick. Wrapping and taping shall be carried out in accordance with the pipe manufactures recommendations.

### SG 5.7 Bedding Material

- 5.7.1 Bedding Material shall consist of a clean coarse sand free from organic matter, clay, shells and deleterious material with 100% passing the 6.7mm AS sieve and not more than 5% passing a 0.150mm AS sieve.

### SG 5.8 Valves

- 5.8.1 All Valves shall be manufactured in accordance with AS 2638 by an Australian Standards quality endorsed company.
- 5.8.2 Valves of 80mm diameter and larger, are to be coated with a thermosetting epoxy powder to AS 2638 and AS 3952.
- 5.8.3 All 50mm diameter valves shall be DR brass construction with appropriate pressure rating or approved equivalent and certified by QAS to Standards Mark or Water Mark. All valves shall be fitted with bronze tee handles.
- 5.8.4 All valves 80mm and greater to be anti clockwise to close.

### SG 5.9 Hydrants

- 5.9.1 Hydrants shall be the spring hydrant "Maxi Flow" 2000 type (DN80) manufactured in accordance with AS 3952 by an Australian Standards quality endorsed company. Hydrants are to be coated with a thermosetting epoxy powder to AS 2638 and AS 3952.

### SG 5.10 Bends and Tees

- 5.10.1 All bends for mains of 80mm diameter or larger and all other associated fittings shall be constructed in accordance with AS/NZS 2280, and have flanged or spigot and socket type joints as specified on the approved Project Drawings. Where flanges are used, bolts shall be matched sets and conform to the following criteria:
- 5.10.2 In above ground uses, bolts shall be Hot Dipped Galvanised □ In below ground uses, bolts shall be Grade 316 Stainless Steel with nuts and washers Grade 304 stainless steel.
- 5.10.3 All bends, tees and miscellaneous fittings shall be factory nylon powder coated unless otherwise specified.

### SG 5.11 Pavement Marking

- 5.11.1 The manufacture, supply and material requirements appropriate to the specification of pavement marking shall be in accordance with Main Roads Standard Specification "MRS11.45 Pavement Marking".

## SG 5.12 Raised Retro Reflective Marking

- 5.12.1 Raised retroreflective pavement markers used to locate hydrants shall be blue bi-directional markers.
- 5.12.2 The material requirements of the raised retroreflective pavement markers shall be in accordance with Main Roads Standard Specification "MRS11.45 Pavement Marking".

## SG 5.13 Setout

- 5.13.1 The location and sizes of the mains and position of valves and hydrants shall be as stated on the approved Project Drawings.
- 5.13.2 Bends shall be positioned such that the correct alignment is maintained and remains within the allotted service corridor.
- 5.13.3 Where levels are nominated on the approved Project Drawings the Contractor shall ensure the main is laid within the given tolerances and the equipment used to level the main is approved and tested.
- 5.13.4 Alignment of the water main shall be 2.500m off the property boundary, with horizontal centreline deviations permissible provided the main remains entirely within the 450 mm wide footpath allocation.
- 5.13.5 Deflection of water mains is not allowed. Bends are to be used for change of direction.
- 5.13.6 Where a hydrant is placed at the end of a water main which will not be extended in the future, e.g., in cul-de-sac; the hydrant shall be installed with a hydrant bend located adjacent to the boundary of the last property serviced.
- 5.13.7 In cases where the main may be extended in the future, a hydrant tee and dead end shall be used, located as near as practicable (<0.5m) to the development boundary or nearest RP boundary.
- 5.13.8 The maximum spacing of hydrants shall be 80m with hydrants located at all crests, sags and ends of lines in cul-de-sacs.
- 5.13.9 Spring hydrants are to be oriented with bolts parallel to the water main.

## SG 5.14 Clearing and Grubbing

- 5.14.1 All trenching and foundation works necessary for the installation of the pipeline or thrust blocks, shall be in accordance with Specification SG 1 EARTHWORKS.
- 5.14.2 The width of trenching excavation shall be in accordance with the Council's Standard Drawing at the trench base and comply with all regulations of Workplace Health and Safety Act.
- 5.14.3 In undertaking trench excavation, the Contractor shall provide any shoring, sheet piling or other stabilisation of the sides necessary to comply with statutory requirements.

- 5.14.4 Where public utilities exist in the vicinity of water main drainage works the Contractor shall obtain the approval of the relevant authority / corporation to the method of excavation before commencing excavation.
- 5.14.5 The safety of the public shall be considered at all times. Where necessary, fenced walkways and controlled vehicular crossways shall be provided across trenches to maintain access from carriageway to individual properties or within individual properties. All such installations shall be of adequate size and strength and satisfactorily illuminated.
- 5.14.6 In the event of any trenching being left open for longer than one week, the Contractor shall provide erosion control measures to ensure minimal soil disturbance and material loss off the site. Some or all of these measures shall be provided immediately upon the onset of rain with an open trench.
- 5.14.7 The Contractor shall leave a clear space of 600mm minimum between the edge of any excavation and the inner toe of spoil banks. No excavated materials shall be stacked against the walls of any building or fence without the written permission of the owner of such building or fence. Topsoil from excavations shall be kept separate and utilised to make good the surface after backfilling.

#### SG 5.15 Trenching

- 5.15.1 All trenching and foundation works necessary for the installation of the pipeline or thrust blocks, shall be in accordance with Specification SG 1 EARTHWORKS.
- 5.15.2 The width of trenching excavation shall be in accordance with the Council's Standard Drawing at the trench base and comply with all regulations of Workplace Health and Safety Act.
- 5.15.3 In undertaking trench excavation, the Contractor shall provide any shoring, sheet piling or other stabilisation of the sides necessary to comply with statutory requirements.
- 5.15.4 Where public utilities exist in the vicinity of water main drainage works the Contractor shall obtain the approval of the relevant authority / corporation to the method of excavation before commencing excavation.
- 5.15.5 The safety of the public shall be considered at all times. Where necessary, fenced walkways and controlled vehicular crossways shall be provided across trenches to maintain access from carriageway to individual properties or within individual properties. All such installations shall be of adequate size and strength and satisfactorily illuminated.
- 5.15.6 In the event of any trenching being left open for longer than one week, the Contractor shall provide erosion control measures to ensure minimal soil disturbance and material loss off the site. Some or all of these measures shall be provided immediately upon the onset of rain with an open trench.
- 5.15.7 The Contractor shall leave a clear space of 600mm minimum between the edge of any excavation and the inner toe of spoil banks. No excavated materials shall be stacked against the walls of any building or fence without the written permission of the owner of such building or fence. Topsoil from excavations shall be kept separate and utilised to make good the surface after backfilling.

## SG 5.16 Cover

- 5.16.1 Unless noted otherwise on the approved Project Drawings the minimum depth of cover to be provided for mains shall be in accordance with WSA 03 – 2011 Table 7.2 Minimum Depths of Pipe Cover and AS 2032 & AS2566, and:
- 5.16.1.1 Where normal cover for mains is unable to be maintained due to the presence of existing services or other restricting factors ductile iron pipe, may be used, subject to the approval of the Engineer.
  - 5.16.1.2 Main shall not be laid under stormwater, sewerage pipes or electricity conduits unless approved by the Engineer.

## SG 5.17 Crossings

### Major Road Crossings

- 5.17.1 Written approval from the Queensland Department of Transport is required if a main is to be constructed underneath or along a declared Main Road.
- 5.17.2 All road crossings shall have an enveloper pipe and the main shall be grouted in the enveloper pipe.
- 5.17.3 The design and construction of the enveloping conduit must be in accordance with Queensland Department of Transport's "Installation of Underground Conduits within the Boundaries of Declared Roads".

### Crossings of Other Existing Roads and Streets

- 5.17.4 Unless otherwise approved in writing, all crossings of existing roads and streets shall be bored or jacked with no disturbance to the pavement, shoulders or kerb.
- 5.17.5 The Engineer may permit open trenching to streets below Collector, determined by the location, traffic conditions and age of the existing pavement.
- 5.17.6 The details of the crossing, pipe materials and grouting shall be submitted to Council for approval.
- 5.17.7 Crossings of other carriageways shall be trenched unless the Engineer specifies otherwise.

### Railway Crossings

- 5.17.8 Written approval from the Queensland Rail is required if a main is to be constructed underneath a railway line. In such cases the crossing shall generally be designed and constructed in accordance with the requirements of Queensland Rail.



## SG 5.18 Bedding

- 5.18.1 All pipes shall be uniformly bedded in order to ensure solid and uniform support for the full length of the barrel with bell holes formed to accommodate the sockets to ensure a minimum clearance of 20mm.
- 5.18.2 The depth of bedding shall be as detailed on Council's Standard Drawing with the bedding material complying with the "Bedding Material" section of this Specification.

## SG 5.19 Laying and Jointing of Pipes

- 5.19.1 All contractors shall have undertaken a manufacturers pipe laying accreditation course.
- 5.19.2 All pipe lines shall be laid to such lines, offset, gradients and levels as shown on approved Project Drawings.
- 5.19.3 Care shall be taken to preserve uniform gradients and correct alignments. Bends shall be used to effect horizontal and vertical changes of direction.
- 5.19.4 The manufacturers' recommendations for maximum deflection at each joint shall be strictly adhered to, if approval is granted by Council to use deflections.
- 5.19.5 Jointing of pipes, valves and fittings is to be carried out to the manufactures recommendations and in accordance with Australian Standards where applicable.
- 5.19.6 For pipes with rubber ring joints, only the lubricant specified in writing by the manufacturer shall be applied in making the joint. When the joint is made, the witness mark shall at no point be more than 1mm from the end of the socket.
- 5.19.7 Before being laid, all pipes, fittings, valves, etc shall be cleaned and examined by the Contractor.
- 5.19.8 Approved plugs shall be used to prevent foreign matter entering sections of pipeline, which are left uncompleted overnight.
- 5.19.9 The Contractor shall take all necessary precautions to prevent flotation of pipes during laying, backfilling and initial testing. Any temporary supports shall be removed prior to completion of backfilling.
- 5.19.10 Pipes shall be cut as needed to suit closing lengths, to remove damaged pipe or fittings or to remove sockets if necessary when jointing a socketed fitting.
- 5.19.11 For field cuts, only an approved mechanical pipe cutter shall be used, except that uPVC pipes may be cut using a power saw or a fine toothed hand saw and mitre box.
- 5.19.12 Any pipes cut in the field shall have their ends prepared in accordance with the manufacturer's written instructions.
- 5.19.13 Where pipes are cut in the field, a witness mark shall be made on the pipe at the length specified by the manufacturer from the end of the pipe. Scoring of uPVC pipes shall not be permitted.

## SG 5.20 Connection to Existing Mains

- 5.20.1 Ready tap, or equivalent, connection points shall be laid with the main within 300 mm of the side property boundaries.
- 5.20.2 The Ready tap connection point is to be installed with a valve on one side and a bung on the other.

## SG 5.21 Fittings

- 5.21.1 The laying and jointing of mains shall include the fixing in position of all valves of any description, fire hydrants and all other fittings, which are necessary for the completion of the mains.
- 5.21.2 Joints to secure fittings to pipes shall be approved under Australian Standard AS1646.
- 5.21.3 All sluice valves, gate valves, air valves and hydrants shall be carefully placed in the final position so as to be the correct distance from the surface and installed in accordance with Council's Standard Drawings. With air valves and hydrants, risers shall be installed where necessary and if required, trenches shall be deepened and graded in the vicinity of all valves and hydrants in order to secure the correct depth below the surface.
- 5.21.4 Valves, hydrants and specials shall be thoroughly cleaned out prior to installation in main.
- 5.21.5 The spring hydrants shall be bolted to the flange of the hydrant junction so that the bolts of the hydrants are in line with the main, and the hydrant cover box fitted with its long axis along the centre line of the main. Hydrants must be protected during backfilling in such a manner as will prevent earth or grit from damaging the seating. Refer to Council's standard drawing.
- 5.21.6 Hydrants and valves shall be fully protected during laying and backfilling, on completion all glands shall be well screwed down, and all valves shall operate freely.

## SG 5.22 Valve/Hydrant Markers

- 5.22.1 The position of all stop valve, scour valve, air valve and hydrants shall be indicated by a kerb marker plate, painted kerb marker or marker post and raised reflective pavement markers. The type of marker to be installed shall be as stated on the approved Project Drawings.
- 5.22.2 Painted symbols used to indicated hydrants shall be in accordance with Council's Standard Drawing.
- 5.22.3 Kerb marker plates used to indicate valve and hydrant locations shall be fixed to the kerb face it shall be in accordance with Council's Standard Drawing.
- 5.22.4 Kerb and channel shall be stamped or engraved, and posts with marker notice plates are to be located adjacent to each valve, hydrant, air valve and scour valve. The posts are to be located 0.3m on the kerbside of the property alignment unless otherwise directed by the Engineer.

- 5.22.5 Kerb stamping or engraving, and marker plates shall be marked “V”, “H”, “AV” and “S” indicating sluice valve, hydrant, air valve and scour valve respectively shall be installed on the posts.
- 5.22.6 In addition to painted kerb markers / marker posts, all hydrants shall have a road pavement marker to indicate the location of the hydrant. The road pavement marker shall be either a painted teardrop or blue bi directional raised retro reflective pavement marker as stated on the approved Project Drawings.
- 5.22.7 Where a painted teardrop is specified the teardrop shall be painted with a solid yellow enamel paint and be 630mm overall length with 200mm radius base and a 25mm radius tip. The teardrop shall be painted across the centreline of a two-lane road or in the middle of the near side lane of a multi laned road. The tapered end of the teardrop shall point towards the relevant hydrant
- 5.22.8 Where a blue bi-directional raised retro reflective pavement marker is specified it shall be fixed securely to the road pavement opposite the hydrant. On two lane roads, the marker is to be positioned on the road centreline. For multi-lane roads, it is to be positioned on the lane line between the first and second lane.
- 5.22.9 The installation requirements of and pavement makings and raised retroreflective pavement markers shall be in accordance with Main Roads Standard Specification "MRS11.45 Pavement Marking".

### SG 5.23 Anchor Blocks

- 5.23.1 Where a main is installed at a grade of 1 in 6 or steeper, concrete anchor blocks shall be provided in accordance with Council’s Standard Drawing
- 5.23.2 Concrete works shall comply with Specification SG 7 CONCRETE WORKS.

### SG 5.24 THRUST BLOCKS

- 5.24.1 For vertical bends with an upward thrust additional concrete shall be placed so that the mass of concrete is greater than the thrust on the filling. Sufficient steel reinforcement shall be included to bend the weight of the block below the pipe centreline to the upper part of the block. These thrust blocks shall be designed to manufacturer's specifications.
- 5.24.2 Thrust blocks, sized in accordance with the requirements of the Manufactures specifications.
- 5.24.3 Concrete works shall comply with Specification SG 7 CONCRETE WORKS

### SG 5.25 Water Service Connections

- 5.25.1 Connection points shall be laid within 300 mm of the side property boundaries and a maximum of 300mm inside the property boundary.

- 5.25.2 The connection point is to be installed in accordance with Council's Standard Drawings.
- 5.25.3 All services shall be turned on during the testing process.
- 5.25.4 Water service pipe riser material must be Copper (Northern Region) & Stainless Steel (Southern Region).

## SG 5.26 Backfilling and Compaction

- 5.26.1 Material for the side support and overlay of the pipe shall comply with the pipe bedding material specification. The material shall be compacted in layers of not more than 150mm to 95 per cent of the standard maximum dry density of the material used when determined in accordance with AS1289.
- 5.26.2 The remainder of the excavation shall be backfilled with excavated material. The backfill shall be compacted in layers of not more than 150mm thick to 95 per cent of the standard maximum dry density of the material used when determined in accordance with AS1289. Flooding of cohesive material shall not be permitted as a means of compacting backfill.
- 5.26.3 Backfilling and compaction shall be carried out without damaging the pipe or its external coating or wrapping or producing any movement of the pipe.
- 5.26.4 The edges of the trench shall be cut with a clean, straight line prior to excavation. The trench above the approved filling shall be backfilled with approved subgrade replacement material conforming to **Table D3.2** Minimum Pavement Design Criteria, to a level 280 mm below the level of the existing pavement surface, 150 mm and 100 mm separate layers of 1.5% and 3.0% cement stabilised road base Type 2.1 and Type 2.3 shall be compacted over the excavated fill layer, both compacted to 95% relative dry density as determined by Test 5.1.1 of AS 1289 (Standard Compaction), and 30 mm of asphaltic concrete shall be used to complete the trench backfilling. The road shall be restored to a minimum standard stated above or equal to the original standard whichever is greater.
- 5.26.5 Backfill material down to a depth of 300mm below the underside of the pavement material shall be compacted to 95 per cent of the standard maximum dry density of the material used when determined in accordance with AS1289, and backfill material below such depth shall be compacted to not less than 95 per cent of the standard maximum dry density of the material used when determined in accordance with AS1289.
- 5.26.6 In cases other than those covered by the above clause backfilling above the level of 300mm above the top of the pipes in open trenches may be carried out by dumping from mechanical plant into the trench providing that no rock is placed in the trench until the pipes are covered by at least 300mm of soil backfill.
- 5.26.7 Compaction testing shall be carried out at a rate of 1 test for each 150 metres of trench backfilled or in the case where trenches are constructed under road pavements and road shoulders, 1 test for each 25 metres of trench backfilled.

## SG 5.27 Restoration of Surfaces

- 5.27.1 Pavements, lawns and other improved areas shall be cleaned and left in the same order as they were at the commencement of the works. Lawns shall be restored with turf cut and set aside from the original surface and / or with imported turf.
- 5.27.2 All restored surfaces shall be maintained in the condition to which they are restored until the expiry of the Defects Liability Period applicable to those surfaces. Pavements shall be maintained with crushed metal, gravel or other suitable material allowing for consolidation and shall then be restored to a condition equivalent to that of the original pavement.
- 5.27.3 Immediately the backfilling of a trench excavated through a pavement has been completed, the pavement shall be temporarily restored. Where the trench crosses bitumen or concrete pavement, a pre-mixed asphaltic material shall be used for such temporary restoration. Temporary restoration works shall be maintained by the Contractor until final restoration is carried out.
- 5.27.4 Final restoration of the pavement shall be carried out to restore the pavement and its subbase to no less than the original condition. Unless noted otherwise on the approved Project Drawings all trenches excavated through bitumen or concrete pavement shall be sawcut each side to facilitate a neat finish to the final restoration. Final restoration may include, if required, the removal of temporary restoration.
- 5.27.5 Backfill shall be placed sufficiently high to compensate for expected settlement and further backfilling shall be carried out or the original backfill trimmed at the end of the Defects Liability Period in order that the surface of the completed trench may then conform to the adjacent surface. Surplus material shall be removed and disposed of to areas arranged by the Contractor.
- 5.27.6 In locations where surplus material left in the vicinity of the trench would not be objectionable, the surplus material may be disposed by spreading neatly in the vicinity of the trench in such a way as to minimise future erosion of the backfill and adjacent ground surfaces. The Contractor shall maintain the backfill and adjacent ground until the end of the Defects Liability Period.
- 5.27.7 Where, within public or private property, the reasonable convenience of persons will require such, trenches to be levelled off at the time of backfilling. Any subsequent settlement shall be made good by the Contractor, as required by placing additional fill.
- 5.27.8 All tunnels shall be completely backfilled. The space between the outer surface of the pipes, internal lining and the fact of the tunnel excavation shall be backfilled with sand which shall be compacted by flooding. Sand used for backfilling shall comply with the grading requirements for bedding sand as hereinbefore specified.
- 5.27.9 The Superintendent may direct the Contractor to backfill the tunnel with Grade N20 concrete in lieu of sand.

#### SG 5.28 Testing of Lines

- 5.28.1 Hydrostatic pressure testing of all water mains shall be carried out prior to the acceptance of the works and witnessed by the consulting Engineer and a council officer.

- 5.28.2 The contractor shall have carried out a successful test prior to arranging a Council witness test.
- 5.28.3 Pressure testing shall not be carried out during wet weather unless otherwise approved by Council.
- 5.28.4 Before testing a pipeline section, it shall be cleaned and filled slowly with water, taking care that all air is expelled.
- 5.28.5 The minimum test pressure acceptable shall be 1600 KPa unless advised otherwise by the relevant Local Authority and shall be considered to be satisfactory if:
  - 5.28.5.1 There is no failure of any thrust block, anchor block, pipe, fitting, valve, joint or any other pipeline component;
  - 5.28.5.2 There is no visible leakage; and
  - 5.28.5.3 There is no loss of pressure in the 24 hour test period outside of the parameters allowed for under AS2566.2, Constant Pressure Method.
- 5.28.6 The specified test pressure shall be maintained as long as required, while the whole section is examined, and in any case not less than 24 hours.
- 5.28.7 Any failure, defect, and / or visible leakage, which is detected during the pressure testing of the pipeline or during the Defects Liability Period shall be made good by the contractor and re-tested.

### SG 5.29 Flushing

- 5.29.1 Upon completion of pressure testing, lines shall be adequately flushed and water samples taken for testing by a Council approved testing authority to the requirements of the National Health and Medical Research Council (NHMRC).
- 5.29.2 Concentrated chlorinated water flowing into the environment after flushing and pressure testing must be adequately de-chlorinated to acceptable levels between 0.2-0.5 mg/L and ensure the water is not de-oxygenated.

### SG 5.30 Tolerances

- 5.30.1 Tolerances for the construction of water reticulation works shall comply with **Table S5.1**.

**Table S5.1 Construction Tolerances**

Description of Works	Tolerance
Alignment	On the allocated alignment (2500m off property boundary)
Hydrants, fittings	Within 0.3m of design relative to side property boundary
Water service connections / conduits	Extend 300mm behind back of kerb, be laid 100mm below pavement subgrade
Valves	Opposite the nearest RP boundary, spaced at 300m apart

## SG 6 – Sewerage Reticulation

### General

#### SG 6.1 Scope

- 6.1.1 This specification details all matters pertaining to Sewerage Reticulation Construction.
- 6.1.2 Where there is any conflict determined between the requirements specified herein and the requirements of any referenced Australian Standard, Statutory Authority Standards or otherwise, the requirements specified herein shall apply.
- 6.1.3 Aspects of modification or clarification of the codes are detailed in Appendix A of Design Guideline – D7
- 6.1.4 The requirements of this Manual will take precedence over the Water Services Association of Australia Codes
- 6.1.5 Aspects of medication or clarification of the codes Standard Drawings are detailed in [Appendix H](#) and [Appendix I](#).

#### SG 6.2 Reference Documents

- 6.2.1 Australian Standards:
  - 6.2.2 AS/NZS 1260 Unplasticised PVC (UPVC) Pipes and Fittings for Sewerage Applications
  - 6.2.3 AS1289 Methods of Testing Soils for Engineering Purposes
  - 6.2.4 AS1432 Copper Tubes for Plumbing, Gasfitting and Drainage Applications
  - 6.2.5 AS/NZS1477 PVC Pipes and Fittings for Pressure Applications
  - 6.2.6 AS1646 Elastomatic Seals for Waterworks Purposed
  - 6.2.7 AS2032 Code of Practice for Installation of PVC Pipe Systems
  - 6.2.8 AS2129 Flanges for Pipes, Valves and Fittings
  - 6.2.9 AS/NZS2280 Ductile Iron Pressure Pipes and Fittings
  - 6.2.10 AS3500 National Plumbing and Drainage Code
  - 6.2.11 AS3996 Metal Access Covers, Road Grates and Frames
  - 6.2.12 AS4198 Precast Concrete Access Chambers for Sewerage Applications
  - 6.2.13 AS4441 Oriented PVC (PVC-O) Pipes for Pressure Applications
  - 6.2.14 AS/NZS4765 Modified PVC (PVC-M) Pipe for Pressure Applications
  - 6.2.15 AS5065 Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications.
- 6.2.2 QLD Government Legislation:
  - 6.2.2.1 Sewerage and Water Supply Act
- 6.2.3 Water Services Association of Australia:
  - 6.2.3.1 WSA 02 – Sewerage Code of Australia
  - 6.2.3.2 WSA 04 – Sewerage Pumping Station Code of Australia

## Materials

### SG 6.3 Pipes General

- 6.3.1 All pipes used for sewer reticulation shall be constructed from the following materials:
  - 6.3.1.1 Polyvinylchloride (PVC)
  - 6.3.1.2 Ductile Iron.

### SG 6.4 Unplasticised PVC (PVC-U)

- 6.4.1 Unplasticised PVC (PVC-U) pipes and fittings for gravity systems shall be manufactured in accordance with AS1260 suitable for rubber ring joints. Pipe classes shall be in accordance with the manufacturers' recommendation and shall be as shown on the approved Project Drawings.
- 6.4.2 Unplasticised PVC (PVC-U) pipes and fittings for rising mains and suction pipes shall be manufactured in accordance with AS/NZS 1477 minimum Class 12 suitable for rubber ring joints with a mauve coloured pigment.
- 6.4.3 Modified PVC (PVC-M) pipes manufactured in accordance with AS/NZS 4765 by an Australian Standards quality endorsed company may be used as an alternative to PVC-U.
- 6.4.4 Oriented PVC (PVC-O) pipes manufactured in accordance with AS 4441 by an Australian Standards quality endorsed company may be used as an alternative to PVC-U.
- 6.4.5 Rubber Rings shall be manufactured and tested in accordance with AS 1646. They shall be of natural rubber and only those impregnated with a Root Inhibitor shall be used.
- 6.4.6 All pressure mains 100m diameter and greater shall be D.I.O.D compatible.

### SG 6.5 Ductile Iron

- 6.5.1 Ductile Iron pipes shall be manufactured and cement lined in accordance with AS 2280 by an Australian Standards quality endorsed company.
- 6.5.2 Socketed Pipes to be Class K9 suitable for the patented "Tyton" type rubber ring joint. Flanged Pipes to be Class K12.
- 6.5.3 Flanges shall comply with AS 2129 Table C. Bolts and nuts for flanged joints shall be in accordance with AS 2129
- 6.5.4 All pipes and fittings shall be wrapped in a mauve coloured loose polyethylene sleeving 0.25mm thick. Wrapping and taping shall be carried out in accordance with the pipe manufactures recommendations.
- 6.5.5 All bends for mains of 100mm diameter or larger and all other associated fittings shall be constructed in accordance with AS2280, and have flange or spigot and socket type joints as specified on the approved Project Drawings.



Where flanges are used, bolts shall be matched sets and conform to the following criteria:

- 6.5.5.1 In above ground uses, bolts shall be Hot Dipped Galvanised
- 6.5.5.2 In below ground uses, bolts shall be Grade 316 Stainless Steel with nuts and washers Grade 304 stainless steel.

## SG 6.6 Polypropylene Pipes

- 6.6.1 Pipes shall conform to the AS 5065. Pipes shall only be used with the prior approval of Council. “As Constructed” drawings shall clearly indicate location of polypropylene pipes.

## SG 6.7 Bedding Materials

- 6.7.1 After the excavation has been completed, inspected and approved by the Superintendent, the foundation layer of bedding concrete or approved bedding material shall be placed. The minimum bedding depth shall be 100mm of approved material. Refer to Council’s standard drawings
- 6.7.2 Where directed, pipes shall be bedded on Grade N20 concrete cradle or encased in Grade N20 concrete surround or otherwise bedded in accordance with the drawings or such instructions as may be given by the Superintendent in writing.
- 6.7.3 Unless shown otherwise on the drawings, no pipes encased in concrete shall extend more than 150mm beyond the face of that concrete. Short pipes laid in sewers shall not exceed 600mm in length and short pipes laid in house connections shall not exceed 300mm in length.
- 6.7.4 Both approved bedding and approved filling or blanket course to 100mm above the crown of the pipe shall be compacted to 95% of the maximum density as determined by the Standard Compaction Test Department of Transport Q110A 1993.
- 6.7.5 The material used for bedding, surround and cover for pipes shall be sieved sand, 5mm pea gravel, or 5mm crushed rock free from dust and foreign material.
- 6.7.6 All junction pipes in a line of sewer shall be concrete bedded and encased with a minimum 150mm cover of Grade N20 concrete unless directed otherwise by the Superintendent.
- 6.7.7 Concrete blocks in Grade N20 concrete shall be built across the trenches where directed by the Superintendent.
- 6.7.8 Where passing through concrete, brickwork or masonry, pipes shall be cleaned and washed over with fresh cement grout and bedded on and surrounded with cement mortar at least 12mm clear thickness.

## SG 6.8 Concrete

- 6.8.1 The concrete and reinforcement used in the construction of cast insitu manholes shall comply with Specification SG 7 CONCRETE WORKS.

### SG 6.9 Precast Manholes

- 6.9.1 Precast manhole components shall comply with SEQ Water Code Queensland urban Utilities sub-variant.

### SG 6.10 Manhole Covers

- 6.10.1 Manhole covers and frames shall be supplied for all sewer manholes shall be Cast Iron sealed (gastight) covers manufactured in accordance with AS 3996.
- 6.10.2 All openings shall conform to the details on Council's Standard Drawing
- 6.10.3 All covers shall have a raised stud pattern with the letters SEWER (65mm high) cast into the centre of the lid and "gatic" type lifting holes.
- 6.10.4 Unless noted otherwise on the approved Project Drawings the minimum class of manhole covers shall be Class C or D.

## Construction

### SG 6.11 Setout

- 6.11.1 The alignment and grade of sewer lines and position of manholes shall be stated on the approved Project Drawings.
- 6.11.2 The position of the centre of each manhole shall be pegged on the ground by a Registered Surveyor prior to the commencement of work.
- 6.11.3 Offset pegs shall be established prior to commencing construction of any line, at a convenient distance to remain clear of all works and remain intact for the duration of the work.
- 6.11.4 The levels of the sewers shall be maintained in strict accordance with bench marks and only approved and tested equipment shall be used to establish and maintain these levels in accordance with the design documents.

### SG 6.12 Clearing & Grubbing

- 6.12.1 All clearing and grubbing works shall be in accordance with Specification SG 1 EARTHWORKS.
- 6.12.2 Where sewer lines pass through allotments any trees or obstructions not on the line of the pipes shall be preserved, Clearing and grubbing shall be carried out in accordance with Specification No. 3.1- Earthworks.
- 6.12.3 The Contractor shall be responsible for all damage to grass, cultivation, fences, building or stock, by fire, falling timber or other causes arising from his operations.

### SG 6.13 Trenching

- 6.13.1 All trenching and foundation works necessary for the installation of the pipeline or thrust blocks, shall be in accordance with Specification SG 1 EARTHWORKS.
- 6.13.2 The width of trenching excavation shall be in accordance with the Council's Standard Drawing at the trench base and comply with all regulations of Workplace Health and Safety Act.
- 6.13.3 In undertaking trench excavation, the Contractor shall provide any shoring, sheet piling or other stabilisation of the sides necessary to comply with statutory requirements.
- 6.13.4 Where public utilities exist in the vicinity of sewer reticulation works the Contractor shall obtain the approval of the relevant authority / corporation to the method of excavation before commencing excavation.
- 6.13.5 In the event of any trenching being left open for longer than one week, the Contractor shall provide erosion control measures to ensure minimal soil disturbance and material loss off the site. Some or all of these measures shall be provided immediately upon the onset of rain with an open trench.
- 6.13.6 The Contractor shall leave a clear space of 600mm minimum between the edge of any excavation and the inner toe of spoil banks. No excavated materials shall be stacked against the walls of any building or fence without the written permission of the owner of such building or fence. Topsoil from excavations shall be kept separate and utilised to make good the surface after backfilling.
- 6.13.7 Where necessary the Contractor must arrange suitable traffic and pedestrian management.

### SG 6.14 Crossings

- 6.14.1 Where a sewer main crosses a State Controlled Road, Railway line or creek, the affected work shall be carried out in accordance with the requirements of the relevant Authority / Corporation. It shall be the Contractor's responsibility to complete written notification to the Authority / Corporation of the intention to carry out the work.
- 6.14.2 Where a sewer main crosses an existing road, the affected work shall be carried out in accordance with the requirements of Council. It shall be the Contractor's responsibility to notify Council of the intention to carry out the work.
- 6.14.3 Unless otherwise approved in writing, all crossing or existing roads and streets shall be bored or jacked with no disruption to the pavement, shoulder or kerb.

### SG 6.15 Bedding

- 6.10.1 Bedding types shall be as detailed on Council's Standard Drawing with the bedding materials complying with the "Bedding Material" section of this Specification.

### **Type 1 Bedding**

- 6.10.2 The bedding material shall be as specified and shall be placed and compacted for the full width of the trench to the level of the underside of the pipe.
- 6.10.3 An area of bedding adjacent to the position of the pipe collar should be removed to provide a minimum 20mm clearance to the collar while the remainder of the pipe is bedded evenly on the bedding material.
- 6.10.4 The remainder of the bedding material is then placed and carefully tamped to avoid disturbing the position of the pipe thus ensuring that the surface of every pipe is in full and even contact with the bedding material.
- 6.10.5 All bell holes shall be rammed prior to completion of the bedding operation. The bedding material shall be uniformly compacted so as to achieve the following standards:
- 6.10.5.1 Minimum dry density ratio 95% Standard (cohesive soils).
- 6.10.5.2 Minimum density index 65% (cohesionless soils)
- 6.10.6 Compaction requirements are with reference to the relevant Test Methods contained in AS1289.

### **Type 2 Bedding**

- 6.10.7 Used in wet conditions particularly where the trench bottom requires stabilising the trench invert shall be over excavated to accommodate a "Crushed Rock Foundation" with a geotextile surround.
- 6.10.8 Water is to be removed from the excavation as work proceeds to allow for placement of the geotextile crushed rock layer. The crushed rock layer shall be laid in 100mm layers and compacted as required.
- 6.10.9 The geotextile shall surround the crushed rock layer and be overlapped minimum of 500mm.
- 6.10.10 The pipe bedding material shall placed and compacted over the crushed rock foundation as specified for Bedding Type 1.

### **Type 3 Bedding**

- 6.10.11 Type 3 bedding incorporating designed piles that are driven by air or electric hammer on a heavy dolly.
- 6.10.12 Piles shall be driven to give a set in accordance with the design requirements and spaced accordingly as stated on the approved Project Drawings.
- 6.10.13 A 150 x 50 hardwood sleeper is placed on top of the pile with 150 x 50 hardwood planks spanning the sleepers.
- 6.10.14 A concrete cradle as detailed on the approved Project Drawings shall then be poured on the planks to support the pipes.

## **SG 6.16 Laying and Jointing of Pipes**

- 6.16.1 All contractors shall have undertaken a manufacturers pipe laying accreditation course.
- 6.16.2 All pipelines shall be constructed of pipes of such sizes and laid true to such levels and grades as shown on the approved Project Drawings.
- 6.16.3 The lines, levels and grades of all lines shall be checked and all pipes found incorrect shall be removed and re-laid.
- 6.16.4 Trenches shall be kept free of water during pipe laying, and until completion of backfill.
- 6.16.5 Jointing of pipes, valves and fittings is to be carried out to the manufactures recommendations and in accordance with Australian Standards where applicable.
- 6.16.6 For pipes with rubber ring joints, only the lubricant specified in writing by the manufacturer shall be applied in making the joint. When the joint is made, the witness mark shall at no point be more than 1mm from the end of the socket.
- 6.16.7 Before being laid, all pipes, fittings, valves, etc shall be cleaned and examined by the Contractor.
- 6.16.8 Approved plugs shall be used to prevent foreign matter entering sections of pipeline, which are left uncompleted overnight.
- 6.16.9 The Contractor shall take all necessary precautions to prevent flotation of pipes during laying, backfilling and initial testing. Any temporary supports shall be removed prior to completion of backfilling.
- 6.16.10 Pipes may be cut as needed to suit closing lengths, to remove damaged pipe or fittings or to remove sockets if necessary when jointing a socketed fitting.
- 6.16.11 For field cuts, only an approved mechanical pipe cutter shall be used, except that uPVC pipes may be cut using a power saw or a fine toothed hand saw and mitre box.
- 6.16.12 Any pipes cut in the field shall have their ends prepared in accordance with the manufacturer's written instructions.
- 6.16.13 Where pipes are cut in the field, a witness mark shall be made on the pipe at the length specified by the manufacturer from the end of the pipe. Scoring of uPVC pipes shall not be permitted.
- 6.16.14 Gravity lines shall be constructed to the tolerances specified hereafter:
  - 6.16.14.1 The maximum horizontal deviations to either side from the design axis of a pipeline shall be 100mm for all sizes of pipes.
  - 6.16.14.2 The maximum vertical deviations from the design grade of pipelines of any diameter and grade, shall be + 5mm.
- 6.16.15 During the progress of the works the Contractor shall have at least two (2) days supply of tested and approved pipes, including junctions on the ground in advance of quantity fixed in position.

#### SG 6.17 Connections to Manholes

- 6.17.1 Pipelines shall be connected to manholes, structures or embedded concrete by means of 600mm long pipes such that two flexible joints are provided, the first joint being at the face of the structure. Refer to Council's Standard drawing
- 6.17.2 The position of the access chamber shall be as shown on the approved Project Drawings. The Contractor shall check the alignment prior to

- commencing construction and advise the design engineer of any obstructions (Structure, Flora, Services etc)
- 6.17.3 Allowable lateral deviations from the final design position of access chambers shall be in accordance with the tolerances for horizontal deviations of pipelines as specified. Longitudinal deviations from that position shall not exceed 300mm.

#### SG 6.18 Connection to Existing Infrastructure

- 6.18.1 Connection to existing live sewer mains and manholes shall be carried out in accordance with the requirements of Council. It shall be the Contractor's responsibility to notify Council of the intention to carry out and arrange for the timing of such works.
- 6.18.2 The upstream side of the existing manhole is to be plugged until all new sewer mains have been approved, tested and cleaned.

#### SG 6.19 Anchor Blocks

- 6.19.1 Concrete anchor blocks shall be provided in accordance with Council's Standard Drawing for 150 dia. lines laid at a grade of 1 in 6 or steeper and 225 dia. lines laid at 1 in 10 or steeper.
- 6.19.2 Concrete works shall comply with Specification SG 7 CONCRETE WORKS.

#### SG 6.20 House Connection Branches

- 6.20.1 House Connection Branches (HCB) to all properties shall be constructed in accordance with Council's Standard Drawing and to the types, locations, levels and dimensions stated on the approved Project Drawings.
- 6.20.2 Concrete surrounds shall be provided to all HCB's. All concrete works shall comply with Specification SG 7 CONCRETE WORKS.
- 6.20.3 Backfill around risers shall be sand compacted to the top of the socket or coupling, for the full width of trench and for a minimum distance of 500mm upstream and downstream of the riser.
- 6.20.4 The position of each riser, junction or end of a sideline shall be clearly marked by the Contractor on completion of backfilling, with a approved 13mm orange electrical conduit tied to the end of HCB and held in a vertical position during backfilling. The top end of the tape shall be left flush with ground level.

#### SG 6.21 Rising Mains

- 6.21.1 All works necessary for the installation of the rising mains including installation of thrust block and anchor blocks, shall be in accordance with Specification SG 5 WATER RETICULATION.
- 6.21.2 Air release valves and scour valves shall be installed where shown on the approved Project Drawings.
- 6.21.3 Unless otherwise noted on the approved Project Drawings, pipes for rising mains shall be laid on continuously rising grades from scour valve to air release valve, notwithstanding any minor irregularities in the ground surface.
- 6.21.4 Marking plates bearing the letters "AV" for air valves, "SV" for scour valves and "RM" at changes of direction and at such chainages that the location of the main is marked at least once each 200 metres.
- 6.21.5 Sewer rising main connections to discharge manholes are to be constructed in accordance with Council's Standard Drawings.

### SG 6.22 Manholes

- 6.22.1 All concrete work associated with the construction of manholes shall comply with Specification SG 7 CONCRETE WORKS.
- 6.22.2 Manholes shall be constructed in accordance with Council's Standard Drawing, and to the types, locations, levels and dimensions stated on the approved Project Drawings.
- 6.22.3 Rendering of this invert and benching shall be in accordance with the Council's Standard Drawing.
- 6.22.4 Precast manholes are an acceptable alternative with precast base units for Inlet Type A manholes in accordance with Council's standard procedure for pre cast manholes.
- 6.22.5 Precast Manhole risers are acceptable for use with cast insitu manhole bases.
- 6.22.6 Precast riser units shall be jointed in accordance with the manufacturers' specifications utilising the recommended method and materials. Inlets into precast units shall be constructed in accordance with the details illustrated on Council's Standard Drawing.
- 6.22.7 The installation of all precast manhole components shall be in accordance with the manufacturers' recommended procedures, requirements and Council's standard installation procedure.

### SG 6.23 Covers and Surrounds

- 6.23.1 Manhole covers shall be finished flush with the surface in roadways, footpaths and paved surfaces. Elsewhere, unless noted otherwise on the approved Project Drawings, covers shall be finished 50mm above the surface of the surrounding ground, in a manner designed to avoid as far as possible, the entry of surface water.
- 6.23.2 Manhole covers are to be located such that the position of the access opening is directly over the outlet pipe.
- 6.23.3 The installation of all precast manhole covers shall be in accordance with the manufacturers' recommended procedures and requirements.

## SG 6.24 Backfill and Compaction

- 6.24.1 Material for the side support and overlay of the pipe shall comply with the pipe bedding material specification. The material shall be compacted in layers of not more than 150mm to 95 per cent of the standard maximum dry density of the material used when determined in accordance with AS1289. Flooding of non-cohesive material shall be considered as an acceptable method of compacting bedding material.
- 6.24.2 The remainder of the excavation shall be backfilled with excavated material. The backfill shall be compacted in layers of not more than 150mm thick to 95 per cent of the standard maximum dry density of the material used when determined in accordance with AS1289. Flooding of cohesive material shall not be permitted as a means of compacting backfill.
- 6.24.3 Backfilling and compaction shall be carried out without damaging the pipe or its external coating or wrapping or producing any movement of the pipe.
- 6.24.4 Where trenches are under constructed pavements or in other situations where required, the material used for backfilling shall be approved excavated material with linear shrinkage of the fines passing a 2.36mm sieve of not greater than 6 per cent. The Contractor may elect to use imported, select fill or sand for this purpose. The backfill shall be spread in layers not exceeding 300mm in loose depth at or near optimum moisture content and compacted using mechanical vibration equipment.
- 6.24.5 Backfill material down to a depth of 300mm below the underside of the pavement material shall be compacted to 95 per cent of the standard maximum dry density of the material used when determined in accordance with AS1289, and backfill material below such depth shall be compacted to not less than 95 percent of the standard maximum dry density of the material used when determined in accordance with AS1289.
- 6.24.6 In cases other than those covered by the above clause backfilling above the level of 300mm above the top of the pipes in open trenches may be carried out by dumping from mechanical plant into the trench providing that no rock is placed in the trench until the pipes are covered by at least 300mm of soil backfill.
- 6.24.7 Compaction testing shall be carried out at a rate of 1 test for each 150 metres of trench backfilled or in the cast where trenches are constructed under road pavements and road shoulders, 1 test for each 25 metres of trench backfilled.

## SG 6.25 Cleaning Sewers

- 6.25.1 Before the sewers, manholes and house drains are accepted they shall be cleaned to remove all clay, sand and other materials.
- 6.25.2 All water plus materials used in the flushing of the reticulation system shall under no circumstances be discharged into existing sewers downstream of construction. All lines shall be inspected after flushing and will not be accepted until they present a clear barrel, free from any obstruction.



## SG 6.26 Test of Manholes

- 6.26.1 All manholes shall be subjected to hydrostatic or vacuum tests to prove their water tightness unless directed otherwise by the Local Authority.
- 6.26.2 For hydrostatic tests, all pipe openings out of the manhole shall be plugged and the manhole filled with water to the lowest point on the top of the manhole cover surround. The plugs shall be positioned in the pipes as near as practicable to the internal face of the access chamber. After allowing an interval for absorption, the manhole shall be refilled.
- 6.26.3 The test on the manhole will be considered satisfactory provided the level does not drop more than 25mm in twenty four (24) hours. The plug of the outlet shall be fitted with a suitable release for emptying the manhole on satisfactory completion of the test.
- 6.26.4 Manholes failing the test shall be repaired and the test repeated. The process of testing, repair of defects and retesting shall continue until a satisfactory test is obtained.
- 6.26.5 Where the ground water level is high, an infiltration test may also be required. This shall not take place until ten (10) days after the placing of concrete.

## SG 6.27 Testing of Lines

- 6.27.1 All gravity lines shall be subject to air testing to prove their water tightness unless directed otherwise by the Local Authority.
- 6.27.2 Testing may be done progressively, a minimum of 24 hours notice shall be provided to Council before commencement of testing. Ensure that pipes are clean before any test is performed.
- 6.27.3 If any of the tests proved to be unsatisfactory, the contractor shall be required to detect and repair the fault and then re-test. The contractor shall continue to repair and re-test until a satisfactory test is obtained. Even if testing produces satisfactory test results, the contractor shall repair any pipeline or conduit in which there is a visible or detectable leak or blockage.
- 6.27.4 The contractor shall carry out a visual inspection to ensure that all sewer lines present a full clean bore.

### Air Testing General

- 6.27.5 Air testing shall be either pressure testing or vacuum testing, as directed by the Local Authority. The tests shall include the house connection branches and inspection tee.
- 6.27.6 Air Testing (Pressure) - The sewer line to be tested shall be pressurised to the “Initial Pressure” shown in the **Table S6.2** for a minimum of 3 minutes to stabilise the temperature.

**Table S6.2 Pressure Air Testing – Initial Pressures**

Pressures	Sewer depth range (metres)				
	0-1.5	1.5-3.0	3.0-4.5	4.5-6.0	Over 6.0

Initial Pressure (KPa)	30	35	40	45	50
Test start pressure (KPa)	25	30	35	40	45

- 6.27.7 After the 3 minute stabilisation period the pressure shall be dropped to the “Test Start Pressure” shown in the above table and the pressure gauge monitored for 5 minutes.
- 6.27.8 The sewer line under test shall be considered to have passed the test when the pressure does not fall by more than 5 KPa during the 5 minute period.
- 6.27.9 Air testing (Vacuum) - The sewer to be tested shall be drawn to a vacuum of 28 KPa and the vacuum gauge monitored for 5 minutes. The sewer under test shall be considered to have passed the test when the vacuum does not fall by more than 5 KPa during the 5 minute period.

### Ovality Testing

- 6.27.10 All gravity sewer pipes shall be tested to determine any excessive pipe deflection (Ovality) by using a proving tool.
- 6.27.11 Testing for ovality shall be carried out in accordance with Appendix G of WSA 02-2002 Sewerage Code of Australia
- 6.27.12 The proving tool shall be:
  - 6.27.12.1 Fabricated from steel or aluminium alloy with pulling rings at each end and marked to indicate the nominal pipe size and the provers’ outside diameter.
  - 6.27.12.2 Rigid, non-adjustable, have an odd-number of legs (min 9) and an effective length of not less than its nominal diameter. The minimum diameter at any point along the length shall be as shown in Table G1 of WSA 02-2002 Sewerage Code of Australia.
  - 6.27.12.3 The shape of the proving tool must be approved.
- 6.27.13 Sewer pipes that exhibit excessive ovality, by failing the maximum allowable deflection as shown above, shall be replaced and the re-laid section retested for ovality.

### SG 6.28 Testing of Rising Mains

- 6.28.1 Hydrostatic pressure testing of all sewer rising mains shall be carried out prior to the acceptance of the works.
- 6.28.2 The contractor shall have carried out a successful test prior to arranging a Council witness test.
- 6.28.3 Pressure testing shall not be carried out during wet weather unless otherwise approved by Council.
- 6.28.4 Before testing a pipeline section, it shall be cleaned and filled slowly with water, taking care that all air is expelled. Purging of air from rising mains shall be promoted by opening air valves.
- 6.28.5 The hydrostatic test pressure which shall be applied to each section of the pipeline shall be such that at each point of the section the test head shall be equal to or greater than the design head specified or shown on the approved Project Drawings, but shall not exceed same by more than 20 per cent.
- 6.28.6 The pressure testing of a section shall be considered to be satisfactory if:

- 6.28.6.1 There is no failure of any thrust block, anchor block, pipe, fitting, valve, joint or any other pipeline component;
- 6.28.6.2 There is no visible leakage; and
- 6.28.6.3 There is no loss of pressure in the 15 minute test period
- 6.28.7 The specified test pressure shall be maintained as long as required, while the whole section is examined, and in any case not less than 15 minutes.
- 6.28.8 Any failure, defect, and / or visible leakage, which is detected during the pressure testing of the pipeline or during the Defects Liability Period shall be made good by the contractor.

## SG 6.29 Restoration of Surfaces

- 6.29.1 Pavements, lawns and other improved areas shall be cleaned and left in the same order as they were at the commencement of the works. Lawns shall be restored with turf cut and set aside from the original surface and / or with imported turf.
- 6.29.2 All restored surfaces shall be maintained in the condition to which they are restored until the expiry of the Defects Liability Period applicable to those surfaces. Pavements shall be maintained with crushed metal, gravel or other suitable material allowing for consolidation and shall then be restored to a condition equivalent to that of the original pavement.
- 6.29.3 Immediately the backfilling of a trench excavated through a pavement has been completed, the pavement shall be temporarily restored. Where the trench crosses bitumen or concrete pavement, a pre-mixed asphaltic material shall be used for such temporary restoration. Temporary restoration works shall be maintained by the Contractor until final restoration is carried out.
- 6.29.4 Final restoration of the pavement shall be carried out to restore the pavement and its subbase to no less than the original condition. Unless noted otherwise on the approved Project Drawings all trenches excavated through bitumen or concrete pavement shall be sawcut each side to facilitate a neat finish to the final restoration. Final restoration may include, if required, the removal of temporary restoration.
- 6.29.5 Backfill shall be placed sufficiently high to compensate for expected settlement and further backfilling shall be carried out or the original backfill trimmed at the end of the Defects Liability Period in order that the surface of the completed trench may then conform to the adjacent surface. Surplus material shall be removed and disposed of to areas arranged by the Contractor.
- 6.29.6 In locations where surplus material left in the vicinity of the trench would not be objectionable, the surplus material may be disposed by spreading neatly in the vicinity of the trench in such a way as to minimise future erosion of the backfill and adjacent ground surfaces. The Contractor shall maintain the backfill and adjacent ground until the end of the Defects Liability Period.
- 6.29.7 Where, within public or private property, the reasonable convenience of persons will require such, trenches to be levelled off at the time of backfilling. Any subsequent settlement shall be made good by the Contractor, as required by placing additional fill.

- 6.29.8 Where shown on the approved Project Drawings or where the Contractor elects to tunnel under paving, kerb and channel or other improved surfaces in lieu of trenching, backfilling shall be so carried out as to restore full support to those surfaces. The Contractor shall remain responsible for the repair of the improved surfaces, if subsequently damaged due to subsidence of the backfill, until the end of the Defects Liability Period.

### SG 6.30 Tolerances

- 6.30.1 Tolerances for the construction of sewer reticulation works shall comply with **Table S6.4**.

**Table S6.4 Construction Tolerances**

<b>Location</b>	<b>Tolerance</b>
Invert Levels	+25mm - -25mm
Location of alignment and structures	Lateral deviation from line + 100mm Longitudinally along line + 300mm
Grade on pipe	Design grade not compromised

## SG 7 – Concrete Works

### General

#### SG 7.1 Scope

- 7.1.1 This specification details all matters pertaining to the supply, placement, compaction and finishing of Concrete Works.
- 7.1.2 Where there is any conflict determined between the requirements specified herein and the requirements of any referenced Australian Standard, Statutory Authority Standards or otherwise, the requirements specified herein shall apply.

#### SG 7.2 Reference Documents

- 7.2.1 Australian Standards
  - 7.2.1.1 AS1012 Methods of Testing Concrete
  - 7.2.1.2 AS1379 The Specification and Manufacture of Concrete
  - 7.2.1.3 AS1478 Chemical Admixtures for Concrete
  - 7.2.1.4 AS1553.1 Low Carbon Steel Electrodes for Manual Arc Welding of Carbon Steels and Carbon-Manganese Steels
  - 7.2.1.5 AS1554.3 Welding of Reinforcing Steel
  - 7.2.1.6 AS2203 Cored Steel Electrodes for Arc Welding
  - 7.2.1.7 AS2717.1 Ferritic Steel Electrodes
  - 7.2.1.8 AS3600 Concrete Structures
  - 7.2.1.9 AS3610 Formwork for Concrete
  - 7.2.1.10 AS3735 Concrete Structures for Retaining Liquids
  - 7.2.1.11 AS3799 Liquid Membrane-forming Curing Compounds for Concrete
  - 7.2.1.12 AS/NZS4671.2 Steel Reinforcing Bars for Concrete
  - 7.2.1.13 AS/NZS4671.3 Steel Reinforcing Wire for Concrete
  - 7.2.1.14 AS/NZS4671.4 Welding Wire Reinforcing Fabric for Concrete.

### Materials

#### SG 7.3 Concrete – General

- 7.3.1 All concrete to be incorporated in the works shall be sourced from a Quality Assured Concrete supplier.
- 7.3.2 The production and delivery of ready-mixed concrete shall be in accordance with the requirements of AS 1379.
- 7.3.3 The quantity of concrete delivered in any truck shall not exceed the rated capacity of its agitator drum. The timing of deliveries shall be such as to ensure an essentially continuous placing operation.

- 7.3.4 Ready-mixed concrete shall be placed and compacted within 1 hour of charging the mixer for concrete temperatures up to 32°C and within 45 minutes of charging the mixer for concrete temperatures exceeding 32°C.
- 7.3.5 The Consulting Engineer's discretion where approved set-retarding admixtures are used. In this instance approved admixtures shall conform with the requirements of AS 1478 and shall be used in accordance with AS 1379. Calcium Chloride shall not be used as an admixture in concrete works.
- 7.3.6 A Manufacturer's Certificate in the form of a delivery docket in accordance with AS 1379 shall be supplied for each batch and shall be retained by the Contractor. Such certificates shall be held and maintained in the Contractors Quality records for the project. Further, the Contractor shall obtain a statement from the manufacturer qualifying the quality standard of the concrete in accordance with the requirements as specified herein.
- 7.3.7 The consistency and workability of concrete shall be such that it can be handled and transported without segregation and can be placed, worked and compacted into all corners, angles and narrow sections of forms, and around all reinforcement.
- 7.3.8 Concrete class shall be classed as Nx where x is the minimum 28-day compressive strength in megapascals.
- 7.3.9 For construction elements involving structural concrete construction activities, (eg. bridge slabs, bridge abutment footings etc.) the concrete class and slump shall be as detailed in the Project Documentation. The material quality compliance testing in this instance shall involve on-site sampling and testing in accordance with Australian Standard AS 1012. The testing of the 200mm x 100mm diameter test cylinders shall be at a frequency not exceeding one sample of 2 cylinders for each 15m<sup>3</sup> or part thereof placed in an essentially continuous manner with a minimum of two samples of 2 cylinders for each casting day.
- 7.3.10 All testing shall be undertaken by a NATA registered testing authority.  
11. The class of concrete relative to each construction element shall be as shown in **Table S7.1**.

**Table S7.1 Concrete Classes**

<b>Construction Element</b>	<b>Class<sup>1</sup></b>
Kerb/Kerb & Channel	N 25
Manholes (Sewer & Stormwater) <sup>2</sup>	N25 or N32 as shown on Standard Drawings
Gully Pits / Field Inlets <sup>2</sup>	N25 or N32 as shown on Standard Drawings
Headwalls/Wingwalls & Apron Slabs <sup>2</sup>	N 25
Pathways / Bikeways	N 25
Access Driveways	N 25
Edge Restraints for Segmental Pavers (On Road Pavements)	N 25
Edge Restraints for Segmental Pavers (On footpaths, bikeways and medians)	N 20
Stamped Concrete (where used in road pavement)	N 32
Stamped Concrete (where used as parking bay behind kerb or not subject to regular street traffic loadings)	N 25
Thrust Blocks	N 20

Concrete Surrounds for Sewerage House Connection Branches	N 20
Concrete Cradle for Sewer Bedding Type 3	N 15
General Concrete Works (Sign Post Bases, Bases for Post and Rail Fences etc.)	N 20
Notes:	
<ol style="list-style-type: none"> <li>1. Tested in accordance with the relevant sections of AS 1012.</li> <li>2. Where any part of the structure is located below RL 1.800 AHD, concrete to be in accordance with the appropriate exposure condition in AS3600</li> </ol>	

### SG 7.4 No Fines Concrete

- 7.4.1 No fines concrete shall consist of cement, water and coarse aggregate. The quantity of cement used shall be as specified below. The nominal size of the aggregate for no-fines concrete shall conform with the grading limits specified in **Table S7.2**.
- 7.4.2 The water / cement ratio shall be within the range 0.5 to 0.6 by mass.

**Table S7.2 No Fines Concrete – Grading Limits**

AS Metric Sieve (mm)	Percentage Passing By Mass	
	Nom. Size 20mm	Nom. Size 10mm
26.5	100	-
19.0	85-100	-
13.2	0-10	100
9.5	0-5	85-100
4.75	0	0-10
2.36	0	0-2
Minimum Cement Content (kg/m <sup>3</sup> )	210	250

### SG 7.5 Lean Mix Concrete

- 7.5.1 Lean mix concrete shall consist of a graded sand and gravel aggregate of 40mm maximum size with the addition of 5% by mass of Portland Cement or 1 part Portland Cement to 19 parts of graded aggregate and sufficient water to ensure a slump of less than 12mm.

### SG 7.6 Reinforcing Steel

- 7.6.1 All reinforcement shall comply with the following requirements where applicable:
- 7.6.1.1 Steel Reinforcing Bar - AS/NZS4671.2 Steel Reinforcing Bars for Concrete
- 7.6.1.2 Hard-draw Steel Reinforcing Bar - AS/NZS4671.3 Steel Reinforcing Wire for Concrete

- 7.6.1.3 Reinforcing Wire Fabric - AS/NZS4671.4 Welding Wire Reinforcing Fabric for Concrete
- 7.6.2 All reinforcement shall be sourced from and Quality Assured manufacturer of such products and the Contractor shall obtain a statement from the manufacturer qualifying the Quality Standard of the reinforcing steel in accordance with the above noted standards.

## Construction

### SG 7.7 Temperature Limits for Concrete Placement

- 7.7.1 No concrete shall be placed in the Works if:
  - 7.7.1.1 The temperature of the concrete is less than 5°C or exceeds 30°C;
  - 7.7.1.2 The ambient air temperature is likely to be greater than 45°C during placement or within two (2) hours subsequent to placement.
- 7.7.2 If the ambient air temperature measured at the point of placement is likely to exceed 30°C during placing and finishing operations, the Contractor shall take practical precautions, to ensure that the temperature of the concrete does not exceed the permitted maximum so that the concrete can be placed and finished without defects, otherwise it shall be rejected. Typical precautions include those listed below:
- 7.7.3 At the concrete manufacturing plant:
  - 7.7.3.1 Shading aggregate stockpiles;
  - 7.7.3.2 Painting water tanks white;
  - 7.7.3.3 Insulating or burying delivery lines;
  - 7.7.3.4 Adding crushed ice to replace mixing water (in part) or chilling the water;
  - 7.7.3.5 Injection of liquid nitrogen into the mixer.
- 7.7.4 At the site:
  - 7.7.5 Cooling the formwork by dampening with water sprays;
  - 7.7.6 Shading the work areas;
  - 7.7.7 Erecting wind breaks;
  - 7.7.8 Minimising the time for placing and finishing;
  - 7.7.9 Use of evaporation retarding curing oil.
- 7.7.5 Special attention shall be paid to providing early curing for hot weather concreting operations.

### SG 7.8 Foundations

- 7.8.1 Foundations for concrete structures shall be prepared as specified on the Project Drawings.
- 7.8.2 Rock foundations shall be neatly excavated to form a bed for the concrete, and shall be thoroughly scraped and cleaned.



- 7.8.3 Soil foundation shall, as far as possible, be excavated neatly from the solid material to coincide with the under-surface of the concrete, or of the subbase material (where specified).
- 7.8.4 All soft, yielding or other unsuitable material shall be replaced with sound material and the subgrade shall be compacted to provide a minimum of 95 per cent standard compaction as determined by AS 1289.5.4.1 for standard compactive effort. If the subgrade is dry it shall be sprinkled with as much water as it will readily absorb, before the concrete is placed.
- 7.8.5 The surface shall then be checked for uniformity, line and level, and all irregularities shall be made good.

## SG 7.9 Formwork and Falsework

- 7.9.1 All Formwork and Falsework shall conform to AS 3610 unless otherwise required by the specific Project Documentation.
- 7.9.2 All forms shall be built mortar tight and of sufficient rigidity to prevent distortion by the pressure of the concrete and other loads incident to the construction operations. Forms shall be constructed and maintained to prevent warping and the opening of joints due to shrinkage of the timber. The forms shall be substantial and unyielding and shall be so designed and set that the finished concrete will conform to the proper dimensions and within the tolerances specified herein. The design of the forms shall take into account the effect of vibration of the concrete as it is placed.
- 7.9.3 When forms are re-used, their original shape, strength, rigidity, mortar tightness and surface smoothness shall be maintained at all times. Material previously used in formwork must be cleaned off and oiled before re-use. Warped timber shall not be used.
- 7.9.4 Forms, which are unsatisfactory in any respect, shall not be re-used.
- 7.9.5 All timber shall be free from knotholes, loose knots, cracks, splits, warps and other defects, which would affect the strength of the structure or the appearance of exposed surfaces.
- 7.9.6 For narrow walls and columns where the bottom of the form is otherwise inaccessible, openings shall be provided so that they may be cleaned before placing the concrete, and for purposes of compaction and inspection.
- 7.9.7 All forms shall be treated with the lightest practical coating of release agent before the reinforcement is placed. Release agent shall not be placed on reinforcement or construction joints.
- 7.9.8 All forms shall be set and maintained to the line and level designated. Forms shall remain in place for periods, which shall be determined as specified herein. When forms appear to be unsatisfactory in any way, either before or during the placing of concrete, the work shall not proceed until the defects have been corrected.
- 7.9.9 Metal form ties shall be of an approved type, and if cast in, shall be of a type which permits removal of the end fittings to a depth of at least 30mm below the finished surface of the concrete. Ordinary wire ties shall not be used.
- 7.9.10 Form ties shall be located in a uniform symmetrical pattern relative to the finished surface. The cavities left when the end fittings of embedded ties are removed shall be as small as possible and shall be filled with cement mortar at

the earliest possible time. The surface of such filled cavities shall be left smooth and uniform in colour.

- 7.9.11 Forms for plain exposed surfaces shall consist of plastic-coated plywood, waterproof plywood, timber lined with tempered hard-board or close-fitting unwarped metal forms. Unless otherwise specified, joints in the form sheeting for plain exposed concrete surfaces shall be either vertical or horizontal and spaced with a regular pattern.
- 7.9.12 Forms for surfaces not exposed to general view may consist of modular timber or metal panels. Timber forms shall be constructed and maintained in such a manner as to prevent warping and opening of joints due to shrinkage of the timber. The timber shall be free of any defects, which will affect the structure.
- 7.9.13 Forms shall be removed with care and without unnecessary hammering or wedging, and so as not to injure the concrete or disturb the remaining supports. Methods of form removal likely to cause overstressing of the concrete shall not be used.

## SG 7.10 Reinforcing Steel

- 7.10.1 Reinforcement shall be free of kinks or other unwanted deformations, and shall be cut to length, and bent in accordance with the Project Drawings. Fabric reinforcement shipped in rolls shall be straightened into flat sheets before use.
- 7.10.2 The surface condition of reinforcement shall comply with the following requirements:
  - 7.10.2.1 At the time concrete is placed reinforcement shall be free from mud, oil, grease and other non-metallic coatings and loose rust which would reduce the bond between the concrete and the reinforcement.
  - 7.10.2.2 For the purpose of this Specification, rust shall not be deemed to be loose if on rubbing with the thumb it leaves only a stain thereon.
  - 7.10.2.3 Nevertheless, a deformed bar complying with AS 1302, or a welded wire fabric complying with AS 1304, and having mill scale or rust or both shall be deemed to comply with this Specification if, after wire-brushing the cross-sectional dimensions, including height of deformations; and mass, are not less than the dimensions and mass required by the applicable Australian Standard.
  - 7.10.2.4 Any reinforcement projecting from a previous concreting operation shall be cleaned free of adhering concrete or loose slurry prior to any further embedment.
  - 7.10.2.5 Any reinforcement placed within 1km of the coastline shall be thoroughly washed with a high pressure fresh water jet immediately prior to pouring concrete to remove any salts deposited during storage and placement.
  - 7.10.2.6 Reinforcement which has been submerged by tidal or flood waters shall also be cleaned with a high pressure fresh water jet prior to pouring concrete.

- 7.10.3 Reinforcement shall be placed in position as shown on the Project Drawings. In the case of bar reinforcement, the bars shall be tied together by wiring each intersection using annealed wire not less than 1.25mm in diameter or by such other fastening devices as may be approved by the Designer, provided that, where the bar spacing is 300 mm or less, alternate intersections only need to be tied.
- 7.10.4 Clearance from forms shall be maintained by use of approved chairs. The shape of the chair shall be such that minimum obstruction is offered to the formation of the homogeneous concrete both within and around the chair. Tubular or cylindrical types shall not be used. Some bar chairs are suitable for soffit use only and should not be used against side forms. Bar chairs shall be sufficient structural strength to support the weight of reinforcement and workmen at temperatures experienced on site.
- 7.10.5 Metal chairs shall not be approved for any locations.
- 7.10.6 Precast mortar blocks shall not be used unless the blocks are manufactured from vibrated concrete of strength equivalent to that of the main concrete, and to a size and shape so as not to interfere with the structural integrity of the works. Such blocks shall have suitable fixing wires cast-in.
- 7.10.7 Layers of bars shall be separated by means of approved bar spacers. Stirrups and ligatures shall pass around the main reinforcement and shall be securely tied thereto.
- 7.10.8 Reinforcement shall be spliced by lapping or where permitted, by welding or by approved mechanical splices. Fabric reinforcement shall be lap spliced only.
- 7.10.9 The system of fixing shall be such as to form a rigid cage which maintains dimensional tolerances under loads experienced during placement of concrete. Welding of reinforcement to form a rigid cage shall comply with the following requirements:
- 7.10.9.1 Welding shall be in accordance with AS 1554.3. In particular tack welds shall not substantially reduce the cross-section of the reinforcing steel nor adversely affect its strength and shall have:
    - 7.10.9.1.1 A throat thickness not less than 4 mm;
    - 7.10.9.1.2 A length not less than the diameter of the smaller bar.
  - 7.10.9.2 Welding shall not be carried out within 75 mm of any portion of a bar which has been bent or will be bent.
  - 7.10.9.3 No more than one-third of the main reinforcement at any cross-section shall be so welded.
  - 7.10.9.4 Hard drawn wire and fabric reinforcement shall not be welded or heated unless approved by the Engineer.
  - 7.10.9.5 Welding electrodes that are to be used complying with AS 1553.1 or AS 2203 or AS 2717.1.
  - 7.10.9.6 Splices shall be made by butt or by fillet welding. Butt welds shall be qualified complete penetration butt joints in accordance with AS 1554.3.
  - 7.10.9.7 Suitability experienced and competent welding personnel shall be engaged to complete the works.
- 7.10.10 Splicing of reinforcement shall occur only in the locations shown on the Project Drawings. Where practical, splices in bar reinforcement shall be staggered.
- 7.10.11 The length of lap splices in bar reinforcement shall be as shown on the Project Drawings. All reinforcement shall be spliced in such a manner as to

maintain specified clear cover to the surface of the concrete. Splicing of fabric reinforcement shall be achieved so that the two outermost transverse wires of one sheet of fabric overlap the outermost transverse wire of the sheet being lapped.

## SG 7.11 Concrete Placement – General

- 7.11.1 The Contractor shall be solely responsible for placing and compacting the concrete in the forms to comply with this Specification and for achieving dense, sound concrete without voids and to the lines and levels shown on the Project Drawings.
- 7.11.2 When rain threatens or seepage exists in excavations, the Contractor shall have on site sufficient dewatering equipment and covers as applicable to prevent any additional water entering the concrete.
- 7.11.3 Concrete shall be placed in an essentially continuous manner between approved construction joints so as to avoid being placed against partially set concrete.
- 7.11.4 Any troughs and chutes used as aids in placing concrete shall be metal or metal lined and shall be arranged and used in a manner that does not cause segregation. The use of water to facilitate the movement of concrete along troughs or chutes is expressly prohibited, but all troughs and chutes shall be kept clean and free of coating of hardened concrete by flushing thoroughly with water, which shall be discharged well clear of concrete in place.
- 7.11.5 Troughs and chutes shall discharge into vertical downpipes at least 1 metre in length. Where steep slopes are required, the chutes shall be equipped with baffles or be in short lengths that reverse the direction of movement so that the concrete slides without segregation.
- 7.11.6 Pneumatic placers and concrete pump may be permitted for use subject to such equipment being arranged so that no vibrations will damage freshly placed concrete. The delivery end of the pipe shall terminate in a fitting of approved design, which shall prevent segregation of the concrete. After the completion of any concreting operations the equipment shall be thoroughly cleaned before re-use.
- 7.11.7 Concrete shall not be dropped from a height or in such a manner as will cause segregation or loss of material on the reinforcing steel or forms. When placing operations would involve dropping the concrete more than 2 metres it shall be deposited through a sheet metal or other approved downpipe in such a way that the concrete does not segregate. As far as practicable, the pipes shall be kept full of concrete during placing and their lower ends shall be kept buried in the newly placed concrete. The depositing of a large quantity of concrete at any point with the intention of moving it along the forms, will not be permitted.
- 7.11.8 After initial set of the concrete, the forms shall not be jarred and no strain shall be placed on the ends of reinforcing bars which project.

## SG 7.12 Concrete Placement – Under Water

- 7.12.1 Concrete shall not be placed under water unless specifically approved. The slump of the concrete to be placed underwater shall be between 150mm and 200mm.
- 7.12.2 Concrete shall not be placed in running water. Any pumping must cease and the water level must be constant where placement commences. The concrete shall be placed carefully in position by a tremie, a closed bottom-dump bucket or by other approved means. Concrete seals shall be placed in one continuous operation, the concrete shall not be disturbed after being deposited and the placing shall be regulated to continually maintain an approximately horizontal surface.
- 7.12.3 When a tremie is used it shall consist of a watertight tube and at no time shall concrete in the tube come in contact with water when it is being filled. The means of supporting the tremie shall be such as to permit free movement of the discharge end and to permit its being lowered rapidly when necessary to choke off or retard the flow of concrete. No water shall enter the tremie tube. The discharge end shall be completely submerged in concrete at all times and the tremie tube shall always be filled to a height to overcome the head of water.
- 7.12.4 When concrete is placed with a bottom-dump bucket, the bucket shall be lowered gradually and carefully until it rests upon the prepared foundation or upon concrete already placed. It shall then be raised slowly during the discharge travel so as to maintain as far as is practicable still water at the point of discharge and to avoid agitating the mixture. The concrete so placed shall not be disturbed.

## SG 7.13 Compaction in Concrete Forms

- 7.13.1 Concrete during and immediately after depositing shall be thoroughly compacted. Concrete other than no fines concrete shall be compacted with high frequency internal vibrations as follows:
- 7.13.1.1 The vibrators shall be of an approved type and shall be capable of transmitting vibrations at a frequency not less than 150 Hz with an intensity which will visibly affect the concrete at a radius of 300mm.
- 7.13.1.2 The number of vibrators to be used by the Contractor shall be not less than one for each 4m<sup>3</sup> of concrete placed per hour, with a minimum of 2 vibrators to be provided at any time.
- 7.13.2 Vibrators shall be inserted vertically at successive positions not more than 450mm apart and in a manner, which ensures compaction of the concrete around the reinforcing steel and any other embedded fixtures, and into all parts of the forms.
- 7.13.3 Vibration shall continue at each position until air bubbles cease to emerge from the concrete. The vibrators shall then be withdrawn slowly so as to avoid leaving a "pocket". The vibration shall be of sufficient duration to thoroughly compact the concrete, but shall not be continued so as to cause segregation.

- 7.13.4 Care shall be taken to ensure that newly deposited concrete is vibrated into any fresh concrete adjacent to it to provide a homogeneous concrete mass.
- 7.13.5 Vibration shall not be applied either directly or through the reinforcement to any concrete, which has taken its initial set.

#### SG 7.14 Removal of Forms and Falsework

- 7.14.1 Unless otherwise specified, forms and falsework shall remain in position until the times stated below have elapsed after completion of concreting:
  - 7.14.1.1 Non structural concrete - Until such time as the concrete has reached 50% of the characteristic 28-day strength or a period of 3 days, whichever is the lesser.
  - 7.14.1.2 Structural Concrete - Soffits of slabs, headstock and diaphragms - Until such time as the concrete has reached 70% of the characteristic 28-day strength or 7 days, whichever is the lesser.  
For side forms on structural concrete - 3 days minimum.
- 7.14.2 Where the timing for the removal of forms is based on concrete strength as specified herein, the strength shall be proven by testing in accordance with AS 1012.
- 7.14.3 Forms shall be removed with care, without hammering and wedging, and in a manner, which will not injure the concrete or disturb the remaining supports. Centre Forms shall be lowered gradually and uniformly in such a manner as to avoid injurious stress in any part of the structure.
- 7.14.4 Hole formers such as pipes and bars shall be removed as soon as the concrete has hardened sufficiently for this to be done without damage to the concrete.

#### SG 7.15 Finishing of Exposed Surfaces

- 7.15.1 Unless otherwise specified in the Project Documentation, all surfaces of concrete exposed to view in the completed structure shall be finished in accordance with the following:
  - 7.15.1.1 Kerb and channel, invert crossings, vehicle crossings and industrial crossings shall be finished with an approved steel finishing tool.
  - 7.15.1.2 Footpaths, bikeways and pram ramps shall be finished with a wooden float and broomed.
  - 7.15.1.3 Where a sample panel is supplied or specified associated with a particular project. The concrete finish shall be in accordance with the specified requirement.
- 7.15.2 All concrete surfaces shall be true and even, free from stone pockets, depressions or projections beyond the surface. All arises shall be sharp and true, and mouldings shall be evenly mitred or rounded. Care shall be exercised in removing forms to ensure this result.
- 7.15.3 Immediately after removal of forms from mass or reinforced concrete work, all rough places, holes and porous spots shall be repaired by removing defective work and filling with stiff cement mortar having the same

proportions of cement and fine aggregate as used in the concrete, and shall be brought to an even surface with a wooden float.

7.15.4 Any tie wires or other fitments extending to outside surfaces, shall be cut back after removal of forms, to a depth of at least 40mm with sharp chisels or cutters. All cavities caused by removal of fitments or tie wires shall be wetted and carefully packed with cement mortar, as above.

7.15.5 The surfaces of bolt cavities, tie wire holes, and all defects in concrete shall be coated prior to the placing of mortar, grout, or fresh concrete, with an approved bonding agent, in lieu of wetting with water. The method of application of such agent and the conditions in which it is to be used shall generally be as laid down by the manufacturer.

### SG 7.16 Weepholes

7.16.1 Drainage adjacent to weepholes shall be provided by either a layer of broken stone or river gravel consisting of clean, hard, durable particles graded from 50mm to 10mm such that:

7.16.1.1 The maximum particle dimension shall not exceed 50mm

7.16.1.2 No more than 5 per cent by mass shall pass the 9.5mm A.S. sieve. 2. The broken stone or river gravel, enclosed in a filter fabric suitable for drainage without scour, shall be continuous in the line of the weepholes, extend at least 300mm horizontally into the fill and extend at least 450mm vertically above the level of the weepholes.

7.16.2 Alternatively the Contractor may provide a synthetic membrane of equivalent drainage characteristics. It shall be stored and installed in accordance with Manufacturer's instructions.

### SG 7.17 Joints

7.17.1 Where horizontal construction joints are found to be necessary in walls, or cast-in-situ drainage structures the joints may be made at the base of walls and at other locations in the walls where approved by the Consulting Engineer. In order to provide for bond between the new concrete and the concrete which has already set, the surface on which the new concrete is to be placed shall be thoroughly cleaned of loose material, foreign matter and laitance. The surface shall be roughened or keyed and saturated with water. After any excess water has been removed, the surface shall be thinly coated with a neat cement grout.

7.17.2 Where vertical expansion joints are shown on the approved Project Drawings in retaining walls or other walls and structures the expansion joints shall consist of jointing material of approved quality, and of thickness stated on the drawings, and a depth sufficient to fill the joint. The jointing material shall be neatly cut to fit the surface of the concrete.

7.17.3 Extruded or cast in place kerbing, shall have narrow transverse vertical grooves, 40mm deep and not more than 6mm wide, formed neatly in the surface of the freshly placed concrete to produce contraction joints for the control of cracking. The contraction joints shall be at intervals not exceeding 3 metres.

- 7.17.4 In footpaths, median toppings and driveways, unless otherwise shown on the approved Project Drawings, expansion joints, 10mm in width for the full depth of paving, shall be constructed at intervals not exceeding 16m and where the pavement abuts against gutters, pits and structures. Expansion joints shall have an approved preformed jointing material. In addition, narrow vertical grooves 20mm deep and not more than 6mm wide shall be formed at internals not exceeding 2m to induce contraction joints for the control of cracking.
- 7.17.5 All unreinforced paving shall be provided with narrow vertical grooves, 20mm deep and not more than 6mm wide to induce contraction joints for the control of cracking. The joints shall be formed in the freshly placed concrete in a neat regular pattern to form "slabs" no bigger than 2m<sup>2</sup>. The ratio of the longest side to the shortest side shall not exceed 1.6.

### SG 7.18 Curing

- 7.18.1 The curing of unformed surfaces of concrete shall commence as soon as finishing operations are complete.
- 7.18.2 If forms are removed in less than 7 days, curing of the formed surface shall commence within two hours of stripping.
- 7.18.3 Curing shall continue for a period after placing the concrete of not less than:  
7.18.3.1 Top surface of slabs - 14 days;  
7.18.3.2 Other surfaces - 7 days.
- 7.18.4 Curing shall be effected by either Water or Membrane Curing.
- 7.18.5 Water curing shall comprise surfaces being kept moist for the period specified by continuous spraying, ponding, wet hessian or wet sand blankets.
- 7.18.6 Membrane curing shall be effected by application of a sprayed curing compound or by covering with polythene sheet.
- 7.18.7 Sprayed curing compounds shall be of a paraffin wax emulsion type formulated and tested by the manufacturer to conform to AS 3799. The compound shall be mixed if necessary and applied at the rate recommended by the manufacturer.
- 7.18.8 Resin and PVA based compounds shall not be used.
- 7.18.9 Polythene sheet shall be of sufficient strength to withstand wind and any imposed foot traffic. Torn or punctured sheeting shall not be used. Laps should be 300mm minimum and edges and laps shall be sealed by tape or held down by boards or reinforcing bars. Water shall be sprayed under the sheeting at edges and at laps on the day after placing concrete and at regular intervals to maintain moist conditions.

### SG 7.19 Backfilling

- 7.19.1 Backfilling at barriers, paving, etc, and minor concrete works shall not commence until after the concrete has hardened and not earlier than three days after placing.
- 7.19.2 No filling shall be placed against retaining walls, headwalls or wingwalls within 21 days after placing of the concrete, unless the walls are effectively supported by struts or when the Contractor can demonstrate that 85 per cent of the design strength of the concrete has been achieved.



- 7.19.3 Selected backfill shall be placed against retaining walls and cast-in-place box culverts for a horizontal distance equal to one-third of the height of the wall. It shall consist of granular material, free from clay and stone larger than 50mm gauge. The Plasticity Index of this selected backfill material shall not be less than 2 or more than 12 when tested in accordance with AS 12893.3.1. The material shall be placed in layers not exceeding 150mm and shall be compacted to provide a relative compaction of not less than 98 per cent as determined by AS 1289.5.4.1 for standard compactive effort.

## SG 7.20 Sprayed Concrete

- 7.20.1 The minimum depth of sprayed concrete to be applied shall be 75mm.
- 7.20.2 Sprayed concrete shall have a minimum 28-day compressive strength of 25 MPa.
- 7.20.3 Earth surfaces shall be graded, trimmed and compacted and shall be dampened prior to applying the sprayed concrete. The Contractor shall take any precautions necessary to prevent erosion when the sprayed concrete is applied.
- 7.20.4 Rock surfaces shall be cleaned of loose material, mud and other foreign matter that might prevent bonding of the sprayed concrete onto the rock surface. The rock surface shall be dampened prior to applying the sprayed concrete.
- 7.20.5 The Contractor shall remove free water and prevent the flow of water, which could adversely affect the quality of the sprayed concrete.
- 7.20.6 Application shall begin at the bottom of the area being sprayed and shall be built up making several passes of the nozzle over the working area. The nozzle shall be held so that the stream of material shall impinge as nearly as possible perpendicular to the surface being coated. The velocity of discharge from the nozzle, the distance of the nozzle from the surface and the amount of water in the mix shall be regulated so as to produce a dense coating with minimum rebound of the material and no sagging. Rebound material shall be removed after the initial set by air jet or other suitable means from the surface as work proceeds and disposed of.
- 7.20.7 Spraying shall be discontinued if wind causes separation of the nozzle stream.
- 7.20.8 Concrete shall not be sprayed in air temperatures less than 5°C.
- 7.20.9 Construction joints shall be kept to a minimum. A joint shall be formed by placing or trimming the sprayed concrete to an angle between 30° and 45° surface. The joint edge shall be cleaned and wetted by air-water jet before recommencing concrete spraying.
- 7.20.10 When spraying around reinforcement, concrete is to be sprayed behind the reinforcement before concrete is allowed to accumulate on the face of the reinforcement.
- 7.20.11 Adjoining surfaces not requiring sprayed concrete shall be protected from splash and spray rebound. Splash or rebound material on these adjoining surfaces shall be removed by air-water jet or other suitable means as work proceeds.
- 7.20.12 Curing shall commence within one hour of the application of sprayed concrete and may be by water or by colourless wax emulsion curing

compound complying with AS 3799 and applied in accordance with manufacturer’s specifications.

- 7.20.13 In water curing, the surface of the sprayed concrete shall be kept continuously wet for at least seven days.

### SG 7.21 No Fines Concrete

- 7.21.1 Where no fines concrete is incorporated in the works it shall be rodded sufficiently only to ensure the form is completely filled. It shall be screeded to the required surface level without tamping or vibrating. No fines concrete shall be moist cured for at least four (4) days by covering with wet hessian, polythene sheet or other similar materials. The use of wet sand or any other material, which can enter the voids, will not be permitted for curing purposes.

### SG 7.22 Tolerances

- 7.22.1 Where tolerances for individual components and associated dimensions are not specified on the Project Drawings, deviations from established lines, grades and dimensions in the completed work shall not exceed the values stated herein.
- 7.22.2 The dimensional tolerances as shown in **Table S7.3** are to cover strength, durability and fit of prefabricated elements and cast-in-situ elements.

**Table S7.3 Dimensional Tolerances**

Description	Tolerance (mm)
Cross-sectional dimension of members and thickness of slabs	+ 10, - 3
Length of members, length and width of slabs: - Up to 18m dimension - 18m or over dimension	± 6 1mm for every 3m in length
Clear cover to reinforcement	+ 6, - 3
Fitments for prefabricated elements – girder anchorages (including dimensions between anchorages on adjacent piers), cored holes, handrail anchorages and other embedded items	± 5 max. 1mm for every 1m in length

- 7.22.3 Positional tolerances, as shown in **Table S7.4** refer to the departure of any point, plane or component of a structure from its correct position within the layout of the structure as shown on the Project Drawings.

**Table S7.4 Positional Tolerances**

Description	Tolerance (mm)
Level of Footings	± 20
Level other than footings	± 5
Horizontal location, where tolerances on fit is not acceptable	± 25

- 7.22.4 Relative tolerances refer to departures from linearity or planarity in any part of the structure. Tolerances are measured as the departure of any point in a line or surface from the remainder of that line or surface.
- 7.22.5 Departure may be sudden (e.g. misfit at joint in formwork) or gradual (e.g. a wobble in the surface). Tolerance on gradual departure is the value calculated by multiplying the overall length of the line or surface under consideration by the factor given below in **Table S7.5**.

**Table S7.5 Relative Tolerances**

Description	Tolerance (mm)
Exposed edge – gradual departure	0.001
Exposed surface – gradual departure	0.004 (10mm max.)
Exposed surface – sudden departure	3 mm max

## SG 8 Landscaping

### General

#### SG 8.1 Scope

- 8.1.1 This specification details all requirements pertaining to Tree Planting, Grassing, Turfing, Hydromulching and Irrigation works associated with permanent and temporary revegetation works.
- 8.1.2 Where there is any conflict determined between the requirements specified herein and the requirements of any referenced Australian Standard, Statutory Authority Standards or otherwise, the requirements specified herein shall apply.

#### SG 8.2 Reference Documents

- 8.2.1 Australian Standards:
- 8.2.1.1 AS1432 Copper Tubes for Plumbing, Gasfitting and Drainage Applications
  - 8.2.1.2 S/NZS1477 PVC Pipes and Fittings for Pressure Applications
  - 8.2.1.3 AS2032 Code of Practice for Installation of PVC Pipe Systems
  - 8.2.1.4 AS2507 The storage and Handling of Pesticides
  - 8.2.1.5 AS2845 Water Supply – Back Flow Prevention Devices
  - 8.2.1.6 AS3785 Solvent Cements and Priming Fluids for Use with UPVC Pipes and Fittings
  - 8.2.1.7 AS4419 Soils for Landscaping and Garden Use
  - 8.2.1.8 S4454 Composts, Soil Conditioners and Mulches
- 8.2.2 Queensland Legislation:
- 8.2.2.1 Queensland Land Protection Act (2002)
- 8.2.3 Whitsunday Regional Council:
- 8.2.3.1 Biosecurity Plan 2016-2020

## Materials

### SG 8.3 Grass Seeding

- 8.3.1 The grass seeding species mix shall consist of the following:
  - 8.3.1.1 30% Cynodon Dactylon (green couch) – hulled
  - 8.3.1.2 30% Cynodon Dactylon (green couch) - unhulled
  - 8.3.1.3 30% Axonopus Affinis (carpet grass)
  - 8.3.1.4 10% Tetila Rye (in dry season) or Japanese Millet (in wet season)
- 8.3.2 The accepted final mix shall be dependent upon local conditions, soil properties, and method of works.

### SG 8.4 Turfing

- 8.4.1 Turf shall consist of 25mm depth of dense, well rooted, vigorous grass growth with 25mm depth of topsoil. It should be free from any material toxic to plant growth, declared weeds, seeds or roots including nut grass and oxalis. The soil attached to the turf shall be free from rubbish, sticks and other deleterious material.
- 8.4.2 The turf shall be supplied as rolls in long lengths of uniform width, not less than 300mm, and shall be in sound unbroken condition.
- 8.4.3 The moisture level in the cut turf should be kept relatively consistent so that it is not saturated or severely dried out when laying. Both of these situations can cause turf to fall apart during laying.
- 8.4.4 The type of grass turf to be used shall as stated on the approved Project Drawings, where not stated broad leaf buffalo shall be used for un-irrigated areas and couch for irrigated areas.
- 8.4.5 Acceptable species for this region are as follows:
  - 8.4.5.1 Axonopus compresus (Broad leaf buffalo)
  - 8.4.5.2 Digitaria didactylia (Blue Couch)
  - 8.4.5.3 Cynodon dactylon (Bermuda Couch / Green Couch).

### SG 8.5 Hydromulch

- 8.5.1 The hydromulching mixture shall consist of the following:
  - 8.5.1.1 Mulch - Pulped Paper / Bagasse or Cane fibre
  - 8.5.1.2 Fertiliser - Broad spectrum type CK55 or equivalent.
  - 8.5.1.3 Seed - 33% Cynodon Dactylon (Green Couch) - hulled 33% Cynodon Dactylon (Green Couch) - unhulled 33% Axonopus Affinis (Carpet Grass)
  - 8.5.1.4 Water - Water used to establish and maintain the grassing shall have a pH of between 5.0 and 8.0, a total soluble salts concentration less than 1000mg/l and contain no chemicals or compounds toxic to growth.

- 8.5.1.5 Binder/Tackifier - Binder is to be non-toxic, inert, water soluble and non-flammable, e.g. Curasol or equivalent. Tackifier is to be a non-toxic and biodegradable e.g. Envirotack or equivalent.

## SG 8.6 Plant Stock

- 8.6.1 All plant species shall be as detailed on the approved Project Drawings. There shall be no substitution of any species without Council approval.
- 8.6.2 All palms, trees, shrubs and groundcovers shall be true to name. The root system of each plant shall be conducive to successful transplantation, all specimens shall be free from pests and disease, especially Phytophthora, palm beetle, sooty mould and scale, and all containers shall be free from pernicious weeds.
- 8.6.3 All plants shall be grown in containers and shall comply with the following minimum size requirements:
  - 8.6.3.1 Trees - 25 litre container for street tree planting,
  - 8.6.3.2 Trees - 45 litre container for medians, tree guards, traffic islands and roundabouts,
  - 8.6.3.3 Single stemmed palms - 45 litre container,
  - 8.6.3.4 Clumping Palms - 45 litre container □ Shrubs - 200mm container,
  - 8.6.3.5 Groundcovers – 140mm container.
- 8.6.4 Plants shall be watered before transportation to the planting site, and shall be delivered to the site in a covered container. During loading and unloading damage in handling shall be avoided.
- 8.6.5 Species identified in the following are prohibited from use:
  - 8.6.5.1 Land Protection (Pest and Stock Route Management) Act 2002,
  - 8.6.5.2 Land Protection (Pest and Stock Route Management) Regulation 2003
  - 8.6.5.3 Species identified in the Local governments Pest Management Plans, and
  - 8.6.5.4 Publication “Agricultural and Environmental Weeds – Far North Queensland” (Wet Tropics Management Authority and Department of Natural Resources and Mines & Energy)

## SG 8.7 Soil Mix

- 8.7.1 A good quality landscaping soil mix shall be imported from an approved source to the planting site for backfilling the planting pits.
- 8.7.2 Specification for the landscaping soil mix are as follows:
  - 8.7.2.1 It shall contain approximately 70% sandy loam and 30% composted or mature organic matter;
  - 8.7.2.2 It shall be friable and not contain any clay;
  - 8.7.2.3 The pH shall be between 5.5 and 7.0;
  - 8.7.2.4 It shall be free from contaminants such as the seed of declared weeds, rocks sticks and salts;
  - 8.7.2.5 It shall not contain any chemical fertilisers.

## SG 8.8 Fertiliser

8.5.1 Fertiliser shall conform to the requirements stated in **Table S8.01**.

**Table 8.01 Fertiliser Types**

Location	Chemical Type	Type of Application	NPK Analysis
Grass Seeding (Complete lawn fertiliser)	Inorganic	Surface broadcast	N 15 to 24 P 6 to 9
Turfing (Complete lawn fertiliser)	Inorganic	Surface broadcast	N 15 to 24 P 6 to 9
Tree Planting (Controlled release fertiliser)	Organic or inorganic	Fertiliser Tables (2 per tree)	N 15 to 25 P 3 to 9
Planting Beds (Controlled release fertiliser)	Organic or inorganic	Granular	N 18 to 25 P 3 to 7 K 9 to 18

## SG 8.9 Irrigation Pipework

- 8.9.1 All below ground pipework shall be unplasticised Poly-vinyl Chloride (uPVC) unless otherwise approved. All pipes shall be Class 12 minimum with Class 18 fittings.
- 8.9.2 All above ground pipe work shall be copper tube (hard drawn) Type D manufactured in accordance with AS 1432 by an Australian Standards quality endorsed company.

## Construction

### SG 8.10 Grass Seeding

- 8.10.1 Prior to grass seeding all weeds shall be killed by spraying a suitable herbicide. Sprayed areas shall remain undisturbed for two weeks.
- 8.10.2 Prior to grass seeding the ground surface shall be lightly tined to a depth of 100mm below finished surface levels (where slopes are less than 10%). All large stones, rubbish and other materials that may hinder germination shall be removed before topsoiling.
- 8.10.3 Parks may require additional topsoil to a depth of not less than 75mm and shall be lightly compacted and grassed if Council considers the in-situ topsoil of waster quality and is too rocky.
- 8.10.4 Grass seeding applied by drill seeding at the minimum rate of 50kg per hectare using the species mix specified.
- 8.10.5 Fertiliser should be applied following seeding at a minimum rate of 350kg per hectare, subject to specific site conditions, soil analysis and desired outcomes.
- 8.10.6 Seed and fertiliser should be applied at an even rate using a calibrated disc drill seeder followed by a chain and roller.

- 8.10.7 Disc's should cut approximately 12mm and create enough friable material for chains to cover the seed.
- 8.10.8 Where one pass fails to develop enough friable material a second pass should be made in a transverse direction.
- 8.10.9 Watering is the application of 10mm of water to the total area in not less than one hour and shall include any natural rainfall. The frequency of watering shall comply with the following minimum requirements in **Table 8.02**:

**Table 8.02 Grass Seeding Water Requirements**

Periods after Grassing	Watering(s)
Immediately	Once
Week 1	Twice / day during hot, dry or windy periods Once / day during cool / overcast periods
Week 2	Once / day
Weeks 3 & 4	Once every second day
Week 5 until necessary	Twice a week or as necessary to ensure 80% minimum strike rate

- 8.10.10 Acceptance shall be the achievement of a minimum vegetative cover of 80% of both the annual and perennial grass cover over the whole area. Grassed areas shall exhibit signs of healthy growth and shall be free of weeds, stones, sticks and other deleterious material. Maximum deviation from finished ground levels 50mm in any 2 metres.

### SG 8.11 Turfing

- 8.11.1 Prior to turfing all weeds shall be killed by spraying a suitable herbicide. Sprayed areas shall remain undisturbed for two weeks.
- 8.11.2 Topsoil shall be uniformly applied to provide an average thickness of 50mm with a minimum compacted thickness of 25mm at any location and graded to even-running contours, so that no ponding or waterlogging occurs across the surface of the grassed area.
- 8.11.3 The prepared surface shall be watered within twenty four (24) hours prior to turfing at an application rate of 10mm of water in not less than 1 hour. Watering is to be carried out in such a way as not to cause any scouring or erosion.
- 8.11.4 After watering an approved lawn pesticide shall be applied at the rate specified by the supplier and in accordance with the Agricultural Chemicals Distribution Contract Act and Regulations.
- 8.11.5 Fertiliser should be applied prior to laying turf at a minimum rate of 350kg per hectare, subject to specific site conditions, soil analysis and desired outcomes.
- 8.11.6 Topsoil shall be raked before turf is laid. Turf shall be laid in straight lines with staggered cross joints on the general line of the contour of the slope. The gaps between adjacent sections of turf should not exceed 5mm.
- 8.11.7 A light top dressing shall be worked into the open joints between the turf and then the turf lightly rolled with one pass of a roller weighing about 80kg on a

1m width of roller. Alternative methods to rolling shall be used where slopes exceed 10%.

- 8.11.8 On steep slopes (exceeding 10%) turf may be held in position by softwood pegs or stakes, located at each end of the turf sections.
- 8.11.9 Watering is the application of 10mm of water to the total area in not less than one hour and shall include any natural rainfall. The frequency of watering shall comply with the requirements in **Table 8.03**:

**Table 8.03 Turfed Watering Requirements**

Periods after Grassing	Watering(s)
Immediately	Once
Week 1	Once every second day
Week 2, 3 & 4	Three times each week
Weeks 5 - 12	Twice a week

- 8.11.10 Acceptance shall be the achievement of an even green colour with a dense continuous sward over the whole area. Turf shall exhibit signs of healthy growth and shall be free of weeds, stones, sticks and other deleterious material. Maximum deviation from finished ground levels 50mm in any 2 metres.

### SG 8.12 Hydromulching

- 8.12.1 Prior to hydromulching all weeds shall be killed by spraying a suitable herbicide. Sprayed areas shall remain undisturbed for two weeks.
- 8.12.2 Batter slopes less than 20% shall then be lightly tined to a depth of 50mm to produce a loose surface and all large stones, rubbish and other materials that may hinder germination shall be removed before topsoiling.
- 8.12.3 Where batters have been stepped, the steps shall be loosely filled with topsoil. Elsewhere, topsoil shall be uniformly applied to provide an average thickness of 75mm with a minimum compacted thickness of 40mm at any location.
- 8.12.4 Dry surfaces shall be watered by a fine spray before the application of the hydromulch.
- 8.12.5 The slurry mixture of mulch, binder, fertiliser and seed is to be kept in a homogenously mixed state throughout the mulching operation.
- 8.12.6 During preparation of the hydromulch, a liquid form pesticide may be added to the storage tank, to facilitate surface application. Application rate should be in accordance with the manufacturer’s recommendation.
- 8.12.7 Additional protective treatments (e.g. fibre matting, anionic bitumen emulsion etc) shall be as specified on the approved Project Drawings.
- 8.12.8 Hydromulch shall not be applied under the following weather conditions at the site:
  - 8.12.8.1 when temperature is higher than 35°C
  - 8.12.8.2 when winds exceed 15 km/hr;



8.12.8.3 where the surface is too wet or

8.12.8.4 during rain periods or when rain appears imminent.

8.12.9 The rate at which the mulch is applied is dependent on slope shall be in accordance with **Table S8.04**.

**Table S8.04 Hydromulching Material and Application Rates (per 1000m)**

Slope	<5%	5% - 12%	12% - 20%	20% - 50%	>50%
Pulped Paper	200kg	120kg	120kg	140kg	200kg
Bagasse (wet weight)	200kg	400kg	500kg	700kg	800kg
Cane Fibre (alternative to bagasse)	200kg	200kg	300kg	400kg	500kg
Fertiliser	50kg	50kg	50kg	50kg	50kg
Seed	5kg	5kg	5kg	5kg	5kg
Water	8000 litres	8000 litres	10,000 litres	12,000 litres	18,000 litres
Binder Curasol Envirotack	5 litres 3kg	5 litres 2kg	7.5 Litres 7.6 3kg	15 litres 5 kg	30 litres 5kg
Mulch Thickness	1-2mm	2-3mm	2-4mm	2-4mm	4-6mm

8.12.10 Watering is the application of 10mm of water to the total area in not less than one hour and shall include any natural rainfall. The frequency of watering shall comply with the following minimum requirements in **Table S8.05**:

**Table S8.05 Irrigation of grass**

Periods after Grassing	Watering(s)
Immediately	Once
Week 1	Twice / day during hot, dry or windy periods Once / day during cool / overcast periods
Week 2	Once / day
Weeks 3 & 4	Once every second day
Week 5 until necessary	Twice a week or as necessary to ensure 80% minimum strike rate

8.12.11 A follow up fertiliser treatment is to be applied to 4 – 6 weeks after germination has occurred. Fertilisation should be with a product that provides for the following elements: Nitrogen (N) 13%, Phosphorus (P) 4% and Potassium (K) 12%.

8.12.12 Acceptance shall be subject to the achievement of a minimum vegetative cover of 80% of both the annual and perennial grass cover over the whole area. Hydromulched areas shall exhibit signs of healthy growth and shall be free of weeds, stones, sticks and other deleterious material.

## SG 8.13 Planting

- 8.13.1 Planting shall be carried out as soon after delivery to the site as possible. All containers, unless fully biodegradable, shall be removed at the latest point before planting.
- 8.13.2 All plants shall be obtained from a nursery located in an area having a similar climate to the site of the Works.
- 8.13.3 Shrub and ground cover planting to verges and traffic islands etc. shall be as detailed on the approved Project Drawings.
- 8.13.4 Prior to planting all weeds shall be killed by spraying a suitable herbicide. Sprayed areas shall remain undisturbed for two weeks.
- 8.13.5 Street trees shall be planted at the locations as shown on the approved Project Drawings.
- 8.13.6 During backfilling around the plants the soil shall be lightly firmed to ensure intimate contact with the roots, but with large material successive layers of soil will need to be firmed as backfilling proceeds.
- 8.13.7 Ensure the plants are held securely by the soil but not so that moisture penetration of the soil is restricted. After planting, damaged, dead, diseased or crossing branches shall be removed by pruning.
- 8.13.8 Plants should be watered directly after planting prior to spreading of mulch. The mulch shall be left just clear of the plant stem.
- 8.13.9 All trees shall be staked with three (3) 38 x 38 x 2400mm hardwood stake, extending into the ground to a depth of 500mm. Do not allow the stake to penetrate the root ball. Secure the tree to the stake with plastic multi-purpose chain ties. Refer Council's Standard Drawings.
- 8.13.10 Mulch shall be aged hardwood woodchip, stockpiled for a minimum of 6 weeks, or other mulch approved by Council, free from rocks, non-biodegradable and toxic material. In paved footpath planters it shall be installed to a depth of 75mm, in tree guards, traffic islands and mulched, mass planted garden beds within parkland and reserves to a depth of 150mm. In areas being re-vegetated, mulching shall be to a depth of 200mm.
- 8.13.11 Peanut shell or forest litter mulch may be used in "natural" planting areas only, such as buffer planting or parkland planting. It should be installed to a minimum 150mm compacted depth, free from rocks, nut grass, and any other invasive weed.
- 8.13.12 Tea-tree mulch is prone to combustion and shall not be used unless permission is obtained from Council.
- 8.13.13 All plants shall be watered, immediately upon planting, and at the rate of 10 litres per plant every third day for the first twelve weeks.
- 8.13.14 Weed and grass growth in mulched areas shall be killed by treatment with herbicide in accordance with the manufacturer's instructions at monthly intervals during the construction period and contract maintenance period. Contact of the herbicide with the new plants shall be avoided and any damage repaired, or damaged plant material replaced.
- 8.13.15 Acceptance shall be subject to achieving the following criteria:
  - 8.13.15.1 Plants, which do not meet the acceptance criteria, shall be replaced.
  - 8.13.15.2 Replacement plants shall be of similar size and quality and of identical species and variety to the plant being replaced.

- 8.13.15.3 Plants shall exhibit signs of healthy growth,
- 8.13.15.4 Plants shall be well formed,
- 8.13.15.5 Plants shall be free from disease or insect pests,
- 8.13.15.6 Plants shall be free of physiological disease symptoms (yellowing, wilting etc),
- 8.13.15.7 Mulch shall be free from weeds, sticks, rubbish and other deleterious material.

## Irrigation

### SG 8.14 General

- 8.14.1 Application shall be made to Council for connection of irrigation systems to the water main. The Contractor shall arrange with the Council for the timing of the work. All works shall be carried out by the relevant Local Authority at the applicants cost.
- 8.14.2 The Applicant will be responsible for the payment of all water used during construction, testing, establishment and maintenance of the irrigation system and landscape works.

### SG 8.15 Excavation

- 8.15.1 Do not excavate by machine within 500mm of existing underground services.
- 8.15.2 The standard width of trench for pipes shall be 150mm.
- 8.15.3 Unless noted otherwise on the approved Project Drawings or directed by Council all pipe work is to be installed with a minimum cover of 350mm.

### SG 8.16 Laying of Pipes

- 8.16.1 All pipe work to be bedded in clean fill sand with a minimum cover of 50mm all round.
- 8.16.2 Special precautions are to be taken to exclude dirt, sand, grit or gravel from entering pipelines.
- 8.16.3 The open ends of pipes shall be plugged at the end of the day's work to prevent entry of water or mud.

### SG 8.17 Pressure Testing

- 8.17.1 All work shall satisfy a test pressure of the nominated working pressure for a period of two (2) hours. The test shall be carried out during the coolest part of the day. The point at which the test pressure is measured shall be at the lowest point in the profile of that section of main under test.

- 8.17.2 All tests shall be carried out under the supervision and in the presence of the Council Inspector.
- 8.17.3 Any defects that arise during the tests shall be repaired in an approved manner. Any leak however small will be classed as a defect. All such repair work shall be similarly tested and approved before acceptance.
- 8.17.4 The Contractor shall give 48 hours notice to Council so that arrangements can be made for supervision of the testing.
- 8.17.5 The Contractor shall accept all risks and expenses incurred during testing and shall provide all labour together with all pumps, engines, pipes, temporary valve plugs, flanges and all other equipment as may be necessary to undertake testing

### SG 8.18 Flushing

- 8.18.1 After pressure testing has been carried out the new pipework shall be flushed as thoroughly as possible with the available water pressure.

### SG 8.19 Controllers

- 8.19.1 All Council landscaped areas, which require irrigation systems shall be controlled by electrically, operated solid state controller.

### SG 8.20 Filtration

- 8.20.1 All irrigation systems shall be fitted with an approved flow strainer installed in a secure enclosure.

### SG 8.21 Valves

- 8.21.1 Electrically actuated solenoid valves shall have flow control, manual bleed screw, 24 VAC solenoid, Buna N diaphragm, and be constructed of PVC and stainless steel. They shall be suitable for direct burial and have 150 psi maximum working pressure. They shall be pressure regulating solenoid valves.
- 8.21.2 Isolation valves shall be of bronze construction and of the BSP screwed gate type as approved by the engineer. They shall be installed on the supply side at every solenoid valve to enable isolating.
- 8.21.3 Protective valve boxes are to be provided for each solenoid valve. They shall be constructed of green high density polyethylene, be 450 x 300 x 300mm in dimension, and have a lockable lid with the word "Irrigation" clearly marked on it.

- 8.21.4 The wiring from the solenoid to the controller shall be laid in conduit and shall be of 250 volt grade and shall be installed to approved standards. The wiring shall be located with all pipework.
- 8.21.5 All solenoid valves shall be connected to controller by 0.05mm solid core wire and to have seven insulated cores within a common plastic protective shield. It shall be similar in all respects to RIS multi-core 7/0.5mm electrical control wire and shall be continuous between valve and controller, and valve to valve. An additional one metre length of cable shall be provided at each wire termination. Cable shall be sized for voltage drop not exceeding four (4) volts over total route length.

## SG 8.22 Backflow Prevention Devices

- 8.22.1 All Council landscaped areas, which require irrigation systems, shall have a backflow prevention device installed. This device should comprise of a stand constructed fully from hard drawn copper pipe (Type D) and should have an inline strainer both before and after the backflow preventer. This should comply with AS 2845.

## SG 8.23 Performance Test

- 8.23.1 On completion of the installation the system shall be tested in the presence of a Council Inspector.
- 8.23.2 The system shall be operated to demonstrate that all components function as required by the design.
- 8.23.3 The Contractor is responsible for making all necessary alterations to the system so that the performance is in accordance with the design specifications.

## SG 8.24 Backfilling of Trenches

- 8.24.1 Trenches shall be backfilled with the excavated material. If the excavated material is considered unsuitable for backfilling by the Council Inspector, it shall be removed from the site and replaced with clean approved backfill material.
- 8.24.2 All trenches so backfilled shall be compacted and lightly raked to ensure that surface levels marry with adjacent surface levels, are free draining and free from mounds or depressions. All rocks or evidence or excavated subgrade shall be raked up and removed.

[Form 1 – Statement of compliance Operational works design](#)

