

WHITSUNDAY REGIONAL COUNCIL

DEVELOPMENT MANUAL

Version No. 1.3

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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 Flow
AHD Australian Height Datum

AMCORD Australian Model Code for Residential Development

ARI Average Recurrence Interval
ASD Approach Sight Distance

ASS Acid Sulphate Soils

AV Air Values
BBQ Bar-Be-Que

CBR California Bearing Ratio

CD Compact Disk

Consulting Engineer Consulting Engineer is an RPEQ

CPESC Certified Professional in Erosion & Sediment Control
CPTED Crime Prevention through Environmental Design

DAYS Business Days

DICL Ductile Iron Cement Lined

EP Equivalent Persons

ESA Equivalent Standard Axles
ESC Erosion & Sediment Control

ESCP Erosion & Sediment Control Plan
ESCS Erosion & Sediment Control Strategy

ESD Entering Sight 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

ITP Inspection & Test Plan

K Potassium

LATM Local Area Traffic Management

MUTCD Manual of Uniform Traffic Control Devices

N Nitrogen

NATA National Association of Testing Authorities

P Phosphorus

PASS Possible Acid Sulphate Soils

PE Polyethylene PVC-M PVC Modified

DTMR Department of Transport and Main Roads

Old	Ouganaland
Old	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 Sight Distance

SQUIDs Stormwater Quality Interception Devices

Surveyor Registered Surveyor with the Surveyors Board Queensland

SV Scour Valves

u PVC Unplasticised PVC

vpd Vehicles per day

Wet Sediment Basin

A wet sediment basin has the capacity to contain all runoff 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 75th

and 90th percentile.

Refer to IECA Best Practice Erosion & Sediment Control

A1 - APPLICATION PROCEDURES

GENERAL

AP1.01 INTRODUCTION

- 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;
- 2. It should be read in conjunction with the relevant preliminary approval and / or development permit conditions;
- 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:
- 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 requesting Council approval of designs and specifications;
- 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 a Registered Professional Engineer Queensland (RPEQ);
- 6. Plans for landscape works by a person of professional standing and competence in the field of Landscape Architecture or Landscape Design, at 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;
- 7. Designs, calculations, drawings and specifications are to be submitted as supporting information to an application for a Development Permit for Operational Works; and
- 8. Operational Works Permits will not be issued until evidence of payment of the Portable Long Service Leave and Occupational Health and Safety fees is provided.

DESIGN APPROVAL

AP1.02 PRE-LODGEMENT DISCUSSIONS

- 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:
- Legal point(s) of stormwater discharge;
- Identify environmentally significant areas and heritage features;
- Internal and external stormwater catchment boundaries;
- Tailwater conditions including water quality requirements and determination of tailwater level;
- Connection point(s) for water supply and available pressure and discharge capacities;
- Discharge point(s) for sewerage;
- Set back distances from watercourses for on-site wastewater treatment and disposal;
- Future planning for the provision of services, eg, 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 larger water mains to serve areas beyond the development;
- Site Conditions:
- Development Permit Conditions for the particular development;
- Layout design, Speed restriction; and
- Landscaping works for on street works and public open space.
- 2. Approval of designs can be expedited where the above issues have been resolved in advance;
- 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);
- 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:
 - Possible variations to Council's manuals and standards;
 - Variations to design due to inability to obtain drainage discharge approvals; and
 - Requests for Council to contribute towards some aspects of the work.
- 5. Resolution of these issues, particularly those requiring a decision of Council, (i.e. amendments to conditions of approval, or requests for Council contributions), is essential to avoid protracted approval periods and wasted design effort.

AP1.03 DESIGN REQUIREMENTS

 The design of operational works shall 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;

- 2. It is Council's requirement that the design of all operational works shall be prepared under the direction of, and certified by a RPEQ. Designer must bear full responsibility for all aspects of the design of all operational works, which they prepare; and
- Road safety audit to be undertaken by a suitably experienced RPEQ as per the requirements in Austroads Guide to Road Safety to verify designs and signage prior to submission to council.

AP1.04 CONSENT OF ADJOINING LANDOWNERS

- 1. Written approval is required from adjoining property owners authorising any operational works on their property; and
- 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. 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);
- 2. Submissions with a full complement of supporting documentation will ensure minimal delays in Council's approval timeframes;
- 3. Following the issue of an operational works permit, any plans that are required to be amended shall be re- submitted with an accompanying letter outlining the amendments and including any necessary calculations or documentation as supporting information; and
- 4. Further, one complete specification shall be issued to Council incorporating any required amendments following the issue of an operational works permit.

AP1.06 LOCAL AUTHORITY APPROVAL

- 1. The 'Statement of Compliance Operational Works Design' (refer <u>Form</u> 1) has been introduced to expedite the approval process;
- 2. In all but critical aspects and the nominated non-complying aspects, Council's review will be on an audit basis only;
- 3. If the Council review reveals the Statement of Compliance to be inaccurate or incomplete, the submission may be returned to the Designer for resubmission. A subsequent review fee will be levied in these cases in accordance with Council's fees and charges;
- 4. It is the Designer's responsibility to ensure the design as submitted takes into account all site conditions and complies with Council's approval conditions, Council's local laws, Policies, the provisions of this Development Manual and other relevant authorities;
- Council's review 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 Whitsunday Regional Council Planning Scheme 2017– Schedule 6 – June 2017 (V3.5)

at the cost of the Developer, despite its prior approval;

- 6. Within five (5) days of Council's approval, the Designer shall submit an electronic copy of the requirements of 1.08 below; and
- 7. Two (2) street names for each new street (in line with any council naming policy) must be lodged for consideration and approved by Council before construction is complete.

AP1.07 APPROVAL OF OTHER AUTHORITIES AND REFERRAL AGENCIES

- 1. The Applicant shall be responsible for gaining the approvals of any other Authorities having jurisdiction over any part of the works;
- 2. All works on State controlled roads will be subject to Department of Transport and Main Roads approval and is to be carried out in accordance with the Department's Policies, Standards and Guidelines; and
- 3. All referral agency conditions to be included in design documents and must be approved by each agency (if required), prior to submission to Council.

AP1.08 SUPPORTING INFORMATION

General

- 1. Supporting Information for Operational works shall include the following:
 - Design Plans (1 x A1 and 1 x A3 plus 1 additional copy of all plans in PDF format);
 - Job Specification (1 copy);
 - Design Report (1 copy);
 - Design Checklist;
 - IDAS Checklist 4 (Operational work);
 - IDAS Form 1 (Application details);
 - IDAS Form 6 (Building or operational work assessable against a planning scheme);
 - Evidence that the prescribed Application Fee as stated in Council's Fees and Charges Schedule, has been paid;
 - Evidence of payment of the Portable Long Service Leave and Occupational Health and Safety fee; and
 - 'Permit to Enter & Construct' letters and easement documents relevant to the application.

Design Plans

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

Job Specification

- 1. A Job Specification shall be prepared by the Designer specifying site specific requirements not covered in standard specifications; and
- 2. All works shall be in accordance with Council's standard specifications where available. Where no Council standard specifications exist for a particular type of work, the Designer may use the Department of Transport and Main Roads specification or their own standard specification. Both options shall be subject to approval by Council.

Design Report

- 1. 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;
- 2. The Design Report shall be a bound report signed by the Designer and shall contain all the necessary design calculations, correspondence and information to enable Council to expeditiously check the design submission and grant approval to construct; and
- 3. The Design Report shall contain the following:
 - A completed "Statement of Compliance Operational Works Design" endorsed by the Designer(s);
 - 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;
 - Records of pre-submission discussions with Council including confirming correspondence;
 - Copies of letters of approval from adjoining property owners for any works or discharge on their properties;
 - Evidence that negotiations have been entered into regarding provision of supply with Service Authorities (including approved reticulation / service plans, if available);
 - Stormwater drainage calculations in spreadsheet format in accordance with QUDM requirements including detail of pit types and capture charts used and tailwater levels adopted:
 - Stormwater Drainage Catchment Plan(s) detailing external catchments and internal sub catchments:
 - Design details of alternatives proposed which depart from the Development Manual /

Development Conditions with supporting arguments for how the alternative meets Council's objectives;

- Design calculations for detention basins, dissipaters, open channel, catch drain, adopted tailwater levels etc:
- Design criteria and parameters, operating regimes and calculations for permanent water quality
 works such as stormwater quality interception 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;
- An Erosion and Sediment Control Strategy (ESCS) addressing erosion and sediment management during construction;
- Traffic Management Plan in accordance with the Manual of Uniform Traffic Control Devices;
- Water and sewerage reticulation networks in a format compatible with Council's network system;
- If the water supply is from a newly developed source, provide information on quality, quantity, disinfection and infrastructure proposed;
- Pavement design including records of geotechnical tests indicating subgrade CBR's, adopted traffic load, requirements for subsoil drainage and subsoil drainage design by a geotechnical engineer;
- Geotechnical reports, where relevant, relating to slope and batter stability, in-situ materials etc;
- Structural and Geotechnical certification of design of miscellaneous structures including retaining walls, non-standard headwalls, drainage structures, reservoirs etc;
- Design parameters and operating regimes for water supply and sewerage pump stations;
- Full design drawings and pre-commissioning plan for water and sewerage pump stations;
- Landscaping Design Drawings for Subdivision Works showing details of Parks / Reserve Planting, Street Tree Planting, Buffer Zone Planting and any Hillslope Development Works if applicable;
- For staged development, master plans showing the overall design concept for:
 - Water including pump stations;
 - · sewer including pump stations;
 - stormwater;
 - roadworks;
 - earthworks;
 - roads hierarchy;
 - pathways;
 - public transport;
 - lighting and other services;
 - easements, freehold lots and land to be deeded to Council for accommodating the works;
 - open space areas, and
 - Erosion and Sediment Control strategy and location of permanent survey marks.

With Stage 1 development and with updated copies to be provided with each subsequent stage. Subsequent development plans will show the 'as constructed' information of all the earlier stages.

- 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 cost; reliability etc);
 and
- A fully priced estimate of construction costs in the form of a priced schedule of quantities.

PLAN PRESENTATION AP1.09 GENERAL REQUIREMENTS

1. These presentation minimum standards shall apply to engineering and landscaping plans submitted for approval for operational works associated with approved developments;

- 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; and
- 3. Scaled Engineering Drawings in accordance with this manual are required for plan review.

AP1.10 TITLE BLOCK

- 1. Each sheet of the Design Drawings shall have a Title Block containing the following information:
 - Development / Estate Name (if any);
 - Locality / Approved Street Name;
 - Developer's Name;
 - Bar Scales as a minimum (Alternately Numerical Scale with original sheet size stated);
 - Plan Number and Sheet Number;
 - Schedule and Date of Amendments; and
 - Certification by RPEQ (for engineering drawings).

AP1.11 SHEET SIZES

1. Preferred sheet sizes (Overall dimensions)

A1 841 mm x 593 mm A3 420 mm x 297 mm

AP1.12 SCALES

1. Scales used for plans should preferably be those recommended by the Standards Association. Generally, the following scales should be used 1:1, 1:2, 1:5 and multiples of 10 of these. All scales should be bar scales.

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

^{*} Sewerage Reticulation should be 1:500

AP1.13 DIMENSIONS

Dimensioning On Plans

- 1. Linear dimensions on all roadworks plans will be in metres, with the exception of some detail plans of small structures (eg. manholes) and some standard plans (eg. kerb and channel), which may be in millimetres; and
- 2. Details of methods of dimensioning shall be in accordance with AS 1155 Appendix A Metric Units in Construction.

Standard Cross-Section Intervals

 Urban and rural cross-sections should be provided to roads at 20.0m intervals and tangent points, with further reduction to 10.0 m or 5.0 m intervals where necessary due to horizontal or vertical curvature.

Chainages and Offset Dimensions

1. Chainage and Offset Dimensions on plans shall be expressed to 0.01 m. (0.005 may be used as the order of accuracy requires).

AP1.14 LEVELS

- 1. All levels shall be reduced to Australian Height Datum, unless otherwise approved by the Local Authority;
- Reduced levels of Bench Marks and Reference Pegs including Permanent Survey Marks shall be expressed to three decimal places i.e. 0.001 m. The location of the origin of the survey shall be on the plan;

- 3. Reduced levels of roadworks and stormwater drainage shall be expressed to three decimal places ie. 0.001m; and
- 4. Reduced levels of sewerage reticulation shall be expressed to three decimal places ie.0.001m.

AP1.15 GRADES

- 1. Road grades shall be shown as a percentage to two decimal places; and
- 2. Pipe grades shall be shown either as a percentage to two decimal places or as gradient to one decimal place.

DESIGN DRAWINGS

AP1.16 DRAWINGS REQUIRED

- 1. Operational works drawings will generally consist of the following:
 - Locality Plan;
 - Subdivision Layout / Staging Plan (if applicable);
 - Earthworks Plan;
 - Roadworks and Drainage Plan;
 - Longitudinal Section of each Road;
 - Type Cross-Sections for each road;
 - Cross-Sections of each Road;
 - Detail Plan of each Intersection and cul-de-sac;
 - Longitudinal Section of each Stormwater Drainage Line;
 - Sewerage Reticulation Plan, long section and pump station details;
 - Water Reticulation Plan and pump station plans and details;
 - Landscape Plan;
 - Erosion and Sediment Control Strategy;
 - Service providers Conduit Plan, including street lighting;
 - Stormwater Catchment Plan / Drainage Calculation Table; and
 - Miscellaneous Details.
- 2. The minimum requirements for each drawing are detailed in the following sections.

AP1.17 LOCALITY PLAN

- 1. Locate the subdivision / development in relation to adjacent towns, main roads, major streets, etc;
- 2. North Point; and
- 3. May be included on Layout / Staging Plan for large jobs or Roadworks and Drainage Plan for smaller jobs.

AP1.18 LAYOUT / STAGING PLAN

- 1. For staged 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;
- 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; and
- 3. For small subdivisions, where all new roads and infrastructure can be shown on one detail plan, the layout plan may be omitted.

AP1.19 EARTHWORKS PLAN

- 1. The Earthworks Plan may be included with the Roadworks and Drainage Plan for smaller subdivisions and shall include:
 - Legend;
 - Existing site contours and finished surface contours. (Spot levels should be used to complement contours);
 - Limits and levels of major allotment cut and fill distinguished by hatching;
 - Locations of cut and fill batters relative to allotment boundaries;
 - Location and levels of retaining walls (if required);
 - Batter slopes and treatments;
 - Appropriate flood levels in accordance with Council's Policies;
 - North Point:
 - Location(s) and level(s) of permanent survey mark(s), reference stations etc, used as datum for the works;
 - Vegetation including trees proposed to be removed and those to be retained; and
 - For smaller subdivisions, the earthwork details may be included on the Roadworks and Drainage Plan.

AP1.20 ROADWORKS AND DRAINAGE PLAN

- 1. The Plan of each road shall include:
 - Legend;
 - Road reserve boundaries;
 - Allotment numbers and boundaries, both existing and proposed (including existing and proposed easements);
 - Chainages, on centreline or construction line;
 - Bearings of the centreline or construction line. (Set out co-ordinates may also be used);
 - Tangent point chainages of each curve;
 - Radius and arc, tangent length of each curve;
 - Chainage and the Intersection Point of road centre lines or construction lines;
 - Kerb lines, kerb radii, and chainage of all tangent points of the kerb line;
 - Footpaths / bikeways and Pram ramp locations;
 - Fencing:
 - Access where required to be constructed;
 - Edge of pavement, where no kerb is to be constructed;
 - Dimensioned road reserve, footpath and pavement widths, where these differ from the standard cross- section;
 - Existing and finished surface contours, highlighting cut and fill areas;

- Drain line locations, diameters (including extent of easements where required);
- Drainage structures and structure number;
- Subsoil drain locations;
- Location of existing utilities or other existing works within the site;
- Location of all service clashes including levels of services and clearance distance;
- Location and levels of Bench Marks and reference pegs;
- North Point;
- Line marking, and signing; *
- Guide posts, guard rails and other traffic control devices; *
- Creek protection works and the like;
- Street name signs;* and
- Overland drainage paths.

AP1.21 LONGITUDINAL SECTIONS OF ROADS

- 1. The longitudinal section of each road shall include:
 - Chainages;
 - Existing surface levels · Design road centreline levels;
 - Cut or fill depths;
 - Design grades;
 - Chainages and levels of grade intersection points;
 - Chainages and levels of tangent points of vertical curves;
 - Chainages and levels of crest and sag locations;
 - Lengths and radii of vertical curves;
 - Sections on control lines on superelevated curves (i.e. pavement edges, kerb or lane edges), curve widening and superelevation details; and
 - Location of services where they cross the centre of the road.

AP1.22 TYPE CROSS-SECTIONS

- 1. A type cross-section shall be shown for each road, including:
 - Road reserve width;
 - Pavement widths including medians (as applicable);
 - Footpath widths;
 - Crossfalls of pavement and footpaths;
 - · Pavement depth nominal or design;
 - Type of kerb and channel;
 - Type of pavement surfacing;
 - Sub-soil drainage;
 - Table Drain details for rural roads; and
 - Batter slopes.
- 2. The standard cross-section may be included in the detailed cross-sections provided for each road.

AP1.23 CROSS-SECTIONS OF ROADS

1. A cross-section shall be shown at the intervals defined in this manual for each road and shall show:

^{*} May be shown on separate plan(s)

- Road reserve boundaries:
- Pavement centre line and / or other construction line;
- Natural surface profile;
- Design Cross-Section;
- Crossfall of pavement and footpath, pavement and footpath widths and pavement depths wherever these differ from the standard cross-section;
- Chainage of cross section; and
- Datum reduced level.

AP1.24 DETAIL PLANS OF INTERSECTIONS & CUL DE SACS

1. Intersection detail 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 all kerb returns, pavement contours, channelisation works, line marking, signing and pram ramps.

AP1.25 LONGITUDINAL SECTIONS OF STORMWATER DRAINAGE LINES

- 1. A longitudinal section of each drain line shall be shown, including:
 - · Chainages;
 - Existing surface levels;
 - Design finished surface and invert levels;
 - Drainage Structure chainages and offsets and inlet and outlet invert levels:
 - Distances between drainage structures;
 - Grade of each pipe;
 - · Material and Diameter of each pipe length;
 - Hydraulic grade line;
 - Drainage structure type and sizes and/or reference to separate detail drawing; and
 - Crossings with any other services (location and invert level of pipe crossing).

AP1.26 SEWER CONCEPT PLAN

- 1. Where a development incorporates multiple stages, a sewer concept plan must be prepared by the consultant;
- 2. This Concept Plan must be submitted prior to proceeding with detailed design and should include the following:
 - Location, size, approximate depth, and alignment of gravity sewers;
 - · Location, size and alignment of rising mains;
 - Location of pump stations and lift stations including justification for the use;
 - Contour information at 1m intervals maximum or to suit the topography of the land for both natural surface and finished surface contours;
 - Contributing catchments (internal and external) showing the equivalent tenement (ET);
 - Justification for re-directing flows between Sewerage Districts where proposed;
 - Details of the influence on downstream catchments and systems; and
 - The flow contributing to each section of main including the estimated design capacity.
 See Example below:



PWWF 14.3 L/sec
Pipe Size 225 diameter
Max Pipe Cap 26.2 L/sec

- 3. Access for maintenance of the system should be considered when locating manholes etc (Refer Section D 7.07);
- 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; and
- 5. As part of the preparation of the Concept Plan, the requirements of Section 2 Concept Design in WSA 04- 2005 Sewage Pumping Code of Australia shall also be included.

AP1.27 SEWERAGE RETICULATION PLAN AND LONGITUDINAL SECTION

- 1. The sewerage reticulation plan shall include:
 - Legend;
 - All allotments and allotment numbers;
 - Boundary of the subdivision;
 - North Point:
 - Location and size of existing sewers;
 - Invert levels of existing lines;
 - Location of other services which cross sewer lines;
 - Location of manholes with manhole numbers (including dimensions where not shown on alignment);
 - Identification of allotments, which are currently sewered;
 - Finished surface contours sufficient to enable verification of property connection design;
 - Details of permanent survey marks including AHD from which levels are to be transferred;
 - Grading information for new sewer lines including distance between manholes, pipe grades, pipe diameter, pipe material and class of each pipe length:
 - Manhole cover type and class;
 - Manhole inlet types;
 - Locations and level of sewer property connections and type;
 - Details of pumping stations including location, inlet/outlet levels, overflow, cut-off levels, electrical switchboard layout and water supply, size of pumping plant;
 - Diameter, material class and route of pressure main(s); indicating air valve and scour valve locations;
 - Clear identification of any alterations/connections to existing sewers to be completed by Council at developer's cost;
 - Finished surface contours with spot levels to compliment contours;
 - Ultimate sewer design flows including catchment plan for staged development if applicable;
 - Gravity sewer pipe capacities;
 - Structural design of pipes for pipes with more than 3m of cover;
 - Thrust block calculation where required;
 - Diagram showing all allotment controls;
 - Flow velocities under different flow conditions:
 - Rising main hydraulic grade line:
 - System resistance and pump curves showing static and friction head and duty points;

- Demonstration of pipeline capacity to resist cyclical pressure effects over a 100-year lifespan of the systems;
- Estimation of pump start, stop, alarm, overflow and other control levels;
- Calculations supporting the provision of wet well storage;
- Calculations showing that floatation forces are counteracted for all buried or partially buried structures;
- Estimation of electrical loads Mains Supply proposed; and Radio Frequency interference screening measures;
- Structural calculations where necessary for the pump well and associated works; and
- Calculations supporting the hydraulic design of emergency relief structures.

2. The longitudinal section of each sewerage line should include:

- Existing surface levels;
- Design finished surface;
- Manhole number;
- Distance between manholes;
- · Grade of each pipe length;
- Diameter, material and class of each pipe length;
- Manhole diameter and cover type;
- Manhole inlet types;
- Invert levels of existing lines; and
- Crossings with any other services (including location, size, invert levels and clearance of pipe crossing).

AP1.28 WATER RETICULATION CONCEPT PLAN

- 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 main sizes, connections to existing mains and valve positions. The Concept Plan is to be supported by a computer network analysis.
- 2. This concept plan shall be submitted prior to providing with detailed design and should include the following:
 - Layout of mains, together with the development layout;
 - Key to network analysis, i.e. Node points, elevation, demand;
 - Size and type of mains, indicated graphically and distinguished by colour and/or line type:
 - Design parameters number of lots, number of ET design flows;
 - Legend of land uses (i.e. Residential, Industrial Precincts etc.);
 - Supply points and pressure or Hydraulic Grade Line (HGL) as supplied by Council;
 - Location of pumps, pressure reducing valves and reservoir top water level (TWL) and volume where applicable;
 - Limit of water district serviced by the reticulation mains;
 - Contours for the entire development, at minimum 1m intervals; and
 - Consideration for connection to adjoining and/or future developments as directed.

AP1.29 WATER RETICULATION PLAN

- 1. The water reticulation plan shall include:
 - Legend;
 - Water services for the development:
 - All allotments and allotment numbers;
 - Boundary of subdivision;
 - North Point;
 - Location and size of existing mains;
 - Location, size, material and class of new mains;
 - Location of other services which cross the mains;
 - Details of connection to existing mains:
 - Location of each bend;
 - The location of valves, hydrants, scours and caps, T's, reducers, etc;
 - Road crossing conduit locations, size and class;
 - · Water service connection details;
 - Pump Stations and reservoir/s (if required);
 - Network Analysis (if required);
 - Type and class of pipes for the pressure and cyclical loading regime;
 - Thrust block calculation where required;
 - Operating conditions for pressure reducing valves; and
 - Structural calculations where necessary for valve pits and associated works.

AP1.30 LANDSCAPE PLAN

1. The landscape plan shall contain the following details:

Site and Layout

- Proposed and existing contours at 5 metre intervals.
- Extent of existing vegetation including type and location.
- Significant trees showing level at base and proposed levels, indicating which trees/vegetation is to be removed.
- Proposed layout of roadways including:
 - Kerb and channel;
 - Stormwater drainage pits and manholes;
 - Street lighting;
 - Property boundaries;
 - Traffic islands, roundabouts, traffic calming devices etc;
 - Existing and proposed water supply, sewerage services and easements; and
 - Proposed freehold lots covering water supply and sewerage infrastructure.
- Layout and numbering of individual lots, including street names;
- Existing parks, reserves etc;
- Adjoining land uses, access corridors;
- Existing watercourses, watersheds, gullies, with a buffer zone to either side of creeks, where required; and
- Revegetation areas including extent, type, technique and erosion prevention proposals.

On-Street Works

- Alignment and location of proposed concrete footpaths and bike paths;
- Grass establishment areas; and
- Lighting proposals and street furniture, if appropriate.

Traffic Islands and Roundabouts

- Alignment of kerb and channel and concrete backing to roadside kerb;
- Soil mix type and depth;
- Proposed planting layout and plant schedule, including species, number, size, set-out, staking;
- Mulch types and depth; and
- Irrigation proposals.

Public Open Space

- Dimensions and landscape treatment to buffer zones;
- Location and dimension of all off-road bikeways and pedestrian pathways, with trees at
 15 metre intervals, showing size and species;
- Location of boundaries to all parkland, reserves and easements, including fencing proposals and details of removable vehicle barriers;
- Location and type of play equipment, if applicable, including type, extent and edge treatment to safety surfacing;
- Proposed lighting;
- Mounding, showing base, crown, levels and gradients;
- Proposed furniture including benches, bins, BBQ's, shade structures, signage;

- Taps, drinking fountains, irrigation couplings;
- · Proposed planting and mulched garden beds; and
- Irrigation plan at 1:200 scale.
- 2. Detailed specifications will be required to cover all proposed works including the following:
 - Play equipment and safety surfacing;
 - Plant schedule;
 - Revegetation requirements;
 - · Grass establishment;
 - Mulch:
 - · Hard landscaping;
 - · Furniture and lighting; and
 - Irrigation, if applicable.

AP1.31 EROSION AND SEDIMENT CONTROL STRATEGY

- 1. The Erosion and Sediment Control Strategy shall include:
 - North Point;
 - A plan of development showing the road and allotment boundaries;
 - Existing surface 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;
 - Existing drainage paths and drainage infrastructure;
 - · Extent of clearing and trees to be removed;
 - Line diagram of drain lines and drainage structures;
 - The identification and location of all Erosion and Sediment control measures (ie catch drains, diversion drains, sediment traps, sediment basins etc.) that are proposed for the period when the site is disturbed;
 - Location of sensitive and restricted access areas;
 - Existing significant vegetation to be retained;
 - Revegetation works;
 - Calculations are to be submitted in accordance with QUDM and based on soil type(s) of the site;
 - Measures to be employed for each facet of the construction process. As a minimum this
 is to include stripping/earthworks, trenching/services installation and when stormwater
 and roadways are completed; and
 - 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.

AP1.32 SERVICE PROVIDERS / CONDUIT PLAN INCLUDING STREET LIGHTING

- 1. This plan shall include:
 - Legend;
 - Road Reserve Boundaries;
 - · Allotment Numbers and Boundaries;
 - North Point;
 - Kerb and channel or edge of pavement where no kerb is to be constructed;

- Road Crossings Conduits Type and size;
- Location of Pad Mount Transformers;
- Location of Telecommunications Authority's Roadside Cabinets & Shelters and Cables;
- Location of Street Lighting including designation of hierarchy of all roads;
- Location of Electricity Authority's Cables and Facilities paying particular attention to connection to existing power supply;
- Electrical reticulation plans; and
- Gas pipes, valve, syphon points and storage facilities.

AP1.33 STORMWATER CATCHMENT PLAN/DRAINAGE CALCULATIONS TABULATION

- 1. A catchment plan shall be submitted, for Council submission purposes only and shall not form part of construction documentation. The catchment plan shall include the following:
 - North point;
 - A plan of the development showing the road and allotment boundaries;
 - Existing and finished surface contours (in different line types) at an interval close enough to define the terrain and allow definition of the sub catchments;
 - Contours shall extend beyond the limits of the development site to fully define the limits of external catchments:
 - Sub catchment boundaries, labels and areas;
 - Line diagram of drainline, manhole, gully and outlet locations;
 - Labelling of stormwater structures;
 - Adjacent to each Stormwater Pit tabulation is to be provided illustrating the roadway approach flow, the width of approach flow, and the bypass flow;
 - Overland flow paths;
 - Proposed easements; and
 - Stormwater calculations shall be in a spreadsheet format in accordance with the QUDM. This tabulation should include a bypass flow width value at all kerb return pits.

AP1.34 PEST PLANT MANAGEMENT

- 1. In accordance with the Land Protection (Pest and Stock Route Management) Act 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;
- 2. Prior to the issue of a Development Permit for Operational Works, the applicant must:
 - Clearly state if there is an excess amount of soil on the development site;
 - Provide appropriate documentation to show where any excess soil is to be used or placed on the site;
 - Provide a plan which indicates where a shake down 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;
 - 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;
 - Permanently contained material which is removed on the site; and
 - Maintain the site to the point of sale so that declared weeds are eradicated or controlled.
- 3. Soil or other matter contaminated with weed seed or organic material should not be used in

landscaping, eg buffer mounds;

- 4. Reference should be made to council pest management unit to obtain advice; and
- 5. These conditions relate to all Class 1, 2 and 3 plants identified in the Land Protection (Pest and Stock Route Management) Act 2002.

AP1.35 MISCELLANEOUS DETAILS

- 1. Detail are required for the following either on separate drawings or appropriate service plan:
 - Stormwater inlet and outlet structures, other than standard head walls;
 - Manhole details where pipe alignments are critical for clearances or flow considerations;
 - Water Quality permanent works structures (SQIDs, sediment basins, trash racks etc.);
 - Details of Erosion Control and Stormwater Management Structures;
 - Surcharge structures;
 - Overland drainage paths;
 - Sewer and water pump stations showing all relevant levels and dimensions for pumps, etc. (where not provided elsewhere);
 - Footbridges;
 - Reservoirs:
 - Water source treatment / disinfection works;
 - Entry structures;
 - Retaining walls;
 - Buildings; and
 - Any details or variations from standard drawings.

RECORDS AP1.36 DESIGN RECORDS

- 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;
- 2. A design file shall be maintained by the Developer or the Developer's 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; and
- 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 a RPEQ.

CP1 – CONSTRUCTION PROCEDURES

GENERAL

CP1.01 INTRODUCTION

- This section of these Operational Works 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.
- 2 This manual does not apply to works or services under the control of other authorities (i.e. works within State controlled road corridor). Separate approvals may be required from the other relevant authorities.
- 3. The section has been divided into four subsections as follows:
 - Requirements Prior to Construction;
 - Requirements During Construction;
 - · Acceptance of Works; and
 - Final Acceptance of Works.

REQUIREMENTS PRIOR TO CONSTRUCTION

CP1.02 GENERAL REQUIREMENTS

Prior to the construction of any works associated with a 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.

CP1.03 CONSTRUCTION INSPECTIONS

- 1. Prior to construction of the works the Consulting Engineer who is a Registered Professional Engineer Queensland (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:
 - Council's development permit conditions;
 - Council's relevant policies and local laws;
 - This Manual, Council approved drawings, specifications and relevant Australian Standards;
 - Good engineering practice; and
 - Records compatible with Councils asset management information recording system are provided.
 - 2. Inspections may be carried out by the Consulting Engineer or a delegate who shall be a suitably qualified/experienced person approved by the consulting engineer.

The Consulting Engineer is required to certify that all works have been carried out in accordance
with the development approval and to the Whitsunday Regional Council (WRC) minimum
Standards prior to Works Acceptance.

CP1.04 INSPECTION AND TEST PLAN

- 1. The Contractor is to prepare an ITP (endorsed by the RPEQ) identifying the following items:
 - Element of work;
 - Tests and checks required;
 - Standard required to meet;
 - Frequency of testing;
 - Contractor's responsibility;
 - · Consulting Engineer's responsibility;
 - Council's responsibility; and
 - Asset data recording requirements

Refer to CP1.16 and Form 2 for the requirements of the Inspection and Test Plan.

- 2 The Consulting Engineer in undertaking Construction Inspections shall:
 - Allocate competent and experienced staff to site inspection and testing;
 - 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 as complying with the design intent and in accordance with the Council's requirements prior to requesting a Council inspection.

CP1.05 CONTRACTOR'S EROSION & SEDIMENT CONTROL PLAN

- 1. Prior to construction commencing the contractor shall prepare an Erosion and Sediment Control Plan (ESCP) to manage the site during construction and the defect liability period.
- 2. The plan shall be consistent with the approved Erosion and Sediment Control Strategy (ESCS) and shall take into consideration the Contractor's proposed construction methodology and program.
- 3. The Contractor may propose an alternate construction methodology that differs from the approved ESCS. In this instance the Contractor shall discuss and obtain approval from the Consulting Engineer for the alternate strategy prior to submitting to Council.
- 4. The Contractor's ESCP shall be prepared by person or persons meeting the following criteria:
 - Six years or more field experience in civil engineering construction practices;
 - Educated in erosion and sediment control practice through regular industry sponsored seminars, publications, etc.;
 - An understanding of Rainfall Hydrology and an ability to calculate rainfall runoff; and
 - An understanding and ability to calculate open channel flows and velocities.
 - 5. A copy of the Contractor's current approved ESCP is to be retained on site by the Contractor's Representative.
 - 6. The Contractor's ESCP shall be submitted to the Consulting Engineer for review and approval prior to the pre-start meeting.

- 7. The Consulting Engineer is to review the ESCP for compliance with the approved ESCS. Any amendments required to ensure ESCS compliance are to be incorporated by the Contractor prior to approval. The Consulting Engineer will issue a copy of the approved ESCP to the Council prior to the pre-start meeting.
- 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 programme.
- 9. All amendments to the Contractor's ESCP shall be approved by the Consulting Engineer and a copy of the revised approved ESCP issued to Council.
- 10. The Contractor's ESCP shall consist of the following:
- A layout plan detailing the measures to be employed during construction. On larger sites where works are to be progressively constructed a plan shall be provided for each stage of works;
- A layout plan detailing the measure(s) to remain in place from the commencement of the defects liability period;
- A written description of the sequencing of works or construction program;
- An inspection and test plan for monitoring erosion and sediment control measures during the construction and the defects liability period;
- Details of all Erosion and Sediment Control measures to be used. The Contractor may adopt standard details developed by other, e.g. IECA Best Practice Erosion and Sediment Control; and
- The name of the person within the Contractor's organization who has the authority and responsibility for implementing, monitoring, updating or amending the Plan.
 - 11. The Contractor's ESCP shall address the following issues:

Minimising Disturbance

- Limiting the exposure time and size of disturbed areas to a minimum;
- Allow for the use of existing vegetation as buffer zones;

Control of Runoff

• Sizing of structures, channels, catch drain and diversion drains for appropriate storm events;

	Design Life	ARI
Non-erosive design capacity	0-6 months	1 year
	6-12 months	2 years
Structural Stability	0-6 months	5 years
	6-12 months	10 years

- Diverting clean water runoff around disturbed areas;
- Dividing the site into smaller more manageable drainage areas;
- Early installation of temporary drainage works;
- Early installation of permanent drainage system and protection works;

Erosion Control

• Protecting service trenches and hard engineering structures (eg. driveways, kerbs, etc.) from erosion caused by runoff;

- Prompt revegetation of disturbed areas;
- Installing structures in drainage channels to slow flow velocity and encourage settlement of soil particles;
- Protection of disturbed areas from wind erosion (dust suppression);

Sediment Control

- Locating stockpiles clear of drainage paths and protecting stockpiles from traffic, runoff and wind erosion;
- Minimising number of site access points;
- Stabilising site access points to prevent vehicles transporting materials off site;
- Intercepting drainage from disturbed areas and installing sediment barriers to slow the velocity of flow and allow fine particles to settle;
- Diverting larger contaminated flows to sediment traps to allow soil particles to settle or be treated prior to release into receiving waters;
- Protecting partially constructed drainage structures from sediment infiltration;

Revegetation

- Progressive stabilisation and rehabilitation of completed works;
- Providing protection to revegetation works on steep batters during establishment period.

Inspection, Clean out and Maintenance

- The inspection, clean out and maintenance regime is 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, clean out and maintenance regime will be required than for a site, which is disturbed during the period June to November.
 - The following References / Guidelines may assist in preparing the ESCP:
 - Best Practice Erosion and Sediment Control, International Erosion Control Association, (Australasia) 2008;
 - Queensland Urban Drainage Manual:
 - Guidelines for the Preparation of Erosion and Sediment Control Plans for Building Sites, Cairns City Council July 2003; and
 - Erosion and Sediment Control Standard Version 9, Brisbane City Council, 2000.

CP1.06 CONSTRUCTION SECURITY BOND

- 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.
- 2. A bank guarantee should include:
- A binding contractual relationship between Council and the guaranteeing bank;
- Specific requirements for renunciation of the guarantee; and
- Require adequate notice of renunciation.
 - 3. The bond is to be accompanied by Council's Security Lodgement Form (Appendix E) clearly

identifying the purpose of the bond together with the Consulting Engineer's certification of the value of the works.

- 4. The bond is required to provide security to Council in the event that costs are incurred as a result of the following:
- Protection of on-street works from damage by contractors, sub-contractors and suppliers;
- Repairs to on-street works resulting from damage caused by contractors, subcontractors and suppliers;
- Protection and repair of existing Council services (i.e. sewerage connections, water connections etc);
- Non-compliance with the approved Erosion and Sediment Control Plan during construction;
- Failure to provide adequately for traffic; and
- Urgent action required by Council to resolve unsafe construction or emergency repairs required to protect persons and/or property from consequential damages.
 - 5. Any costs incurred by Council in responding to the above circumstances will be recovered from the Security Bond.
 - 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.

CP1.07 NOTICE OF COMMENCEMENT OF WORK

- A Notice of Intention to Commence Works is to be issued to Council by facsimile or email seven
 (7) days prior to the intended date for commencement of the works. No works will be permitted to
 commence until the following information is provided:
- Name, address and telephone number (including after-hours contact) of the Consulting Engineer for the works:
- Name, address and telephone number (including after-hours contact) of the Contractor(s) and major sub-contractor(s) for the works;
- Name and telephone number of the person to be contacted in regard to any matter arising from the construction of the works;
- Intended date of commencement of works, and contract period;
- An invitation to the relevant Council Representative to attend the pre-start meeting and confirmed by phone or email a minimum of 24 hours prior;
- 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;
- · Location of Project Sign (if required); and
- Inspection and Test Plan (refer CP1.16).

This submission will form notification of the date of the "Pre-Start" meeting.

CP1.08 DOCUMENTATION TO BE PROVIDED PRIOR TO PRE-START MEETING

- 1. The following documents (to a standard acceptable to Council) are required to be submitted and accepted by Council prior to pre-start meeting:
- Evidence of Public Liability Insurance;
- Proof of payment of Portable Long Service Leave Levy (PLSL);
- Contractors Erosion and Sediment Control Plan;
- Traffic Management Plan;

- Construction Security Bond;
- · Safety Plan;
- Evidence that all fees and charges have been paid; and
- Cultural Heritage Management Plan (if applicable).
 - 2. A Site Safety Induction is to be undertaken for each Council representative at initial attendance on-site (prior to initial inspection);
 - 3. Evidence of Concurrence Agency, Service Authority or adjoining landowner consents/approvals is to be provided to Council prior to commencing. any elements of works affecting/involving those parties;
 - 4. The project specific inspection and Test Plans endorsed by the RPEQ.

CP1.09 PRE-START MEETING

- 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 Councils representative.
- 2. Items to be considered at this meeting will include but not be limited to the following:
- 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;
- Review of Council's construction requirements;
- Discuss the Contractor's Erosion and Sediment Control Plan approved by the Consulting Engineer;
- A review of the processes for, monitoring, compliance assessment and auditing of the ESCP;
- Inspection and identification of parks and environmentally significant areas and/or trees for preservation;
- Site access conditions;
- Identification of areas to be left undisturbed:
- Evidence of compliance with the Workplace Health and Safety Act; including site safety inductions, site safety plans, notifications;
- Review of Inspection and Test Plan including a notice of nominated Hold / Witness points;
- · Relevant provisions of any other Acts;
- Traffic Management Plan;
- Location of Project Sign (if required):
- Sewerage and Water Pump Station Commissioning Plan (if applicable to the project); and
- Issued plans for construction are the latest approved plans.
 - 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.
 - 4. Council may require that subdivisions in difficult terrain or environmentally sensitive areas to have all road centrelines 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 hand 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

CP1.10 GENERAL REQUIREMENTS

- 1. The general requirements during the construction of the project are as follows:
- Work may only proceed subsequent to Council being issued with all the relevant documentation set out in CP 1.09;
- No work shall commence on any existing road open to the public unless specifically approved by Council;
- No work may be carried out on 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;
- 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.;
- Use of Council services, (e.g. water from existing mains), is subject to approval by Council and payment of appropriate fees;
- 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
- Pumping stations, electrical switchboards, access covers, compounds and associated equipment installed during construction shall be padlocked when left unattended.
 - 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 Queensland Department of Transport and Main Roads Manual of Uniform Traffic Control Devices. Council will require submission of plans indicating traffic control proposals and a program of work for sites involving the travelling public.
 - 3. No public road may be closed, traffic diverted from public roads, or traffic diverted elsewhere without the prior approval of the Council, the District Superintendent of Traffic (if required) 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 signing.
 - 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 works shall be submitted to Council upon finalisation of the works.
 - 5. If connections or alterations to Council mains are required, the Council Engineer shall be given a minimum of ten (10) working days' notice of the Contractor's requirements. (Council's notification requirements are to be noted on the Project Drawings / Specification).

CP1.11 PUBLIC NOTICES / PROJECT SIGNAGE

- 1. Where as 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:
- An overall concept plan of the development showing the stage or works about to commence construction:
- Name of Developer;
- Name of the Project;
- Street address of the site;
- Project Manager's name and contact number;
- Consulting Engineer's name and contact number;
- Contractor's name and contact number' and
- Other Specialist Consultants (geotechnical, landscaping, architects, hydraulics etc) names and contact numbers.
 - 2. Material and size of the sign shall be as follows:
- Made of a weatherproof material; and
- Not less than 1200mm x 900mm.
 - 3. Position of the sign on the land:
- The sign must be place on, or within 1.5m of, the road frontage of the land;
- The sign must be mounted at least 300mm above ground level; and
- The sign must be positioned so that it is visible from the road.
 - 4. The lettering on the sign:
- Each item listed above must start on a new line; and
- The minimum lettering height shall be 50mm in height.

CP1.12 DOCUMENT CONTROL

- 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.
- 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 maybe 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 amendment together with any supporting information.
- 3. Submissions with a full complement of supporting documentation will expedite Council's approval time frame.
- All amendments shall be issued to Council for approval prior to the works being undertaken.
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CP1.13 EROSION AND SEDIMENT CONTROL

- 1. The Consulting Engineer shall ensure that the construction contract contains provisions requiring the Contractor to implement the approved Erosion and Sediment Control Strategy and to prepare and implement an Erosion and Sediment Control Plan complying with the approved Strategy.
- 2 The Contractor shall ensure that all reasonable measures are taken to protect nearby properties from dust pollution erosion, siltation or sediment transport.
- 3. Council reserves the right to order whatever action deemed necessary and appropriate at the time to prevent environmental harm, including ordering temporary cessation of work in extreme cases.
 - 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.

CP1.14 NOISE

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

CP1.15 PARKS & ENVIRONMENTALLY SIGNIFICANT AREAS

- 1. In cases where the subject land or the adjacent land is an existing or proposed Park, Bushland Reserve, or area otherwise declared by Council as environmentally significant, the following general precautions shall be mandatory:
- The areas shall be clearly pegged, flagged, (and fenced if ordered by Council) inspected and approved by Council Officers; and
- The approved design, or Certificate of Approval for tree clearing issued pursuant to Tree Preservation By-laws (if applicable) shall have identified any unavoidable intrusion into such areas and nominated work practices such as maximum widths of disturbance, nominated access routes, methods and timing of rehabilitation, which shall be strictly adhered to.
 - 2. Council shall be notified immediately 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.

CP1.16 INSPECTION AND TESTING

- 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 Test Plan (ITP).
- 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 <u>Appendix B</u> contain Inspection and Test Plan Templates. The contractor's ITP is to be based on these templates and updated with project specific testing requirements.

- 3. Any proposed changes to the ITP must be notified to and accepted by Council prior to the affected works commencing.
- 4. The submitted Inspection and Test Plan is to be implemented by the Consulting Engineer. The test results and the certification that the plan has been followed are to be submitted with the "As Constructed" documentation.
- 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.
- 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.
- 7. For the RPEQ's test inspections and Hold/Witness points, a "Certificate of Inspection" will record the inspections. If requested, a copy is to be provided to Council for each Hold Point / witness point inspection.
- 8. For Council Hold/Witness points, the RPEQ's information will include as a minimum the details contained within Appendix F.

CP1.17 APPLICATION FOR COUNCIL TO COMPLETE PRIVATE WORKS

- Unless otherwise approved, Council requires any connections and alterations to Council's live sewer or water mains associated with developments to be completed by the Developer at the Developer's expense subject to Council's approval and supervision.
- 2. Sewer and water mains are considered to be live once the Defects Liability period has been commenced. All work on live sewers and water mains must be carried out by the Contractor with Council approval and subsequent supervision.
- 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.
- 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.
- 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 Whitsunday Regional Council Planning Scheme 2017– Schedule 6 June 2017 (V3.5)

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.

CP1.18 APPLICATION FOR APPROVAL TO DRAW WATER FROM COUNCIL MAINS

- 1. The drawing of construction water from Council's mains must be approved and the relevant fees paid in advance. Application for approval should be made, on the prescribed form. The attached form shall include Council's endorsements on the form that the relevant fee has been paid.
- 2. Permission to draw water shall be subject to the following conditions:
- Backflow prevention;
- Water may only be taken between the hours of 8.00am and 4.30pm;
- Must be through a metered connection or metered standpipe;
- The approval shall be limited to the days and dates nominated in Council's notice of approval;
- Water may only be taken from the approved hydrant point;
- A copy of this approval is to be held by the driver of any vehicle taking water covered by this approval;
- Council may withdraw this approval at any time, such notice shall be in writing and will become effective immediately; and
- The applicant is responsible for the cost of the reinstatement of damages to Council property caused by the taking of water covered by this permit.

ACCEPTANCE OF WORKS

CP1.19 INTRODUCTION

- 1. For works requiring Council approval a "Defects Liability" period is a period of twelve months minimum 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.
- 2. The following are required to be completed prior to Council acceptance of works:
- Completed "As Constructed" submission lodged with Council a minimum five (5) days prior to the
 "Works Acceptance" Inspection or early plan sealing inspection for bonding or uncompleted works
 and being to Council satisfaction;
- Satisfactory "Works Acceptance" Inspection;
- All documentation outlined in section CP1.25(2) submitted to and accepted by Council;
- All appropriate documentation to be completed by the Consulting Engineer and retained for records purposes. This consists of the "Works Acceptance Inspection Checklist" (<u>Appendix G</u>), the certified "Inspection and Testing Plan" and all test results and records for the works;
- Approval has been given by Council or private certifier for construction of any buildings forming part of the operational works approval; and
- Satisfactory commissioning and acceptance of any water pump station, reservoir or sewerage pump station.
 - 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 release of any uncompleted works bond held.
 - 4. The date of the works acceptance shall be the date of issue of the Works Acceptance Certificate

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and shall be taken as the date all documentation outlined in CP1.25 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 works acceptance certificate.

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-compliances 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 contractors work to the extent necessary such that any deviations from the design are approved prior to making application for works acceptance, alternatively the consultant instruct the Contractor to rectify the work.

CP1.20 DEFECTS LIABILITY BOND

- 1. Council requires a bond, in an amount of 5% of the value of the works, which is kept for the period of twelve months or until the works are finally accepted.
- 2. The bond is to be submitted with Council's Security Lodgement Form (<u>Appendix E</u>) clearly identifying the purpose of the bond together with the Consulting Engineer's certification of the value of the works.
- 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.

CP1.21 "AS CONSTRUCTED" SUBMISSION

- 1. "As Constructed" documentation serves two distinct functions:
- 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
- Recording: To provide an accurate record of the "As Constructed" services.
- 2. Information required for the checking function must be presented in a form which allows ready comparison between design and "As Constructed" data by experienced engineering staff, whereas information required for the recording function must be presented in a form which allows ready and unambiguous interpretation and understanding by a wide range of users including engineers, maintenance and tradespersons, and the general public.
- 3. "As Constructed" documentation in accordance with these requirements is essential 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 (5) days prior to the "Works Acceptance" inspection or early plan sealing inspection for bonding of uncompleted works.
- 4. The following items must be submitted as part of the "As Constructed" submission:
 - Electronic copy of the updated Management Plans, Operation and Maintenance Manuals, and Environmental Management Plans where these have been amended or not previously provided to

Council (where applicable);

- Asset valuation report in a format acceptable to council and certified by an RPEQ;
- An electronic copy of the Council Approved Final Engineering Drawings in the same electronic format as the As Constructed data PDF is suitable;
- Where applicable, Pump Station RTU number and pump station identifier to be obtained from Council;
- Electronic copy of the Council Approved Landscaping and Parks embellishments drawings;
- Electronic copy of park / landscaping irrigation system drawings;
- Electronic copy of design plans for building/structure and copy of Structural Certificate;
- "As Constructed" digital data and drawings of services and infrastructure including works completed by Council for the Contractor under a Private Works Agreement;
- Digital Ground Model data to the requirements of council in an appropriate format (e.g. DWG or as nominated by the Council);
- Any necessary information required for Council's asset management records;
- Certification of installed playground equipment to relevant Australian Standards; and
- Works carried out on mains, whether or not they are a part of the original project design or for a future stage.

CP1.22 COMPLIANCE CERTIFICATIONS

- 1. With the implementation of these minimum standards, it is Council's intention to expedite the approval and checking process by reducing the level of checking from rigorous detailed checking to checking on an audit basis. In doing so, Council requires that the "As Constructed" documentation be supported by appropriate certifications in accordance with the requirements noted herein.
- 2. All "As Constructed" works including the Sewerage Property Connection branches, must be surveyed by a Registered Surveyor, who shall certify the details upon completion of the project. The certification must note that the "As Constructed" survey data represents the true and accurate location of the relevant construction element presented in the data, relative to all appropriate survey datums. (i.e. the exact location in space of each construction element/entity). The Registered Surveyor's certification must accompany the "As Constructed" submission to Council. An example of an acceptable Registered Surveyor's (Consulting) Certification is attached. (Appendix K).
- 3. 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 does not compromise the design intent and/or operational effectiveness of the infrastructure.
- 4. 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.
- 5. 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.
- 6. The Consulting Engineer shall be responsible for the completion of the "Statement of Compliance As Constructed works, which satisfies the requirements for Certification. (Appendix J).

CP1.23 MANAGEMENT PLANS, OPERATION AND MAINTENANCE MANUALS

- 1. Where works comprise pump stations, reservoirs, treatment plants etc., Operations and Maintenance Manuals for all components of the works 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/cleaning functions in wet and dry seasons.
- 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.

CP1.24 "AS CONSTRUCTED" DIGITAL DATA AND DRAWINGS

- 1. This section of the manual covers the four main elements that will comprise the total submission of the "Digital Data and Drawings" component of the "As Constructed" submission for the "Acceptance of Works". The four main components are:
- Survey Datum;
- "As Constructed" Digital Ground Survey;
- "As Constructed" Drawings; and
- "As Constructed" Attribute Information.

The submission will also be accompanied with the relevant Consulting Engineer's Certification or Registered Surveyor's Certification and the "As Constructed" Data Submission Form.

Requirements for Digital Data and Drawings are contained within **Appendix N**

CP1.25 PROJECT DOCUMENTATION

- 1. Development works will not be accepted until construction records have been certified as being completed by the Consulting Engineer and accepted by Council.
- 2. A complete copy of the following documents shall be provided to Council for acceptance prior to the "Works Acceptance":
- Inspection and Test Plan certified by the Consulting Engineer;
- "Works Acceptance" Inspection Checklist;
- "As Constructed" Submission in accordance with 1.21;
- Compliance Certifications in accordance with 1.22;
- Management Plans, Operation & Maintenance Manuals in accordance with 1.23;
- "As Constructed" Digital Data and Drawings in accordance with 1.24;
- Water and sewerage inspection certificates including pump station and reservoir commissioning certificate; and
- Digital copy of CCTV survey for Sewer and Stormwater with Engineering Report and Certification.
- 3. Copies of all test results required to confirm compliance with Council's Standard Specifications shall be assembled and retained as a part of the project documentation within the Consulting Engineer's record storage facilities. While not a complete listing, the following details some major records to be included:
- · Fill compaction test results;
- Subgrade CBRs;
- Subgrade replacement material quality, thickness and locations;*
- Subgrade replacement material compaction test results;*
- Subsoil drain filter media quality statements (or gradings where required);
- Subbase course and base course material quality statements and thicknesses;
- Subbase course and base course compaction test results;
- Prime or primer seal spray and application rates;
- · AC core test results;
- Sewer pressure test records:
- Grading to sewer bedding quality statements;
- Grading to water main bedding quality statements;
- · Water main pressure test records;
- Pump Station commissioning and test certification by Council (sewer and water) including wet-well,

pumps and switchboard;*

- Any concrete testing required by the technical specifications;
- Pipework material quality statements for all pipework material (water, sewer, stormwater, etc.);
- Geofabric material quality statements;
- Digital copy of CCTV survey for Sewer and Stormwater with Engineering Report and Certification;
- Any other testing results or statements required to conform with this manual; and
- · Any other job specific testing carried out or ordered by the Consulting Engineer, if used.
 - * Where required to be used.
- 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:
- The pump station allotment number, as it appears on the survey plan;
- The name of the pump station and RTU number;
- · Copy of approved design drawings;
- Copy of as-constructed drawings (can be preliminary);
- Copy of completed pre-commissioning checklist;
- Details of any non-conformances and uncompleted works;
- · Rectification plan if required;
- Copy of Inspection and Test Plan;
- Certification by the Consultant for structural design, buoyancy and compliance with design drawings and WRC Development Manual;
- Request that Council make application to Ergon for connection of power accompanied with a locality plan with street names showing the PS location to attach to the application; and
- Evidence that an application for commissioning a sewerage pump station has been lodged.
- 5. The information to be provided to Council shall include as a minimum the requirements of the Pump Station Commissioning Checklist (**CP1 Appendix D**). The following pump information shall also be provided to Council:
- Pump Manufacturer, Model, Type, and Impeller diameter (as a cut sheet);
- Rating of the motor;
- Weight of the pump and motor;
- Manufacturer's Performance curve as a cut sheet;
- Curves with at least four points plotted of the actual performance established in the field, or similar supervised works certificate plotted with the manufacturer's pump curve;
- KWH/1000 litres pumped;
- Complete wiring diagrams and details (if not Council standard);
- Mechanical details and parts list of pump and motor;
- Maintenance catalogue showing also daily, weekly, monthly and annual maintenance requirements;
- A complete set of the manufacturers recommended spares delivered to Council.
- 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.
- 7. The construction record should be retained in a logically assembled and bound document including a table of contents confirming completeness and presented to Council on completion of the works.

8. Site specific as-constructed drawings for pump stations and reservoirs must be prepared and included with the works acceptance documentation. The drawings must be prepared in accordance with the requirements set out in **Appendix N.**

CP1.26 "WORKS ACCEPTANCE" INSPECTION

- 1. The "Works Acceptance " inspection requires attendance by:
- The Consulting Engineer for the project;
- The Contractor: and
- Council's nominee/s.
- 2. It is the responsibility of the Contractor and the Consulting Engineer to ensure the 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.
- 3. The general requirements to be met prior to Council's "Works Acceptance" inspection of the works are as follows:
- The site is clean, tidy, free of rubbish, rocks, sticks, unauthorised stockpiles, etc;
- Allotment earthworks and site grading to be free draining and in accordance with the approved Design;
- Relevant Erosion and Sediment Control measures are in place;
- Integrity of environmentally significant areas is maintained;
- All Sewers flushed and gravity sewers inspected by CCTV; and
- Valve boxes and manhole tops visually located and not covered.
- 4. Prior to requesting a "Works Acceptance" inspection, the Consulting Engineer is responsible for confirming:
- That the approved works have been completed;
- Any non-compliant issues or defects noted during the construction process, have been rectified to Council satisfaction;
- The above listed items are in accordance with the approved drawings, Council's technical specifications and accepted engineering and landscaping practice; and
- Project documentation listed in CP1.25 has been submitted. Failure to do so may result in cancellation of the inspection and/or the incurring of a reinspection fee.
- 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 (**Appendix G**) as appropriate to the works being constructed.
- 6. The completed checklist shall be presented to the relevant Council Officer prior to the "Works Acceptance" inspection. Council Officer 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.

CP1.27 BONDING OF UNCOMPLETED WORKS

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 Whitsunday Regional Council Planning Scheme 2017 – Schedule 6 – June 2017 (V3.5)

development as defined in the Operational Works Approval. Parts of a stage will not be considered for early plan sealing.

- 2. Prior to the submission of any bond or plans for sealing, the following matters must be completed to the satisfaction of Council:
- Engineering plans have been approved;
- All survey pegs placed;
- 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 allotments submitted and approved by Council;
- Roads have been constructed to subbase level;
- All stormwater systems including kerb and channel constructed;
- Sewer systems to be installed tested, operational and 'As Constructed' Plans lodged and accepted. (Bonding of pump stations could be accepted);
- Water supply system to be installed, tested, commissioned and 'As Constructed' plans lodged and accepted;
- 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);
- All outstanding rates are paid;
- All works within allotments are fully completed and no further disturbance required on the allotments;
- Appropriate erosion and sediment control measures are in place for all disturbed areas;
- All other bonded works (or works under agreement) are included in a bone-fide contract between the developer and a contractor to be completed within 90 days;
- All contributions required by the conditions of approval shall be paid prior to sealing of survey plans (Headworks, Drainage and Traffic Contributions to Council, Contributions to service providers, Department of Main Roads Contributions, etc);
- "As Constructed" information provided for all completed works and accepted by Council;
- Submission of CCTV survey of completed sewers and stormwater drainage systems; and
- Building approval for all buildings/structures.
- 3. When the above matters have been completed, the Applicant or Consulting Engineer shall submit the following to Council:
- Security Lodgement Form (<u>Appendix E</u>) to be completed clearly indicating that the purpose of the bond is for uncompleted works;
- Fully priced schedule of outstanding works including the cost of preparation of the "As Constructed" submission;
- 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:
 - A binding contractual relationship between Council and the guaranteeing bank;
 - Specific requirements for renunciation of the guarantee; and
 - Require adequate notice of renunciation.
- 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 programme must be Council approved:
- All bonds submitted shall be clearly identified as to the particulars of the site and, the purpose of the bond: and
- "Contribution Payment" Form clearly noting all required contributions associated with the Development.
- 4. Subject to its discretion Council may require an Uncompleted Works inspection to ensure that the on

allotment works and all associated documentation have been completed to Council's satisfaction. Should an inspection be required Council will require five (5) days' notice and payment of the required inspection fee in advance of any inspection.

CP1.28 SEALING OF PLAN OF SURVEY

- 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.
- 2. Where the survey plans differ from the approved proposed plan, details of any changes are to be provided with the application.
- 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.
- 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.
- 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

CP1.29 "FINAL ACCEPTANCE" INSPECTION GENERAL REQUIREMENTS

- 1. The "Final Acceptance" inspection will generally confirm the matters raised in the "Final Acceptance" Inspection checklist (<u>Appendix H</u>) 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.
- 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.
- 3. Once a period of twelve month's minimum 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.

The "Final Acceptance" inspection is to be attended by:

- · Council's nominee/s;
- · The Consulting Engineer for the project; and
- The Contractor.

The Consulting Engineer for the works shall be responsible for ensuring that Council's requirements for acceptance of the works are satisfied prior to requesting a Final Acceptance inspection.

Council's requirements for final acceptance of the works comprise the following:

- No outstanding payments are due to Council or other Authorities from the development;
- Completion of the "Final Acceptance" Inspection Checklist (Appendix H);
- Satisfactory "Final Acceptance" Inspection by relevant Council Officers; and
- All conditions of the approvals for as constructed drawings, works acceptance and plan sealing have been completed to the satisfaction of Council.

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.

DP1 – DEVELOPMENT PRINCIPLES

GENERAL

DP1.01 INTRODUCTION

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.

DP1.02 URBAN DEVELOPMENT OBJECTIVES

- 1. In addition to the requirements of the relevant planning scheme, local laws and policies, urban development layouts should:
 - Protect and enhance environmentally significant areas;
 - Be sympathetic to the existing topography and landform;
 - Minimise the impacts on the surrounding environment;
 - Facilitate the provision of urban services; and
 - Provide a safe urban living environment.

DP1.03 IDENTIFICATION OF SITE CONSTRAINTS AND VALUES

- 1. In preparing an urban development layout, it important to identify the natural constraints and values of the site and any engineering constraints on the provision of urban services and amenities.
- 2. Factors that may impose constraints on the development layout include but are not limited to the following:
 - Existing significant vegetation;
 - Road and service connections to adjoining properties:
 - Public transport networks;
 - Railway and cane tramway lines;
 - External stormwater drainage catchments;
 - Downstream stormwater drainage and receiving waters;
 - Low lying areas subject to flooding and ponding;
 - Constraints and impact on adjoining properties;
 - Constraints and limitation of existing utility services and planned augmentation works:
 - Main Roads resumption requirements;
 - Existing topographical features;
 - Water quality issues; and
 - Geotechnical considerations.
- 3. Designers are encouraged to consult with the Council and other relevant authorities prior to or during the preparation of the site layout and design concept. Designers should in addition to

requirements of this manual ascertain any specific requirements of these authorities as they relate to the designs in hand.

DP1.04 VEGETATION PROTECTION AND ENVIRONMENTALLY SIGNIFICANT AREAS

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

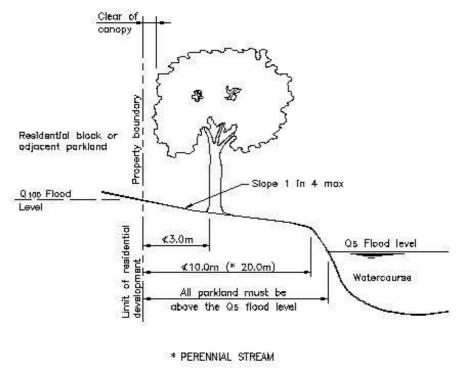


Figure DP1.1 Limits of development adjacent natural stream banks

- 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.
- 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.

DP1.05 CRIME PREVENTION THROUGH ENVIRONMENTAL DESIGN

- 1. It is important when designing development layouts that the principles of crime prevention through environmental design are considered, in particular:
 - Natural surveillance of public open spaces is optimised; and
 - Long pathway or obscured park areas that can become potential assault site are avoided.

ENGINEERING ISSUES

DP1.06 GENERAL

- 1. The optimum site and road layout needs to be developed through consideration of social, environmental, town planning, traffic and engineering issues.
- 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 be fully aware of the engineering issues to ensure that the road layouts proposed are satisfactory in this respect. Major alterations to the development layout may otherwise be necessary to accommodate engineering requirements.
- 3. The factors to be taken into consideration when designing new development layouts include the following:
 - Proposed land use;
 - Road hierarchy, interim and ultimate;
 - Public transport network;
 - Local planning policies, bikeways / pathways and open space;
 - Council's drainage management plans;
 - Council's traffic management plans;
 - Railway and cane tramway lines;
 - Access requirements for services vehicles and emergency vehicles;
 - Topography of the area;
 - Adequate road frontage to parks and drainage reserves;
 - Existing utility services constraints and proposed augmentation works:
 - Crime prevention through environmental design;
 - Impacts on adjoining properties;
 - Existing stormwater drainage;
 - Flooding and ponding;
 - Preservation of natural watercourses;
 - Significant existing vegetation;
 - Bushfire protection measures:
 - Impact of earthworks;
 - Water quality improvement structures and features;
 - Existing soil conditions; and
 - Geotechnical considerations.

DP1.07 ROAD NETWORK

- 1. The provision of a road network within a subdivision development is to be designed so as to achieve the following aims:
 - Convenient and safe access to all allotments for pedestrians, vehicles and cyclists;
 - Safe, logical and hierarchical transport linkages with existing street system;
 - Appropriate access for buses, emergency and service vehicles;
 - Convenient service corridors for public utilities;
 - Opportunity for street landscaping; and
 - Convenient parking for visitors.
- 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. A typical hierarchy is shown on Figure DP1.2.

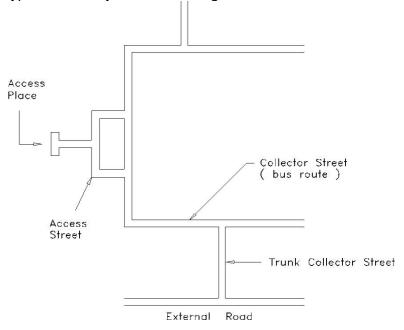


Figure DP1.2 Typical Road Hierarchy

- 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.
- 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.
- 5. Where an Access Place forms part of a pedestrian or cycle network, suitable connectivity with adjoining Access Places or open space systems should be provided so as to ensure such pedestrian and cycle network are functionally efficient.
- 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.
- 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. Normally roads above the Access Street in the hierarchy are designed as bus routes.

DP1.08 SITE REGRADING CONCEPT

- 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. 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.

DP1.09 STORMWATER DRAINAGE

- 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.
- 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.
- 3. The development layout shall be designed to accommodate both existing and future developed flows from upstream catchments on the basis of development in accordance with the relevant Planning Scheme.
- 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.
- 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.
- 6. Some Councils have or are in the process of producing drainage management plans for particular catchments within their boundaries. Where a drainage management plan does not exist, Council may require the developer as a condition of the approval, to undertake a drainage study in accordance with Council's standard brief as supporting information to a drainage management plan for the catchment, to establish contributions for future upgrading works. The cost of the drainage management plan shall be credited against contributions required under Council's Flooding and Drainage Policy.

DP1.10 STORMWATER QUALITY MANAGEMENT

- 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.
- All developments are required to include appropriate interception devices 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.
- 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.

DP1.11 SEWERAGE RETICULATION

- 1. In preparing a development layout, consideration should be given to the provision of sewerage reticulation connections to adjoining properties on the basis of their future development in accordance with Council's Strategic Plan.
- 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 so as to minimise the extent of the sewerage relocation work necessary.

DP1.12 ELECTRICITY SUPPLY AND TELECOMMUNICATION SERVICES

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.

DP1.13 TRAMLINES THROUGH URBAN AREAS

- 1. Where cane tramlines run through urban areas a tramway reserve shall be created over tramline and transferred to Council.
- 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).
- 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.
- 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.
- 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.
- 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.
- 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.

DESIGN GUIDELINES

D1 - ROAD GEOMETRY

GENERAL

SCOPE

- 1. This section sets out the minimum standards developed specifically for the design of roadworks using principles of street design to ensure safety and improved amenity and to reduce pedestrian/vehicular conflicts.
- 2. This Manual will be read in conjunction with the Institute of Public Works Engineering Australia publication Complete Streets: Guideline for Urban Street.

AIMS

- 1. The geometry of a road is to be designed so as to achieve the following aims:
- Provide convenient and safe access to all allotments for pedestrians, vehicles and cyclists;
- Provide appropriate access for buses, emergency and service vehicles;
- Provide a convenient way for public utilities;
- Provide an opportunity for street landscaping and
- Provide convenient parking for visitors.

REFERENCE DOCUMENTS

Note: Where *Acts* or reference documents are updated, reference should be made to the current version.

Australian Standards

- AS1158 Lighting for Roads and Public Spaces
- AS1348.1 Road and Traffic Engineering Glossary of terms, Road Design and Construction
- AS1428 Design for Access and Mobility
- AS2890.1 Parking Facilities: Off-street parking
- AS2890.2 Parking Facilities: Off street Commercial Vehicle Facilities
- AS2890.5 Parking Facilities: On street Car Parking
- AS/NZS 3845 Road Safety Barrier Systems
- AS4282 Obtrusive Effects of Outdoor Lighting

Department of Transport and Main Roads

- Road Planning and Design Manual
- Manual of Uniform Traffic Control Devices (MUTCD)
- Transport Operations (Road Use Management) Act

AUSTROADS

- Guide to Road Design
- Guide to Traffic Management
- Guide to Road Safety
- Cycling Aspects of AUSTROADS Guides

Disability Discrimination Act

Disability Standards for Accessible Public Transport

- The Institute of Public Works Engineering Australia, QLD Division. (IPWEA)
- Complete Streets: Guidelines for Urban Street Design

Joint Venture for More Affordable Housing

• Australian Model Code for Residential Development. (AMCORD)

CONSULTATION

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 ascertain specific requirements of these authorities as they relate to the designs in hand.

ROAD DESIGN CRITERIA

DESIGN SPEED

- For geometric design of roads, design speeds shall be as nominated in Table D1.1 unless specified otherwise by Council. Developments 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.
- 2. Adoption of a low design speed discourages speeding, 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.
- 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.

LONGITUDINAL GRADIENT

- 1. A general minimum gradient of 0.5 per cent 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 per cent.
- 2. A desirable minimum gradient of 1.0 per cent should be adopted for all roads, which will

have earth table drains, except where approved otherwise by Council, in exceptional cases.

- 3. Roads constructed, without kerb and channel, completely in embankment may have zero grade.
- 4. Maximum grades shall be as nominated in Table D1.1.
- 5. Longitudinal grade through intersections should not exceed 4 per cent, the actual gradient 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 have to stand waiting for traffic in the priority road.
- 6. Turning circles in cul-de-sacs on steep grades should have grades less than 5 per cent.
- 7. Where minimum radius crest vertical curves are used local widening is to be provided to facilitate safe ingress/egress from properties.

HORIZONTAL ALIGNMENT

- 1. Horizontal alignment shall generally comply with the requirements of Complete Streets, Department of Transport and Main Roads or AUSTROADS manuals, as applicable.
- 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.
- 3. The horizontal alignment shall ensure adequate sight distances taking into account construction of solid fencing on property boundaries.

VERTICAL CURVES

- 1. Vertical curves should be used on all changes of grade where the algebraic change of grade exceeds:
- Access Place, Access Street Collector Streets 1.0%
- Trunk Collector Streets 0.6%
- 2. The length of the crest vertical curve for stopping sight distance should conform to Complete Streets.
- 3. For adequate riding comfort, lengths of sag vertical curves should conform to Complete Streets.
- 4. Every effort should be made to provide vertical curves as long as possible, for improved appearance.

- 5. Drainage poses a practical limit to the length of sag curves and a maximum length (in metres) of 15 times the algebraic sum of the intersecting vertical grades should be adopted. This is to avoid water ponding in excessively flat sections of kerb and channel. A minimum grade of 0.5 per cent should be maintained in the kerb and channel.
- 6. In general, a minimum 10m length vertical curve shall be provided where the side road joins the through road at three way intersections.
- 7. The 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 a concrete invert in lieu of a vertical curve where the side road is an Access Place and the algebraic change of grade is less than 6.0 per cent.
- 8. The three dimensional coordination of the horizontal and vertical alignment of a road should be aimed at improved traffic safety and aesthetics. The following principles should be applied:
- The design speed of the road in both horizontal and vertical planes should be of the same order;
- Combined horizontal and vertical stopping sight distance and minimum sight distance should be considered three dimensionally;
- Sharp horizontal curves shall not be introduced at or near the crest of a vertical curve;
- Horizontal curves should leave the vertical curve and be longer than the vertical curve; and
- 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.

CROSSFALLS

- 1. Carriageway crossfalls for streets shall conform to the requirements of Complete Streets.
- 2. Generally, pavement crossfalls on straight roads shall be:

• Bituminous seal coat 3 per cent

• Asphaltic concrete pavement 3 per cent

Cement concrete pavement 3 per cent

Paved surfaces 3 per centGravel 5 per cent

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.

For roundabouts detailed consideration of crossfall is required taking into account diameter, heavy vehicle turning etc.

Table D1.1 WRC Street and Road Hierarchy - Deemed to Comply Requirements

Roadway Classification	No. of dwellings	Traffic Generation	Reserve Width 7 (Minimum)	Carriage Width 3,6 (Minimum)	Verge Width (Each sides) Min	Max. Grade (Desirable)%	Design speed kph
Access place	0 - 4 4 - 19	0 – 40 vpd 40 – 190 vpd	15	3.5m ₁ 5.5m ₁	4 m	(12) 16 4	30
Access street	20 - 74	200 – 740 vpd	15	6.5 m ₁	4 m	(12) 16 4	30
Collector street	75 – 299	750 – 2,900 vpd	16	7.5 m ₂	4 m	(8) 10	40
Trunk Collector street	300 – 599	3,000 –5,900 vpd	20	10.0 m 8	4.5 m	(8) 10	50
Sub Arterial road	600 –2,000	6,000-20,000 vpd	28	2 x 7.0 m carriageway 5.0 m median	4.5 m	(6) 8	50
Low Density Residential	0 – 74	740 vpd 750 vpd	20	6.0 m 7.5 m	5 m	(12) 16 4	50
Rural	Refer table D1.4 for details of Rural Road Elements						
Arterial and Major Arterial	The requirements for these categories shall be provided by the Council or Relevant Authority (QDMR) Traffic volumes shall be identified in a traffic management report.						
Industrial Access	<8 ha	-	20	12 m	4 m	(6) 10	50
Industrial Collector	<30 ha	-	22	14 m	4 m	(6) 8	50

Notes:

- Carriageway (and reserve) widening shall be provided on bends in accordance with Queensland Streets.
- Widening of carriageway to 10m shall be required on all bus routes, and a minimum road reserve of 18m provided.
- 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.
- 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.
- Road reserve widths may require widening to accommodate table drains, provision for services, on-street car parking provision and bus bays.
- Minimum reserve width must be provided, irrespective of minimum verge and carriageway widths specified.
- Where the road is nominated as part of the bikeway network, allowance for bike lanes shall be added to this width (minimum bikeway width is 1.5m, or 2.0m where the design speed is >60km/hr).

For Intersection detailed consideration of crossfall is required to take into account longitudinal grades and the implication for high vehicles turning through an intersection.

CARRIAGEWAY WIDTH

- 1. Minimum carriageway widths for all streets shall be as nominated in Table D1.1.
- The carriageway width 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.
- 3. The safety of pedestrians and cyclists where it is intended they use the carriageway must also be assured by providing sufficient width and visibility.
- 4. The carriageway width 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 on the carriageway opposite the driveway.
- 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.
- 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.
- 7. Where a "split level" road is proposed, a stable form of retaining structure such as reinforced concrete, crib block, gabion or masonry walling (or other approved alternative) is required between upper and lower road levels. Carriageways widths are to be exclusive of the plan area of the retaining structure. Excessive earth batters will not be permitted.
- 8. Traffic islands shall be designed in accordance with the current Department of Transport and Main Roads or AUSTROADS Design Manuals.

VERGES

1. Minimum verge widths for all streets shall be as nominated in Table D1.1.

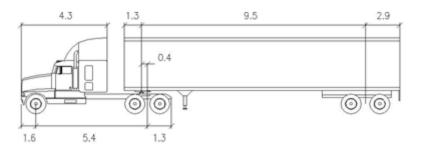
- 2. A suitable design of the verge will depend on utility services, access to allotments, pedestrian usage, tree preservation and stormwater drainage.
- 3. All verges shall fall from the frontage property boundary to the adjacent kerb and channel with acceptable crossfalls of between 3% 5%. In the case 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%.
- 4. The maximum slope permissible within a road verge is 1 in 4.
- 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.
- 6. Utilities service locations shall be in accordance with the relevant Authorities requirements.
- 7. Verges shall be covered full width with topsoil to a depth of not less than 40mm and shall be lightly compacted and grassed in accordance with Council's minimum standards and Specifications.

INTERSECTIONS

- 1. All new intersections of Access Places, Access Streets and Collector Streets, shall be three way intersections designed and located in accordance with Complete Streets.
- 2. A roundabout shall be used in the design of four way intersections.
- Intersections of Trunk Collector, Industrial, and Sub Arterial roads shall be designed in accordance with AUSTROADS Design Manuals and shall allow for potential improvement to incorporate other traffic control methods e.g. Traffic signals.
- 4. Intersections with State controlled roads shall be designed and constructed in accordance with the requirements of the Department of Transport and Main Roads.
- 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.
- 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.
- 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.

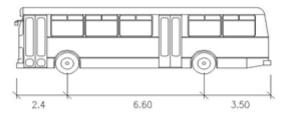
- 8. All vehicle turning movements are accommodated utilising AUSTROADS Design Vehicles and Turning Templates, as follows:
- For turning movements involving trunk collector streets or collector streets, the "design semi-trailer" with turning path radius 15.0 m;
- For turning movements involving access streets but not involving collector streets, the "design single unit truck/bus" with turning path radius 13.0 m;
- For turning movements on access places but not involving, collector streets or access streets the garbage collection vehicle with turning path radius 12.0 m;
- For turning movements at the head of cul-de-sac streets sufficient area is provided for the "design single unit truck" to make a three-point turn and
- Road furniture shall be located to allow for clear manoeuvring of the design semi-trailer.
- 9. Intersection channelisation is to be provided and designed in accordance with the current Department of Transport and Main Roads or AUSTROADS Design Manuals.
- 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.
- 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.
- 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.
- 13. On Trunk Collectors, Sub-Arterial and Arterial roads, median breaks will only be permitted at approved intersections.
- 14. Pavement markings associated with channelisation and signs shall be provided in accordance with the Department of Transport and Main Roads Manual of Uniform Traffic Control Devices.



Tractor Width : 2.50 Trailer Width : 2.50 Tractor Track : 2.50 Trailer Track : 2.50

Turning Radius (Outside) : 15.00

Semi-Trailer

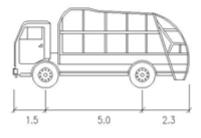


 Width
 : 2.50

 Track
 : 2.50

 Turning Radius (Outside)
 : 13.00

Single Unit Truck / Bus



Width : 2.50
Track : 2.50
Turning Radius (Outside) : 12.00

Garbage Truck

Figure D1.3 Standard Vehicles

ROUNDABOUTS

- 1. Design of roundabouts will generally be in accordance with current Department of Transport and Main Roads Design Manuals and AUSTROADS Guide to Road Design.
- 2. Roundabout shall only be used at intersection of Collector Streets and Access Streets or higher order roads only. All roundabouts shall have a minimum inscribed circle diameter of 30.0m.
- 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.
- 4. Landscaping to centre islands to be in accordance with Council minimum standards and Specifications.
- 5. Roundabouts shall include provision for on road cycle lanes unless alternate cycle paths are provided.

CUL-DE-SAC TURNING AREAS

- 1. The turning areas at the ends of the cul-de-sac in streets is to be designed in accordance with Complete Streets, excepting as follows:
- 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.
- 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.
- 2. Where a full turning circle is provided the minimum kerb radii shall be:
- Approach and departure curves 15 m
- The turning circle
 10 m
- 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:
- Approach and departure curves 30 m
- The turning circle 15 m
- 4. All turning heads shall have adequate provision for on-street parking at cul-de-sacs in accordance with Complete Streets. Provision of parking areas within the verge must not compromise the future connection of services to the allotments.

LOCAL AREA TRAFFIC MANAGEMENT

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 the AUSTROADS Guide to Road Design and are to be approved by Council.

- 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.
- 3. Emergency vehicles must be able to reach all residences and properties.
- 4. Where bus routes are involved, buses should be able to pass without mounting kerbs and with minimised discomfort to passengers.
- 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.
- 6. In newly developing areas where street systems are being developed in line with LATM principles, building construction traffic must be catered for.
- 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.
- 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.
- 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.
- 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.
- 11. Sight distances to be considered include those of and for pedestrians, cyclists and property accesses, as well as for drivers.
- 12. Night time visibility of street features and LATM devices must be adequate and in accordance with the MUTCD.
- 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:
- Pavement narrowing:

- Single lane 3.5m between kerbs;
- 3.75m between obstructions; and
- Two lane 5.50m minimum between kerbs;
- Bicycle lanes (including adjacent to pavement narrowings) 1.5m minimum;
- Plateau or platform areas:
- 75mm to 150 mm height maximum, with 1 in 15 ramp slope;
- Dimensions of mountable areas required for the passage of large vehicles to be determined by appropriate turning templates.

BUS STOPS

- 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.
- 2. Unless otherwise approved, bus stops shall be constructed in accordance with AUSTROADS Guide to Road Design, MUTCD and Disability Standards for Accessible Public Transport.
- 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 metre ¹	Single Bay and shelter ²
Trunk Collector or higher order Road	400 metre	Single Bay and Shelter ²

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.

ACCESS TO ALLOTMENTS

- 1. Criteria for acceptable access to allotments are to be in accordance with Standard Drawings R- 0050, R-0051, R-0053.
- 2. Criteria for acceptable access to steep allotments are to be in accordance with Design Manual D2.
- 3. All rear access (Hatchet or Battleaxe) allotments or allotments accessed via an easement, shall be provided with a reinforced concrete driveway (or other surface as approved by Council in rural areas only) a minimum width of 3.0m, extending the full length of the access leg of the allotment. The 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 driveway unless otherwise approved.

PARKING PROVISIONS

- 1. Parking provisions in accordance with the relevant sections of Complete Streets shall be accorded with on all roads, except that for Major Collector Street with a traffic generation of 3000 vpd 5999 vpd.
- 2. Streets which cannot comply with the on-street parking provisions of Complete Streets, 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.
- 3. Verge widths are to be maintained alongside indented or verge parking areas. Where necessary, property boundaries shall be adjusted to meet this requirement.

PATHWAYS

- 1. Unless otherwise approved, pathways will be constructed taking into consideration the Disability Discrimination Act and Disability Standards for Accessible Public Transport.
- 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 and at least 2.5m wide 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.
- 3. Maximum cross fall on all access pathways 2.5%.
- 4. Pathways constructed using alternate material (e.g. Asphalt, Paving blocks) are to be approved by Council.
- 5. The pathway shall extend to the property boundary remote from the roadway where the path is not connecting two street frontages.
- 6. Bends shall be provided with a minimum internal radius of 6m.
- 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).
- 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.
- 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.
- 10. The requirements for pathways to be constructed longitudinally along roads shall be in accordance with Table D1.3.

Table D1.3 Pathways along Roads

Road Classification	Pathway Requirements ²		
Access Place	Nil (Kerb ramps to intersections only) 1		
Access Street	1.5m wide Pathway on one side of reserve ³		
Collector Streets	2.0m wide Pathway on one side of reserve ³		
Sub Arterial / Arterial	2.5m wide Pathway on both sides of reserve		
Industrial	1.5m wide Pathway on each side of reserve		

- 11. All pathways shall have appropriate immunity against cross drainage.
- 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.
- 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.

BIKEWAYS

- 1. 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 AUSTROADS Guides and MUTCD Part 9, Bicycle Facilities*.
- 2. Bikeways constructed using alternate material (e.g. Asphalt, Paving blocks) are to be approved by Council.
- 3. Bikeways located in parks shall be constructed above the flow of a storm of 5 year ARI, unless approved otherwise by Council.
- 4. Where bikeways connect to or crosses over an Access Street or higher order road, a slow point shall be installed as approved by Council.
- 5. 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).

KERB AND CHANNEL

- 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 Complete Streets.
- 2. Standard kerbs in accordance with Standard Drawing R-0080 shall be used in the following cases:
- Residential Streets Layback Kerb and Layback Kerb and Channel;
- Medians Maintenance Strip Kerb;
- Grassed and Landscaped Traffic Islands Maintenance Strip Kerb;
- Concrete Traffic Islands Semi-mountable Kerb; and
- Roundabouts (centre island only), Maintenance Strip Kerb.

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.

- 4. Minimum channel grade should be 0.5 percent unless approved other approved by Council.
- 5. Every effort should be made to provide vertical curves as long as possible, for improved appearance.
- 6. At all changes in horizontal alignment, kerbs and kerb and channel shall be constructed with horizontal curves.
- 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 AUSTROADS Design
 Manuals.
- 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.
- 9. Access crossovers for Industrial, Commercial and Multi Residential site shall be installed in accordance with Standard Drawings R-0050, R-0051, R-0053 and R-0056.

SIGNS AND ROAD MARKINGS

- 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.
- 2. Temporary or construction signing and road marking shall be in accordance with current edition of the MUTCD.
- 3. The relevant sign reference number from the MUTCD shall be included on the construction drawings.
- 4. All signs and pavement markings shall be adequately dimensioned to ensure accurate setting out.
- Signs located in grassed areas shall have a surrounding 500mm dia x 100mm thick concrete
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mowing strip.

- 6. Signs located in concrete islands or medians shall be installed with the "V Loc" socket system and fitted with anti-theft bolts.
- 7. The bottom of all un-sleeved posts shall be flattened prior to placing in concrete footing.
- 8. Vandal proof bolts and fittings shall be used on all permanent signing.
- 9. Street Name signs shall be installed in accordance with Standard Drawing R-0130.

ROAD EDGE GUIDE POSTS AND GUARDRAILS

- 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.
- 2. Guide posts shall conform to and be installed in accordance with Department of Main Roads 'Manual of Uniform Traffic Control Devices'.
- 3. Guardrails shall be installed in accordance with the Department of Main Roads Road Planning and Design Manual.

PEDESTRIAN FOOT BRIDGES

- 1. Pedestrian foot bridges are to be provided where necessary and are to be constructed from concrete, steel or timber (all steelwork is to be hot dipped galvanised) and shall be provided with handrails / fences for pedestrian safety.
- 2. 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.
- 3. Designers shall consult with Council at concept stage to confirm location, widths, flood immunity etc.

TRAMLINES CROSSINGS

- 1. Road crossings are to be constructed in accordance with Department of Transport and Main Roads Standard Drawing 881.
- 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.

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.

FENCING

- 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 Standard Drawing G-0045.
- 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 Standard Drawing G-0045.

RURAL DESIGN CRITERIA

GENERAL

 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 D1.4 details specific road demands for rural roads.

Table D1.4 Rural Road Elements

AustRoads Classification								
	Class 5	Class 5	Class 4	Class 3	Class 1 & 2			
	WRC Classification							
	Rural Access Place	Rural Access St	Rural Collector	Rural Sub Arterial	Rural Arterial			
Traffic Volumes or Road Class (vpd)	<100	100-199	200-999	1000-7999	>8000			
Road Reserve (flat terrain < or = 5%)	20m	20m	20m	25m	25m			
Road Reserve (Undulating/Hilly>5%	25m	25m	25m	30m	30m			
Formation	8m	8m	8m	10m	12m			
Pavement Width	6.0m	6.0m	6.5m	8m	10m			
Seal Width	Optional	4m (min)	6.5m	8m	10m			
Shoulders ²	1.2m	1.2m	0.75m	0.5m seal	1.5m seal			
Speed kph (max)	80	80	100	100	100			

Notes:

- 1. In undulating terrain this width shall be increased to enable services to be constructed on accessible flatter land on top and below batters.
- 2. Where the road is a designated on-road bicycle route (signposted and pavement marked) the shoulder provision needs to conform to the AUSTROADS.
- 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 AUSTROADS Guide to Road Design.
- 3. Where appropriate superelevation, widening and centreline shift and their associated transitions are to comply with AUSTROADS Guidelines.
- 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 per cent will require scour protection).

HORIZONTAL AND VERTICAL ALIGNMENT

Horizontal and vertical curves are to be designed generally to the requirements of AUSTROADS
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.

INTERSECTIONS

1. Intersections should generally be designed in accordance with the publication

AUSTROADS Guide to Road Design.

 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).

ACCESS TO ALLOTMENTS

- All accesses onto sealed roads are to be sealed as per R-0056. Where the access falls from the
 property towards the sealed road the whole access shall be sealed from the edge of the sealed
 bitumen to the property boundary. Accesses off gravel roads do not have to be sealed.
- 2. Drainage under accesses shall be designed and constructed to a size and length as determined by Council. Minimum pipe size 375mm dia, Minimum length 4.8m long.
- 3. All pipe and box culverts under accesses shall have headwalls to protect and retain gravel fill.
- 4. Precast vertical headwalls with wings are preferred, but insitu cast concrete or grouted stone may be used subject to Council Approval.
- 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.
- 6. Accesses are to be designed to ensure that stormwater runoff from the road and the access discharge to the table drain.
- 7. Allotment Accesses shall be constructed in accordance with Standard Drawing R-0056 unless otherwise approved by Council.

D2 - SITE REGRADING

GENERAL

D2.01 SCOPE

- 1. This section sets out the minimum standards specifically developed for site regrading involved in land development and subdivision.
- 2. The designer needs to make reference to the associated design manual related to, D1 Road Geometry, D4 Stormwater Drainage and D5 Stormwater Quality Management.

D2.02 OBJECTIVES

This Manual aims to assist the Designer in achieving:

- Efficient and economical design;
- Enhancement of the environmental character and maintenance of natural features of the site; and
- Minimal impact on adjoining properties and developments.

D2.03 REFERENCE DOCUMENTS

Council Guidelines & Specifications

D1 Road Geometry,

D4 Stormwater Drainage

D5 Stormwater Quality Management.

S1 Earthworks

S8 Landscaping

Standard Drawings (Various)

Australian Standards

- AS 3798 Guidelines on Earthworks for Commercial and Residential Development
- AS 4373 Pruning of Amenity Trees
- AS 4970 Protection of Trees on Development Sites

Note: Where Acts or reference documents are updated, reference should be made to the current version.

QLD State Authorities

- State Planning Policy 1/03 –Mitigating the adverse impact of Flood, Bushfire and Landslide
- State Planning Policy 2/02 Planning and Managing Development involving Acid Sulfate Soils

D2.04 SITE REGRADING CONCEPT

- 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 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.
- 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.
- 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.
- 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.

D2.05 CLEARING

- 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. 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.
- 3. Reference should be made to the Vegetation Management Act and any relevant Local Laws and Policies prior to any tree clearing.
- 4. Generally, in areas with significant trees and vegetation:
 - 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
 - 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.
- 5. No trees shall be damaged or removed from areas to be dedicated under the control of Council without prior written approval of Council.
- 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.
- 7. Prior to any clearing, all existing and future parkland shall be delineated to ensure its protection from unauthorised clearing.

D2.06 GENERAL STANDARD OF LOT PREPARATION

- 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. 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.
- 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.

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.

D2.07 FILLING

- 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. Fill comprising industrial wastes or by-products is not permitted.
- 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.
- 4. No person shall be permitted to fill any land if such filling may detrimentally affect natural drainage of any of the surrounding land.
- 5. All new allotments are to be flood free. Immunity levels shall be in accordance with relevant Council Policies and Planning Scheme requirements.
- 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:
 - Queensland Urban Drainage Manual (QUDM);
 - · Council's Local Laws & Policies; and
 - Council's Flooding and Drainage Policies.

D2.08 COMPACTION

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

D2.09 CARTAGE OF SOIL

- 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. 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.

3.

- 4. 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.
- 5. Unless otherwise approved by Council all topsoil shall be retained on the development site and utilised effectively to encourage appropriate revegetation.

D2.10 ALLOTMENT EARTHWORKS

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

D2.11 BATTER TREATMENTS

- Cut and fill batters shall not straddle allotment boundaries unless otherwise approved by the Council.
- 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.
- 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.
- 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.
- 5. In environmentally sensitive areas or steep terrain, consideration may be given to relaxation of clause 4 subject to council approval.

- 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.
- 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.
- 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.
- 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).

D2.12 ALLOTMENT ACCESSES

 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 ¹	8%	10%

Note:

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

- 2. Steep allotment access and drainage shall be designed and constructed to include the following (unless otherwise approved by Council):
- The driveway shall 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;
- 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;
- A turn around shall be provided adjacent to each of the proposed dwellings sufficient to allow turning movements for an emergency services vehicle;
- The driveway shall be located to minimise the visual impact, and minimise the amount of earthworks required; and
- 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.

D2.13 RETAINING WALLS

- 1. Council will allow retaining walls to be constructed up to a maximum height of 900mm without structural certification provided they are constructed fully in accordance with the technical literature provided by the manufacturer (ie. Koppers logs, Keystone or similar).
- 2. All retaining walls greater than 900mm 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.
- 3. Retaining walls shall be designed so as 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.

D2.14 EARTHWORKS ON HILLSLOPES

- 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.
- 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.
- 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.

D2.15 EARTHWORKS TO PARKS

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

D2.16 FOOTPATHS / VERGE CROSSFALL

1. All footpaths / verges shall fall from the frontage property boundary to the adjacent kerb and

channel with acceptable crossfalls of between 2.5% - 5%. In the case where the allotment falls away from the road reserve (ie. 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%.

D2.17 TOPSOILING AND GRASSING

- 1. Topsoil is defined as surface soils high in organic matter and contaminated by residual grass seeds and grass roots.
- 2. The area under paved areas, footpaths, batters and areas of fill shall be stripped of topsoil and any other organic matter.
- 3. On the completion of the works, topsoil shall be re-spread to allotments, batters and footpaths and fill areas to a depth of 75mm with an absolute minimum of 40mm.
- 4. The footpath areas, batters and all disturbed areas including allotments are to be trimmed and drill seeded with an approved grass species.
- 5. All cut and fill batters shall be hydro-mulched or approved equivalent.

D2.18 INSPECTION REQUIREMENTS

- 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. A higher level of inspection and testing may be required for more significant works as determined by Council.
- 3. Council may approve a lower level of inspection and testing for minor works and drainage works.

D3 - ROAD PAVEMENTS

GENERAL

D3.01 SCOPE

- 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.
- 2. The Manual contains procedures for the design of the following forms of road pavement construction:
- · Flexible pavements; and
- Rigid pavements (ie. concrete pavements).
- 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.

D3.02 OBJECTIVES

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.

D3.03 REFERENCE DOCUMENTS

Note: Where Acts or reference documents are updated, reference should be made to the current version.

Department of Transport and Main Roads

- Pavement Design Supplement
- MRTS 30Asphalt Pavements
- Road Planning and Design Manual Chapter 3 Appendix A 1st Edition

Australian Asphalt Pavement Association (AAPA)

National Asphalt Specification-Advisory Notes

AUSTROADS / ARRB Publications

- Guide to Pavement Technology
- Guide to Road Design
- Design of Sprayed Seals
- ARRB-SR35 Special Report No. 35 Subsurface Drainage of Road Structures
- APRG 21 Report No. 21 A guide to the design of new pavements for light traffic
- Special Report No. 35 Subsurface Drainage of Road Structures
- Guide to Pavement Structural Design
- Technical Report Pavement Design for Light Traffic A supplement to Austroads Pavement Design Guide AP-T36/06

Cement and Concrete Association of Australia.

T51 Concrete Pavement Design for Residential Streets and Paths

Concrete Masonry Association of Australia.

- T44 Concrete Segmental Pavements Guide to Specifying
- T45 Concrete Segmental Pavements Design Guide for Residential Access Ways and Roads
- T46 Concrete Segmental Pavements Detailing Guide

PAVEMENT DESIGN CRITERIA

D3.04 DESIGN VARIABLES

- 1. Regardless of the type of road pavement proposed, the design of the pavement shall involve consideration of the following five input variables:
 - Design Traffic;
 - Subgrade Evaluation;
 - Environment Factors;
 - · Pavement and Surfacing Materials; and
 - Construction and Maintenance Considerations.

D3.05 DESIGN TRAFFIC

- 1. The design traffic shall be calculated based on the following minimum design lives of pavement:
 - Flexible 20 years;
 - Rigid (Concrete) 40 years; and
- Segmental Block 25 years.
- 2. Unless determined otherwise by the Council, the minimum number of design Equivalent Standard Axles (ESA's ie, 80 kN axle load passes) for the various road categories shall be as calculated in accordance with the requirements of the AUSTRODS publications Guide to Pavement Technology and APRG Report 21 A guide to the design of new pavements for light traffic. For design traffic volumes approaching or exceeding 5 x 10⁵ ESA's (Trunk Collector Street), Department of Transport and Main Roads' Pavement Design Manual shall be used.
- 3. Design traffic shall be calculated for the applicable design life of the pavement, taking into account present and predicted commercial traffic volumes, axle loadings and configurations, commercial traffic growth and street capacity. For new subdivisions, the design traffic shall take account of both the construction traffic associated with the subdivision development, the in-service traffic, proposed and potential public transport routes and connection to adjacent development.
- 4. For interlocking concrete segmental pavements, the simplification of replacing ESA's with the number of commercial vehicles exceeding 3 tonne gross contained in CMAA T45 is acceptable up to a design traffic of 5 x 5⁵.
- 5. The pavement design shall include all traffic data and/or assumptions made in the calculation of the design traffic.
- 6. In the absence of other traffic data, the traffic values provided in Table D3.1 may be taken as a

guide to the minimum design traffic, but shall be subject to variation depending on the circumstances for the particular development.

Table D3.1 Minimum Traffic Loadings

Street Type	%CV ¹	%ESA / CV	Minimum ESA's
Urban			
Access Place	3.6	1.0	5 x 10 ⁴
Access Street	5	1.0	1 x 10 ⁵
Minor Collector Street	7	1.0	5 x 10 ⁵
Major Collector Street	10	1.0	1 x 10 ⁶
Sub Arterial	10	1.0	3.25 x 10 ⁶
Rural			
<250vpd	5	1.0	2.5 x 10 ⁵
>250vpd	-250vpd 9		2.5 x 10 ⁶
Industrial	To be determine	ed by specific design data	5 x 10 ⁵
Business / Commercial	To be determine	ed by specific design data	5 x 10 ⁵

Note:

1. Consider potential for bus routes.

D3.06 SUBGRADE EVALUATION

- 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.
- 2. Design CBR for each subgrade area shall be determined in accordance with the method outlined in
- 3. AUSTROADS publications Guide to Pavement Technology and ARRG Report 21 A guide to the design of new pavements for light traffic.
- 4. The following factors must be considered in determining the design strength/stiffness of the subgrade:
- Sequence of earthworks construction;
- The compaction moisture content and field density specified for construction;
- Moisture changes during service life;
- Subgrade variability; and
- The presence or otherwise of weak layers below the design subgrade level.
- 5. 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.

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6. If the insitu subgrade test results in a CBR of 3 or less, the pavement is to be designed with input

D3.07 ENVIRONMENT FACTORS

- 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 AUSTROADS publications Guide to road Design and Special Report No. 35 Subsurface Drainage of Road Structures.
- 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:
 - Rainfall/evaporation pattern;
 - Permeability of wearing surface;
 - Depth of water table;
 - Relative permeability of pavement layers;
 - Whether shoulders are sealed or not;
 - · Pavement type (boxed or full width); and
 - Subject to flooding (eg. Causeways and Floodways).
- 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 (ie. CBR or modulus) at the highest moisture content likely to occur during the design life, ie 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.
- 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.

D3.08 MATERIALS TESTING

- 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 the following authorities:
- · Department of Transport and Main Roads; and
- Standards Association of Australia.

PAVEMENT THICKNESS DESIGN

D3.09 PAVEMENT STRUCTURE - GENERAL

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) ¹	Surface Treatment	Minimum Base Course CBR	Minimum Subbase Course CBR
Access Place / Access Street / Residential Street	200	Minimum 30mm AC	80	45
Collector Streets -Minor -Major	250 250	Minimum 30mm AC Minimum 30mm AC	80 80	45 60
Sub Arterial	300	50mm AC	80	60
Rural & Rural Residential				
<100vpd 100-999vpd >1,000vpd	150 200 200	Gravel 2 Coat Seal 2 Coat Seal	60 80 80	45 60
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 with a single coat seal.
- 2. Notwithstanding subgrade testing and subsequent pavement thickness design, the thickness of subbase and base layers shall not be less than the following:

Flexible payment: Subbase 100mm, Base 100mm
 Rigid pavement: Subbase 100mm, Base 150mm

- 3. The subbase layer shall extend a minimum of 150mm behind the rear face of any kerbing.
- 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.
- 5. For un-kerbed roads, the subbase and base layers shall extend at least to the nominated width of shoulder.

6. A change of pavement types may be considered for intersection thresholds and traffic control features.

D3.10 FLEXIBLE PAVEMENTS

- 1. Flexible pavements with a design traffic up to 5 x 10⁵ ESA's shall be designed in accordance with AUSTROADS publications Guide to Pavement Technology and ARRG Report 21 A guide to the design of new pavements for light traffic.
- 2. Flexible pavement with a design traffic above 5 x 10⁵ ESA's shall be designed in accordance with Department of Transport and Main Roads' Pavement Design Manual.
- 3. In areas of high water table (within 300mm of subgrade level). Base course should be cement modified (1% by weight)
- 4. Concrete segmental pavements with design traffic up to 5 x 10⁵ and estimated commercial vehicles exceeding 3T gross shall be designed in accordance with CMAA-T45.
- 5. For design traffic above 5 x 10⁵ estimated commercial vehicles exceeding 3T gross the design shall be in accordance with AUSTROADS Guide to Pavement Technology with the calculation of design traffic in terms of ESA's.

D3.11 RIGID PAVEMENTS

- 1. Rigid (concrete) pavements, with design traffic up to 5 x 10⁵ ESA's shall be designed in accordance with either CCAA -T51 or AUSTROADS Guide to Pavement Technology.
- 2. Rigid (concrete) pavements for design traffic above 5 x 10⁵ ESA's, the design shall be in accordance with AUSTROADS Guide to Pavement Technology.

SURFACING DESIGN

D3.12 BITUMEN WEARING SURFACE

- 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:
 - Urban Residential, Low Density Residential Primer, plus 2 coat sprayed

Seal (14mm / 7mm Aggregate)

 Rural & Rural Residential (16mm / 10mm
 Aggregate) Primer, plus 2 coat sprayed bitumen Seal

D3.13 SEGMENTAL PAVERS

- 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 (eg. 'threshold' treatments). The use of clay pavers on road wearing surfaces is not permitted.
- 2. The edges of all paving shall be constrained by either kerbing and/or guttering, or by concrete edge strips.
- 3. Sand bedding layers are to be provided with adequate drainage.

D3.14 ASPHALTIC CONCRETE

- 1. All roadworks shall be surfaced with an appropriate thickness of Asphaltic Concrete in accordance with Table D3.2.
- 2. Council requires the use of dense graded asphalt on all roads.
- 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.
- 4. Asphalt Surfacing
 - Where asphalt surfacing is required to be between 30mm and 50mm, it is considered to function as a wearing surface only;
 - Asphalt 40mm or thicker is required to be a dense graded asphalt (DG14) in accordance with Department of Transport and Main Roads' MRTS 30;
 - Asphalt of 30 40 mm thickness must be a dense graded asphalt (AC10) in accordance with the AAPA's National Asphalt Specification; and
 - A light prime is to be applied over the pavement material prior to the asphalt being laid.

SUBSURFACE DRAINAGE

D3.15 SUBSOIL DRAINS

1. Subsoil or sub-pavement drains shall be provided on both sides of the formation in the following

locations, 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:

- Cut formations where the depth to finished subgrade level is equal to or greater than 400mm below the natural surface level;
- Locations of known hillside seepage, high water table or isolated springs;
- Irrigated, flood-prone or other poorly drained areas;
- Subgrades, which are highly susceptible to moisture, (ie. commonly displaying high plasticity or low soaked CBRs);
- Pavement materials, which are susceptible to moisture;
- Existing pavements displaying signs of distress due to excess subsurface moisture; and
- At cut to fill transitions.
- 2. Subsoil drains shall always be installed to all grassed/landscaped central medians and islands, unless otherwise approved by Council.
- 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.
- 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 poorer subgrade being uncovered that were not identified in the geotechnical investigation.
- 5. The requirements for subsoil drains should be assessed and designed by a registered geotechnical engineer or specialist pavement engineer.
- 6. Subsoil drains shall be constructed in accordance with Standard Drawing R-0140.
- 7. In kerbed roads, the preferred location for the line of the trench is directly behind the kerb.
- 8. In un-kerbed roads, subsoil and sub-pavement drains shall be located within the shoulder, preferably at the edge of the pavement layers.
- 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
- 10. The minimum desirable longitudinal design grade shall be 1.0 1.5%. (Absolute minimum grade of 0.5%).
- 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.

- 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.
- 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.
- 14. Flushing Points and Outlets shall be constructed in accordance with Standard Drawing R-0142.

D3.16 DRAINAGE MAT (BLANKETS)

- 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.
- 2. In embankments drainage mats are constructed after the site has been cleared and grubbed and before commencement of embankment construction.
- 3. In excavations drainage mats are constructed after completion of the subgrade construction and before construction of the pavement.
- 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.
- 5. The requirements for and design of drainage mats shall be undertaken by a geotechnical engineer experienced in the design of road pavements.
- 6. All drainage mats shall be wrapped in appropriate geotextile.

D4 – STORMWATER DRAINAGE

GENERAL

D4.01 SCOPE

- 1. This section sets out the minimum standards for the design of stormwater drainage systems for urban and rural areas.
- 2. The designer needs to make reference to the associated design manuals related to D1 Road Geometry and D5 Stormwater Quality Management.
- 3. The Queensland Urban Drainage Manual (QUDM) shall be the basis for the design of stormwater drainage, except as amended by these manuals.

D4.02 OBJECTIVES

- 1. The objectives of stormwater drainage design are as follows:
- To 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;
- Limit flooding of public and private property, both within the catchment and downstream, to acceptable levels; and
- To provide convenience and safety for pedestrians and traffic in frequent stormwater flows by controlling those flows within prescribed velocity/depth limits.
- 2. For new developments a stormwater drainage system in accordance with the "major/minor" system concept in accordance with QUDM; 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.
- 3. For redevelopment areas where the proposed development replaces an existing development, 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 recurrence interval (ARI) of the receiving minor system is no greater than that which would be expected from the existing development and is not concentrated in such a way as to cause nuisance to downstream properties.

D4.03 REFERENCE DOCUMENTS

Note: Where Acts or reference documents are updated, reference should be made to the current version.

Department of Energy and Water Supply

Queensland Urban Drainage Manual

Institute of Engineers Australia

Australian Rainfall and Runoff - A Guide to Flood Estimation

Australian Standards

•AS 3600-2009 Concrete Structures

DESIGN CRITERIA

D4.04 GENERAL

- 1. The QUDM shall be the basis for design of stormwater drainage except where amended by these manuals.
- 2. Minor system flows (as defined by QUDM) are to be conveyed underground to a legal point of discharge unless otherwise approved by Council.
- 3. Councils have or are in the process of producing drainage management plans for particular catchments within their boundaries.
- 4. 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
- 5. 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.
- 6. Alternatively, where a development will result in increased runoff the stormwater drainage system

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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.

- 7. 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.
- 8. The design 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.
- 9. The designer 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.
- 10. 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.
- 11. All Material and components of the Stormwater Drainage system shall be durable and fit for purpose, with a minimum lifespan 60 years.

D4.05 DESIGN AVERAGE RECURRANCE INTERVAL

- 1. Design Average Recurrence Interval (ARI) shall be in accordance with Table D4.1 (modified from QUDM Table 7.3.1).
- 2. For the purpose of drainage, a major road shall be defined as a major collector or higher order road.

Table 4.1 Recommended Design Average Recurrence Intervals

Major System Design ARI (years)	100			
4. Minor System Design ARI (years)				
Development Category				
Central Business and Commercial	10			
Industrial	5			
Urban Residential High Density	10			
-Greater than 20 dwelling units / ha				
Urban Residential Low Density	5			
-Greater than 5 and up to 20 dwelling units / ha				
Rural Residential	5			
-2 to 5 dwelling units / ha				
Open Space – parks, etc	1			
	Kerb & Channel Flow	10 ¹		
Major Road	Cross Drainage (Culverts)	50 ²		
Minor Road	Kerb & Channel Flow	Refer to relevant development category in QUDM		
	Cross Drainage (Culverts)	10 ²		

Notes:

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

D4.06 DESIGN RAINFALL DATA

1. Design Intensity Frequency Duration (IFD) Rainfall Charts have been developed for the Whitsunday Regional Council Area. Table D4.2 shows the location of the appropriate Rainfall Chart to be used for stormwater drainage design (Refer **Appendix A** in this manual).

2. If the location of a proposed development falls between two IFD Charts or is not covered by the above charts, Council should be contacted to confirm appropriate table to be used.

Table D4.2 IFD Rainfall Charts

Location	IFD Chart
Abbot Point	1
Airlie Beach	2
Bowen	3
Cannonvale	4
Collinsville	5
Conway Beach	6
Dingo Beach	7
Gumlu	8
Hamilton Island	9
Mount Coolon	10
Proserpine	11
Proserpine Airport	12
Shute Harbour	13

D4.07 CATCHMENT AREA

- 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.
- 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.

D4.08 KERB INLETS AND MANHOLES

- Kerb Inlet pits shall be in accordance with Standard Drawings D-0061 D-0063. All pits are to be recessed sufficiently to maintain a continuous lip line in accordance with these drawings. Alternate proprietary kerb inlets systems may be used only where approved by Council.
- Kerb Inlet capacity design charts have been prepared for the standard kerb inlets (Refer Appendix B in this manual). Where alternate proprietary 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 Whitsunday Regional Council Planning Scheme 2017– Schedule 6 –June 2017 (V3.5)

Council with the design submission.

3. Blockage Factors shall be used for the design of the drainage system as shown in Table D4.3.

Table D4.3 Kerb Inlet Blockage Factors

Inlet Type	Blockage Factor
On Grade – Side Entry (no grate)	20%
On Grade – Side Entry (with grate)	10%
On Grade – Grate only	50%
Sag – Side Entry (no grate)	20%
Sag – Side Entry (with grate)	Nil
Sag – Grate only	50%

- 4. The kerb inlet capacity design charts shall be used in accordance with the following:
- Curves indicated on the charts that are shown in full are considered "Reliable" curves;
- Curves indicated on the charts that are shown dashed up to an Approach Flow of 250 l/sec are considered "Satisfactory" for use;
- 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
- No extrapolation beyond the limits of these charts shall be permitted.
- 5. 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.
- 6. 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 Standard Drawing D-0010 D-0012. 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.
- 7. Other factors to be considered in the design are as follows:
- Pits to be free draining;
- 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;
- Reductions in pipe sizes shall not be permitted; and
- 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.
- 8. The desirable maximum inlet pit depth should be limited to 1.5m to enable maintenance.
- 9. The desirable minimum and maximum stormwater manhole depth is to be limited to 1.2m and 3.0m

respectively.

10. Inlet pits should be located at the mid-point of allotment frontages to reduce the likelihood of conflict with service conduits and future driveways

D4.09 PIPES / BOX CULVERTS

- 1. Stormwater drainage pipes and boxes shall be generally of reinforced concrete (including FRC) construction and in accordance with the following:
- Minimum pipe size 375mm dia, minimum box culvert size 450mm x 300mm;
- Minimum clear cover shall be 600mm in general or in accordance with manufacturers specification, otherwise approved by the Council;
- The minimum vertical and horizontal clearances between a stormwater pipe and any other pipe or service conduit shall be 150mm:
- In areas of high water table, the designer must consider buoyancy uplift in relation to pipe/culvert joints; and
- 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.

D4.10 OVERLAND FLOW

- 1. Overland flow paths or emergency relief paths shall be formed and located in accordance with the requirements of QUDM. The following additional requirements shall also be required.
- 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 per cent and be constructed with a layback kerb and channel or
 approved equivalent along one edge. The ARI 100 year flow shall be contained completely within
 the pathway;
- 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;
- Flows through parks shall have non-erosive velocity or adequate protection against scouring to the satisfaction of Council;
- 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
- 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.

D4.11 DRAINAGE CALCULATIONS

1. If a legal 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.

- 2. 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.
- 3. 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.

D4.12 OPEN CHANNELS

- 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
 QUDM.
- 2. Maximum side slopes on grass lined open channels shall be 1 in 4, with a preference given to 1 in 6 side slopes, channel inverts shall generally have minimum cross slopes of 1 in 10.
- 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. Subsurface drainage shall be provided in grass-lined channels to prevent waterlogging of the channel bed.
- 5. Profiles of all grass lined channels shall such that mowing may be undertaken by a tractor and slasher to the satisfaction of Council.
- 6. 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.
- 7. The depth velocity product and the gutter flow widths are to be included in the submitted drainage calculations

D4.13 ALLOTMENT DRAINAGE

1. Interallotment drainage systems shall be designed in accordance with Q.U.D.M section 5.18. The

minimum standard shall be Level 2 as defined in Q.U.D.M figure 5.18(b) and 5.18.3, however the Engineer may direct a higher level for specific developments or parts thereof..

- 2. Interallotment drainage system shall be provided to all allotments where:
- 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.

Easement shall be required over level 2 interallotment drainage systems.

- 3. Interallotment pipes shall generally be:
 - uPVS sewer pipe minimum class SHE;
 - uPVC drainage pipe PLASCOR or equivalent, of equivalent class to uPVC sewer class SHE;
 - R.C. Pipe class "1" rubber ring jointed;
 - F.R.C pipe class "X" rubber ring jointed; and
 - uPVC pipes to be rubber ring jointed. Standard manufactures fittings shall be used in all cases: site fitted saddles are not permitted.
- 4. Interallotment drainage system shall be discharged into an underground drainage system or approved open channel. Discharge of interallotment systems to kerbs and channel shall not be permitted.

COVER

- 1. The general minimum cover to pipe shall be 500mm. the minimum cover to house connections shall be 500mm.
- 2. The depth of the house connection shall be determined as follows (subject to the above minimum);
 - Determine the longest run of house drain to the connection point possible within the allotment;
 - Allow 0.3 meters cover to the house drain at the head of the line; and
 - Allow minimum grade of 1 in 100 for the house drain.
- 3. 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 *	N/A
*precast boxes shall b	e approved prior to installation, wal	I thickness may vary according to

- 4. Manholes shall be provided in the following locations:
 - One per lot;
 - · Changes in grade;
 - Changes in direction;
 - Changes in pipe diameter; and
 - End of lines

D4.14 TELEMETRY SYSTEMS

- 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.
- 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

D4.15 RETAINING WALLS

- 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.
- 2. Appropriate scour protection is to be provided to the base of the wall.

D4.16 DETENTION BASINS

1. Detention basins may be considered as drainage solutions but shall be subject to approval of Council. Where approved detention basins shall be designed in accordance with QUDM.

D4.17 HEADWALLS

- 1. Pipe / Box culvert headwalls shall be in accordance with the Department of Transport and Main Roads Standard Drawings 1303 1306 and 1318 Proprietary precast headwall may also be used as an alternative to cast insitu structures.
- 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.
- 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.

D4.18 TABLE DRAINS

- 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.
- 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.

D4.19 EASEMENTS

- Where stormwater drainage pipes pass through property other than a road reserve an easement shall be provided over the line 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.
- 2. If a stormwater pipe passes adjacent to a property and based on the above formula the area of influence passes within the property, an easement over that portion shall be required.
- 3. The width of easement shall contain the ARI 100 year storm flow from the upstream catchment or be three (3) metres wide, whichever is greater.
- 4. 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.

D4.20 OUTLET / OUTLET PROTECTION

- 1. Outlet into natural watercourse, open channels and tidal areas shall be designed in accordance with the requirements of QUDM.
- 2. Protection works to outlet shall be designed to meet the following criteria:
- Dissipate the outflow velocity to minimise scouring;
- Provide protection from stream flows in receiving waters;
- Provide protection from overland (Major Storm) flows into receiving waters; and
- Provide protection from local scouring or undermining of the outlet structure.
- 3. 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. 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.
- 5. All tidal outlets shall be fitted with floodgates to prevent the intrusion of salt water into the system.
- 6. 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.
- 7. 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.
- 8. All outlets shall be located to facilitate inspection and maintenance access.

APPENDIX A

IFD RAINFALL CHARTS

CHART 1 – ABBOT POINT

Duration	Rainfall Intensity (mm/h) by ARI								
	1	2	5	10	20	50	100		
	year	years	years	years	years	years	years		
5 Mins	116	150	191	216	249	293	326		
6 Mins	109	141	180	203	234	275	307		
10 Mins	91.2	117	150	169	194	228	254		
20 Mins	69.9	89.6	113	127	145	170	188		
30 Mins	58.3	74.6	93.6	105	120	140	155		
1 Hr	40.3	51.5	64.8	72.5	83.1	96.9	107		
2 Hrs	25.8	33.2	42.5	47.9	55.3	65	72.5		
3 Hrs	19.4	25.2	32.6	37.1	43.1	51	57.2		
6 Hrs	11.8	15.5	20.6	23.8	27.9	33.6	38		
12 Hrs	7.37	9.73	13.3	15.5	18.4	22.3	25.5		
24 Hrs	4.85	6.42	8.82	10.4	12.3	15.1	17.2		
48 Hrs	3.23	4.27	5.89	6.91	8.25	10.1	11.5		
72 Hrs	2.42	3.21	4.46	5.26	6.29	7.72	8.86		

CHART 2 – AIRLIE BEACH

Duration	Rainfall Intensity (mm/h) by ARI								
	1	2	5	10	20	50	100		
	year	years	years	years	years	years	years		
5 Mins	127	163	210	238	275	325	363		
6 Mins	120	154	198	225	260	307	344		
10 Mins	99.8	129	166	188	217	257	288		
20 Mins	75.3	97.1	124	141	163	192	215		
30 Mins	62.7	80.8	103	117	135	160	178		
1 Hr	44.2	57.1	73.5	83.4	96.7	114	128		
2 Hrs	29.9	38.9	51.1	58.7	68.6	82	92.6		
3 Hrs	23.5	30.8	41.1	47.6	56.1	67.7	76.9		
6 Hrs	15.5	20.5	28.3	33.3	39.9	48.9	56.1		
12 Hrs	10.5	14	19.7	23.4	28.2	35	40.4		
24 Hrs	7.39	9.86	13.8	16.4	19.7	24.4	28.2		
48 Hrs	5.3	7.01	9.6	11.3	13.4	16.4	18.8		
72 Hrs	4.2	5.56	7.56	8.85	10.5	12.8	14.7		

CHART 3 – BOWEN

Duration		Rainfall Intensity (mm/h) by ARI								
	1	2	5	10	20	50	100			
	year	years	years	years	years	years	years			
5 Mins	118	152	194	219	253	297	332			
6 Mins	110	142	182	206	238	280	313			
10 Mins	92.3	119	152	171	197	232	259			
20 Mins	70.6	90.5	114	128	147	172	192			
30 Mins	58.8	75.3	94.9	106	122	142	158			
1 Hr	40.7	52.1	65.8	73.8	84.6	98.9	110			
2 Hrs	26.3	33.8	43.3	48.9	56.5	66.5	74.2			
3 Hrs	19.9	25.7	33.4	37.9	44	52.2	58.5			
6 Hrs	12.2	16	21.2	24.4	28.7	34.4	38.9			
12 Hrs	7.69	10.1	13.7	16	19	23	26.3			
24 Hrs	5.05	6.69	9.22	10.8	12.9	15.8	18.1			
48 Hrs	3.35	4.45	6.21	7.34	8.81	10.8	12.5			
72 Hrs	2.5	3.35	4.73	5.63	6.8	8.42	9.72			

CHART 4 – CANNONVALE

Duration	Rainfall Intensity (mm/h) by ARI						
	1	2	5	10	20	50	100
	year	years	years	years	years	years	years
5 Mins	127	164	210	238	275	324	363
6 Mins	120	155	199	225	260	307	344
10 Mins	100	129	166	188	218	257	288
20 Mins	75.6	97.4	125	141	163	192	215
30 Mins	62.9	81.1	104	117	135	159	178
1 Hr	44.5	57.4	73.8	83.8	97	115	129
2 Hrs	30.1	39.2	51.5	59.2	69.2	82.8	93.5
3 Hrs	23.6	31	41.5	48.2	56.9	68.7	78.1
6 Hrs	15.6	20.7	28.8	34	40.7	50.1	57.7
12 Hrs	10.6	14.2	20.1	24.1	29.1	36.3	42
24 Hrs	7.62	10.2	14.3	17.1	20.6	25.5	29.5
48 Hrs	5.61	7.43	10.2	11.9	14.2	17.4	19.9
72 Hrs	4.52	5.96	8.11	9.47	11.2	13.7	15.6

CHART 5 – COLLINSVILLE

Duration	Rainfall Intensity (mm/h) by ARI						
	1	2	5	10	20	50	100
	year	years	years	years	years	years	years
5 Mins	99.4	129	170	196	228	273	307
6 Mins	93.2	121	160	183	214	255	288
10 Mins	77.6	101	132	151	176	210	236
20 Mins	59.2	76.7	99.6	113	132	156	175
30 Mins	49.3	63.7	82.3	93.5	108	128	144
1 Hr	33.8	43.6	56.1	63.6	73.5	86.8	97
2 Hrs	21.4	27.6	35.6	40.4	46.8	55.3	61.9
3 Hrs	15.9	20.6	26.6	30.3	35.2	41.7	46.7
6 Hrs	9.46	12.3	16.1	18.4	21.4	25.5	28.7
12 Hrs	5.86	7.61	10	11.4	13.3	15.9	17.9
24 Hrs	3.91	5.06	6.57	7.48	8.69	10.3	11.6
48 Hrs	2.69	3.46	4.4	4.96	5.71	6.7	7.46
72 Hrs	2.05	2.62	3.31	3.72	4.26	4.98	5.54

CHART 6 – CONWAY BEACH

Duration	Rainfall Intensity (mm/h) by ARI						
	1	2	5	10	20	50	100
	year	years	years	year	years	years	years
5 Mins	132	170	214	240	275	322	358
6 Mins	125	160	202	227	260	305	340
10 Mins	104	134	169	189	218	255	284
20 Mins	79	101	127	142	163	190	212
30 Mins	65.8	84.1	106	118	135	158	176
1 Hr	46.1	59.1	74.8	84.1	96.7	113	126
2 Hrs	30.9	39.9	51.5	58.5	67.8	80.3	90.1
3 Hrs	24.1	31.3	41	47	54.9	65.5	73.9
6 Hrs	15.6	20.6	27.8	32.3	38.3	46.4	52.9
12 Hrs	10.3	13.7	19.1	22.5	27	33.2	38.2
24 Hrs	7.03	9.42	13.4	16	19.3	24	27.9
48 Hrs	4.79	6.47	9.35	11.3	13.8	17.3	20.2
72 Hrs	3.7	5.02	7.37	8.97	11	14	16.4

CHART 7 – DINGO BEACH

Duration	Rainfall Intensity (mm/h) by ARI						
	1	2	5	10	20	50	100
	year	years	years	year	years	years	years
5 Mins	119	155	203	232	270	322	362
6 Mins	113	146	192	219	256	305	343
10 Mins	93.9	122	160	183	213	254	286
20 Mins	71.1	92.3	120	138	160	191	215
30 Mins	59.1	76.8	100	114	133	159	179
1 Hr	41.3	53.7	70.5	80.8	94.3	113	127
2 Hrs	27.3	35.6	47.3	54.5	64	76.9	87
3 Hrs	21	27.5	36.8	42.7	50.3	60.7	68.9
6 Hrs	13.3	17.6	24	28	33.3	40.5	46.3
12 Hrs	8.74	11.6	16.1	19	22.8	28	32.2
24 Hrs	6.07	8.14	11.5	13.7	16.6	20.6	23.8
48 Hrs	4.32	5.84	8.45	10.2	12.4	15.6	18.2
72 Hrs	3.4	4.61	6.77	8.24	10.1	12.8	15

CHART 8 – GUMLU

Duration	Rainfall Intensity (mm/h) by ARI						
	1	2	5	10	20	50	100
	year	years	years	years	years	years	years
5 Mins	113	146	188	213	246	290	325
6 Mins	106	137	177	200	231	273	305
10 Mins	88.9	115	147	167	192	227	253
20 Mins	68.2	87.7	112	126	145	170	189
30 Mins	56.9	73.1	92.	104	120	140	155
1 Hr	39.1	50.3	64	72.1	83	97.3	108
2 Hrs	24.8	32.1	41.	47.7	55.4	65.7	73.7
3 Hrs	18.5	24.1	32	36.9	43.2	51.8	58.5
6 Hrs	11	14.6	20.	23.6	28.1	34.4	39.3
12 Hrs	6.77	9.06	12.	15.3	18.4	22.8	26.3
24 Hrs	4.41	5.91	8.3	10	12.1	15	17.3
48 Hrs	2.93	3.9	5.4	6.48	7.79	9.59	11
72 Hrs	2.18	2.91	4.0	4.84	5.83	7.19	8.27

CHART 9 - HAMILTON ISLAND

Duration		Rainfall Intensity (mm/h) by ARI					
	1 year	2 years	5 years	10 years	20 years	50 years	100 years
5 Mins	125	161	208	236	274	325	365
6 Mins	117	152	196	223	259	307	345
10 Mins	98	127	164	186	216	256	287
20 Mins	74.1	95.7	123	140	162	192	215
30 Mins	61.5	79.5	102	116	134	159	179
1 Hr	43.1	55.8	72	81.8	94.9	113	126
2 Hrs	29	37.6	48.9	55.8	65	77.4	87.1
3 Hrs	22.7	29.5	38.7	44.3	51.7	61.7	69.6
6 Hrs	14.9	19.5	25.7	29.7	34.8	41.8	47.4
12 Hrs	9.85	12.9	17.4	20.2	23.8	28.8	32.8
24 Hrs	6.62	8.75	11.9	14	16.6	20.3	23.2
48 Hrs	4.4	5.86	8.15	9.65	11.6	14.3	16.5
72 Hrs	3.36	4.49	6.33	7.54	9.11	11.3	13.1

CHART 10 - MOUNT COOLON

Duration		Rainfall Intensity (mm/h) by ARI					
	1	2	5	10	20	50	100
	year	years	years	years	years	years	years
5 Mins	102	130	163	182	208	242	268
6 Mins	94.8	121	152	170	194	226	250
10 Mins	79.2	101	125	140	159	185	204
20 Mins	61.2	77.5	94.6	104	118	135	149
30 Mins	51	64.3	77.9	85.5	96.2	110	121
1 Hr	34.4	43.3	52.4	57.3	64.5	73.7	80.6
2 Hrs	21	26.6	32.6	36	40.7	46.8	51.4
3 Hrs	15.3	19.5	24.1	26.8	30.5	35.3	39
6 Hrs	8.67	11.2	14.2	16	18.5	21.7	24.2
12 Hrs	5.02	6.52	8.52	9.74	11.3	13.5	15.2
24 Hrs	3.04	3.97	5.28	6.1	7.16	8.59	9.72
48 Hrs	1.84	2.41	3.26	3.8	4.49	5.43	6.18
72 Hrs	1.3	1.71	2.34	2.75	3.27	3.99	4.57

CHART 11 - PROSERPINE

Duration		Rainfall Intensity (mm/h) by ARI					
	1	2	5	10	20	50	100
	year	years	years	years	years	years	year
5 Mins	129	166	210	237	272	320	356
6 Mins	122	156	199	224	258	303	338
10 Mins	102	131	166	187	215	253	282
20 Mins	77.1	98.9	125	141	161	189	211
30 Mins	64.2	82.3	104	117	134	157	175
1 Hr	44.9	57.7	73.4	82.8	95.4	112	125
2 Hrs	29.8	38.5	49.7	56.5	65.6	77.7	87.2
3 Hrs	23	29.9	39.1	44.8	52.2	62.2	70.1
6 Hrs	14.8	19.4	25.9	30	35.3	42.6	48.4
12 Hrs	9.65	12.8	17.5	20.5	24.5	29.9	34.2
24 Hrs	6.56	8.76	12.3	14.6	17.6	21.9	25.3
48 Hrs	4.49	6.05	8.76	10.6	12.9	16.2	18.9
72 Hrs	3.45	4.69	6.93	8.46	10.4	13.2	15.5

CHART 12 – PROSERPINE AIRPORT

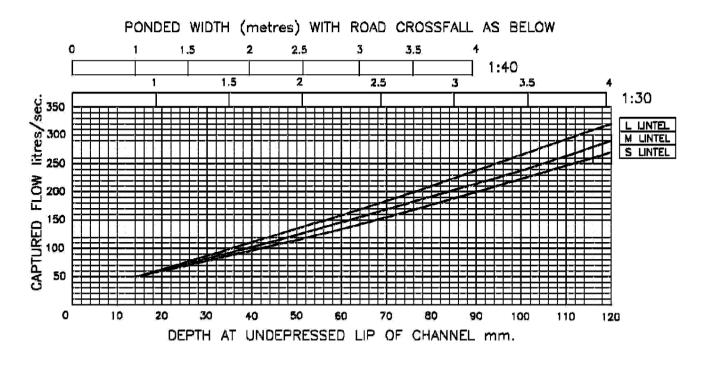
Duration		Rainfall Intensity (mm/h) by ARI					
	1	2	5	10	20	50	100
	year	years	years	years	years	years	years
5 Mins	130	166	210	236	271	317	352
6 Mins	122	156	198	222	255	300	334
10 Mins	102	131	165	186	213	250	278
20 Mins	77.7	99.4	125	140	160	187	208
30 Mins	64.7	82.7	104	116	133	156	173
1 Hr	44.8	57.5	72.8	81.9	94.2	110	123
2 Hrs	29.2	37.8	48.8	55.5	64.4	76.3	85.6
3 Hrs	22.3	29	38.1	43.6	51	61	68.8
6 Hrs	13.9	18.3	24.8	28.9	34.2	41.6	47.4
12 Hrs	8.82	11.8	16.4	19.4	23.4	28.8	33.2
24 Hrs	5.83	7.84	11.2	13.5	16.4	20.5	23.9
48 Hrs	3.87	5.25	7.72	9.41	11.6	14.7	17.2
72 Hrs	2.91	3.99	5.97	7.37	9.13	11.7	13.8

CHART 13 – SHUTE HARBOUR

Duration		Rainfall Intensity (mm/h) by ARI					
	1	2	5	10	20	50	100
	year	years	years	years	years	years	years
5 Mins	127	163	210	237	275	324	363
6 Mins	120	154	198	224	260	307	343
10 Mins	99.8	129	165	187	217	256	287
20 Mins	75.2	97	124	141	163	192	215
30 Mins	62.6	80.7	103	117	135	159	178
1 Hr	44.1	56.9	73.2	83.1	96.1	114	127
2 Hrs	29.8	38.7	50.6	57.8	67.3	80.2	90.3
3 Hrs	23.4	30.6	40.4	46.5	54.5	65.3	73.9
6 Hrs	15.5	20.4	27.5	32.1	38	46.1	52.5
12 Hrs	10.4	13.8	19	22.3	26.6	32.5	37.2
24 Hrs	7.32	9.69	13.3	15.6	18.6	22.7	26
48 Hrs	5.19	6.84	9.26	10.8	12.8	15.5	17.7
72 Hrs	4.1	5.4	7.29	8.48	10	12.2	13.9

APPENDIX B

KERB INLET CAPACITY CHART



CAPTURE
WITH KERB OVERTOPPED 90mm.

LINTEL	CAPACITY
S	330 I/sec
1M.	350 І/зес
L	480 I/sec

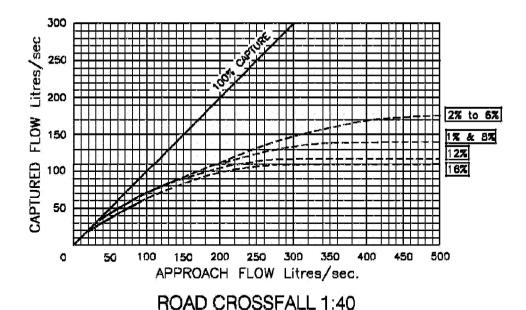
SAG GULLY CAPTURE

NOTES

- This capture chart should only be used in conjunction with the requirements of Design Guidelines D4 Stormwater Drainage.
- 2. Refer to Standard Drawings D-0061 D-0063 for Kerb

Schedule 6 –June 2017 (V3.5)

KERB INLET
CAPACITY DESIGN CHART
SAG INLET
NO BLOCKAGE FACTOR



FLOW CAPTURED 100 50 100 200 250 300 350 O 150 APPROACH FLOW Litres/sec.

ROAD CROSSFALL 1:30

LEGEND

_ %

Kerb & channel longitudinal slope

NOTES

- 1. This capture chart should only be used in conjunction with the requirements of Design Guidelines D4 Stormwater Drainage.
- 2. Refer to Standard Drawings D-0061Seh 200635 forel 2015 (V3.5)

KERB INLET CAPACITY DESIGN CHART ON GRADE - TYPE 'S' 10% BLOCKAGE FACTOR

2% to 6%

1% & 8%

12% 16%

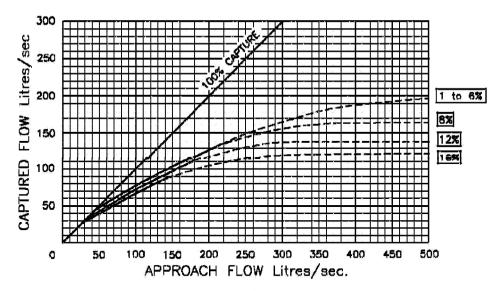
500

300

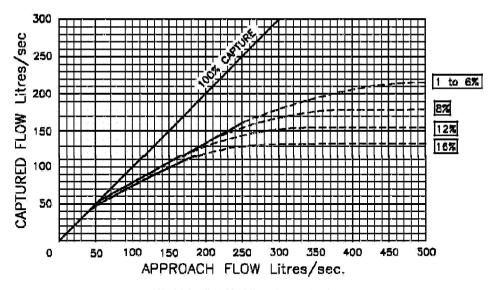
250

150

Litres/s 200



ROAD CROSSFALL 1:40



ROAD CROSSFALL 1:30

LEGEND

_ %

Kerb & channel longitudinal slope

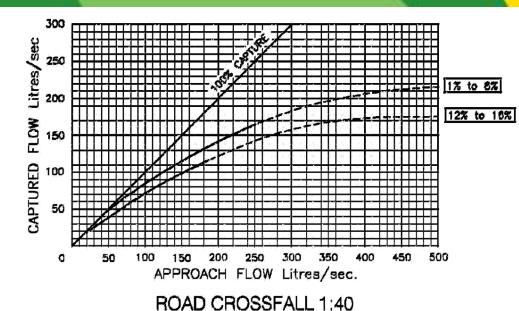
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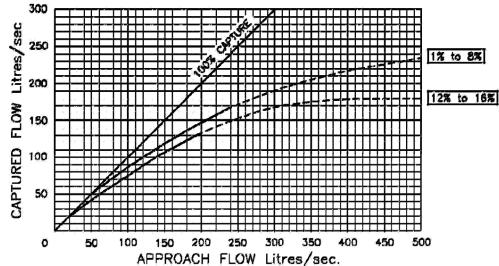
 This capture chart should only be used in conjunction with the requirements of Design Guidelines D4 Stormwater Drainage.

11.

2. Refer to Standard Drawings D-0061 – D-0063 for Kerb
Inlet Pit details. Schedule 6 – June 2017 (V3.5)

KERB INLET
CAPACITY DESIGN CHART
ON GRADE - TYPE 'M'
10% BLOCKAGE FACTOR





ROAD CROSSFALL 1:30

LEGEND

_ %

Kerb & channel longitudinal slope

NOTES

- This capture chart should only be used in conjunction with the requirements of Design Guidelines D4 Stormwater Drainage.
- 2. Refer to Standard Drawings D-0061 D-0063 for Kerb Inlet

KERB INLET CAPACITY DESIGN CHART ON GRADE - TYPE 'L' 10% BLOCKAGE FACTOR

D5 – WATER RETICULATION

GENERAL

D5.01 SCOPE

- 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.
- 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.
- 3. The planning, design, construction and certification of water reticulation infrastructure is to be carried out in accordance with the following provisions:
 - 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;
 - The criteria contained within the Water Services Association of Australia WSA 03 2011 Water Supply Code of Australia;
 - 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
 - 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.
- 4. Aspects of modification or clarification of the Water Supply Code of Australia WSA 03 2011 are detailed in Appendix A of this document.
- 5. 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*.

D5.02 GENERAL

- 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.
- 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.

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.

D5.03 OBJECTIVE

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.

D5.04 REFERENCE DOCUMENTS

Note: Where Acts or reference documents are updated, reference should be made to the current version excluding Water Services Association Australia (WSAA).

Australian Standards

- AS/NZS 2566 Buried Flexible Pipelines
- AS 2368 Test Pumping of Water Wells
- AS 3952 Water Supply Spring Hydrant Valve for Waterworks Purposes

Council Approved Product Register

National Health and Medical Research Council

Australian Drinking Water Guidelines

QLD Government Legislation

- Water Act
- Water Supply (Safety and Reliability) Act

Water Services Association of Australia

- WSA 03 2011 Water Supply Code of Australia
- WSA 01 –2004- Polyethylene Pipeline Code

Information and Guidance Note -

 WSA-TN4 Guidelines for design of pressure pipeline systems for water supply using PVC-M and PVC-O pipes

Department of Energy and Water Supply

- Planning Guidelines for Water Supply and Sewerage National Uniform Drillers Licensing Committee 2012
- Minimum Construction Requirements for Water Bores in Australia

RETICULATION

D5.05 GENERAL

- 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.
- 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.
- 3. Council approval of water reticulation does not relieve the Consulting Engineer of responsibility for the design.
- 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, 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. 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 D6.07 below.
- 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.
- 7. The network analysis shall be based on the design drawings and be spatially accurate.

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.

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 C Whitsunday Regional council standard conditions for water supply above RL50.

D5.06 EXISTING MAINS

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

D5.07 DESIGN CRITERIA

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:

Average Daily Consumption (AD) 500 litre/person/day

Mean Day max Month (MDMM) 1.50 x AD Peak Day (PD) 2.25 x AD Peak Hour (PH) 1/12 x PD

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	
Lot > 1500m ²	3.7
Lot 1101m ²	3.4
Lot 901m² to 1100m²	3.1
Lot 401m² to 900m²	2.8
Lot < 400m ²	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 90m² GFA	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 (401m² to 900m²).
- 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.

2. Pressure Parameters

• Minimum Service Pressure (excluding fire-fighting)

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

Maximum Pressure	80 metres head, see Note
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

Note:

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.

3. Fire Fighting Parameters

Category	Fire flow Requirement	Number & Duration
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

Residual pressure 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.

Background Demand

The following minimum criteria should be adopted for background demand during a fire event:

- Predominantly Residential Areas:
 - The minimum residual pressure specified should be exceeded with a background demand of 2/3 Peak Hour demand;
 - A check should be undertaken at Peak Hour demand to ensure that pressures in the network remain positive; and
 - The calculated background demand should not be less than Average Day demand.
- Predominantly Commercial / Industrial Areas In this case, the following scenarios should be investigated with the worst case being adopted:

- 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
- 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.
- 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.

4. Storage Parameters

Component	Sizing
Reservoirs (ground level)	3 (PD-MDMM) + (greater of Emergency Storage/Firefighting Storage)
Elevated reservoir	6 (PH – MDMM) 12 + firefighting reserve

5. Pump Parameters

Treated water pumps feeding a ground level reservoir			
Treated water pumps feeding an elevated reservoir	Capacity (L/s) = 6PH – reservoir operating volume 6 x 3600		
	Volume in litres		
Standby pumps	Standby pump capacity to match the largest single unit pulcapacity		
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.	

6. Pipeline Parameters

Pipe capacity – Trunk & Reticulation Mains	Size for PH + Fire Flow
Friction Equation	Hazen-Williams
Maximum Velocity	2.5m/s Velocities up to 4.0m/s may be acceptable during fire flows
Minimum Velocity	N/A

7. 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:

Pipe Diameter (D)	C Value
D ≤ 150mm	100
150mm < D ≤ 300mm	110
300mm < D ≤ 600mm	120
D > 600mm	125

The above values take into account losses for pipe fittings such as bends, valves, tees, crosses etc and the effect of pipeline ageing.

8. Road Crossing

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

D5.08 DEDICATION OF LAND, EASEMENTS & PERMITS TO ENTER

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
- Pumping Stations not sited beside a road reserve are to be provided with a 5-metre wide access transferred to Council as freehold.

2. Pipelines

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

D5.09 RURAL AND RURAL RESIDENTIAL DEVELOPMENTS

- 1. Where a development is approved subject to the provision of domestic water supply from an underground source to service individual lots, water bores shall be installed in accordance with *Minimum Construction Requirements for Water Bores in Australia* and to the satisfaction of Council.
- 2. Bores must produce a minimum sustainable yield of one litre per second as determined by a 4 hour pump test in accordance with *AS 2368* and pump test analysis, including observations of potential interference between bores, by a person qualified in groundwater hydrology.
- 3. Water samples must be collected from the bores in accordance with *AS 2368* and analysed by a NATA registered laboratory or other laboratory as approved by Council. Water must be chemically suitable for human consumption in accordance with the "Australian Drinking Water Guidelines" issued by National Health and Medical Research Council.
- 4. The placement of the bore must be determined by an appropriately qualified person and shall be positioned in conjunction with the placement of any on-site wastewater disposal system to be used on the allotment.
- 5. Boreholes shall be cased and sealed at its surface to prevent the inflow of contaminated surface water.
- 6. Maximum bores casements size shall be 125mm indiameter.
- 7. Bores shall be sunk to a minimum depth of 60 metres, or until the bore reaches bedrock.
- 8. The development must have adequate water and access to that water for fire-fighting services acceptable to the rural fire services and/or Queensland Fire and Rescue Service.
- 9. In low density residential areas, where re-subdivision of lots is proposed (reconfiguration for densification), rider mains are also required by the developer/applicant in accordance with Appendix A4.6. In this case, the rider main must be placed across the full length of frontage to provide connection points for densification on both sides (each side) of the developer/applicant's lot(s). Should a rider main exist on one or both sides of the lot(s), the applicant/developer is required to connect to that rider main as well as providing full frontage coverage himself.

D5.10 RETICULATION NETWORK

1. All water mains shall be laid on a standard alignment and unless directed otherwise alignments shall be as follows:

Urban 2.5m

Rural 2.5m

2. Bending of pipes is not permitted notwithstanding any clause to the contrary in the WSA Code.

D5.11 COVER

1. Unless noted otherwise on the approved Project Drawings the minimum depth of cover to be provided for mains shall be as follows:

Verge, Parks etc. 600mm
Under Kerbed Roads 800mm
Under Un-Kerbed Roads 900mm

The maximum depth of cover to be provided for mains shall be 1500mm

D5.12 HYDRANTS

- 1. Hydrants shall be installed for fire-fighting purposes on all potable water mains unless approved otherwise by Council.
- 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.
- 3. Hydrants shall be located at ends of lines in cul-de-sacs opposite the nearest allotment boundary.
- 4. Hydrants shall be located near access legs of battle-axe or hatchet shaped allotments.
- 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.
- 6. In undulating areas, hydrants should also be positioned at all high and low points of the main.
- 7. Hydrants shall be constructed in accordance with Standard Drawings W-0060, W-0061 and W-0063.

D5.13 VALVES

- 1. Valves shall be located opposite the first truncation point at a three-way intersection; or opposite the nearest allotment boundary.
- 2. All valves shall be located within the verge. Valves shall only be located within the road carriageway where specifically approved by Council.

- 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 maximum number of houses inconvenienced should be no greater than 20.
- 4. Cul-de-sacs shall have an isolation valve if more than 4 lots are served.
- 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.
- 6. The maximum spacing between isolation valves shall be 300m.
- 7. In higher density areas the spacing of isolation valves may be reduced to the requirement of the Council.
- 8. Valves shall be constructed in accordance with Standard Drawings W-0060 W-0063.

D5.14 IRRIGATION

- All irrigation systems connected to Council's water supply shall be installed to satisfaction of Council. The installation of water meters, backflow prevention device and isolation valves are mandatory in all irrigation system. Refer Design Manual D9 Landscaping for design of irrigation systems.
- 2. A hydraulic design certificate is required for the irrigation system and to ascertain the required service size.
- 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

D5.15 GENERAL

- 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.
- 2 Council acceptance of pump station design does not relieve the Consulting Engineer of responsibility for the correctness of the design.

D5.16 PUMP STATIONS

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.

- 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.
- 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.
- 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. 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.
- 6. Internal and external pump station surfaces are to be painted as directed.

D5.17 TELEMETRY SYSTEMS

- 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.
- 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

D5.18 ALTERNATIVE WATER PUMPING SYSTEMS

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. 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.

- 1. In general, Council will only permit the use of such booster pump stations where all of the following conditions apply:
 - Where Council considers it impractical to build a storage reservoir for topographical, geotechnical, or aesthetic reasons;
 - Where a reservoir would service only that particular development:
 - Where the number of lots to be serviced by the booster pump station is less the 25;
 and
 - Where the booster pump station building can be blended with the architectural style of residences within the development.
- 2. 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:

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

D5.19 DUAL WATER SUPPLY SYSTEMS

- 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.
- 2. **Appendix B** 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*.

D5.20 PRIVATE BOOSTERS

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

D5.21 CONDUITS

- 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.
- 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.
- 3. Conduits under roadways shall be a minimum 100mm dia. uPVC Class 9 sealed each end with push-on caps.
- 4. Cover to conduits under roads shall be 600mm minimum or 100mm below subgrade, whichever is the greater.
- 5. The position of all conduits under roadways shall be clearly marked by the casting a non-ferrous cuphead bolt into of the top of the kerb.
- 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.
- 7. Conduits under footpaths shall be a minimum 80mm 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.

APPENDIX A

ADDENDUM TO WATER SUPPLY CODE OF AUSTRALIA

WSA 03-2011

APPENDIX A - Addendum to Water Supply Code of Australia WSA 03-2011

SYSTEM PLANNING PROCESS

2.2.2 Extending/Upgrading an Existing Water Supply Scheme

Where a water supply network simulation model exists Council shall assess the impacts of the proposed development on the existing water supply system. The assessment shall be based on the details of the system extension provided by the Consulting Engineer.

DEMANDS

Refer to Section D6.07 – Design Criteria of this Manual for the water supply demand requirements to be adopted in design.

2.5.3 Operating Pressures

Refer to Section D6.07 – Design Criteria of this Manual for operating pressure parameters to be adopted in design.

PUMPING STATIONS 2.8.3(c) Standby Arrangements:

Council requires standby pump units to be provided. The standby capacity shall be as directed by Council.

The power supply to pumping stations shall have 50% spare capacity for future upgrading and be electrically configured such that the pumping station can operate from an emergency generator supply at times of power failure (thus, a provision of space in the switchboard for a manual ATS change over panel is required).

2.9 SERVICE RESERVOIRS

Refer to Section D6.07 – Design Criteria of this Manual for storage parameters.

1.2.3 CONCEPT PLAN FORMAT

Refer to AP 1.29 – Water Reticulation Concept Plan of this Manual for requirements for a Concept Plan.

3.1.3 Empirical sizing of reticulation mains

Table 3.1 is not to be used for sizing of reticulation mains. Refer to Section D6.07 – Design Criteria of this Manual for population and design flow requirements.

3.1.6.3 Hydraulic Roughness Values

Refer to Section D6.07 – Design Criteria of this Manual for roughness values to be used in design. The Hazen-Williams formula is to be used for head loss calculations.

3.8 Pipeline Components Minimum pressure class

The minimum class for pipe and fittings, including rider mains, shall be PN 16.

PIPELINE MATERIALS

Pipes used for water mains shall comply with the following table.

Nominal Size DN	Type of Pipe	Class of Pipe
63, 90	MDPE	Series 1 PE100 – SDR11 MIN PN 16
100 150, 200, 250, 300	PVC, PVC-M & PVC-O	Series 2 MIN PN16
100, 150, 200, 250, 300	Ductile Iron	PN20

Notes:

- Where ductile iron is used above ground, the minimum class required will be PN35.
- Where required by Council, a lining material may be required to restrict the loss of lining due to calcium leaching.

5.1.1 Design Tolerances

Horizontal alignment shall be referenced to the MGA co-ordinate system.

LOCATION OF WATER MAINS

5.6 SHARED TRENCHING

Shared trenching shall not be specified without prior approval of Council

5.8 RIDER MAINS

1. Rider mains are not permitted

5.9 CONNECTION OF NEW MAINS TO EXISTING MAINS

The connection of new water reticulation to Councils existing system shall only be completed by that the Developers cost and subject to appropriate conditions agreed with Council.

5.10.1 Permanent ends of water mains

1. Dead Ends to water mains should be avoided. However, should Dead Ends be unavoidable, the following facilities shall be constructed to facilitate scouring of the lines:

For mains 100m diameter or greater a hydrant shall be positioned at the end of the line.

For mains of 50mm diameter, a 50mm valve shall be installed to the end of line with a 50mm flushing line extended to the adjacent kerb and channel.

8.7 SWABBING POINTS

Swabbing points shall be provided where specified by Council.

8.8.4 Hydrant types

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.

8.8.8 Hydrant Spacing

- Hydrants should be installed for fire-fighting purposes on all mains unless approved otherwise by Council;
- Generally, hydrants are to be at 80 metres maximum centres for all urban areas and where ever possible, located opposite allotment boundaries, and at every second allotment boundary for Rural, Rural Residential and Low Density Residential allotments. Care should be taken to ensure there is no clash with other services such as light poles;
- Hydrants are to be located at ends of lines in cul-de-sacs opposite the nearest allotment boundary;
- Hydrants are to be located near access legs of battle-axe or hatchet shaped allotments;
- Staged developments resulting in temporary dead ends are to have a hydrant located within close proximity to the end of line to enable maintenance flushing;
- In undulating areas, hydrants should also be positioned at all high and low points of the main:
- Hydrants are to be constructed in accordance with Standard Drawings W-0060, W-0061 and W-0063; and
- Locate Hydrants within 90 m of Property sites. This may require the construction of private fire mains.

9.4 RECORDING OF WORK AS-CONSTRUCTED INFORMATION

As constructed information shall conform to Section CP1 – Operational Works Construction Procedures of the Whitsunday Regional Council Development Manual.

Inspection and Test Plans

For an ITP template for construction of water reticulation works refer to Appendix C of CP1 – Operational Works Construction Procedures of the Whitsunday Regional Council Development Manual.

Traffic Management

Traffic management shall be in accordance with the requirements of the authority responsible for the roads where construction activities are carried out.

15.2.3 Curving of Pipe

Bending of pipes is not permitted.

APPENDIX B

ADDENDUM TO DUAL WATER SUPPLY SYSTEMS

WSA 03-2011

APPENDIX B - Addendum to Dual Water Supply Systems - WSA 03-2002

NWD 2.2 Water Supply Mains - Drinking Water

Buried appurtenances shall be colour coded blue.

NWD 2.3 Water Supply Mains - Non-Drinking Water

Buried appurtenances shall be colour coded lilac.

NWD 3.1 Design – Demands

Fire-fighting demands shall be provided from the drinking water mains.

NWD 3.4 Cross-Connections between Drinking and Non-Drinking Water Supply Systems.

No cross-connections, either permanent or temporary, shall be installed between drinking and non-drinking water supply systems downstream of Councils headwork storages without prior council approval.

NWD 3.4.2 Temporary Cross-Connections

No temporary cross-sections shall be installed downstream of Councils headwork storages without prior council approval.

NWD 3.5 Sizing of Mains

The sizing of external non-drinking water mains shall be undertaken by the Consulting Engineer.

The standard sizes for non-drinking water mains shall be the same as the standard sizes for drinking water mains.

NWD 3.7 Location of Mains

Water mains shall be laid on the standard alignment – refer to Section D6.10 of this manual. Where the non-drinking water mains and drinking water mains are laid in the same footpath, the drinking water main shall be laid nearest to the property boundary. Access to the valve and pipe need to be clear of the footpath.

NWD 3.8 Main Depths

The depths of non-drinking water mains shall comply with the requirements for drinking water mains.

NWD 3.10 Property Services

The size of non-drinking water property services shall be DN20 or DN25 as agreed with Council.

Where non-drinking water and drinking water property services are laid across a road at a common location, the services shall be placed in a common DN100 conduit.

Meters for the non-drinking water shall be placed above ground.

NWD 3.12 Hydrants

Hydrants shall only be installed on the drinking water mains. Flushing points shall be provided on the non-drinking main, at all ends of line and cul-de-sac heads. Flushing points shall consist of an isolation valve and camlock coupling with dust cap.

NDW 3.18 Identification Markers and Marker Posts

Identification markers for the components for the non-drinking water network shall comply with that specified for drinking water components except that:

The hydrant road pavement markers shall be purple.

Where there is no road pavement adjacent to hydrants, posts with reflective indicator plates shall be installed similar to that for the hydrants marker posts on drinking water mains.

All marker posts for the non-drinking water components shall have the letters NDW added to the lettering on the indicator plates and the top of the marker posts painted purple.

NWD 7.1 Tapping of Mains

Tapping of non-drinking water mains shall be carried out to the same requirements as specified for tapping of drinking water mains.

NWD 8.3 Independent testing of Reticulation Main

The test pressure for non-drinking water property services shall be 1.2 MPa.

APPENDIX C

STANDARD CONDITIONS FOR WATER SUPPLY ABOVE RL50

9. The water supply system shall be designed in accordance with Water Resources Commission Guidelines and amendments, Council's Development Manual, Council's Standard Drawings, and to the requirements of the Council's Water Supply and Sewerage Engineer. Similarly, adherence to Acts, Regulations, relevant standards and Council's ByLaws is required.

RESERVOIRS

- 10. The reservoir is to be reinforced concrete cast insitu with a concrete roof, as per Whitsunday Regional Council, Standard Drawings and notes, fully secured and to the full satisfaction of Council's Water and Sewerage Engineer.
- 11. The land on which the reservoir is constructed and sufficient surrounding land, 4 meters minimum, shall be dedicated to Council at no cost to Council.
- 12. A 240v power supply shall be provided to the reservoir site.
- 13. A suitable sealed access and turning area shall be constructed and dedicated to Council at no cost to Council, in accordance with Council's Development Manual.
- 14. The access road to the reservoir is not to be utilised as a common access. Land in which the access road is situated is to be dedicated to Council at no cost to Council.
- 15. The gradient of the access road is not to exceed 20%.
- 16. Storm water layout with details of overflow / scour / underdrainage flow path is to be identified.
- 17. Security fence details are to be provided.

PUMP STATION BUILDING

- 18. The reservoir is to be reinforced concrete cast insitu with a concrete roof, as per Whitsunday Regional Council, Standard Drawings and notes, fully secured and to the full satisfaction of Council's Water and Sewerage Engineer.
- 19. The land on which the pump station is constructed and sufficient surrounding land, 3 meters minimum, shall be dedicated to Council at no cost to Council.
- 20. The finished floor level of the pump station should be self draining and no less than

200mm above the surrounding finished ground level.

- 21. Should be situated at a suitable RL AHD so that the return gravity system does not exceed to maximum head recommended by the Water Resources Commission Guidelines.
- 22. Provision is to be made within the building, opening to external, for a suitable sized room to house the disinfection equipment and storage tank. The room shall be independent of all mechanical and electrical equipment.
- 23. Pump control room is to be fitted with sufficient ventilation to allow air flow within the room.
- 24. A suitable sealed access and hard standing area shall be provides and constructed as per Council's Development Manual.
- 25. Security fence details are to be provided.
- 26. Building to be sized to house the following but not limited to:
- 27. Duty / Stand-by pump arrangement.
- 28. Electromagnetic type flow metering. (ie. Kent or combined Instruments).
- 29. Control cabinet and switching equipment as per council's standard specifications.
- 30. Telemetry connected and commissioned to be fully compatible with Councils existing telemetry control system.
- 31. Low pressure safety cut out switch on the suction side of the pumping system, shall be installed in a manner so that it can be isolated from the main and release the pressure to text the suitability without having to close down the water supply to the pumps.
- 32. Room to house the disinfection equipment.

PUMPS

- 1. For calculating the duty head of the pump please note that the BWL of the Cannonvale reservoir is at RL 72.
- 2. Duty / Stand-by pump arrangement is to be provided. They must be able to run in parallel if required.

- 3. Pumps must be fitted with mechanical seals.
- 4. Reflux valves shall be on the discharge side of the pump.
- 5. Valving is to be provided so each pump can be isolated and removed if necessary should the case arise.
- 6. Vacuum and pressure gauges are to be fitted -
- 7. Pumps and system should be protected against water hammer.
- 8. All pumping equipment is to be new.

POWER TO THE SITE

33. All power used up until the project is placed on maintenance shall be the developers responsibility. At On MTCE the developer shall have the Ergon account transfer to Council.

PIPEWORK

- 34. All appropriately sized pipe work into / out of the pump station and pipe work associated with the pump connections shall be DLCL and fully flanged.
- 35. A dedicated rising main, appropriated sized, of K9 DICL shall link the pump station to the reservoir.
- 36. All gravity mains, appropriately sized, may be uPVC Class 16.
- 37. Water mains are to be installed on the topside of the road, in natural ground, where possible.
- 38. Horizontal separation of the rising main and the gravity main shall be maintained at 300mm.
- 39. Any under-boring of main roads shall utilise 6mm steel for the sleeve as a minimum or as their approval.
- 40. Long section of the main on the suction side of the pumps shall be submitted, to ensure air locks can not affect the performance of the pumps.

DISINFECTION

Disinfection facilities (sodium hypochlorite) to be provided should include but not limited to:

- 41. Adequate sized room to house all equipment to comply with WHS regulations.
- 42. Adequate sized storage tank complete with an approved measuring device
- 43. Pumping equipment with adequate pumping capacity to maintain a chlorine residual in the reticulation system to the satisfaction of Council'.
- 44. Bunding details, pump out pit (300 x 300 x 200mm deep) and the method of sealing all of the concrete works and walls are to be provided
- 45. The retractable injection quell shall be installed external to the building and suitably protected from damage.
- 46. The injection point is to be installed on the discharge side of the pumps.
- 47. Provide an approved safety shower / eye wash basin in a secured area, external to the building.
- 48. Provide a 20mm hose tap in a secured area

CONSULTATION

- 49. It is essential that the applicant's water supply consultant discuss in full the system with Council's Water and Sewerage Engineer prior to and during the design phase.
- 50. An Elpro approved installation contractor is to be used for the telemetry system. (Belmont Electrical.)

D6 - SEWERAGE SYSTEM

GENERAL

D6.01 SCOPE

- 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.
- 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.
- 3. The planning, design, construction and certification of infrastructure is to be carried out in accordance with following provisions:
 - 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:
 - The criteria contain within the Water Services Association of Australia (WSAA) publications identified in D7.04. While vacuum and pressure sewer scheme WSA codes are listed, they are still considered unconventional infrastructure –refer D7.07;
 - 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
 - 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.
- 4. Aspects of modification or clarification of the Water Services Association of Australia codes are detailed in Appendix A of this manual.
- 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. Smart Sewers are considered Unconventional Infrastructure.

7. 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 are detailed in Appendix D of this manual and approved by Council.

D6.02 GENERAL

- 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.
- 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.

D6.03 OBJECTIVE

- 1. The objective of the sewerage system is to transport sewage from domestic, commercial and industrial properties using gravity flow pipes and, where this is uneconomic, by pumping to the treatment plant.
- 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.

D6.04 REFERENCE DOCUMENTS

Note: Where Acts or reference documents are updated, reference should be made to the current version excluding Water Services Association of Australia (WSAA)

Australian Standards

- AS/NZS 1547-2012 On-site domestic wastewater management.
- AS/NZS 3500-2013 Plumbing and drainage set

Council Approved Products Register QLD Government Legislation

- Water Act 2000
- Water Supply (Safety and Reliability) Act 2008
- Plumbing and Drainage Act 2002
- Queensland Plumbing and Wastewater Code

Water Services Association of Australia

- WSA 02-2014 Gravity Sewerage Code of Australia
- WSA 04-2005 Sewerage Pumping Station Code of Australia
- WSA 05-2013 Conduit inspection Reporting Code of Australia
- WSA 06-2008 Vacuum Sewerage Code of Australia
- WSA 07-2007 Pressure Sewerage Code of Australia
- WSA 01-2004 Polyethylene Pipeline Code

Department of Energy and Water Supply

Planning Guidelines for Water Supply and Sewerage

DESIGN CRITERIA

D6.05 GENERAL

- 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.
- 2. Council approval of sewerage reticulation does not relieve the Consulting Engineer of responsibility for the correctness of the design.
- 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.

D6.06 EXISTING SEWERS

- 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.
- 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, Ovality Testing is to be undertaken after the completion of works in accordance with this Manual and supervised by a Council Representative.
- 3. Where finished surface levels around existing manhole covers are altered, the manhole shall be reconstructed to conform with the requirements of this manual.
- 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.

D6.07 UNCONVENTIONAL INFRASTRUCTURE

- 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.
- 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.
- 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.
- 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:
 - Description of proposed infrastructure;
 - Reasons for departing from Conventional systems;
 - Reasons for and cost benefits to Council;
 - Connection points to existing system;

- Schematic layout plan; and
- Maintenance and operational issues.
- 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. All costs associated with the engagement of the independent Consultant shall be at the Developers expense.
- 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.

D6.08 DESIGN CRITERIA

1. Capacity

- Population estimates shall be based on those equivalent demands detailed in Table 6.1; and
- The minimum pipe capacity shall be based on the criteria detailed in Table 6.2.

Table 6.1 Equivalent Demands

Description	Equivalent Persons/Connection
Single Family Dwelling	
Lot > 1500m ²	3.7
Lot 1101m² to 1500m²	3.4
Lot 901m² to 1100m²	3.1
Lot 401m ² to 900m ²	2.8
Lot < 400m ²	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 90m² GFA	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 (401m² to 900m²).
- 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.

Table 6.2 Sewerage Loading

Average Dry Weather Flow (ADWF)	270L /EP / d	Based upon analysis of pump station flows and STP inflow records during dry weather
Peak Wet Weather Flow (PWWF)	5 x ADWF or C ₁ x ADWF whichever is greater	C1 Peaking Factor = 15 x (EP) ^{0.1587} Minimum value C1 to be 5
Peak Dry Weather Flow (PDWF)	C ₂ x ADWF	C2 Peaking Factor = $4.7 \times (EP)^{-0.105}$
Vacuum Sewer Peak Wet Weather Flow (PWWF)	4 x ADWF	Peaking Factor of 4
Smart Sewer Peak Wet Weather Flow (PWWF)	4 x ADWF	Peaking Factor of 4

2. Pipe Velocity

• Pipe velocities shall be based on the details shown in Table 6.3.

Table 6.3 Pipe Velocities

Design Criteria	Recommended Value
Mannings 'n' (PVC)	0.013
Mannings 'n' (Poly)	0.013
Minimum Velocity @ PWWF	0.6 m/s
Minimum Velocity @ PDWF	0.3 m/s
Depth of Flow @ PWWF – Proposed Sewers	Max Flow depth shall not exceed ¾ pipe full

3. Minimum Grades

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

Table 6.4 Minimum Grades for Gravity Sewers

Diameter	Minimum Grade	
100mm – Property Connection Branches	1 in 60	1.66%
150mm – Property Connection Branches	1 in 80	1.25%
150mm – First MH Length, head of sewer	1 in 10 0	1.00%
Second MH Length	1 in 15 0	0.67%
Remaining MH Lengths	1 in	0.67%
(see note below)	15 0	
225mm	1 in 29 0	0.34%
300mm	1 in 42 0	0.24%
375mm	1 in 57 0	0.18%
450mm	1 in 73 0	0.14%
525mm	1 in 90 0	0.11%
600mm	1 in 10 00	0.10%
675mm	1 in 12 00	0.08%
5. > or = 750mm	1 in 15 00	0.07%

- 4. Gravity Sewer Flows in Equivalent Domestic Connections
 - Table 6.5 details the maximum allowable Equivalent Domestic Connections for various gravity sewer pipeline grades and diameters.

Table 6.5 Gravity Sewer Flows in Equivalent Domestic Connections

Grade	150dia	225dia	300dia	375dia
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

5. Sewer Depths

- Sewers shall be not greater than 3m deep unless approved by the Council; and
- Where sewers are greater than 3m deep, the following requirements shall apply:
- Submit calculations demonstrating sufficiency of the strength of the proposed pipe type and trenching condition.

D6.09 SEWER ALIGNMENT

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 Counc Approval	
Private Property (other than Commercial)		
Side Boundary	0.8m inside allotment	
Front and Rear Boundary	1.5m inside allotment	
Commercial Property		
Front Boundary	1.5m inside front of allotment	

 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.

- 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.
- 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.
- 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. 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.
- 7. Stubs must be extended a minimum of 0.5m past the property boundary.

D6.10 MANHOLES

- 1. Manholes shall be placed on gravity sewers at the following locations:
- At changes of pipe diameter;
- At ends of lines where ends are more than 30m from previous manhole;
- At ends of lines where the line depth is greater than 1.5m;
- At end of lines servicing greater than one Property Connection Branches; and
- At council approved connections to trunk sewer.
 - 2. Manhole shall not be constructed across property boundaries. Minimum clearance from the edge of manhole to the property boundary shall be 400mm.
 - 3. The maximum change of angle through a manhole shall be 90° unless specifically approved otherwise by Council.

- 4. Manholes shall be constructed in accordance with the Standard Drawings S-0020 S-0026.
- 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.

D6.11 COVERS AND SURROUNDS

- 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.
- 2. Manhole covers are to be gas tight.
- 3. Manhole covers are to be located such that the position of the access opening is directly over the outlet pipe.
- 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.

D6.12 DEDICATION OF LAND, EASEMENTS, AND PERMITS TO ENTER

1. General Infrastructure

- 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 zoned for sewerage purposes;
- 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
- Dedicated or freehold land requirements shall include provision for the pump station offset as indicated in D7.16 Pump Stations.

2. Pipelines

- 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 as follows:
- All sewage rising (pressure) mains; and
- All gravity sewers.
- 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 following criteria must be met:
- 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.
- Sewers are to be no closer than 1m from an easement boundary except where the sewer is on a preferred alignment; and
- 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;
- Where the property is owned or to be dedicated to Council approval of the relevant section of Council that will manage the property; and
- Proof of the registration of easements in favour of Council as specified above.

D6.13 PROPERTY CONNECTIONS

- 1. Property connections shall be installed in accordance with Standard Drawing S-0030 in all allotments.
- 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.

- 3. Property connections will not be accepted within 0.5m of a lot boundary.
- Property connections into manholes will be permitted at ends of line manholes only. Elsewhere, property connections are required "on line" and not into manholes.
- 5. Property connections into maintenance shafts require Council approval.
- 6. Combined Property Drains are not permitted in any development works.
- 7. For commercial / industrial premises, where the PCB is to be built over, a manhole is to be constructed at the point of connection.
- 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.
- 9. Property connections sizes shall be as follows:
- Residential (single Dwelling) 100mm dia; and
- Others (i.e. Commercial, Industrial, Multi Residential) 150mm dia.
 - 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.
 - 11. All Property connections shall be deep enough to service the entire lot using the following property drain design criteria:
- 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);
- 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
- Consideration will be given to the finished level of the lot after all

D6.14 ON-SITE SEWERAGE FACILITIES - TREATMENT AND DISPOSAL

- 1. Due to the increased loading of on-site sewerage facilities on the environment and legislative considerations, the Consultant shall submit a report containing a detailed assessment of site and soil factors, an elevation of the site constraints and review of all relevant information available. The report shall consider all major constraints and opportunities relating to the management of wastewater in relation to the development. The report shall also include a cumulative impact on the effects to the existing ground water table, creeks and watercourses so that the development achieves environmental objectives of air, land and water resources.
- 2. To accommodate the on-site sewerage facility, required for a dwelling with five or less bedrooms and a range of associated facilities, a minimum area of 2000m2 shall be required. It should be noted that this area is based on an ideal site and the minimum area shall be located above the Q50 Flood Level and shall not contain any land required for access, or drainage and service easements.
- 3. The Consultant should refer to the Queensland Plumbing and Wastewater Code, On-Site Sewerage Code and AS/NZ 1547-2012 and Environmental Protection Act, so that the most appropriate on-site sewerage facility can be chosen for the development and, in particular, be of sufficient capacity to receive, treat and absorb all wastewater outputs from premises on a property, complete the treatment, uptake, and absorption of the final effluent within the boundaries of the property, and avoid likelihood of creating unpleasant odours, or the accumulation of offensive matter. In accordance with AS/NZ 1547-2012, on-site sewerage facilities are to be designed for up to 10 equivalent persons. For loading greater than 10 EP additional facilities will be required.
- 4. The minimum requirements for the wastewater disposal report:
- Site plan showing dams, creeks and water courses;
- Contour plan maximum of 1 metre intervals;
- Areas of each block with proposed Lot No's and property boundaries;
- Proposed use of the land to be developed;
- Soil survey, including permeability of soil by either a percolation test or textural classification of soil;
- Depth of ground water, if any encountered during testing;
- Estimated daily flows and site evaluation in accordance with AS1547-2012;
- A daily allowance of 200 litres/person for all waste units (AS/NZ1547-2012:2,4,2,1)
- Method of disposal, eg. DSTP, split septic system or other;
- Size of estimated disposal area to suit system;
- Calculations to justify disposal site; and
- Assessment of any additional nutrient loadings of the area caused by onsite waste water disposal.

PUMPING STATIONS AND PRESSURE MAINS

D6.15 GENERAL

- 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.
- Council prefers that sewage be conveyed by gravity and a pumping station be used only when all other options have been considered and rejected.
- 3. Council requires documentary evidence that life cycle costs of all options have been analysed before approving a pumping station.
- 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.
- 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. Wet well washers are required in all sewage pumping stations unless otherwise approved by council.

D6.16 PUMP STATIONS

- 1. Pump stations shall be designed as detailed on Standard Drawings S-0050 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.
- 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.

- 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.
- The designer shall be responsible for obtaining all necessary licenses and approvals associated with the provision of pump station emergency overflow.
- 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.
- 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
- 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.
- 8. The sealed access can be either of the following construction:
- 2 coat seal on 100mm sub-base and 100mm base course, subject to the sub grade strength indicated by the CBR;
- 30mm asphalt on minimum 100mm base course; and
- 125mm thick reinforced concrete.
 - 9. Pump stations will be located a minimum 300mm above the ARI 100 year storm event. 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.
 - 11. The Sewerage Pump Station Commissioning Plan shall be completed in accordance with WSA 04- 2005 2.17.
 - 12. Pump Station switchboards are to be painted with a graffiti resistant paint prior to application.

13. 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 ARI 100 year flood event.

D6.17 SEWAGE PUMPING SYSTEMS

- 1. Sewage Pumping Station Design Criteria
- Sewage pumping stations shall be designed in accordance with the minimum specific design criteria shown in Table 7.14 and WSA 04-2005.

Table 7.14 Sewage Pumping Station Design Criteria

Item	Description	Adopted Design Parameter	Comments
1	Pump Motor Drives	Pump Motor Drives shall be as follows: • <15kW - Soft Start • >15 to 22 kW - VFD • >22kW - special design, refer to Council	Where Variable Frequency Drives (VFD) are used, cables are to be shielded. Where VFD's are used, a magnetic flow meter must be provided with the pump station.
2	Number of Pumps	Two (2)	Pump station controls must allow for automatic alternating duty pumps.
3	Fixed Speed Pumps Wet Well Operating Volume (kL)	0.9 x 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.
4	Variable Speed Pumps We Well Operating	0.9 x 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.
5	Volume (kL) Bottom Water Level (duty pump cutout)	 For fixed speed pumps: 100mm above minimum submergence level of pumps. For variable speed pumps: minimum of 100mm above top of motor casing. 	In case of variable speed drives a permanent water level must be maintained above the motor casing to ensure continuous cooling of the motor.
6	Well Diameter	Minimum internal well diameter 2100mm internal well diameter may be increased in increments of 300mm depending upon considerations such as: Clearance around pumps and pipework; Depth of pump station; and Geotechnical conditions.	
7	Top Water Level (TWL) (standby start)	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.	

8	Operating Range	This shall be in accordance with WSA 04,	
	(TWL – BWL)	Clause 5.4. Generally this range should be between 1000mm and 2800mm.	

Item	Description	Adopted Design Parameter	Comments
9	Duty Point	With static head corresponding to top water level and pipe friction factors as follows determine Duty Point 1 and 2: Duty Point 1 – Single Pump operation: C1 x ADWF (L/s) vs. Static Head = Friction Head (m) Duty Point 2 – Duty Pump operating in parallel with Standby Pump: S x ADWF (L/s) vs. Static Head + Friction Head (m).	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 7.2 of this Manual.
10	Pump Selection	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 determined by the Conditions detailed below: • Where pressure sewers are allowed to interconnect with existing sewers (refer Table 7.15), pumps are to be designed to operate against the ultimate pressure in the receiving main unless otherwise approved by Council; • Condition 1 – Normal Operating Condition lower limit system resistance curve: • Static Head corresponding to Top Water Level with pressure (rising) main friction factors as follows: • C = 120 (dia. <300mm); and • C = 140 (dia. >300mm) • Condition 2 – Normal Operating Condition Upper limit system resistance curve: • Static Head corresponding to Bottom Water Level with pressure (rising) main friction factors as follows:	The friction factors used in pump selection depend on Top and Bottom Water Level so as to ensure the fullest possible range of heads are taken into account in the selection of the pumps.

		• C = 100 (dia. <300mm)	
11	Emergency Storage	4 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.
12	Duty Pump Capacity	Refer DERM Guidelines (or subsequent department)	Refer DERM Guidelines (or subsequent department)
13	Standby Pump Capacity	Refer DERM Guidelines (or subsequent department)	Refer DERM Guidelines (or subsequent department)
14	Total Pump Station Capacity	Refer DERM Guidelines (or subsequent department)	Refer DERM Guidelines (or subsequent department)

- 2. Pump Information
- The following information shall be provided when the plans are submitted for approval:
- Preliminary pump selection;
- Rating of the motor;
- · Weight of the motor;
- Duty Point;
- Estimate of KWh/1000 litres pumped; and
- Performance, power and efficiency curve.

D6.18 PRESSURE MAINS

- 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:
- Air release valving should be provided to high points as required;
- Scour valving should be provided to low points as required. Scouring must be to a scour manhole or adjacent gravity sewer system;
- Thrust Block and Trenching Details shall be as per the Standard Drawings W-0040 and W-0041: and
- Line valves, scours and air valves are to be provided as required to reduce scour volume.
 - 2. Consideration needs to be given to the potential for sulphide generation in pressure mains.
 - Sewer rising mains shall be a minimum 125mm DN HDPE PN16 unless approved otherwise by Council. Sewer rising mains shall be 'cream' in colour.
 - 4. Sewer pressure mains shall be 'cream' in colour.
 - 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.
 - Sewer pressure mains shall be designed in accordance with the minimum specific design criteria shown in Table 7.15 and WSA 04-2005.

Table 7.15 Pressure Main Design

Item	Description	Adopted Design Parameter	Comments
1	Flow Equation	Hazen – Williams	
2	Minimum Diameter	100mm – Unless approved otherwise by Council	
3	Friction Factors	Refer Item 10 in Table 7.14	
4	Minimum Velocity (on a daily basis)	0.75m/s	To prevent the deposition of solid material such as grit
5	Preferred Minimum Velocity	1.5m/s	To provide for slime stripping on a regular basis
6	Maximum Velocity	2.5m/s	To prevent damage to pipe lining
7	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: Population growth; Staging; Operational features to provide for maintenance and replacement activities; Minimisation of energy costs; and Detention times (reduction of odours)	
8	Interconnection of Pressure (rising) Mains from different Pump Stations	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, Table 7.14

PRIVATE PUMP STATION AND PRESSURE MAINS

D6.19 GENERAL

- 1. Sewage pumping stations serving more than one "Titled" property shall meet the requirements of this Manual and WSA 04–2005.
- 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.

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.

D6.20 CONNECTION TO EXISTING GRAVITY MAIN

- 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.
- 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.

D6.21 ALTERNATIVE CONNECTION POINTS

- 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.
- A private pressure main is not permitted to inject into another private pressure main.
- If Council approves the alternative connection to be a Council rising main, the conditions outlined in Table 7.15 Item 8 of that table shall apply.

D6.22 PRIVATE PUMP STATION SIZING AND OPERATION

- 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.
- 2. Less than 6 hours of storage may be provided, as long as a standby generator is part of the sewer scheme
- 3. The pumps are to be set up to operate automatically as Duty / Standby and should be of the positive displacement electric type.

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.

D6.23 PRIVATE PRESSURE MAINS

- 1. Medium density polyethylene pressure main class PN12 is approved for use with cream colouring.
- 2. If the pressure main is not readily available in cream colour, the pressure main shall be wrapped in cream coloured tape.

D6.24 SPECIFIC REQUIREMENTS

- 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.
- 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.
- 3. As constructed details and the location of the pressure main shall be submitted to Council.
- 4. Where Council accepts a Maintenance Service Agreement with the owner of a private pump station, the following conditions will apply:
- The pump station control panel should incorporate SCADA equipment for transmission of monitoring data and control of Council's existing master system;
- 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;
- 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;
- Notwithstanding b) and c) above, Council may monitor the operation and performance of the pump station during the defects liability period; and
- The following information shall be provided when the plans are submitted for approval:
- Place of Manufacture of all components;
- Pump Manufacturer, Model, Type, and Impeller diameter (as a cut sheet)
- Rating of the motor;
- · Weight of the pump and motor;

- Duty Points;
- KWh/1000 litres pumped;
- · Performance curves; and
- Guarantee.
 - 5. Upon commissioning, the following information shall be provided to the Council for checking prior to survey plans being endorsed by Council.
- Curves with at least four points plotted of the actual performance established in the field, or similar supervised works certificate;
- Actual KWh/1000 litres pumped;
- · Complete wiring diagrams and details;
- Mechanical details and parts list of pump and motor;
- Maintenance catalogue showing daily, weekly, monthly and annual requirements;
- A complete set of the manufacturers recommended spares delivered to Council; and
- A set of cover lifters delivered to Council.

TELEMETRY SYSTEMS AND MANAGEMENT PLAN

D6.25 TELEMETRY SYSTEMS

- 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.
- 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

D6.26 MANAGEMENT PLAN

- 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:
- Details of proposed regular maintenance of private sewer systems; and
- A bi-annual report of sewerage flows to Council's sewer and details of maintenance activities.

APPENDIX A

ADDENDUM TO GRAVITY SEWERAGE CODE OF AUSTRALIA

WSA 02-2014

APPENDIX A

Addendum to Gravity Sewerage Code of Australia WSA 02-2014

2.4.1 Loading per Serviced Lot

Refer to Section D7.08 - Design Criteria of this Manual.

2.3.2 Estimating future catchment loads

Refer to Section D7.08 - Design Criteria of this Manual.

3.2 DESIGN FLOW ESTIMATION

Refer to Section D7.08 - Design Criteria of this Manual.

3.3 DESIGN FLOW ESTIMATION METHOD

Refer to Section D7.08 – Design Criteria of this Manual.

5.2.8 Easements

Refer to Section D7.12 – Dedication of Land, Easements and Permits to Enter of this

Manual

5.3.7 Horizontal Curves in Sewers

Horizontal curves in sewers are not permitted.

5.5.3 Minimum Air Space

Refer to Section D7.08 – Design Criteria of this Manual.

5.5.4 Minimum pipe sizes for maintenance purposes

Refer to Section D7.13 – Property Connections in this Manual.

5.5.7 Minimum Grades for Self Cleansing

Refer to Section D7.08 – Design Criteria of this Manual.

5.6.5 Minimum Depth of Sewer Connection Point

The sewer shall be deep enough to drain the entire lot except where a private pump station is approved on the lot.

5.6.7 Vertical Curves

Vertical curves are not permitted.

5.6.8 Compound Curves

Compound curves are not permitted.

6.2 LIMITS OF CONNECTION TO SEWERS

Add: connections into manholes will be permitted at end of lines only, elsewhere connections are required in line only.

6.3 METHODS OF PROPERTY CONNECTION

The methods of property connection shall be as per Council's Standard Drawing No S-0030.

6.4 NUMBER OF PROPERTY CONNECTIONS

6.4.2 Multiple Occupancy Lots

An application shall be made at design stage for determination of servicing method.

6.5 LOCATION OF CONNECTION POINTS

6.5.2 Vacant lots

Replace with:

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.

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 connection shall extend 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.

6.7 TYPE 7 SPUR OR Y PROPERTY SEWER CONNECTIONS

Y-property connections are not permitted.

7. MAINTENANCE STRUCTURES

Table 7.1

The use of horizontal and vertical bends is not permitted.

7.3.2 Maintenance Structure Spacing - Reticulation Sewers

The maximum distance between any two consecutive maintenance structures shall be 90m.

7.6.2 Types of Manhole Construction

Approved PE manholes may be used as a standard manhole for a pumping/lift station or as a discharge manhole for a pressure (rising) main. PE manholes are not permitted in the following locations:

- Within roadway central medians, roundabouts or within kerb & channel;
- As the connection structure for future development stages; and / or
- In an area zoned Industrial or Commercial.

7.6.3 Design Parameters for MHs

External drops are not permitted for use with precast or any other manholes unless otherwise approved by Council.

7.6.4 Property Connections in MHs

Property connections must not be connected into maintenance holes except at end of line.

6.6.9 Ladders Step Irons and Landings

Ladders, step irons and landings are not required.

D7 - MAINTENANCE SHAFTS

7.01 General

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

7.02 Design Parameters for MSs and TMSs

The following design parameters apply to maintenance shafts and terminal maintenance shafts in addition to or instead of those detailed in WSA 02-2002:

- Sizing and installation of maintenance shafts to generally comply with the manufacturers recommendations;
- Maintenance shafts shall be graded to the intersection point of the sewer main and maintenance shaft coupling / fitting;
- Maintenance shafts may be used on 100mm, 150mm and 225mm diameter sewer mains and Property connection branches only;
- Maintenance shafts shall be used to a maximum depth of 3.0m;
- Testing of maintenance shafts shall generally be carried out in conjunction with the testing of the sewer main;
- Property connection branch inspection tees shall be 2000mm clear of the centre of the Maintenance Shaft:
- Property connections must not be made into maintenance shafts;
- 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;
- 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;
- Maintenance Shafts are to be located with a maximum spacing of 60 metres to a maintenance hole or shaft;
- The combined flow entering a MS will not exceed 22 L/s;
- The flow to be redirected at an angle greater than 45 degrees will not exceed 12 L/s; and

 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.

Maintenance shafts and terminal maintenance shafts are not permitted in the following locations:

- As the receiving manhole at a pumping / lift station;
- As a discharge manhole for a pressure (rising) main;
- · Within roadway central medians, roundabouts or within kerb and channel;
- As the connection structure for future development stages; and
- In an area zoned Industrial, Commercial, or Multi-unit.

D8 - WATER SEALS, BOUNDARY TRAPS AND WATER - SEALED MH'S AND GAS CHECK MHs

D8.01 WATER SEALS

Water seals are not required.

D8.02 GAS CHECK MH'S

Gas check MH's are not required.

D8.03 VERTICAL AND NEAR VERTICAL SEWERS

Prior approval must be obtained from Council for the use of vertical or near vertical sewers.

D8.04 VORTEX INLETS AND WATER CUSHIONS

Prior approval must be obtained from Council for the use of water inlets and water cushions

D8.05 INVERTED SYPHONS

The use of inverted syphons is not permitted.

D8.06 FLOW MEASURING DEVICES

Flow measuring devices are not required to be installed. Notwithstanding this provision shall be made in the design of the valve chamber to allow the future installation of an electromagnetic flowmeter.

D8.07 WET WEATHER STORAGE

Prior approval must be obtained from Council for using wet weather storage as a means of reducing downstream infrastructure.

APPENDIX B

ADDENDUM TO SEWERAGE PUMPING STATION CODE OF AUSTRALIA

WSA 04-2005

APPENDIX B

Addendum to Sewerage Pumping Station Code of Australia WSA 04-2005

Part 3 - Construction

To the specification 25. Metalwork, add the following:

25.1 Pump Lifting Chains

- Lifting chains shall be fitted to each pump and shall be in accordance with AS 2321;
- Eyebolts shall be in accordance with AS 2317 galvanised;
- Shackles in accordance with AS 2741 galvanised;
- Lifting eyes in accordance with AS 3776 galvanised;
- Lifting chain to be grade L galvanised;
- The lifting chain for pumps less than 1 tonne shall be 10mm link as a uniform standard;
- Lifting chain for pumps weighing greater than 1 tonne shall be sized accordingly;
- Provide a suitable bracket and hook in an out of the way location for hanging the chain; and
- For checking and chain replacement, each pump station shall have an easily visible plaque mounted adjacent to the wet well stating length and weight of chain and the weight of the pump to which it is attached.

25.2 Brackets

- Provide stainless steel brackets for mounting of floats; and
- · Provide stainless steel brackets for fastening the level sensor stilling well.

APPENDIX C

ADDENDUM TO THE VACUUM SEWERAGE CODE OF AUSTRALIA

WSA 06-2008

APPENDIX C

Addendum to the Vacuum Sewerage Code of Australia WSA 06-2008

PART 1 – PLANNING AND DESIGN

To the specification 5.3 Vacuum Sewer Design Flows, amend the following:

5.3.1 General

Remove references to PVC-U and PVC-M – use PE pipe only.

Specification 6.6 VACUUM GENERATORS AND PIPE WORK

Clause 6.6.3 Generator Types, add the following:

In larger stations (>20 l/s), Liquid ring vacuum generators shall not be used. Oil filled vacuum generators are required. For stations < 20 l/s, dry run vacuum generators are preferred.

Add new Clause 6.6.9 Air Handling Pipe Material, as follows:

Any pipe within the Vacuum Station designated for the handling of air or air sewage / water mixture shall be Stainless Steel 316L with wall thickness designed for the application.

Specification 6.10 NOISE

Add the following:

- In addition to noise environmental regulations to be met, the noise level in residential areas, measured as the Adjusted Maximum sound pressure level LA10adj, 10mins shall not be greater than the background noise level plus 3 dB(A) at the boundary of vacuum station lot;
- In Industrial or Commercial areas it shall not be greater than the background noise level plus 8 dB(A). It will likely be necessary to provide sound attenuation construction within the building, sound rated doors and mufflers on pipes leading to the exterior of the building in order to meet requirements.; and

• The developer shall perform noise studies before and after commissioning to demonstrate that requirements have been met.

Specification 6.11 ODOUR CONTROL

Clause 6.11.2 Bio-filters add the following:

- The odour control bed shall be roofed; and
- The odour control bed shall have fitted over it an automatic sprinkler system with moisture control, to ensure that the bed operates at an operator selectable moisture content

Specification 8.3 ALARMS

TABLE 8.1

Add to the list of Alarms required:

 Vacuum Generator HIGH TEMPERATURE. Provide a high temperature sensor for each of the Vacuum Generators which will both alarm and shut down the unit in the event of the temperature rising to a manufacturer recommended maximum set point.

Specification 9.5 PIPEWORK AND FITTNGS FOR VACUUM SEWERS

Remove references to PVC-U and PVC-M – use PE pipe only.

Specification 16 SUPPORTING SYSTEMS

16.1 SERVICES

Add a new Clause:

16.1.5 Tool Kit and Special Tools, as follows:

Provide a tool kit with the station containing a range of tools which will allow the operator to perform the duties required to operate and maintain the system. Provide also any specialized tools required for the same purpose.

16.2 VACUUM STATION FIXTURES

Add a new Clause:

16.2.4 Vacuum Testing Station as follows:

Provide a vacuum testing station on the workbench utilising the station vacuum in order to test valves and vacuum equipment after repair. Pipe and valve the test station appropriately.

PART 3 - CONSTRUCTION

C26.2 SWITCHBOARD INSTALLATION

Clause 25.6.4.4 Cubicle Labels, add the following:

Ensure pump labels match with the labelling of the pumps on the floor.

C28.3 INSTALLATION OF PUMPING AND VACUUM GENERATOR UNITS

Clause 28.3.3 Unit Numbers, add the following:

 Ensure that Unit numbers match with the labelling numbers on the switchboard.

PART 4 – STANDARD DRAWINGS

Chamber series of drawings, VAC 1200, VAC 1201, VAC 1202, VAC 1203, VAC 1204 and VAC 1205:

- Remove references to brickwork risers in the construction of the collection chambers. Brickwork is not permitted; and
- To the vacuum layout series of drawings, VAC 1300 and VAC 1301, add the following: provide an appropriately sized suction line (minimum DN 200), from the Vacuum Vessel to the outside of the building for a sucker truck connection. The suction line shall be valved outside the building to permit the draining of the Vacuum Vessel without the operator of the suction truck having to enter the building.

D9 - UTILITIES

GENERAL

D9.01 SCOPE

- 1. This section sets out the minimum standards for the provision of utility services within new subdivisions and developments.
- 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.

D9.02 OBJECTIVE

- 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:
- Telecommunications;
- Electricity Supply;
- Road Lighting; and
- Gas

D9.03 REFERENCE DOCUMENTS

Note: Where Acts or reference documents are updated, reference should be made to the current version.

AS/NZS 1158-2010 Lighting for Roads and Public Spaces

Ergon Energy Standard Drawings

- Standard Drawing 5162/1 Joint Electricity, Gas and Telecommunications; and
- Standard Drawing 5162/2 Joint Electricity, Gas and Multiple Telecommunications

Civil Aviation Safety Authority Australia – Manual of Standards Part 139 Aerodromes

Ergon Energy Lighting Construction Manual

Ergon Energy Underground Construction Manual

G645:2011 Fibre Ready Pit and Pipe Specification for Real Estate Development Projects / NBN Co Installing Pit and Conduit Infrastructure – Guidelines for Developers

D9.04 SERVICE AUTHORITY'S GENERAL REQUIREMENTS

- 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. Eg Telstra, Ergon and NBN Co.
- 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.
- 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.
- 4. Should any amendment occur in the design, both Authorities are to be notified immediately together with an amended plan.
- 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.
- 6. Underground telecommunication services shall be provided to all new developments.
- 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.
- 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. Layout plans for telecommunication and electrical services including the road lighting design shall be submitted to Council with the design submission.
- 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.

D9.05 TELECOMMUNICATION SERVICES

- 1. Installing of underground telecommunication conduits shall be in accordance with the Service Authority's requirements.
- 2. Consideration shall be given to the location of any roadside cabinets, pillars and pits within the subdivision design.
- 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.
- 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.
- 5. The developer is responsible for the provision of telecommunication conduits across roads, existing roads are to be bored.
- 6. Permanent non-ferrous cable markers are to be installed in the kerb to mark the location of all road crossings.

D9.06 ELECTRICITY SUPPLY

Underground Supply

- Unless otherwise approved by Council, electricity reticulation is to be placed underground.
- 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.
- 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.
- 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.

- 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.
- 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.
- 7. No other services shall pass beneath the Ergon Energy pillars or substations.
- 8. The developer is responsible for the provision of electrical conduits across roads, existing roads are to be bored.
- 9. Permanent non-ferrous cable markers are to be installed in the kerb to mark the location of all road crossings.
- 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 were unusual conditions or lot layouts exist and where approved by Council and the Ergon Energy.
- 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.
- 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.
- 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

- 1. The overhead electrical reticulation shall be designed in accordance with the Ergon Energy requirements.
- 2. Power poles shall be placed on an appropriate alignment as approved by Council and the Ergon Energy.

D9.07 ROAD LIGHTING

1. All road lighting designs shall be prepared by an approved Engineering Consultant i.e.

- a Registered Professional Engineer Queensland and shall be included in the design submission for acceptance by Council.
- 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.
- 3. All light columns, luminaries and lamps are to be specified from the Ergon Energy Lighting Construction Manual and Underground Construction Manual.
- 4. All installation works shall be in accordance with the Ergon Energy Lighting Construction Manual.
- 5. Lighting on declared roads shall be designed and installed to the requirements of the Department of Transport and Main Roads.
- 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.
- 7. The required lighting category for a particular road hierarchy shall be determined from Table D9.1.

Table D9.1 Lighting Categories

Category	Application ¹	Luminaire Type	Lamp Type	Rate²
V3	Sub Arterial Road	Aeroscreen	150 – 400 Watt HPS	2
V5	Major Collector Road	Aeroscreen	150 – 400 Watt HPS	2
P3	Minor Collector Road	Normal	80 Watt MV ⁴	2
P4	Residential Street	Normal ³	50 Watt MV ⁴	2
	Access Street			
	Access Place			
P4	Industrial Collector Street	Normal	80 Watt MV ⁴	2
	Industrial Access Street			
P1 – P3	Pathway and Cycleway	Normal ⁵	80 Watt MV	2
		OR		
		Council Specific	Council Specified	3
Р3	Bus Stop	Aeroscreen	Wattage as required	2
		OR	HPS – Cat V Lighting	
		Normal	MV - Cat P Lighting	

Notes:

- 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
- 2. Rate 2 Lighting owned and maintained by the Ergon Energy. Rate 3 Lighting owned and maintained by Council
- 3. 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.
- 4. 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.
- 5. Where lighting is located next to residences (on a pathway or cycleway) then a Type 4 Aeroscreen luminaire is required.
- 6. 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.
- 7. Council may consider a lesser standard for subdivisions with lots greater than 4000m² and outside the designated urban footprint. e.g. Category P5 or lighting at intersections, cul-de-sac's and other hazardous locations.
- 8. Lighting shall be provided at the following locations in accordance with the development approval conditions and AS/NZS 1158:
- Straight Sections;
- Curves:
- Intersections and Junctions;
- Pedestrian Refuges;

- Cul-de-sacs; and
- Local Area Traffic Management Devices including Roundabouts. (The maintained horizontal illuminance is not to be less than 3.5 lux).

Note

Where a pedestrian crossing has been installed it shall be lit in accordance with AS 1158.4 – 2009, Lighting of Pedestrian Crossings.

- 9. Lighting of entry points to pathways and cycleways shall be achieved by the selected placement of a road light nearby.
- 10. Additional lighting shall be provided at a designated bus stop facility; the design shall include the entry and exit lengths of the bus stop.
- 11. 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.
- 12. 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.
- 13. The placement of lighting columns shall not occur within 1m of any water main that crosses the road.
- 14. 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.
- 15. 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.
- 16. 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.
- 17. Documentation shall be submitted to Council with the design submission demonstrating compliance with the AS/NZS 1158.
- 18. Foundation footing for minor road lighting must be cast in situ, a precast concrete foundation is not permitted without prior approval of council.
- 19. Existing timber street light poles are to be replaced with a steel lighting column when Whitsunday Regional Council Planning Scheme 2017– Schedule 6 –June 2017 (V3.5)

overhead powerlines are augmented underground.

D9.08 PARK LIGHTING

- 1. Lighting requirements in parks will be advised by Council in accordance with the classification of the park.
- 2. A point of supply is required to all parks location will be advised by Council in consultation with Ergon Energy
- 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.

D9.09 GAS

- 1. Gas reticulation within a new subdivision or development may be installed subject to Council's approval.
- 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.
- 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.
- 4. The Developer shall be responsible for obtaining all relevant approvals and licences necessary for installation.

D10 - LANDSCAPING

GENERAL

D10.01 SCOPE

- 1. This section sets out the minimum standards for landscaping within new subdivisions and on-street works for private developments.
- 2. This manual contains procedures for the design of:
- On-street landscaping works, including buffers mounds, traffic islands and roundabouts; and
- Public Open Spaces including, signage, furniture and playgrounds.

D10.02 OBJECTIVE

- 1. The objective of this manual is to define Councils minimum landscaping requirements and to assist the designer in achieving the following:
- · Visually enhancement of the streetscapes;
- Enlargement of the habitat and plant diversity in order to provide a food source for indigenous fauna;
- Enhanced living environments by reducing the impacts of noise, fumes and car headlights;
- · Provision of shade trees; and
- Crime prevention through environmental design (CPTED).

D10.03 REFERENCE DOCUMENTS

Note: Where Acts or reference documents are updated, reference should be made to the current version.

Whitsunday Regional Council

- Planning Scheme
- Local Laws and Policies

Australian Standards

- AS/NZS 1158.3-2005 Pedestrian area (Category P) lighting
- AS 3500 National Plumbing and Drainage, Part 1.2 Water Supply Acceptable Solutions
- AS/NZS 4486 Playgrounds and playground equipment Development, installation, inspection, maintenance and operation

Wet Tropics Management Authority

 Weed Pocket Guide of Agricultural and Environmental weeds for Far North Queensland

ON-STREET LANDSCAPING WORKS

D10.04 GENERAL

- 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 and buffer mounds.
- 2. Council should be consulted prior to commencement of the design to ascertain whether there are any site specific design requirements.
- 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.
- 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.
- 5. CCA treated timber is not to be used for the construction of Council assets.
- 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, eg '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.

D10.05 EXISTING VEGETATION

- 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.
- 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.

D10.06 VERGES

- All verges shall be covered full width with topsoil to a depth of not less than 50mm and shall be lightly compacted and grassed in accordance with Councils minimum standards and Specifications.
- 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.
- 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.
- 4. 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.

D10.07 STREET TREE PLANTING

- 1. The ultimate aim of street tree planting is to provide:
- An attractive streetscape with character and charm. An individual character may be obtained by using a specific tree species for each street;
- Shade, and the reduction of heat and glare from the road pavement. Parked cars may remain cool during the summer months; and
- Habitat provision and enhancement. Native flowering trees provide a source of food and shelter for insects, birds and animals.
- 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.
- 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.
- 4. Tree species shall be selected for their suitability to the site conditions (eg. small trees under power lines, drought resistance, soil suitability) and shall be in accordance with any relevant Council plant selection guidelines and suburban planting themes.
- 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.

- 6. The alignment and placement of street trees measured from the tree at the estimated ultimate size shall be in accordance with the following:
- Greater than 4.0 metres from electricity or telecommunication poles or pillars;
- Greater than 7.5 metres from streetlights to ensure effective street lighting;
- Greater than 4.0 metre radius from high voltage transmission lines;
- Greater than 2.0 metres from stormwater drainage pits;
- 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;
- Trees are to be placed a minimum 1000mm from the back of kerb where achievable;
- Trees are to be placed a minimum of three (3) metres from driveway;
- At intersections trees are to be placed a minimum of ten (10) metres back from the face of the kerb of the adjoining street;
- Trees are to be located so as not to obstruct access to any services or signage; and
- Trees are to be located so as not to obstruct pedestrian or vehicular traffic, nor create traffic hazard or cause damage to existing trees.
- 7. Street trees shall be planted in accordance with Standard Drawings SEQ G-010 SEQ G-012 and installed in accordance with Council Specifications.
- 8. Street trees should not be a plant listed in:
- Land Protection (Pest and Stock Route Management) Regulation;
- · Pest Management Plan; or
- Wet Tropics Management Authority Publication Agricultural and Environmental Weeds.

D10.08 BUFFER ZONES

- 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 herein. Generally, these buffers are ten (10) metres wide along the full frontage of the major road.
- 2. The aim of the Buffer Mound landscaping is to:
- Reduce the visual impact of adjacent development by screening rooflines;
- Reduce the visual impact of proposed noise attenuation barriers, which may be constructed at some time in the future on the mound crest;
- Reduce the visual impact of the mound's severe geometric landform by screening with foliage to ground level;
- Introduce a "natural" vegetated landscape appearance by replacing open agricultural land with a facade of dense planting;
- Reinforce the local character by indigenous tree and shrub species; and
- Provide additional functions, ie. shade over adjacent bikeways.
- 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.

- 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.
- 5. Strong recognisable character is further reinforced by repetition of some suitable species as street and park trees in the adjacent subdivision
- 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.
- 7. Advance ordering and growing on contracts are desirable to ensure availability of desired species in the large quantities required.
- 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.
- 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. No tree planting shall be done higher than 1/3 from the base of mound i.e. no trees on top of the mound.

PUBLIC OPEN SPACE

D10.09 GENERAL

- 1. At the time of development, the developer shall landscape all public open spaces to the satisfaction of Council and in accordance with this manual.
- 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.
- 3. 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.
- 4. CCA treated timber is not to be used for the construction of Council assets.
- 5. 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, eg '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.

D10.10 CRIME PREVENTION THROUGH ENVIRONMENTAL DESIGN

1. It is important when designing parks that the principles of crime prevention through environmental design are considered, in particular:

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;

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;

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

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.

D10.11 TREATMENT TO PARK BOUNDARIES

- 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 log barriers, 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.
- 2. Definition of the park side boundaries should be indicated by installing log barrier fencing or bollards at approximately 20 metre centres, down each side. These should be offset from the surveyed boundary by 100 mm in order to allow future erection of private fencing without having to remove Council's markers. Definition of the park boundary is intended to deter encroachment onto park by adjacent private properties and to define the park limits.
- 3. Log barriers and bollards shall be in accordance with Standard Drawing SEQ G-0042 unless otherwise approved by Council.

D10.12 INTERNAL CIRCULATION

- 1. The park layout should be designed to ensure that internal circulation or movement within the park is:
- Safe;
- Unencumbered;
- Highly visible internally and externally; and
- Linked to external cycle and pedestrian networks.
- 2. Design features including access points, street frontages, carparks, pedestrian/bike paths, park equipment and lighting should be considered.
- 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.

D10.13 PLANTING

- 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:
- Shade trees evenly planted throughout the site to maximise protection from the sun;
- Island or corridor planting to concentrate trees for easy maintenance and encourage bird life for pleasure viewing:
- Grouped planting will also provide shade adjacent to open space to allow unencumbered active play areas; and
- Lines of tree planting to define edges of informal kick-about areas.
- 2. 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.
- 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.
- Some Local Authorities have plant selection guidelines and suburban planting themes and designers are encouraged to consult with Council in the preparation of the landscaping design.
- 5. Street trees should not be a plant listed in:
- Land Protection (Pest and Stock Route Management) Regulation;
- Local governments Pest Management Plan; and
- Publication, Agricultural and Environmental Weeds (Wet Tropics Management Authority).

D10.14 GRASSING

- All parks shall be covered with topsoil to a depth of not less than 50mm and shall be lightly compacted and grassed in accordance with Councils' minimum standards and Specifications.
- 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 evenrunning contours.
- 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.

D10.15 MOUNDING

- Mounding may be used within the park design to provide topographical interest, to emphasise views, to help screen adjacent properties or eyesores, 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. Planting of trees and shrubs over the mound will further emphasise height and shape.
- Care should be given to ensuring that the mound does not restrict visibility into and out of the park thus threatening the safety of users or provide unwanted visibility into private properties.

D10.16 FURNITURE

- Park furniture should reflect the intended function of the park and compliment any distinguishing features present eg. seating situated to maximise a view scape. Some preferred features of furniture include:
- 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 eg.colourbond to provide shelter during rain;
- Well drained ground and hard surfacing below any structure. Surface material could be pavers, coloured or exposed aggregate concrete etc;
- Shade structures should maximise protection from the sun during the hours of 11 am -3 pm; and
- Refuse bins should be located for ease of use and pickup by refuse trucks eg adjacent to playgrounds or picnic areas, at park exits.
- 2. Designs of furniture should reflect a strong aesthetic and vandal resistant appearance.
- 3. Where possible, natural features may be used eg. mounding for seating, trees or natural rock for bollards to simulate park furniture; and
- 4. Some Local Authorities have park furniture themes and master plans designers are encouraged to consult with Council in the preparation of the landscaping design.

D10.17 SIGNAGE AND INTERPRETATION

- A park name sign is to be provided. 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.
- 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.

D10.18 LIGHTING

Lighting requirements within parks will be advised by Council in accordance with the classification of the park.

- 1. As a guide 2 park lights on poles shall be provided for every park of 4,000 square metres. However, this may vary depending upon the shape and alignment of the park, and the presence of existing vegetation. Generally, parks should be well lit providing a safe nocturnal environment for local users. Council will consider the relaxation of one or both lights where existing street lights are adjacent to the park area. Underground power should be provided to each pole. Light fittings should be vandal resistant.
- Pathways within parks that require lighting shall be lit to the lighting category determined from the road Lighting Standards AS/NZS 1158.3 Pedestrian area (Category P) lighting.

D10.19 PROVISION OF WATER

Facilities for drinking, such as drinking tap / bubbler, shall be provided for each park area, and 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.

- 1. In order to irrigate the park 1 water service connection in a cast iron valve box should be provided for each 2,000 square metre of park and should be a minimum 40 mm diameter with hose connection.
- 2. As an alternative, irrigation may be provided, on condition that the proposed system complies with the Council Standard Specification for Irrigation.

D10.20 WATER FEATURES

Water features should not be included in infrastructure to be adopted be Council.

D10.21 PLAYGROUNDS

- 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.
- 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:
- Type of play equipment proposed should be selected in consultation with Council;
- The age range of the users should influence the type of equipment provided; and
- 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.
- 3. To conform to safety requirements impact absorbing surfacing should be installed to the play area, eg sand, continuous rubberised matting, shredded car tyres.
- 4. Shade cover over playgrounds is to be provided, in order to encourage day long use. Preferably this should be a permanent shade structure approved by Council, however shade trees planted at maximum 6 metre centres around the safety area are acceptable.
- 5. The provision of seating overlooking the playground will be required.
- 6. Bench seating should be of the recycled plastic or aluminium type.

D10.22 MAINTENANCE

The design of a park should carefully consider long-term maintenance requirements. Mulched garden beds containing trees and shrubs are easier to mow around than numerous small trees and shrubs planted individually throughout the grassed areas.

- Where single shade trees occur they should be mulched to 200 mm depth in a minimum 1.2 metre diameter circle, thus avoiding damage to trunks by mowers or whipper snippers.
- 2. Access to the parks, drainage reserves and public open spaces for maintenance vehicles should be via a lockable gate or removable bollards.
- 3. 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.

IRRIGATION

D10.23 GENERAL

- All irrigation systems connected to Council's water supply shall be installed to satisfaction of Council. The installation of water meters, backflow prevention device and isolation valves are mandatory in all irrigation system. Refer AS 3500.
- 2. The installation of an irrigation system to all landscaped traffic islands and roundabouts is mandatory.
- 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.
- 4. The design of all watering systems must ensure an efficient and economical application of water. Such systems are to be designed to use low water application, and shall run only during Council's nominated times.
- 5. The irrigation system shall use the following components and shall be installed in accordance with Council Specifications:
 - A backflow prevention unit, installed to the requirements of AS 3500;
 - 20mm, 25mm or 32mm or 40mm diameter blue line poly pipework (as required) to garden bed areas; laid in a ring around the periphery of each garden bed;
 - Pop-up sprinklers to periphery of garden beds. Fixed shrub heads to centre of islands only; and
 - Automatically operated controller in PVC box laid flush with finished ground level.
- 6. All irrigation pipework installed under roadways shall be laid in minimum 100mm dia. uPVC Class 9 conduit.
- 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.

- 8. The installation of an irrigation system on Council property, other than buffer mounds, traffic islands and roundabouts, eg. verges will not be permitted unless:
 - The system is separate from the development and all pipework is located adjacent to the kerb and channel; and
 - Or the verge is irrigated from sprinklers that fall within the development property boundaries.
- 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.
- 10. If a separate irrigation system within the verge is desired, the developer will be required to pay all installation costs, which include:
 - Tapping into main;
 - Installation of 25mm diameter (typical) backflow prevention device;
 - Installation of pipework and pop-up sprinklers; and
 - Installation of solenoid valves and automatic controller.

SPECIFICATIONS

S1 - EARTHWORKS

GENERAL

S1.01 SCOPE

- This specification details all requirements pertaining to earthworks operations associated with construction sites. This specification excludes earthworks associated with roadworks construction.
- 7. 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.

S1.02 REFERENCE DOCUMENTS

Australian Standards

AS 3798 Guideline on Earthworks for Commercial and Residential Developments.

MATERIALS

S1.03 TOPSOIL

8. Topsoil is defined as surface soils normally high in organic matter and contaminated by residual grass seed and grass roots. Topsoil shall be free from large roots, stones, rocks and unsuitable material as defined below.

S1.04 UNSUITABLE MATERIAL

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

S1.05 SUITABLE MATERIAL

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

CONSTRUCTION

S1.06 GENERAL

11. 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.

S1.07 PROTECTION OF EARTHWORKS

- 12. 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.
- 13. The Contractor shall install effective erosion and sedimentation control measures, prior to commencing earthworks, and shall maintain these control measures as required.
- 14. 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.
- 15. 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.
- 16. 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.

S1.08 CLEARING AND GRUBBING

- 17. Clearing and grubbing operations shall be in accordance with AS 3798 Section 6.1.4.
- 18. The extent of clearing and grubbing shall be taken to mean the removal and disposal of:
 - Trees, Shrubs and overhanging branches, both living and dead;
 - Tree stumps and roots to a depth not less than 300mm below ground surface;
 - Rocks, rubbish and other artificial obstructions from the ground surface;
 - Abandoned services to a depth not less than 300mm below ground surface;
 - Old foundations, buildings and structures;
 - Minor made structures (such as fences);
 - Other materials, which are unsuitable for use in the works.
- 19. 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.
- 20. 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.
- 21. 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.
- 22. 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.

S1.09 TOPSOIL OPERATIONS

1. Stripping of topsoil shall be in accordance with AS 3798 Section 6.1.5.

- 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.
- 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.
- 4. Topsoil material stripped from the site shall be stockpiled for later use in spreading on footpaths, allotments and parkland areas.
- 5. Topsoil stockpiles shall not contain any timber or other rubbish and shall be trimmed to a regular shape.
- 6. To minimise erosion, stockpiles are to be protected by effective usage of erosion and sediment control devises, which are to be defined within the Erosion and Sediment Control Management Plan.
- 7. Where seeding of stockpiles to encourage vegetation cover is specified, such work shall be carried out in accordance with the Specification S8 LANDSCAPING.
- 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.

S1.10 GENERAL EARTHWORKS

- 1. Placement and Compaction of earthworks shall be in accordance with AS 3798 Sections 5 and 6.
- The methods of testing and frequency of testing shall be in accordance with AS 3798 Sections 7 and 8.
- 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.
- 4. All testing is to be carried out by a NATA registered laboratory with appropriate accreditation and suitably qualified personnel

S1.11 EXCAVATIONS

- 1. Materials encountered in excavation shall be loosened and broken down as required so that they are acceptable for incorporation in the works.
- 2. All excavations shall be constructed to the shape and slopes shown on the approved Project Documents.
- 3. Batter shall be trimmed neatly to the shapes specified and shall be free of loose or unstable material.
- 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).
- 5. Vertical tolerances for all excavation shall be ± 50mm.6. When completed all culvert excavations, benches, berms and drains shall be free draining.
- 7. 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.

S1.12 EMBANKMENTS / FILL AREAS

- 23. All embankments and fill areas shall be constructed to the shape and slopes shown on the approved Project Documents.
 - 1. When completed, the average planes of the batters of embankments shall conform to those shown on the approved Project Documents.
 - 2. 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).
 - Vertical tolerances for all embankments / fill areas, shall be ± 50mm except where such fill defines the subgrade level for a structure, then the vertical tolerances are to be +15mm – 30mm.
 - 4. When completed all embankments / fill areas shall be free draining.
 - 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.
 - 6. 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

S1.13 TRENCHING OPERATIONS

- 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.
- 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.
- 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.
- 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.
- 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 so as to minimise the extent of site open to the effects of the environment.

S2 - ROAD PAVEMENTS

GENERAL

S2.01 SCOPE

- 1. This specification details all requirements pertaining to the construction of flexible road pavements, including kerbing, subsoil drainage and trimming of verges.
- 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.

S2.02 REFERENCE DOCUMENTS

Australian Standards

- AS1289 Methods of Testing Soils for Engineering Purposes
- AS2439.1 Perforated Drainage Pipe and Associated Fittings
- AS3706.7 Determination of Pore-sized Distribution Dry Sieving Methods

All Australian Standards referenced in this specification shall be the current edition.

Department of Main Roads Standard Specifications

- MRS 11.03 Drainage, Retaining Structures and Protective Treatments
- MRS 11.04 General Earthwork
- MRS 11.05 Unbound Pavements
- MRS 11.11 Sprayed Bitumen Surfacing (Excluding Emulsions)
- MRS 11.14 Road Furniture
- MRS 11.17 Bitumen
- MRS 11.19 Bitumen Cutter and Flux Oils
- MRS 11.20 Cutback Bitumen
- MRS 11.22 Supply of Cover Aggregate
- MRS 11.30 Dense Graded Asphalt Pavements
- MRS 11.45 Pavement Marking

Department of Main Roads Publications

• Manual of Uniform Traffic Control Devices

Australian Asphalt Pavement Association (QLD Branch)

• Asphalt Specification for Subdivision Pavements – Edition 1 November 1993

MATERIALS

S2.03 PAVEMENT MATERIAL

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

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

- 2. All references to material type in the above table refer to the Main Roads Standard Specification MRS11.05 "Unbound Pavements".
- 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.

S2.04 ASPHALTIC CONCRETE SURFACING

- 1. 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 the "Asphalt Specification for Subdivision Pavements" Edition 1 November 1993, published by the Australian Asphalt Pavement Association (Queensland Branch).
- 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".

S2.05 SPRAYED BITUMEN SURFACING

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.

 Main Roads Specification MRS 11.11 "Sprayed Bitumen Surfacing (Excluding Emulsions)"

- Main Roads Specification MRS 11.17 "Bitumen"
- Main Roads Specification MRS 11.19 "Bitumen Cutter and Flux Oils"
- Main Roads Specification MRS 11.20 "Cutback Bitumen"
- Main Roads Specification MRS 11.22 "Supply of Cover Aggregate"

S2.06 CONCRETE INTERLOCKING PAVERS

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

S2.07 ROAD FURNITURE

- 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. All signs to be Class 1 reflectivity
- 3. Signs located in concrete islands or medians shall be supplied with the "V Loc" socket system and fitted with anti-theft bolts.

S2.08 PAVEMENT MARKING

 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

S2.09 INSPECTION, SAMPLING AND TESTING

- 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. All testing shall be carried out by a NATA registered laboratory with appropriate accreditation and suitably qualified personnel.

S2.10 SETOUT

1. The construction setout 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.

S2.11 CLEARING AND GRUBBING

 All clearing and grubbing works shall be in accordance with the Specification for S1 EARTHWORKS.

S2.12 TOPSOIL OPERATIONS

1. All topsoil operations associated with roadworks construction (topsoil stripping, stockpiling and re-spreading), shall be in accordance with the Specification for S1 EARTHWORKS.

S2.13 EARTHWORKS

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

S2.14 TRIM AND COMPACT SUBGRADE

- 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. The subgrade material shall be compacted to provide a relative compaction determined by AS1289 for a standard compactive effort as follows:
 - Minimum Dry Density Ratio (Cohesive soils) 98%
 - Minimum Density Index (Cohesion less soils) 80%
- 3. Testing frequency not less than one (1) test per 1000m² with a minimum number of three (3) tests per sample area being tested.
- 4. At least one (1) sample area shall be tested for type of subgrade material evident on site.
- 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.
- 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.
- 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.
- 8. The tolerances appropriate to the construction of subgrade and to subgrade replacement material shall comply with the following:
 - Design Level Tolerance +15mm, 30mm
 - Shape Tolerance of 25mm maximum deviation from a 3m straight edge laid in any direction.
- 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.

S2.15 PAVEMENT COURSES

- 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. 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.
- 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.
- 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.
- 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].
- 6. The pavement course material shall be compacted to provide a relative compaction determined by AS1289 for a standard compactive effort as follows:
 - Base Course 100%
 - Sub-base Courses 100%
- 7. Testing frequency not less than one test per 500m² with a minimum of four (4) tests per sample area being tested for sand replacement method and two tests per 500 m² with a minimum" of eight (8) tests per sample for nuclear test.
- 8. The tolerances for the construction of the pavement courses shall comply with Table

S2.2. Table S2.2 Construction Tolerances

Course	Design Level	Layer Thickness	Shape
	Tolerance	Tolerance	Tolerance
Sub-base	+ 20mm	+ 40mm	25mm in 3m
	- 20mm	- 20mm	Maximum
Base	+ 10mm	+ 15mm	15mm in 3m
	- 10mm	- 15mm	Maximum
Overall	+20mm -10mm	+20mm -10mm	

S2.16 FINAL TRIM

- Following placement and compaction of the base course material, the whole of the surface
 of the base course shall be final graded and trimmed to the specified tolerances so as to
 leave a hard, dense, tightly packed surface free of lenses, compaction planes and caking.
- 2. Sprayed bituminous or asphaltic concrete surfacing works shall not be commenced until the profile, surface, compaction, quality and finish of the base course has been inspected and confirmed satisfactory. [Hold Point].

S2.17 ASPHALTIC CONCRETE SURFACING

- 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 the "Asphalt Specification for Subdivision Pavements" Edition 1 November 1993, published by the Australian Asphalt Pavement Association (Queensland Branch).
- 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".
- 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.
- 4. The tolerances appropriate to Asphaltic Concrete surfacing shall comply with the following:
 - Design Level Tolerance +10mm, 10mm
 - Layer Thickness Tolerance +15mm, 0mm
 - Shape Tolerance 7mm in 3m Maximum (Any direction).

S2.18 SPRAYED BITUMEN SURFACING

- 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.
 - Main Roads Specification MRS 11.11 "Sprayed Bitumen Surfacing (Excluding Emulsions)"
 - Main Roads Specification MRS 11.17 "Bitumen"
 - Main Roads Specification MRS 11.19 "Bitumen Cutter and Flux Oils"
 - Main Roads Specification MRS 11.20 " Cutback Bitumen"
 - Main Roads Specification MRS 11.22 "Supply of Cover Aggregate"

S2.19 CONCRETE SEGMENTAL PAVERS

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

S2.20 KERBING AND CHANNELLING

- 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 Standard Drawing R-0080.
- 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.
- The finished kerbing shall be well compacted and shall have exposed surfaces free from voids and honeycombing.
- 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.
- 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:

- The difference between the deviations from correct levels at any two points 30m apart shall not exceed 30mm
- The deviation from a straight edge laid parallel to the centreline shall not exceed 10mm in 3m.
- 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.
- 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.

S2.21 SUBSOIL DRAINAGE

- 1. Unless otherwise detailed on the Project Drawings subsoil drainage shall be constructed beneath the kerbing on an alignment as shown on Standard Drawing R-0140.
- 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".
- 3. Subsoil Drainage cleanouts shall be constructed in accordance with the requirements of Standard Drawing R-0140 and shall preferably, be located with the upstream flushing point internally within a stormwater gully pit or manhole.

S2.22 TRIM VERGES AND BATTERS

- 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. Cut batters shall be lightly tined to a depth of 25 50mm prior to respreading of topsoil material

S2.23 ROAD FURNITURE AND PAVEMENT MARKING

- 24. The construction of all Road Signs and associated Road Furniture shall comply with the requirements of the following: Main Roads Standard Specification MRS 11.14 "Road Furniture"
 - Main Roads "Manual of Uniform Traffic Control Devices"
 - Standard Drawing R-0130 for Street Name Signs.
 - Standard Drawing S1041 for Traffic Control Devices.
- 25. All Pavement Marking shall comply with the requirements of Main Roads Standard Specification MRS 11.45 "Pavement Marking"

S3 - SEGMENTAL PAVING

GENERAL

S3.01 SCOPE

- 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.
- 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.

S3.02 REFERENCE DOCUMENTS

Australian Standards

- AS1012 Method of Testing Concrete
- AS1141.1 Particle Size Distribution of Dry Sieving
- AS/NZS4455 Masonry Units and Segmental Pavers
- AS/NZS4456 Masonry Units and Segmental Pavers Methods of Test General Introduction and list of Methods

Concrete Masonry Association of Australia Specifications

- T44 Concrete Segmental Pavements Guide to Specifying
- T45 Concrete Segmental Pavements Design Guide for Residential Access Ways and Roads
- T46 Concrete Segmental Pavements Detailing Guide

Clay Brick and Paver Institute Specifications

Paver Note 1 – Specifying and Laying Clay Pavers

MATERIALS

S3.03 CONCRETE SEGMENTAL PAVERS

- 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.
- 2. Concrete pavers are identified by shape as being one of the following

types: 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.

Shape Type B

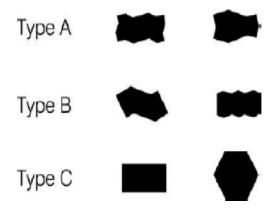
Dentated units which key into each other on two sides, are not (usually) laid in herringbone bond, and by their plan geometry, when keyed together, resist the spread of joints parallel to the longitudinal axes of the units and rely on their dimensional accuracy and accuracy of laying to interlock on the other faces.

Shape Type C

Units which do not key together and which rely on their dimensional accuracy and accuracy of laying to develop interlock.

3. Figure S3.1 shows examples of some of the more common shapes.

Figure S3.1 Paver Shape Types



- 4. Concrete segmental pavers shall comply with the requirements of T44, T45, T46, and AS/NZS 4455 for each area of application.
- 5. The material requirements for concrete pavers for each application, derived from T44, are shown in Table S3.1.
- 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 Requirements for Concrete Segmental Pavers

Application	Characteristic breaking load ₂ (kN)	Characteristic flexural strength ² (MPa)	Minimum Thickness (mm)	Shape ³ (Type)	Dimensional deviations (Category - AS 4455)	Abrasion resistance (mean abrasion
Residential Driveways						
Light Traffic	3	2	No limit	Any	DPA1 or DPB1	7
Medium Traffic ¹	5	3	No limit	Any	DPA1 or DPB1	7
Public Footpaths Low Volume High Volume and	5	3	No limit	Any	DPB2	5
Pedestrian Malls ¹	5	3	No limit	Any	DPB2	3.5
Roads ³ All Roads	5	3	80	A	DPB2	5

Notes:

- Capable of taking occasional 8.2-t axle loads.
- At 28 days.
- 3. Interlocking shapes offer superior performance in road applications.

S3.04 CLAY SEGMENTAL PAVERS

- 1. Clay pavers are manufactured from clay, shale or argillaceous materials, which may be mixed with additives. Clay pavers may have square, bevelled (chamfered), rounded or rumbled edges. They are generally rectangular in shape, with the length twice the width, plus 2mm.
- 2. Clay segmental pavers shall comply with the requirements of Part 1 Specifying Clay Pavers of Paver Note 1 'Specifying and Laying Clay Pavers' and with the requirements of AS/NZS 4455.
- 3. Clay pavers shall be classified as Class 2, 3 or 4 in accordance with Paver Note 1 Specifying and Laying Clay Pavers. Unless otherwise indicated, Class 4 pavers shall be used for all driveway pavements, medians and traffic islands. Class 2 or 3 pavers may be used for footpaths, cycleways and other pedestrian areas, except where they are subject to vehicular traffic with axle loads greater than 2.7 tonnes, in which case Class 4 pavers shall be used.
- 4. The abrasion resistance as determined by the SCC Abrasion Test (Paver Note1) shall conform to the recommended characteristic abrasion losses contained in Paver Note 1.
- 5. Laying patterns of pavers are identified as being Herringbone, Basket weave, or Stretcher as shown in Annexure A. Each of these may be laid at either 90° restraints. A variation of Stretcher is the Zig Zag Running Bond, also shown in Annexure A.

S3.05 BEDDING SAND

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

AS Metric Sieve (mm)	% Passing
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

- 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. The bedding sand shall be free of deleterious soluble salts or other contaminants, which may cause, or contribute to, efflorescence.

S3.06 JOINT FILLING SAND

1. 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

AS Metric Sieve (mm)	% Passing
2.36	100
1.18	90 - 100
0.600	60 - 90
0.300	30 - 60
0.150	15 - 30
0.075	5 - 10

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

S3.07 CONCRETE FOR EDGE RESTRAINTS

1. Concrete supplied and placed for the construction of edge strips shall comply with the Specification for S7 CONCRETE WORKS.

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

S3.08 PAVER TYPE, SHAPE, CLASS AND LAYING PATTERN

1. The choice of concrete or clay segmental pavers, the paver class (for clay pavers), shape type (for concrete pavers), shape name, colour, thickness and laying pattern shall be as shown on the Project Drawings for each area of application.

S3.09 SUBGRADE PREPARATION

- 1. For road pavements and areas subject to vehicle loads (ie. delivery traffic areas to pedestrian malls) 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 S2 ROAD PAVEMENTS.
- 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. For pedestrian and light traffic areas (ie. footpaths, bikeways, medians and driveways) 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 ± 30mm of the design subgrade level.

S3.10 SUBBASE / BASE

- Base course for pedestrian and light traffic areas (ie. footpaths, bikeways, medians and driveways) 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 S2 ROAD PAVEMENTS.
- 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 r S2 ROAD PAVEMENTS.
- 3. The base course shall extend in width to at least the rear face of all new edge restraints.
- 4. Notwithstanding the finished level tolerances contained within Specification S2 ROAD PAVEMENTS for base of ± 10mm 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.
- 5. The finished surface of the base shall drain freely without ponding.

S3.11 EDGE RESTRAINTS

- 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 S2- ROAD PAVEMENTS and S7 CONCRETE WORKS
- 2. Faces of edge restraints abutting pavers shall be vertical.
- 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.
- 4. Unless otherwise shown on the Project Drawings, expansion and contraction joints shall be provided in accordance with Specification S7 CONCRETE WORKS.
- 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.
- 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.

S3.12 SAND BEDDING COURSE

- 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.
- 2. Any depressions in the screeding sand exceeding 5mm shall be loosened, raked and rescreeded before laying pavers.
- 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.
- 4. Drainage of the bedding course shall be as detailed on the approved Project

Drawings. **S3.13 LAYING PAVERS**

- 1. Unless otherwise specified, concrete pavers for road pavements shall be placed in herringbone laying pattern.
- 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. 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.
- 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.

- 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.
- 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.
- 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.

S3.14 BEDDING COMPACTION

- 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.
- 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. 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.
- 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.
- 5. The abutting edges of two adjacent pavers should match, but in no circumstances should they differ by more than 2mm.
- 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.
- 7. All compaction shall be complete and the pavement shall be brought to design profiles before spreading or placing sand filling in the joints.

S3.15 FILLING JOINTS

- 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.
- 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. 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.

S3.16 PROTECTION OF WORK

 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.

S3.17 OPENING TO TRAFFIC

- 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'.
- 2. Excess joint filling sand shall be removed prior to opening to traffic.
- 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.

S3.18 TOLERANCES

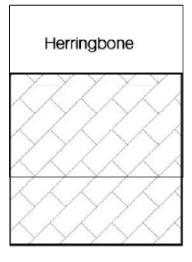
- 1. Where tolerances for individual components and associated dimensions are not specified on the Project Drawings, deviations from established lines, grades and dimensions in the completed work shall not exceed the values stated herein.
- 2. The dimensional tolerances as shown in Table S3.3

Table S3.3 Summary of Limits and Tolerances

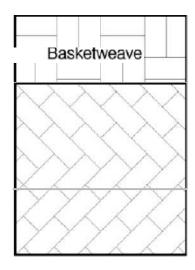
DESCRIPTION	LIMITS / TOLERANCES
	Finished level of base for pavements to be within +10mm or -0mm of design levels.
BASE	Finished level of base other than for road pavements, to be within +/10mm of design levels.
	The top surface of the base for all segmental paving shall not deviate from a 3m straight edge, laid in any direction, by more than 10mm.
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.
	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.
SEGMENTAL PAVING UNITS	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.
(SURFACE LEVEL)	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.

APPENDIX A

PAVER LAYING PATTERNS



Stretcher



Zig Zag Running Bond

S4 - STORMWATER DRAINAGE

GENERAL

S4.01 SCOPE

- 1. The specification details are all the requirements pertaining to the construction of stormwater drainage works.
- 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.

S4.02 REFERENCE DOCUMENTS

Australian Standards

- AS1597 Precast Reinforced Concrete Box Culverts
- AS1650 Hot-Dipped Galvanised Coatings on Ferrous Articles
- AS1761 Helical Lock-Seam Corrugated Steel Pipes
- AS2338 Preferred Dimensions of Wrought Metal Products
- AS2423 Galvanised Wire Fencing Products
- AS3725 Loads on Buried Concrete Pipes
- AS4058 Prescast Concrete Pipes (pressure and non-pressure)
- AS4159 Fibre-Reinforced Concrete Pipes and Fittings
- AS5065 Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications

All Australian Standards referenced in this specification shall be the current edition.

Department of Main Roads

MRS 11.03 Drainage, Retaining Structures and Protective Treatments

Others

- American Association of State Highway and Transportation Officials (AASHTO) M197-82 (1986) Aluminium Alloy Sheets for Culverts and Underdrains
- American Association of State Highway and Transportation Officials (AASHTO) M196-84 Corrugated Aluminium Alloy Culverts and Underdrains

MATERIALS

S4.03 STEEL REINFORCED CONCRETE PIPES (RCP)

- 1. Pipes shall conform in all respect to AS 4058.
- 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.
- 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. 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 (RL 2.19m AHD) the pipe will have cover to reinforcement in accordance with the exposure classification requirements of AS 3600.
- 5. The class of pipe shall be as specified or shown on the drawings. All pipes under roadways shall be a minimum of Class "2".

S4.04 FIBRE REINFORCED CONCRETE PIPES (FRC)

- 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.
- 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.
- 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.

S4.05 REINFORCED CONCRETE BOX CULVERTS (RCBC)

- 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.
- 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 (RL 2.19m AHD) the box culvert will have cover to reinforcement in accordance with the exposure classification requirements of AS 3600.

S4.06 CORRUGATED ALUMINIUM ALLOY PIPES

- 1. The pipes shall be manufactured in accordance with AASHTO M196-84 and to the tolerances shown in AS 1761 and incorporate a staked, double offset lock-seam joint.
- 2. The base metal shall conform to AASHTO M197-82 and shall comprise "Alclad 3004-H34" alloy or approved equivalent.

S4.07 POLYPROPYLENE PIPES

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.

S4.08 BEDDING MATERIALS

Concrete and Fibre Reinforced Concrete Pipes

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.

Reinforced Concrete Box Culverts

2. 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.

Corrugated Aluminium Alloy Pipes

- Where rock is encountered at the foundation, the bedding material shall consist of a loose granular cushion of maximum 12mm aggregated size to a depth sufficient to allow the corrugations to become filled. This material shall form the top portion of the bedding material.
- 4. Where soft unstable foundation material is excavated below the invert, backfill material shall consist of gravel, crushed stone or other suitable material.
- 5. All material directly in contact with the pipe shall be within a pH range 4-9 and have a resistivity greater than 500 ohm cms.

S4.09 STEEL WIRE GABION AND MATTRESS PROTECTION WORKS

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.

S4.10 CONCRETE

1. The concrete and reinforcement used in the construction of gully pits, manholes, headwalls and aprons etc shall comply with Specification S7 CONCRETE WORKS.

S4.11 MANHOLE COVERS AND FRAMES

- 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.
- 2. All openings shall conform to the details on Standard Drawing D-0010
- 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. Minimum classes of manhole covers shall be as follows:

Within Residential Properties and Parks	Class B
Residential Road Reserves	
(Up to collector street status)	Class C
(Trunk Collector or higher)	Class D
Industrial, Commercial Road Reserves	Class D

S4.12 GRATES AND FRAMES

- 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 Standard Drawing D-0060 and shall be Hot Dipped Galvanised to the requirements of AS 1650.
- 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.

S4.13 FLOODGATES

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

S4.14 BACKFILL MATERIAL

- 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.
- 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. Whitsunday Regional Council Development Manual

CONSTRUCTION

S4.15 SETOUT

- 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.
- 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.

S4.16 CLEARING AND GRUBBING

- All clearing and grubbing works shall be in accordance with Specification S1 EARTHWORKS.
- 2. Where stormwater lines pass through allotments any trees or obstructions not on the line of the pipes shall be preserved.

S4.17 TRENCHING

- 1. All trenching and foundation works necessary for the installation of stormwater drainage works, shall be in accordance with Specification S1 EARTHWORKS.
- 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.

- The width of trenching excavation shall be in accordance with the Standard Drawings S1045 and S1046 at the trench base and comply with all regulations of Workplace Health and Safety Act.
- 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.
- 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.

S4.18 DIVERTING WATER AND DEWATERING

- 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.
- 2. The necessary pumping items shall be kept on hand to ensure the excavation is constantly dewatered during the progress of the works.
- 3. Discharge for dewatering pumps shall be directed to location approved by and to the satisfaction of Council.
- 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.
- 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.

S4.19 BEDDING

General

- 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.
- 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.
- 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.

Corrugated Aluminium Alloy Pipes

- 4. Where soft unstable foundation material is encountered below the pipe invent, the minimum width of replacement material under the pipe shall be twice the pipe diameter. The depth of replacement material shall be such as to achieve a good foundation for the constructed works.
- 5. When rock is encountered in the foundation, the rock shall be excavated and replaced with suitable bedding material to a depth of D/4 or 250mm, whichever is lesser (where D is the pipe diameter).

Box Culverts

6. 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 ± 10mm in level and ± 50mm in line

S4.20 LAY AND JOINT PIPES

Concrete and Fibre Reinforced Concrete Pipes

- 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.
- 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.
- 3. External joints shall be taped with the manufacturers supplied tape or rubber external sand bands upon final bedding and alignment.
- 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.
- 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.
- 6. Drainage lines shall be constructed with a tolerance of ± 15mm 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

- 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.
- 8. All construction methods, tolerances and requirements for box culverts shall conform to the requirements detailed in Main Roads Standard Specification MRS 11.03.

Helical Lock Seam - Corrugated Aluminium Alloy Pipes

- 9. Coupling of one pipe segment to another shall be by means of an external coupling band.
- 10. Large diameter pipes may be end match marked in the factory in order to simplify installation. Where multiple cell structures are being installed, each difference shall be marked in a unique manner for ease of identification.
- 11. Bands have corrugations or dimples that correspond to those of the pipe sections. They shall be fitted so as to overlap each pipe section equally. Where the pipes have not been re-corrugated and "dimple" bands are being used, the pipes shall be rotated sufficiently for the helical corrugations to match adjacent pipes.
- 12.To speed the coupling operation, especially for large diameter structures, a chain or a cable-cinching device may be used to help draw the band tight. On large structures merely tightening the bolts and nuts will not assure a tight joint, due to the friction between the band and the pipe ends. In such installations, the band shall be tapped with a rubber or wooden mallet as the band is tightened to reduce any tendency for the band to bend on the pipe.

13. The coupling bands shall be evenly tightened to provide a firm tough clamp to the jointed pipes.

S4.21 BACKFILL

Concrete and Fibre Reinforced Pipes

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

Table S4.1 Backfill Compaction

Location	Minimum Dry Density Ratio	Minimum Density Index	
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.

- 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.
- 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. 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.
- 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.

Helical Lock Seam - Corrugated Aluminium Alloy Pipes

- 6. Backfill material shall be placed in layers not exceeding 200mm loose thickness both sides of the structure such that the difference in fill height either side of the pipe is minimal.
- 7. Tamping may be done with hand or mechanical equipment, tamping rollers or vibrating compacters. Each layer shall be compacted to a standard of compaction in accordance with Table S4.1
- 8. Where very fine granular material is encountered in conjunction with a high ground-water table, special provision may need to be made to prevent infiltration of the surrounding material into the pipe (such as at coupling band joints), which could cause loss of backfill material surrounding the pipe. Geotextile fabrics or gasket material are typically used.

S4.22 DRAINAGE STRUCTURES

1. Gullies, manholes and field inlets shall be constructed to the form and dimensions shown on the plans and in accordance with Standard Drawings D-0060, D-0063and D-0067. 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.

- 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.
- 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. 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.
- 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.
- 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.
- 7. Compaction of material surrounding drainage structures shall be in accordance with Table \$4.1

S4.23 STEEL WIRE GABIONS AND MATRESS PROTECTION

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

S4.24 HEADWALLS, WINGWALLS AND APRONS

Cast Insitu

- 1. Where necessary, localised excavations shall be carried out to allow construction of cast insitu end structures.
- 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 Standard Drawings D-0080 and D-0081.
- 3. Concrete work shall comply with Specification S7 CONCRETE WORKS. Construction of endwalls and wingwalls shall include the construction of integral cut-off walls, where required.

Precast

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

- 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:
 - Cohesive material to not less than 95% Standard Compaction.
 - Non-cohesive material to a density index of not less than 65.
- 6. 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.
- 7. Any holes and recesses provided in end structures to assist installation shall be neatly plugged or filled with cement mortar.
- 8. 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.

S4.25 FLOODGATES

 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.

S4.26 TOLERANCES

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

Table S4.2 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 Spillways and Detention Basins	Trimmed to +25mm - 10mm

S5 - WATER RETICULATION

GENERAL

S5.01 SCOPE

- This specification details all matters pertaining to Water Supply Reticulation Construction.
- 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.
- 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.
- 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.

\$5.02 REFERENCE DOCUMENTS

Australian Standards

- AS1289 Methods of Testing Soils for Engineering Purposes
- AS1432 Copper Tubes for Plumbing, Gasfitting and Drainage Applications
- AS/NZS1477 PVC Pipes and Fittings for Pressure Applications
- AS1646 Elastomatic Seals for Waterworks Purposed
- AS/NZS1906 Retroreflective Material and Devices for Road Traffic Control Purposes
- AS2032 Code of Practice for Installation of PVC Pipe Systems
- AS2033 Installation of Polyethylene Pipe Systems
- AS2129 Flanges for Pipes, Valves and Fittings
- AS/NZS2280 Ductile Iron Pressure Pipes and Fittings
- AS2638 Sluice Values for Waterworks Purposes
- AS3500 National Plumbing and Drainage Code
- AS3952 Water Supply DN80 Spring Hydrant Valve for General Purposes
- AS/NZS4129 Fittings for Plyethylene (PE) Pipes for Pressure Applications
- AS/NZS4130 Polyethylene (PE) Pipes for Pressure Applications
- AS4441 Oriented PVC (PVC-O) Pipes for Pressure Applications
- AS/NZS4765 Modified PVC (PVC-M) Pipe for Pressure Applications

All Australian Standards referenced in this specification shall be the current edition.

Department of Main Roads

MRS 11.45 Pavement Markings

Water Services Association of Australia

WSA 03 – Water Supply Code of Australia

MATERIALS

\$5.03 PIPES GENERAL

- 1. All pipes used for water main reticulation shall be constructed from the following materials:
- (i) Polyvinylchloride (PVC)
- (ii) Polyethylene (PE)
- (iii) Ductile Iron

S5.04 UNPLASTICISED PVC (PVC-U)

- 1. Unplasticised PVC (PVC-U) pipes shall be manufactured in accordance with AS/NZS 1477 by an Australian Standards quality endorsed company.
- 2. 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.
- 3. 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
- 4. PVC pipes 100mm diameter and greater to be Class 16 rubber ring jointed (Ductile iron O.D compatible).
- 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.

\$5.05 POLYETHYLENE PIPE

- 1. Polyethylene pipe shall be manufactured in accordance with AS/NZS 4130 by an Australian Standards quality endorsed company.
- 2. PE pipes up to 50mm inside diameter to be Class 12.5
- 3. Fittings shall comply with AS/NZS 4129.

\$5.06 DUCTILE IRON

- 1. Ductile Iron pipes shall be manufactured and cement lined in accordance with AS/NZS 2280 by an Australian Standards quality endorsed company.
- 2. Socketed pipes to be Class K9 suitable for the patented "Tyton" type rubber ring joint. Flanged pipes to be Class K12.
- 3. Flanges shall comply with AS 2129 Table C. Bolts and nuts for flanged joints shall be in accordance with AS 2129.
- 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.

\$5.07 BEDDING MATERIAL

 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.

S5.08 VALVES

- 1. All Valves shall be manufactured in accordance with AS 2638 by an Australian Standards quality endorsed company.
- Valves of 80mm diameter and larger, are to be coated with a thermosetting epoxy powder to AS 2638 and AS 3952.
- 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.
- 4. All valves 80mm and greater to be anti clockwise to close

S5.09 HYDRANTS

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.

S5.10 BENDS AND TEES

- 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:
 - 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.
- 2. All bends, tees and miscellaneous fittings shall be factory nylon powder coated unless otherwise specified.

\$5.11 PAVEMENT MARKING

 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".

\$5.12 RAISED RETRO REFLECTIVE MARKING

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

CONSTRUCTION

S5.13 SETOUT

- 1. The location and sizes of the mains and position of valves and hydrants shall be as stated on the approved Project Drawings.
- 2. Bends shall be positioned such that the correct alignment is maintained and remains within the allotted service corridor.
- 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.
- 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. Deflection of water mains is not allowed. Bends are to be used for change of direction.
- 6. Where a hydrant is placed at the end of a water main which will not be extended in the future, eg, in cul-de-sac; the hydrant shall be installed with a hydrant bend located adjacent to the boundary of the last property serviced.
- 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.
- 8. The maximum spacing of hydrants shall be 80m with hydrants located at all crests, sags and ends of lines in cul-de-sacs.
- Spring hydrants are to be oriented with bolts parallel to the water main

S5.14 CLEARING AND GRUBBING

- All clearing and grubbing works shall be in accordance with Specification S1 EARTHWORKS.
- 2. Any trees or obstructions not on the line of the pipes shall be

\$5.15 TRENCHING

preserved.

- 1. All trenching and foundation works necessary for the installation of the pipeline or thrust blocks, shall be in accordance with Specification S1 EARTHWORKS.
- 2. The width of trenching excavation shall be in accordance with the Standard Drawing W0440 at the trench base and comply with all regulations of Workplace Health and Safety Act.
- 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. 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.
- 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.
- 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.

S5.16 COVER

- 1. Unless noted otherwise on the approved Project Drawings the minimum depth of cover to be provided for mains shall be as follows:
 - For mains of 100mm and 150mm diameter: minimum 600mm maximum 750mm, in a verge or roadway; measured from the top of pipe to the adjacent top of kerb.
 - For 225mm and 300mm diameter: minimum 700mm, maximum 850mm
 - For mains greater that 225 mm diameter, individual assessment dependent upon valve height shall be determined by the Engineer.
 - 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.
 - Main shall not be laid under stormwater, sewerage pipes or electricity conduits unless approved by the Engineer.

S5.17 CROSSINGS

Major Road Crossings

- 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.
- 2. All road crossings shall have an enveloper pipe and the main shall be grouted in the enveloper pipe.
- 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

- 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. The Engineer may permit open trenching to streets below Collector, determined by the location, traffic conditions and age of the existing pavement.

- 6. The details of the crossing, pipe materials and grouting shall be submitted to Council for approval.
- Crossings of other carriageways shall be trenched unless the Engineer specifies otherwise.

Railway Crossings

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.

S5.18 BEDDING

- 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.
- 2. The depth of bedding shall be as detailed on Standard Drawing W-0040 with the bedding material complying with the "Bedding Material" section of this Specification.

S5.19 LAYING AND JOINTING OF PIPES

- 1. All contractors shall have undertaken a manufacturers pipe laying accreditation course.
- 2. All pipe lines shall be laid to such lines, offset, gradients and levels as shown on approved Project Drawings.
- 3. Care shall be taken to preserve uniform gradients and correct alignments. Bends shall be used to effect horizontal and vertical changes of direction.
- 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. Jointing of pipes, valves and fittings is to be carried out to the manufactures recommendations and in accordance with Australian Standards where applicable.
- 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.
- 7. Before being laid, all pipes, fittings, valves, etc shall be cleaned and examined by the Contractor.
- 8. Approved plugs shall be used to prevent foreign matter entering sections of pipeline, which are left uncompleted overnight.
- 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.
- 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.
- 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.
- Any pipes cut in the field shall have their ends prepared in accordance with the manufacturer's written instructions.

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.

\$5.20 CONNECTION TO EXISTING MAINS

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

S5.21 FITTINGS

- 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.
- 2. Joints to secure fittings to pipes shall be approved under Australian Standard AS1646.
- 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 Standard Drawings W-0060 and W-0061. 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.
- 4. Valves, hydrants and specials shall be thoroughly cleaned out prior to installation in main.
- 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 standard drawing W-0060 and W-0061.
- 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.

\$5.22 VALVE / HYDRANT MARKERS

- 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.
- Painted symbols used to indicated hydrants shall be in accordance with Standard Drawing W-0060
- 3. Kerb marker plates used to indicate valve and hydrant locations shall be fixed to the kerb face it shall be in accordance with Standard Drawing W-0061.
- 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. 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.

- 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.
- 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
- 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.
- 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".

S5.23 ANCHOR BLOCKS

- 1. Where a main is installed at a grade of 1 in 6 or steeper, concrete anchor blocks shall be provided in accordance with Standard Drawing W-0041
- Concrete works shall comply with Specification S7 CONCRETE WORKS.

S5.24 THRUST BLOCKS

- 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.
- Thrust blocks, sized in accordance with the requirements detailed on Standard Drawing W-0041.
- 3. Concrete works shall comply with Specification S7 CONCRETE WORKS.

S5.25 WATER SERVICE CONNECTIONS

- 1. Ready tap, or equivalent, connection points shall be laid with the main within 300 mm of the side property boundaries.
- 2. The Ready tap connection point is to be installed with a valve on one side and a bung on the other.
- 3. All services shall be turned on during the testing process.

S5.26 BACKFILLING AND COMPACTION

- 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.
- 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.
- 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.
- 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 specification No. 3.2 Pavements, to a level 350mm below the level of the existing pavement surface and shall be compacted to 95% of the maximum dry density as determined by compaction test Department of Transport Q110A 1993. 300mm of cement stabilised gravel and 50 mm of asphaltic concrete shall be used to compete the trench backfilling. The surface shall be restored to a condition at least equal to that of the original pavement
- 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.
- 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.
- 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.

S5.27 RESTORATION OF SURFACES

- 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.
- 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.
- 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.
- 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. 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. 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.
- 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.
- 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.
- 9. The Superintendent may direct the Contractor to backfill the tunnel with Grade N20 concrete in lieu of sand.

\$5.28 TESTING OF LINES

- 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.
- 2. The contractor shall have carried out a successful test prior to arranging a Council witness test
- Pressure testing shall not be carried out during wet weather unless otherwise approved by Council.
- 4. Before testing a pipeline section, it shall be cleaned and filled slowly with water, taking care that all air is expelled.
- 5. The minimum test pressure acceptable shall be 1200 KPa unless advised otherwise by the relevant Local Authority and shall be considered to be satisfactory if:
- (a) There is no failure of any thrust block, anchor block, pipe, fitting, valve, joint or any other pipeline component;
- (b) There is no visible leakage; and
- (c) There is no loss of pressure in the 15 minute test period
 - 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 15 minutes.
 - 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.

S5.29 FLUSHING

 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).

\$5.30 TOLERANCES

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

Table S5.1 Construction Tolerances

Alignment	On the allocated alignment (2500m off property boundary)
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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		

S6 - SEWERAGE RETICULATION

GENERAL

S6.01 SCOPE

- 1. This specification details all matters pertaining to Sewerage Reticulation Construction.
- 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.
- 3. Aspects of modification or clarification of the codes are detailed in Appendix A of Design Guideline D7
- 4. The requirements of this Manual will take precedence over the Water Services Association of Australia Codes
- 5. Aspects of medication or clarification of the codes Standard Drawings are detailed in Appendix A and B of this section.

S6.02 REFERENCE DOCUMENTS

Australian Standards

- AS/NZS 1260 Unplasticised PVC (UPVC) Pipes and Fittings for Sewerage Applications
- AS1289 Methods of Testing Soils for Engineering Purposes
- AS1432 Copper Tubes for Plumbing, Gasfitting and Drainage Applications
- AS/NZS1477 PVC Pipes and Fittings for Pressure Applications
- AS1646 Elastomatic Seals for Waterworks Purposed
- AS2032 Code of Practice for Installation of PVC Pipe Systems
- AS2129 Flanges for Pipes, Valves and Fittings
- AS/NZS2280 Ductile Iron Pressure Pipes and Fittings
- AS3500 National Plumbing and Drainage Code
- AS3996 Metal Access Covers, Road Grates and Frames
- AS4198 Precast Concrete Access Chambers for Sewerage Applications
- AS4441 Oriented PVC (PVC-O) Pipes for Pressure Applications
- AS/NZS4765 Modified PVC (PVC-M) Pipe for Pressure Applications
- AS5065 Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications

All Australian Standards referenced in this specification shall be the current edition.

QLD Government Legistation

Sewerage and Water Supply Act

Water Services Association of Australia

- WSA 02 Sewerage Code of Australia
- WSA 04 Sewerage Pumping Station Code of Australia

MATERIALS

S6.03 PIPES GENERAL

- 1. All pipes used for sewer reticulation shall be constructed from the following materials:
- (i) Polyvinylchloride (PVC)
- (ii) Ductile Iron

S6.04 UNPLASTICISED PVC (PVC-U)

- 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.
- 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.
- 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.
- 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.
- 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.
- All pressure mains 100m diameter and greater shall be D.I.O.D compatible.

S6.05 DUCTILE IRON

- 1. Ductile Iron pipes shall be manufactured and cement lined in accordance with AS 2280 by an Australian Standards quality endorsed company.
- 2. Socketed Pipes to be Class K9 suitable for the patented "Tyton" type rubber ring joint. Flanged Pipes to be Class K12.
- 3. Flanges shall comply with AS 2129 Table C. Bolts and nuts for flanged joints shall be in accordance with AS 2129
- 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.
- 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:

- 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.

S6.06 POLYPROPYLENE PIPES

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.

S6.07 BEDDING MATERIALS

- 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 standard drawing S-0090
- 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.
- 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.
- 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.
- 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. 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.
- 7. Concrete blocks in Grade N20 concrete shall be built across the trenches where directed by the Superintendent.
- 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.

S6.08 CONCRETE

1. The concrete and reinforcement used in the construction of cast insitu manholes shall comply with Specification S7 CONCRETE WORKS.

S6.09 PRECAST MANHOLES

- 1. Precast manhole components shall comply with AS 4198. Standard drawing S-0020 and S-0021
- 2. Precast manholes may only be used subject to separate Council approval.

S6.10 MANHOLE COVERS

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.

- 2. All openings shall conform to the details on Standard Drawing S-0024 and S-0025 (min 600c for opening).
- 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. Whitsunday Regional Council Development Manual
 - 4. Unless noted otherwise on the approved Project Drawings the minimum class of manhole covers shall be Class C or D

CONSTRUCTION

S6.11 SETOUT

- 1. The alignment and grade of sewer lines and position of manholes shall be stated on the approved Project Drawings.
- 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.
- 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.
- 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.

S6.12 CLEARING AND GRUBBING

- 1. All clearing and grubbing works shall be in accordance with Specification S1 EARTHWORKS.
- 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.

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.

S6.13 TRENCHING

- 1. All trenching and foundation works necessary for the installation of the pipeline or thrust blocks, shall be in accordance with Specification S1 EARTHWORKS.
- 2. The width of trenching excavation shall be in accordance with the Standard Drawing S-0090 at the trench base and comply with all regulations of Workplace Health and Safety Act.
- 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.
- 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.
- 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. 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.
- 7. Where necessary the Contractor must arrange suitable traffic and pedestrian management.

S6.14 CROSSINGS

- 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.
- 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.
- 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.

S6.15 BEDDING

1. Bedding types shall be as detailed on Standard Drawing S-0090 with the bedding materials complying with the "Bedding Material" section of this Specification.

Type 1 Bedding

- 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.
- 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.
- 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.
- 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:
 - Minimum dry density ratio 95% Standard (cohesive soils).
 - . Minimum density index 65% (cohesionless soils)
- 6. Compaction requirements are with reference to the relevant Test Methods contained in AS1289.

Type 2 Bedding

- 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.
- 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.
- 9. The geotextile shall surround the crushed rock layer and be overlapped minimum of 500mm.
- 10. The pipe bedding material shall placed and compacted over the crushed rock foundation as specified for Bedding Type 1.

Type 3 Bedding

11. Type 3 bedding incorporating designed piles that are driven by air or electric hammer on a heavy dolly.

- 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.
- 13. A 150 x 50 hardwood sleeper is placed on top of the pile with 150 x 50 hardwood planks spanning the sleepers.
- 14. A concrete cradle as detailed on the approved Project Drawings shall then be poured on the planks to support the pipes.

S6.16 LAYING AND JOINTING OF PIPES

- 1. All contractors shall have undertaken a manufacturers pipe laying accreditation course.
- 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.
- 3. The lines, levels and grades of all lines shall be checked and all pipes found incorrect shall be removed and re-laid.
- 4. Trenches shall be kept free of water during pipe laying, and until completion of backfill.
- 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. 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.
- 7. Before being laid, all pipes, fittings, valves, etc shall be cleaned and examined by the Contractor.
- 8. Approved plugs shall be used to prevent foreign matter entering sections of pipeline, which are left uncompleted overnight.
- 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.
- 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.
- 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.
- 12. Any pipes cut in the field shall have their ends prepared in accordance with the manufacturer's written instructions.
- 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.
- 14. Gravity lines shall be constructed to the tolerances specified hereafter:
 - The maximum horizontal deviations to either side from the design axis of a pipeline shall be 100mm for all sizes of pipes.
 - The maximum vertical deviations from the design grade of pipelines of any diameter and grade, shall be + 5mm.
- 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

S6.17 CONNECTIONS TO MANHOLES

- 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 standard drawing S-0020
- 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 advice the design engineer of any obstructions (Structure, Flora, Services etc)
- 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.

S6.18 CONNECTION TO EXISTING

- 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.
- 2. The upstream side of the existing manhole is to be plugged until all new sewer mains have been approved, tested and cleaned.

S6.19 ANCHOR BLOCKS

- 1. Concrete anchor blocks shall be provided in accordance with Standard Drawing W-0040 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.
- 2. Concrete works shall comply with Specification S7 CONCRETE WORKS.

S6.20 HOUSE CONNECTION BRANCHES

- 1. House Connection Branches (HCB) to all properties shall be constructed in accordance with Standard Drawing S-0030 and to the types, locations, levels and dimensions stated on the approved Project Drawings.
- 2. Concrete surrounds shall be provided to all HCB's. All concrete works shall comply with Specification S7 CONCRETE WORKS.
- 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.
- 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.

S6.21 RISING MAINS

- 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 S5 WATER RETICULATION.
- 2. Air release valves and scour valves shall be installed where shown on the approved Project Drawings.
- 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.

- 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.
- 5. Sewer rising main connections to discharge manholes are to be constructed in accordance with Standard Drawings S-0020, S-0021, S-0022, S-0023 and S-0024

S6.22 MANHOLES

- 1. All concrete work associated with the construction of manholes shall comply with Specification S7 CONCRETE WORKS.
- 2. Manholes shall be constructed in accordance with Standard Drawing S-0020 and S-0022, and to the types, locations, levels and dimensions stated on the approved Project Drawings.
- 3. Rendering of this invert and benching shall be in accordance with the Standard Drawing S-0020.
- 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.
- 5. Precast Manhole risers are acceptable for use with cast insitu manhole bases.
- 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 Standard Drawing S-0020.
- 7. The installation of all precast manhole components shall be in accordance with the manufacturers' recommended procedures, requirements and Council's standard installation procedure.

S6.23 COVERS AND SURROUNDS

- 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.
- 2. Manhole covers are to be located such that the position of the access opening is directly over the outlet pipe.
- 3. The installation of all precast manhole covers shall be in accordance with the manufacturers' recommended procedures and requirements.

S6.24 BACKFILL AND COMPACTION

- 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.
- 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.
- 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.
- 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.

- 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. 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.
- 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.

S6.25 CLEANING SEWERS

- 1. Before the sewers, manholes and house drains are accepted they shall be cleaned to remove all clay, sand and other materials.
- 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.

S6.26 TEST OF MANHOLES

- 1. All manholes shall be subjected to hydrostatic or vacuum tests to prove their water tightness unless directed otherwise by the Local Authority.
- 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.
- 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.
- 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.
- 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.

S6.27 TESTING OF LINES

- 1. All gravity lines shall be subject to air testing to prove their water tightness unless directed otherwise by the Local Authority.
- 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.
- 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.

4. The contractor shall carry out a visual inspection to ensure that all sewer lines present a full clean bore.

Air Testing General

- 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. 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

	Sewer depth range (metres)				
	0-1.5	1.5 -	3.0-	4.5-	Over
		3.0	4.5	6.0	6.0
Initial pressure (KPa)	30	35	40	45	50
Test start pressure (KPa)	25	30	35	40	45

- 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.
- 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.
- 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 then 5 KPa during the 5 minute period.

Ovality Testing

- 10. All gravity sewer pipes shall be tested to determine any excessive pipe defection (Ovality) by using a proving tool.
- 11. Testing for ovality shall be carried out in accordance with Appendix G of WSA 02-2002 Sewerage Code of Australia
- 12. The proving tool shall be:
- (a) 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.
- (b) 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.
- (c) The shape of the proving tool must be approved.

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.

S6.28 TESTING OF RISING MAINS

- 1. Hydrostatic pressure testing of all sewer rising mains shall be carried out prior to the acceptance of the works.
- 2. The contractor shall have carried out a successful test prior to arranging a Council witness test.
- 3. Pressure testing shall not be carried out during wet weather unless otherwise approved by Council.
- 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.
- 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. The pressure testing of a section shall be considered to be satisfactory if:
- (a) There is no failure of any thrust block, anchor block, pipe, fitting, valve, joint or any other pipeline component;
- (b) There is no visible leakage; and
- (c) There is no loss of pressure in the 15 minute test period
- 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.
- 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.

S6.29 RESTORATION OF SURFACES

- 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.
- 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.
- 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.
- 4. Final restoration of the pavement shall be carried out to restore the pavement and its sub-base 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. 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. 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.
- 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.
- 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.

S6.30 TOLERANCES

1. Tolerances for the construction of sewer reticulation works shall comply with Table S6.4.

Table S6.4 Construction Tolerances

Location	Tolerance	
Invert levels	+25mm25mm	
Location of alignment and structures	Lateral deviation from line + 100mm Longitudinally along line + 300mm	
Grade on pipe	Design grade not compromised	

S7 - CONCRETE WORKS

GENERAL

S7.01 SCOPE

- 1. This specification details all matters pertaining to the supply, placement, compaction and finishing of Concrete Works.
- 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.

S7.02 REFERENCE DOCUMENTS

Australian Standards

- AS1012 Methods of Testing Concrete
- AS1379 The Specification and Manufacture of Concrete
- AS1478 Chemical Admixtures for Concrete
- AS1553.1 Low Carbon Steel Electrodes for Manual Arc Welding of Carbon Steels and Carbon-Manganese Steels
- AS1554.3 Welding of Reinforcing Steel
- AS2203 Cored Steel Electrodes for Arc Welding
- AS2717.1 Ferritic Steel Electrodes
- AS3600 Concrete Structures
- AS3610 Formwork for Concrete
- AS3735 Concrete Structures for Retaining Liquids
- AS3799 Liquid Membrane-forming Curing Compounds for Concrete
- AS/NZS4671.2 Steel Reinforcing Bars for Concrete
- AS/NZS4671.3 Steel Reinforcing Wire for Concrete
- AS/NZS4671.4 Welding Wire Reinforcing Fabric for Concrete

All Australian Standards referenced in this specification shall be the current edition.

MATERIALS

S7.03 CONCRETE - GENERAL

- 1. All concrete to be incorporated in the works shall be sourced from a Quality Assured Concrete supplier.
- 2. The production and delivery of ready-mixed concrete shall be in accordance with the requirements of AS 1379.
- 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.
- 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.
- 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.
- 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. 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.
- 8. Concrete class shall be classed as Nx where x is the minimum 28-day compressive strength in megapascals.
- 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 15m³ or part thereof placed in an essentially continuous manner with a minimum of two samples of 2 cylinders for each casting day.
- 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

Construction Element	1
Kerb / Kerb & Channel	N25
Manholes (Sewer & Stormwater) ²	N25 or N32 as shown on Standard Drawings
Gully Pits / Field Inlets ²	N25 or N32 as shown on Standard Drawings
Headwalls/Wingwalls & Apron Slabs ²	N25
Pathways / Bikeways	N25
Access Driveways	N25
Edge Restraints for Segmental Pavers (On Road Pavements)	N25
Edge Restraints for Segmental Pavers (On footpaths, bikeways and medians)	N20
Stamped Concrete (where used in road pavement)	N32
Stamped Concrete (where used as parking bay behind kerb or not subject to regular street traffic loadings)	N25
Thrust Blocks	N20
Concrete Surrounds for Sewerage House Connection Branches	N20
Concrete Cradle for Sewer Bedding Type 3	N15
General Concrete Works (Sign Post Bases, Bases for Post and Rail Fences etc.)	N20

Notes:

- 1. Tested in accordance with the relevant sections of AS 1012.
- 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

S7.04 NO FINES CONCRETE

- 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.
- 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	Percentage Passing by Mass			
(mm)	Nom. Size 20 mm	Nom. Size 10 mm		
26.5 19.0	100 85 - 100	-		
13.2	0 - 10	100		
9.5 4.75	0 - 5 0	85 - 100 0 - 10		
2.36	0	0 - 2		
Minimum Cement Content (kg/m ₃)	210	250		

S7.05 LEAN MIX CONCRETE

 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.

S7.06 REINFORCING STEEL

- 1. All reinforcement shall comply with the following requirements where applicable:-
 - Steel Reinforcing Bar AS/NZS4671.2 Steel Reinforcing Bars for Concrete
 - Hard-draw Steel Reinforcing Bar AS/NZS4671.3 Steel Reinforcing Wire for Concrete
 - Reinforcing Wire Fabric AS/NZS4671.4 Welding Wire Reinforcing Fabric for Concrete
- 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

S7.07 TEMPERATURE LIMITS FOR CONCRETE PLACEMENT

- 1. No concrete shall be placed in the Works if:
 - (a) The temperature of the concrete is less than 5°C or exceeds 30°C;
 - (b) The ambient air temperature is likely to be greater than 45°C during placement or within two (2) hours subsequent to placement.
- 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:

At the Concrete Manufacturing Plant

- · Shading aggregate stockpiles;
- · Painting water tanks white;
- Insulating or burying delivery lines;
- Adding crushed ice to replace mixing water (in part) or chilling the water;
- Injection of liquid nitrogen into the mixer.

At the Site

- Cooling the formwork by dampening with water sprays;
- Shading the work areas;
- · Erecting wind breaks;
- Minimising the time for placing and finishing;
- Use of evaporation retarding curing oil.
- 3. Special attention shall be paid to providing early curing for hot weather concreting operations.

S7.08 FOUNDATIONS

- 1. Foundations for concrete structures shall be prepared as specified on the Project Drawings.
- 2. Rock foundations shall be neatly excavated to form a bed for the concrete, and shall be thoroughly scraped and cleaned.
- 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).
- 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.

5. The surface shall then be checked for uniformity, line and level, and all irregularities shall be made good.

S7.09 FORMWORK AND FALSEWORK

- 1. All Formwork and Falsework shall conform to AS 3610 unless otherwise required by the specific Project Documentation.
- 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.
- 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.
- 4. Forms, which are unsatisfactory in any respect, shall not be re-used.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.

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.

S7.10 REINFORCING STEEL

- 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.
- 2. The surface condition of reinforcement shall comply with the following requirements:
 - 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.
 - 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.
 - 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.
 - Any reinforcement projecting from a previous concreting operation shall be cleaned free of adhering concrete or loose slurry prior to any further embedment.
 - 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.
 - 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.
- 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.
- 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.
- 5. Metal chairs shall not be approved for any locations.
- 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. 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.
- 8. Reinforcement shall be spliced by lapping or where permitted, by welding or by approved mechanical splices. Fabric reinforcement shall be lap spliced only.

- 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:-
 - 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:-
 - A throat thickness not less than 4 mm;
 - o A length not less than the diameter of the smaller bar.
 - Welding shall not be carried out within 75 mm of any portion of a bar which has been bent or will be bent.
 - No more than one-third of the main reinforcement at any cross-section shall be so welded.
 - Hard drawn wire and fabric reinforcement shall not be welded or heated unless approved by the Engineer.
 - Welding electrodes that are to be used complying with AS 1553.1 or AS 2203 or AS 2717.1.
 - 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.
 - Suitability experienced and competent welding personnel shall be engaged to complete the works.
- 10. Splicing of reinforcement shall occur only in the locations shown on the Project Drawings. Where practical, splices in bar reinforcement shall be staggered.
- 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.

S7.11 CONCRETE PLACEMENT - GENERAL

- 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.
- 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.
- 3. Concrete shall be placed in an essentially continuous manner between approved construction joints so as to avoid being placed against partially set concrete.
- 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.
- 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.

- 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. 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 approve 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.
- 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.

S7.12 CONCRETE PLACEMENT – UNDER WATER

- 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.
- 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.
- 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.
- 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.

S7.13 COMPACTION IN CONCRETE FORMS

- 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 in the manner described below:-
- 2. 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.
- 3. The number of vibrators to be used by the Contractor shall be not less than one for each 4m³ of concrete placed per hour, with a minimum of 2 vibrators to be provided at any time.

- 4. 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.
- 5. 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.
- 6. 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. Vibration shall not be applied either directly or through the reinforcement to any concrete, which has taken its initial set.

S7.14 REMOVAL OF FORMS AND FALSEWORK

1. Unless otherwise specified, forms and falsework shall remain in position until the times stated below have elapsed after completion of concreting:

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.

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.
- Side forms on structural concrete 3 days minimum.
- 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.
- 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.
- 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.

S7.15 FINISHING OF EXPOSED SURFACES

- 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:
 - Kerb and channel, invert crossings, vehicle crossings and industrial crossings shall be finished with an approved steel finishing tool.
 - Footpaths, bikeways and pram ramps shall be finished with a wooden float and broomed.
 - Where a sample panel is supplied or specified associated with a particular project.
 The concrete finish shall be in accordance with the specified requirement.
- 2. All concrete surfaces shall be true and even, free from stone pockets, depressions or projections beyond the surface. All arrises shall be sharp and true, and mouldings shall

be evenly mitred or rounded. Care shall be exercised in removing forms to ensure this result.

- 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.
- 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.
- 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.

S7.16 WEEPHOLES

- 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:
 - (a) The maximum particle dimension shall not exceed 50mm
 - (b) 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.
- 3. Alternatively the Contractor may provide a synthetic membrane of equivalent drainage characteristics. It shall be stored and installed in accordance with Manufacturer's instructions.

S7.17 JOINTS

- 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.
- 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.
- 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.
- 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.
- 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 2m². The ratio of the longest side to the shortest side shall not exceed 1.6.

S7.18 CURING

- 1. The curing of unformed surfaces of concrete shall commence as soon as finishing operations are complete.
- 2. If forms are removed in less than 7 days, curing of the formed surface shall commence within two hours of stripping.
- 3. Curing shall continue for a period after placing the concrete of not less than:-
 - Top surface of slabs 14 days;
 - Other surfaces 7 days.
- 4. Curing shall be effected by either Water or Membrane Curing.
- 5. Water curing shall comprise surfaces being kept moist for the period specified by continuous spraying, ponding, wet hessian or wet sand blankets.
- 6. Membrane curing shall be effected by application of a sprayed curing compound or by covering with polythene sheet.
- 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.
- 8. Resin and PVA based compounds shall not be used.
- 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.

S7.19 BACKFILLING

- 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.
- 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.
- 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.

S7.20 SPRAYED CONCRETE

- 1. The minimum depth of sprayed concrete to be applied shall be 75mm.
- 2. Sprayed concrete shall have a minimum 28-day compressive strength of 25 MPa.
- 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.
- 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.
- 5. The Contractor shall remove free water and prevent the flow of water, which could adversely affect the quality of the sprayed concrete.
- 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. Spraying shall be discontinued if wind causes separation of the nozzle stream.
- 8. Concrete shall not be sprayed in air temperatures less than 5°C.
- 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.
- 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.
- 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.
- 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.
- 13. In water curing, the surface of the sprayed concrete shall be kept continuously wet for at least seven days.

S7.21 NO FINES CONCRETE

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.

S7.22 TOLERANCES

- 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.
- 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

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 applicable	+ 25

- 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.
- 5. Departure may be sudden (eg. misfit at joint in formwork) or gradual (eg. 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 departur		0.004 (10mm max.)
	- Sudden departure	3mm max.

S8 LANDSCAPING

GENERAL

S8.01 SCOPE

- 1. This specification details all requirements pertaining to Tree Planting, Grassing, Turfing, Hydromulching and Irrigation works associated with permanent and temporary revegetation works.
- 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.

S8.02 REFERENCE DOCUMENTS

Australian Standards

- AS1432 Copper Tubes for Plumbing, Gasfitting and Drainage Applications
- AS/NZS1477 PVC Pipes and Fittings for Pressure Applications
- AS2032 Code of Practice for Installation of PVC Pipe Systems
- AS2507 The storage and Handling of Pesticides
- AS2845 Water Supply Back Flow Prevention Devices
- AS3785 Solvent Cements and Priming Fluids for Use with UPVC Pipes and Fittings
- AS4419 Soils for Landscaping and Garden Use
- S4454 Composts, Soil Conditioners and Mulches

All Australian Standards referenced in this specification shall be the current edition.

QLD Government Legislation

Queensland Land Protection Act (2002)

Whitsunday Regional Council

• Whitsunday Pest Management Plan

MATERIALS

S8.03 GRASS SEEDING

- 1. The grass seeding species mix shall consist of the following:
 - 30% Cynodon Dactylon (green couch) hulled
 - 30% Cynodon Dactylon (green couch) unhulled
 - 30% Axonpus Affinis (carpet grass)
 - 10% Tetila Rye (in dry season) or Japanese Millet (in wet season)
- 2. The accepted final mix shall be dependent upon local conditions, soil properties, and method of works.

S8.04 TURFING

- 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.
- The turf shall be supplied as rolls in long lengths of uniform width, not less than 300mm, and shall be in sound unbroken condition.
- 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.
- 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.
- 5. Acceptable species for this region are as follows:
 - Axonopus compresus (Broad leaf buffalo)
 - Digitaria didactyia (Blue Couch)
 - Cynodon dactylon (Bermuda Couch / Green Couch).

S8.05 HYDROMULCH

1. The hydromulching mixture shall consist of the following:

Mulch

Pulped Paper / Bagasse or Cane fibre

Fertiliser

Broad spectrum type CK55 or equivalent.

Seed

33% Cynodon Dactylon (Green Couch) - hulled

33% Cynodon Dactylon (Green Couch) - unhulled

33% Axonopus Affinis (Carpet Grass)

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.

Binder / Tackifier

Binder is to be non-toxic, inert, water soluble and non-flammable, e.g. Curasol or equivalent.

Tackifier is be a non-toxic and biodegradable e.g. Envirotack or equivalent.

S8.06 PLANT STOCK

- 1. All plant species shall be as detailed on the approved Project Drawings. There shall be no substitution of any species without Council approval.
- 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 Phytopthera, palm beetle, sooty mould and scale, and all containers shall be free from pernicious weeds.
- 3. All plants shall be grown in containers and shall comply with the following minimum size requirements:
 - Trees 25 litre container for street tree planting
 - Trees 45 litre container for medians, tree guards, traffic islands and roundabouts
 - · Single stemmed palms 45 litre container
 - Clumping Palms 45 litre container
 - Shrubs 200mm container
 - Groundcovers 140mm container.
- 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.
- 5. Species identified in the following are prohibited from use:
 - Land Protection (Pest and Stock Route Management) Act 2002, and the associated
 - Land Protection (Pest and Stock Route Management) Regulation 2003
 - Species identified in the Local governments Pest Management Plans, and
 - Publication "Agricultural and Environmental Weeds Far North Queensland" (Wet Tropics Management Authority and Department of Natural Resources and Mines

S8.07 SOIL MIX

- 1. A good quality landscaping soil mix shall be imported from an approved source to the planting site for backfilling the planting pits.
- 2. Specification for the landscaping soil mix are as follows:
 - It shall contain approximately 70% sandy loam and 30% composted or mature organic matter;
 - It shall be friable and not contain any clay;

- The pH shall be between 5.5 and 7.0;
- It shall be free from contaminants such as the seed of declared weeds, rocks sticks and salts;
- ☐ It shall not contain any chemical fertilisers.

S8.08 FERTILISER

1. Fertiliser shall conform to the requirements stated in Table S8.01.

Table S8.01 Fertiliser Types

Location	Chemical Type	Type of Application	NPK Analysis
Grass Seeding	Inorganic	Surface broadcast	N 15 to 24
(Complete lawn fertiliser)			P 6 to 9
Turfing	Inorganic	Surface broadcast	N 15 to 24
(Complete lawn fertiliser)			P 6 to 9
Tree Planting	Organic or Inorganic	Fertiliser Tablets	N 15 to 25
(Controlled Release	inorganic	(2 per tree)	P 3 to 9
Planting Beds	Organic or	Granular	N 18 to 25
(Controlled Release Fertiliser)	Inorganic		P 3 to 7
1 31411331)			K 9 to 18

S8.09 IRRIGATION PIPEWORK

- 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.
- 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

S8.10 GRASS SEEDING

- 1. Prior to grass seeding all weeds shall be killed by spraying a suitable herbicide. Sprayed areas shall remain undisturbed for two weeks.
- 2. Prior to grass seeding the ground surface shall be lightly tyned 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.
- 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 poor quality and is too rocky.
- 4. Grass seeding applied by drill seeding at the minimum rate of 50kg per hectare using the species mix specified.
- 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.
- 6. Seed and fertiliser should be applied at an even rate using a calibrated disc drill seeder followed by a chain and roller.
- 7. Disc's should cut approximately 12mm and create enough friable material for chains to cover the seed.
- 8. Where one pass fails to develop enough friable material a second pass should be made in a transverse direction.
- 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:-

Periods after grassing	Watering(s)
Immediately	Once
Week 1	Twice / day during hot, dry or windy periods
	Once / day during cool / overcast periods
Weeks 2	Once / day
Weeks 3 & 4	Once every second day
Week 5 until necessary	Twice a week
or as necessary to ensure 80% minimum	m strike rate.

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

S8.11 TURFING

1. Prior to turfing all weeds shall be killed by spraying a suitable herbicide. Sprayed areas shall remain undisturbed for two weeks.

- 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.
- 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.
- 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.
- 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.
- 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.
- 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. On steep slopes (exceeding 10%) turf may be held in position by softwood pegs or stakes, located at each end of the turf sections.
- 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:-

Periods after grassing	Watering(s)
Immediately	Once
Week 1	Once every second day
Weeks 2, 3 and 4	Three times each week
Weeks 5 to 12	Twice a week

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.

S8.12 HYDROMULCHING

- 1. Prior to hydromulching all weeds shall be killed by spraying a suitable herbicide. Sprayed areas shall remain undisturbed for two weeks.
- 2. Batter slopes less than 20% shall then be lightly tyned 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.
- 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.
- 4. Dry surfaces shall be watered by a fine spray before the application of the hydromulch.

- 5. The slurry mixture of mulch, binder, fertiliser and seed is to be kept in a homogenously mixed state throughout the mulching operation.
- 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.
- 7. Additional protective treatments (eg. fibre matting, anionic bitumen emulsion etc) shall be as specified on the approved Project Drawings.
- 8. Hydromulch shall not be applied under the following weather conditions at the site:
 - when temperature is higher than 35°C
 - when winds exceed 15 km/hr;
 - where the surface is too wet or
 - during rain periods or when rain appears imminent.
- 9. The rate at which the mulch is applied is dependent on slope shall be in accordance with Table S8.02.

Table S8.02 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 3kg	15 litres 4kg	30 litres 5kg
Mulch Thickness	1-2mm	2-3mm	2-4mm	2-4mm	4-6mm

2

11. 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:-

Periods after grassing	Watering(s)
Immediately	Once
Week 1	Twice / day during hot, dry or windy periods
	Once / day during cool / overcast periods
Weeks 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.

- 12.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%.
- 13. 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.

S8.13 PLANTING

- 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.
- 2. All plants shall be obtained from a nursery located in an area having a similar climate to the site of the Works.
- 3. Shrub and ground cover planting to verges and traffic islands etc. shall be as detailed on the approved Project Drawings.
- 4. Prior to planting all weeds shall be killed by spraying a suitable herbicide. Sprayed areas shall remain undisturbed for two weeks.
- 5. Street trees shall be planted at the locations as shown on the approved Project Drawings.
- 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.
- 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. Plants should be watered directly after planting prior to spreading of mulch. The mulch shall be left just clear of the plant stem.
- 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 Standard Drawing S4210 for details.

- 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 depth.
- 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.
- 12. Tea-tree mulch is prone to combustion and shall not be used unless permission is obtained from Council. .
- 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.
- 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.
- 15. Acceptance shall be subject to achieving the following criteria. Plants, which do not meet the acceptance criteria, shall be replaced. Replacement plants shall be of similar size and quality and of identical species and variety to the plant being replaced.
 - · Plants shall exhibiting signs of healthy growth,
 - Plants shall be well formed,
 - Plants shall be free from disease or insect pests,
 - Plants shall be free of physiological disease symptoms (yellowing, wilting etc)
 - Mulch shall be free from weeds, sticks, rubbish and other deleterious material,

IRRIGATION

S8.14 GENERAL

- 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.
- 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.

S8.15 EXCAVATION

- 1. Do not excavate by machine within 500mm of existing underground services.
- 2. The standard width of trench for pipes shall be 150mm.
- 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.

S8.16 LAYING OF PIPES

- 1. All pipe work to be bedded in clean fill sand with a minimum cover of 50mm all round.
- 2. Special precautions are to be taken to exclude dirt, sand, grit or gravel from entering pipelines.
- The open ends of pipes shall be plugged at the end of the day's work to prevent entry of water or mud.

S8.17 PRESSURE TESTING

- 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.
- 2. All tests shall be carried out under the supervision and in the presence of the Council Inspector.
- 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.
- 4. The Contractor shall give 48 hours notice to Council so that arrangements can be made for supervision of the testing.
- 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.

S8.18 FLUSHING

1. After pressure testing has been carried out the new pipework shall be flushed as thoroughly as possible with the available water pressure.

S8.19 CONTROLLERS

1. All Council landscaped areas, which require irrigation systems shall be controlled by electrically, operated solid state controller.

S8.20 FILTRATION

1. All irrigation systems shall be fitted with an approved flow strainer installed in a secure enclosure.

S8.21 VALVES

- 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.
- 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.
- 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.
- 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.

2

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.

S8.22 BACKFLOW PREVENTION DEVICES

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.

S8.23 PERFORMACE TEST

- 1. On completion of the installation the system shall be tested in the presence of a Council Inspector.
- 2. The system shall be operated to demonstrate that all components function as required by the design.
 - 3. The Contractor is responsible for making all necessary alterations to the system so that the performance is in accordance with the design specifications.

S8.24 BACKFILLING OF TRENCHES

- 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.
- 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

This form duly completed and signed by an authorised agent of the Designer shall be submitted with the Operational Works Application for Council Approval.

me of Development
cation of Development
pplicant
esigner

It is hereby certified that the Calculations, Drawings, Specifications and related documents submitted herewith have been prepared, checked and amended in accordance with the requirements of the Whitsunday Regional Council Development Manual and that the competed works comply with the requirements therein, except as noted below.

Compliance with the requirements of the Operational Works Design Guidelines	Non-Compliance refer to non- compliance report / drawing number
Plan Presentation	
Geotechnical requirements	
Geometric Road Design	
Pavements	
Structures / Bridges	
Subsurface Drainage	
Stormwater Drainage	
Site Re-grading	
Erosion Control and Stormwater Management	
Pest Plant Management	
Cycleway / Pathways	
Landscaping	
Water Source and Disinfection / Treatment Infrastructure (if applicable)	
Water Reticulation and Pump Stations	
Compliance with the requirements of the Operational Works Design Guidelines	Non-Compliance refer to non- compliance report / drawing number
Sewer Reticulation and Pump Stations	
Electrical Reticulation and Street Lighting	

Public Transport	
Associated Documentation / Specification	
Priced Schedule of Quantities	
Referral Agency Conditions	
Supporting Information (AP1.08)	
Other	

Conscientiously believing the above statements to be tr	ue and correct, signed on behalf of:
Designer	RPEQ No
Name in Full	
Signature	Date

APPENDIX A - INSPECTION & TEST REQUIREMENTS

Elements of Work	Consulting Engineer's Responsibility	Council's Responsibility
Clearing and Grubbing		
Location	HOLD POINT upon completion of survey, inspect defined limits of clearing.	WITNESS POINT Joint inspection of defined limits and tree removal if considered warranted.
Allotment Filling		
Quality of Material	Examine and assess all test results.	Visit site for random audit inspections if considered warranted.
Compaction	Examine and assess all test results.	Visit site for random audit inspections if considered warranted.
Alignment		Visit site for random audit inspections if considered warranted.
Subgrade		
Compaction	Routinely visit site.	Visit site for random audit inspections.
	HOLD POINT Attend during proof rolling.	HOLD POINT Joint inspections during proof rolling.
CBR Tests (if ordered)	Examine and assess all test results.	Assess all test results
Horizontal & Vertical	Routinely visit site.	Visit site for random audit inspections.
Alignments	Examine and assess all test results and cross section geometry.	Assess all test results and cross section geometry.
Profile	Routinely visit site.	Visit site for random audit inspections.
	HOLD POINT Attend during completion of trimming and removal of soft spots.	HOLD POINT Joint inspections during trimming and removal of soft spots.
Embankments	Routinely visit site.	WITNESS POINT Visit site for random audit
	HOLD POINT Attend during placement of fill.	inspections if considered warranted.
Subgrade Replacement		
Material Quality	HOLD POINT Make sufficient routine visits to assess quality of materials.	WITNESS POINT Visit site for random audit inspections if considered warranted.
	HOLD POINT Examine and assess all test results.	
Compaction	HOLD POINT Make sufficient routine visits	WITNESS POINT Visit site for random audit
(a) For on site material	to assess that operations will achieve a sound compacted layer.	inspections if considered warranted.
(b) For graded material	HOLD POINT Examine and assess all test results.	
Profile & Depth	HOLD POINT Examine and assess all test results.	WITNESS POINT Visit site for random audit inspections if considered warranted.
Sub-base Layer		
Material Quality	Routinely visit site.	WITNESS POINT Visit site for random
	Examine and assess all test results.	inspections if considered warranted.
Compaction	Routinely visit site.	WITNESS POINT Visit site for random
	HOLD POINT Attend during proof rolling.	inspections if considered warranted.
	Examine and assess all test results.	
Profile & Depth	Routinely visit site.	HOLD POINT Joint inspection on
	HOLD POINT Attend at completion of final preparation.	completion of final preparation.
	Examine and assess all test results and cross section geometry.	

Elements of Work	Consulting Engineer's Responsibility	Council's Responsibility
Base layer		
Material Quality	Routinely visit site.	Visit site for random audit inspections.
Compaction	Routinely visit site.	Visit site for random audit inspections.
	HOLD POINT Attend during proof rolling.	HOLD POINT Joint inspection on
	Examine and assess all test results and cross section geometry.	completion of final preparation.
Horizontal and vertical	Routinely visit site.	Visit site for random audit inspections.
alignment (a) With no Kerb & Channelling (b) With Kerb & Channeling	Examine and assess all test results and cross section geometry.	
Profile	Routinely visit site.	Visit site for random audit inspections.
	HOLD POINT Attend at completion of final preparation	HOLD POINT Joint inspection on completion of final preparation.
Surfacing		
Material Quality		WITNESS POINT Visit site for random inspections if considered warranted.
Compaction & Thickness		WITNESS POINT Visit site for random inspections if considered warranted.
Horizontal & Vertical Alignments		WITNESS POINT Visit site for random inspections if considered warranted.
Profile	HOLD POINT Undertake a Pre-seal Inspection.	HOLD POINT Undertake a Pre-seal Inspection.
Sub-soil Drains		
Pipe	Routine inspections of Contractor's Performance and progress of works.	Visit site for random inspections if considered warranted.
Filler Material	Routine inspections of Contractor's Performance and progress of works.	Visit site for random inspections if considered warranted.
Cleaning Joints and Markers	Routine inspections of Contractor's Performance and progress of works.	Visit site for random inspections if considered warranted.
Geofabric	Routine inspections of Contractor's Performance and progress of works.	Visit site for random inspections if considered warranted.
Kerb & Channel		
Material Quality	HOLD POINT Inspect foundations prior to kerb placement	HOLD POINT Visit site for inspection
Horizontal & Vertical	Inspect completed kerb.	HOLD POINT Visit site for inspection
Alignments	Water test where appropriate.	
Road Crossing Conduits		
Location	Routine inspections of Contractor's Performance and progress of works.	Visit site for random inspections if considered warranted.
Markers	Routine inspections of Contractor's Performance and progress of works.	Visit site for random inspections if considered warranted.
Building / Structures	Ensure Council Approval of all building / structures.	Inspect and ensure compliance.

Elements of Work	Consulting Engineer's Responsibility	Council's Responsibility
Stormwater Drainage		
Location of Structures	HOLD POINT Sufficient visits to assess compliance and to view progress and works.	
SL & IL at Structures	HOLD POINT Sufficient visits to assess compliance and to view progress and works.	
Material Quality (Bedding, Concrete, Pipes)	HOLD POINT Sufficient visits to assess compliance and to view progress and works.	WITNESS POINT Visit site for inspection prior to laying of pipe and bedding.
	HOLD POINT Visual inspection prior to placement of structure/s after bedding sand.	
Manholes	HOLD POINT Sufficient visits to assess compliance and to view progress and works.	
Drain Lines	HOLD POINT Sufficient visits to assess compliance and to view progress and works.	
Backfilling	HOLD POINT Sufficient visits to assess compliance and to view progress and works.	HOLD POINT Visit site for inspection prior to backfilling.
'Cast Insitu' Reinforced Concrete Work	HOLD POINT Inspect reinforcement and formwork prior to concrete pour.	HOLD POINT Inspect reinforcement and formwork prior to concrete pour.
Landscaping		
Grass Establishment	Routine inspections of Contractor's Performance.	Visit site for check at defects liability inspection.
Tree Planting	Routine inspections of Contractor's Performance.	
	Confirm all affected areas are topsoiled, grassed and maintained.	
Irrigation	WITNESS POINT Witness and approve	
(a) Pipelines	pressure and performance test.	
(b) Pressure Testing Pipelines		
(c) Performance Testing		
Soil & Water Quality	HOLD POINT Examine and approve contractors ESCP for compliance with ESCS.	WITNESS POINT Visit site for inspection if considered warranted.
	ESC Measures for works area are in place prior to works commencing on this section or stage.	
	Randomly audit and inspect ESC measures for compliance with contractors ESCP.	

Elements of Work	Consulting Engineer's Responsibility	Council's Responsibility
Sewerage Reticulation		
Location MH's & HC's	Routine inspections.	
IL at MH & HC's	Routine inspections and review of field information.	
Backfilling	Routine inspections of Contractor's Performance .	WITNESS POINT Visual inspection after excavation prior to bedding.
	HOLD POINT Visual inspection after excavation prior to bedding.	Visual inspection of lines prior to backfill.
SP Boundary Set Out	Routine inspections of Contractor's Performance.	
	Review of field measurements.	
Material Quality (Bedding, Concrete, Pipes)	Assess all test results.	
Manholes, Maintenance Shafts & Benching	Routine inspections.	
Hydrostatic Testing of Manholes	HOLD POINT Witness hydrostatic testing of manholes.	WITNESS POINT Witness hydrostatic testing of manholes.
Pipelines	HOLD POINT Witness pressure test of lines.	HOLD POINT Visual inspection after excavation prior to bedding.
		HOLD POINT Witness pressure test of lines.
Thrust/anchor blocks	HOLD POINT Visual site inspection of anchor/thrust blocks prior to concrete pour.	WITNESS POINT Visual site inspection of anchor/thrust blocks prior to backfill.
Trunk Infrastructure	HOLD POINT Pre-connection visual inspection of trunk lines.	HOLD POINT Pre-connection visual inspection of trunk lines.
Pump Stations and Valve Chambers		
Excavation	Routine inspections of Contractor's performance.	
Foundation Inspection	WITNESS POINT. Confirm water table level and founding condition.	WITNESS POINT Inspect foundation prior to placing formwork / reinforcement.
	WITNESS POINT Inspect foundation prior to placing formwork / reinforcement.	
Base slab reinforcement, formwork and water stop	HOLD POINT Inspect reinforcement, water stop and formwork prior to concrete pour.	Visual inspection of reinforcement, water stop and formwork prior to concrete base pour.
Reinforcement and formwork	HOLD POINT Inspect reinforcement and formwork prior to concrete pour.	Visual inspection of reinforcement and formwork prior to concrete pour.
		WITNESS POINT Visual inspection of concrete prior to stripping of formwork.
Materials testing	Assess all test results.	WITNESS POINT Review materials testing.
Hydrostatic Testing	HOLD POINT Witness hydrostatic test.	HOLD POINT Witness hydrostatic test.
Electrical and SCADA equipment	WITNESS POINT. Review switchboard test certification. Inspect installation.	WITNESS POINT Review certification of switchboards prior to delivery to site.
		WITNESS POINT Review certification of telemetry (SCADA) prior to delivery to site.
Lifting chain	WITNESS POINT Review certification of lifting chain.	WITNESS POINT Review certification of lifting chain.
Pump testing and Station Commissioning	HOLD POINT Witness pressure and draw down testing of pumps.	HOLD POINT Witness pressure and draw down testing of pumps.
	HOLD POINT Inspection against commissioning checklist.	HOLD POINT Inspection against commissioning checklist.

Elements of Work	Consulting Engineer's Responsibility	Council's Responsibility
Water Reticulation		
Location	Routine inspections of Contractor's Performance.	
	Review of field measurements.	
SP Boundary Set Out	Routine inspections of Contractor's Performance.	
	Review of field measurements.	
Valves, Hydrants, Scours, Bends	Routine inspections of Contractor's Performance.	
	Review of field measurements.	
Depth	Routine inspections of Contractor's Performance.	
	Review of field measurements.	
Material Quality (Bedding, Concrete, Pipes) Pipelines	Assess all test results.	
	HOLD POINT Visual inspection after excavation prior to bedding.	HOLD POINT Visual inspection after excavation prior to bedding.
	HOLD POINT Witness pressure test of lines.	HOLD POINT Witness pressure test of lines.
	HOLD POINT Witness chlorine swabbing of lines – pre-amalgamation DSC area.	
	WITNESS POINT Disinfection / flush of pipeline.	WITNESS POINT Disinfection / flush of pipeline.
Thrust/anchor blocks	HOLD POINT Visual site inspection of anchor/thrust blocks prior to concrete pour.	HOLD POINT Visual site inspection of anchor/thrust blocks prior to concrete pour.
Backfilling	Routine inspections of Contractor's Performance	Visual inspection of lines prior to backfill.
	HOLD POINT Visual site inspection prior to backfill.	WITNESS POINT Visual site inspection prior to backfill.
Prior to Acceptance of works for "Defects Liability Period"	Forward As Constructed submission to Council with Registered Surveyor's and Consulting Engineer's certification attached.	Council to accept and conduct Audit checks of As Constructed Drawings and advise any requirements.
	Finalise all other Documentation in accordance with Construction Procedures.	Council Inspector to accompany Consulting Engineer and Contractor and to advise any requirements.
	Complete "Defects Liability" Inspection Checklist prior to joint inspection with Council.	When completed advise in writing of acceptance of works for commencement of "Defects Liability Period".
During "Defects Liability Period"	Consulting Engineer to confirm all minor omissions and defects have received suitable attention and to examine and approve site prior or asking for "Final Acceptance of works" Inspection.	Council to advise Consulting Engineer of any defects.
Prior to Final Acceptance of works	Consulting Engineer to accompany Council Inspector and to note any requirements.	Council Inspector to accompany Consulting Engineer and Contractor and to advise any requirements.
		When completed advise in writing of final acceptance of works.

TEST REQUIREMENTS

Verificat Construction Activity		on Requirement	Minimum Test	Specification	Minimum
Construction Activity	Description Test Required		Frequency	Requirement	No. of Tests
		SEWER MAIN CONS	TRUCTION		
Embedment	Compaction		WSA02-2014 19		
Trench Fill	Compaction		WSA02-2014 20.1		
One it Bines	Air Pressure and Vacuum	Table S6.2, Operational Wo	orks Specification S6 "Sewerage Re	eticulation", WRC Developmer	t Manual
Gravity Pipes	Deflection		WSA02-2014 20.1.4		
	CCTV Inspection		WSA02-2014 22.7		
Manholes	Vacuum or Hydrostatic	Clause S6.26, Operational W	orks Specification S6 "Sewerage R	Reticulation", WRC Developme	ent Manual
		SEWER PUMP STATION CO	NSTRUCTION		
Embedment	Compaction		WSA04-2005 36.3		
Backfilling	Compaction		WSA04-2005 36.3		
Switchboards	Electrical Testing		WSA04-2005 36.9		
		WATER MAIN CONST	RUCTION		
Embedment	Compaction		WSA03-2011 16		
Trench Fill	Compaction		WSA03-2011 17.1		
Pipes	Pressure	Clause S5.28, Operational	Works Specification S5 "Water Ret	ticulation", WRC Development	Manual
Disinfection	Bacteriological		WSA03-2011 20		
		STORMWATER DRAINAGE C	ONSTRUCTION		
		Q111A/B/C or			
		RDD AS 1289.5.4.1 or	1/50m²		1
Excavation Compaction	AS 1289.5.7.1		050/ 0000		
	Compaction	Q110A or		95% SRDD	
		MDD AS 1289.5.1.1 or AS 1289.5.7.1	1/RDD		n/a

	Ver	Verification Requirement Description Test Required		Minimum Test	Specification	Minimum		
Construction Activity	Description			Frequency	Requirement	No. of Tests		
	STORM	MWATER DRA	AINAGE CONSTRUC	TION (cont'd)		•		
		Grading	Q103A or AS 1289.3.6.1					
	Material Quality	Linear	Q106 or	1/material type	Table 19.2.6, MTRS04	n/a		
		Shrinkage	AS 1289.3.4.1					
			Q111A/B/C or	Under trafficable area 1/side/50m				
Bedding/Haunch	Compaction (Cohesive)	RDD	AS 1289.5.4.1	Elsewhere 1/side/100m	Table S4.1, Operational Works Specification S4 "Stormwater Drainage",	2		
(RCP, RCBC or similar)		MDD	Q110A or Q132A	1/material type		n/a		
		Density	Q132B or	Under trafficable area 1/side/50m	WRC Development Manual	2		
	Compaction (Cohesionless)	Index	AS 1289.5.6.1	Elsewhere 1/side/100m		2		
				Min/Max	AS 1289.5.1.1 or	1/material type		n/a
		Dry Density	AS 1289.5.5.1	innatorial type		11/4		
		Grading	Q103A or AS 1289.3.6.1		Table 19.2.3, MRTS04			
	Material Quality	Linear	Q106 or	1/material type		n/a		
		Shrinkage	AS 1289.3.4.1					
Backfill	II or similar) Compaction (Design Trench Width ≤ 4m)			Q111A/B/C or	Under trafficable area 1/300mm lift/50m	Table S4.1 Operational	1	
(RCP, RCBC or similar)		RDD	AS 1289.5.4.1 or	Elsewhere	Table S4.1, Operational Works Specification S4	(between		
				AS 1289.5.7.1	1/900mm lift/100m	"Stormwater Drainage", WRC Development	structures)	
		MDD	Q110A or AS 1289.5.1.1 or	1/material type	- Manual	n/a		

			AS 1289.5.7.1		1/RDD		
Construction Activity	Verif	erification Requirement Test Required		Minimum Test Frequency		Specification Requirement	Minimum No. of
Construction Activity	Description						Tests
	STO	ORMWATER	DRAINAGE CONS	TRUCTIO	N (cont'd)		
			Q111A/B/C or		r trafficable area		4
Backfill	Compaction	RDD	AS 1289.5.4.1 or	1/300	0mm lift/200m ²		(between
(RCP, RCBC or similar)	(Design Trench Width > 4m)		AS 1289.5.7.1	1/9	Elsewhere 00mm lift/400m ²		structures)
(cont'd)	,	MDD	Q110A or AS 1289.5.1.1 or AS 1289.5.7.1	1/r	material type 1/RDD		n/a
	Material Quality Plasticity index	Q103A or AS 1289.3.6.1			100% < 50mm	,	
Backfill			Q105 or AS 1289.3.3.1	1/material type		2 <u>≤</u> IP <u>≤</u> 12	— n/a
(In-Place Structures other than RCP, RCBC or similar)		RDD	Q111A/B/C or AS 1289.5.4.1 or AS 1289.5.7.1	2	:/500mm lift	Table S4.1, Operational Works Specification S4	2
	Compaction	MDD	Q110A or AS 1289.5.1.1 or	1/r	material type	"Stormwater Drainage", WRC Development Manual	n/a
			AS 1289.5.7.1	1/RDD			
Backfill (Stabilised Sand)	Material Quality	Table 19 MI	Stabilised sand shall comprise sand meeting the requirements of Table 19 MRS11.04 in an intimate mixture of 12 parts sand and 1 part of either Type GP or GB cement			Table 19.2.5, MRTS04	n/a
Bedding/Haunch/Backfill/Overlay	Material Quality	recommer	All materials shall be in accordance with the manufacturer's recommendations. Evidence of these recommendations and subsequent compliance shall be incorporated with the Contractor's quality records.		As per manufacturer recommendations.		
(Buried Metal Corrugated Structures)	Installation	recommer	tion shall be in accordant ndations. Evidence of the equent compliance shall Contractor's qualit	ese recomm be incorpor	nendations and	As per manufacturer recommendations.	's

Construction Activity	Verifica	ation Requir	ement	Minimum Test	Specification	Minimum No. of						
Constitution Activity	Description	on	Test Required	Frequency	Requirement	Tests						
	ST	ORMWATE	ER DRAINAGE CONSTRUCTION (cont'd)									
Stormwater Drainage System	CCTV Inspec	tion	Appendix A, Operational Works Specification S4 "Stormwater Drainage", WRC Development Manual									
			ROAD CONSTRUCTION									
			Q111A/B/C or AS 1289.5.4.1 or AS 1289.5.7.1	1/2500m²	>0.3m below pavement subgrade - 95% SRDD	3						
Ground Surface Treatment	Compaction	MDD	Q110A or AS 1289.5.1.1 or AS 1289.5.7.1	1/RDD	<0.3m below pavement subgrade - 97% SRDD	n/a						
Embankment	O-manuting.	RDD	Q111A/B/C or AS 1289.5.4.1 or AS 1289.5.7.1	1/200mm lift/2500m² or 1/500m³	>0.3m below pavement subgrade - 95% SRDD	3						
(Road)	Compaction	MDD	Q110A or AS 1289.5.1.1 or AS 1289.5.7.1	1/RDD	<0.3m below pavement subgrade - 97% SRDD	n/a						
Embankment	Compaction	RDD	Q111A/B/C or AS 1289.5.4.1 or AS 1289.5.7.1	1/200mm lift/500m ² or 1/100m ³	>0.3m below pavement subgrade - 95% SRDD	3						
(Concentrated Operations – Gullies etc)	Compaction	MDD	Q110A or AS 1289.5.1.1 or AS 1289.5.7.1	1/RDD	<0.3m below pavement subgrade - 97% SRDD	n/a						

Construction Activity	Verif	ication Require	ement	Minimum Test	Specification	Minimum No. of Tests	
•	Description	Te	st Required	Frequency	Requirement		
		ROAD	CONSTRUCTION (C	ont'd)			
	Material Quality	CBR	Q113C (soaked)	Representative each material and 1 test per 500m carriageway or part thereof	97% MDD 100% OMC	n/a	
Subgrade			Q111A/B/C or				
(General)	Compaction	RDD	AS 1289.5.4.1 or	1/1000m²		3	
			AS 1289.5.7.1		97% SRDD		
	Compaction		Q110A or		37 70 OKDD		
		MDD	AS 1289.5.1.1 or	1/RDD		n/a	
			AS 1289.5.7.1				
			Q111A/B/C or				
		RDD	AS 1289.5.4.1 or	1/100m²		1	
Subgrade	Compaction		AS 1289.5.7.1		97% SRDD		
(Turnouts and Entrances)	Compaction		Q110A or		0770 01122		
		MDD	AS 1289.5.1.1 or	1/RDD		n/a	
			AS 1289.5.7.1				
	Material Quality	supplier a		facturer's testing to assure prated with the Contractor's	MRTS05 Section 7.2 "Type 2 Unbound Material"		
			Q111A/B/C or	1/500m²		4	
Pavement Layers		RDD	Q112 or	2/500m²		8	
(General)	Compaction	ואס	AS 1289.5.4.1	1/500m² (2/500m² if using AS1289.5.8.1)	100% SRDD	4 (8)	
		MDD	Q110A or AS 1289.5.1.1 or AS 1289.5.4.2	1/material type/5000m² as required		n/a	

Construction Activity	Veri	fication Requi	rement	Minimum Test	Specification	Minimum No. of
Construction Activity	Description	Te	st Required	Frequency	Requirement	Tests
		ROA	l (cont'd)			
			Q111A/B/C or	1/100m²		
		RDD	Q112 or 2/100m ²		1	
Pavement Layers	Compaction	KDD	AS 1289.5.4.1	1/100m² (2/100m² if using AS1289.5.8.1)	100% SRDD	
(Turnouts and Entrances)	·		Q110A or	4 /m etarial tura		
		MDD	AS 1289.5.1.1 or	1/material type		n/a
			AS 1289.5.4.2	as required		
			AS 1012.1			
	Communicacións		AS 1012.3.1	1 sample of 2 cylinders	Table S7.1, "Concrete	1 sample
Structural Concrete	Compressive		AS 1012.8.1	for each 15m³ or part thereof placed in an essentially	Classes", WRC	per casting
	Strength		AS 1012.9	continuous manner	Development Manual	day
			AS 1012.12.1			

Table 19.2.3 - Select Backfill Properties

MRTS04

AS SIEVE SIZE (mm)	Percent (by mass) Passing Sieve								
AS SIEVE SIZE (IIIII)	Gravel *	Loam							
37.5	100	100							
9.5	60 – 85	100							
2.36	25 - 70	70 – 100							
0.425	10 – 40	10 – 40							
0.075	3 - 30	3 - 30							
Other Properties Linear Shrinkage	8 maximum	6 maximum							

^{*} Material of size greater than 2.36mm shall be stone

Table 19.2.5 - Sand Properties

MRTS04

Property	Natural Sand	Blended and Manufactured Sand
Percent passing 6.7mm AS sieve	100	100
Percent passing 0.075mm AS sieve (maximum)	5	20
Plasticity Index (maximum)	5	10

Table 19.2.6 – Grading Limits for Bedding Material

MRTS04

AS SIEVE SIZE (mm)	% Passing By Mass
19	100
2.36	30 – 100
0.425	15 – 70
0.075	Mar-30
Other Properties Linear Shrinkage	6 maximum

APPENDIX B - SEWER MAINS INSPECTION AND TEST PLAN TEMPLATE

INSPECTION AND TEST PLAN - SEWER MAIN LAYING

ITP to be completed by Consulting Engineer

Devel	oper:		Consultant Engineer:		Consultant Engineer Representative:						
Proje	ct:		Contractor:		Contractor S	Site Represe	ntative:				
Descr	iption:		Sub-contractor:		Witness, Ho	ld & Surveill	ance poir	its added to IT	P		
			Field Tester:								
Locat	ion:		ITP Prepared by:	Reviewed by:	Council Representative:						
			Date / /	Date / /	Date / /						
No	Construction/Inspection Activity			ure & Acceptance Criteria	Contractor	Consulting Engineer	Council*	Record	Comment		
1	Pre start/Site establish	Pre-Start (S1)	Meeting Checklist. Site establis	shment visual check. Checklist completed.	I	н	Н	Checklist S1			
2	Approved materials on Site and delivered	Visual ch	eck approved materials. Quant	ity and condition. Checklist completed (S2)	I	I	S	Checklist S2			
3	Excavation and pipe laying			Standards. Checklist completed. (S3)	I	н	W	Checklist S3			
4	Maintenance Shafts	Visual an	d dimensional check to WRC S	Standards. Checklist completed (S4)	I	Н	S	Checklist S4			
5	Survey of main in easement	Survey of	pipe location before backfill		1	I	S				
6	Anchor/Thrust Blocks	Visual an	d dimensional check to WRC S	Standards. Checklist completed.	I	Н	Н				
7	Embedment and Trench Fill	Visual ch	eck and compaction testing to	WRC Standards	1	н	W	Compaction test results			
8	Surface fittings	Visual an	d dimension check to WRC Sta	andards (S5)	I	I	S	Checklist S5			
9	Testing		, deflection and compaction tes		I	Н	W	Test Results			
10	Pre-Connection Inspection		spection to all party's standards nagement procedures as per Jo		Н	н	Н	Checklist S6			
12	Restoration	Visual ins	spection against photographs.	Clearance letter from Council/property owner	1	W	S	Clearance letter			
Sym	bol Legend	No	0	Amendment	Date	Reviewed	ı	Valida	tion		
I ⊢	Inspection Mandatory Hold Pe	pint					constr		s have been lance with WRC spection and Test		
٧	/ Witness Point										
S	Surveillance						Consu Date	lting Engineer / /			

^{*} Council reserves the right to vary these requirements at any time ** Council's written approval MUST be obtained prior to varying these requirements

SEWER CHECKLIST S1

PRE-START AND SITE ESTABLISHMENT

JECT:	CONSULTING ENGINEER:													
from: to:	PIPE TYPE: SIZE:						LASS:		CONTRAC	CTOR:				
												SITE 4	SITE 5	SITE 6
			SI	IE			DATE:						1	
DESCRIPTION	1	2	3	4	5	6	MINIM	UM STANI	DARD		•	COMMENT	•	SIGNATURES
Plan current and on site														
Pre construct report inc. photographs														
Fees paid							Counc	il Requirem	nents					
Traffic mgt plan implemented														
Environmental Management Plan on site and implemented														
Receiving sewer located														
Property entry agreement														
Main laying Specification on site														
Footways to finished levels							If layin	g in road re	eserve					
							Regist	ered survey	yor					
All services located							'Dial B	efore You [Dig', Servi	ces				
									vant					
Main layer holding relevant accreditation on site														
ATIONS AND CHANGES:	•						SITE II	NSTRUCTI	ONS:					
MENT:														
	from: to: DESCRIPTION	pescription Plan current and on site Pre construct report inc. photographs Road opening requirements Fees paid Traffic mgt plan implemented Environmental Management Plan on site and implemented Safe Work Plan on site and implemented Receiving sewer located Property entry agreement Main laying Specification on site Footways to finished levels Survey pegs in place Job set out/level sheets All services located Main layer holding relevant accreditation on site ATIONS AND CHANGES:	from: to: PIPE TYPE: DESCRIPTION 1 2 Plan current and on site Pre construct report inc. photographs Road opening requirements Fees paid Traffic mgt plan implemented Environmental Management Plan on site and implemented Safe Work Plan on site and implemented Receiving sewer located Property entry agreement Main laying Specification on site Footways to finished levels Survey pegs in place Job set out/level sheets All services located All services marked Main layer holding relevant accreditation on site ATIONS AND CHANGES:	DESCRIPTION	from: to: PIPE TYPE: SIZE: SITE DESCRIPTION 1 2 3 4 Plan current and on site Pre construct report inc. photographs Road opening requirements Fees paid Traffic mgt plan implemented Environmental Management Plan on site and implemented Safe Work Plan on site and implemented Receiving sewer located Property entry agreement Main laying Specification on site Footways to finished levels Survey pegs in place Job set out/level sheets All services located Main layer holding relevant accreditation on site ATIONS AND CHANGES:	from: to: PIPE TYPE: SIZE: SITE DESCRIPTION 1 2 3 4 5 Plan current and on site Pre construct report inc. photographs Road opening requirements Fees paid Traffic mgt plan implemented Environmental Management Plan on site and implemented Safe Work Plan on site and implemented Receiving sewer located Property entry agreement Main laying Specification on site Footways to finished levels Survey pegs in place Job set out/level sheets All services marked Main layer holding relevant accreditation on site ATIONS AND CHANGES:	from: to: PIPE TYPE: SIZE: C SITE DESCRIPTION 1 2 3 4 5 6 Plan current and on site Pre construct report inc. photographs Road opening requirements Fees paid Traffic mgt plan implemented Environmental Management Plan on site and implemented Safe Work Plan on site and implemented Receiving sewer located Property entry agreement Main laying Specification on site Footways to finished levels Survey pegs in place Job set out/level sheets All services located Main layer holding relevant accreditation on site ATIONS AND CHANGES:	from: to: PIPE TYPE: SIZE: CLASS: DATE: DATE: DATE:	from: to: PIPE TYPE: SIZE: CLASS: SITE DESCRIPTION 1 2 3 4 5 6 MINIMUM STANI Plan current and on site Pre construct report inc. photographs Road opening requirements Fees paid Traffic mgt plan implemented Environmental Management Plan on site and implemented Safe Work Plan on site and implemented Receiving sewer located Property entry agreement Main laying Specification on site Footways to finished levels Survey pegs in place Job set out/level sheets All services marked Main layer holding relevant accreditation on site ATIONS AND CHANGES: SITE INSTRUCTI	from: to: PIPE TYPE: SIZE: CLASS: CONTRACT SITE DATE: DATE	from: to: PIPE TYPE: SIZE: CLASS: CONTRACTOR: SITE DESCRIPTION 1 2 3 4 5 6 MINIMUM STANDARD Plan current and on site Pre construct report inc. photographs Road opening requirements Fees paid Traffic mgt plan implemented Environmental Management Plan on site and implemented Safe Work Plan on site and implemented Receiving sewer located Property entry agreement Main laying Specification on site Fotoways to finished levels Survey pegs in place Job set out/level sheets All services marked Main layer holding relevant accreditation on site Main layer holding relevant accreditation on site ATIONS AND CHANGES: SITE I SITE 1 SITE 1 SITE 2 DATE: CONTRACTOR: SITE I SITE 1 SITE 1 SITE 1 SITE 1 SITE 2 DATE: DATE: PATE: DATE: SITE I SITE 2 DATE: FOMINIMUM STANDARD Council Requirements Council Requirements Founcil Requirements Function Requirements Fu	from: to: PIPE TYPE: SIZE: CLASS: CONTRACTOR: SITE DATE: SITE 2 SITE 3 DESCRIPTION 1 2 3 4 5 6 MINIMUM STANDARD Plan current and on site Pre construct report inc. photographs Road opening requirements Fees paid Council Requirements Fees paid Council Requirements Fees paid Council Requirements Fees paid Fraffic mgt plan implemented Environmental Management Plan on site and implemented Receiving sewer located Property entry agreement Main laying Specification on site Footways to finished levels Survey pegs in place Job set out/level sheets All services located Main layer holding relevant accreditation on site Main layer holding relevant accreditation on site Main layer holding relevant accreditation on site Main layer holding relevant accreditation on site SITE INSTRUCTIONS:	from: to: PIPE TYPE: SIZE: CLASS: CONTRACTOR: SITE DATE: SITE 1 SITE 2 SITE 3 SITE 4 DATE: SITE 1 SITE 2 SITE 3 SITE 1 SITE 2 SITE 3 SITE 1 SITE 2 SITE 3 SITE 1 SITE 1 SITE 1 SITE 2 SITE 3 SITE 1	from: to: PIPE TYPE: SIZE: CLASS: CONTRACTOR: SITE

SEWER CHECKLIST S2 APPROVED MATERIALS ON SITE AND DELIVERED

PRO	JECT:			CONSULTING ENGINEER:										
Date	from: to:	PIPE T	YPE:		SIZE:		CL	ASS:	C	CONTRACTOR:				
				•	AY		•	DAY 1 DAY 2 DATE:			DAY 3	DAY 4	DAY 5	DAY 6
ITEN	DESCRIPTION	1	2	3	4	5	6		INIMUM ST	STANDARD COMM			.1	SIGNATURES
2.1	Delivery Inspection Pipe type and size to current plan Bedding material Trench fill Fittings Surface Fittings Pre Cast chambers Mortar / Plaster Pipe laying accessories IATIONS AND CHANGES													
2.2	Pipe type and size to current plan							Currer	nt Plan					
2.3	Bedding material													
2.4	Trench fill													
2.5	Fittings													
2.6	Surface Fittings													
2.7	Pre Cast chambers													
2.8	Mortar / Plaster													
2.9	Pipe laying accessories													
	MENTS							SITE	NSTRUCTIO	JNS				

SEWER CHECKLIST S3 - PAGE 1 OF 2

	AVATION AND PIPELAYING															
PRO	JECT:	C	CONSULTING ENGINEER:													
Date	from: to:	PIPE T	YPE:		SIZE:		CL	ASS:	C	ON	TRACTOR:					
	***				AY				DAY 1		DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	
				U	AT			DATE:								
	DESCRIPTION	1	1 2 3 4 5 6			MIM	NIMUM ST	AND	DARD	(SIGNATURES					
3.1	Environmental Management Plan on site															
	and implemented															
3.2	WH&S Plan on site and implemented															
	Services exposed															
3.4	Clearance from Services															
3.5	Trench width mm															
3.6	Trench depth to design level															
3.7	Trench shoring/Plating															
3.8	Trench drainage															
3.9	Pipe Embedment															
	Compaction															
	Bedding mm															
	Surrounds/sides mm															
3.10	Pipe laid to grade Jointing to Standards Concrete															
3.11	Jointing to Standards															
3.12	Concrete															
	Trench stops in place															
	Bulkheads in place															
3.13	Property Connection Sewers to Standard															
	Identification tape															
VARI	ATIONS AND CHANGES:							SITE IN	STRUCTIO	ONS:	:					
СОМ	MENT:															

SEWER CHECKLIST S3 – PAGE 2 OF 2

EXCAVATION AND PIPELAYING

PRC	JECT:				C	ONSULTING	ENGINEER:										
Date	from: to:	PIPE T	YPE:	5	SIZE:		CI	LASS: CONTRACTOR:									
		DAY						DATE:	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6			
ITEN	I DESCRIPTION	1	2	3	4	5	6		MUM STA	NDARD		COMMENT	•	SIGNATURES			
3.14	Trench Fill																
	Material																
	Compaction																
	Compaction test							NATA Cei	rtified Lab)							
3.15	Terminal Maintenance Shaft to Standard																
CON	IMENT:																

SEWER CHECKLIST S4MAINTENANCE SHAFTS

PRO	JECT:			CONSULTING ENGINEER:												
Date	from: to:	PIPE TYPE: SIZE:					CL	ASS:	C	CONTRACTOR:						
					MBER			DATE:	CH 1	CH 2	CH 3	CH 4	CH 5	CH 6		
ITEM	DESCRIPTION	1	2	3	4	5	6		NIMUM STA	NDARD	•	COMMENT		SIGNATURES		
4.1	Finished Surface Levels Supplied															
4.2	Drainage requirements															
4.3	Base															
	Placement															
	Channels															
	First shaft section															
4.4	Pre cast chamber															
	Shaft assembled in correct order															
	Step iron location and spacing															
	Sealing															
	Offset cone located correctly															
	Minimum one make up ring															
	Cover and frame															
4.5	In-situ chamber															
	Reinforcement							Plan Sp	ecification							
	Cover															
	Concrete type to Specification															
	Step iron location and spacing															
	Dimension check															
	Cover and frame															
4.6	Plastering/rendering															
4.7	Benching															
VAR	ATIONS AND CHANGES:							SITE IN	STRUCTIO	NS:						
COM	MENT:															

SEWER CHECKLIST S5 SURFACE FITTINGS

PRO	JECT:									CON	ISULTING E	NGINEER:			
Date	from: to:	PIPE T	YPE:	Is	SIZE:		CL	_ASS:		CON	ITRACTOR	:			
				SI	TE			DATE:	SITE 1	1	SITE 2	SITE 3	SITE 4	SITE 5	SITE 6
ITEM	DESCRIPTION	1	2	3	4	5	6		NIMUM S	TANI	DARD	•	COMMENT		SIGNATURES
5.1	Surface boxes and surrounds to finished levels														
5.2	Surface box lids hinged in direction of traffic flow														
5.3	Shroud pipes assembled to Standards														
5.4 5.5	Fitting bolts protected to Standards														
5.5	Correct depth to Spindle tops														
5.6	Correct depth to Hydrant lugs														
5.7	Spindle retaining disc in place														
5.8	Indicator plates in place														
	IATIONS AND CHANGES:							SITE I	NSTRUCT	TONS	S:				
COM	MENT:														

SEWER CHECKLIST S6 PRE-CONNECTION INSPECTION

PROJ	ECT:								CONSULT	ING ENGINEER:			
Date 1	from: to:	PIPE T	YPE:	S	SIZE:		CI	LASS:	CONTRAC	TOR:			
					ITE			DATE:	1 SIT	E 2 SITE 3	SITE 4	SITE 5	SITE 6
ITEM	DESCRIPTION	1	2	3	4	5	6		STANDARD	<u> </u>	COMMENT		SIGNATURES
	WAC compiled												
6.2	Compaction and concrete tests												
6.3	Pressure test results												
6.4	Deflection Test Results												
	CCTV Inspection												
	Junction tracer tape in place												
	Surface boxes and surrounds level												
6.0	Terminal Mtce Shaft/Rodding Points to Standard												
	Chambers sized to Standard												
	Cover and frame to Standard												
	Minimum one make up ring												
	Chamber step irons to Standard												
	First shaft section												
	Channels to Standard												
	Benching to Standard												
	Sealing to Standard												
6.18	Site restored satisfactorily												
	ATIONS AND CHANGES: MENT:							SITE INSTRUC	ETIONS:				

APPENDIX C - WATER MAIN INSPECTION AND TEST PLAN TEMPLATE

INSPECTION AND TEST PLAN - WATER / RECEYCLED WATER MAIN LAYING

ITP to be completed by Consulting Engineer

Deve	loper:		Coi	nsultant Engineer:			Consultant	Engineer Ro	epresentati	ve:	
Proje			Coi	ntractor:			Contractor	Site Repres	entative:		
Desc	ription:		Sul	b-contractor:			Witness, Ho	old & Survei	llance poin	ts added to ITP	
			Fie	eld Tester:							
Loca	tion:		ITP	Prepared by:		Reviewed by:	Council Rep	oresentative)		
			Dat			Date / /	Date /				
No	Construction/Inspection	on		Inspection Proce			Contractor	Consult. Engineer	Council*	Record	Comment
1	Pre-start/Site establish	Pre-S (W1)		eting Checklist. Site establish	ment visual ched	ck. Checklist completed.	I	Н	н	Checklist W1	
2	Approved materials on Site/delivered	Visua	al check a	approved materials. Quantity	and condition. C	checklist completed (W2)	1	I	S	Checklist W2	
3	Excavation & Pipe Layin	J		mensional check to WRC Star		. ,	1	Н	W	Checklist W3	
4	Chambers	Visua	al and din	mensional check to WRC Star	dards. Checklis	t completed (W4)	I	ı	S	Checklist W4	
5	Survey of main in easem	nent Surv	ey of pipe	e location before backfill			1	I	S		
6	Anchor/Thrust Blocks	Visua	al and din	mensional check to WRC Star	dards. Checklis	t completed.	I	Н	W		
7	Embedment and Trench	Fill Visua	al check a	and compaction to WRC Stan	dards		1	н	W	Compaction test results	
8	Surface fittings	Visua	al and din	mension check to WRC Stand	ards. Checklist	completed (W5)	I		S	Checklist W5	
9	Disinfection			WRC Standards			I	Н	W	Test Results	
10	Testing	Pres	sure test	and Compaction test to WRC	Standards		I	H	Н	Test Results	
11	Pre-connection inspection			tion to WRC Standards. Chec edure as per Job Specific Lett		(W6, W7)	н	н	н	Checklist W6, W7	
12	Dual water flow test prop service/s (main to meter			rinking water system. Lock ar ecycled water system. Lock ar			I	W	н	Test results	
13	Restoration	Visua	al inspect	tion against photographs. Clea	arance letter from	m Council/property owner	1	W	S	Clearance letter	
Syr	nbol Legend	l	No		Amendr	nent	Date	Revie	wed	Valida	tion
	I Inspect	ion								rtify that the works	
	<u> </u>									structed in accorda	
	H Mandatory He	old Point							Sta Plai	ndards and the Insp n	pection and Test
١	W Witness F	Point									
;	S Surveilla	ince								nsulting Engineer Comparison	

^{*} Council reserves the right to vary these requirements at any time

^{**} Council's written approval MUST be obtained prior to varying these requirements

WATER CHECKLIST W1

PRE-START AND SITE ESTABLISHMENT

PRO	IECT:								CO	NSULTING E	NGINEER:			
Date	from: to:	PIPE T	YPE:	S	SIZE:		CI	LASS:	CO	NTRACTOR:				
				SI	ITE		•	DATE:	SITE 1	SITE 2	SITE 3	SITE 4	SITE 5	SITE 6
ITEM	DESCRIPTION	1	2	3	4	5	6		NIMUM STAN	NDARD		COMMENT		SIGNATURES
	Plan current and on site													
	Pre construct report inc. photographs													
	Property Entry Agreement													
1.4	Road opening requirements													
	Fees paid													
	Traffic mgt plan implemented													
1.5	Environmental Management Plan on site and implemented													
1.6	Wh&S Plan on site and implemented													
1.7	Main laying Specification on site													
1.8	Footways to finished levels													
1.9	Survey pegs in place							Registe	red Surveyor					
	Job set out													
1.11	All services located							'Dial Be	fore You Dig	', services				
	All services marked							search	and Relevant	Authorities				
	Main layer holding relevant accreditation on site													
	ATIONS AND CHANGES:							SITE IN	STRUCTION	IS:				
СОМ	MENT:													

WATER CHECKLIST W2 APPROVED MATERIALS ON SITE AND DELIVERED

PRO	JECT:								CC	NSULTING E	NGINEER:			
Date	from: to:	PIPE T	YPE:	5	SIZE:		CL	ASS:	CC	ONTRACTOR:				
					ITE		•	DATE:	SITE 1	SITE 2	SITE 3	SITE 4	SITE 5	SITE 6
ITEM	DESCRIPTION	1	2	3	4	5	6		NIMUM STA	NDARD	(COMMENT		SIGNATURES
2.1	Delivery Inspection Pipe type and size to current plan Polyethylene sleeving & accessories Marking tape Bedding material Trench fill Fittings Surface Fittings Pre Cast chambers Pipe laying accessories													
2.2	Pipe type and size to current plan													
2.3	Polyethylene sleeving & accessories													
2.4	Marking tape													
2.5	Bedding material													
2.6	Trench fill													
2.7	Fittings													
2.8	Surface Fittings													
2.9	Pre Cast chambers													
2.10	Pipe laying accessories													
VAIN	ATIONO AND GHANGEO.							SITE II	NSTRUCTIOI	NS:				
COM	MENT:													

WATER CHECKLIST W3 - PAGE 1 OF 2

EXCAVATION AND PIPE LAYING

PRO	JECT:								CONSULTING E	NGINEER:			
Date	from: to:	PIPE T	YPE:	Is	SIZE:		CI	_ASS:	CONTRACTOR:				
				•	AY			DAY DATE:		DAY 3	DAY 4	DAY 5	DAY 6
ITEM	DESCRIPTION	1	2	3	4	5	6		STANDARD	(OMMENT	•	SIGNATURES
3.1	Environmental Management Plan on site and implemented												
3.2	Traffic Management Plan on site and implemented												
3.3	Services exposed												
	Clearance from Services												
3.5	Trench width mm												
3.6	Trench depth mm												
3.7	Trench shoring												
3.8	Excavation prior to placement of backfill												
3.9	Sleeving												
	Pipe and/or Fitting clean												
	Sleeving overlapped & sealed												
	Sleeving Ends sealed												
3.10	Laying												
3.11	Laying Pipe Embedment												
	Compaction												
	Bedding												
	Surround												
	Overlay												
	Testing												
	ATIONS AND CHANGES:							SITE INSTRUC	TIONS:				
СОМ	MENT:												

WATER CHECKLIST W3 - PAGE 2 OF 2

EXCAVATION AND PIPE LAYING

PRO.	JECT:									CONS	SULTING E	NGINEER:			
Date	from: to:	PIPE T	YPF.	[c	SIZE:		С	LASS:		CON	TRACTOR:				
			<u> =. </u>		AY			DATE:	DAY 1		DAY 2	DAY 3	DAY 4	DAY 5	DAY 6
	DESCRIPTION	1	2	3	4	5	6		NIMUM S	TAND	ARD	,	COMMENT		SIGNATURES
3.12	Pipe joints														
	Witness mark														
	Deflection limits														
	Restrained joints														
3.13	Valves, Hydrants & Surface fittings installed														
	Shroud assembly														
	Valve anchorage														
3.14	Marking tape														
	Correct location														
	Connected to fittings														
3.15	Concrete														
	Trench stops in place														
	Bulkheads in place														
	Thrust blocks in place														
	Embedment & Encasement in														
	place				1										
3.16	Trench fill														
	Material														
	Compaction														
	Compaction Testing								Certified L						
	ATIONS AND CHANGES:							SITE	ISTRUCT	ΠONS:	:				
СОМ	MENT:														

WATER CHECKLIST W4 CHAMBERS

PRO	JECT:								CC	ONSULTING E	NGINEER:			
Date	from: to:	PIPE T	YPE:	S	SIZE:		CI	LASS:	CC	ONTRACTOR:	_		_	
				CHAI	MBER			DATE:	CH 1	CH 2	CH 3	CH 4	CH 5	CH 6
	DESCRIPTION	1	2	3	4	5	6	MII	NIMUM STA	NDARD	(COMMENT	•	SIGNATURES
4.1	In-Situ Chamber													
	Formwork – correct sizing													
	Formwork – correct levels													
	Reinforcement													
	Conduits													
4.2	Pre Cast Chamber													
	Size to Standards													
	Base slab to Standards													
	Base levelled													
4.3	Reduced Size Chamber													
4.3 4.4 4.5 4.6 4.7 4.8 4.9	Scour Chamber													
4.5	Ladders / handrails / step irons													
4.6	Puddle Flanges													
4.7	Sealing							Manufa	cturer Specit	fication				
4.8	Drainage													
4.9	Metal access cover													
4.10	Operational access													
	ATIONS AND CHANGES: MENT:							SITE IN	ISTRUCTIO	NS:				

WATER CHECKLIST W5 SURFACE FITTINGS

PRO	JECT:								C	ONSULTING I	ENGINEER:			
Date	from: to:	PIPE T	YPE:	5	SIZE:		CL	ASS:		ONTRACTOR				
				s	ITE			DATE:	SITE 1	SITE 2	SITE 3	SITE 4	SITE 5	SITE 6
ITEN	DESCRIPTION	1	2	3	4	5	6		NIMUM STA	NDARD		COMMENT		SIGNATURES
5.1	Surface boxes and surrounds to finished levels													
5.2	Surface box lids hinged in direction of traffic flow													
5.3	Shroud pipes assembled to Standards													
5.4	Fitting bolts protected to Standards													
5.5	Correct depth to Spindle tops													
5.6 5.7	Correct depth to Hydrant lugs													
5.7	Spindle retaining disc in place													
5.8	Indicator plates in place													
	IATIONS AND CHANGES:							SITE IN	NSTRUCTIO	NS:				
CON	IMENT:													

WATER CHECKLIST W6 PROPERTY SERVICE INSTALLATION

PRO	ECT:									CONSULTING	ENGINEER:			
Date	from: to:	PIPE T	YPE:	S	SIZE:		CL	ASS:		CONTRACTOR	:			
2 0.10					TE		•	DATE:	SITE 1		SITE 3	SITE 4	SITE 5	SITE 6
ITEM	DESCRIPTION	1	2	3	4	5	6		NIMUM S	TANDARD		COMMENT		SIGNATURES
0.1	Plumber holding relevant accreditation on site							AS/NZS	3500					
6.2	Install property service (main to meter) - Drinking Water							AS/NZS	3500					
6.3	Install property service (main to meter) - Recycled Water							AS/NZS						
	Drinking water riser is plain copper							AS/NZS						
6.5	Recycled water riser is coloured lilac							AS/NZS						
	Drinking water riser has correct ball valve							AS/NZS	3500					
	Recycled water riser has correct ball valve							AS/NZS	3500					
6.8	Risers are a minimum 300mm apart							Meter F	it Policy					
6.9	Drinking Water non-return valve fitted							AS/NZS	3500					
6.10	Termination of property service as per standard							AS/NZS	3500					
0.11	Embedment and trench fill – Drinking water property services							AS/NZS	3500					
0.12	Embedment and trench fill – Recycled water property services							AS/NZS						
	Clearances from other services							AS/NZS	3500					
0.14	Plumbers Compliance Certificate supplied for drinking water property service/s							AS/NZS	3500					
0.15	Plumbers Compliance Certificate supplied for recycled water property service/s							AS/NZS						
	ATIONS AND CHANGES:							SITE	STRUCT	ions.				

WATER CHECKLIST W7 PRE-CONNECTION INSPECTION

PRO	ECT:									CONSULTING E	NGINEER:			
Date	from: to:	PIPE T	YPE:	S	SIZE:		CI	LASS:		CONTRACTOR:				
				SI	TE		•	DATE:	SITE 1		SITE 3	SITE 4	SITE 5	SITE 6
ITEM	DESCRIPTION	1	2	3	4	5	6		IIMUM S	TANDARD		COMMENT		SIGNATURES
	WAC compiled													
	Compaction and concrete tests													
	Pressure test results													
	Marking tape in place & tested													
	Surface boxes and surrounds level													
	Indicator plates in place													
	Fitting box lids positioned correctly													
	Hydrant lugs positioned correctly													
	Fitting bolts protected to Standard													
	Min 100mm max 200mm to hydrant lugs													
7.11	Shroud assembly to Standard													
7.12	Min 100mm max 350mm to top spindle													
7.13	Extension spindle in place (if req.)													
7.14	Spindle retaining disc in place (if req.)													
7.15	Chambers sized to Standards													
7.16	Chamber ladder or step irons to Standards													
7.17	Chamber drainage adequate & to Standards	3												
7.18	Scour outlet protected from erosion													
	Site restored satisfactorily													
	Chemical Analysis report													
VARI	ATIONS AND CHANGES:							SITE IN	STRUCT	IONS:				
СОМ	MENT:													

APPENDIX D - PUMP STATION INSPECTION ANDTEST PLAN TEMPLATES INSPECTION AND TEST PLAN – WATER/SEWAGE PUMP STATION ITP to be completed by Consulting Engineer

Devel	oper:	Consultar	nt Engineer:				Consultan	t Engineer	Represen	tative:	
Projec	et:	Contracto	or:				Contractor	r Site Repr	esentative	:	
Descr	iption:	Sub-conti	ractor:				Witness, H	lold & Surv	eillance p	oints added to ITI	0
		Field Test	ter:								
Locati	on:	ITP Prepa			Reviewed	bv:	Council Re	epresentati	ive		
		=	1 1		Date /	1	Date /	1			
No	Construction/Inspection Activity	<u>'</u>	Inspection Procedu	ure & Accepta	ance Crite	ria	Contractor	Consult. Engineer	Council*	Record	Comment
1	Pre-start/Site establish	Pre-Start Meeting C (PS1)	Checklist. Site establi	shment visual	check. Ch	necklist completed.	I	Н	Н	Checklist PS1	
2	Approved materials on Site/delivered	Visual check approv	ved materials. Quant	ity and condit	ion. Check	ist completed (PS2)	I	I	S	Checklist PS2	
3	Excavation	Visual inspection to	FNQROC Standard	s. Checklist co	ompleted. (PS3)	I	I	S	Checklist PS3	
4	Foundations	Visual and dimension	onal check to FNQR	OC Standards			I	W	W	Checklist PS4	
5	Base slab	Visual inspection to	FNQROC Standard	S.			I	Н		Checklist PS4	
6	Reinforcement and formwork	Visual inspection to	FNQROC Standard	S.			I	Н	W	Checklist PS4	
7	Anchor/Thrust Blocks	Visual and dimension	onal check to FNQR	OC Standards			ı	Н	Н		
8	Embedment and Backfill	Visual check and co	ompaction to FNQRC	C Standards			I	Н	Н	Compaction test results	
9	Electrical/Scada	Review certification	and visually check in	nstallation to I	NQROC s	tandards.	I	W	I	Certification	
10	Lifting Chain	Review certification).				ı		I	Certification	
11	Surface fittings	Visual and dimension	on check to FNQRO	C Standards.	Checklist c	ompleted (PS6)	I		S	Checklist PS5	
12	Disinfection	Disinfection to FNQ	ROC Standards			, ,	I	Н	Н	Test Results	
13	Testing	Pressure test and C	Compaction test to FI	NQROC Stand	dards		I	Н	Н	Test Results	
14	Pre-connection	Visual inspection to	FNQROC Standard	s. Checklist co	ompleted (F	PS6)	н	Н	Н	Checklist PS6	
	inspection	Isolation procedure	as per Job Specific	Letter	•		7 7	п	П	CHECKIIST PS6	
15	Commissioning of System	Visual and dimension RPZD.	onal check to FNQR	OC Standards	and, wher	e required, removal of	I	Н	Н	PS Commiss. Checklist	

Symbol	Legend	No	Amendment	Date	Reviewed	Validation
I	Inspection					certify that the works have been constructed in accordance with
Н	Mandatory Hold Point					FNQROC Standards and the Inspection
W	Witness Point					and Test Plan
S	Surveillance					Consulting Engineer Date / /

^{*} Council reserves the right to vary these requirements at any time ** Council's written approval MUST be obtained prior to varying these requirements

PUMP STATION CHECKLIST PS1

PRE-START AND SITE ESTABLISHMENT

PROJECT:							CONSULTING ENGINEER:							
Date from: to: PIPE TYPE: SIZE: (CL	LASS: CONTRACTOR:							
		SITE					DATE:	SITE 1	SITE 2	SITE 3	SITE 4	SITE 5	SITE 6	
ITEM DESCRIPTION		1 2		3 4 5		6	MINIMUM STANDARD		COMMENT			SIGNATURES		
1.1 Plan current and on site														
1.2 Pre construct report inc. photographs														
1.3 Property Entry Agreement														
1.4 Road opening requirements														
Fees paid														
Traffic mgt plan implemented														
1.5 Environmental Management Plan on site and implemented														
1.6 WH&S Plan on site and implemented														
1.7 Receiving sewer located														
1.8 Specification on site														
1.9 Footways to finished levels														
1.10 Survey pegs in place							Register	ed Surveyor						
1.11 Job set out								•						
1.12 All services located							'Dial Bef	ore You Dia'	services					
1.13 All services marked							search a	ore You Dig' nd Relevant	Authorities					
1.14 Contractors holding relevant accreditation on site														
VARIATIONS AND CHANGES:						SITE INS	STRUCTION	IS:						
COMMENT:														

PUMP STATION CHECKLIST PS2

APPROVED MATERIALS ON SITE AND DELIVERED

PRO	JECT:			CONSULTING ENGINEER:									
Date	from: to:	PIPE T	YPE:	ķ	SIZE:		С	LASS:	CONTRACTOR:				
				S	ITE		•	DATE:		SITE 3	SITE 4	SITE 5	SITE 6
	DESCRIPTION	1	2	3	4	5	6	MINIMUM S	TANDARD		COMMENT		SIGNATURES
2.1	Delivery Inspection												
2.2	Types and sizes to current plan												
2.3 2.4	Marking tape												
2.4	Bedding material												
2.5 2.6	Trench fill												
2.6	Fittings												
2.7	Surface Fittings												
2.8	Pre Cast chambers												
	ATIONS AND CHANGES:							SITE INSTRUCT	TIONS:				
COM	MENT:												

PUMP STATION CHECKLIST PS3 - PAGE 1 OF 2

EXCAVATION

PRO	JECT:			CONSULTING ENGINEER:										
Date	from: to:	PIPE T	YPE:		SIZE:		С	LASS:	DAY 1	NTRACTOR	DAY 3	DAY 4	DAY 5	DAY 6
				D	ΑY			DATE:	2,	5, (, , _	2711 0	2,	2711 0	37110
ITEN	DESCRIPTION	1	2	3	4	5	6		NIMUM STAI	NDARD	(OMMENT	•	SIGNATURES
3.1	Environmental Management Plan on site and implemented													
3.2	Traffic Management Plan on site and implemented													
3.3	Services exposed													
3.4	Clearance from Services													
3.5	Trench width mm													
3.6	Trench depth mm													
3.7	Trench shoring													
3.8	Excavation prior to placement of backfill													
3.9	Embedment													
	Compaction													
	Bedding													
	Surround													
	Overlay													
	Testing													
	IATIONS AND CHANGES:							SITE IN	ISTRUCTION	NS:				
COM	IMENT:													

PUMP STATION CHECKLIST PS3 - PAGE 2 OF 2

EXCAVATION AND PIPE LAYING

PRO.	ROJECT:								CONSULTING ENGINEER:							
Date	from: to:	PIPE T	YPE:	5	SIZE:		С	LASS:		NTRACTOR:		DAY 4				
				D	AY			DATE:	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6		
ITEM	DESCRIPTION	1	2	3	4	5	6		NIMUM STAN	NDARD		OMMENT	<u> </u>	SIGNATURES		
3.10	Valves, Hydrants & Surface fittings installed															
	Shroud assembly															
	Valve anchorage															
3.11	Marking tape															
	Correct location															
	Connected to fittings															
3.12	Concrete															
	Trench stops in place															
	Bulkheads in place															
	Thrust blocks in place															
	Embedment & Encasement in															
	place															
3.13	Trench fill															
	Material															
	Compaction															
	Compaction Testing								Certified Lab							
VARI	ATIONS AND CHANGES:							SITE IN	ISTRUCTION	NS:						
COM	MENT:															
COIVI	IVIEN I .															

PUMP STATION CHECKLIST PS4 – PAGE 1 OF 2

CHAMBERS

Date	from: to:	PIPE T	YPE:		SIZE:		С	LASS:			ACTOR:				
				CHA	MBER			DATE	CH 1		CH 2	CH 3	CH 4	CH 5	CH 6
ITEN	DESCRIPTION	1	2	3	4	5	6		INIMUM ST	TANDAF	RD	COMMENT		<u>.l</u>	SIGNATURES
4.1	Finished Surface Levels Supplied														
4.2	Base														
	Placement														
	Channels														
	First shaft section														
4.3	In-situ chamber														
	Formwork – correct sizing														
	Formwork – correct levels														
	Reinforcement														
	Cover														
	Concrete type to Specification														
	Step iron location and spacing														
	Dimension check														
	Cover and frame														
	Conduits							Plan S	Specification)					
4.4	Pre cast chamber								•						
	Shaft assembled in correct order														
	Step iron location and spacing														
	Sealing														
	Offset cone located correctly														
	Minimum one make up ring														
	Cover and frame														
VAR	IATIONS AND CHANGES:	· · · · · · · · · · · · · · · · · · ·		1				SITE	INSTRUCTI	ONS:					•
COM	IMENT:														

PUMP STATION CHECKLIST PS4 - PAGE 2 OF 2 CHAMBERS

PRO.	JECT:			CONSUL	TING EN	IGINEER:								
Date	from: to:	PIPE T	YPE:	S	SIZE:		C	CLASS:	CONTRA	CTOR:				
					MBER		•	DATE:		H 2	CH 3	CH 4	CH 5	CH 6
ITEM	DESCRIPTION	1	2	3	4	5	6	MINIMUM	STANDARI)	(COMMENT	I	SIGNATURES
4.5	Ladders / handrails / step irons													
4.6 4.7	Sealing							Manufacturer Sp	oecification					
4.7	Drainage													
4.8	Security Grate lid													
4.9	Plastering/rendering													
4.10	Benching													
4.11	Operational access													
	MENT:							SITE INSTRUC						

PUMP STATION CHECKLIST PS6

PRE-CONNECTION INSPECTION

PROJ	PROJECT:										CONSULTING ENGINEER:					
Date	rom: to:	PIPE T	/PE:	S	SIZE:		CI	LASS:	CC	ONTRACTOR	:					
					TE		I		SITE 1	SITE 2	SITE 3	SITE 4	SITE 5	SITE 6		
				31	16			DATE:								
	DESCRIPTION	1	2	3	4	5	6	MIN	IIMUM STA	NDARD		COMMENT		SIGNATURES		
6.1 6.2 6.3 6.4 6.5 6.6 6.7 6.8 6.9 6.10	WAC compiled															
6.2	Compaction and concrete tests															
6.3	Pressure test results															
6.4	Deflection Test Results															
6.5	CCTV Inspection															
6.6	Marking tape in place & tested															
6.7	Surface boxes and surrounds level															
6.8	Indicator plates in place															
6.9	Chambers sized to Standard															
6.10	Chamber ladder or step irons to Standards															
6.11	Chamber drainage adequate & to															
6.12	Benching to Standard															
6.13	Sealing to Standard															
6.14	Benching to Standard Sealing to Standard Scour outlet protected from erosion Site restored satisfactorily															
6.15	Site restored satisfactorily															
VARI	ATIONS AND CHANGES:	•	•	•			•	SITE IN	STRUCTION	NS:						
COM	MENT:							II.								

APPENDIX E SECURITY LODGMENT FORM

FORM 3 - SECURITY LODGEMENT FORM

his sheet must be completed prior to the acceptance of any bond by Council.									
Development Name:									
Stage:			File No.:						
Applicant:									
Consultant:									
Purpose of Bond:									
Constr	uction Security	Uncompleted Works	Defects Liability						
Incompleted Works B	ond Assessmen	t							
Estimated time to con	nplete bond works	s (not greater than 90 days)		days					
Current Contract Con	npletion date								
Anticipated Completic	on date								
Consulting Engineer's	s estimated value	of uncompleted works	\$						
Bond Value (apply Fa	actor 1.50)		\$						
Construction/Defects L	iability Bond As	sessment							

Consulting	Engineer's estimated value of completed works	\$
Construction	on/Maintenance Bond Value (apply Factor 0.05)(min \$500	0.00) \$
	retain any interest accrued on cash monies paid to Coluding monies paid pursuant to Section 6.3 of the Local Act 1990.	
Consulting En	gineer:	
Signature:		RPEQ No.:
Date:		

APPENDIX F - INSPECTION CERTIFICATE FOR WITNESS / HOLD POINT

FORM 4 - INSPECTION CERTIFICATE FOR WITNESS/HOLD POINT

This certificate registers evidence that the works as noted herein have been inspected by the Council officer noted below and were found to be satisfactory.

Development Name:	File No:
Development Location:	
Consulting Engineer:	
Contractor:	
Works being Inspected / Tes	sted / Witnessed:
Defaults/Corrective Action R	Required:

Defaults Corrected:	Υ	N	N/A	
Council Inspector Signa	ature:			
Name of Inspector:				
Date of Inspection:				

APPENDIX G - WORKS ACCEPTANCE INSPECTION CHECKLIST

FORM 5 - WORKS ACCEPTANCE INSPECTION CHECKLIST

DEVELOPMENT NAME:	File No:
DEVELOPMENT LOCATION:	

ITEM	VERIFICATION (Yes / No / NA)	COMMENT
ALLOTMENT DRAINAGE		
The works have been finally inspected and:		
Concrete catch drains constructed in approved location and to a satisfactory standard.		
Field Inlets constructed in approved location and to a satisfactory standard.		
Overland flow path constructed to correct profile.		
4. Pipework has been visually inspected and is satisfactory ie.:		
alignment and grade;		
free of debris and siltation; no visual sign of transh subsidences and		
no visual sign of trench subsidence; andoutlets are satisfactory.		
S. Lots not provided with Allotment Drainage		
can be drained to the kerb and channel.		
STORMWATER DRAINAGE SYSTEM		
The works have been finally inspected and:		
 Pipe layout is as per plan or approved amendments with respect to pipe size, levels and location. 		
Pipework has been visually inspected and is satisfactory, ie.:		
alignment and grade;free of debris and siltation;		
 nee of debris and sittation, pipe joints satisfactory; 		
lifting plug holes sealed;		
 no visible sign of trench subsidence; and 		
no damaged pipes.		

3. Gully pits and manholes have been constructed to the correct standards, ie.: • correct type of grate or cover; • lintels; • side entry slots; • benching (no water ponding); • grates are satisfactorily seated in frames; • weepholes provided to bedding material; • no damaged structures; • converter slabs/sections mortar bedded; • correct drops through gullies/manholes; and • all lids/grates finished to match surface level.	
 All density tests to backfill are available and satisfactory. 	
Material gradings are available for bedding material and satisfactory.	
Outlet/Inlet structures are satisfactorily constructed and are free from scour or siltation.	

ITEM	VERIFICATION (Yes / No / NA)	COMMENT
 All manhole and gully pit pipe connections are mortared flush with the walls and no pipe reinforcement is exposed. 		
8. Open cut channels have been finally inspected are satisfactory, ie.: • cut to design profiles; and • lining of channel is to the required thickness and reinforcement, with appropriate weepholes		
Overland flow, the works have been finally inspected and appropriate flow paths are provided and clear of obstruction.		

10. Outlets and outfalls have been	
constructed to control discharge flow in	
accordance with the plans.	
11. Subsoil drainage discharges to gullies or	
other approved points of discharge.	
All grassing requirements to channels,	
swales, outlets, inlets etc have been	
completed.	
13. CCTV inspections of stormwater pipes	
WATER QUALITY	
The works have been finally inspected and:	
 Water Quality structures have been 	
constructed in accordance with approved	
engineering drawings	
2. Structures are free of debris and sediment	
EROSION AND SEDIMENT CONTROL	
The works have been finally inspected and:	
Control structures required until the site is	
stabilised in accordance with the Contractor's	
ESCP are in place	
Structures are free of debris and sediment	
EARTHWORKS	<u>'</u>
The works have been finally inspected and:	
Toe of batters not on Council road reserve	
except as approved	
2. Retaining walls clear of road reserve except	
as approved	
Retaining walls constructed in accordance	
with drawings	
4. Batter slopes constructed in accordance with	
drawings	
Batter slopes stabilised against erosion	
Interim drainage constructed in accordance	
with drawings	
7. All areas disturbed by the works have been	
rehabilitated	
8. Allotment levels are as per the design plans	
Verge levels are as per the design plans	

ITEM	VERIFICATION (Yes / No / NA)	COMMENT
SEWER RETICULATION		
The works have been finally inspected and:		
Pipe layout is as per the plan or approved		
amendments with respect to pipe size, levels,		
and location.		
2. Pipework has been visually inspected and is		
satisfactory, ie.:		
pipework flush with internal walls of		
manhole;		
alignment and grade;		
flexible joints; line flexible and alleger		
line flushed and clean; representations of transplants are simple to the side of		
no visible sign of trench subsidence; A density test of healfill are sycilable and		
 A density test of backfill are available and satisfactory; and 		
CCTV survey results submitted and		
satisfactory.		
Manholes and Maintenance Shafts have		
been constructed to the correct standards,		
ie.:		
cast in situ;		
benching;		
 curvature satisfactory; 		
no ponding;		
 profile satisfactory; 		
 no weeps (free of infiltration); 		
concrete work;		
no honey combing;		
• covers;		
 covers checked to be gas tight; 		
correct type;		
 imprint in accordance with standards; 		
 depth of cover surround; 		
depth of top slab;		
• location;		
 relative to lot boundaries; and 		

 50-75mm proud of finished surface level. 		
4. Material gradings for bedding material are		
available and satisfactory.		
Pressure test results are available and		
satisfactory.		
Manhole hydrostatic test all satisfactory.		
Sewerage connection Private Works fees paid.		
8. On site Sewer Report provided (if applicable).		
9. PUMP STATION – refer separate PS		
Checklist.		
WATER RETICULATION		
The works have been finally inspected and:	Т	
Pipe layout and services fixtures (valves and budgents) are as por the plan or approved.		
hydrants) are as per the plan or approved amendments with respect to pipe size and		
location.		

ITEM	VERIFICATION (Yes / No / NA)	COMMENT
Pipework has been pressure tested in		
accordance with Council's requirements and		
test results are available and satisfactory.		
3. Pipework has been chlorinated in accordance		
with Council's requirements.		
There are no visible signs of trench		
subsidence or leaks.		
5. Valves and hydrants have been inspected		
and are satisfactory, ie.: • location		
setts and surrounds correctly installed to		
prevent ingress of soil, etc.;		
 mortar packing to boxes correctly 		
completed;		
depth to top of hydrant or valve stem		
within limits;		
 dust caps to hydrants; 		
 colour of marker plate correct; 		
 direction of flow indicated; 		
 marking plates correctly installed; and 		
size of plate correct.		
Material gradings for bedding material are		
available and satisfactory.		
7. Water supply connection Private works fees		
paid.		
8. PUMP STATION – refer separate checklist		
ROAD PAVEMENTS		
The works have been finally inspected and:		
Plan layout and geometry of road system is in		
accordance with the drawings.		
Finished levels at crown and channel are at		
design levels.		
Crossfalls are to the approved plan.		
4. AC is satisfactory with regard to finish and		
thickness.		

5. Joints in the seal (especially where various development stages apply) are flush.	
6. The sealed surface is free of blemishes.	
7. All compaction test, material quality (CBR),	
material grading, AC core tests are	
satisfactory and available.	
Ponding of stormwater does not occur.	
SEGMENTAL PAVERS (Where constructed)	
The works have been finally inspected and:	
1. All pavers have been correctly laid to pattern,	
within allowable tolerance, compacted, and	
the joints filled.	
Bedding sand for pavers drains to subsoil	
drainage.	
Pavers adjacent to concrete kerb and	
channel, edge restraints etc have been cut	
and laid in accordance with all relevant	
requirements.	

ITEM	VERIFICATION (Yes / No / NA)	COMMENT
CONCRETE WORKS		
The works have been finally inspected and:		
The correct type has been used to all		
locations in accordance with drawings.		
Ponding of stormwater does not occur.		
Transitions and connection to existing		
construction are smooth and to a satisfactory		
standard of workmanship.		
4. Service conduit markers have been placed to kerb face.		
5. Lip and back of kerb are flush with the		
roadway and footpath respectively.		
All channelisation works and medians have been satisfactorily completed.		
7. Infill treatment of medians has been		
inspected and found satisfactory. Any		
landscaping has been completed to		
standard.		
8. Subsoil drains have been provided (including under medians).		
Appropriate expansion and contraction joints provided		
10. Subsurface finish is to approved design		
and within tolerances		
FOOTPATHS		
The works have been finally inspected and:		
Profiles are as per plan.		
Footpath has been topsoiled and		
satisfactory.		
3. Footpaths have been stabilized / turfed.		
4. All service fixtures (such as valves etc.)		
25mm above the surrounding footpath.		
5. Concrete footpaths have been constructed to Council requirements.		
Pram ramps constructed as required.		

7. Footpaths to be free of rock and loose	
stones.	
BIKEWAYS	
The works have been finally inspected and:	
 Location and width are as per the drawings. 	
Kerb ramps and crossings are constructed.	
Safety rails and signs have been installed	
where required.	
LIGHTING	
The works have been finally inspected and:	
 Lighting has been installed and is operating 	
as per approved design.	
If lighting is yet to be installed, or made	
operational, copy of service agreement has	
been provided from the lighting/energy	
provider and all uncompleted works have	
been adequately guarded.	

ITEM	VERIFICATION (Yes / No /NA)	COMMENT
FENCING AND FEATURES		
The works have been finally inspected and:		
All fences including approved entrance		
features have been constructed within		
allotments. Survey pegs are visible.		
Specifically approved entrance features are		
constructed in accordance with the drawings.		
3. Entrance features and fences have satisfied		
Building Approvals (if required). 4. Sound attenuation fences and/or mounds are		
constructed on private property and in		
accordance with the drawings where		
required.		
BUILDING/STRUCTURE		
The works have been finally inspected and:		
Council approval for building/		
Building/Structure		
OTHER		
Approvals for completed works received from		
applicable referral agencies		
2. Street name signs, traffic signs and pavement		
marking have been installed.		
3. Works have not resulted in problems on		
neighbouring properties. Clearance letters		
from property owners are available where		
applicable.		
All boundaries of Subdivision/Development have been inspected to ensure works as		
constructed will not affect adjoining		
properties.		
5. All necessary testing to ensure the quality of		
the work has been carried out and results are		
available.		
6. Consulting Engineer's compliance certificate		

is completed (refer AP1 – Appendix A)	
7. "As Constructed" submission has been	
provided to Council and is to Councils	
satisfaction	
8. All allotment boundaries, easements etc,	
have been pegged.	
All test results and records have been	
compiled and stored in the Record Storage	
facilities of the Consulting Engineer's office	
and a copy forwarded to Council.	
10. All operating Manuals, maintenance	
procedures, mechanical warranties etc have	
been submitted to Council.	
 Parkland is in a mowable condition 	
where practical and free of rock and loose	
stones.	
12. Irrigation systems have been provided,	
are operating as designed and "As	
Constructed" drawings provided.	

INSPECTOR'S NAME:	
SIGNATURE:	DATE:/
CONSULTING ENGINEER:	RPEQ No:
SIGNATURE:	

APPENDIX H - FINAL ACCEPTANCE INSPECTION CHECKLIST

FINAL ACCEPTANCE INSPECTION CHECKLIST

DEVELOPMENT NAME:	File No:
DEVELOPMENT LOCATION:	

ITEM	VERIFICATION (Yes / No / NA)	COMMENT
STORMWATER DRAINAGE SYSTEM		
 a) Pipework has been visually inspected and is satisfactory, ie.: free of debris and siltation; pipe joints satisfactory with no deflection or movement; no visible sign of trench subsidence; and no exposed reinforcing steel to cut pipe ends. 		
 b) Gully pits and manholes have been visually inspected and are satisfactory, ie.: no ponding; no excessive cracking or distress of reinforced concrete works; clear of silt and debris; all mortar is in place, no excessive spalling, flaking or cracking; and no visible sign of subsidence. 		
c) Overland flow paths clear		
 WATER QUALITY a) Water Quality Structures have been visually inspected and are satisfactory, ie.: free of debris and siltation; no cracking or distress of concrete at fixing points; fasteners are secure; structures have not misaligned due to excessive loads; and no corrosion at any location evident. 		

ALLOTMENT DRAINAGE		
a) Concrete catch drains have been visually		
inspected and are satisfactory, ie.:		
 clear of silt and debris; 		
 no damage or cracking; and 		
 overland flow path profile maintained. 		
EARTHWORKS/SITE WORKS		
a) All batter slopes stable and no distress		
exhibited.		
EROSION AND SEDIMENT CONTROL		
a) Site has been visually inspected and has no		
obvious signs of erosion or sediment deposits		
and has achieved 80% grass cover		
b) Erosion and sediment control measures no		
longer required have been removed and		
rehabilitation works completed.		

ITEM	VERIFICATION (Yes / No / NA)	COMMENT
WATER RETICULATION		
a) No visible signs of trench subsidence.		
b) Valves and hydrants have been inspected		
and are satisfactory, ie.:		
no leaks;		
 valve and hydrant markings; and 		
 no damage. 		
SEWERAGE RETICULATION		
 a) No visible signs of trench subsidence. 		
b) Pipework has been visibly inspected and is		
satisfactory, ie.:		
alignment satisfactory;		
clear of silt and debris (flushed);		
no ponding; and		
 pipework not oval or compressed. 		
c) Manholes/structures have been visually		
inspected and are satisfactory, ie.:		
 benching no signs of cracking, spalling ok; 		
 no weeping or infiltration; and 		
 no ponding or disposition of solids. 		
ROADWORKS		
a) Road pavement has been visually inspected		
and satisfactory, ie.:		
 no damage to Wearing Course; 		
no ponding; and		
 clear of siltation and debris. 		
b) Kerb and channel has been visually		
inspected and is satisfactory, ie.:		
 no excessive cracking or distress to 		
concrete works;		
no ponding;		
service conduit markers ok; and		
 no differential settlement or dislocation of 		
pavement surface and concrete kerb and		
channel.		
c) Linemarking and road signage satisfactory.		
BUILDING/STRUCTURE		T
a) Building/Structure Inspected MISCELLANEOUS		
a) Footpaths and concrete works satisfactory.		
b) Bikeways and associated works satisfactory.		
c) Street name signage satisfactory.		
 d) Alternative pavement surfacing (eg. pavers, stamped concrete) is satisfactory. 		
e) Street lighting has been installed and is		
operating as per the approved design.		
f) Landscaping has been provided for a		
minimum 13 week period and is in an acceptable condition for handover to Council.		
OTHER MATTERS		
a) Specific matters in relation to the site.		

FINAL ACCEPTANCE INSPECTION CHECKLIST

INSPECTOR'S NAME:	
SIGNATURE:	DATE://
	DDEC N
CONSULTING ENGINEER:	. RPEQ No:
SIGNATURE.	DATE://
SIGNATURE:	DATE://

APPENDIX I - SEWERAGE AND WATER PUMP STATION COMMISSIONING CHECKLISTS

PRE-COMMISSIONING CHECKLIST FOR NEW ASSETS SEWERAGE PUMP STATIONS

REQUIREMENTS BY CONTRACTORS

The following checklist is required to be fully completed, signed and returned to Council before a joint commissioning is considered. Please note, in the event of a commissioning being abandoned due to works not completed or operational, Council will recover costs incurred.

STATION NAME:	STATION NO:	
Ergon Power available	Yes	No
Provision of sufficient water for all testing purpose	es Yes	No
Fresh water discharge flushing system operating	as per design Yes	No
Ancillaries (GPO's, lighting, etc) tested and worki	ng correctly Yes	No
Pre- Commission switchboard test completed	Yes	No
Station telemetry points list supplied	Yes	No
Established telemetry communications and verific	ed inputs locally Yes	No

VERIFICATION OF AS CONSTRUCTED LEVELS AND OPERATION

Note: Levels taken from top of well cover down

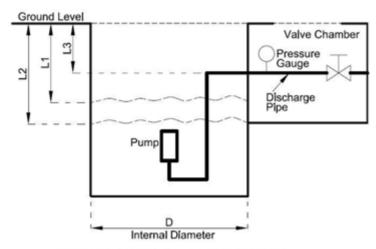
Setting / Alarm	Measurement	Operational fur (Contractor correct ope	to verify
Spill Alarm	m	Yes	No
H/L back up pump 2 start	m	Yes	No
H/L back up pump 1 start	m	Yes	No
Probe high level alarm	m	Yes	No
H/L pump cut out / Transfer	m	Yes	No
Duty pump cut-in	m	Yes	No
Duty pump cut-out	m	Yes	No
Probe low level alarm (indication only)	m	Yes	No
Level settings according to design	m	Yes	No

PRE-COMMISSIONING CHECKLIST FOR NEW ASSETS - SEWERAGE PUMP STATIONS

PROCEDURE FOR PERFORMANCE TESTING OF PUMPS

Contractor to complete for all pumps:

Pump Duty flowrate



General Sewerage Pump Station Well

Date:			
Pump No.:			
Pump: Make / Model:	-		
Electric Motor kw Speedrpm			
Serial No.:	-		
Measure inside diameter of well: D =	m	Measure L3 =	m
Pump Duty Head H =	m		

Q = ____L/S

PRE-COMMISSIONING CHECKLIST FOR NEW ASSETS - SEWERAGE PUMP STATIONS

m

•	L2 =m
•	Delivery gauge reading HD height HD =m
•	Correction HC = L2 – L3 Total HC =m
•	Head TH1 = HD + HC
•	Check TH1 against the pump curve at no flow condition; and
•	Check AMPs on pump curve.
	2. QUICK CHECK OF INFLOW Q1 (IF INFLOW BLOCKED OFF – GO TO (C))
	2. Goldkonzokon iki zovi gr (ii iki zovi bzodkeb ori - od ro (o))
	L1 and L2 – operating levels;
	Switch off the pump and keep the delivery valve closed;
	Read L1 in meters at the beginning of one (1) minute;
	Read L2 in meters at the end of this minute; and
	Record:
	L1 =m
	L2
	Calculate flowrate Q1 during this minute.
•	Q1 =l/s
	3. NORMAL FLOWRATE Q2 TEST (VALVE OPEN)
•	L1 and L2 – operating levels;
	Run pump for one (1) minute with the delivery valve open;
	Read L1 in meters at the beginning of one minute;
•	Read L2 in meters at the end of this minute;
•	Read AMP meter;
•	Read HD in meters at the end of this minute;
•	Record:
•	L1 =m
	L2 =m
•	Delivery gauge reading HD HD =m
•	Height correction HC = L2 – L3 HC =m
•	Total head TH2 = HD + HC TH2 =m
•	Calculate flowrate Q2 during this minute; and
•	Q2
•	Check AMPs on pump curve.

• L1 and L2 – operating levels;

· Close the valve;

• Read AMP meter;

• Record:

• L1

• Run pump for one (1) minute with the delivery valve open;

• Read pressure gauge (HD) in meters at the end of one (1) minute;

L1 =

• Read L1 in meters at the beginning of one (1) minute;

• Read L2 in meters at the end of this minute;

4. QUICK CHECK OF INFLOW AGAIN Q2 (IF INFLOW BLOCKED OFF GO TO (E)) • L1 and L2 – operating levels; • Switch off the pump and keep the delivery valve closed; Read L1 in meters at the beginning of one (1) minute; Read L2 in meters at the end of this minute; and L1 L1 = _____m L2 = mCalculate flowrate Q3 during this minute. Q3 = mQ3 5. SUMMARY If inlet is blocked off for the time of test the duty head H and duty flowrate Q should be similar to TH2 and Q2; and If inlet is not blocked off for the time of the test the duty head should be similar to TH2 and duty flowrate should be similar to: • QD = Q2 = (Q1 + Q3)/2End of testing of pumps. Pressure gauges calibrated according to QA requirements: Yes No Pump performance satisfactory: Yes No

Yes

No

Test performed by:

Pump performance results as compared to tender offer satisfactory

PRE-COMMISSIONING CHECKLIST FOR NEW ASSETS - SEWERAGE PUMP STATIONS

General Contractor Comments:		
		_
All information has been supplied and verified ready for Comm	nissioning / /	
,	1	
Signed (Contractor) Date		
Orint name		
Print name		
Note: The telemetry is to be fully ready for commissioning		
3		
COUNCIL use only		
Level information and Operational function satisfactory	Yes	No
Pump performance results as compared to tender offer satisf	actory Yes	No
Pump motor information readings satisfactory	Yes	No
Telemetry commissioned satisfactorily	Yes	No
General Council Comments:		

PRE-COMMISSIONING CHECKLIST FOR NEW ASSETS - SEWERAGE PUMP STATIONS

All information has been supplied and verified at Contractor Pre-commissioning		
Signed (Council)	Date	
Print name		

Commissioning of Civil Works

Ite	m	Complete	Date / Initials	Council Audit
Management				
1.	Verify that consultant has provided all documentation (as constructed details, operating manuals, test results etc).			
	If NO then close audit.			
Со	ncrete			
1.	Verify that the concrete slab is 150mm above the finished surface level.			
2.	Verify that the pump station concrete works is as designed e.g. Cast in-situ.			
3.	Verify that there is no damage to any exposed concrete surface.			
4.	Verify that drainage of the site is away from the Pump Station.			
5.	Verify that the surface dimensions of the top slab are in accordance with the design drawings.			
6.	Verify that the below ground concrete structures are dimensionally correct and in accordance with the design drawings.			
7.	Verify no seepage through the concrete structure.			
8.	Verify the verticality of the structure is within tolerance in accordance with SEWL specifications.			
9.	Verify that all chamfers are provided in accordance with the design drawings.			
	Verify that the pump well benching has been provided in accordance with design drawings.			
11.	Verify that the specified coating to the internal walls has been applied in accordance with the WRC Development Manual.			
12.	Thickness of internal coating tested (µm)			

Item		Complete	Date / Initials	Council Audit
ОН	&S			
1.	Verify that ladder access to dry wells only, meets OH&S requirements.			
2.	Verify that ladder access to valve chamber meets OH&S requirements.			
3.	Verify that all ladders are provided with the extension above the FSL.			
4.	Verify that the ladders have non-slip treads.			
	Have safety cages been specified in accordance with Australian Standards.			
6.	Verify that safety cages have been installed in accordance with the design drawings.			
7.	Verify that adequate distance between wet well opening and switchboard is in accordance with OH&S requirements and the WRC Development Manual.			
8.	Verify that adequate set down areas for the covers has been provided in accordance with OH&S requirements.			
9.	Verify that no overhead cables restrict access via crane trucks.			
10.	Verify Full Risk Assessment has been performed and permanent operational/ maintenance risks identified.			
11.	Verify that all signage pertaining to those risks is in place.			
	Facility Name and contacts signage.			
13.	Standby Emergency Generator – cover, refueling, manuals.			
14.	Adequate access, maneuver and parking for maintenance vehicles.			
Pro	ducts & Materials			
1.	Verify that all products incorporated on the project are included on the list of approved products for Council.			
2.	Verify that all markings as required by Council specification are visible on the covers.			
3.	Verify that the covers and frames are greased in accordance with the manufacturer's requirements.			
4.	Verify that the covers are gas tight.			
5.	Verify that the interchangeable multi part covers have lifting lugs on the beams for removal and covers have clockwise lifting key holes.			
6.	Verify that council approved penstock stuffing box is installed.			
7.	Wet well covers are to be in accordance with the WRC Development Manual.			
8.	Wet well covers are to be lockable.			

Item		Complete	Date / Initials	Council Audit
Pip	es and Fittings	•		
1.	Verify that the valves are anticlockwise closing.			
2.	Verify that there is only one inlet pipe to the pump			
	station.			
3.	Verify that pumps are clear of all inlet pipework.			
4.	Verify that adequate supports have been provided for			
	the valves.			
5.	Are valve extension spindles required.(includes	N/A		
	penstock).	14// (
6.	Verify that there is sufficient clearance for			
	maintenance.			
7.		N/A		
0	Council standard drawings. Verify that DICL pipe work has been provided to			
8.	correct nominal diameter DN.			
9.	Verify that adequate supports for vertical pipe work			
٥.	has been provided in accordance with WRC			
	Development Manual (i.e. vibration not noticeable			
	when pumps operating).			
10.	Verify that all gate valves operate through the full			
	range and are left in the open position.			
11.	Verify that a flap valve has been installed on the valve			
	chamber drain if required by the design e.g. when			
	overflow levels higher than valve pit base.			
12.	Verify that bleeders have been installed on the NRV's			
	and NRV's have counterweights.			
13.	Verify that probe stilling tube has been installed as per			
	Council standard			
14.	Verify that the Council specified coating for all valves			
4.5	has been applied.			
15.	Verify that the Council specified coating for the pipe work has been applied.			
16	Verify that the pipe work for the incoming sewer is in			
10.	accordance with the design drawings including			
	dropper pipe.			
17.	Verify that the specified bolting system on the flanges			
	has been used			
18.	Verify that all valves can be removed through the			
	available cover opening			
19.	Verify that a flanged dismantling joint has been			
	provided to allow ease of removal of valves in			
	accordance with standard drawings.			
20.	Has the consultant submitted completed project ITP			
21	containing all signatures.			
۷١.	Verify all steel metalwork has been Hot Dipped Galvanized.			
22	Verify all bolts are 316 stainless steel with 308 nuts.			
	Verify that the emergency pump out pipework has			
20.	been installed.			
24.	Verify that either rising main air releases or scours are			
	provided at the pump station.			

Item		Complete	Date / Initials	Council Audit
Oth	ner Services			
1.	Verify that the water service has been fitted with an			
	approved back flow prevention device.			
2.	Verify that a 25mm water service has been provided.			
3.	Verify that all conduits through the walls have been			
	sealed to prevent odour escaping.			
4.	Verify that electricity is below ground, not above.			
5.	Verify that the sealed access track is in accordance			
	with the design drawings and the WRC Development			
	Manual.			
6.	Verify that adequate site drainage has been provided.			
7.	Verify that wet well washers have gate valves and regulators fitted if fitted.			
Re	storation	1		
1.	Verify that the site restoration has been completed.			
	sting	<u>, </u>		
	Verify that pump well infiltration test passed.			
2.	Verify that pump draw down tests passed.			
3.	Verify rising main has been tested.			
4.	If pump station has been constructed as open cut,			
	verify compaction standard under pipes.			
Me	chanical Equipment			
1.	Verify that the guide rails comply with the standard			
٠.	drawings.			
2.	Verify that the lifting chain complies with Council			
	specification.			
3.	Verify that the Pump footstool has been secured to			
٥.	wet well floor with appropriate chemical anchors &			
	have 316 S/S bolts.			
4.	Are wet well washers specified on design drawings?			
5.	Verify wet well washers meet the Council specified			
	requirement.			
6.	Verify that pumps can be fully removed from pump			
	station without disconnecting the guide rails.			
Ele	ctrical Equipment	1		
	Verify that the Station Identification plate has been			
	fitted to the electrical cabinet.			
2.	Verify that the telemetry antenna has adequate			
	protection in accordance with Council specification.			
3.	Verify that lighting within the switchboard has been			
	provided.			
4.	Verify that the Council locks fitted to switchboard and			
	operational.			
5.	Verify that quick link generator connectors provided.			

Item	Complete	Date / Initials	Council Audit
Security			
Verify that the security fencing has been installed in			
accordance with the design drawings.			
Verify that Council keyed locks installed.			
3. Verify that the switchboard meter cabinet has been			
fitted with Ergon Locks.			
Have all NCD items been reached (including any missel			
Have all NCR items been resolved (including any raised			
as a result of <i>this</i> audit)?			
If YES Issue Acceptance of Works., and close audit.			
Would outstanding NCR items impact on the ability to			
operate the pump?			
If YES then close audit (wait for NCRs to be resolved).			
Has Operations authorized the pumps to remain on?			
If YES record the name of the person who			
authorized this. NAME			
authorized this. NAME			
Lift Station			
Has discharge pit been lined in accordance with the			
WRC Development Manual?			
2. Has benching been completed?			
Overflow	•		
Verify overflow has been constructed to design			
drawings and WRC Development Manuals including			
levels.			
Verify flap valves are in place and operational.			
3. Verify covers are in place and are to class specified.			
4. Verify Overflow can be accessed for maintenance.			

PRE-COMMISSIONING CHECKLIST FOR NEW ASSETS - WATER SITES

REQUIREMENTS BY CONTRACTOR

The following checklist is required to be fully completed, signed and returned to Council before a joint commissioning is considered. Please note: in the event of a commissioning being abandoned due to works not completed or operational, Council will recover costs incurred.

SITE NAME RESERVOIR:	SITE NAME P/S:	
Ergon Power available	Yes	No
Provision of sufficient water for all testing purposes	Yes	No
Fresh water discharge flushing system operating as	per design Yes	No
Ancillaries (GPO's, lighting etc) tested and working of	correctly Yes	No
Pre commission switchboard test completed	Yes	No
Station telemetry points list supplied	Yes	No
Established telemetry communications and verified in	nputs locally Yes	No

VERIFICATION OF AS CONSTRUCTED LEVELS AND OPERATION.

Note: Levels taken from floor level

Setting/Alarm Measureme		Operational function (c	-
Overflow level	m		
High Level alarm	m	Yes	No
Fill stop level	m	Yes	No
Fill request level	m	Yes	No
Low level alarm	m	Yes	No
Very Low Level Alarm	m	Yes	No
Level settings according to design	Yes	No	N/A

PRE-COMMISSIONING CHECKLIST FOR NEW ASSETS - WATER SITES

Commissioning of Civil Works Checklist

Item		Complete	Date / Initials	Council Audit
Ма	nagement			
1.	Verify that consultant has provided all documentation.			
	(as constructed details, operating manuals, test results			
	etc).			
2.	Consultants have supplied O&M manuals			
_	incorporating all drawing both electrical & mechanical.			
3.	Consultants have supplied test results including			
	performance pump curves.			
	If NO then close audit.			
	ncrete			
	Verify that there is no damage to any exposed concrete surface.			
2.	Verify that drainage of the site is away from the structures.			
3.	Verify that the below ground concrete structures are			
	dimensionally correct and in accordance with the			
	design drawings.			
4.	Verify no seepage through the concrete structure.			
5.	Verify the verticality of the structure is within tolerance			
	in accordance with SEWL specifications.			
6.	Verify that all chamfers are provided in accordance			
	with the design drawings.			
7.	Verify that the specified coating to the internal walls			
	has been applied in accordance with the WRC			
	Development Manual.			
8.	Thickness of internal coating tested (µm)			
ОН	&S			1
1.	Verify that ladder access meets OH&S requirements.			
2.	Verify that access to valve chamber meets OH&S			
	requirements.			
3.	Verify that all ladders are provided with the extension			
	above the FSL.			
4.	Verify that the ladders have non-slip treads.			
5.	Have safety cages been specified in accordance with Australian Standards?			
6.	Verify that safety cages have been installed in accordance with the design drawings.			
7.	Verify that adequate set down areas for the covers has			
	been provided in accordance with OH&S			
	requirements.			
8.	Verify that no overhead cables restrict access via crane trucks.			
9.	Verify Full Risk Assessment has been performed and permanent operational/maintenance risks identified,			
10.	Verify that all signage pertaining to those risks is in			
	place.			
11	Facility Name and contacts signage.			
	Standby Emergency Generator – cover, refueling,			
	manuals.			
13.	Adequate access, maneuver and parking for			

_			
	maintenance vehicles.		
14.	Switchboard access and clearance meets		
	requirements under Electrical Safety Act.		
15.	Personnel/maintenance access ring install in side wall		
	of reservoir.		
Pro	ducts & Materials		
1.	Verify that all products incorporated on the project are		
	included on the list of approved products for council.		
2.	Verify that all markings as required by Council		
	specification are visible on the covers.		
3.	Verify that the covers and frames are greased in		
	accordance with the manufacturer's requirements.		
4.	Verify that the interchangeable multi part covers have		
	lifting lugs on the beams for removal and covers have		
	clockwise lifting key holes.		
5.	Verify that internal ladders are stainless steel.		
_	es & Fittings	<u> </u>	
1.	Verify that the valves are anticlockwise closing.		
2.	Verify that adequate supports have been provided for		
	the valves.		
	Are valve extension spindles required?		
4.	Verify that there is sufficient clearance for		
_	maintenance.		
5.	Are adequate supports provided in accordance with		
6	standard drawings?		
6.	Verify that DICL pipe work has been provided to		
-	correct nominal diameter DN.		
7.	Verify that adequate supports for vertical pipe work		
	has been provided in accordance with WRC		
	Development Manual.		
8.	Verify that all gate valves operate through the full		
	range and are left in the open position.		
9.	Verify that a flap valve has been installed on the valve		
10	chamber drain if required by the design.		
10.	Verify that the specified coating for all valves has been		
14	applied.		
111.	Verify that the specified coating for the pipe work has		
40	been applied.		
12.	Verify that the specified bolting system on the flanges		
10	has been used.		
13.	Verify that all valves can be removed through the		
4.4	available cover opening.		
14.	Verify that a flanged dismantling joint has been		
1	provided to allow ease of removal of valves in		
4-	accordance with standard drawings.		
15.	Has the consultant submitted completed project ITP		
4.	containing all signatures.		
16.	Verify all steel metalwork has been Hot Dipped		
	Galvanized.		
17.	Verify all bolts are 316 stainless steel with 308 nuts.		

PRE-COMMISSIONING CHECKLIST FOR NEW ASSETS - WATER SITES

1. Verify that the water service has been fitted with an approved back flow prevention device. 2. Verify that all conduits through the walls have been sealed. 3. Verify that electricity is below ground, not above. 4. Verify that the sealed access track is in accordance with the design drawings and the WRC Development Manual. 5. Verify that adequate site drainage has been provided. Restoration 1. Verify that the site restoration has been completed. Electrical Equipment 2. Verify identification plates have been fittled to the electrical cabinet. 3. Verify that the telemetry antenna has adequate protection in accordance with specification. 4. All wiring is installed, terminated and tagged as per drawings. 5. All Earthing systems are installed & tested to Australian standards. 6. Switchboard testing - Fault protection, Breakers & cable insulation tests have been carried out. Results Attached. 7. Verify that lighting within the switchboard has been provided. 8. Verify that lighting within the switchboard and operational. 9. Verify that the Council locks fitted to switchboard and operational. 9. Verify that the security fencing has been installed in accordance with the design drawings. 2. Verify that the switchboard meter cabinet has been fitted with Ergon Locks. Have all NCR items been resolved (including any raised as a result of this audit)? If YES Issue Acceptance of Works, and close audit. Would outstanding NCR items impact on the ability to operate the pump? If YES details of the person who authorised this. NAME	Oth	ner Services
2. Verify that all conduits through the walls have been sealed. 3. Verify that electricity is below ground, not above. 4. Verify that the sealed access track is in accordance with the design drawings and the WRC Development Manual. 5. Verify that adequate site drainage has been provided. Restoration 1. Verify that the site restoration has been completed. Electrical Equipment 2. Verify identification plates have been fitted to the electrical acbinet. 3. Verify identification plates have been fitted to the electrical acbinet. 4. All wiring is installed, terminated and tagged as per drawings. 5. All Earthing systems are installed & tested to Australian standards. 6. Switchboard testing - Fault protection, Breakers & cable insulation tests have been carried out. Results Attached. 7. Verify that lighting within the switchboard has been provided. 8. Verify that the Council locks fitted to switchboard and operational. 9. Verify that quick link generator connectors provided if applicable. Security 1. Verify that the security fencing has been installed in accordance with the design drawings. 2. Verify that the security fencing has been installed in accordance with the design drawings. 3. Verify that the security fencing has been installed in accordance with the design drawings. 4. Verify that the security fencing has been installed in accordance with the design drawings. 5. Perify that the switchboard meter cabinet has been fitted with Ergon Locks. 1. Have all NCR items been resolved (including any raised as a result of this audit)? 1. If YES issue Acceptance of Works, and close audit. Would outstanding NCR items impact on the ability to operate the pump? 1. If YES then close audit (wait for NCRs to be resolved). 1. Has Council authorised the pumps to remain on? 1. If YES, details of the person who authorised this.	1.	Verify that the water service has been fitted with an
sealed. 3. Verify that electricity is below ground, not above. 4. Verify that the sealed access track is in accordance with the design drawings and the WRC Development Manual. 5. Verify that adequate site drainage has been provided. Restoration 1. Verify that the site restoration has been completed. Electrical Equipment 2. Verify identification plates have been fitted to the electrical cabinet. 3. Verify that the telemetry antenna has adequate protection in accordance with specification. 4. All wring is installed, terminated and tagged as per drawings. 5. All Earthing systems are installed & tested to Australian standards. 6. Switchboard testing - Fault protection, Breakers & cable insulation tests have been carried out. Results Attached. 7. Verify that lighting within the switchboard has been provided. 8. Verify that the Council locks fitted to switchboard and operational. 9. Verify that quick link generator connectors provided if applicable. Security 1. Verify that the security fencing has been installed in accordance with the design drawings. 2. Verify that the switchboard meter cabinet has been fitted with Ergon Locks. Have all NCR items been resolved (including any raised as a result of this audit)? If YES Issue Acceptance of Works, and close audit. Would outstanding NCR items impact on the ability to operate the pump? If YES then close audit (wait for NCRs to be resolved). If YES, details of the person who authorised this. NAME. SIGNATURE: POSITION:		approved back flow prevention device.
3. Verify that the sealed access track is in accordance with the design drawings and the WRC Development Manual. 5. Verify that adequate site drainage has been provided. Restoration 1. Verify that the site restoration has been completed. Electrical Equipment 2. Verify identification plates have been fitted to the electrical cabinet. 3. Verify that the telemetry antenna has adequate protection in accordance with specification. 4. All wiring is installed, terminated and tagged as per drawings. 5. All Earthing systems are installed & tested to Australian standards. 6. Switchboard testing - Fault protection, Breakers & cable insulation tests have been carried out. Results Attached. 7. Verify that the Council locks fitted to switchboard and operational. 9. Verify that the Council locks fitted to switchboard and operational. 9. Verify that the security fencing has been installed in accordance with the design drawings. 2. Verify that the security fencing has been installed in accordance with the design drawings. 2. Verify that the security fencing has been installed in accordance with the design drawings. 2. Verify that the security fencing has been installed in accordance with the design drawings. 3. Verify that the security fencing has been installed in accordance with the design drawings. 4. Verify that the security fencing has been installed in accordance with the design drawings. 5. Verify that the security fencing has been installed in accordance with the design drawings. 6. Verify that the switchboard meter cabinet has been fitted with Ergon Locks. 8. Have all NCR items been resolved (including any raised as a result of this audit)? 1. Verify that the switchboard meter cabinet has been fitted with Ergon Locks. 1. Verify that the switchboard meter cabinet has been fitted with Ergon Locks. 1. Verify the design drawings. 2. Verify that the switchboard meter cabinet has been fitted with Ergon Locks. 1. Verify the design drawings. 2. Verify the drawings. 3. Verify that the switchboard meter	2.	Verify that all conduits through the walls have been
4. Verify that the sealed access track is in accordance with the design drawings and the WRC Development Manual. 5. Verify that adequate site drainage has been provided. Restoration 1. Verify that the site restoration has been completed. Electrical Equipment 2. Verify identification plates have been fitted to the electrical cabinet. 3. Verify that the telemetry antenna has adequate protection in accordance with specification. 4. All wring is installed, terminated and tagged as per drawings. 5. All Earthing systems are installed & tested to Australian standards. 6. Switchboard testing - Fault protection, Breakers & cable insulation tests have been carried out. Results Attached. 7. Verify that lighting within the switchboard has been provided. 8. Verify that the Council locks fitted to switchboard and operational. 9. Verify that the Council locks fitted to switchboard and operational. 9. Verify that the security fencing has been installed in accordance with the design drawings. Security 1. Verify that the switchboard meter cabinet has been fitted with Ergon Locks. Neverify that the switchboard meter cabinet has been fitted with Ergon Locks. Altave all NCR items been resolved (including any raised as a result of this audit)? If YES Issue Acceptance of Works, and close audit. Would outstanding NCR items impact on the ability to operate the pump? If YES then close audit (wait for NCRs to be resolved). NAME		sealed.
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POSITION:		
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DATE:		PU5111UN:
UNI L		DATE:

APPENDIX J - STATEMENT OF COMPLIANCE "AS CONSTRUCTED"

STATEMENT OF COMPLIANCE

"AS CONSTRUCTED" DOCUMENTATION

Name of Development:					
Location of Development:					
Applicant:					
Consulting Engineer:					
Registered Surveyor:					
checked and amended in a and that the completed work	It is hereby certified that the "As Constructed" drawings submitted herewith have been prepared checked and amended in accordance with the requirements of the WRC Development Manual and that the completed works comply with the requirements therein. Certification by Registered Surveyor (Consulting) attached Yes / No				
Compliance with the manu Intent and Function not co by the "As Constructed" V	ompromised	Compliance Yes / No	Non-Compliance refer to attached redesign of works to ensure satisfactory performance		
			P		
Earthworks			P. C. C. C.		
Earthworks Roadworks					
Roadworks Stormwater Drainage Flow System and Str					
Roadworks Stormwater Drainage Flow System and Str Major Flow System a					
Roadworks Stormwater Drainage Flow System and Str Major Flow System a Water Reticulation					
Roadworks Stormwater Drainage Flow System and Str Major Flow System a Water Reticulation Sewerage Reticulation	and Structures				
Roadworks Stormwater Drainage Flow System and Str Major Flow System a Water Reticulation Sewerage Reticulation "As Constructed" Document	and Structures	nents to be true and corre			
Roadworks Stormwater Drainage Flow System and Str Major Flow System a Water Reticulation Sewerage Reticulation "As Constructed" Documer Conscientiously believing the	ntation e above staten				
Roadworks Stormwater Drainage Flow System and Str Major Flow System a Water Reticulation Sewerage Reticulation "As Constructed" Documer Conscientiously believing the Consulting Engineer: Name in Full:	ntation e above statem	RPI	ct:		

APPENDIX K - EXAMPLE OF SURVEYOR'S CERTIFICATION OF "AS CONSTRUCTED" WORKS

EXAMPLE OF SURVEYOR'S CERTIFICATION OF "AS CONSTRUCTED" WORKS

We	hereby certify that the locations, surface and invert
(Name of Surveying Consu	Itant)
	structure presented on the drawings noted below and in the digital data eet the accuracy standards as defined within the WRC Development
Registered Surveyor / Dire	ctor:
Date:	
Drawings and Documents pe	ertaining to the above:

APPENDIX L - AS CONSTRUCTED DATA SEWER PROPERTY CONNECTION BRANCHES

AS CONSTRUCTED DATA

SEWER HOUSE CONNECTION BRANCHES

Development Name:					. Date:	
Contractor:				Ву:		
Stage:						
M/H US	Ф	D/S IL	U/S IL	Grade	Length	
M.H			ERTY CON	IECTIONS		
\perp		D/S Mh No.	U/S Mh No.	Total	Lot. No.	
	Ch					
	IL SL					
	Ch					
	IL					
	SL				_	
	Ch IL					
	SL					
	Ch					
	IL SL				- -	
	Ch L				-	
	SL				-	
	Ch					
	IL SL					
M.H				U/S I	M/H	
				TOP RL		
M/H D.S						
NOTES:						
Certified as True and Correct	et location:	Regis	tered Surve	yor:		
		Signa	ture:			

AS-CONSTRUCTED DATA SEWER HOUSE CONNECTION BRANCHES

Stillson Estate Date 16-5-96 Development Name Contractor Stage ____ D/S IL U/S IL Grade | Length 8.190 8.601 1150 0.150 61.45 0.8 M/H US M.H. 3/3 HOUSE CONNECTIONS OVS MI D/S Mi Total 46 68 No. 69 46.12 61.44 19936 25 0.984 Lor 63 . IL SL Ch IL SL Lot 70 61 21 U/S M/H TOP RL //-23 MH 2/3 M/H D.S. NOTES: Signature Tremble

APPENDIX M - AS CONSTRUCTED DATA SUBMISSION FORM

AS CONSTRUCTED DATA SUBMISSION FORM For Consulting Engineers' or Registered Surveyors' Submission Of "As Constructed" Data

Applicant Details	Development Name (Title on approved Engineering Drawing)						
	File Number		Sta	je Number			
D (A)	D 1D 1 D 1 1						
Property Address	Real Property Description	<u>n</u>					
	Address						
	Company Name						
	Address						
	Phone Number email						
	THORIO TAGITIDOI	Oman					
As Constructed				Ī	Electronic	Amendment	
Documentation				Hardcopy	Сору	#(A,B,C)	
Submitted	Survey Datum					,	
	Water						
	Sewer						
	Drainage						
	Road						
	Parks / Landscape / Stru						
	Utilities						
	Contours						
	Digital field survey data,	ASCII	1				
Other Documentation Submitted			Previous Submitte	LATTACHEG	N/A	Amendment #	
	Engineering drawings in electronic format (AUTO)	CAD)					
	Landscaping and park	<i>5/(D)</i>					
	embellishments in electro	onic					
	format (AUTOCAD)						
	Building / Structural Cert	fication					
	Subgrade CBR results						
	Maintenance Manuals						
Office Use Only	Date Received	DISK No	imber				
-							
	Officer Checked	Docume	nt Numbe	r			

APPENDIX N - ADAC DIGITAL DATA AND DRAWING STANDARDS

1. SURVEY DATUM

Survey Datum is the framework of all geospatial information and provides the starting reference that not only supports the accuracy and integrity of survey data, but also provides the geospatial correlation of assets with other data sets. The following publications, or their successors, are to be used in conjunction with this section:

Standards and Practices for Control Surveys (SP1) - Inter-governmental advisory Committee on Surveying and Mapping (ICSM) publication. Available in .PDF format from the ICSM website. http://www.icsm.gov.au/icsm/publications/sp1/sp1v1-6.pdf

GDA Technical Manual - Inter-governmental advisory Committee on Surveying and Mapping (ICSM) publication. Available in .PDF format from the ICSM website. http://www.icsm.gov.au/icsm/gda/gdatm/index.html

Cadastral Survey Requirements – Refer to the relevant State Government website e.g. in 2012 this www.derm.qld.gov.au/services-resources/item_details.php?item_id=32574 publication available in PDF format.

Datum Recorded

The datum adopted must be recorded, allowing full traceability back to the origin. As the Department of Natural Resource and Water carry out periodic adjustments on both the coordinate and level networks, information to be included as part of the "As Constructed' submission must include a copy of the basic elements of traceability that include but not restricted to:

- Starting point of Datum;
- State the type, material and condition of marks used;
- Show all calculations relating to datum establishment i.e. copy of traverse and levelling details;
- Table of adjusted coordinates, coordinate system, datum and zone;
- Baseline closure details from processing software;
- Report on adjustment (generated from software);
- Network map (A3 .pdf); and
- Permanent Survey Mark Reports (pdf).

This information is necessary to allow subsequent re-computation of the datum's for any future corrections made to the network.

Co-ordinate Datum

Co-ordinate Datum may be:

- Assumed (arbitrary) plane co-ordinates No previous co-ordinates and no correlation required. Used only for where work is undertaken in an already proclaimed survey area or for subdivisions of five (5) lots or less;
- MGA co-ordinates grid co-ordinates from the adjustment of a survey traverse to a
 minimum of two (2) but preferably three (3) or more appropriate survey marks with
 MGA coordinates. Appropriate survey marks will meet or exceed Class B Order 2
 specifications as set out in the ICSM Standards and Practices for Control Surveys
 (SP1). Used for new survey areas to be proclaimed or for subdivision development
 of greater than five (5) lots (subject to negotiation where MGA is not practical); and

 Where no suitable control exists in the form of co-ordinated permanent survey marks, Council will provide coordinates of Class B Order 2 within two (2) weeks of receiving a formal request, at a set fee. Refer <u>Appendix N</u> for Request Form.

Height Datum

All height information will be on either Australian Height Datum or Australian Height Datum (Derived) and to a minimum standard of Third Order Levelling. Third order levelling is retained because of traditional acceptance. (Refer to Class C Differential Levelling (LC) as defined in the ICSM Standards and Practices for Control Surveys (SP1))

Meridian Datum

The meridian datum may be one of the following:

- For MGA co-ordinates:
- The meridian is derived from the adjusted survey traverse between the coordinated survey marks.
- For Assumed co-ordinates:
- Azimuth of the current Australian Mapping Grid;
- · County Arbitrary Meridian; and
- Meridian from an original survey or adjoining survey.

2. "AS CONSTRUCTED" DIGITAL GROUND SURVEY

A digital ground survey is required to produce the three-dimensional model of the changes to the natural surface and the location of all artificial features, pursuant to an approved operational works development permit. The Digital Ground Survey will comprise of:

- Sufficient measurements to both topographical features and constructed assets, to ensure that all points and strings in the digital model accurately reflect their true geometric shape and location on the earth's surface; and
- Spacing between points will ensure that a tolerance for the length of triangle sides in the triangulation model do not exceed 25m on pavement and 50m outside of pavement.

Data provided to Council as part of the "As Constructed" submission shall include the export of the processed survey data in either an ASCII format or in an appropriate format that is requested by Council.

3. "AS CONSTRUCTED" DRAWINGS

Council requires "As Constructed" Drawings to be produced using "AutoCAD" Software and submitted in DWG format only. Consultants shall ensure that when lodging AutoCAD drawing files that they are compatible with the current version of AutoCAD being used by the relevant member Council. No drawing sheets or title blocks shall be used on the file:

- Specific features are represented by blocks and certain line styles and such require specific definition and attribute details recorded. These features, their definitions and attribute data requirements are covered in the following sections of this document;
- Service plans shall be submitted in Gray scale "PDF" format, digitally certified or with the certification (**Appendix K**) as per Section CP1.22 sub-section 2 and with two (2) additional B & W hard copy paper prints, produced for each service on the consultants drawing sheets. Both PDF and hardcopy plans must be legible. The plans shall be

prepared according to the following scales and sheet sizes:

Stormwater Drainage 1:500 (A1 sheets)
Sewerage 1:500 (A1 sheets)
Water 1:500 (A1 sheets)

Reservoir Sites 1:200 (A1 sheets)

Pump Stations 1:200 (A1 sheets)Treatment Plants 1:200 (A1 sheets)

- Electronic Data shall be supplied on CD's or DVD;
 - The "As Constructed" drawing may be prepared by either the Consulting Engineer or the Registered Surveyor but must comply with the requirements presented herein;
 - Survey accuracy to be meters to three decimal points; and
 - The AutoCAD drawing shall be a single drawing containing seven (7) main elements:
 - Cadastral Base showing property boundaries, easements and Permanent Survey Marks and Survey Control;
 - Topographical Features including kerbing / edge of seal, top and toe of batters, change of grades, retaining wall, watercourses, structures, landscaping and park embellishments, contours at 0.5m intervals, etc.;
 - Water showing existing infrastructure and the connection details for new infrastructure, offsets from boundary, connection points, main size, valves, hydrant locations to property boundaries, etc. together with the location of any irrigation pipes and associated fittings, and details of any water infrastructure abandoned or removed as a result of the new works;
 - Sewerage showing existing infrastructure and the connection details for new
 infrastructure, pipe invert levels, pipe diameter and grades, cover levels, location
 to property boundary, distance from downstream manhole to PCB's, PCB's
 levels and type, and details of any sewerage infrastructure abandoned or
 removed as a result of the new works;
 - Stormwater Drainage showing pipe invert levels, pipe diameter and grades, pipe material, finished surface levels, drainage structure description, catch drains, open drains / swales, etc.;
 - Roads showing centre of road carriageway, kerbing / edge of seal; and
 - Pump and lift stations Specifications as listed in "Drafting Requirements" Sewerage Pump Stations.

4. DRAFTING REQUIREMENTS ("AS CONSTRUCTED")

The general drafting requirements for the preparation of "AutoCAD" drawings shall be as detailed in this section. Any elements encountered in the preparation of these drawings not specifically covered by this manual shall be confirmed with Council's Asset Management Section prior to submission of drawing file.

- The orientation of the drawing must be set to AutoCAD's default (ie 90 at 12 o'clock, and anticlockwise measured angles);
- 1 Drawing unit = 1 metre;
- All symbols and line types to be as specified within this section. A digital file of Councils linestyles, layers and blocks will be made available;
- All colours are to be by layer (except internal block linework);
- All line types are to be by layer;
- AutoCAD layer names shall be in accordance with Table CP1.2 or as specified within this section; and
- All lines are to be 2D poly lines and all blocks are to have a z value (level value).

Table CP1.2 Layering Standards

Description of Layer	Annotation	AutoCAD Layer	AutoCAD Linetype	AutoCAD Colour Index
2.0 mm high text	2.0 mm	020_TXT	Continuous	254 (light grey)
2.5 mm high text	2.5 mm	025_TXT	Continuous	7 (white)
3.5 mm high text	3.5 mm	035_TXT	Continuous	2 (yellow)
5.0 mm high text	5.0 mm	050_TXT	Continuous	1 (red)
7.0 mm high text	7.0 mm	070_TXT	Continuous	5 (blue)
10.0 mm high text	10.0 mm	100_TXT	Continuous	30 (Orange)
Contours	N/A	CONTOUR	Continuous	252 (dark grey)
Contour heights	2.0 mm	CONTOUR_HEIGHT	Continuous	254 (light grey)
As Constructed Above Ground Electricity	N/A	ELECTRIC_ABOVE	-E-E-	220
As Constructed Underground Electricity	N/A	ELECTRIC_UNDER	_EE_	220
As Constructed Aboveground Telecommunication	N/A	TELECOM_ABOVE	_T_T_	133
As Constructed Underground Telecommunications	N/A	TELECOM_UNDER	_TT_	133
As Constructed Above ground Optical Fibre	N/A	OPTIC_ABOVE	_OF_OF_	133
As Constructed Underground Optical Fibre	N/A	OPTIC_UNDER	-OFOF-	133
As Constructed Fuel Line	N/A	FUEL_LINE	_FF_	44
As Constructed Gas Line	N/A	GAS_LINE	_GG_	23
Electricity text	2.5 mm	ELECTRIC_TXT	Continuous	7 (white)
Telecom Text	2.5 mm	TELECOM_TXT	Continuous	7 (white)
Optical Fibre Text	2.5 mm	OFTIC_TXT	Continuous	7 (white)
Fuel Line Text	2.5 mm	FUEL_LINE_TXT	Continuous	7 (white)
Gas Line Text	2.5 mm	GAS_LINE_TXT	Continuous	7 (white)

5. LINEWORK

It should be noted that Pen Size Colours are as follows:

•	0.15	132	
•	0.25	8	(Grey)
•	0.25	4	(Cyan)
•	0.35	7	(White)
•	0.35	200	(Purple)
•	0.50	2	(Yellow)
•	0.50	3	(Green)
•	0.70	5	(Blue)
•	0.50	6	(Magenta)
•	1.00	1	(Red)
•	1.00	30	(Orange)

- Linetype scale shall be = 10; and
- All line types shall be taken from the Department of Main Roads 'Drafting and Design Presentation Standards'.

6. TEXT STYLES

• Text styles to be used on all Drawings shall be specified as below:

Text Style Name	Font Name	Height	Width	Oblique Angle	Backwards	Upside Down	Vertical
RS	Romans	0.0	1.0	0d0'0"	N	N	N
RSO	Romans	0.0	1.0	15d'0'0"	N	N	N

7. BLOCKS

Council supplied blocks shall be used at all times and XREF blocks shall not be used. Many of
these blocks will have numerous attributes (visible and hidden) attached to them. It is the
responsibility of the Consultant preparing the "As Constructed" Digital Submission to complete all
attributes as identified in the block attributes tables. The remaining attributes are for Council's use.
Blocks must be inserted at and must remain at a scale of 1:1.

8. ACCURACY REQUIREMENTS

Dimensions shall be used to accurately define the location of the service entities in the asconstructed data (the dimension requirements are described below). However, to ensure the clarity
of the utility plans, Council requires that consultants separate the entities to enable them to be
easily identifiable at the appropriate scale. Relativity among the entities and in relation to other
features must be maintained (eg if an entity is to the east of a boundary it must be shown on the
plan to be east of that boundary).

Location:

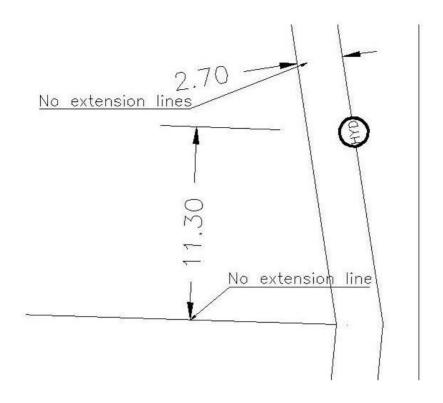
- Dimensions shall be shown to two decimal place; and
- Pipe lengths shall be shown to two decimal place.

I evel:

- PCB Invert Levels shall be shown to two decimal places;
- Pipeline Invert Levels shall be shown to two decimal places;
- RL Manhole Lid levels shall be shown to two decimal places;
- All depths shall be shown to two decimal places;
- Finished Surface Levels shall be shown to two decimal places; and
- Pipe Grades shall be expressed as a ratio (eg 1:150) determined from full survey accuracy.

9. DIMENSIONING

- Council requires the Dimensioning of "As-Constructed" services to conform to the following criteria:
- There must be sufficient dimensions to define the location of the service without ambiguity. Pipelines must be dimensioned sufficiently to show their alignment in relation to the cadastre. Service entities (valves, hydrants, manholes, PCB's, etc) must be located in relation to the nearest cadastral corner. PCB's must be located in relation to the nearest cadastral corner of the lot it services. If PCB's have been installed to service a future stage of development, then PCB details relevant to the future stage lots are to be presented on the as-constructed drawing for that stage. Note: in areas containing a number of service entities clustered together, dimensioning is to be sufficient to locate the main elements of the cluster only (eg every service entity is not required to be fully dimensioned). Service entities located opposite cadastral boundary intersections do not require dimensioning;
- The dimensioning of the utilities is to be in accordance with the Council's dimensioning styles. These styles are set in the prototype drawing that can be obtained from Councils Asset Management Section upon request. Council has developed a style for use with each of the utilities (water, sewerage and drainage). The appropriate style to use is listed with the individual utilities' requirements;
- Dimension extension lines must be created manually in the appropriate dimension's layer.
 Extension lines are not to be created that cover other linework (pipelines, property boundaries etc).
 See diagram below. Note: the dimension styles supplied by Council have the extension lines set to none as a default. Do not reset;
- Dimension text is to be outside of the extension lines and clear of the roadways. See diagram below: and
- Dimensions are to be layered separately for each utility. Please refer to the relevant utilities requirements for the appropriate layer.



10. SURVEY CONTROL

The Survey Control entity requirements are as follows:

• Line work

Description	Layer	Colour (by layer)	Line Type (by layer)
Survey Traverse	AC_SURVEY_TRAVERSE	Dark Green (96)	Continuous

Text

Descriptio n	Layer	Colou r (b y la ye r)	Text S t y I e	Text H ei g ht
Permanent Survey Mark	AC_SURVEY_PSM	Dark Re d (12)	RS	1.25
Survey Instrumen t Station	AC_SURVEY_IS	Dark Re d (12	RS	1.25
Survey Traverse	AC_SURVEY_TRAVERS E	Dark Gr	RS	1.25

details	ee	
	n	
	(96	
)	

Blocks

Bloc k	Name	Descriptio n	Layer	Colou r
	SURVEY_PS M	Permanent Survey Mark	AC_SURVEY_PS M	Dark Re d (1 2)
Δ	SURVEY_INS T	Instrument Station	AC_SURVEY_INS T	Dark Re d (1 2)

 Bearings and Distances shall be recorded against all sections of the traverse line in the AC_SURVEY_TRAVERSE layer.

11. CADASTRAL BASE

The Cadastral Base entity requirements are as follows:

Line work

Description	on Layer		Line Type (by layer)
Property Boundary	AC_CADASTRE_PROPBDY	4 (Cyan)	Continuous
Easements	AC_CADASTRE_EASE	4 (Cyan)	Dashed (0.0 wide)
Existing Boundary	AC_CADASTRE_EXBDY	8 (Grey)	Continuous
Existing Easement	AC_CADASTRE_EXEASE	8 (Grey)	Dashed (0.0 wide)
Future Boundary	AC_CADASTRE_FUTBDY	8 (Grey)	Continuous
Future Easement	AC_CADASTRE_FUTEASE	8 (Grey)	Dashed (0.0 wide)
Major Contours	AC_MAJOR_CONTOURS	252 (Dark Grey)	Contour Major
Minor Contours	AC_MINOR_CONTOURS	254 (Light Grey)	Contour Minor

Note: Contour information will be for internal Council use only.

Not required on plotted hard copies.

- Property boundary line work shall not be broken when crossed by text. All text is to be located clear of line work whenever possible. Refer to the Table above;
- All boundaries between allotments and road reserve will be placed in the AC_CADASTRE_PROPBDY layer; and
- Each parcel to be an individual close polyline.

Text

Description	Layer	Colour (by layer)	Text Style	Text Height
Permanent Survey Mark	AC_CADASTRE_PSM	4 (Cyan)	RS	1.25
Lot No.	AC_CADASTRE_LOTN O	2 (Yellow)	RS	1.25
Registered Plan No.	AC_CADASTRE_RPNO	3 (Green)	RSO	2.0
Drainage Reserv e Text	AC_CADASTRE_DRTE XT	4 (Cyan)	RS	1.25
Contour Text	AC_CONTOURS	252 (Dark Grey)	RS	1.0

- Allotment numbers are to be located in the centre of the boundary opposite the sewer line and
 inside the allotment (eg. If the sewer line is along the rear boundary, numbers should be placed
 centrally along the front boundary) or close by in a clear position; and
- All text shown on a plan, other than acceptable abbreviations, shall be in uppercase.

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12. WATER RETICULATION

The Water entity requirements are as follows:

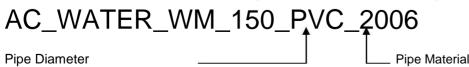
Linework

Description	Layer	Colour (by lay er)	Line Type (by Layer)
Water Main > 50 dia	Refer below	2 (Ye Ilow)	Continuous Polyline (0.0 wide)
Water Main =< 50 dia	Refer below	4 (Cy an)	Continuous Polyline (0.0 wide)
Trunk Main	Refer below	2 (Ye Ilow)	Dashed Polyline (0.0 wide)
Private Service	Refer below	4 (Cy an)	Continuous Polyline (0.0 wide)
Reclaimed Water Main	Refer below	200 (Pu rple)	Continuous Polyline (0.0 wide)
Service to Park or Landsca ping	Refer below	7 (W hite)	Continuous Polyline (0.0 wide)
Existing Water Feature s	AC_WATER_EXIST	8 (Gr ey)	Dashed (0.0 wide)

• Layer Names for water mains shall be in the format shown below:

Denotes Water Reticulation Type: WM – Water Main, WT – Trunk Main, WP – Private Main, WI – Irrigation and WR – Reclaimed Water

Year Installed

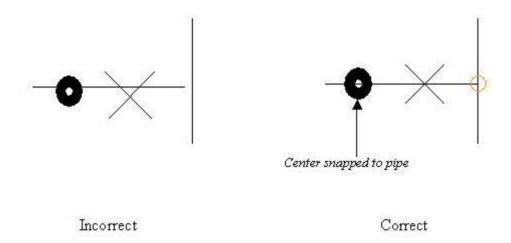


• Crossing and connecting water pipes are to be shown as below. Connecting water pipes are to be represented by the Water Junction block.



Water pipes cross but not joined.

- Water pipes join.
- Water mains and irrigation pipes are to be one continuous 2D Polyline, broken only at pipe junctions and valves.
- Ensure that all pipes/ junctions/ valves are snapped to the centre/ end of the object.



- Connections to existing water features in Council controlled land are required and are to be placed in the AC_WATER_EXIST layer.
- Text

Descript ion	Layer	Col o u r	Te	Text H e i g h t
Pipe size,	AC_WATER_T EXT	4 (RS	2.0

mate rials and note s		C y a n)		
Reservoi r Text	AC_WATER_T EXT	4 (C y a n)	RS	2.0

- Dimensioning
- Dimension Style WATER
- Dimension Layer AC_WATER_DIM

Water Block Details

Block	Name	Description	Layer	Colour
¥	Water_Air	Air Valve	AC_WATER_AV	2 (Yellow)
С	Water_Chlorin	Chlorination Plant	AC_WATER_WC	4 (Cyan)
E	Water_Elec	Electrical Controls	AC_WATER_EC	4 (Cyan)
	Water_End	Endcap for pipes	AC_WATER_END	2 (Yellow)
, *	Water_Float	Float Valve	AC_WATER_FV	2 (Yellow)
X	Water_Hydraulic	Hydraulic / Control Valve	AC_WATER_HV	2 (Yellow)
•	Water_Hydrant	Fire Hydrant	AC_WATER_HYD	2 (Yellow)
0	Water_Junction	Junction of Water Pipes	AC_WATER_JUNC	30 (Orange)
*	Water_Pressure	Pressure reducing Valve	AC_WATER_PRV	2 (Yellow)
\triangleright	Water_Reducer	Reducer	AC_WATER_RED	2 (Yellow)
K	Water_Reflux	Reflux Valve	AC_WATER_RFV	2 (Yellow)
RES	Water_Res	Reservoir	AC_WATER_RES	2 (Yellow)
×	Water_Scour	Scour Valve	AC_WATER_SCRV	2 (Yellow)
X	Water_Stop	Stop Valve	AC_WATER_SV	2 (Yellow)
V	Water_VPit	Valve Pit	AC_WATER_VP	4 (Cyan)
	Water_Meter	Water Meter	AC_WATER_WM	4 (Cyan)
Р	Water_PStn	Water Pump Station	AC_WATER_PS	4 (Cyan)

13. SEWERAGE RETICULATION

The Sewer entity requirements are as follows:

• Line work

Descriptio n	Layer	Colour (by Iayer)	Line Type (by layer)
Pressure (Rising) Main	Refer below	6 (Mag enta)	P main (assig n line type to object)
Gravity Mains	Refer below	6 (Mag enta)	Continuou s
Vacuum Mains	Refer below	6 (Mag enta)	V main (assig n line type to object)
Existing Feature s	AC_SEWER_EXIS T	8 (Grey)	Dashed (0.0 wide)
*PCB's	AC_SEWER_PCB	1 (Red)	Continuou s

^{*} Refers to all PCB's, which are to service new lots created by the development to which the as-constructed drawing relates, regardless of whether or not the PCB's were installed in a previous construction or installed on an existing sewer. (Where existing PCB's have been obtained from a third party, it is recognised that they cannot be certified and in such cases need to be noted.)

- Connections to existing sewer features in Council controlled land are required and are to be placed in the AC_SEWER_EXIST layer.
- Sewer pipes are to be one continuous 2D polyline between manholes / valves / pump or lift stations.
- Layer Names for Mains shall be in the format shown below:

Denotes Sewerage Type: SG – gravity, SR – Rising & SV – Vacuum

Year of

AC_SEWER_SG_150_PVC_2005

Installation

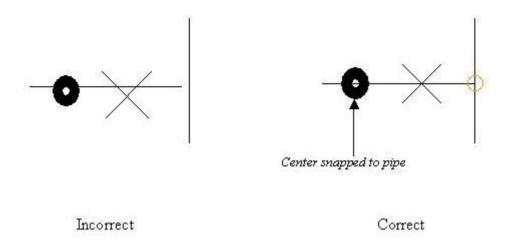
Pipe Diameter	Material

Text

Descript ion	Layer	Colo u r (b y I a y e r	Te	Text H e i g h t
Pipe dia, Mate rial, Leng th, grad e & Inver t level	AC_SEWER_P IPE	4 (C y a n)	RS	1.25
PCB Detai Is	AC_SEWER_P CB	4 (C y a n	RS	1.0

• All text other than acceptable abbreviations shall be in uppercase.

• Ensure that all pipes / junctions / valves are snapped to the centre / end of the object.



- Dimensioning
- Dimension Style SEWER
- Dimension Layer AC_SEWER_DIM

Sewer Block Details

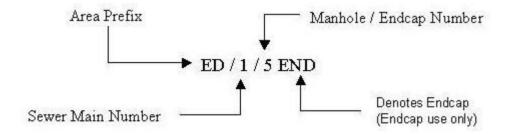
Block	Name	Descr ip ti o n	Layer	Col o u r
¥	Sewer_ Air	Air V al v e	AC_SEWE R_AV	3 (G r e e n
	Sewer_ End	Endc a p fo r Pi p e s	AC_SEWE R_END	6 (M a g e n t a)
X	Sewer_ FSL	Finish e d S ur fa c e L e v el	AC_SEWE R_FSL	4 (C y a n)
December 711	Sewer_ PCB	Prope rt y C o n n e cti o n	AC_SEWE R_PCB	6 (M a g e n t a)
\supset	Sewer_ Refl ux	Reflu x V al v e	AC_SEWE R_RFV	3 (G r e e n)

	I	1	T.	
×	Sewer_ Sco ur	Scour V al v e	AC_SEWE R_SCR V	3 (G r e e n
©	Sewer_I O	Inspe cti o n O p e ni n g s	AC_SEWE R_IO	4 (C y a n
MS	Sewer_ MS	Sewe r M ai nt e n a n c e S h af t	AC_SEWE R_MH	4 (C y a n)
MH	Sewer- MH	Sewe r M a n h ol e	AC_SEWE R_MH	4 (C y a n)
⊕	Sewer_ ScM H	Sewe r S c o ur M a n h ol e	AC_SEWE R_MH	4 (C y a n)
0	Sewer_ PSt n	Sewe r P	AC_SEWE R_PS	6 (N

		u m p St at io n		a g e n t a
×	Sewer_ Stop	Sewe r St o p V al v e	AC_SEWE R_SV	3 (G r e e n)
E	Sewer_ Elec	Electri c al C o nt ro ls	AC_SEWE R_EC	4 (C y a n)
V	Sewer_ VPit	Valve Pi t	AC_SEWE R_VP	4 (C y a n
	Sewer_ Vac Stn	Vacu u m P u m p St at io n	AC_SEWE R_VAC PS	3 (G r e e n)
③	Sewer_ Stor e	Stora g e T a n k	AC_SEWE R_ST	4 (C y a n)
	Sewer_ Oflo w	Overfl o w Pi t	AC_SEWE R_OP	4 (C y a n)

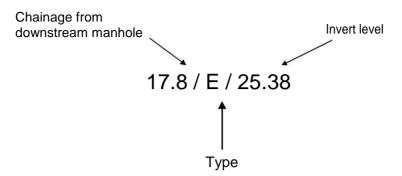
®	Sewer_ Vac Pit	Vacu u m Pi t	AC_SEWE R_VAC PT	4 (C y a n)
	Sewer_ Red ucer	Redu c er	AC_SEWE R_RED	3 (G r e e n)
LEMOT GARD) LPSTRZ, DOMNISTR	Sewer_ Pipe	Pipe at tri b ut e d et ai	AC_SEWE R_PIPE	4 (C y a n)

- The preferred method of denoting pipe invert levels for all sewer pipes is via the use of Sewer_Pipe Block.
- Manhole



- Endcaps and rodding points use a very similar format. Endcaps must have the work "END" included after the endcap number (eg. ED/26/6 END) and rodding points must have the letters "RP" included as part of the rodding number (eg. ED/26/RP6).
- Area prefix numbers are listed in the Local Government Specific section.
- Property Connection Branches shall be described using the following format. Refer to Standard

drawing S3005 for different PCB types.



Note: For Type A, the invert level will be taken as the invert level of the IO pipe of the branch (refer S3005). All other types are invert level of the sewer main at the PCB.

- Finished Surface Levels
 - Finished surface levels are required at all cadastral corners. The Sewer_FSL block must be used for all finished surface level information. The surface level data at cadastral corners must be placed in the layer AC_SEWER_FSL.
- Pipe Invert Levels
 - Gravity Mains Invert levels must be provided for all gravity mains. The pipe invert levels are to be recorded in the Sewer Pipe Block; and
 - Pressure (Rising) Mains Invert level information is required along all pressure (rising) mains. They must be shown at valves, in the pump station and at discharge points. The pipe invert levels are to be recorded in the Sewer Pipe Block.
- For pump and lift stations, all relevant details are to be recorded in the relevant pump station block. Refer to block for required data.

14. SEWERAGE PUMP STATIONS

- The pump / lift station number shall be provided by Council.
- Text

Description	Layer	()	Text Style	Text Height
Pipe Dia, Material, Length, Grade & Invert Levels	SEWERAGE _SPS	4 (Cyan)	RS	1.25
Misc. text descriptions	AC_SEWER_TEXT	4 (Cyan)	RSO	1.0

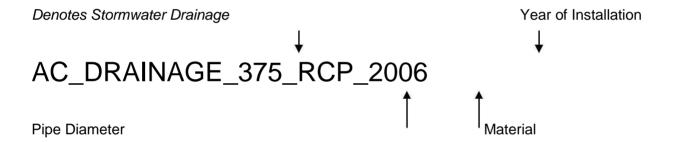
15. STORMWATER DRAINAGE SYSTEM

The Stormwater entity requirements are as follows:

Line work

Description	Layer	Colour (by layer)	Linetype (by layer)
RC Pipes	Refer below	1(Red)	RCP (Polyline 0.5 wide)
PVC Pipes	Refer below	1(Red)	Continuous (Polyline 0.25 wide)
Box Culverts	Refer below	7(White)	RCBC (Polyline 0.5 wide)
Catch Drain	Refer below	1(Red)	CDP (Polyline 0.5 wide)
Sub Surface Drains	AC_DRAINAGE_SSURF	3(Green)	SSD (Polyline 0.0 wide)
Retaining Walls	AC_DRAINAGE_RETWALL	132	Continuous (Polyline 1.0 wide)
Existing Features	AC_DRAINAGE_EXIST	8(Grey)	Dashed (0.0 wide)

- Connections to existing stormwater features in Council controlled land are required and are to be placed in the AC_DRAINAGE_EXIST layer.
- Layer names for stormwater lines shall be in the format shown below:



- Catch Drain polylines are to be a 2D polyline and based on the centre of the constructed drain.
- Text

Description	Layer		Text Style	Text Height
Catch Drain Levels	AC_DRAINAGE_TEXT	4 (Cyan)	RS	1.0
RCP Diameter, Material, Length and Invert Levels	AC_DRAINAGE_TEXT	4 (Cyan)	RS	1.0
Box Culvert, Size, Material Length & Invert Levels	AC_DRAINAGE_TEXT	4 (Cyan)	RS	1.0
Sub Surface Drain Text	AC_DRAINAGE_TEXT	4 (Cyan)	RS	1.0
Kerb Inlet Type & RL Top	AC_DRAINAGE_KERB	4 (Cyan)	RS	1.0

Manhole & RL Top	AC_DRAINAGE_MH	4 (Cyan)	RS	1.0
Endwalls	AC_DRAINAGE_HDWALL	4 (Cyan)	RS	1.0
Field Inlet Pit	AC_DRAINAGE_PIT	4 (Cyan)	RS	1.0
Finished Surface Level	AC_DRAINAGE_FSL	132	RS	1.0

- Dimensioning
 - Dimension Style DRAINAGE
 - Dimension Layer AC_DRAINAGE_DIM
- Finished Surface Levels.
- Finished surface levels are required at all cadastral corners and at changes of grade. The AC_DRAINAGE__FSL block must be used for all finished surface level information and placed in the layer AC_DRAINAGE_FSL.
- Both above ground and underground drainage details are to be recorded in the AC_DRAINAGE_TEXT layer.

Drainage Blocks

Block	Name	Description	Layer	Colour
	Drain_Culvert	Culvert Text Box	AC_DRAINA GE_CUL VERT	4 (C ya n)
×	Drain_FSL	Finished Surface Level	AC_DRAINA GE_FSL	4 (C ya n)
	Drain _GPT	Gross Pollutant Trap	AC_DRAINA GE_GPT	4 (C ya n)
0	Drain_IO	Inspection Opening	AC_DRAINA GE_IO	4 (C ya n)
	Drain_HW	Headwall	AC_DRAINA GE_HD WALL	4 (C ya n)
	Drain_EWW	Head and Wingwalls	AC_DRAINA GE_HD WALL	4 (C ya n)
	Drain_RKerb	Kerb Inlet Pit / Grate located RHS	AC_DRAINA GE_KER B	4 (C ya n)
	Drain_MKerb	Kerb Inlet Pit / Grate located Middle	AC_DRAINA GE_KER B	4 (C ya n)
	Drain_LKerb	Kerb Inlet Pit / Grate located LHS	AC_DRAINA GE_KER B	4 (C ya n)
M I	Drain_MH	Manhole	AC_DRAINA GE_MH	4 (C ya n)
	Drain_Open	Open Drain Text Box	AC_DRAINA GE_DR AIN	4 (C ya n)
#E	Drain_Pipe	Pipe Text Box	AC_DRAINA GE_PIP	4 (C ya

			E	n)
	Drain_Pit	Field inlet Pit	AC_DRAINA GE_PIT	4 (C ya n)
	Drain_CPit	Field Inlet Put, Concrete Shute	AC_DRAINA GE_PIT	4 (C ya n)
0	Drain_PStn	Drain Pump Station	AC_DRAINA GE_PS	4 (C ya n)
	Drain_Tide	Tide Flap / Grate	AC_DRAINA GE_TID E	4 (C ya n)

• Location of Structure Point and Levels

Drainage structure location point for the various structures shall be as shown.



GRATED KERB INLET PIT

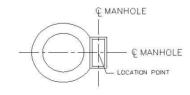


FIELD INLET PITS





HEADWALLS



GROSS POLLUTANT TRAPS

16. ROAD NETWORK

The Road Network entity requirements are as follows:

Line work

Description	Layer	Colour (by layer)	Linetype (by layer)
Barrier Kerb & Edge Restraint	AC_ROAD_KERB_SKNC	4 (Cyan)	Continuous (Polyline 0.0 wide)
Barrier Kerb & Channel	AC_ROAD_KERB_SKCC	4 (Cyan)	Continuous (Polyline 0.0 wide)
Maintenance Strip	AC_ROAD_KERB_MEDNC	4 (Cyan)	Continuous (Polyline 0.0 wide)
Semi Mountable & Layback	AC_ROAD_KERB_SMKNC	4 (Cyan)	Continuous (Polyline 0.0 wide)
Layback & Channel	AC_ROAD_KERB_SMKCC	4 (Cyan)	Continuous (Polyline 0.0 wide)
Concrete Invert	AC_ROAD_KERB_NKCC	4 (Cyan)	Continuous (Polyline 0.0 wide)
Bridge Deck	AC_ROAD_BRIDGE	6 (Magenta)	Continuous (Polyline 0.0 wide)
Paths	AC_ROAD_PATH	4 (Cyan)	Continuous (Polyline 0.0 wide)
Existing Features	AC_ROAD_EXIST	8 (Grey)	Dashed (0.0 wide)
Thresholds	AC_ROAD_THOLD	4 (Cyan)	Continuous (Polyline 0.0 wide)
Centreline	AC_ROAD_CLINE	132	Continuous (Polyline 0.0 wide)

Text

Description	Layer	Colour (by layer)	Text Style	Text Height
Kerb & Channel	AC_ROAD_KERB	4 (Cyan)	RS	1.0
Path Material	AC_ROAD_PATH_TEXT	1 (Red)	RS	2.0
Threshold Material	AC_ROAD_THOLD	1 (Red)	RS	2.0
Pavement Details	AC_ROAD_PAV	1 (Red)	RS	2.0
Road Names	AC_ROAD_TEXT	1 (Red)	RS	4.0

- All constructed footpaths are to be located and recorded in the AC_ROAD_PATH layer, with path material type recorded in the AC_ROAD_PATH_TEXT layer.
- All different kerb types are to be individually identified by their respective Layer Names refer to standard kerb drawings S1000 & S1001.

- All Thresholds are to be represented by a closed polyline, with threshold material type recorded in the AC_ROAD_THOLD layer.
- All bridge decks are to be located and recorded in the AC_ROAD_BRIDGE layer.
- Subgrade CBR, Road pavement and surface details are to be recorded in the AC_ROAD_PAV layer in the Pavement block
- Road Block Details

Block	Name	Description	Layer	Colour
	Traffic_Sign	MUTCD Traffic Signs	AC_ROAD_SIGN	6 (Magenta)
BRIDGE	Bridge	Bridge details	AC_BRIDGE	6 (Magenta)
SUR_MATRL SUR_DEP_CBR BASE_MATRL BASE_DEP_CBR SBASE_MATRL SBASE_MATRL SBASE_DEP_CBR	Pavement	Pavement details	AC_ROAD_PAV	

17. PARKS / LANDSCAPING / STRUCTURES

The Park / Landscaping / Structure entity requirements are as follows:

Linework

Description	Layer	Colour (by layer)	Linetype (by layer)
Vegetation	AC_LAND_VEGETATION	96 (Dark Green)	Continuous (Polyline 0.0 wide)
Soft fall Area	AC_LAND_SOFTFALL	30 (Orange)	Continuous (Polyline 0.0 wide)
Paving / Concrete	AC_LAND_PAVING	4 (Cyan)	Continuous (Polyline 0.0 wide)
Building / Structure	AC_LAND_STRUCTURE	4 (Cyan)	Continuous (Polyline 0.0 wide)
Pedestrian Bridge	AC_LAND_BRIDGE	2 (Yellow)	Continuous (Polyline 0.0 wide)

Text

Description	Layer	Colour (by layer)	Text Style	Text Height
Vegetation	AC_LAND_TEXT	96 (Dark Green)	RS	1.0
Soft fall Area	AC_LAND_TEXT	96 (Dark Green)	RS	1.0
Lighting Electrical	AC_LAND_TEXT	96 (Dark Green)	RS	1.0
Paving Details	AC_LAND_TEXT	96 (Dark Green)	RS	1.0

- All distinct landscaping features with the development are to be represented by a closed polyline and on their respective layers. These features shall include but not limited to:
 - Garden Beds AC_LAND_VEGETATION, including areas of vegetation with medians and roundabouts;
 - Areas of pavers / concrete that are not part of a pathway AC_LAND_PAVING and attribute details recorded in the attribute block Structure; and
 - Soft fall areas AC_LAND_SOFTFALL and the description of both the border edge and soft fall material in the attribute block Park Misc.
- All individual features with the development are to be represented by their respective blocks.
 These shall include but not limited to:
 - Individual Trees:
 - · Rubbish Bins;
 - Water bubblers:
 - · Play Ground equipment; and
 - Park Embellishments.
- The outer edge of all constructed structures are to be located and represented by a closed polyline. In association with the polyline, the relevant block will be used to record the attribute details for that structure and placed at the centre of the structure. These structures shall include but not limited to:
 - Buildings / Shelters Attribute block, Structure;
 - Pedestrian Bridge Attribute block, Bridge, refer road section; and
 - Playing Court (eg. Basketball or Tennis) Attribute block, Park_Misc.
- Parks / Landscaping Block Details

Block	Name	Description	Layer Colou	
\oplus	TREE	Single Tree	AC_LAND_VEGETATION	92
Ť	WATER_FNTN Water Drinking Fountain		AC_LAND_STRUCTURE	4 (Cyan)
4	RUBBISH	Rubbish Bin	AC_LAND_STRUCTURE	4 (Cyan)
\$	PLAY_EQUP	Play Equipment	AC_LAND_STRUCTURE	4 (Cyan)
1	PARK_MISC	Landscape Embellishments	AC_LAND_STRUCTURE	4 (Cyan)
	STRUCTURE	Building / Shelter	AC_LAND_STRUCTURE	4 (Cyan)

18. UTILITIES

Any utility laid outside of the service trench, ie. Gas or electricity that connects to a Council asset in a park or reserve (other than road reserve), must be located and recorded on layer AC_LAND_UTILITY with reference to linestyles, text and symbols as per AS 1100.401 – 1984 "Engineering Survey and Engineering Survey Design Drawing".

19. ATTRIBUTE INFORMATION REQUIREMENTS ("AS CONSTRUCTED")

WATER

Attribute Information is to be supplied for all new water reticulation assets which ultimately become the property and responsibility of Council. Attribute information is recorded in the water layer format and the various blocks as listed in the "As Constructed" Drawing Requirements water section.

Mains

- · Pipe diameter;
- · Pipe material;
- Pipe manufacturer;
- Pipe Class;
- Pipe lining material;
- Pipe protection;
- JTYPE Joint type;
- End caps, bends, fittings and thrust blocks;
- Location Above or below ground, default below;
- Length Length of pipe measured between junctions or changes in horizontal direction;
- Installation depth, if not standard;
- Operating pressure at critical locations (low points, high points);
- Running chainages from the pump station to changes of grade, valves, air vents, scour valves, bends and access chambers along the main;
- Surface level and crown level at changes of grade, and at a maximum of 30 metre centres;
- Dimensions from horizontal bends in the main to two (2) property boundaries or corners; and
- Year of Installation.

Valves and Hydrants

A valve entity is classified as any sort of flow controlling or limiting device that is attached to a water reticulation or service line. Entities will include but not limited to air valves, sluice valves, scour valves, reducers, end caps and hydrants.

- Type Type of flow control entity i.e. stop valve, scour valve, air valve;
- Size Internal Diameter of pipeline valve/ hydrant is connected too. Reducer size shown as 250/150;
- Pressure Setting Pressure Setting in kilo Pascal's;
- Valve off Direction Direction to turn off valve i.e. Left / Right;
- Open/Closed Whether valve is open or closed;
- Service Whether the valve is on a potable or non-potable supply; and
- Installation Date Year in which the water asset was constructed or installed ie. 2007.

Reservoir

Required Attributes:

- Site locality plan showing the pump station building and associated works in relation to cadastral boundaries;
- Significant variations from the approved drawings including tolerances outside those specified;
- Level of floor in metres, A.H.D;
- Actual dimensions of reservoir;
- Actual configuration of associated pipework, ladders, walkways, control boxes, man access hatch etc;
- · Real Property description;
- · Location of water service;
- Set out, configuration and details of scour and overflow pipework;
- · Location and details of any driveways, apron slabs, fences etc;
- FSL Finished surface level of the reservoir pad in metres A.H.D;
- BWL Bottom water level in metres A.H.D;
- TWL Top water level in metres A.H.D;
- Capacity Maximum storage capacity in mega litres;
- Diameter Internal; and
- Installation Date Year in which the water asset was constructed or installed i.e. 2007.

Water Meter

Required Attributes:

- Type Whether meter is District or Service;
- Meter Number Unique number assigned to meters by Council;
- Size Internal Diameter of pipeline meter is connected too;
- Bore Size Internal diameter of meter bore size; and
- Installation Date Year in which the water asset was constructed or installed i.e. 2007.

Pump Station

- Asset No. Council asset number;
- Actual dimensions of building;
- Control Pressure Pump control pressure;
- Control Capacity Pump control capacity;
- Number Number of pumps Installed. The pumps are individually represented by the Pump block and placed next to the pump station;
- Inlet pipe inlet diameter;
- Outlet pipe outlet diameter;
- Head System head pressure;
- Flow Design flow rate;
- Installation Date Year in which the water asset was constructed or installed i.e. 2007;
- Slab Level in metres, A.H.D;
- Valve Pit Floor Level, lid level and outside FSL in metres, A.H.D;
- Cross reference detail drawings and standard drawings;
- Full pump specification includes duly, make, model, motor rating, curve number, impeller, diameter, etc;

- Site locality plan at (scale 1:200) showing the as-constructed pump station and associated works in relation to cadastral boundaries:
- · Real Property description;
- Location of water service;
- Location of operation and maintenance manuals;
- Finished surface contour levels and spot levels;
- Clearance dimensions between flanges and wall surfaces;
- Cover to pipe work;
- Switch Board Layout Details;
- Actual internal configuration of pumps, pipework, control panel, generator etc;
- Q100 flood line level and highest Recorded Flood Level in metres, A.H.D;
- Locations and details of any driveways, apron slabs, fences etc; and
- Reference Dwg Drawing number for design of constructed water asset.

Pumps

Required Attributes:

- Type Duty or Standby;
- Type end suction, vertical turbine, split case (Horizontal / Vertical) etc;
- Manufacturer:
- Model:
- Number Pump serial number;
- Housing Housing material;
- Impeller Impeller material;
- Impeller Diameter;
- Impeller curve;
- Shaft size;
- Shaft seal Type of seal used;
- Flow Rate:
- Motor Kilowatts:
- Motor Current;
- Bearing Size; and
- Size Pump Size (weight and outside dimensions).

• Electrical Controls

- Iso_size Main Isolator size;
- Type Isolator Type;
- Manufacturer Isolator manufacturer;
- Inc_Size Main Incomer size;
- Wiring_enclosure whether wiring enclosure is buried direct, conduit, cable tray;
- Voltage Voltage of switchboard;
- IP IP rating;
- Installation Date Year in which the water asset was constructed or installed i.e. 2007;
- Reference Dwg Drawing number for design of constructed water asset;
 and
- Reference Manual Manual detailing components etc of switchboard.

Valve Pit / Chlorination Plant

Required Attributes:

- Installation Date Year in which the water asset was constructed or installed i.e. 2007; and
- Reference Dwg Drawing number for design of constructed water asset.

SEWER

Attribute Information is to be supplied for all new waste water assets which ultimately become the property and responsibility of Council. Attribute information is recorded in the sewer layer format and the various blocks as listed in the "As Constructed" Drawing Requirements sewer section.

Valves

A valve entity, is classified as any sort of flow controlling or limiting device that is attached to a sewer pressure (rising) or vacuum line. Entities will include but not limited to air valves, reflux valves, scour valves and reducers.

Required Attributes:

- Manufacturer Valve Manufacturer;
- Control Manual or Automatic;
- Material Valve Material;
- Seat Valve seat material;
- Size Internal Diameter of pipeline valve is connected too. Reducer size shown as 250/150:
- Pressure Setting Pressure Setting in Pascal's;
- Valve off Direction Direction to turn off valve i.e. Left / Right;
- Open/Closed Whether valve is open or closed; and
- Installation Date Year in which the sewer asset was constructed or installed i.e. 2007.
- Manholes / Maintenance Shafts

- Name Identity label of manhole / Maintenance Shaft as per Appendix P;
- Type Preformed or Cast In-Situ;
- Material Manhole / maintenance shaft material PB or PE;
- Class Classification rating;
- Seal Seal Type;
- Lining Manhole lining;
- LidRL Surface level of Lid, in metres A.H.D;
- Lid Material Material of lid;
- Depth Depth to invert of Manhole / Inspection Shaft;
- Diameter Inside diameter of manhole; and
- Installation Date Year in which the sewer asset was constructed or installed i.e. 2007.

Endcaps

Required Attributes:

- Name Identity label of endcap as per Appendix P;
- IL Invert level;
- FSL Finished Surface level above location of Endcap; and
- Installation Date Year in which the sewer asset was constructed or installed i.e. 2007.
- Sewer Pipes

Gravity Sewer Required Attributes:

- Size Pipe inside diameter;
- Material Pipe material;
- Manufacturer Pipe manufacturer;
- Class Pipe Class;
- Lining Pipe lining material;
- JTYPE Joint type;
- Location Above or below ground, default below;
- Pipe Length Length from end to end. Chamber dimensions are not to be included. The length is recorded in metres;
- Node Length Length centre of node to centre of node. Length is to be recorded in metres;
- Grade Grade of pipe between manholes/ inspection shaft or endcap;
- USIL Upstream invert level of pipe; and
- DSIL Downstream invert level of pipe.

Pressure (Rising) Sewer Mains Required attributes:

- Pipe diameter;
- Pipe material;
- Pipe material class;
- Pipe Protection;
- Pipe manufacturer;
- Class Pipe Class;
- Pipe lining material;
- JTYPE Joint type:
- Location Above or below ground, default below:
- Length Length of pipe measured between pump stations, pits, bends, connection or discharge point;
- Depth of pipe if not standard;
- Fittings (bends, reducers, tees);
- Valves Type (scour, air);
- Operating pressures at low and high points;
- Line velocity at maximum operating flow;
- Invert levels at ends and changes in grade;
- Running chainages from the pump station to changes of grade, valves, air vents, scour valves, bends and access chambers along the main;
- Surface level and crown level at changes of grade, and at a maximum of 30 metre centres;
 - Dimensions from horizontal bends in the main to two (2) property boundaries or corners; and
 - Year of Installation.

Storage / Overflow

Required Attributes:

- Name Identity label of storage/overflow;
- Site locality plan showing the as-constructed tank and associated works in relation to cadastral boundaries:
- Show all significant variations from the approved drawings including tolerances outside those specified;
- LidRL Surface level of Lid, in metres A.H.D;
- Lid_Material Material of lid;
- Actual dimensions of tank;
- Depth Depth to invert of Manhole / Inspection Shaft;
- Invert level in metres of outlet pipe, A.H.D;
- Invert level in metres of inlet pipe, A.H.D;
- Floor Slab Level and top of tank in metres, A.H.D;
- · Well diameter:
- Capacity of well;
- · Actual set out and configuration of piping and external to the tank;
- Installation Date Year in which the sewer asset was constructed or installed i.e. 2007;
- Q100 flood line level and Highest Recorded Flood level in metres, A.H.D;
- Protection coating system used;
- Real Property description;
- Overflow invert level;
- Overflow discharge location;
- Location of water services; and
- Finished surface contour levels and spot levels.

· Pump and Lift Stations

- Identity label of pump station;
- Pump or Lift station;
- The protection coating system used;
- Real Property description;
- Lid RL Lid level in metres, A.H.D:
- Well Invert Invert level of well in metres, A.H.D;
- Wet Well Diameter:
- Locations and details of any driveways, apron slabs, fences etc;
- Depth Difference between lid RL and Well Invert;
- Inlet invert Invert level of inlet pipe in metres, A.H.D.
- Inlet Diameter Pipe inlet diameter;
- Overflow invert Invert level of outlet pipe in metres, A.H.D;
- Outlet Diameter Pipe outlet diameter;
- Alarm RL High level alarm in metres, A.H.D;
- Diameter Well Diameter or dimensions;
- Wet/Dry Whether well is wet or dry;
- Capacity Emergency Storage Capacity of well in hours;
- Volume Operational volume;
- Pumps Number of pumps;
- System Head System head pressure;
- Pump Head Pump design head;

- Head Maximum head at receiving mains;
- Flow Design flow rate;
- Start Frequency Design starts per hour;
- Installation Date Year in which the sewer asset was constructed or installed i.e. 2007;
- Reference Dwg Drawing number for design of constructed sewer asset;
- Slab Level in metres, A.H.D;
- Underside of plug in metres, A.H.D;
- Invert Level of Rising Main in metres, A.H.D.
- Underside of plug in metres, A.H.D;
- Standby Start Level in metres, A.H.D;
- Duty Start Level in metres, A.H.D;
- Pump Stop Level in metres, A.H.D;
- Pump Suction Level in metres, A.H.D;
- Valve Pit Floor Level, Lid level and outside FSL in metres, A.H.D;
- The Level at Which the contributing sewerage system or sewer pumping station will overflow in metres. A.H.D;
- Q₁₀₀ flood line level and Highest Recorded Flood Level in meters, A.H.D;
- Rising Main Diameter;
- Riser Pipe Diameter;
- Incoming Sewer Diameter xli. Capacity of wet well;
- Maximum Operational Volume;
 - Cross-reference detail drawings and standard drawings;
 - Full pump specification including duty, make, model, motor rating, curve number, impeller, diameter, etc;
 - The protection coating system used;
 - Site locality plan at (Scale 1:200) showing the as-constructed pump station and associated works in relation to cadastral boundaries;
 - Real Property description;
 - Overflow discharge location;
 - · Location of water service;
- Location of operation and maintenance manuals li. Finished Surface Contour Levels and spot levels:
- Clearance dimensions between flanges and internal wall surfaces liii. Cover to pipe work;
- Show existing and proposed Manholes within the area of the locality plan including manhole number:
- Inlet Level in metres, A.H.D;
- Switch Board Layout Details; and
- All significant variations from the approved drawings including tolerances outside those specified.
- Electrical Controls and Pumps

Required Attributes:

Refer to attribute details for water electrical controls and pumps.

Valve Pit

Required Attributes:

- Installation Date Year in which the sewer asset was constructed or installed i.e. 2007; and
- Reference Dwg Drawing number for design of constructed sewer asset.
- Property Connection Branch

Required Attributes:

- Chainage Distance from downstream manhole/inspection shaft;
- Type Type as per standard drawing S3005; and
- IL Invert level of connection to sewer pipe, in metres A.H.D.

STORMWATER

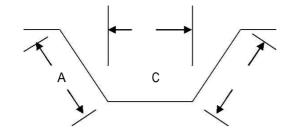
Attribute Information is to be supplied for all new waste water assets which ultimately become the property and responsibility of Council. Attribute information is recorded in the drainage layer format and the various blocks as listed in the "As Constructed" Drawing Requirements stormwater drainage section.

· Catch Drains

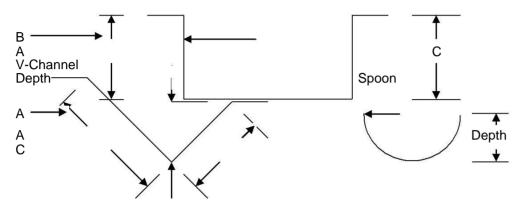
- Type Type of Catch Drain i.e. lined, unlined and lined invert;
- Shape Shape of channel, Trapezoidal, Rectangular, V-Channel or Spoon;
- Material Construction Material;
- Length Slope length of drain;
- USIL Upstream invert level;
- DSIL Downstream invert level;
- DIMA Dimension A, average length of lined material, refer below;
- DIMB Dimension B, length of lined material, refer below:
- DIMC Dimension C, average length of lined material, refer below;
- Depth Depth from channel invert to top of lowest embankment; and
- Thickness Average thickness of channel lining.

Trapezoidal

В



Rectangular



Note: Where changes in cross sections occur, the relevant attributes should be noted on 'As Constructed' drawings

Stormwater Quality Improvement Device

Required Attributes:

- Type Type of SQID;
- Manufacturer Name of Manufacturer of the device;
- Lid Material Material from which the cover is constructed;
- LidRL Surface level on the centre of the cover lid;
- StorageRL- Level at which maximum storage capacity is reached;
- SumpIL Invert level at the lowest point in the device;
- Volume Volume of material in cubic metres that the device is capable of holding;
- Dimension A Overall internal maximum width in millimetres;
- Dimension B Overall internal maximum breadth in millimetres, zero value if circular; and
- Installation Date Year in which the drainage asset was constructed or installed i.e. 2007.

• Detention / Retention and Bio-Retention Basins

- Type Type of Basin, Dry, Wet, Bio;
- Capacity Storage capacity in storage basin;
- Weir Surface level of weir in metres, A.H.D;

- Length Length of weir at recorded weir height;
- Material weir Material, soil, rock etc;
- Area Area of filter material;
- Filter Type of filter material;
- Filter_depth Depth of media material;
- Wall Wall material type;
- Wall_volume Volume in cubic metres of wall material;
- UG Storage Underground Storage or Drainage, Yes/No;
- Installation Date Year in which the drainage asset was constructed or installed i.e. 2007; and
- Reference Dwg Drawing number for design of constructed drainage asset.

· Head and Wing walls

Required Attributes:

- Type Precast, Cast In-Situ, Stone Pitche;
- Width Length of headwall;
- Height Height of headwall;
- Apron Yes/No, default no;
- Wingwalls Yes /No, default no;
- Debris Trap Yes/No, default no;
- Floodgate Yes/No, default no; and
- Installation Date Year in which the drainage asset was constructed or installed i.e. 2007.

Kerb / Field Inlet Pits and Manhole / Access Chambers

- Type Type of Inlet;
- Dimension 1 The overall internal width or diameter of pit;
- Dimension 2 The overall height of a rectangular pit;
- LidRL Surface level on the centre of the cover lid, grate or centre of kerb inlet;
- IL Invert level at the lowest point in the pit/ manhole or chamber;
- Cover Material Cover Type;
- Chamber Material Construction material of the chamber;
- Lintel No's Number of lintels;
- Grate No's Number of grates; and
- Installation Date Year in which the drainage asset was constructed or installed i.e. 2007.

• Pipe / Culvert

Required Attributes:

- Type Pipe, Culvert or Slab Link Culvert;
- Number Number of pipes / culverts;
- Dimension 1 The overall internal width for culverts or diameter of pipes;
- Dimension 2 The overall height of a culvert;
- Length Slope length from end to end. Chamber dimensions are not to be included and pipe length shall be actual length, not plan length. The length is recorded in metres;
- Material Construction Material;
- Class Classification of pipe/culvert type;
- USIL Upstream invert level of pipe/culvert; and
- DSIL Downstream invert level of pipe/culvert.

Pump Station

Required Attributes:

- LidRL Surface level on the centre of the cover lid;
- SumpIL lowest point in the well;
- LidMaterial Lid material type, concrete, cast iron etc;
- Material Pump chamber material, concrete, masonry block etc;
- Dimension 1 The overall internal width for well:
- Dimension 2 The overall height of well;
- Capacity Capacity of well;
- Volume Operational volume;
- Installation Date Year in which the drainage asset was constructed or installed ie. 2007; and
- Reference Dwg. Drawing number for design of constructed sewer asset.
- Electrical Controls / Pumps

Required Attributes:

Refer to attribute details for water electrical controls and pumps.

Tidal Flap

Required Attributes:

- Type Type of Tidal Flap;
- Manufacturer Manufacturer of the tidal flap;
- Material Construction Material:
- Size Dimension of tidal flap; and
- Installation Date Year in which the drainage asset was constructed or installed i.e. 2007.

ROAD

Attribute Information is to be supplied for all new road assets which ultimately become the property and responsibility of Council. Attribute information is recorded in the road layer as text or in the various blocks as listed in the "As Constructed" Drawing Requirements road section.

Pavement / Surfacing

Required Attributes:

- Surface Type of wearing course material, Asphaltic Concrete, 2 Coat Bitumen, 80mm Pavers or Concrete;
- Surface_Depth Depth of sealed road surface where applicable;
- Reinforcement Type of reinforcement used in concrete surfacing;
- Each pavement Layers Type of pavement material used, as per Main Roads Standard Specification;
- Each pavement Layers Depth Depth of pavement material;
- Width Pavement width from kerb invert to kerb invert or seal width where no kerb and channel exists; and
- CBR Sub-grade CBR test results, based on a 4-day soaked CBR test of the in situ sub-grade material upon which the pavement design was based.

Pathways

Required Attributes:

- Width Width of pathway;
- Type Material type, concrete, paved, Asphaltic Concrete; and
- Depth Depth of material.

Signs

- MUTCD Code Numbering system for sign specified by the Queensland Department of Main Roads in the Manual of Uniform Traffic Control Devices (MUTCD);
- Name Common name for the sign, i.e. street, give way stop etc;
- Number number of signs attached to the same supports; and
- Supports Number of support posts the sign is attached to.

Roundabouts

Required Attributes:

- Type Type of roundabout, concrete or vegetated;
- Size Diameter of roundabout excluding concrete annulus if present; and
- Annulus Width of concrete annulus.

• Bridge

Required Attributes:

- Type Type of bridge, i.e. Road or Pedestrian;
- Deck Deck material;
- Span Number of bridge spans;
- Width Width of bridge decking;
- Length Length of Bridge decking;
- Pylon Pylon material;
- Headstock Headstock material;
- WC Wearing course type, for road bridges;
- Depth Wearing Course depth, for road bridges; and
- Installation Date Year in which the bridge was constructed or installed i.e. 2007.

PARKS / LANDSCAPING / STRUCTURES

Playground Equipment

- Type Type of playground equipment, i.e. Swing, climbing frame, adventure playground etc;
- Make Manufacturer of the play equipment;
- Model Manufacturers model number for the play equipment; and
- Installation Date Year in which the play equipment was constructed or installed i.e. 2007.

• Landscape Embellishments

Required Attributes:

- Type Descriptive comment on feature type;
- Material Construction material, if applicable;
- Dimensions Dimension of feature, if applicable; and
- Installation Date Year in which the asset was constructed or installed i.e. 2007.
- Buildings / Structures

Required Attributes:

- Type Type of building / structure;
- Roof Roof material;
- Wall Wall material;
- Floor Floor material;
- Dim_A Width of building in metres;
- Dim_B Depth of building in metres; and
- Height Height to roof line in metres.
- Tree

- Type Species name;
- Name Common Name; and
- Size Trunk size.

STANDARD DRAWINGS

Std. Dwg. No.	Descriptions	Std. Dwg. No.	Descriptions	
	CROSS SECTIONS		KERB AND CHANNEL	
R-0031	TYPE CROSS SECTIONS BI-LEVEL STREET AND VERGE PROFILE FOR	R-0080	KERB AND CHANNEL KERBS AND CHANNELS, PROFILES AND DIMENSIONS, INCL EDGE RESTRAINTS, MEDIAN AND INVERT	
R-0032	ACCESS PLACE, ACCESS STREET AND COLLECTOR STREETS COMMERCIAL / INDUSTRIAL, URBAN RESIDENTIAL AND LOW DENSITY RESIDENTIAL < 1.0 HA STREETS	R-0081 R-0084	KERB AND CHANNEL, DRAINAGE CONNECTIONS KERB RAMP	
R-0033	RURAL ROADS AND LOW DENSITY RESIDENTIAL > 1.0 HA ROADS		PUBLIC UTILITIES	
	CULVERTS	R-0100	PUBLIC UTILITIES IN SUBDIVISIONS, TYPICAL SERVICE CORRIDOR AND SECTIONS	
QT 1303 QT 1316 QT 1317 QT 1318	RC BOX CULVERTS AND SLAB LINK BOX CULVERTS CONSTRUCTION OF RC WINGWALLS AND HEADWALLS NSTALLATION OF PRECAST UNITS CONSTRUCTION OF BASES WITH NIBS AND APRONS CONSTRUCTION OF BASES WITH RECESSES AND APRONS	QT 1505 QT 1506	RELIEVING SLAB BRIDGE APPROACHES - RELIEVING SLAB 3 METRE SPAN BRIDGE APPROACHES - RELIEVING SLAB 6 METRE SPAN ROAD EDGE GUIDE POSTS	
QT 1320 QT 1304	CROWN UNIT HOLDING DOWN ANCHORS RC PIPE CULVERTS — CONSTRUCTION OF RC WINGWALLS & APRONS FOR PIPE DIA 750 TO 2400	QT 1356	ROAD EDGE GUIDE POSTS TIMBER AND TUBULAR STEEL POST AND INSTALLATION DETAILS	
QT 1305	PIPE CULVERTS - HEADWALLS AND APRONS FOR PIPE DIA 375 TO 675		SIGNS	
QT 1359	CULVERTS — INSTALLATION, BEDDING AND FILLING / BACKFILLING AGAINST / OVER CULVERTS	R-0130 R-0131	STREET NAME SIGN TRAFFIC CONTROL DEVICES	
R-0050 R-0051 R-0052 R-0053	DRIVEWAYS RESIDENTIAL DRIVEWAY - SLAB AND TRACKS COMMERCIAL DRIVEWAY SLAB - TYPE A - TWO WAY ACCESS COMMERCIAL DRIVEWAY SLAB - TYPE B - TWO LANES ACCESS TYPICAL MINOR ACCESS DETAILS FOR COUNCIL RURAL ROADS FLOODWAYS	R-0140 R-0141 QT 1116	SUBSURFACE DRAINAGE SUBSURFACE DRAINAGE SUBSOIL DRAINAGE DETAILS AT MEDIANS / ISLANDS SUBSOIL DRAINS — OUTLETS AND CLEANOUTS	
QT 1170	FLOODWATS FLOOD DEPTH INDICATORS			
R-0065	FOOTPATHS CONCRETE STRIP FOOTPATHS	R-0160	WATER SERVICE CONDUITS WATER SERVICE CONDUITS	
QT 1601 QT 1561	GATES AND GRIDS RURAL FENCE AND GATES — CHS POSTS AND STAYS MOTOR GRID — GENERAL ARRANGEMENT			
QT 1474 QT 1475 QT 1476 QT 1341 QT 1479 QT 1480 QT 1481 QT 1482 QT 1483 QT 1484 QT 1485	GUARD RAILS AND BARRIERS STEEL BEAM GUARD RAILS INSTALLATION AND SETOUT INSTALLATION OF BRIDGE AND BARRIER APPROACHES TERMINAL AND COMPONENTS INSTALLATION OF BACK TO BACK GUARDRAIL BOLTS, NUTS, SCREWS AND WASHERS CABLE ASSEMBLY WITH FASTENERS DETAILS FOR W BEAM RAILS AND RAIL COMPONENTS DETAILS FOR THRIE BEAM RAILS AND RAIL COMPONENTS W BEAM AND THRIE BEAM ASSEMBLIES DETAILS FOR ANCHOR CABLE ASSEMBLY AND SUPPORTING PLATES DETAILS FOR GUARDRAIL DELINEATOR BRACKET CONCRETE BARRIERS, EXTRUDED AND PRECAST BARRIERS			
		BOWE	ROA	AD/STREET

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С	Dwg R-066 DELETED	10/3/98	
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Ā	ORIGINAL ISSUE	1/3/97	
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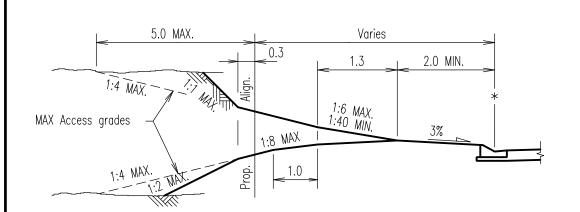
67 Herbert St Bowen 4805 Q Ph 07 4761 3600

COLLINSVILLE Cnr Stanley & Conway Sts Collinsville 4804 Q Ph 07 4785 5366

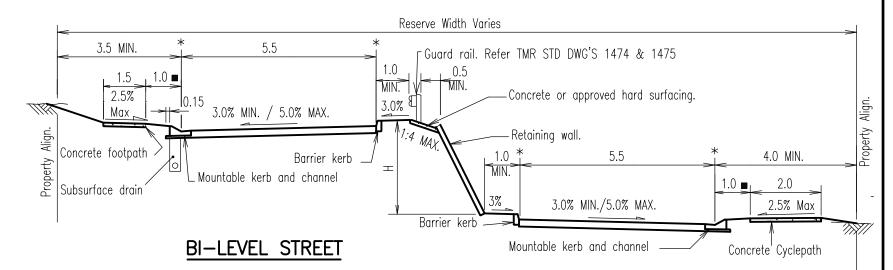
PROSERPINE 83-85 Main St Proserpine 4800 Q Ph 07 4945 0200 INDEX
STANDARD DRAWINGS
ROAD / STREET

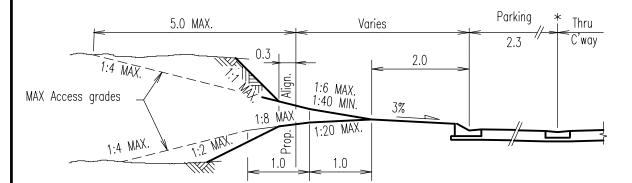
Standard Drawing R-0001

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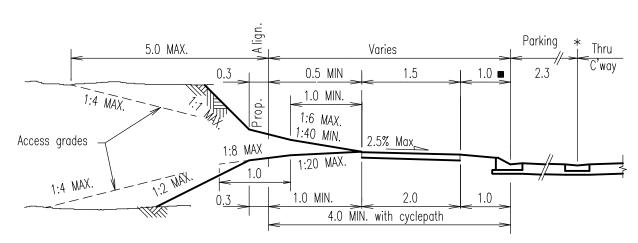


VERGE WITHOUT PATHWAYS

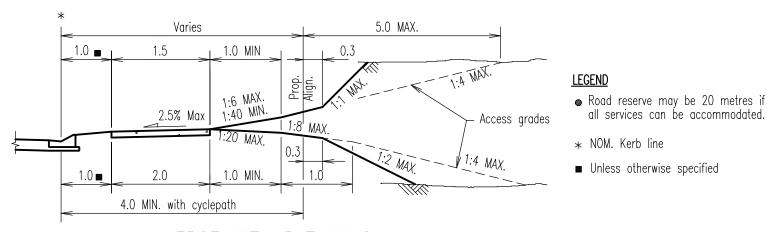




VERGE AT PARKING BAYS WITHOUT PATHWAYS



VERGE WITH PARKING BAYS AND PATHWAYS



VERGE WITH PATHWAYS

- 1. A concrete footpath or cyclepath may be provided on one side only depending on allotment catchment. It shall be constructed parallel to the kerb and channel, and transition smoothly around any parking bays.
- 2. Retaining wall to be designed specifically to suit site conditions. The retaining wall face should be of a type which will compliment the amenity of the area. Rock faced walls are acceptable, however each wall should be considered individually.
- 3. An approved guardrail shall be installed when height 'H' (top of kerb to top of kerb) exceeds 1.5m, refer TMR STD DWG 1474.
- 4. Landscaping may be possible in the area between the guardrail and top of wall when this dimension exceeds 1.5m, where guardrail is not required or when the width of centre median exceeds 1.5m. Landscaping will not be be permitted in the 1.0m strip behind the barrier kerbs to allow for manoeuvring of vehicles.
- 5. The minimum reserve widths indicated on the standard road cross sections may need to be increased in certain circumstances in order to comply with this drawing.
- 6. For pavement design requirements refer Development design manual.

BOWEN

7. All dimensions in metres.

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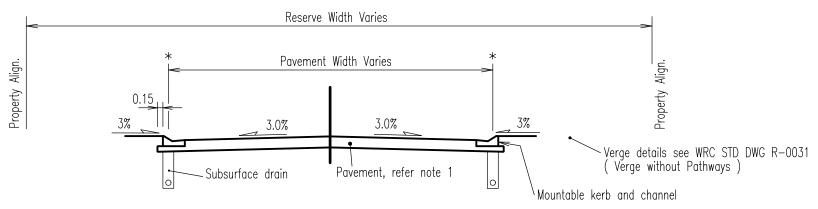
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nley & Conway Sts Collinsville 4804 C Ph 07 4785 5366 **PROSERPINE**

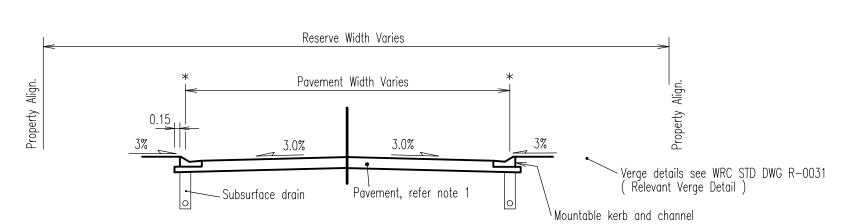
Proserpine 4800 Ph 07 4945 020

TYPE CROSS SECTIONS BI-LEVEL STREET & VERGE PROFILES FOR ACCESS PL. ACCESS STS. & COLLECTOR STS. **ROAD/STREET** Standard Drawing

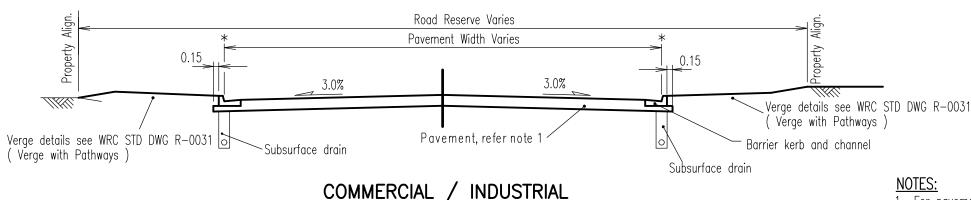
all services can be accommodated.



LOW DENSITY RESIDENTIAL < 1.0 HA



URBAN RESIDENTIAL



LOW DENSITY RESIDENTIAL < 1.5 HA SPECIFICATIONS (Refer Table 1.4—1 for total requirements)

	RESERVE WIDTH	PAVEMENT WIDTH	MIN VERGE WIDTH
ACCESS STREET	16.0	6.0	5.0
COLLEC- TOR	20.0	7.5	5.0

URBAN RESIDENTIAL SPECIFICATIONS (Refer Table 1.4—1 for total requirements)

<u> </u>				
RESERVE WIDTH	PAVEMENT WIDTH	MIN VERGE WIDTH		
15.0	3.5	3.0		
15.0	5.5	3.0		
17.0	7.5	3.5		
21.0	9.0	4.5		
25.0	11.0	5.5		
	15.0 15.0 17.0 21.0	WIDTH WIDTH 15.0 3.5 15.0 5.5 17.0 7.5 21.0 9.0		

COMMERCIAL / INDUSRTIAL SPECIFICATIONS (Refer Table 1.4-1 for total requirements)

,			
	RESERVE WIDTH	PAVEMENT WIDTH	MIN VERGE WIDTH
ACCESS STREET	21.0	12.0	4.5
COLLEC- TOR	23.0	14.0	4.5

NOTES:

- 1. For pavement design requirements refer Development manual.
- 2. All dimensions in metres.

LEGEND

* NOMINAL kerb line

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Whitsunday
Regional Council

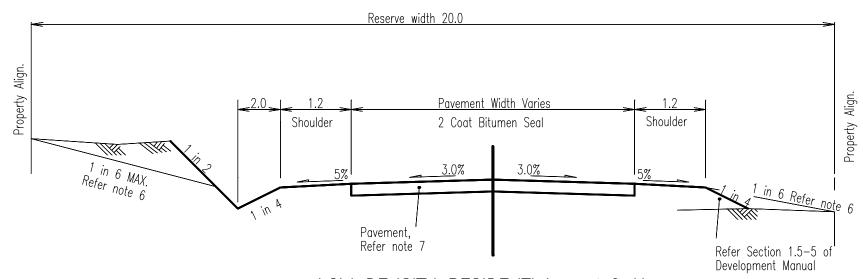
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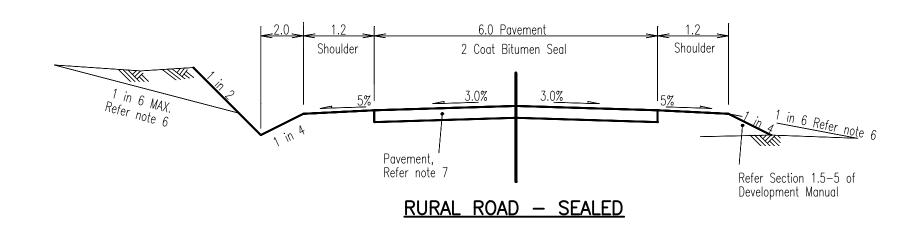
TYPE CROSS SECTIONS COMMERCIAL / INDUSTRIAL STREETS URBAN RESIDENTIAL AND LOW DENSITY RESIDENTIAL < 1.0 HA ROAD/STREET Standard Drawing



LOW DENSITY RESIDENTIAL > 1.5 HA (Refer Table 1.4-1 for total requirements)

	RESERVE WIDTH	PAVEMENT WIDTH	SHOULDER WIDTH	MIN VERGE WIDTH
ACCESS STREET	20.0	6.0	1.2	5.0
COLLEC- TOR	20.0	7.5	1.2	5.0





RURAL ROAD - SEALED (Refer Table 1.4–1 for total requirements)

No.	RESERVE	PAVEMENT	SHOULDER
LOTS	WIDTH	WIDTH	WIDTH
31-100	20.0	6.0	

Shoulder Shoulder Varies Varies 200 mm Pavement

RURAL ROAD - UNSEALED (Refer Table 1.4–1 for total requirements)

No. LOTS	RESERVE WIDTH	PAVEMENT WIDTH	SHOULDER WIDTH
1-15	20.0	4.0	1.2
16-30	20.0	4.0	2.4

LEGEND

- Refer development permit for type of construction to be adopted.
- 150mm MIN. pavement overlap

NOTES:

- 1. Table Drains steeper than 5% should have erosion protection measures installed.
- 2. Cut batter slopes may be varied on site to ensure long term stability of
- 3. Minimum slope of table drain inverts shall be 0.5% (1 in 200).
- 4. Floodways shall be constructed with cross road drainage nominated in development permit.
- 5. Unsealed roads shall be designed using parameters set out in AUSTROADS "Unsealed Roads Manual" unless noted otherwise in the project drawings.
- 6. One access point to be constructed to each lot at a maximum slope of 1 in 6. The access point is to have a pipe crossing where a table drain is provided.
- 7. For pavement design requirements refer Development manual.
- 8. All dimensions in metres unless shown otherwise.

RURAL ROAD - UNSEALED

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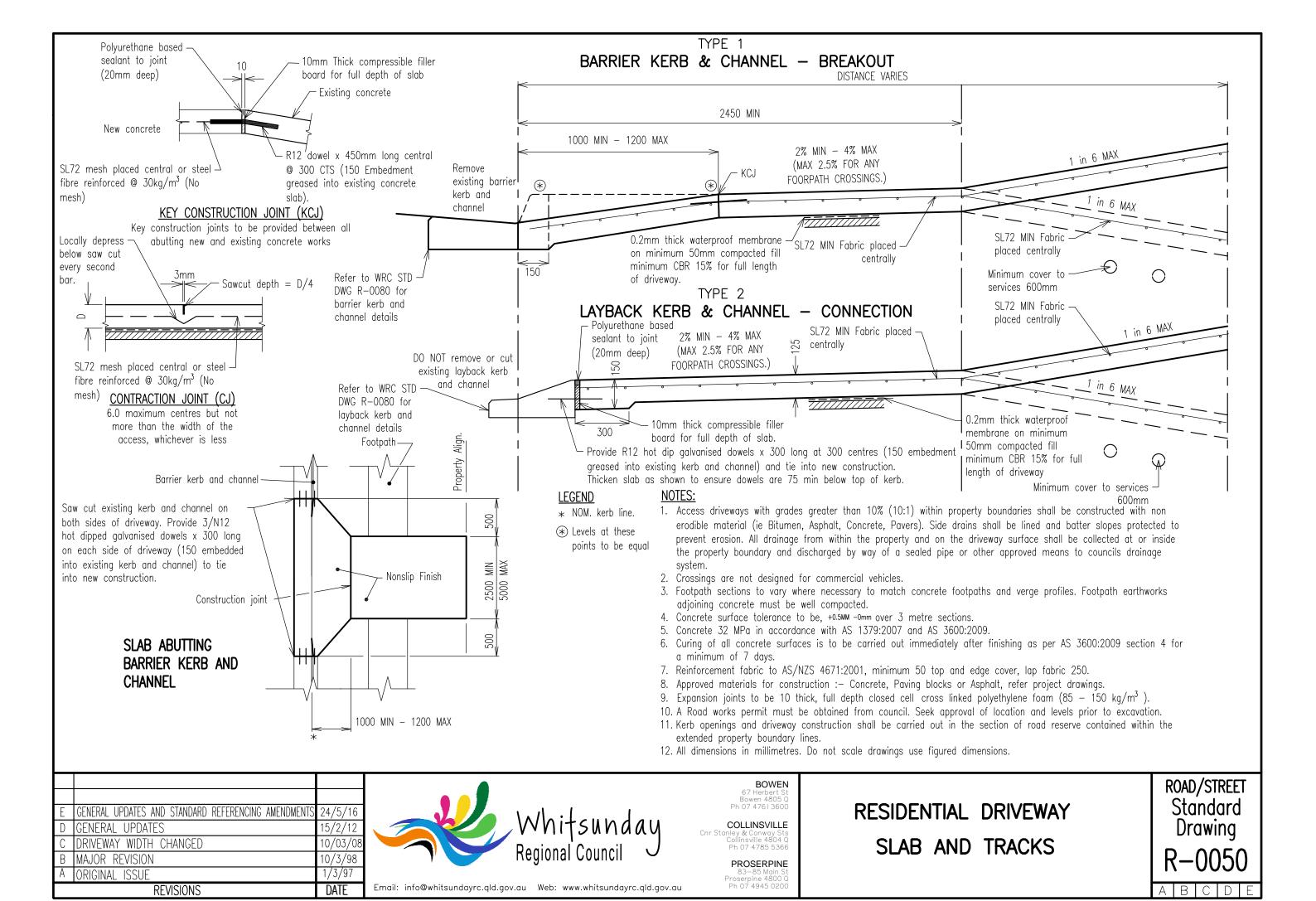
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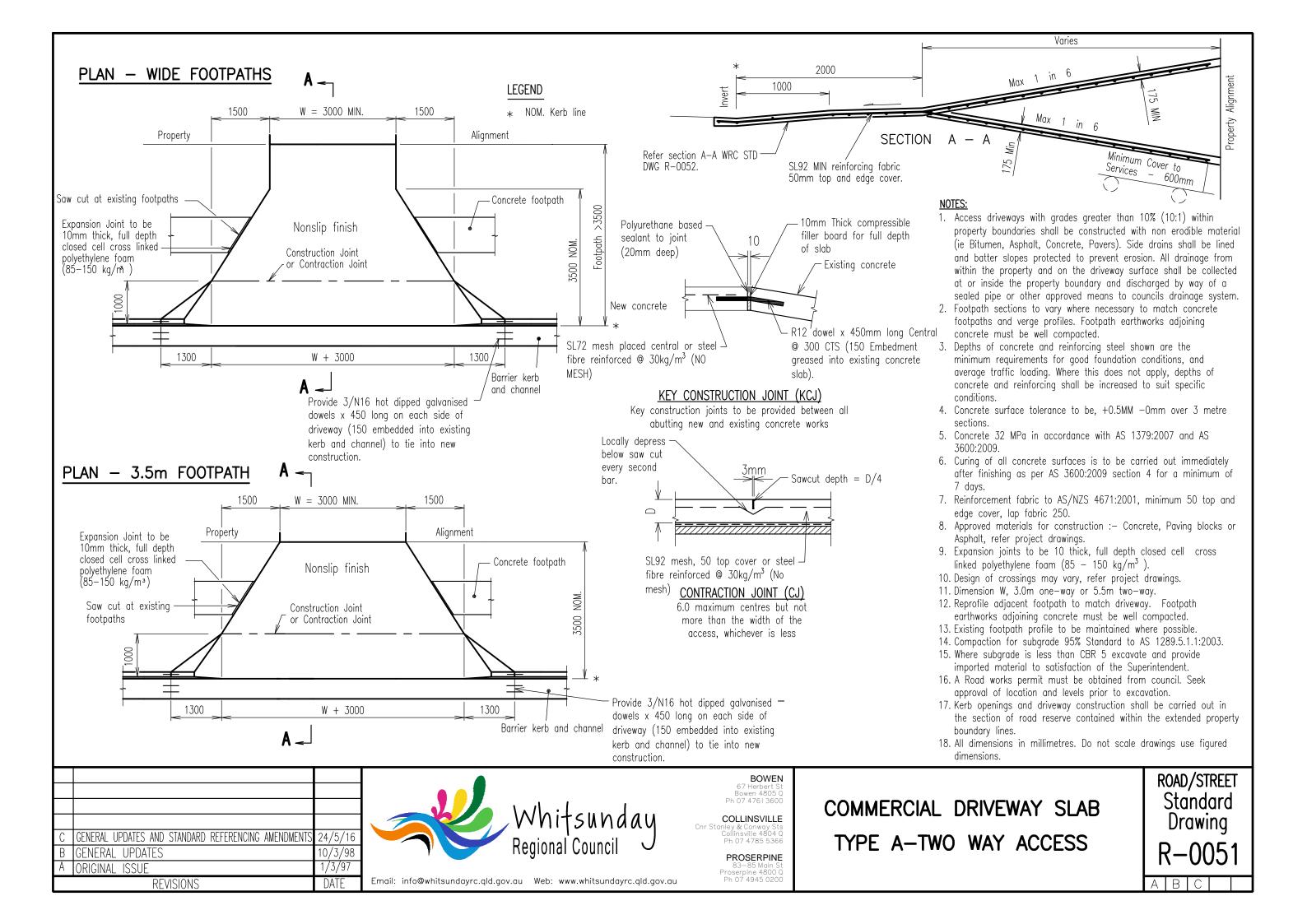
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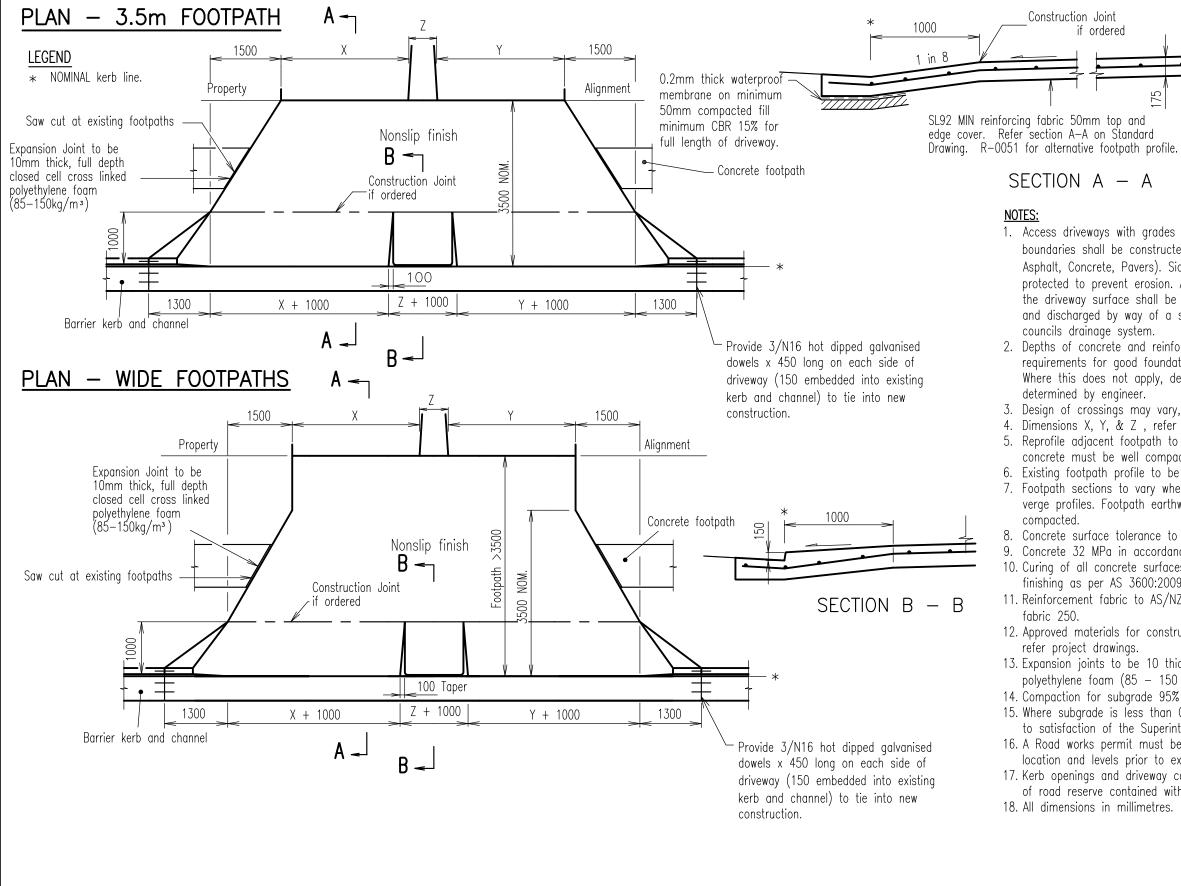
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TYPE CROSS SECTIONS RURAL ROADS

ROAD/STREET Standard Drawing







SECTION A - A

Construction Joint

if ordered

NOTES:

- 1. Access driveways with grades greater than 10% (10:1) within property boundaries shall be constructed with non erodible material (ie Bitumen, Asphalt, Concrete, Pavers). Side drains shall be lined and batter slopes protected to prevent erosion. All drainage from within the property and on the driveway surface shall be collected at or inside the property boundary and discharged by way of a sealed pipe or other approved means to councils drainage system.
- 2. Depths of concrete and reinforcing steel shown are the minimum requirements for good foundation conditions, and average traffic loading. Where this does not apply, depths of concrete and reinforcing shall be determined by engineer.
- 3. Design of crossings may vary, refer project drawings.
- 4. Dimensions X, Y, & Z, refer specification or project drawings.
- 5. Reprofile adjacent footpath to match driveway. Footpath earthworks adjoining concrete must be well compacted.
- 6. Existing footpath profile to be maintained where possible.
- 7. Footpath sections to vary where necessary to match concrete footpaths and verge profiles. Footpath earthworks adjoining concrete must be well
- 8. Concrete surface tolerance to be, +0.5MM -0mm over 3 metre sections.
- 9. Concrete 32 MPa in accordance with AS 1379:2007 and AS 3600:2009.
- 10. Curing of all concrete surfaces is to be carried out immediately after finishing as per AS 3600:2009 section 4 for a minimum of 7 days.
- 11. Reinforcement fabric to AS/NZS 4671:2001, 50 top and edge cover, lap fabric 250.
- 12. Approved materials for construction :— Concrete, Paving blocks or Asphalt, refer project drawings. 13. Expansion joints to be 10 thick, full depth closed cell cross linked
- polyethylene foam $(85 150 \text{ kg/m}^3)$.
- 14. Compaction for subgrade 95% Standard to AS 1289.5.1.1:2003.
- 15. Where subgrade is less than CBR 5 excavate and provide imported material to satisfaction of the Superintendent.
- 16. A Road works permit must be obtained from council. Seek approval of location and levels prior to excavation.
- 17. Kerb openings and driveway construction shall be carried out in the section of road reserve contained within the extended property boundary lines.
- 18. All dimensions in millimetres. Do not scale drawings use figured dimensions.

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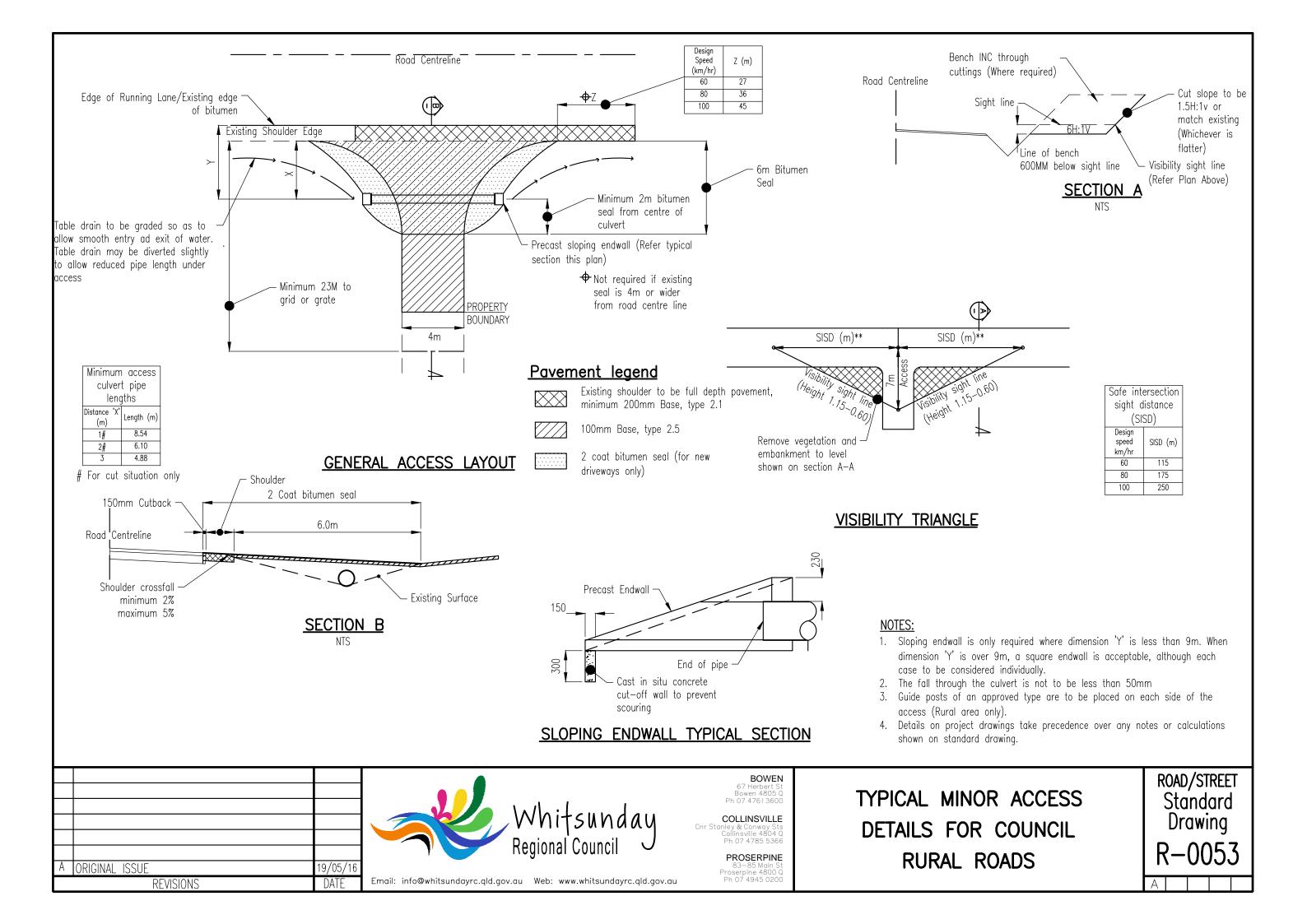


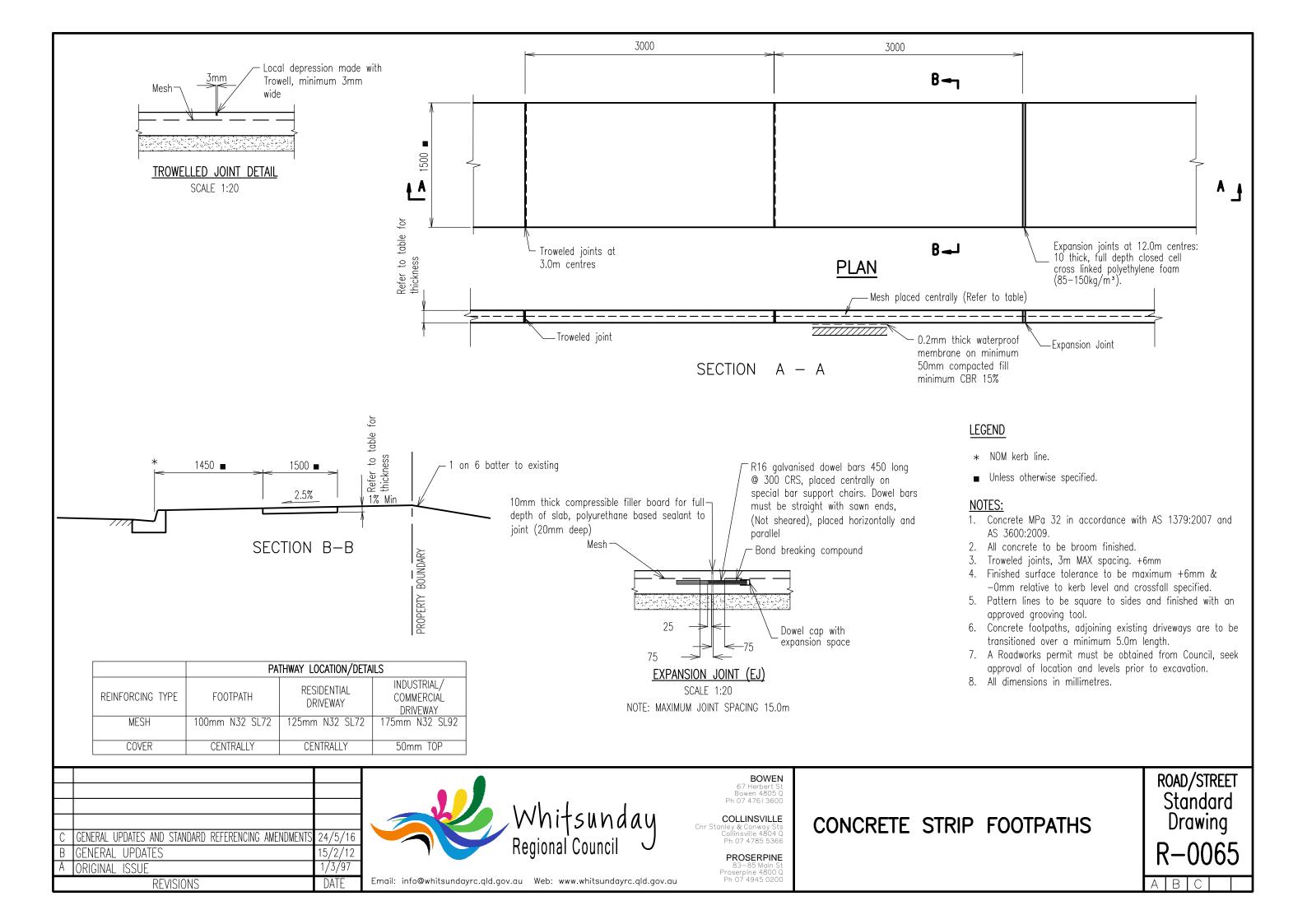
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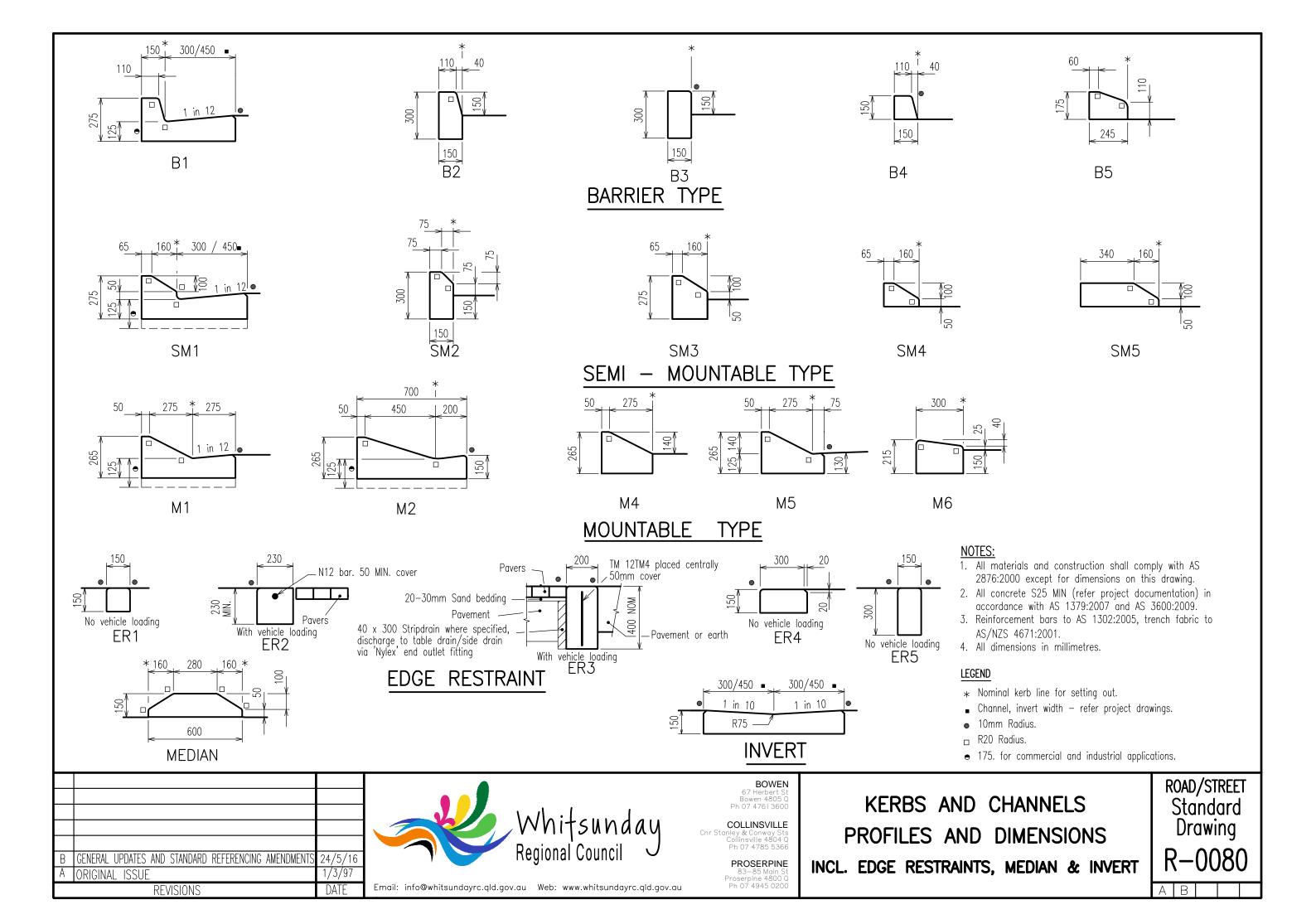
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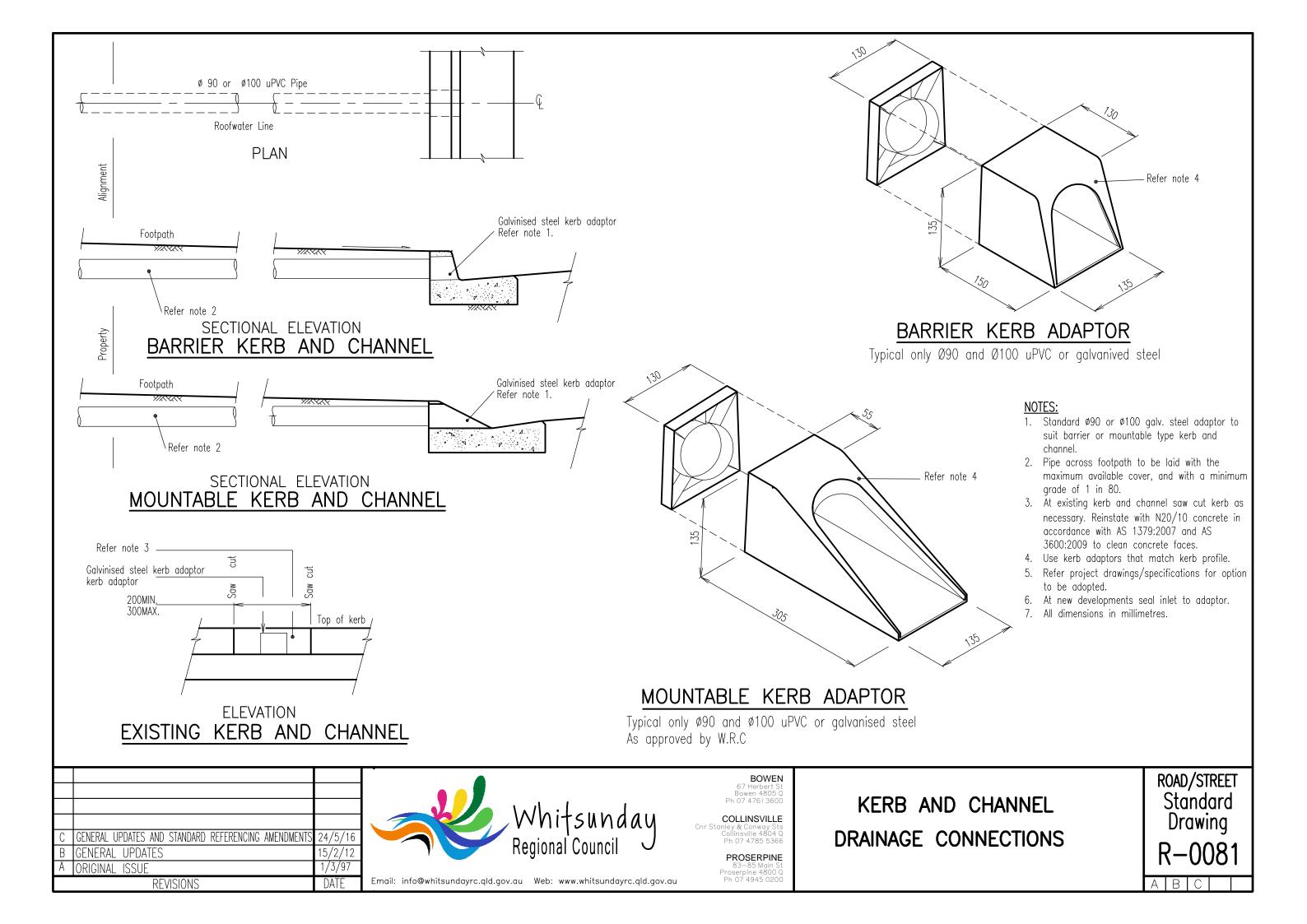
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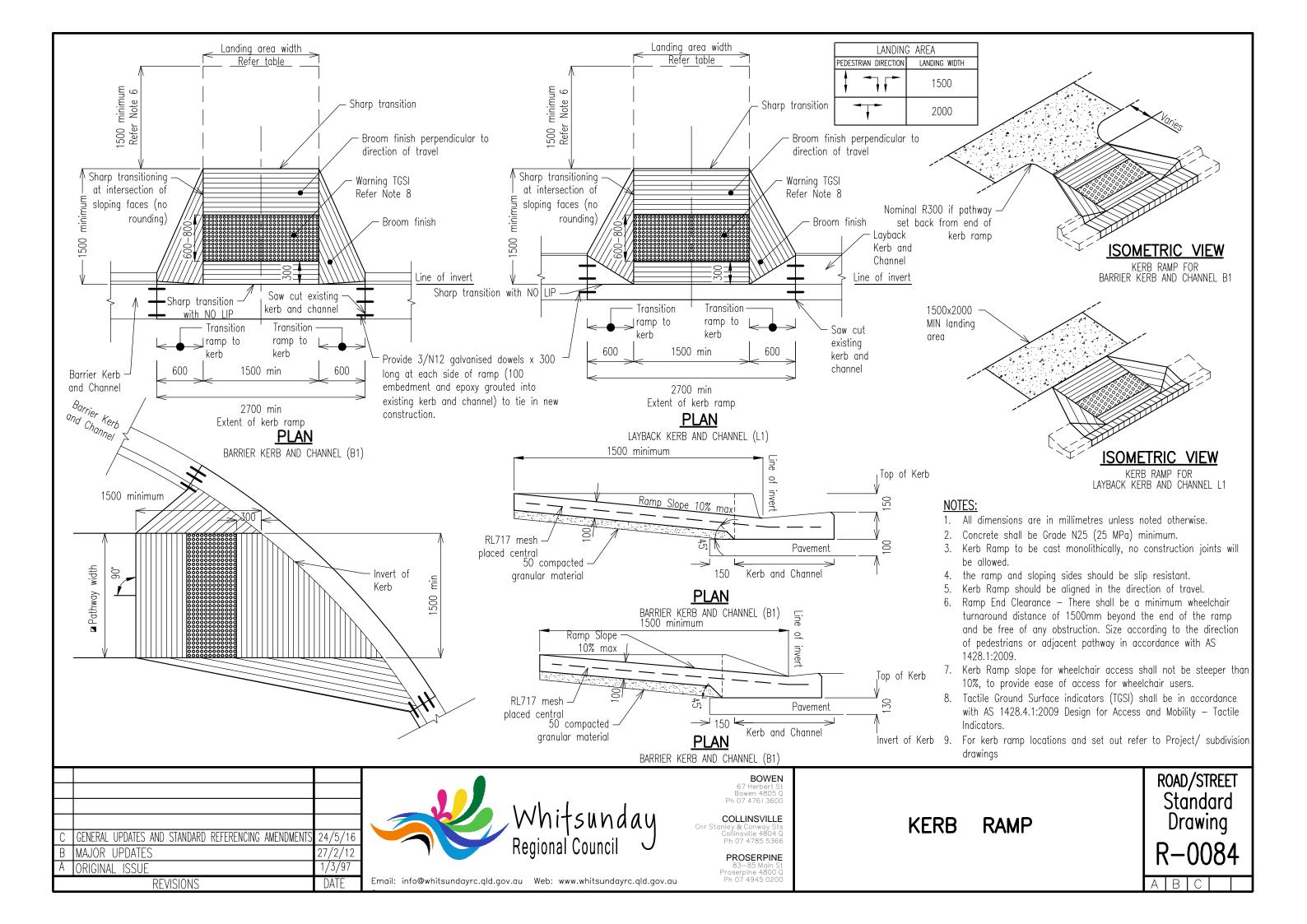
COMMERCIAL DRIVEWAY SLAB TYPE B - TWO LANES ACCESS ROAD/STREET Standard Drawing



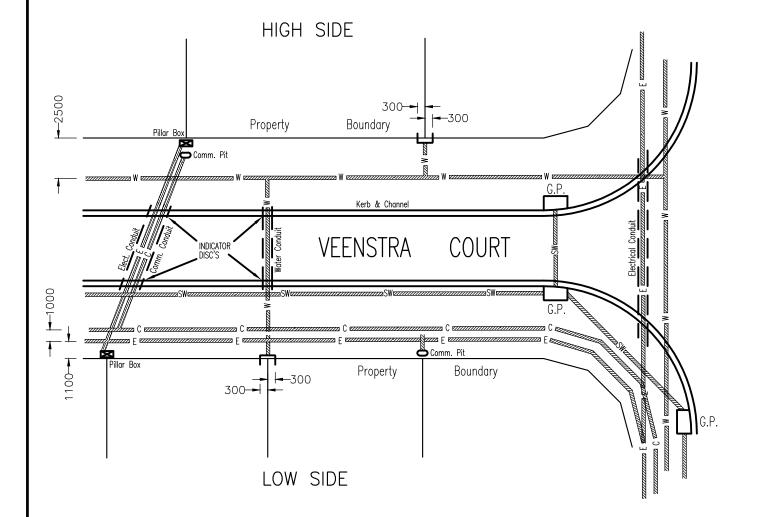








TYPICAL SERVICE CORRIDOR

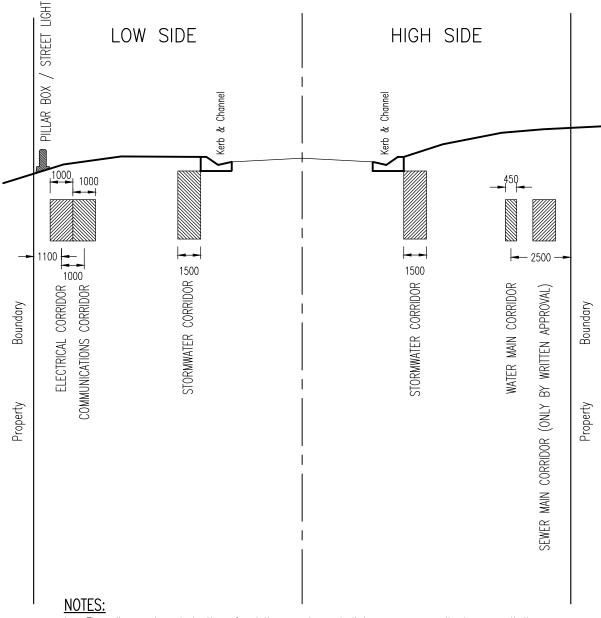


LEGEND

Electricity -

Road crossing conduits
Water - ZZZZ
Stormwater - ZZZZ
Communications - ZZZZ

TYPICAL CONDUIT SECTION



- 1. The alignment and depths of existing services shall be proven on site by consultation with the relevant service authorities prior to any excavation and shall not be inferred from this drawing.
- 2. Various configurations of trench width and conduit numbers/diameters exist for both electicity and common trench arrangements with communication companies.
- 3. For split level roads, service corridors to be determined by council prior to completion of engineering design.
- 4. All dimensions in millimetres

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Bowen 4805 Q
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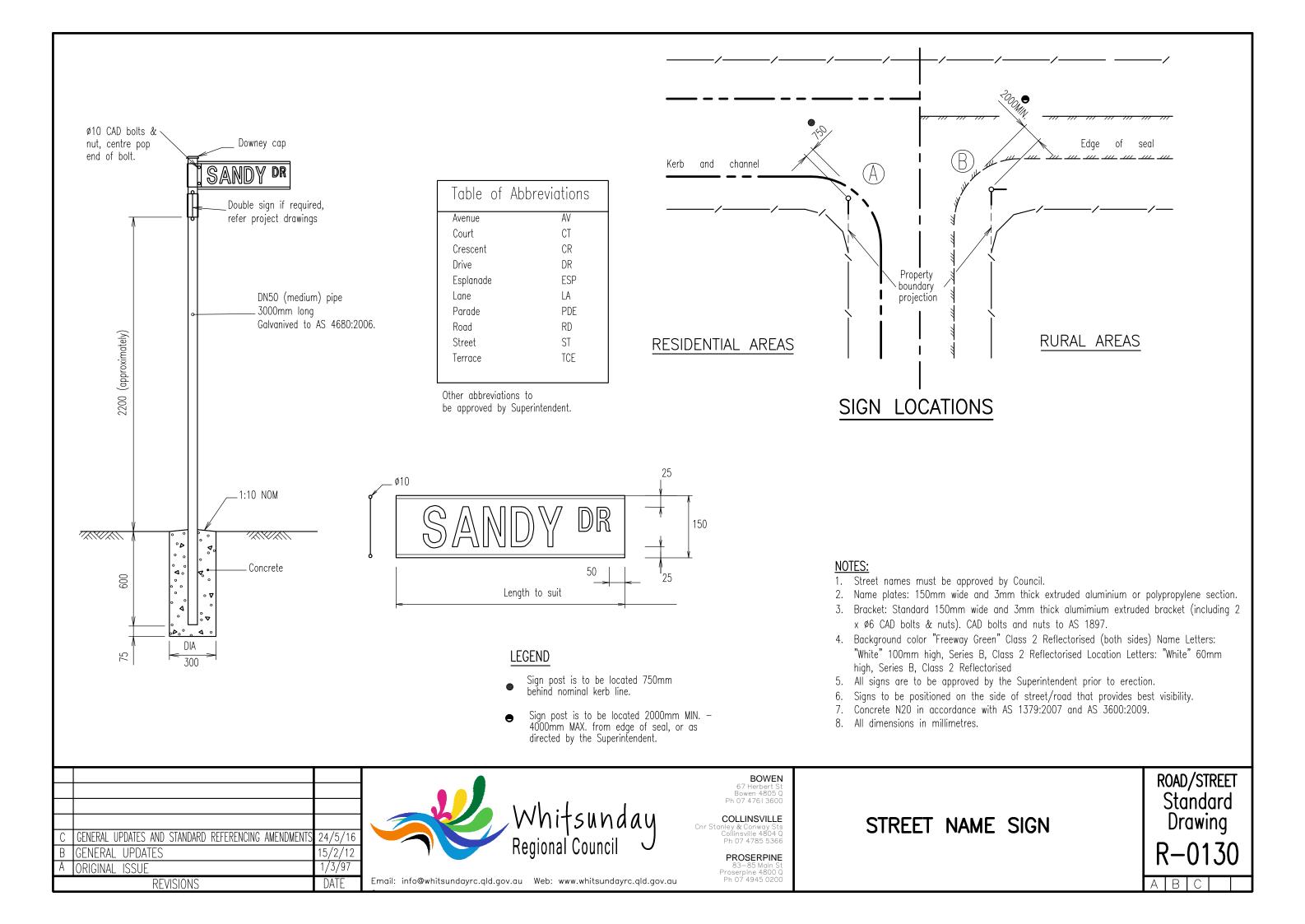
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Cnr Stanley & Conway Sts
Collinsville 4804 Q
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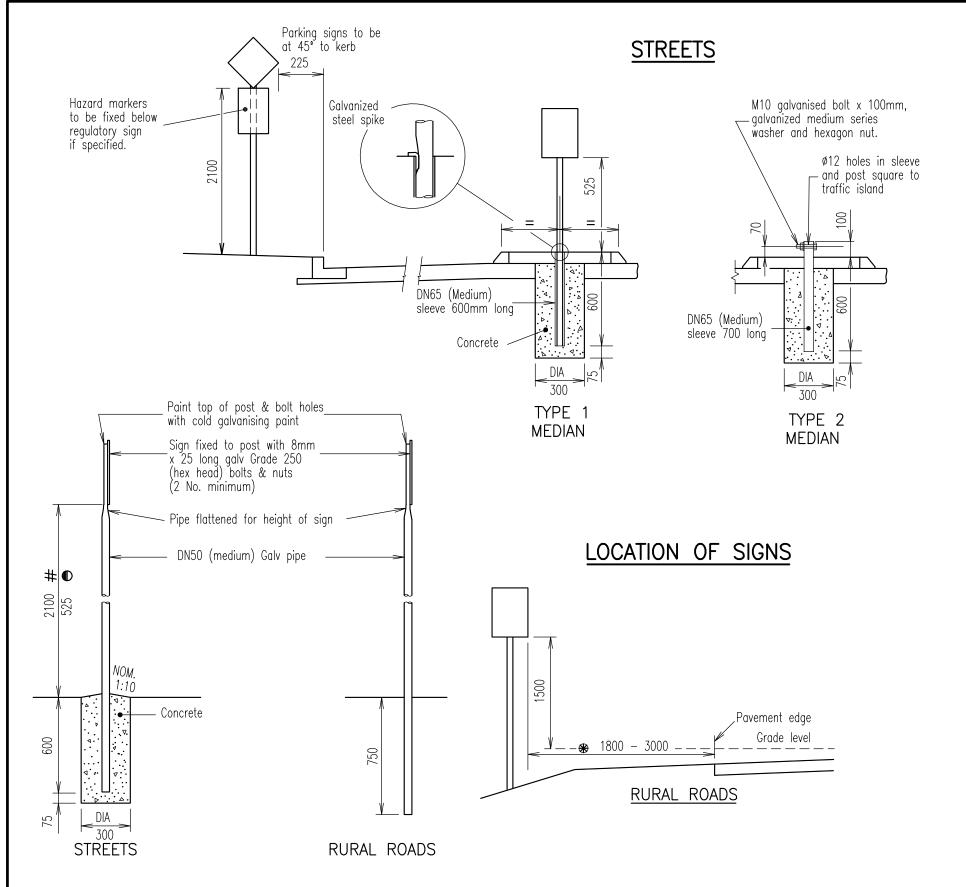
PROSERPINE 83-85 Main St Proserpine 4800 Q Ph 07 4945 0200

PUBLIC UTILITIES IN SUBDIVISIONS TYPICAL SERVICE CORRIDORS AND SECTIONS

ROAD/STREET
Standard
Drawing
R-0100

AB





NOTES:

- 1. All signage to be fabricated and installed as per M.U.T.C.D unless noted
- 2. All signs are to be approved by the Superintendent prior to erection.
- 3. Where signs are to be erected in streets where footpaths are not constructed to permanent levels the Rural Roads type base shall be
- 4. The DN65 sleeve and spike shall only be used on medians.
- 5. All pipes to be galvanised. Steel pipe to AS 1074:1989. Galvanising to AS/NZS 4680:2006.
- Concrete N20 in accordance with AS 1379:2007 and AS 3600:2009.
- 7. Hexagonal head bolts to AS 1111.1:2015

Nuts to AS 1112.1:2015

Washers to AS 1237.1:2002

Galvanizing to AS/NZS 1214:2016

8. All dimensions in millimetres.

LEGEND

- Series A, medium spacing
- Series A, medium spacing where space is available, if not adopt narrow spacing

on footpaths

- ★ As directed by the Superintendent
- on medians

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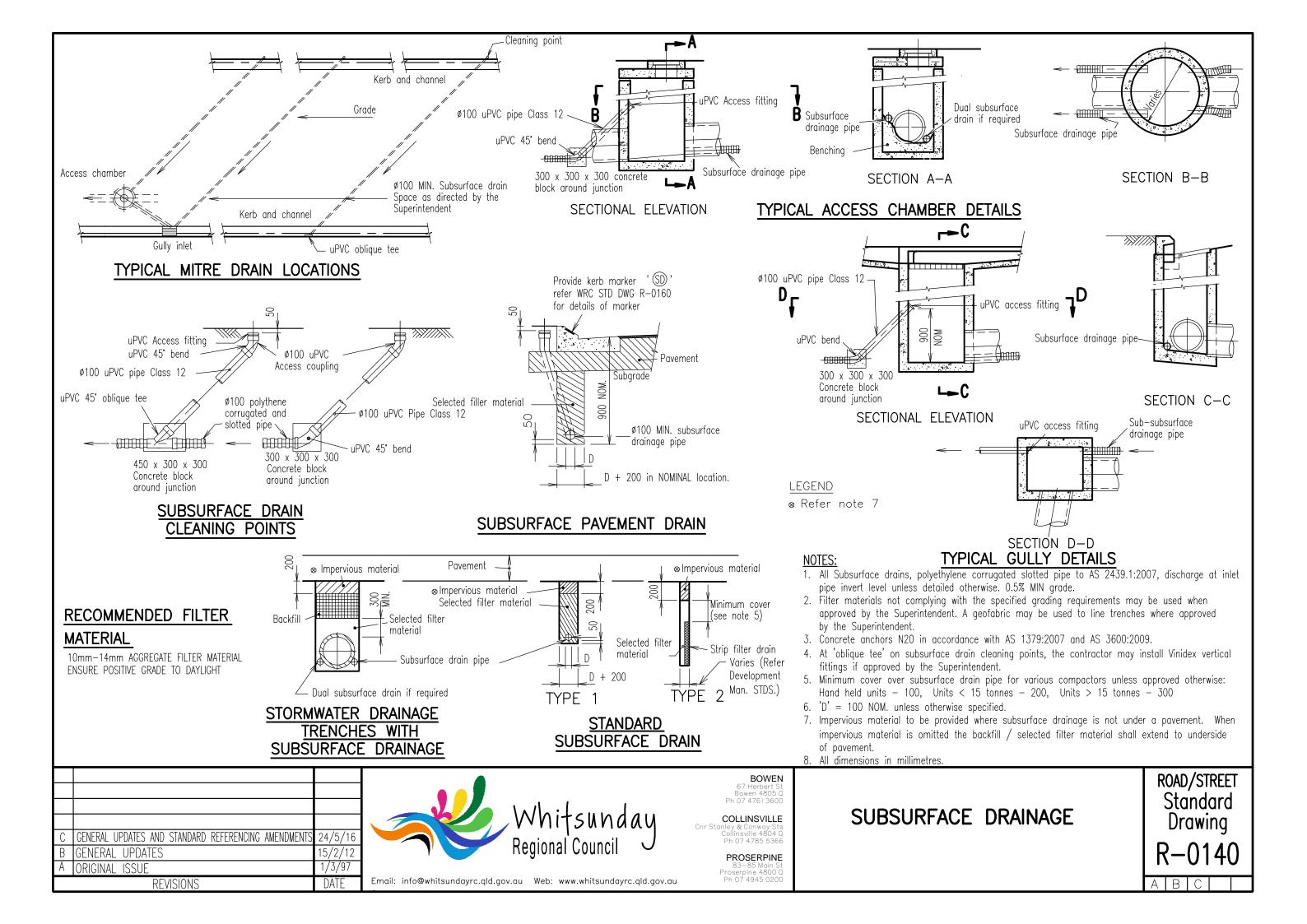
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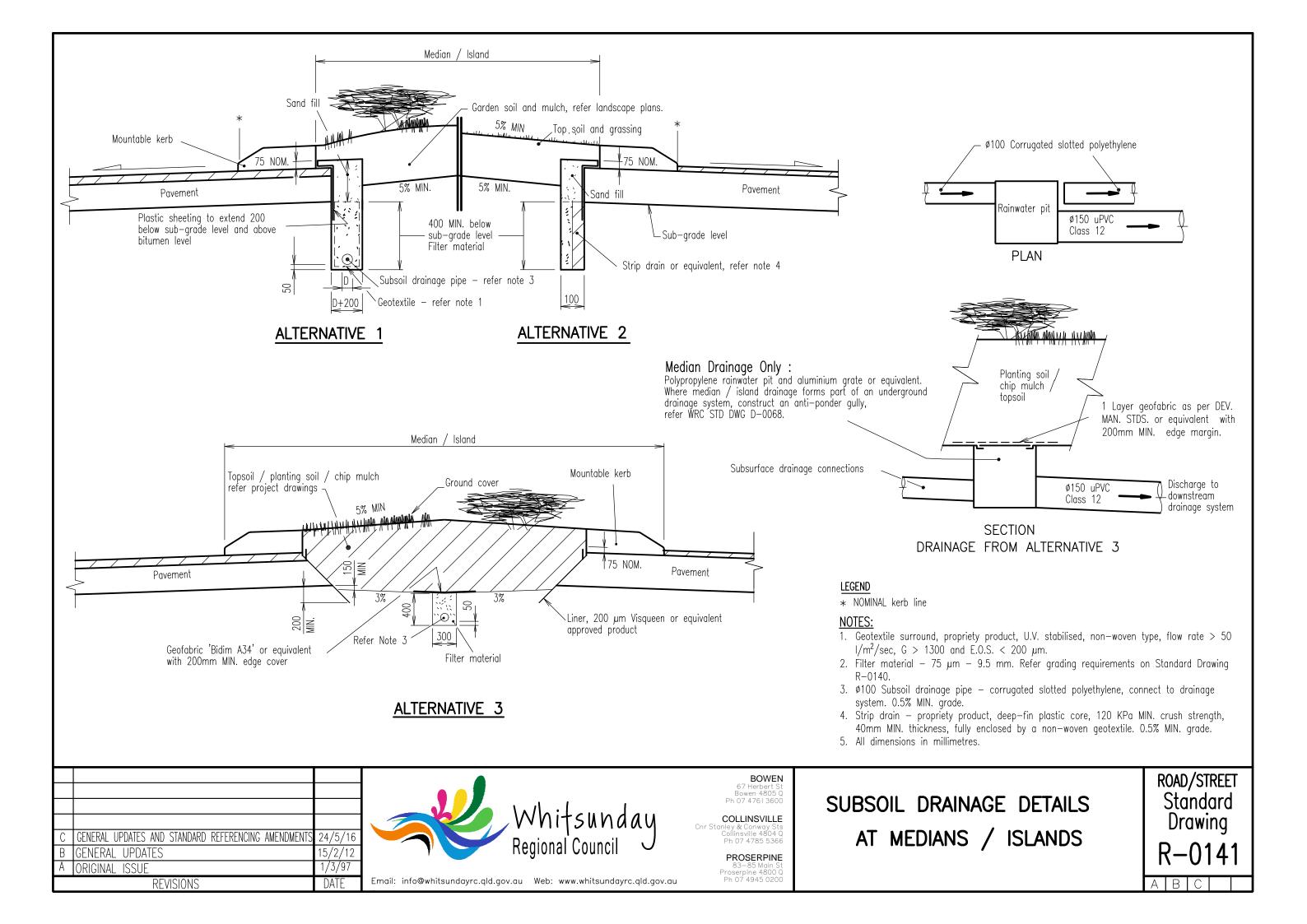
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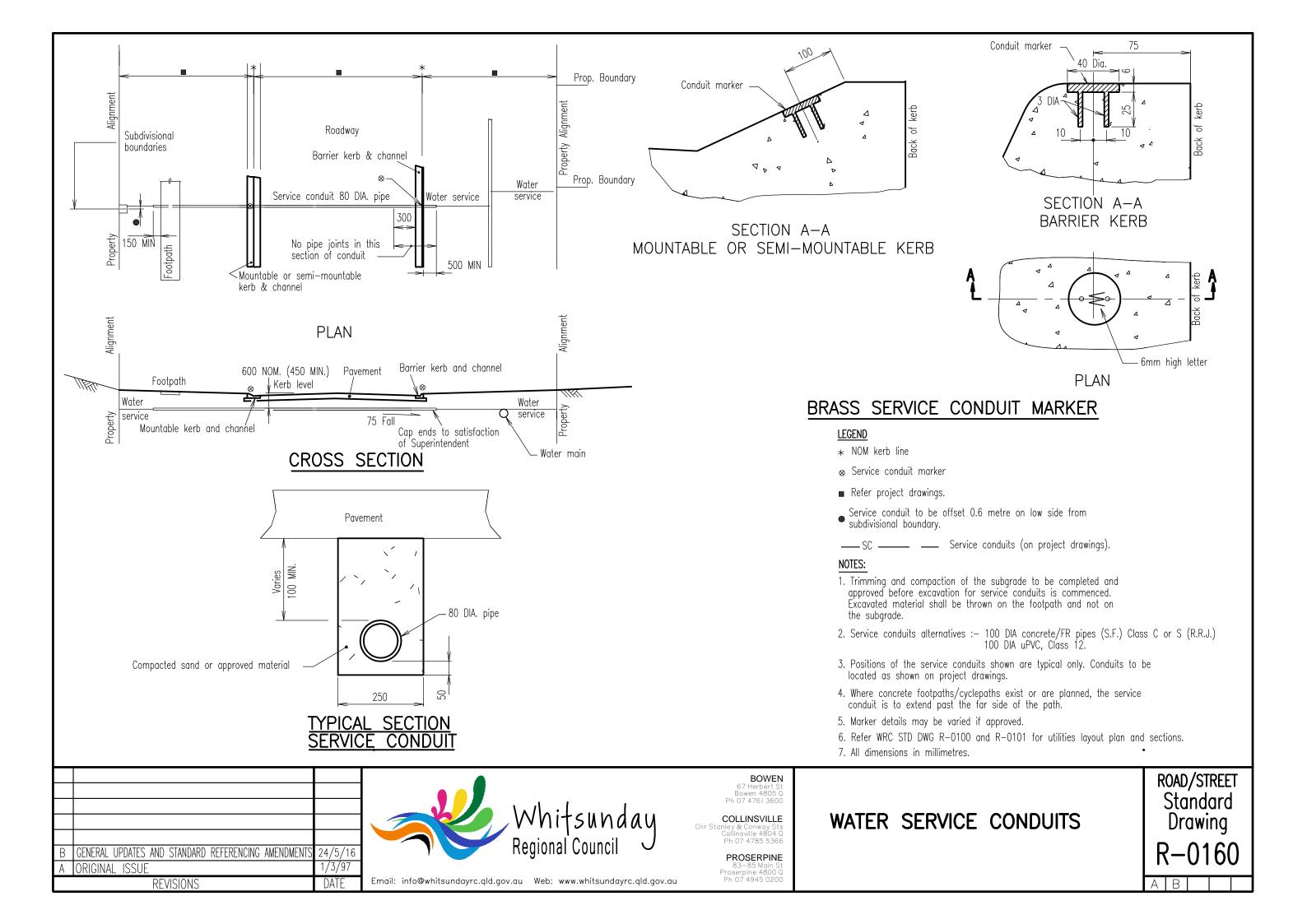
> **PROSERPINE** Proserpine 4800 0 Ph 07 4945 0200

TRAFFIC CONTROL **DEVICES**

ROAD/STREET Standard Drawing







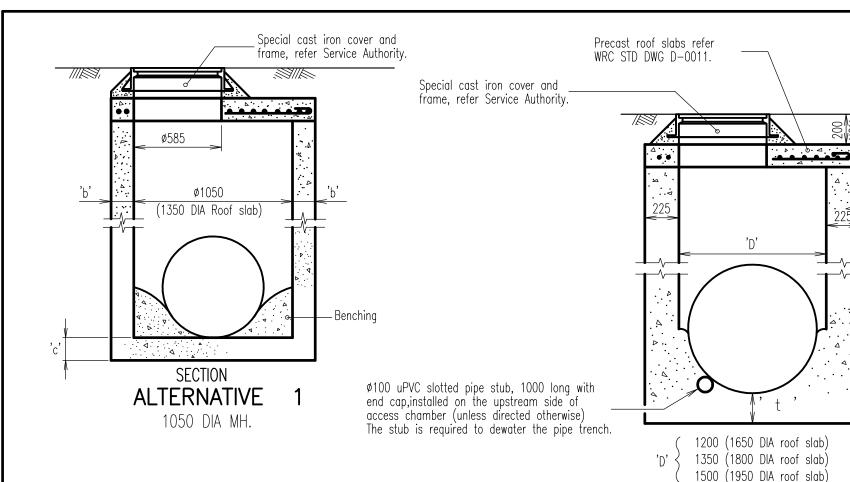
	Std. Dwg. No.	Descriptions
	D-0010 D-0011 D-0012 D-0013 D-0014 D-0015 D-0030 D-0031 D-0061 D-0062 D-0063 D-0064 D-0065 D-0066 D-0067 D-0068 D-0069 D-0080 D-0110	ACCESS CHAMBERS ACCESS CHAMBER DETAILS DIA 1050 TO 1500 ROOF SLABS DIA 1050 TO 1500 ROOF SLABS DIA 1500 EXTENDED 600 AND 900 ROOF SLABS DIA 1500 EXTENDED 600 AND 900 ROOF SLAB RECTANGULAR CAST IRON COVER AND FRAME CI CONCRETE FILLED COVER CAST IRON COVER AND FRAME BOLT DOWN BEDDING AND BACKFILLING EXCAVATION, BEDDING AND BACKFILLING OF CONCRETE/FIBRE REINFORCED DRAINAGE PIPES EXCAVATION, BEDDING AND BACKFILLING OF PRECAST BOX CULVERTS FIELD INLET FIELD INLET FIELD INLET AND OVERFLOW GULLY TYPE 1 AND TYPE 2 GULLY GULLY — ROADWAY TYPE PRECAST LINTEL DETAILS KERB IN LINE GRATE AND FRAME GULLY — ROADWAY TYPE CHANNEL LIP IN LINE DRAINWAY STORMWATER INLET COMPONENTS CAST IRON GRATE COVER AND FRAME TEST LOAD PROCEDURE CONSTRUCTION SETTING OUT BARRIER/MOUNTABLE KERB & CHANNEL GULLY — ANTI-PONDING DEPRESSED 17mm ROCLA/BROPIT SYSTEM INLETS AND OUTLETS ROOF WATER DRAINAGE ROOFWATER INSPECTION CHAMBER
D GENERAL UPDATES AND STANDARD REFERENCING AMENDMENTS 5/5/16 C GENERAL UPDATES B DWG D-0020 ADDED A ORIGINAL ISSUE 1/3/97 Email: info@whitsundayrc.qld.gov.au Web: www.whitsundayrc.qld.gov.au	BOWE 67 Herbert S Bowen 4805 Ph 07 4761 360 COLLINSVILL Cnr Stanley & Conway S Collinsville 4804 Ph 07 4785 536 PROSERPIN 83-85 Main S Proserpine 4800 Ph 07 4945 020	STANDARD DRAWINGS Drawing

REVISIONS

DATE

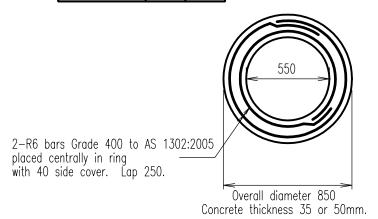
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A B C D



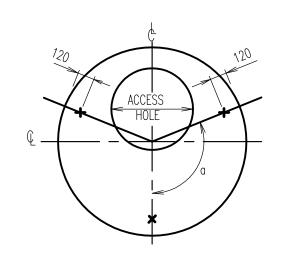
CRITICAL DIMENSIONS					
Depth to outlet invert	Thick	iness			
outlet invert	'b'	, ,			
Minimum to 3000	150	150			
3000 to 6000	225	300			

>1050 DIA MH. ACCESS CHAMBER DETAILS

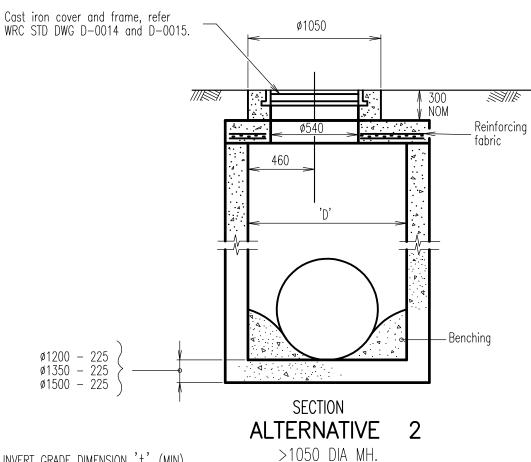


PLAN ROOF RING

For use in raising covers and frames of existing access chambers



LIFTING ANCHOR LOCATIONS



INVERT GRADE DIMENSION 't' (MIN)

Access chamber	FLOOR THICKNESS 't'				
DIA	INLET	OUTLET			
1200	250	225			
1350	250	225			
1500	250	225			

NOTES:

- 1. Structural concrete N25, benching N10 in accordance with AS 1379:2007 and
- 2. Refer WRC STD DWG D-0011 and D-0012 for roof slab reinforcement details.
- 3. Alternatives :-

For access hole location refer Service Authority. For turent type refer Service Authority.

- 4. Refer Project Drawings for size and level of culverts, and chamber cover level.
- 5. Lifting anchors to be "swiftlift" or equivalent 1.8 tonne, galvanized to AS/NZS 4680:2006 and fitted to manufacturer's specifications.
- 6. Access chambers deeper than 3.0m to have an access ladder to AS 1657:2013 in lieu of step irons.
- 7. All dimensions in millimetres.

D	UPDATE TO WALL AND BASE THICKNESS FOR MANHOLE DEPTH	9/6/16
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BOWEN

 $a = 112^{\circ} \text{ For } \emptyset 1350$

 $a = 120^{\circ} \text{ For } \emptyset 1650 - 1950$

TYPICAL SECTION

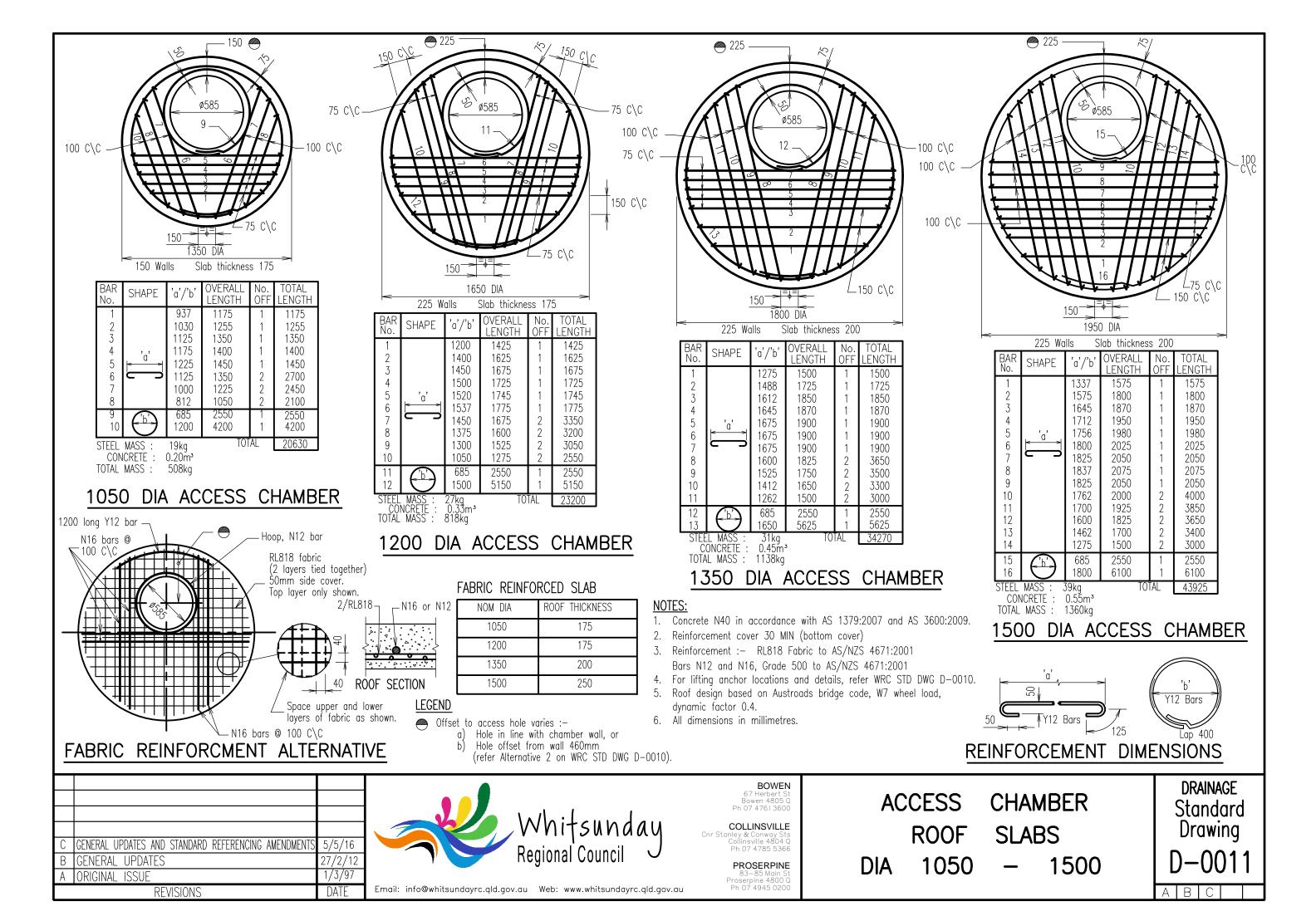
COLLINSVILLE Ph 07 4785 5366

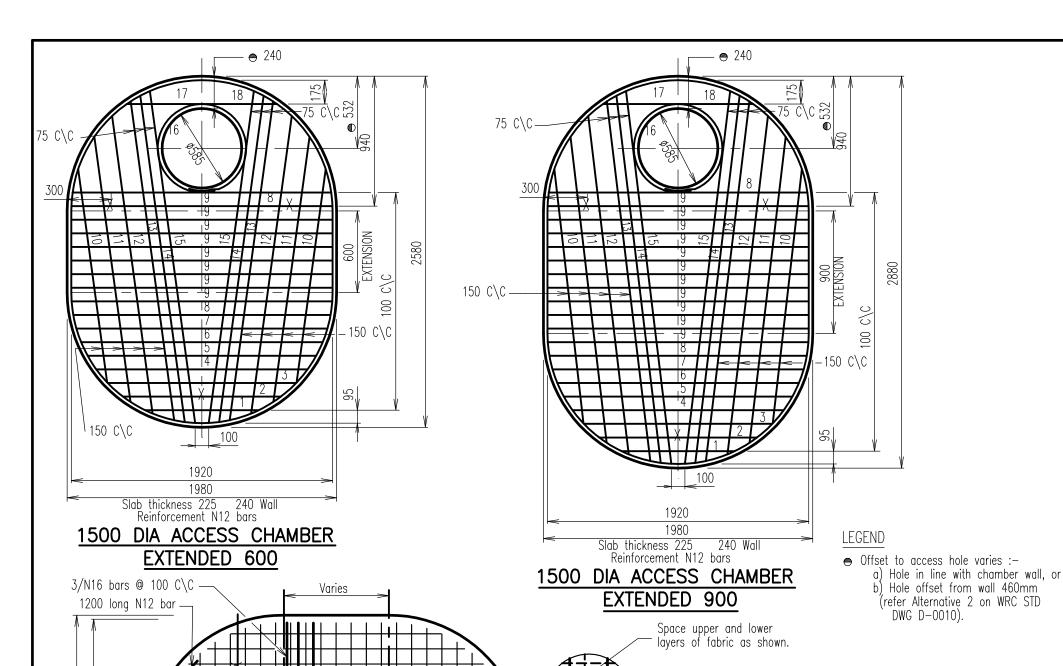
> **PROSERPINE** Proserpine 4800 (Ph 07 4945 020

ACCESS **CHAMBER DETAILS** 1050 TO 1500

DRAINAGE Standard Drawing

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1500 DIA ACCESS CHAMBER EXTENDED 600

BAR NO. SHAPE LENGTH TOTAL 1160 1160 1385 1385 1550 1550 1680 1680 1775 1775 6 1845 1845 1890 3780 8 1920 15360 9 10 1560 3120 1920 11 3840 4340 12 2170 13 2300 4600 2375 4750 14 2450 4900 15 2550 2550 16 7195 7195 17 18 1105 1105 Steel Mass 59 kg 0.90 m³ 2250 kg 65770 TOTAL LENGTH Concrete Volume

1500 DIA ACCESS CHAMBER EXTENDED 900

BAR NO.	SHAPE	LENGTH	NO. OFF	TOTAL					
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18		835 1160 1385 1550 1680 1775 1845 1890 1920 1800 2200 2470 2650 2700 2750 2550 7795 1105	1 1 1 1 1 1 2 11 2 2 2 2 2 2 2 1 1	835 1160 1385 1550 1680 1775 1845 3780 21120 3600 4400 4940 5300 5400 5500 2550 7795 1105					
Steel Mass Concrete Volum	67 kg e 1.03 m³	TOTA	L LENGTH	75720					

⊢N16 or N12

- Roof design based on Austroads Bridge code, W7 wheel load, dynamic
- Concrete N40 in accordance with AS 1379:2007 and AS 3600:2009.
- 3. Reinforcement cover 30 MIN (bottom face).
- 4. Reinforcement: RL818 Fabric to AS/NZS 4671:2001
 - Bars N12 and N16, Grade 500 to AS/NZS 4671:2001
- 5. Refer WRC STD DWG D-0011 for 'reinforcement dimensions'.
 - Lifting anchors to be "swiftlift" or equivalent. 1.8 tonne, galvanized to AS/NZS 4680:2006 and fitted to manufacturer's specification at points Concrete Vo shown 'X'.
- RL818 fabric (2 layers tied together) 7. Lifting capacity of mechanical devices to be no less than 4 tonnes.
 - 8. All dimensions in millimetres.

C B A	GENERAL UPDATES AND STANDARD REFERENCING AMENDMENTS GENERAL UPDATES ORIGINAL ISSUE	5/5/16 27/2/12 1/3/97	Whitsunday Regional Council
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FABRIC REINFORCING DETAIL

240

250

thickness

Slab

2/N16 bars @ 100 C\C

1980



ROOF SECTION

2/RL818 -

50mm side cover. Top layer only

BOWEN

COLLINSVILLE Ph 07 4785 5366

> **PROSERPINE** 83-85 Main S Proserpine 4800 (Ph 07 4945 0200

ACCESS CHAMBER **ROOF SLABS** DIA. 1500 EXTENDED 600 AND 900

2575 ka

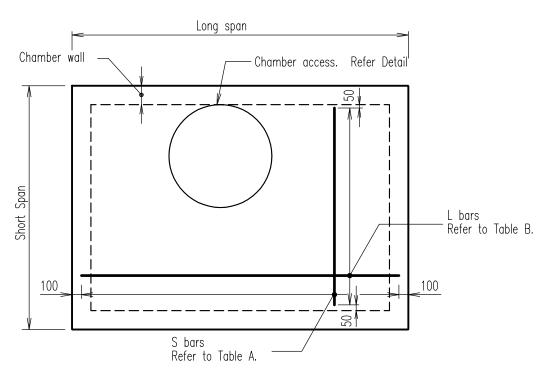
Total Mass

DRAINAGE Standard Drawing

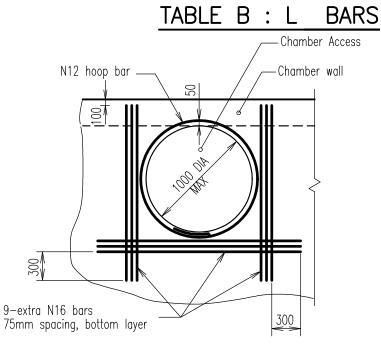
						LONG	SPAN					SLAB
		1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	DEPTH
	1200	N12 AT 150	N16 AT 200	N16 AT 200	N16 AT 200	N16 AT 175	N16 AT 175	N16 AT 175	N16 AT 150	N16 AT 150	N16 AT 150	200
	1400		N12 AT 150	N16 AT 200	N16 AT 200	N16 AT 175	N16 AT 175	N16 AT 150	N16 AT 150	N16 AT 150	N16 AT 150	200
	1600			N12 AT 150	N16 AT 200	N16 AT 200	N16 AT 175	N16 AT 150	N16 AT 150	N16 AT 150	N16 AT 150	200
A	1800				N12 AT 150	N16 AT 200	N16 AT 200	N16 AT 200	N16 AT 175	N16 AT 175	N16 AT 175	225
SPAN	2000					N12 AT 150	N16 AT 200	N16 AT 200	N16 AT 200	N16 AT 175	N16 AT 175	225
L	2200						N12 AT 150	N16 AT 200	N16 AT 200	N16 AT 175	N16 AT 175	225
SHORT	2400							N16 AT 200	N16 AT 200	N16 AT 200	N16 AT 175	225
S	2600		·		·				N16 AT 200	N16 AT 200	N16 AT 175	250
	2800									N16 AT 200	N16 AT 175	250
	3000										N16 AT 175	250

TABLE A : S BARS

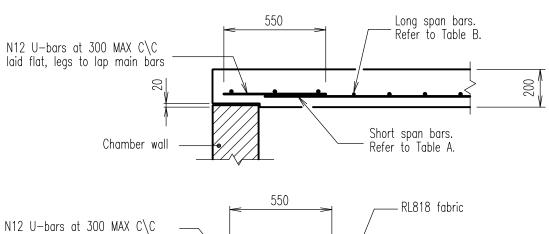
						LONG	SPAN					SLAB
		1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	DEPTH
	1200	N12 AT 150	N12 AT 200	200								
	1400		N12 AT 150	N12 AT 200	200							
	1600			N12 AT 150	N12 AT 150	N12 AT 200	200					
¥	1800				N12 AT 150	N12 AT 150	N12 AT 200	225				
SPAN	2000					N12 AT 150	N12 AT 150	N12 AT 200	N12 AT 200	N12 AT 200	N12 AT 200	225
┕	2200						N12 AT 150	N12 AT 150	N12 AT 150	N12 AT 200	N12 AT 200	225
SHORT	2400							N16 AT 200	N12 AT 150	N12 AT 150	N16 AT 150	225
S	2600								N16 AT 200	N16 AT 200	N16 AT 200	250
	2800									N16 AT 200	N16 AT 200	250
	3000										N16 AT 175	250

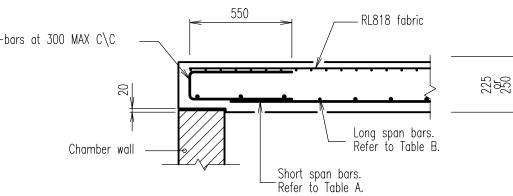


TYPICAL SLAB REINFORCEMENT



SLAB REINFORCMENT AROUND CHAMBER ACCESS





TYPICAL SECTIONS

NOTES:

- 1. Concrete N32/20 in accordance with AS 1379:2007 and AS 3600:2009.
- 2. Reinforcement :- RL818 Fabric to AS/NZS 4671:2001

 Bars N12 and N16, Grade 500 to AS/NZS 4671:2001.
- 3. All laps in reinforcment shall be :- N12 300, N16 400
- 4. Formwork in accordance with AS 3610:1995.
- 5. Designed to Austroads Bridge Code, W7 wheel load, dynamic factor 0.4.
- 6. Maximum fill over roof slab shall be 3000mm.
- 7. Reinforcement cover 45 MIN.
- 8. Refer Service Authority for access hole alternative to be adopted.
- 9. Refer project drawings for details of chamber walls and floors.
- 10. For sections at chamber access refer WRC STD DWG D-0010.
- 11. All dimensions in millimetres.

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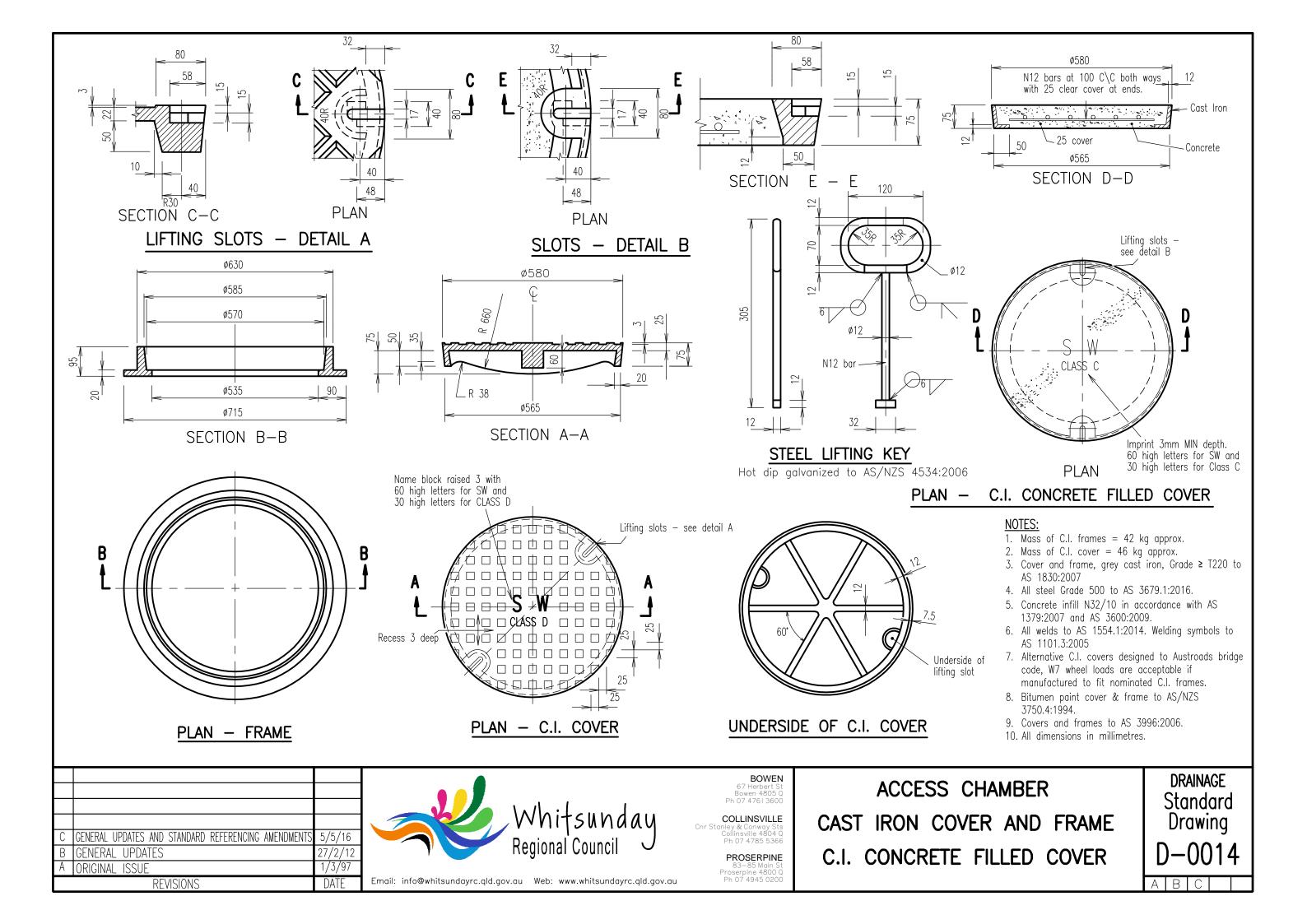
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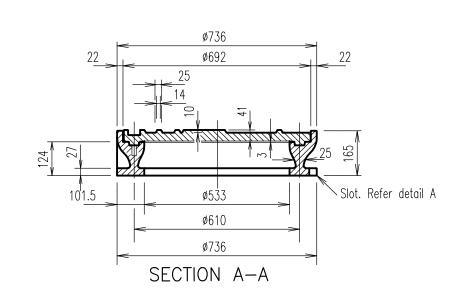
> PROSERPINE 83-85 Main St Proserpine 4800 Q Ph 07 4945 0200

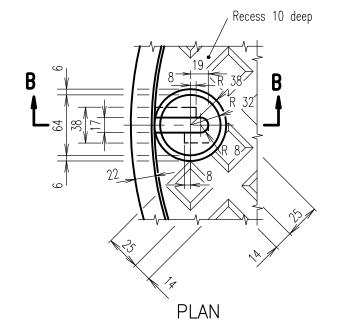
ACCESS CHAMBER
ROOF SLAB
RECTANGULAR

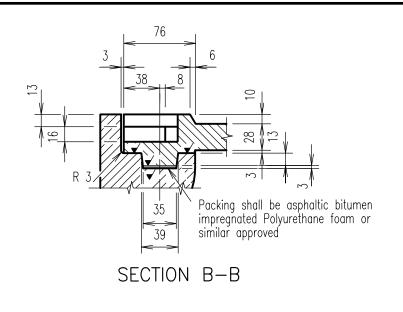
DRAINAGE Standard Drawing

BC

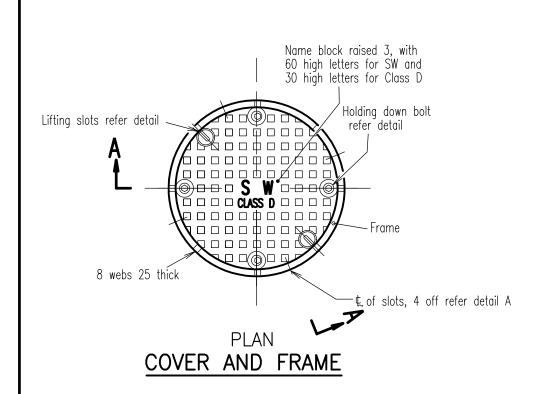


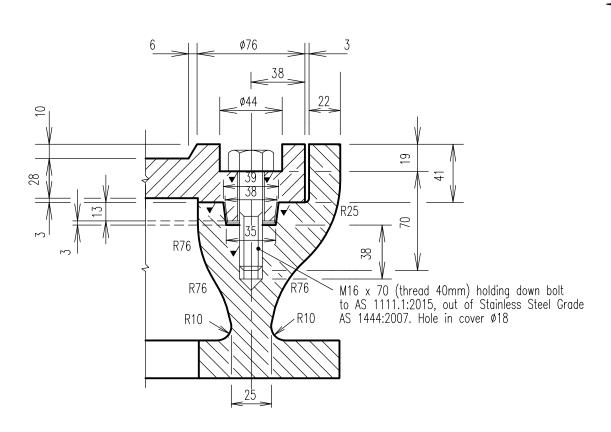




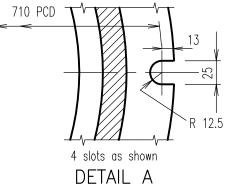


DETAIL AT LIFTING SLOTS





DETAIL OF HOLDING DOWN BOLTS



LEGEND

✓ Denotes machined surface.

NOTES:

- $\overline{1}$. Mass of cover = 66 kg approx.
- 2. Mass of frame = 100 kg approx.
- 3. Cover and frame, grey cast iron Grade ≥ T220 to AS 1830:2007.
- 4. Cover design Class D to AS 3996:2006.
- 5. Alternative C.I. covers designed to Austroads bridge code, W7 wheel loads are acceptable if manufactured to fit nominated C.I. frames.
- 6. Bitumen paint cover & frame to AS/NZS 3750.4:1994. 7. All dimensions in millimetres.

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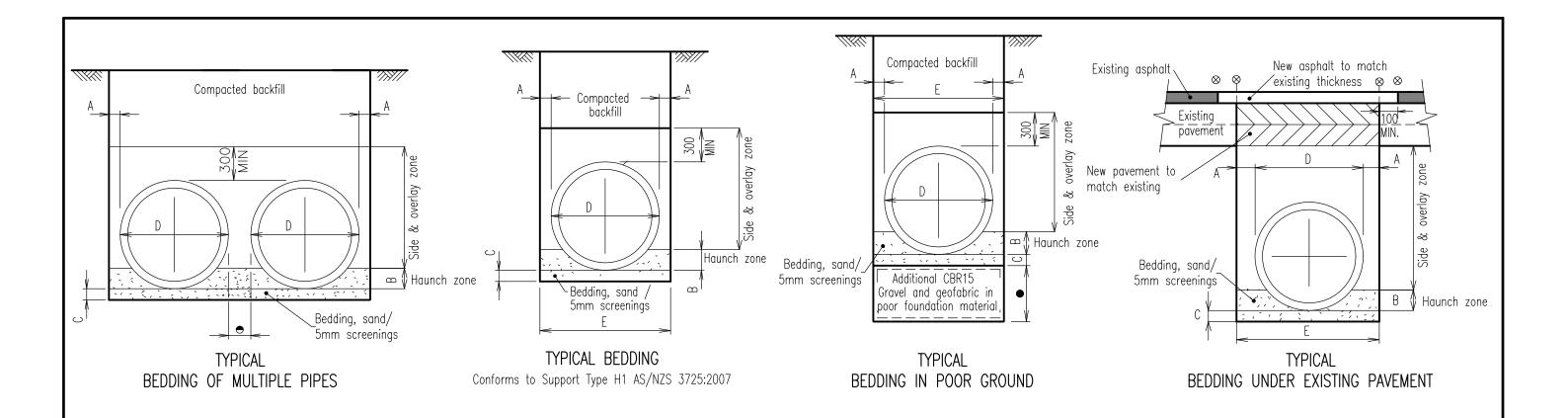
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> PROSERPINE 83-85 Main St Proserpine 4800 Q Ph 07 4945 0200

ACCESS CHAMBER CAST IRON COVER AND FRAME BOLT DOWN

DRAINAGE
Standard
Drawing
D-0015

A B C



<u>NOTES</u>

- 1. Selected backfill in all cases shall be carried through to the wings and continued 300 thick for the length and height of wings.
- 2. Bedding compaction (Compacted selected fill / sand bedding)

 Cohesive material 95% standard compaction

 Non—cohesive material density index of 70 MIN, refer AS 1289.5.5.1:1998.

Sand - compact by flooding and use of vibrators.

3. Backfill compaction

Compacted gravel (300mm) layer under road pavement 95% standard compaction. Compacted ordinary fill / CBR15 Gravel 90% standard compaction — below 300mm zone.

Compacted backfill — at footpaths / private property 90% standard compaction. MAX. densities determined by standard compaction tests to AS 1289.5.1.1:1998.

- 4. Refer project drawings for types and/or alternatives to be adopted.
- 5. Type U & Type H1 to conform to AS/NZS 3725:2007.
- 6. All dimensions in millimetres.

LEGENI

⊗ Saw cut at existing pavement

ullet Pipes : 300 when NOMINAL D \leq 600

600 when NOMINAL D 600 - 1800 900 when NOMINAL D \geq 1800

• Depth to be approved by the Superintendent

Bedding & Haunch material (Gravel, loam, sand or mixture) grading

AC Ciovo Cizo	% Passing	by mass
AS Sieve Size	Bedding & haunch zone	Side/overlay zone
19.0	100	_
2.36	40 - 100	30-100
0.425	15 - 70	15-50
0.075	3 - 30	0-25

NOMINAL Ø culvert	MINIMUM width A	HAUNCH depth B	Bedding depth C	Allowable width,E(m)	
D(mm)	(mm)			DES	MAX
300	300	36	100	1.0	1.1
375	300	45	100	1.1	1.2
450	300	53	100	1.1	1.3
525	300	61	100	1.2	1.5
600	300	69	100	1.3	1.6
750	300	85	100	1.5	1.8
900	300	103	100	1.6	1.9
1050	300	120	100	1.8	2.1
1200	300	135	100	2.0	2.2
1350	300	150	100	2.1	2.4
1500	300	169	100	2.3	2.7
1650	330	184	150	2.6	2.9
1800	360	200	150	2.8	3.1
1950	390	222	150	3.1	3.3
2100	420	239	150	3.4	3.5
2400	480	270	150	3.9	4.2
2700	540	303	150	4.3	4.6
3000	600	335	150	4.9	5.0

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B GENERAL UPDATES 27/2/12 A ORIGINAL ISSUE 1/3/97			
B GENERAL UPDATES 27/2/12 A ORIGINAL ISSUE 1/3/97			
B GENERAL UPDATES 27/2/12 A ORIGINAL ISSUE 1/3/97			
A ORIGINAL ISSUE 1/3/97	С	GENERAL UPDATES AND STANDARD REFERENCING AMENDMENTS	5/5/16
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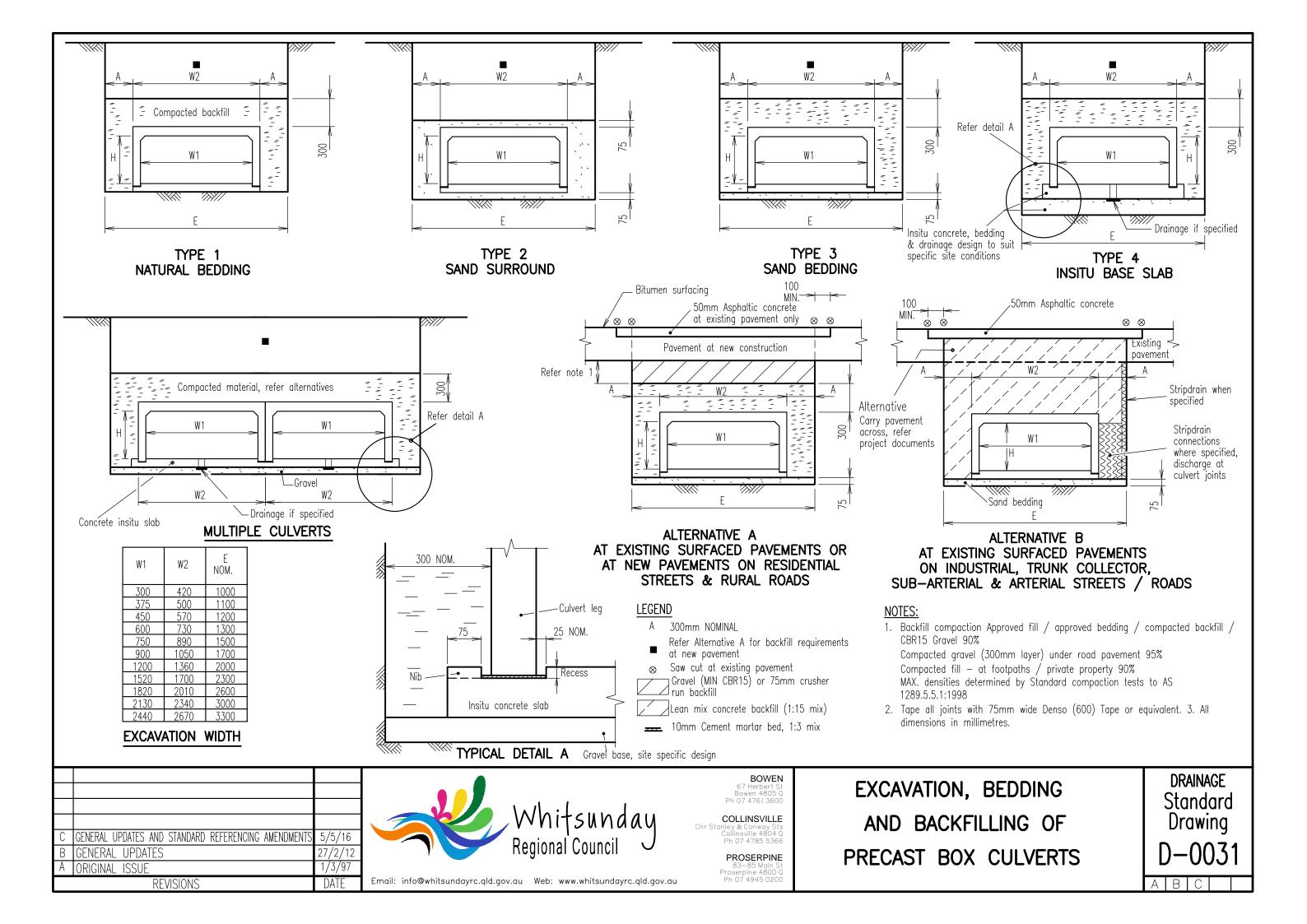
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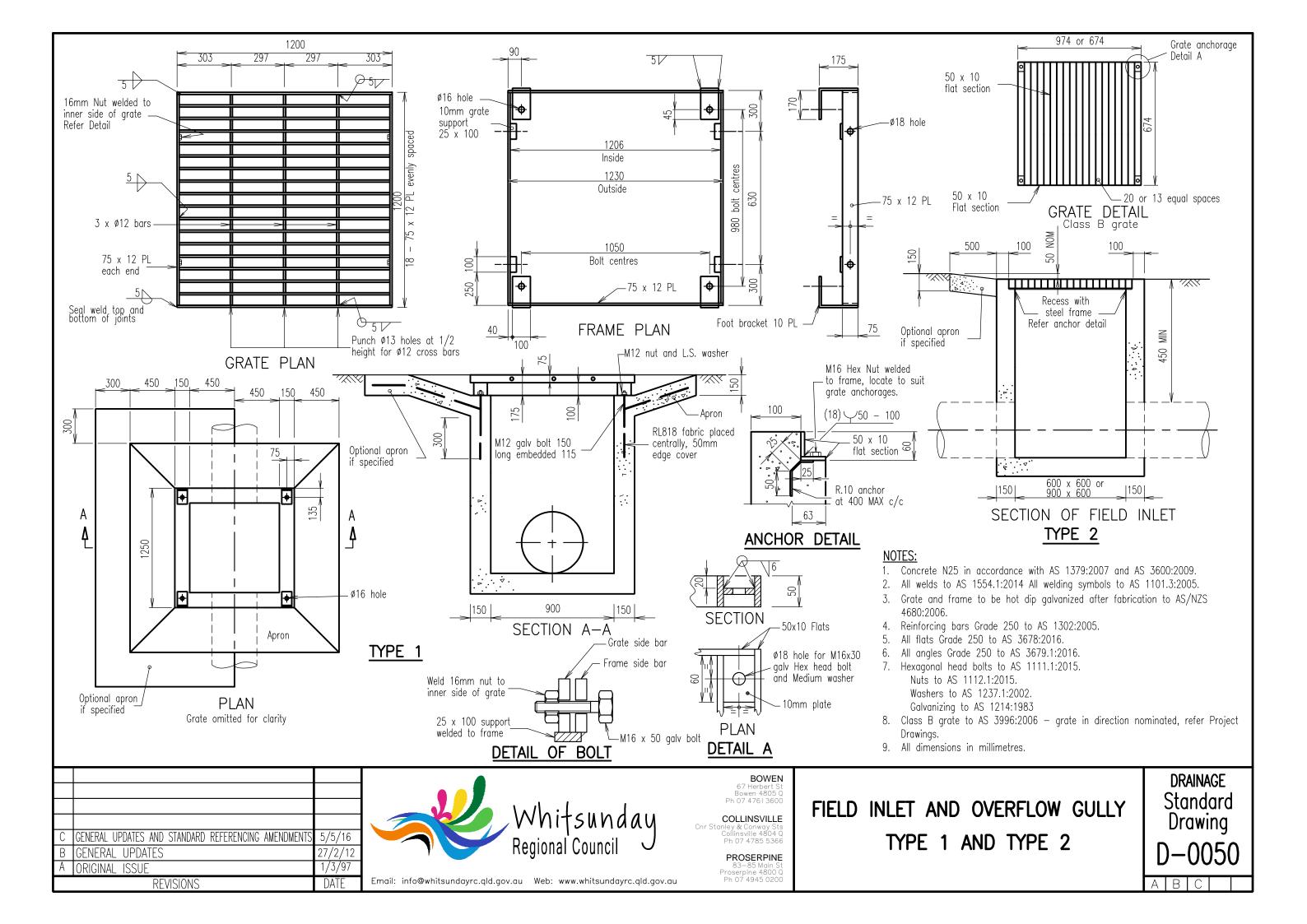
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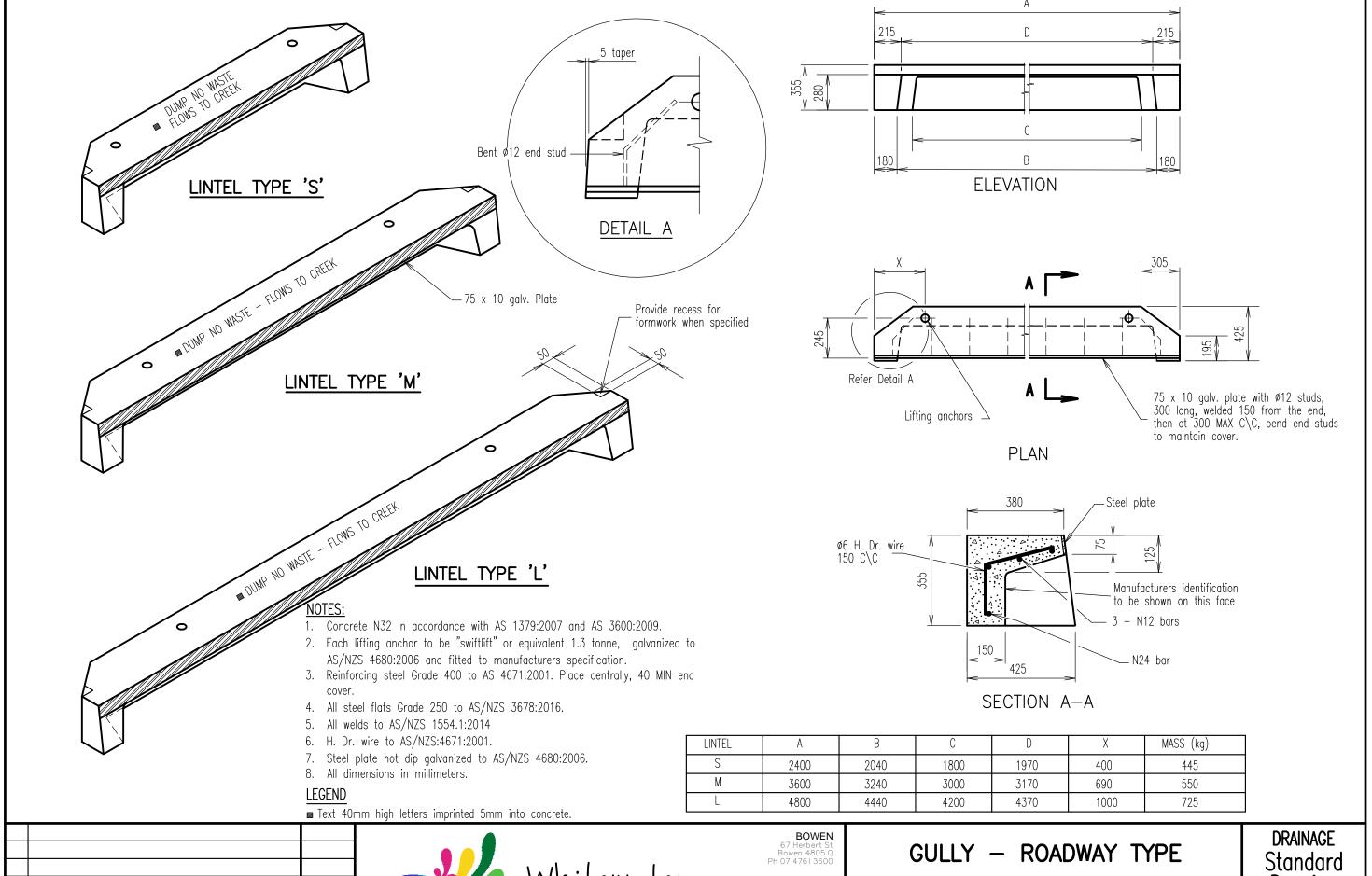
> PROSERPINE 83-85 Main St Proserpine 4800 Q Ph 07 4945 0200

EXCAVATION, BEDDING AND BACKFILLING OF CONCRETE/FIBRE REINFORCED DRAINAGE PIPES

DRAINAGE Standard Drawing D-0030







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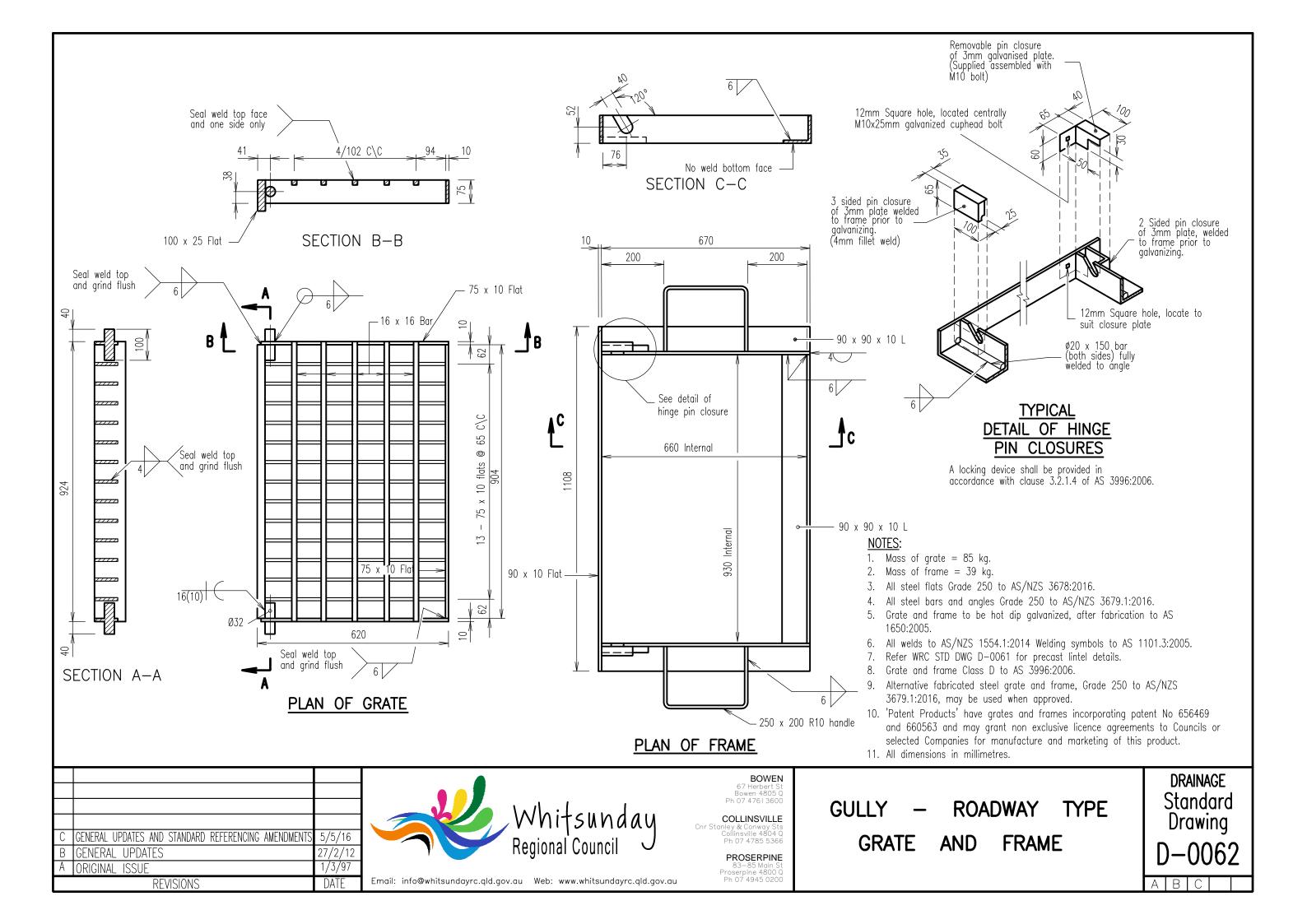
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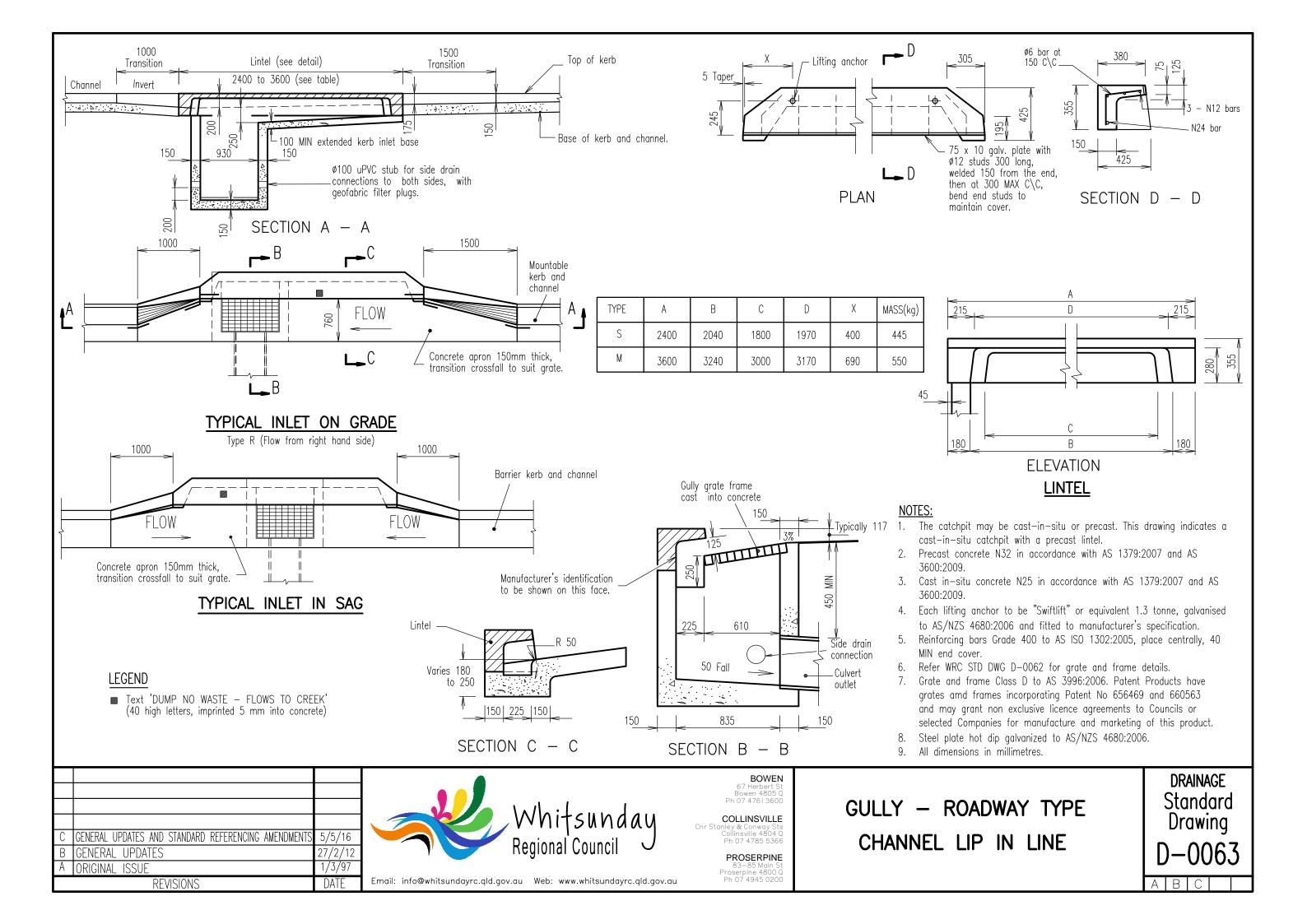
> PROSERPINE 83-85 Main St Proserpine 4800 Q Ph 07 4945 0200

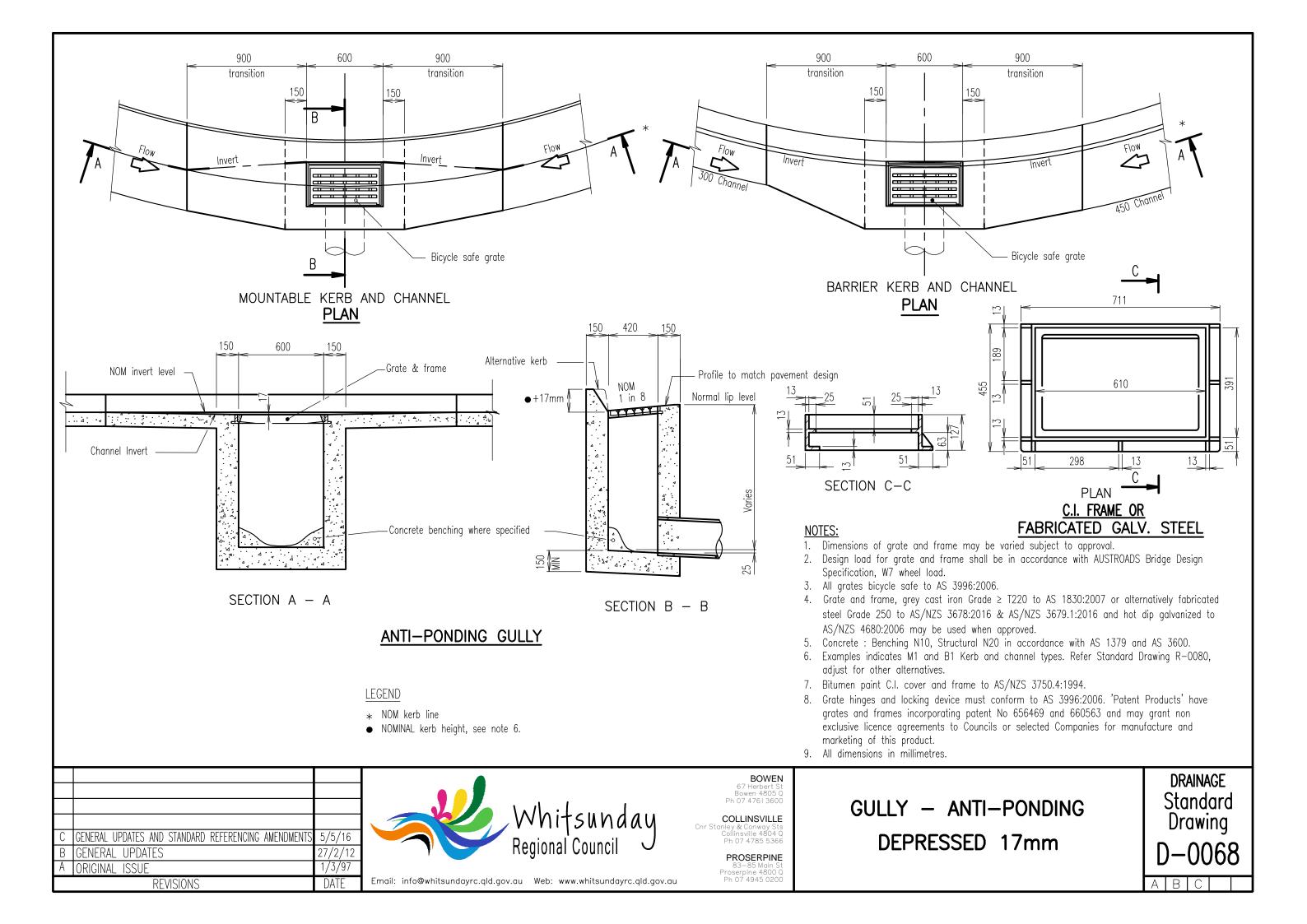
GULLY — ROADWAY TYPE
PRECAST LINTEL DETAILS
KERB IN LINE

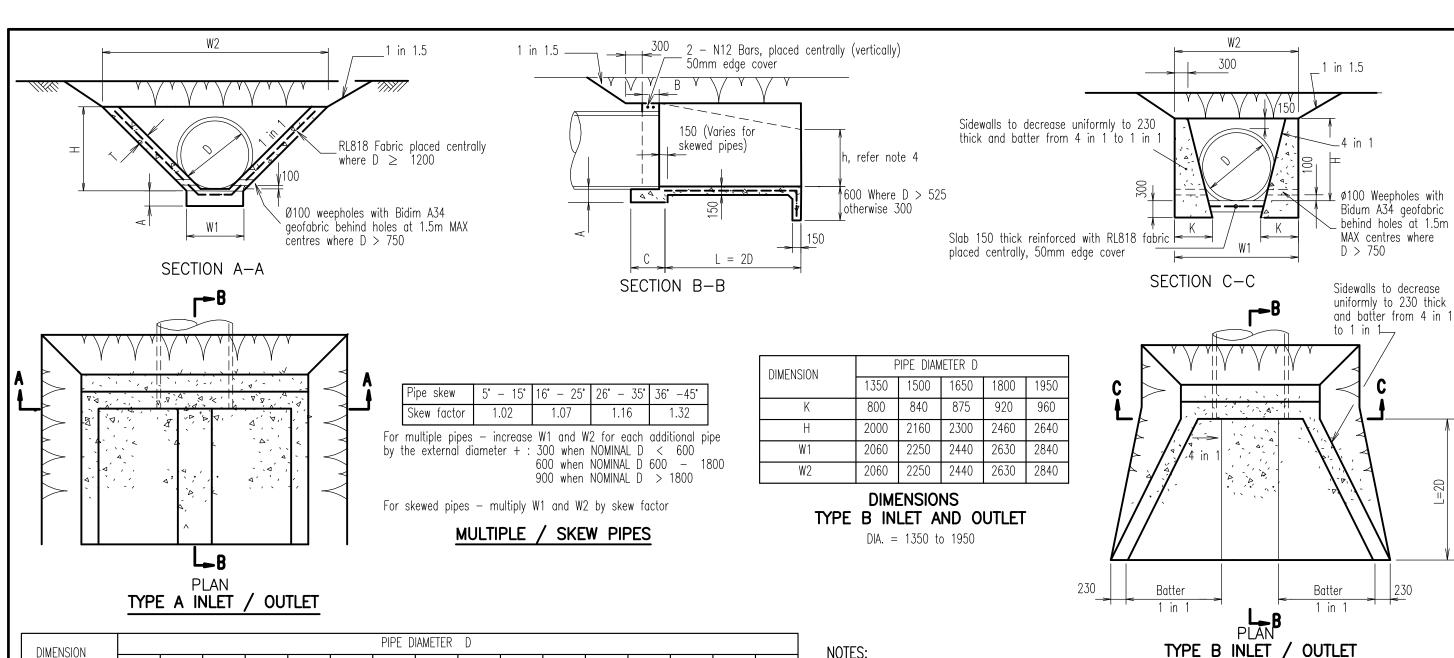
Standard Drawing D-0061

A B C









DIMENSION							PIPE D	IAMETER	D							
DIWENSION	300	375	450	525	600	675	750	825	900	1050	1200	1350	1500	1650	1800	1950
А	150	150	150	200	200	200	250	250	250	250	250	300	300	300	300	300
В	225	225	225	300	300	300	300	300	300	300	300	300	300	300	300	300
С	450	450	450	450	450	450	600	600	600	600	600	600	600	600	600	600
Н	580	670	750	830	900	980	1060	1140	1220	1370	1530	1690	1840	2000	2160	2340
Т	150	150	150	200	200	200	200	200	200	200	200	200	200	200	200	200
W1	700	730	760	790	820	850	880	920	950	1010	1070	1140	1200	1260	1320	1380
W2	1860	2070	2260	2450	2620	2810	3000	3200	3390	3750	4130	4520	4880	5260	5640	6060

DIMENSIONS

TYPE A INLET DIA. = 300 to 1200TYPE A OUTLET DIA. = 300 to 1950

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	Whitsunday
16	Regional Council
[/] 12	regional council
97	

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83-85 Main S Proserpine 4800 (Ph 07 4945 020)

INLETS AND OUTLETS TO STORMWATER DRAINS (CONCRETE)

1. Design bearing pressure 75 KPa. Where this bearing pressure cannot be obtained, the Superintendent may direct

2. Concrete N20 or Grade S32/10 shotcrete may be used in accordance with AS 1379:2007 and AS 3600:2009. 3. In tidal areas where fabric reinforcement is specified, concrete is to be sulphate resistant Grade S40 to AS

4. In embankment situations, the height of the wingwall at the toe should be reduced to "h" so that the slope of

5. See project drawings for the following: No. and diameter of pipes; Skew angles of pipes if applicable; Invert

8. Refer project drawings for protection proposed between end of outlet structure and open drain / creek.

6. If directed (by the Superintendent), the apron slab to a Type A outlet may be lowered by the pipe wall thickness

the top of the wingwall equals the adjacent embankment batter. Refer project drawings.

7. At inlets or outlets, transition uniformly from concrete to open channel over 5m to 10m.

9. Reinforcement: Bars Grade 400 to AS ISO 1302:2005. Fabric to AS/NZS 4671:2001.

levels of pipes; Height of wingwall "h" at toe if applicable.

10. All dimensions in millimetres, unless shown otherwise.

DRAINAGE Standard Drawing

BOWEN 67 Herbert St Bowen 4805 Q Ph 07 4761 3600

that a wider footing be used.

1379:2007 and AS 3600:2009.

to allow for future pipe extension.

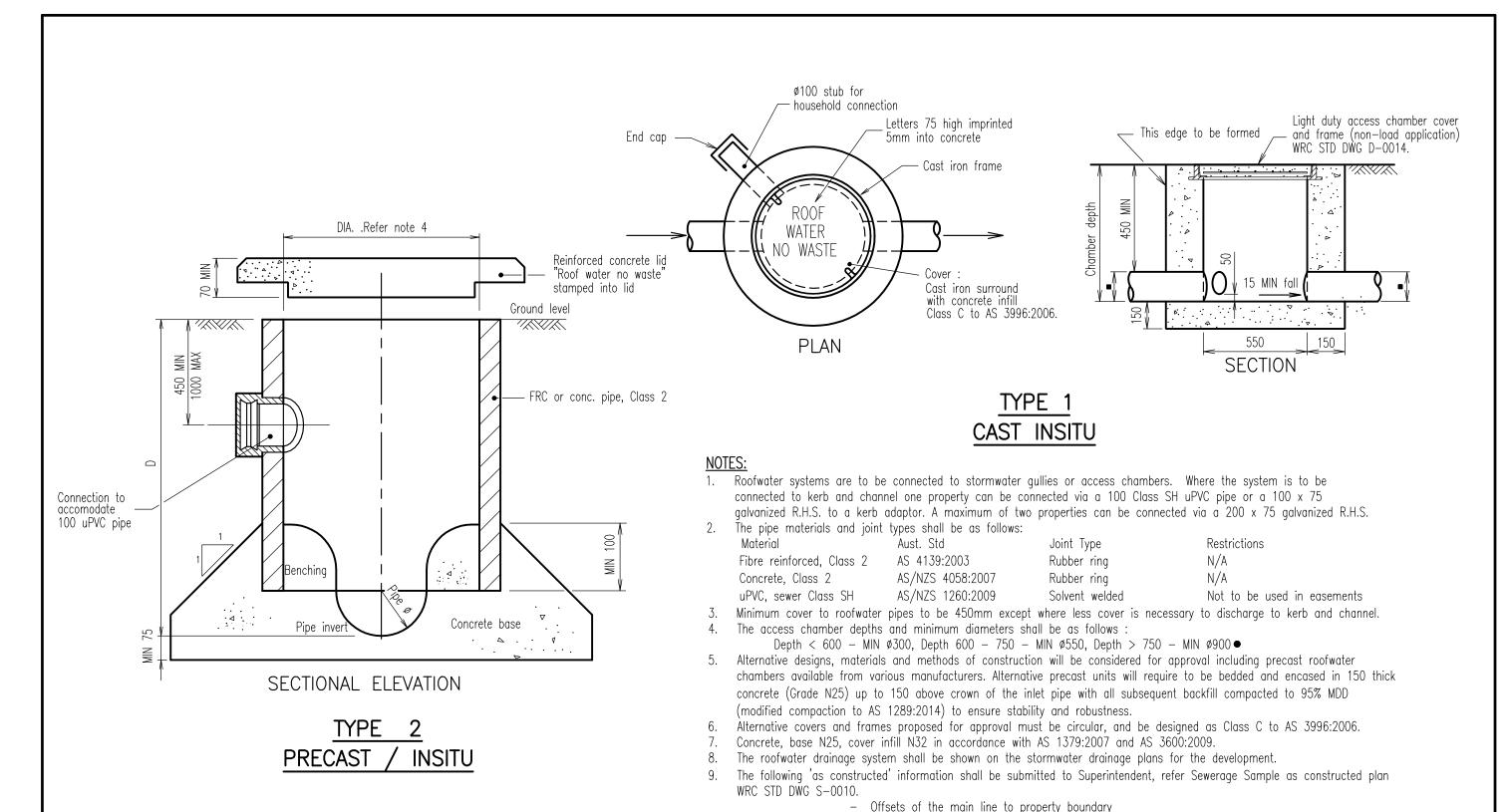
COLLINSVILLE

PROSERPINE

C GENERAL UPDATES AND STANDARD REFERENCING AMENDMEN B GENERAL UPDATES 27/2/ 1/3/9 A ORIGINAL ISSUE

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LEGEND

- Refer project drawings for pipe diameter and type
- At Ø900 chambers adopt roof design off WRC STD DWG D-0011.

BOWEN

67 Herbert St Bowen 4805 C

11. All dimensions in millimetres.

COLLINSVILLE Ph 07 4785 5366

> PROSERPINE Proserpine 4800 (Ph 07 4945 0200

ROOFWATER INPECTION CHAMBER

- The locations of access chambers and Y junctions measured from the property boundary.

10. Where individual lots can directly discharge to the kerb and channel, kerb adaptors shall be used. Refer WRC STD DWG

DRAINAGE Standard Drawing

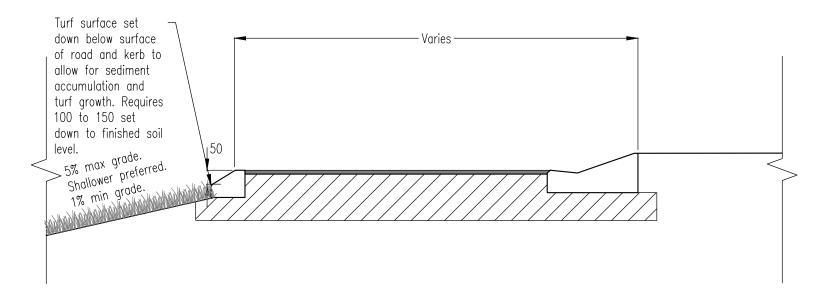
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Std. Dwg. No.	Descriptions	Std. Dwg. No.	Descriptions	
	STORMWATER QUALITY			
Q-0002 Q-0003 Q-0004 Q-0005 Q-0006	FLUSH KERBING AND GRASS BUFFER STRIP DETAIL UNDERDRAINAGE FLUSH OUT POINT IN STREETSCOPE SELF WATERING STREET TREE CONSTRUCTED WETLAND INLET ZONE WEIR DETAILS CONSTRUCTED WETLAND RISER PIT			
DS-070 DS-071 DS-076 DS-077 DS-078	BIORETENTION IPWEAQ STANDARD DRAWINGS BIORETENTION DRAINAGE PROFILE—TYPE 1 SATURATED ZONE—UNCONSTRAINED BIORETENTION DRAINAGE PROFILE—TYPE 1 SATURATED ZONE—CONSTRAINED BIORETENTION WEIR BIORETENTION STREET TREE BIORETENTION STANDARD NOTES			
DS-079 DS-080	SWALES IPWEAQ STANDARD DRAWINGS STREETSCAPE SWALE—TYPICAL SECTION SHEET 1 OF 2 STREETSCAPE SWALE—TYPICAL SECTION SHEET 2 OF 2			
	Whitsunday Regional Council	BOWEN 67 Herbert St Bowen 4805 Q Ph 07 4761 3600 COLLINSVILLE Cnr Stanley & Conway Sts Collinsville 4804 Q Ph 07 4785 5366	STANDARD DRAWINGS	SW QUALITY Standard Drawing Q-0001
A ORIGINAL ISSUE	8/6/16 REVISIONS DATE Revisions	PROSERPINE 83-85 Main St Proserpine 4800 Q Ph 07 4945 0200	STORMWATER QUALITY	Q-0001

NOTES:

- 1. Engineering works to be in accordance with councils engineering guidelines, standards and specifications.
- 2. All dimensions in millimetres unless specified otherwise.
- 3. Ensure appropriate drainage downstream of buffer. Design to suit context (eg. open space, swale).



TYPICAL SECTION

Α	ORIGINAL ISSUE	8/6/16
	REVISIONS	DATE



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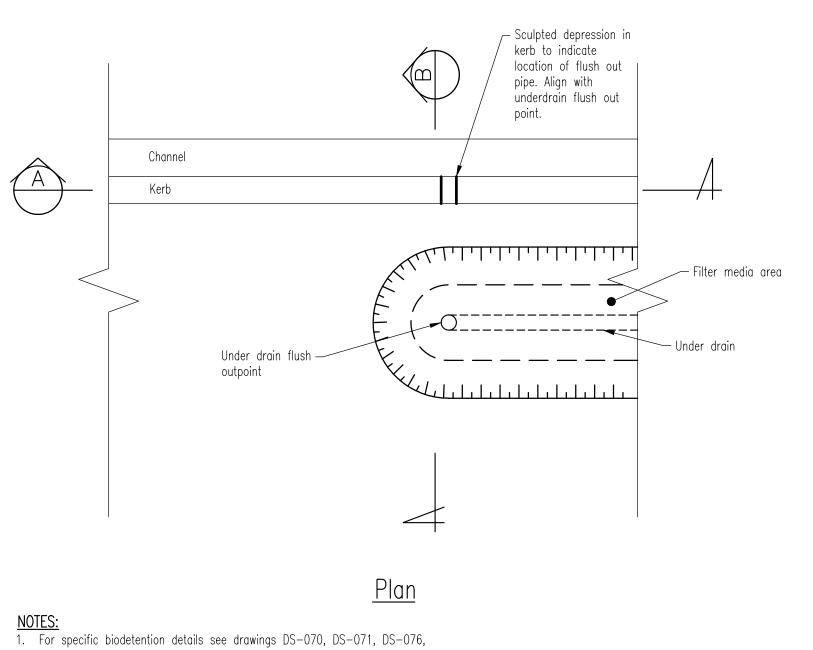
COLLINSVILLE Cnr Stanley & Conway Sts Collinsville 4804 Q Ph 07 4785 5366

PROSERPINE

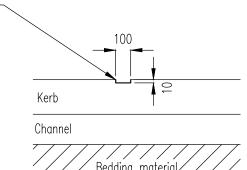
GRASS BUFFER STRIP 83-85 Main St Proserpine 4800 C Ph 07 4945 0200

FLUSH KERBING AND

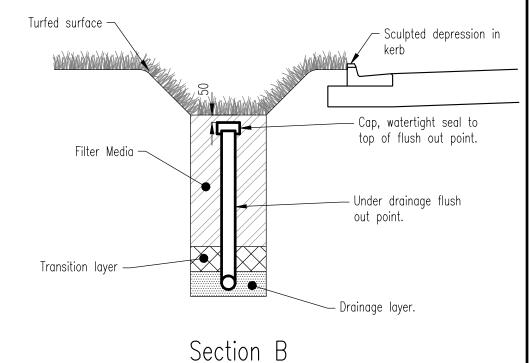
SW QUALITY Standard Drawing



Sculpted depression in kerb to indicate location of flush out pipe. Align with underdrain flush out



Section A



- DS-077 & DS-078.
- 2. All measurements in millimetres.

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> PROSERPINE 83-85 Main S Proserpine 4800 (Ph 07 4945 020)

UNDERDRAINAGE FLUSH OUT PIPE IN STREETSCAPE

SW QUALITY Standard Drawing

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Tree type as specified NOTES: 1. Use standard fittings for all connections including joining lengths of pipe. 2. All dimensions in millimetres Distribution pipe sealed Place the tree so that the top of to inlet pipe the rootball is 20 Mulch, generally 75 below the adjacent thick. Finished 25 below adjacent. Adjacent surface - Inlet pipe sealed into Distribution pipe sealed and flush with kerb Treatment to outlet pipe Edge if specified Edging if specified. Refer note 1. Outlet pipe sealed to Distribution pipe kerb Root ball depth 300 Interlocking PVC tic Distribution pipe. Lightly compact topsoil in 150 Tree canopy Flexible corrugated, perforated or rigid Stake, place carefully layers and place slotted as to prevent damage to If specified for aggressive rootball on top. specified. distribution pipe. tree roots, use root barrier or approved material. Inlet and kerb detail - Tree trunk Adjacent surface treatment Inlet pipe alignment. Refer self watering street tree guideline (Water by Design 2016). Distribution pipe sealed -Inlet pipe sealed into to inlet pipe and flush with kerb Inlet pipe sealed into

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Pavement material

SELF WATERING STREET TREE

SW QUALITY Standard

Drawing

In-situ soil

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Alternate inlet and kerb detail

and flush with kerb

Channel

Kerb

8/6/16

Distribution pipe sealed

Plan

to inlet pipe

Mulch 75 thick. Type

as specified. maintain

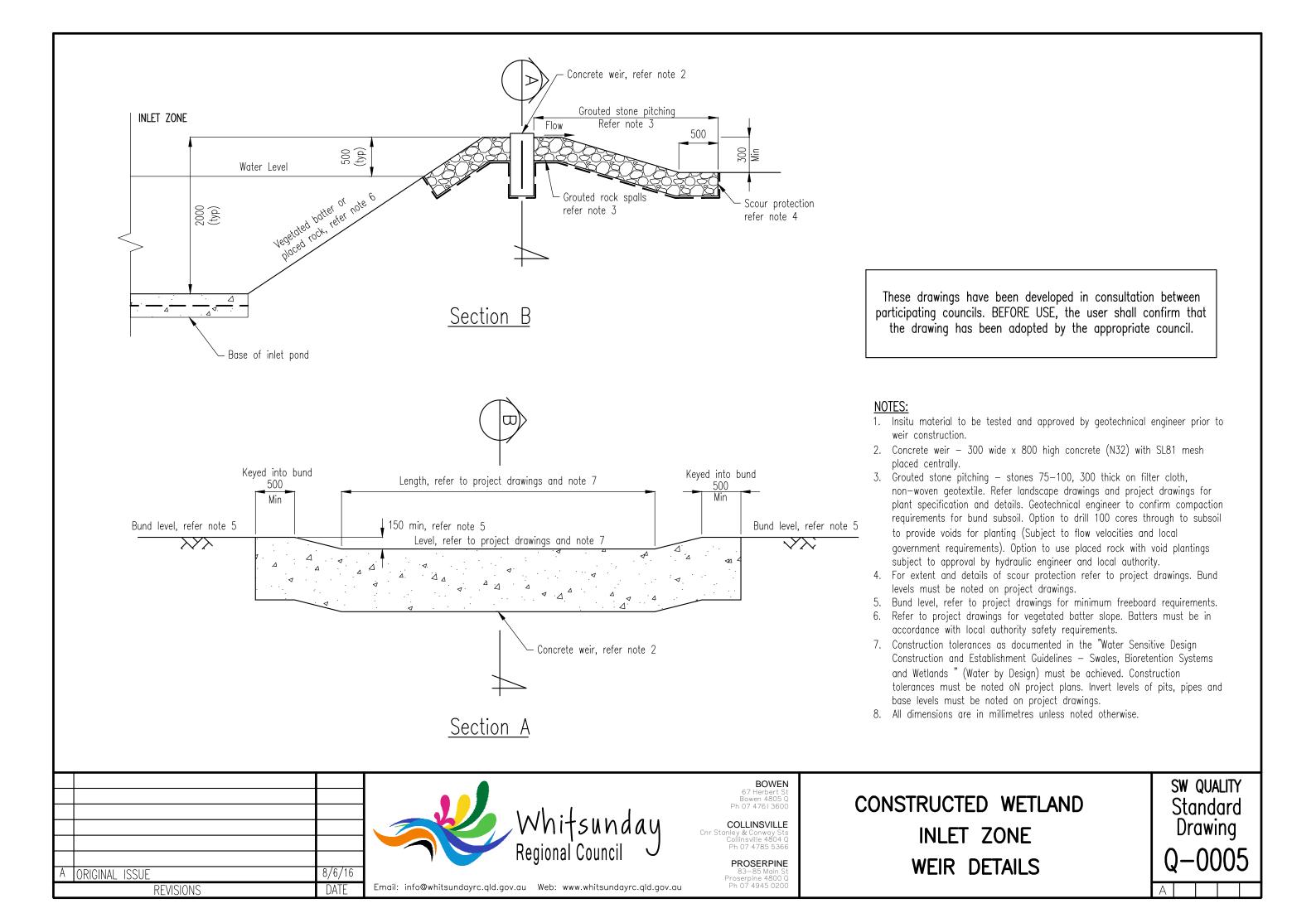
50 to 100 radius

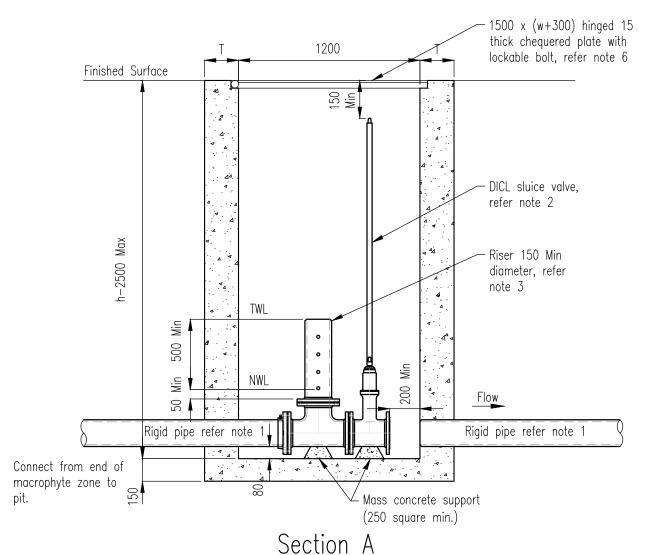
separation between mulch and stem of

A ORIGINAL ISSUE

REVISIONS

tree.

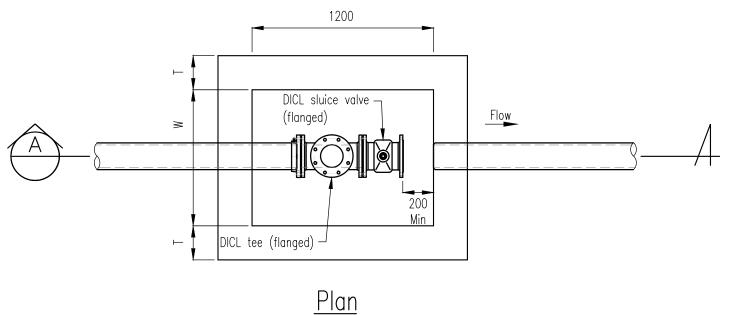




Dit Dimonoione	

	Pit Dimensions	
Height (h)	Width (w)	Wall thickness
0-1500	600	150
1500-2500	900	225

These drawings have been developed in consultation between participating councils. BEFORE USE, the user shall confirm that the drawing has been adopted by the appropriate council.



NOTES:

- 1. Refer to project drawings for rigid pipe diameter and invert level.
- 2. DICL sluice valve, refer project drawings for valve size. Valve to remain in closed position for normal operation. Valve to be opened to lower the water level for maintenance of the wetland.
- 3. Riser rigid pipe CL16, refer to project drawings for holes sizes and locations. Hole size and number as per relevant section of "Water Sensitive Urban Design Technical Design Guidelines" (Water by Design).
- 4. For pits over 2500 in depth refer project drawings for pit dimensions and reinforcing details.
- 5. Concrete N25 in accordance with AS 1379:2007 AS 3600:2009
- 6. Lid and frame to be hot dip Galvanised after fabrication to AS 1650:1989.
- 7. Construction tolerances as documented in the "Water Sensitive Urban Design Construction and Establishment Guidelines Swales, Bioretention Systems and Wetlands" (Water by Design) must be achieved. Construction tolerances must be noted on project plans. Invert levels of pits, pipes and base levels must be noted on project drawings.
- 8. All dimensions in millimetres unless noted otherwise.

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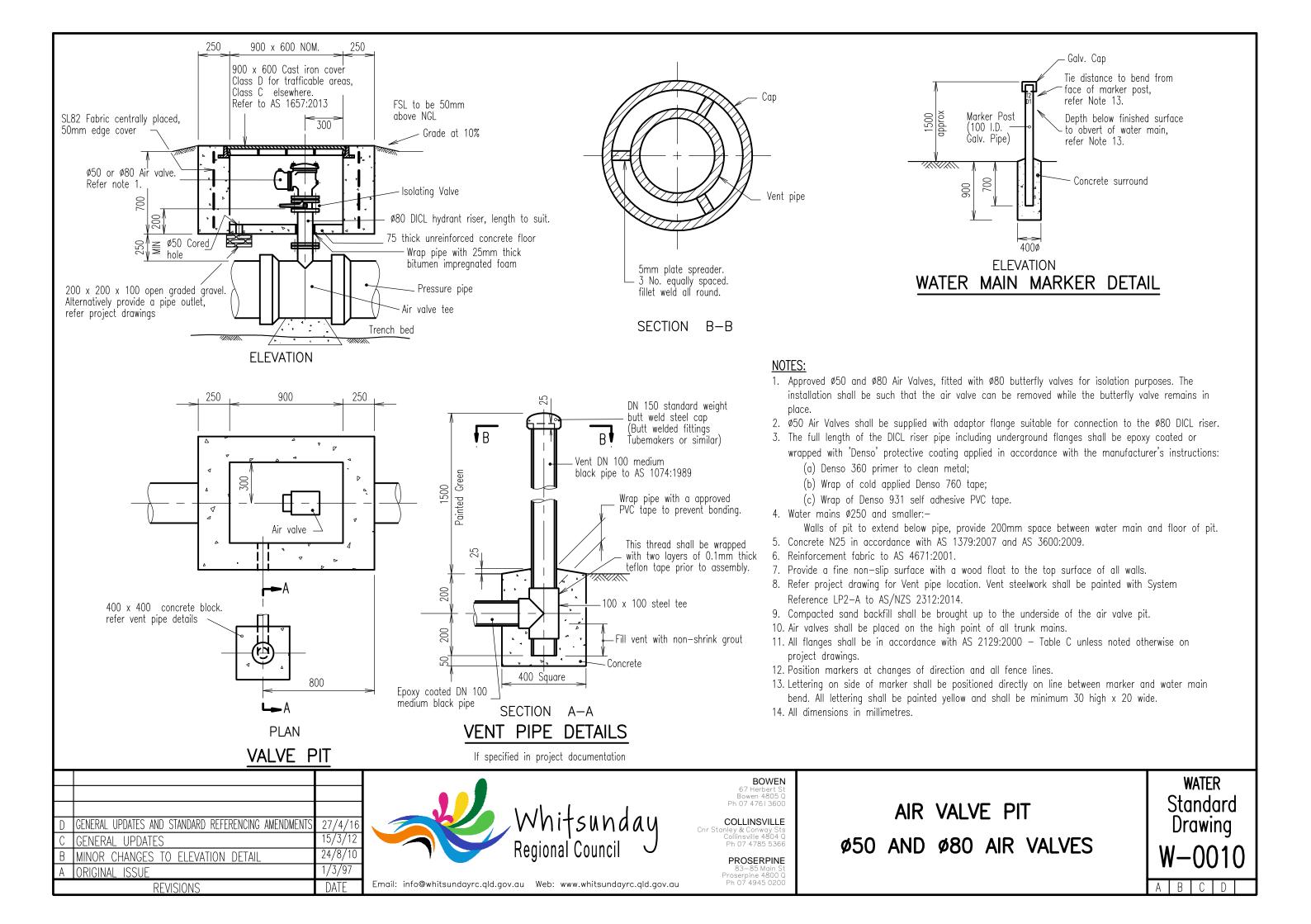
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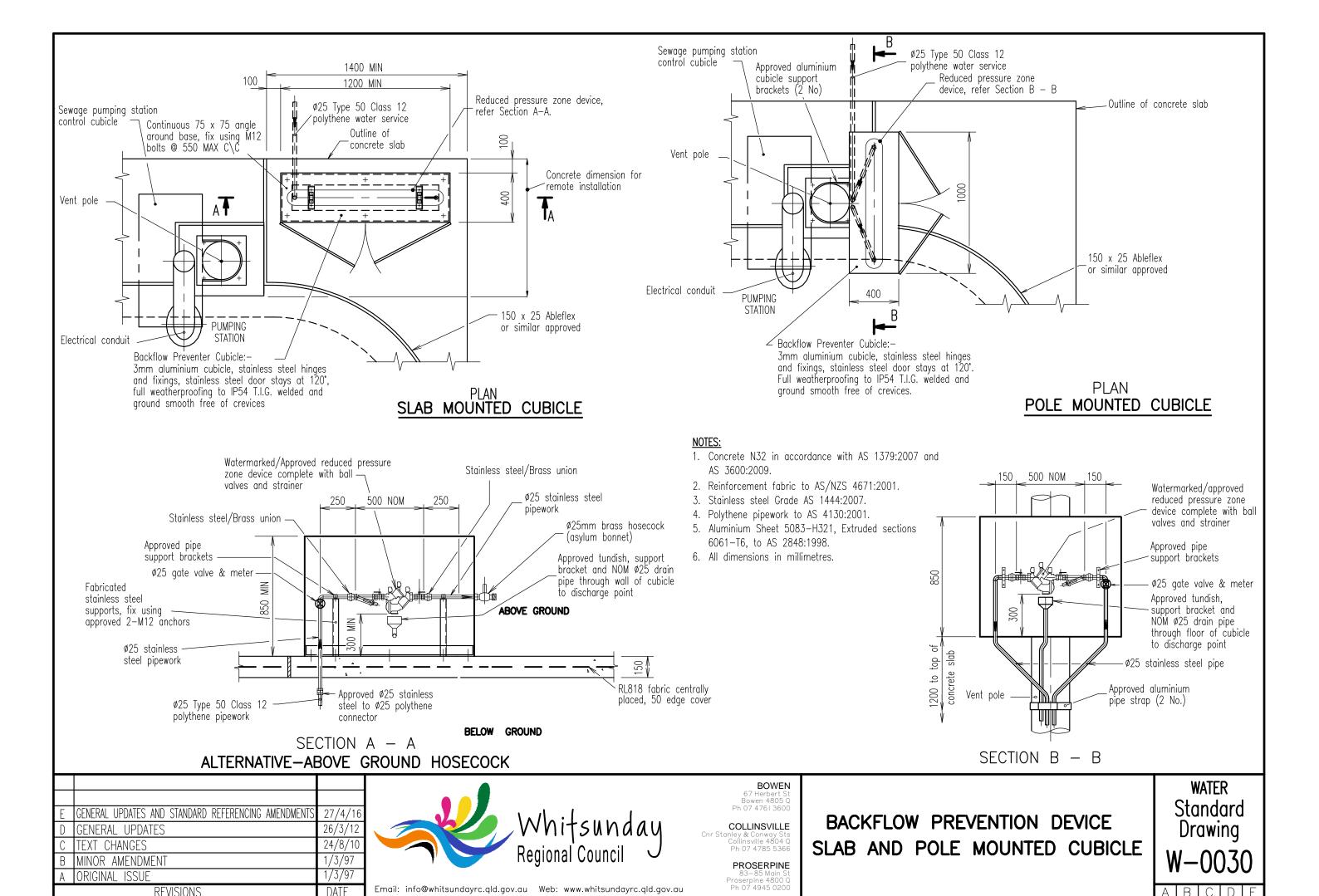
> PROSERPINE 83-85 Main St Proserpine 4800 Q Ph 07 4945 0200

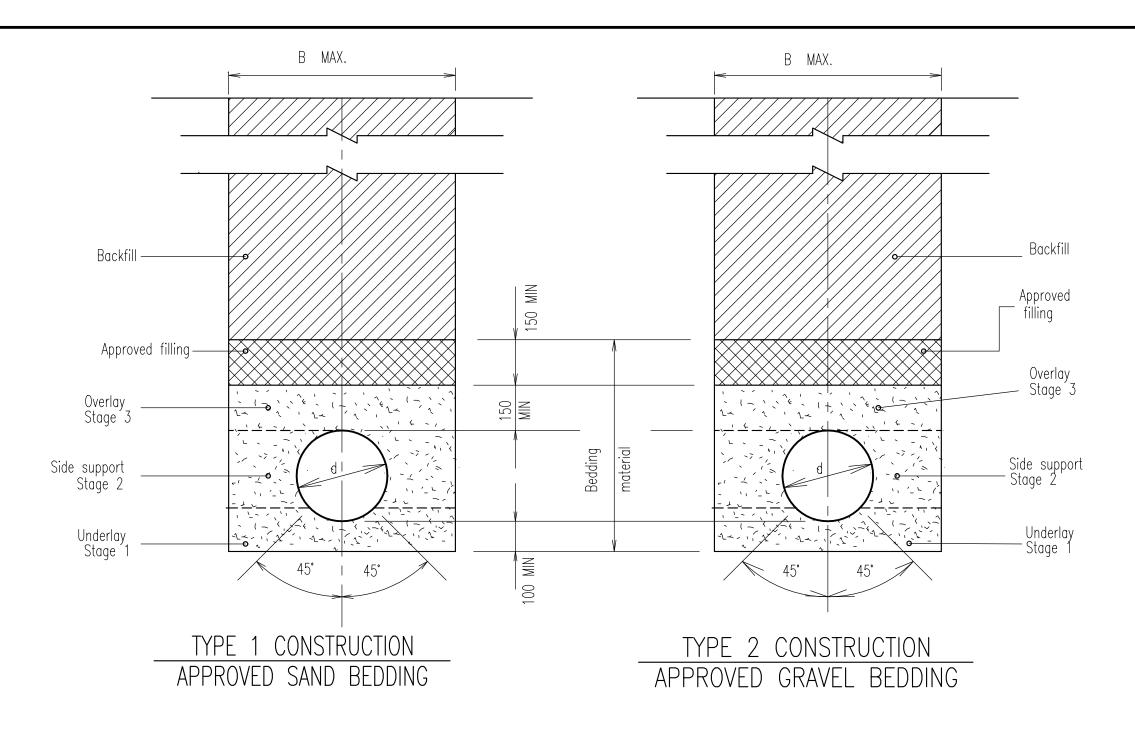
CONSTRUCTED WETLAND OUTLET RISER PIT

OUTLET RISER PI

Std. Dwg. No.	Descriptions		Std. Dwg. No.	Descriptions	
W-0020 W-0021 W-0030 W-0031 W-0041 W-0042 W-0043 W-0061 W-0062 W-0063	AIR VALVES AIR VALVE PIT, Ø50 AND Ø80 VALVES AS CONSTRUCTED WATER RETICULATION, SAMPLE AS CONSTRUCTED WATER TRUNK MAIN, SAMPLE AS CONSTRUCTED BACKFLOW BACKFLOW BACKFLOW PREVENTION DEVICE, SLAB AND POLE BACKFLOW PREVENTION, FIRE AND DOMESTIC SER BEDDING AND THRUST BI BEDDING AND BACKFILL FOR WATER MAIN CONST WATER MAIN, THRUST BLOCK DETAILS ROAD CONDUIT CROSSINGS FOR WATER AND IRR WATER MAIN OFFSET CONNECTION NEW TO EXIST HYDRANTS AND VALVES HYDRANT AND VALVE INSTALLATION C.I. HYDRANT AND VALVE BOXES TYPICAL VALVE BOX INSTALLATION DETAILS TO SUI	E MOUNTED CUBICLE RIVICE CONNECTION DETAILS, TYP. LAYOUT BLOCKS STRUCTION RIGATION LINES (100mm TO 800mmø) STING	W-0090 W-0091 W-0093 W-0094 W-0095 W-0096 W-0097 W-0100	WATER CONNECTIONS AND METERING WATER CONNECTIONS SINGLE AND DOUBLE ABOVE GROUND METER WATER CONNECTION SINGLE AND DOUBLE BELOW GROUND METER WATER CONNECTION SINGLE AND DOUBLE ABOVE GROUND METER A SUPPLY WITH AND WITHOUT BYPASS INDUSTRIAL WATER METERING COMBINED FIRE MAIN & DOMESTIC SU OR GREATER WATER SERVICE METERS MULTIPLE OFF—TAKE MANIFOLD WITH 50mr WATER SERVICE METERS MULTIPLE OFF—TAKE MANIFOLDS WITH 100 STANDARD WATER METER LOCATIONS DOMESTIC/COMMERCIAL SUPPLY 50mm METER	LTERNATIVES PPLY 80mm n INPUT SUPPLY
	DED 27/9/10 EMPLATE, 92 TO 97 ADDED 8/7/08 21,W-0030-31,W-0041-42,W-0090-91 10/3/98 1/3/97	Whitsunday Regional Council fo@whitsundayrc.qld.gov.au Web: www.whitsundayrc.qld.gov.au	BOWEN 67 Herbert St Bowen 4805 Q Ph 07 4761 3600 COLLINSVILLE Cnr Stanley & Conway Sts Collinsville 4804 Q Ph 07 4785 5366 PROSERPINE 83-85 Main St Proserpine 4800 Q Ph 07 4945 0200	STANDARD DRAWINGS WATER	WATER Standard Drawing W-0001







Refer to TMR standards for bedding and backfill details where conditions vary from those shown hereon, and when required under local & TMR roadways.

NOTES:

- 1. Refer specification for definition of:
 - (a) Bedding material
 - (b) Approved filling
 - (c) Flexible pipe systems
 - (d) Geofabric
 - (e) Backfill
 - (f) Stabilized sand filling
 - (a) Lean mix concrete
 - (h) Pavement
- 2. Spacing of concrete anchor blocks

 Slope 1 in 5 to 1 in 6 every 4th pipe

 Slope 1 in 4 to 1 in 5 every 3rd pipe

 Slope 1 in 3 to 1 in 4 every 2nd pipe

 Slope greater than 1 in 3 every pipe.
- 3. Concrete N20 in accordance with AS 1379:2007 and AS 3600:2009.
- 4. Refer project drawings for dimensions to be adopted where MIN's have been shown.
- 5. All dimensions in millimetres

NOM DIA. PIPE	d	ø100	Ø150	Ø225	ø300	ø375	ø450	ø525	Ø600	Ø675	ø750	Ø825	ø900
OPEN TRENCH	В	600	600	700	750	850	900	1000	1050	1150	1300	1300	1450
TUNNEL CONST.	В	750	750	750	900	900	1000	1050	1150	1220	1300	1350	1450
TOWNEL OUNGT.	Н	1100	1100	1100	1200	1200	1400	1400	1400	1450	1500	1600	1650

NOTE:- d = NOMINAL DIAMETER OF PIPE

С	GENERAL UPDATES AND STANDARD REFERENCING AMENDMENTS	27/4/16
В	GENERAL UPDATES	26/3/12
Α	ORIGINAL ISSUE	1/3/97
	DATE	



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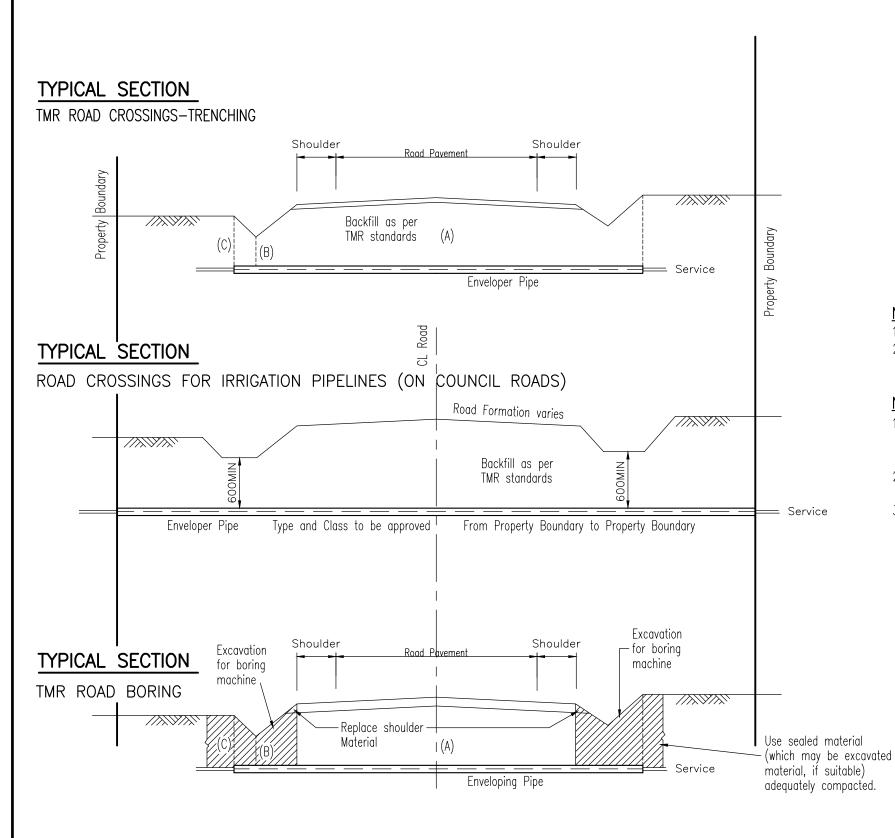
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> PROSERPINE 83-85 Main St Proserpine 4800 Q Ph 07 4945 0200

BEDDING AND BACKFILL FOR WATER MAIN CONSTRUCTION

WATER
Standard
Drawing
W-0040

A B C



- 1. Backfilling of trenching details as per TMR standards.
- 2. Enveloper pipe class details and treatments refer to Water Services Association of Australia (WSAA) drawings 1212 and 1214

NOTES FOR TMR ROAD CROSSINGS:

- Minimum depth of service shall be (A) 750mm below road surface,
 (B) 450mm below lowest level of table drain, or (C) 600mm below natural Surface, whichever is the lowest.
- 2. Where there is no Bitumen seal, the Lean Mix Concrete is to be continued to 150mm below surface level of road.
- 3. All work shall be in accordance with TMR Standard Conditions.

Ε	GENERAL UPDATES AND STANDARD REFERENCING AMENDMENTS	27/4/16
D	GENERAL UPDATES	27/3/12
С	"OUTSIDE DECLARED WATER AREA" BLOCK, STAR PKT. TO BOUNDRY	11/7/07
В	QT ROAD BORING ADDED	10/3/98
Ā	ORIGINAL ISSUE	1/3/97
	REVISIONS	DATE



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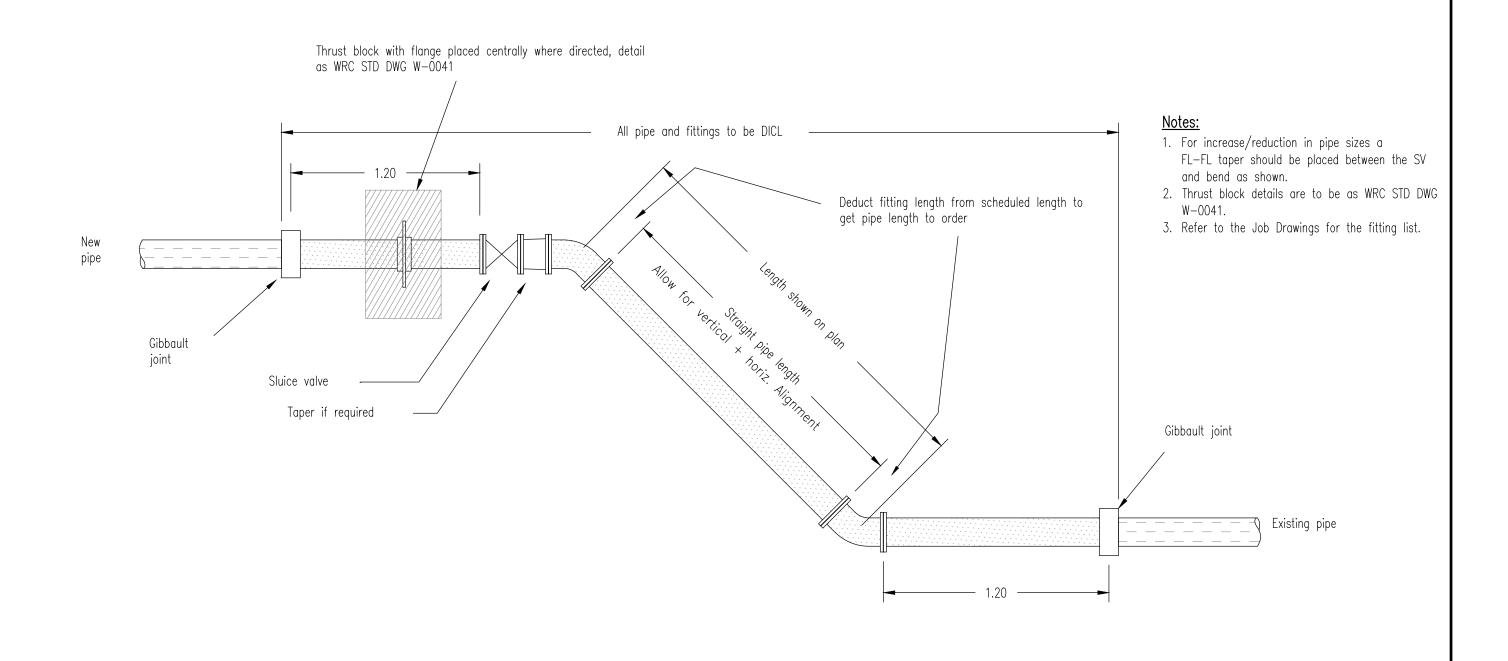
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> PROSERPINE 83-85 Main St Proserpine 4800 Q Ph 07 4945 0200

ROAD CONDUIT CROSSINGS FOR WATER AND IRRIGATION LINES (100mm TO 800mm Ø)

WATER
Standard
Drawing

A B C D E



D	GENERAL UPDATES AND STANDARD REFERENCING AMENDMENTS	27/4/16
С	GENERAL UPDATES	27/3/12
В	CHANGES TO TEXT	25/8/10
Α	ORIGINAL ISSUE	1/3/97
	DATE	



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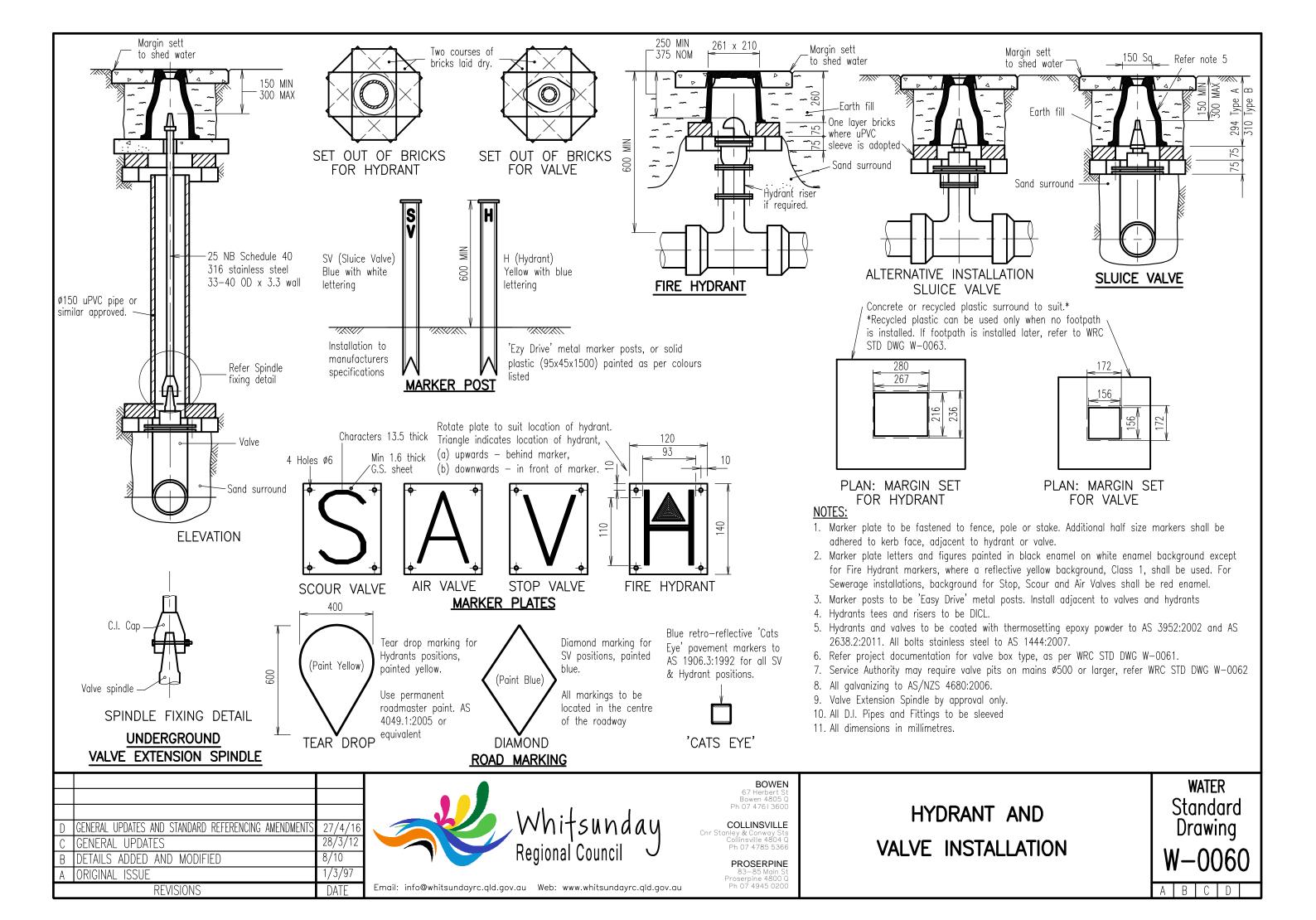
COLLINSVILLE

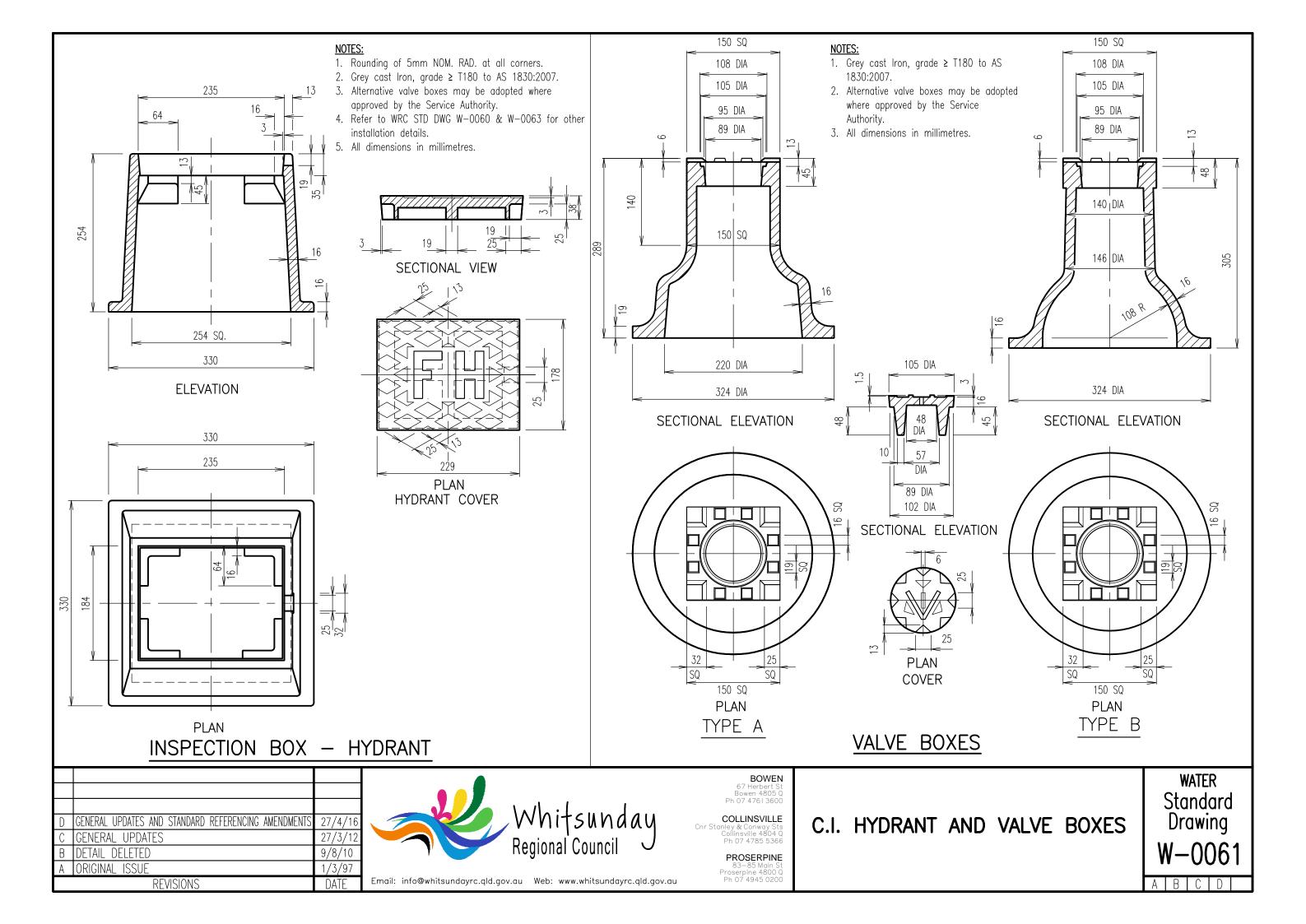
PROSERPINE

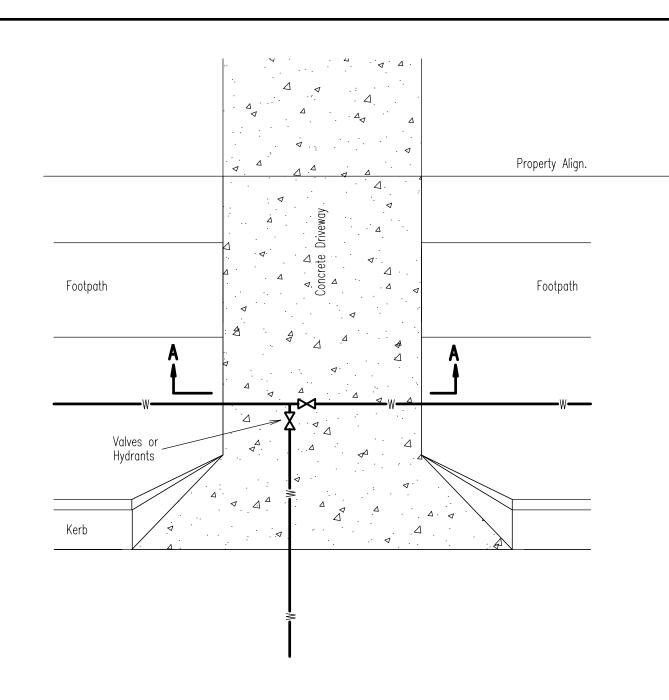
83-85 Main S Proserpine 4800 (Ph 07 4945 0200

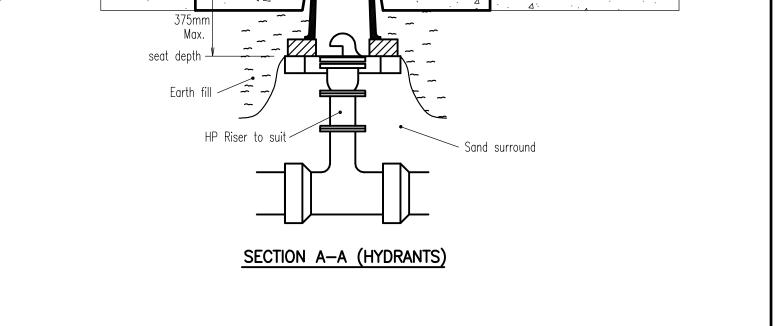
WATER MAIN OFFSET CONNECTION **NEW TO EXISTING**

WATER Standard Drawing





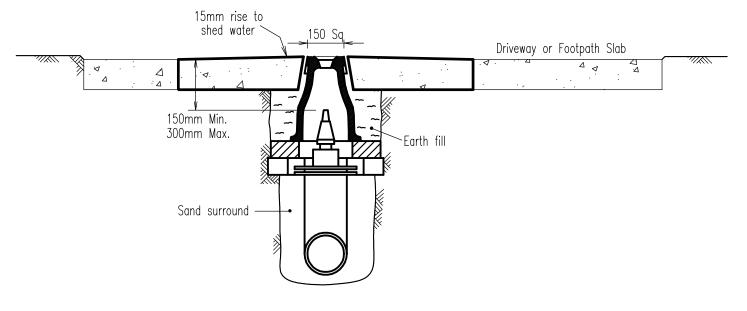




Driveway or Footpath Slab

261 x 210

15mm rise to shed water



SECTION A-A (VALVES)

VALVES & HYDRANTS IN DRIVEWAYS & FOOTPATHS

Repair method for concrete driveways and footpaths.

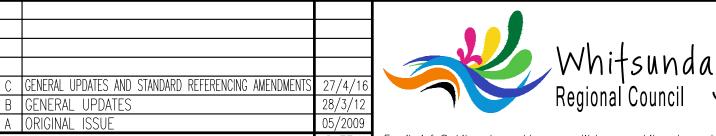
NOTES:

B GENERAL UPDATES

A ORIGINAL ISSUE

- 1. Valve boxes are to be raised to new driveway height.
- 2. Works are to be inspected by Council.
- 3. SV marker to be removed from current position and relocated to a suitable position under the direction of council water officers.

REVISIONS



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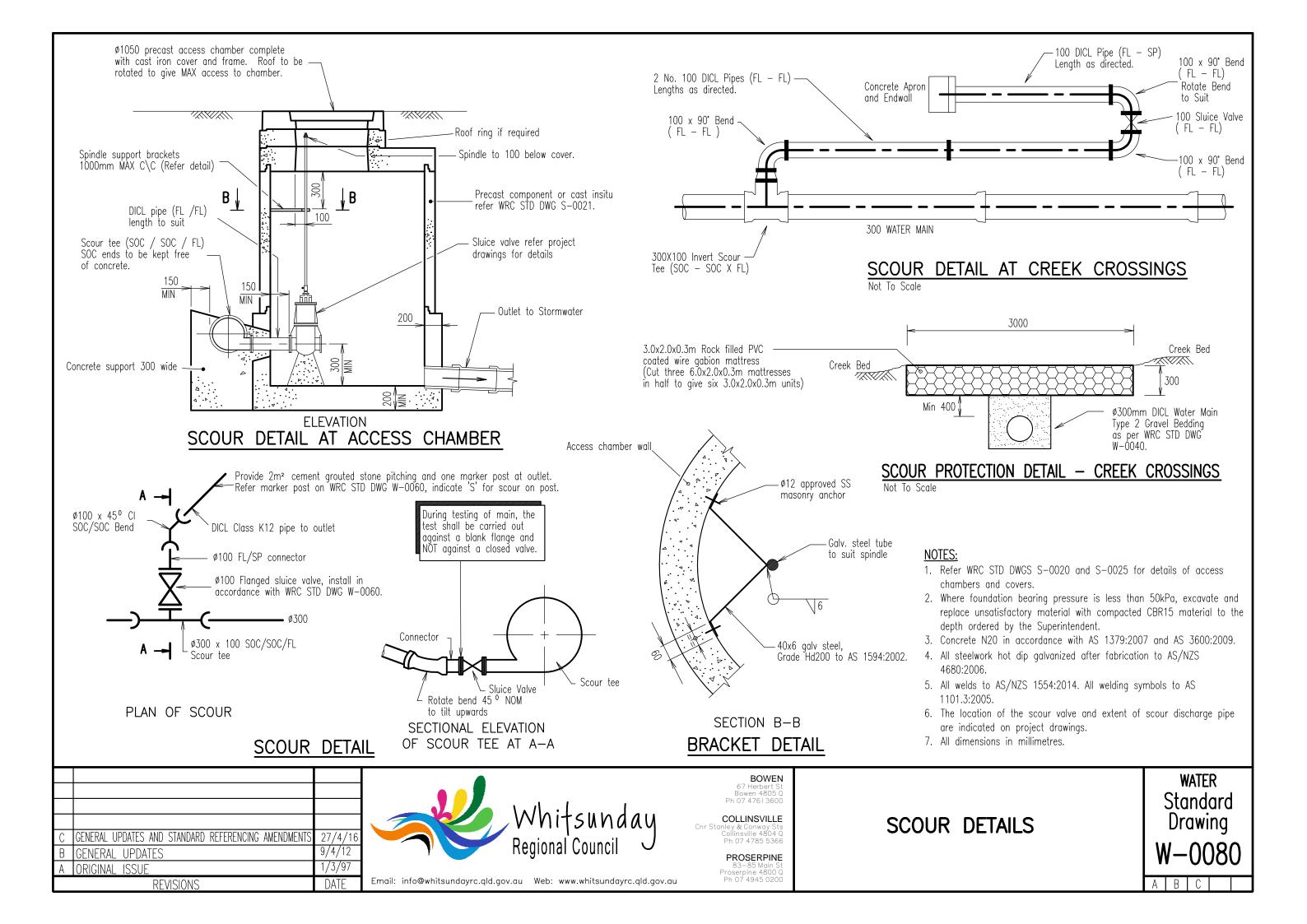
COLLINSVILLE inley & Conway Sts Collinsville 4804 Q Ph 07 4785 5366

> PROSERPINE 83-85 Main Proserpine 4800 Ph 07 4945 02

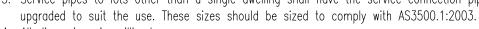
TYPICAL VALVE & HYDRANT TREATMENT WHEN LOCATED IN SEALED DRIVEWAYS & FOOTPATHS

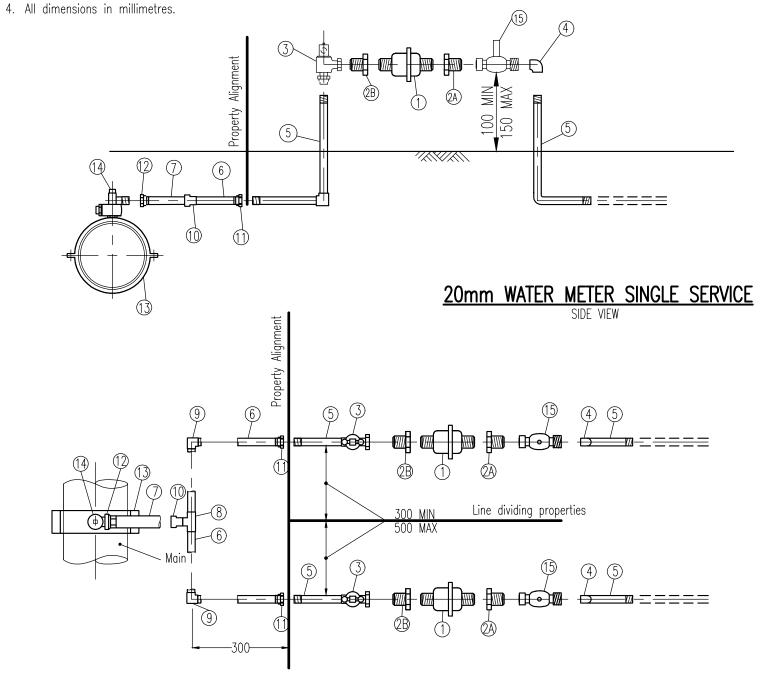
WATER Standard Drawing W - 0063

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- 1. Polythene pipe and connectors:
 - (a) All polythene pipe shall be MDPE Class 12 in accordance with AS 4130:2009
 - (b) All mechanical joint fittings shall be in accordance with AS 4129:2008.
- 2. Cross road services shall be located 500mm downhill from dividing allotments so as not to conflict with electrical supply authority poles.
- 3. Service pipes to lots other than a single dwelling shall have the service connection pipes





20mm WATER METER 2 LOT SERVICE PLAN VIEW

F	GENERAL UPDATES AND STANDARD REFERENCING AMENDMENTS	27/4/16	
Ε	GENERAL UPDATES	9/4/12	
D	FITTINGS AND DETAILS AMMENDED	9/8/10	
С	MINOR AMENDMENTS	11/7/07	
В	MINOR AMENDMENTS	10/3/98	
Α	ORIGINAL ISSUE	1/3/97	
REVISIONS			



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BOWEN

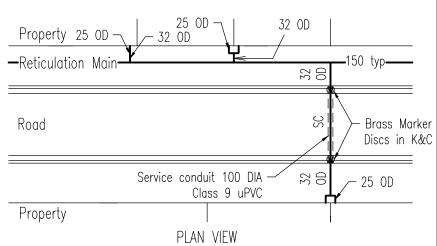
COLLINSVILLE Ph 07 4785 5366

PROSERPINE Proserpine 4800 (Ph 07 4945 0200

NO	DESCRIPTION
1.	Water Meter. Complete with Backflow to comply with AS 2845.1:2010
2A.	Meter tail piece with BSP-MI end, supplied with meter
2B.	As above except pre—drilled to suit wire seal.
3.	Rt. angled ball valve F—F
4.	Stanless Steel FL Elbow
5.	316 stainless steel pipe (20 NB) pre—bent fixed length pipe to be
	purchased from council.
6.	Polyethylene 25 OD Class 12
7.	Polyethylene 32 OD Class 12
8.	Poly 25 tee fitting
8. 9.	Poly 25 elbow fitting
10.	Poly reducing fitting 32-25
11.	25 FI—Poly end connector
12.	32 FI—Poly end connector
13	Gunmetal tapping brand or Ready Tap Connection
14.	25x32 OD Poly TPR bonnet poly ferrule stop cock
15.	House hold isolating valve FM Ball

DESCRIPTION

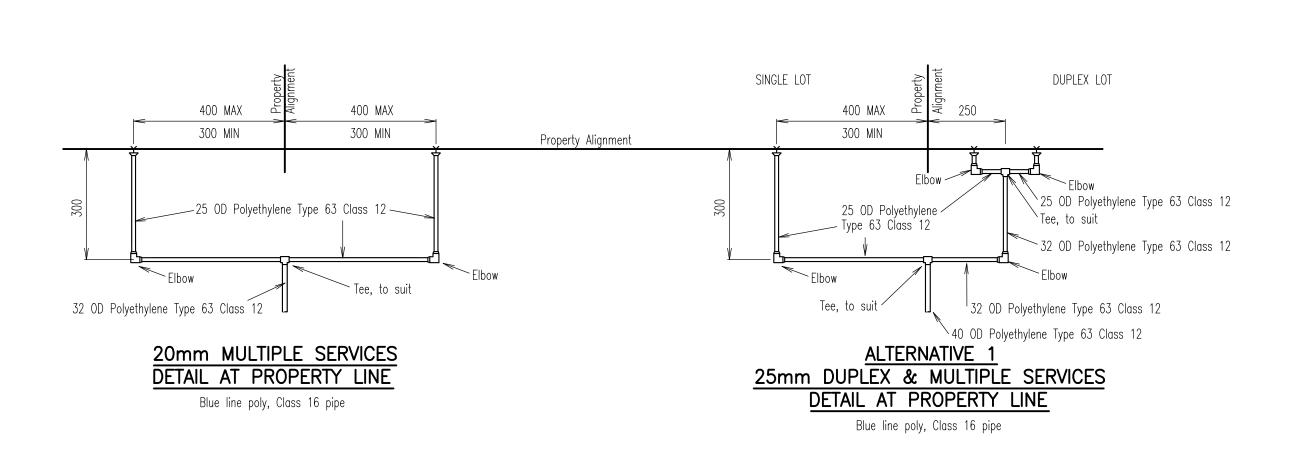
MARK



TYPICAL MAIN CONNECTIONS

WATER CONNECTIONS SINGLE AND DOUBLE ABOVE GROUND METER

WATER Standard Drawing



- 1. Underground Meter Box on approval only.
- 2. The section of main at the proposed tapping point must be first cleaned and wrapped with a minimum of two layers of self-adhesive polyvinylchloride wrapping.
- 3. A 20mm meter is to be installed on all services,
- unless otherwise specified on the project drawings. 4. All pipes & fittings as per WRC STD DWG W-0090
- 5. Single 20mm service road crossing refer to WRC STD DWG W-0042.
- 6. All dimensions in millimetres.

GENERAL UPDATES

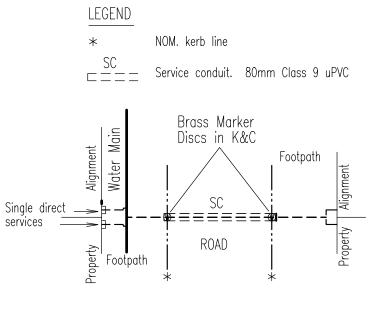
A ORIGINAL ISSUE

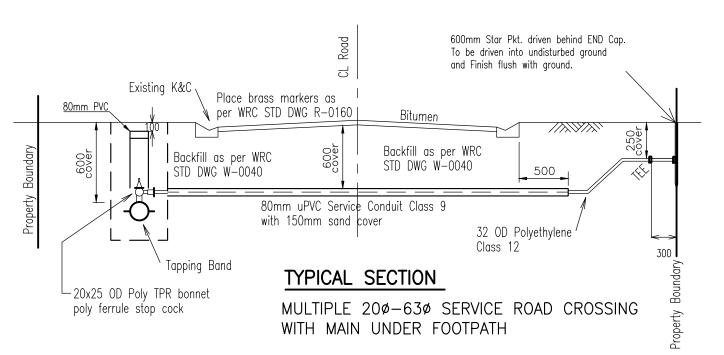
B DUPLEX SERVICES ADDED

7. All services must cross the road at right angles.

REVISIONS

8. Ferrule stop cock access tube and cap must not have any barring pressure on the ferrule cock and pipe leading away.





GENERAL UPDATES AND STANDARD REFERENCING AMENDMEN 27/4/1 9/4/12 15/5/09

11/7/0

SERVICES LAYOUT

BOWEN

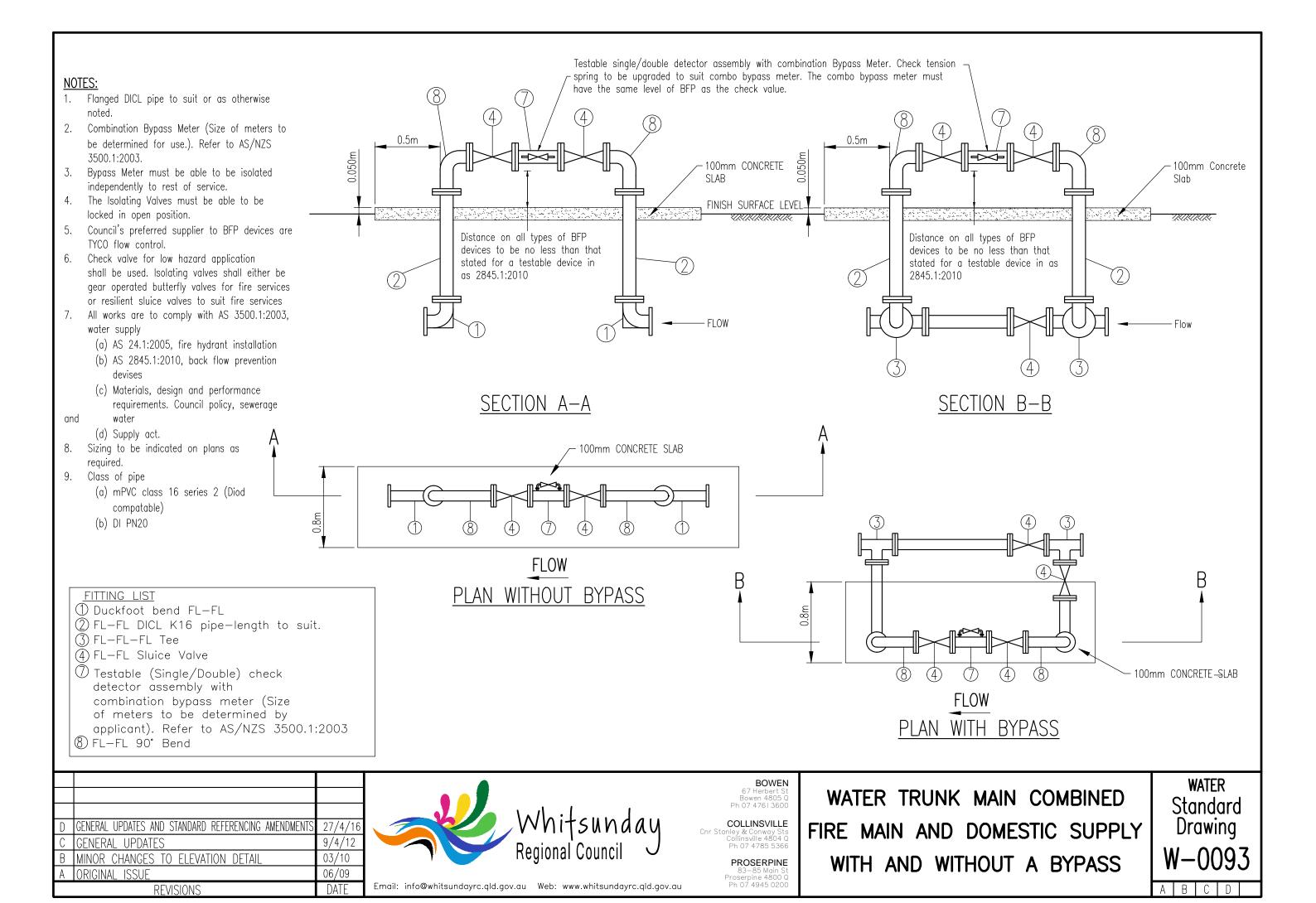
COLLINSVILLE Ph 07 4785 5366

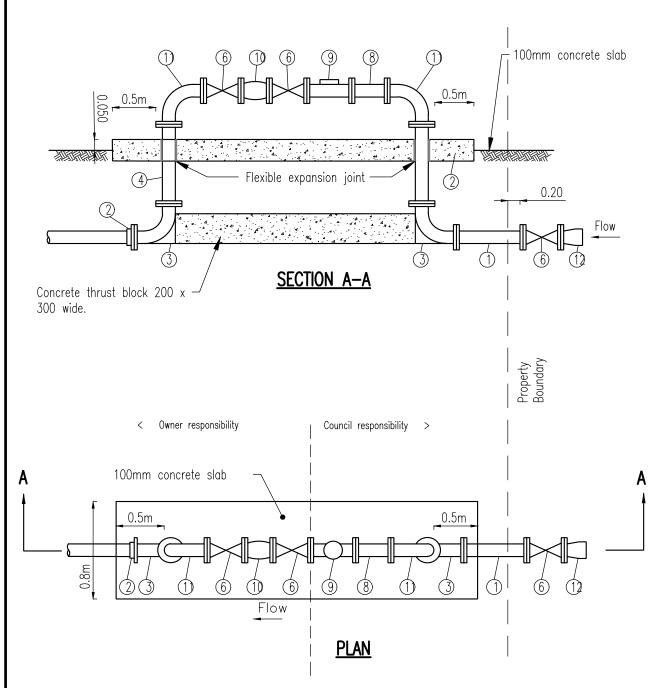
> **PROSERPINE** 83-85 Main S Proserpine 4800 Ph 07 4945 020

CONNECTIONS SINGLE WATER AND DOUBLE ABOVE **GROUND METER ALTERNATIVES**

WATER Standard Drawing

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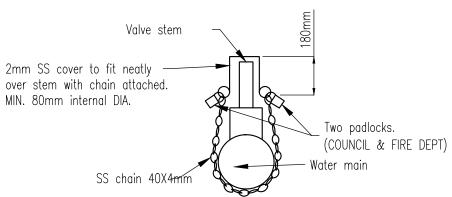


FITTING LIST

- ① DI FL-FL Pipe length 800mm
- (2) DI SP-FL Connector
- 3 Duckfoot bend FL-FL
- (4) FL-FL DICL K16 Pipe-length to suit
- (5) FL-FL-FL Tee
- (6) FL-FL Sluice Valve.
- (8) Flanged DICL Length = $5X \phi$ of pipe
- (9) Combo meter
- (10) FL-FL BFP Device to suit the use
- (1) FL-FL 90° Bend
- (12) DI SO-FL Connection

NOTES:

- 1. Flanged DICL pipe to suit or as otherwise noted.
- 2. Combination Bypass Meter (Size of meters to be determined for use). refer to AS/NZS 3500.1:2003.
- The Isolating Valves must be able to be locked in open position.
- Council's preferred supplier to BFP devices are TYCO flow control.
- 5. Check valve for low hazard application shall be used. isolating valves shall either be gear operated butterfly valves for fire services or resilient sluice valves to suit fire services.
- 6. All works are to comply with as 3500 water supply
 - (a) AS 2419-1, fire hydrant installation
 - (b) AS 2845-1, back flow prevention devises
 - (c) Materials, design and performance requirements. council policy, sewerage and water.
 - (d) Supply act.
- Sizing to be indicated on plans as required
- 8. Class of pipe
 - (a) mPVC class 16 series 2 (DIOD compatible)
 - (b) DI PN20



TAMPER PROOF VALVE **COVER**

D	GENERAL UPDATES AND STANDARD REFERENCING AMENDMENTS	27/4/16
С	GENERAL UPDATES	10/4/12
В	MINOR CHANGES TO ELEVATION DETAIL	06/09
Α	ORIGINAL ISSUE	07/08
	REVISIONS	DATE



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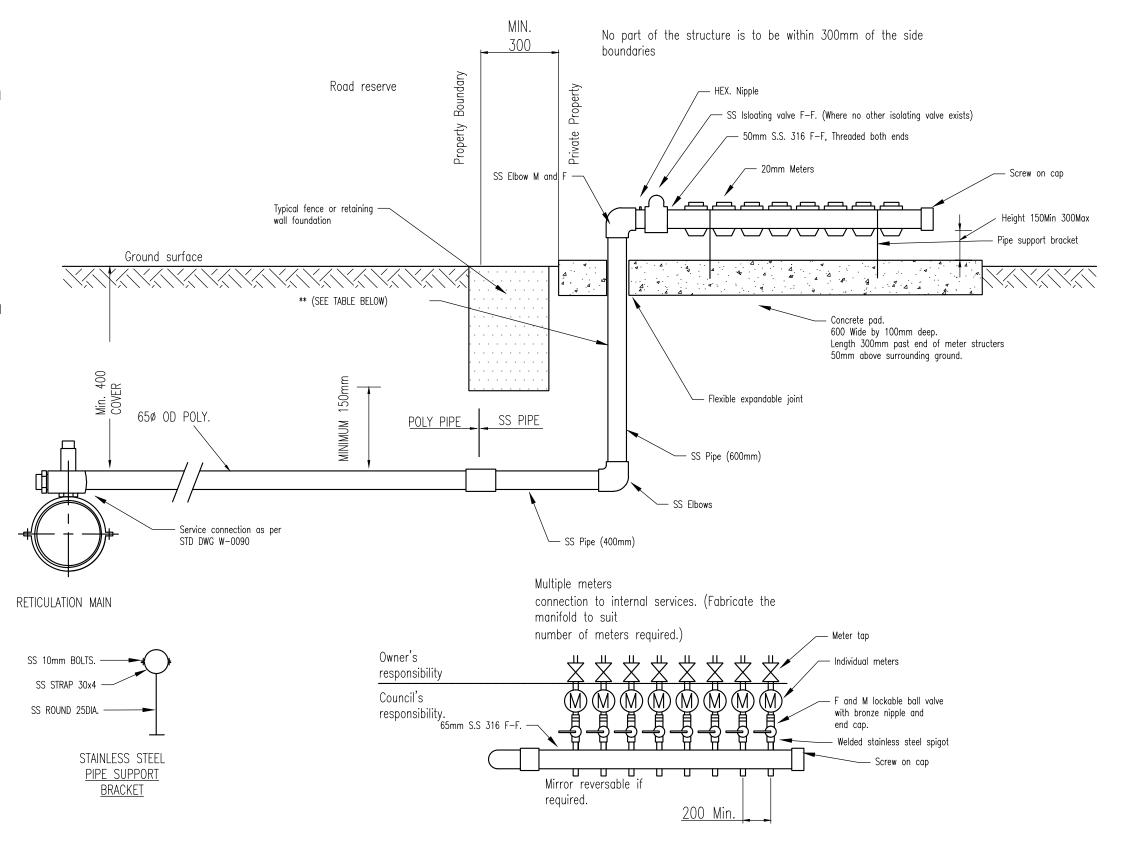
PROSERPINE 83-85 Main S Proserpine 4800 (Ph 07 4945 0200

INDUSTRIAL WATER METERING COMBINED FIRE MAIN AND DOMESTIC SUPPLY 80mm OR GREATER

WATER Standard Drawing



- 1. A maximum of 10 meters may be connected to any particular manifold before a sub meter is required.
- 2. The minimum meter size is 20mm, but each installation must be individually sized to suit the usage proposed.
- 3. Each installation is to be sized to suit the installation proposed by a hydro engineer.
- 4. The location of the manifold is to be approved by the council in writing before installation.
- 5. Council may require an approved vehicle proof buffer placed 500mm clear on any side exposed to vehicular traffic.
- 6. Each offtake is to be clearly engraved with the number of the unit to be served by that meter.
- 7. Any proposed manifold is to be designed and submitted to council for approval prior to any construction being carried out and no work is to start until council's written approval is received.
- 8. Meters must be able to be read from the road reserve and if a fence is constructed, an appropriate gate system is to be provided to allow unhindered access by the meter reader.



Ε	GENERAL UPDATES AND STANDARD REFERENCING AMENDMENTS	27/4/16
D	GENERAL UPDATES	11/4/12
С	EXTRA DETAILS ADDED	06/09
В	EXTRA DETAILS ADDED	09/08
Α	ORIGINAL ISSUE	07/08
	DATE	



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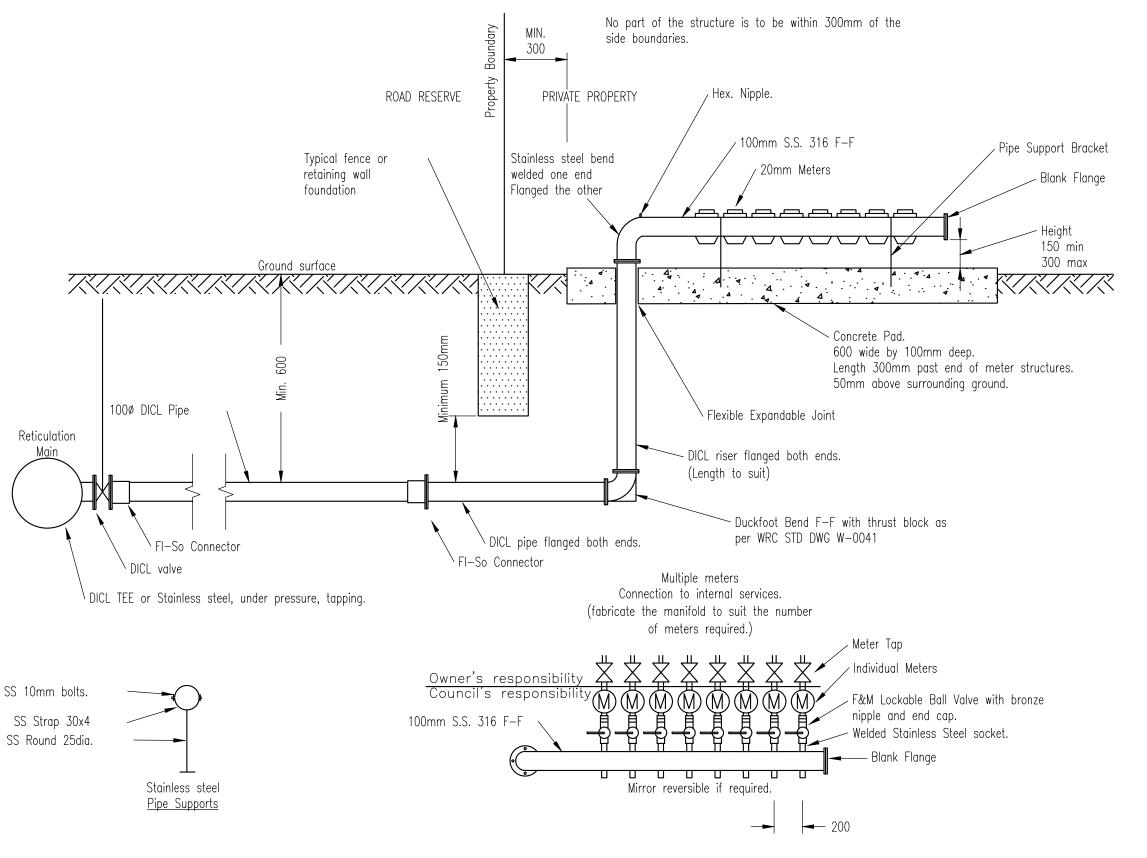
> PROSERPINE 83-85 Main St Proserpine 4800 Q Ph 07 4945 0200

WATER SERVICE METERS MULTIPLE
OFF-TAKE MANIFOLDS 50mmø
INPUT SUPPLY

WATER
Standard
Drawing
W-0095

A B C D E

- 1. A maximum of 20 meters may be connected to any particular manifold before a sub meter is required.
- 2. The minimum meter size is 20mm, but each installation must be individually sized to suit the usage proposed.
- 3. Each installation is to be sized to suit the installation proposed by a Hyrdo Engineer.
- 4. The location of the manifold is to be approved by the Council in writing before installation.
- 5. Council may require an approved vehicle proof buffer placed 500mm clear on any side exposed to vehicular traffic.
- 6. Each offtake is to be clearly engraved with the number of the unit to be served by that meter.
- 7. Any proposed manifold is to be designed and submitted to Council for approval prior to any construction being carried out and no work is to start until Council's written approval is received.
- 8. Meters must be able to be read from the road reserve and if a fence is constructed, an appropriate gate system is to be provided to allow unhindered access by the meter reader.



D	GENERAL UPDATES AND STANDARD REFERENCING AMENDMENTS	27/4/16
С	GENERAL UPDATES	11/4/12
В	EXTRA DETAILS ADDED	06/09
Α	ORIGINAL ISSUE	07/08
	DATE	



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COLLINSVILLE Cnr Stanley & Conway Sts Collinsville 4804 Q Ph 07 4785 5366

> PROSERPINE 83-85 Main St Proserpine 4800 Q Ph 07 4945 0200

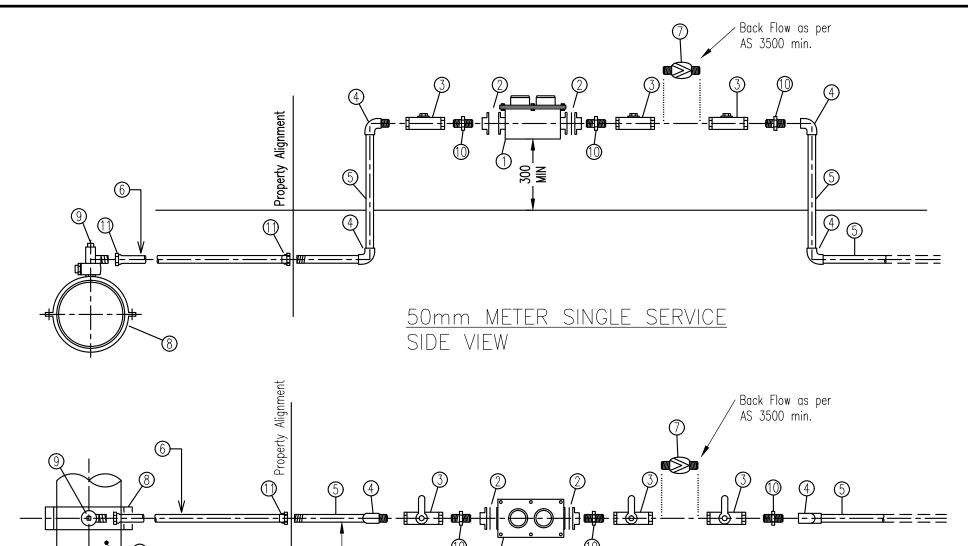
WATER SERVICE METERS

MULTIPLE OFF—TAKE MANIFOLDS

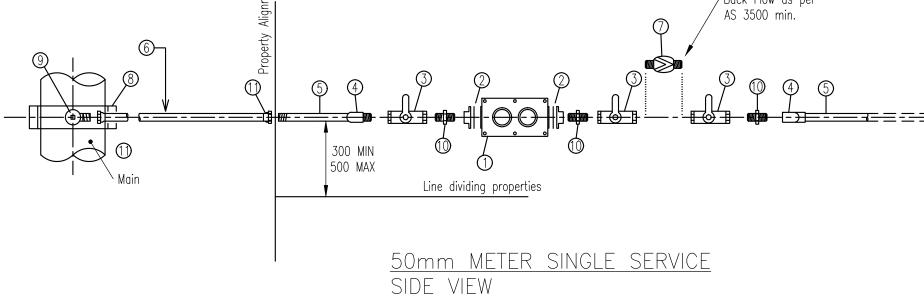
WITH 100mmø INPUT SUPPLY.

WATER
Standard
Drawing
W-0096

A B C D



MARK NO.	DESCRIPTION
1	Water Meter. 50mm Combo Meter with flange adapter purchased
2	from council Flange adaptor purchased from Council
	S/Steel quarter turn ball valve F—F Stainless Steel Elbow
(2) (3) (4) (5)	316 Stainless Steel 50 NB fixed length pipe to be purchased from Council
60	Polyethylene 63 OD Class 12 Approved back flow prevention device to suit specific internal hazard, as per AS 3500
@@ @	Gunmetal tapping band or Ready Tap Connection 50x63mm OD Poly TPR bonnet poly ferrule stop cock 50mm stainless steel nipple adaptor
) (FI-Poly end connector



Reticulation Main Kerb & Channel Road Service conduit 100 DIA Class 12 uPVC Property 150 typ Brass Marker Discs in K&C

TYPICAL MAIN CONNECTIONS

PLAN VIEW

NOTES:

- 1. Polythene pipe and connectors:
 - (a) All polythene pipe shall be MDPE Class 12 in accordance with AS 4130 (interim) 1993
 - (b) All mechanical joint fittings shall be in accordance with AS 4129:2008.
- 2. Cross road services shall be located 500mm downhill from dividing allotments so as not to conflict with electrical supply authority poles.
- 3. Service pipes to lots other than a single dwelling shall have the service connection pipes upgraded to suit the use. These sizes should be sized to comply with AS3500
- 4. All dimensions in millimetres.

С	GENERAL UPDATES AND STANDARD REFERENCING AMENDMENTS	27/4/16
В	GENERAL UPDATES	11/4/12
Α	ORIGINAL ISSUE	08/10
	REVISIONS	DATE



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> PROSERPINE 83-85 Main St Proserpine 4800 Q Ph 07 4945 0200

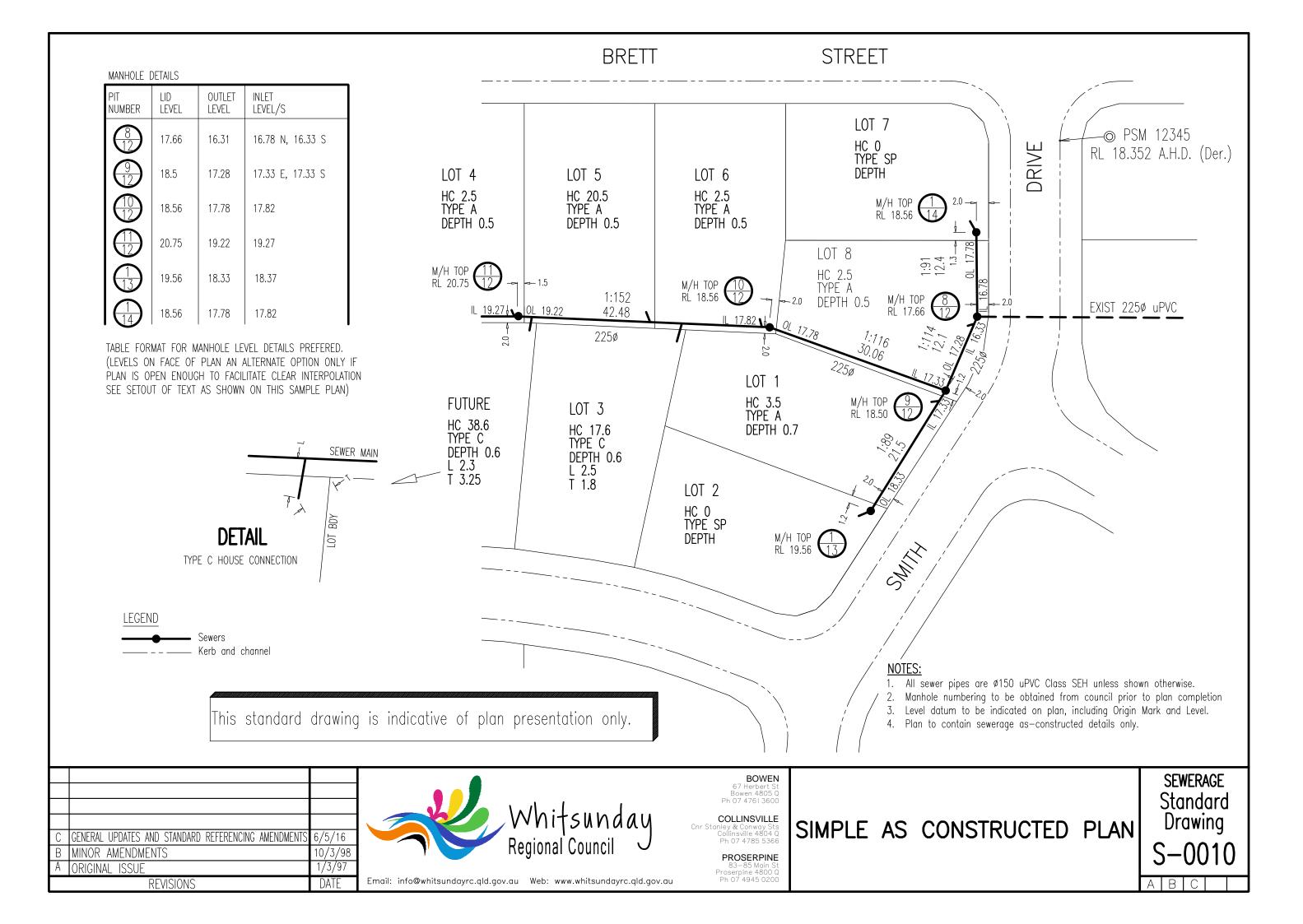
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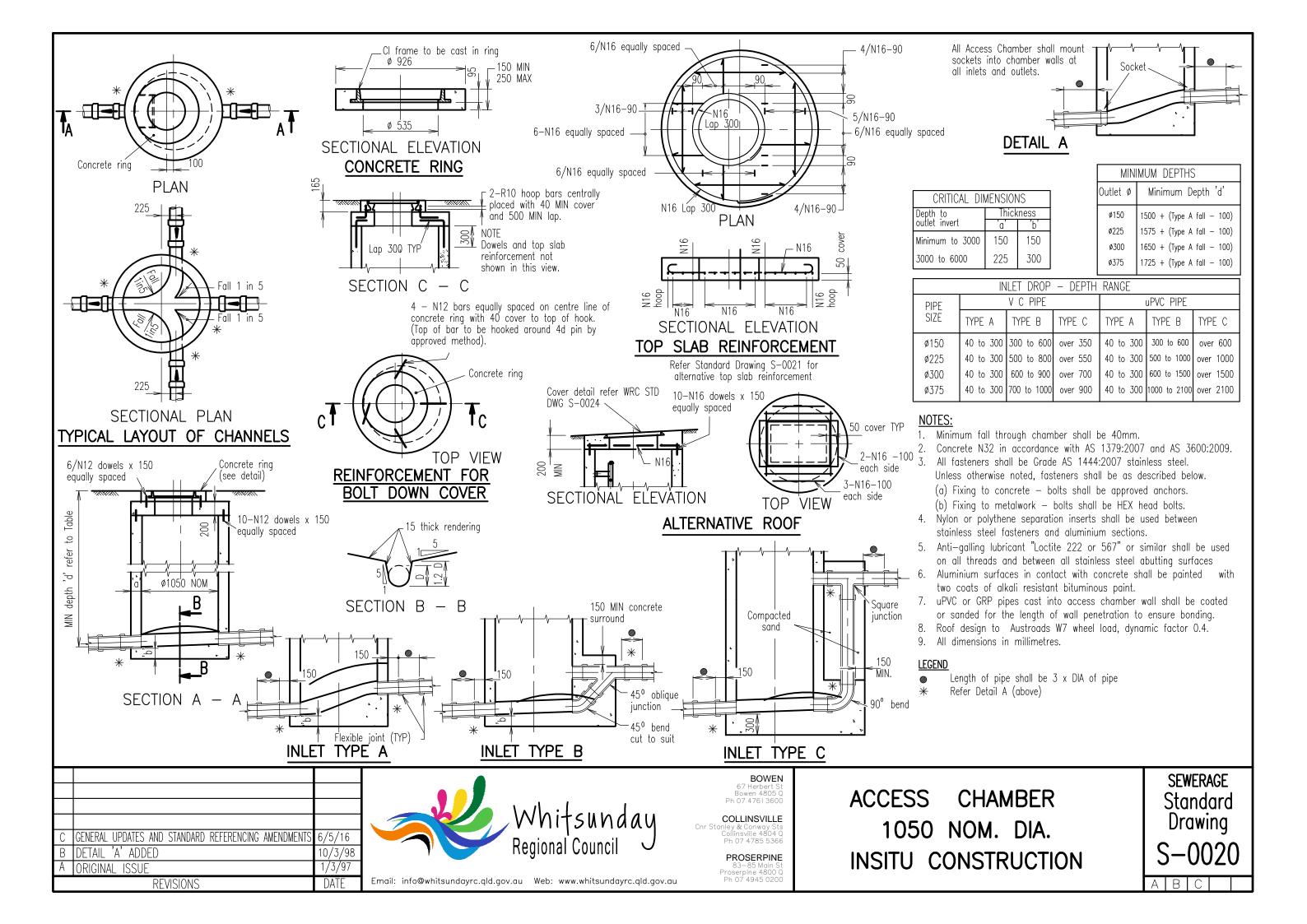
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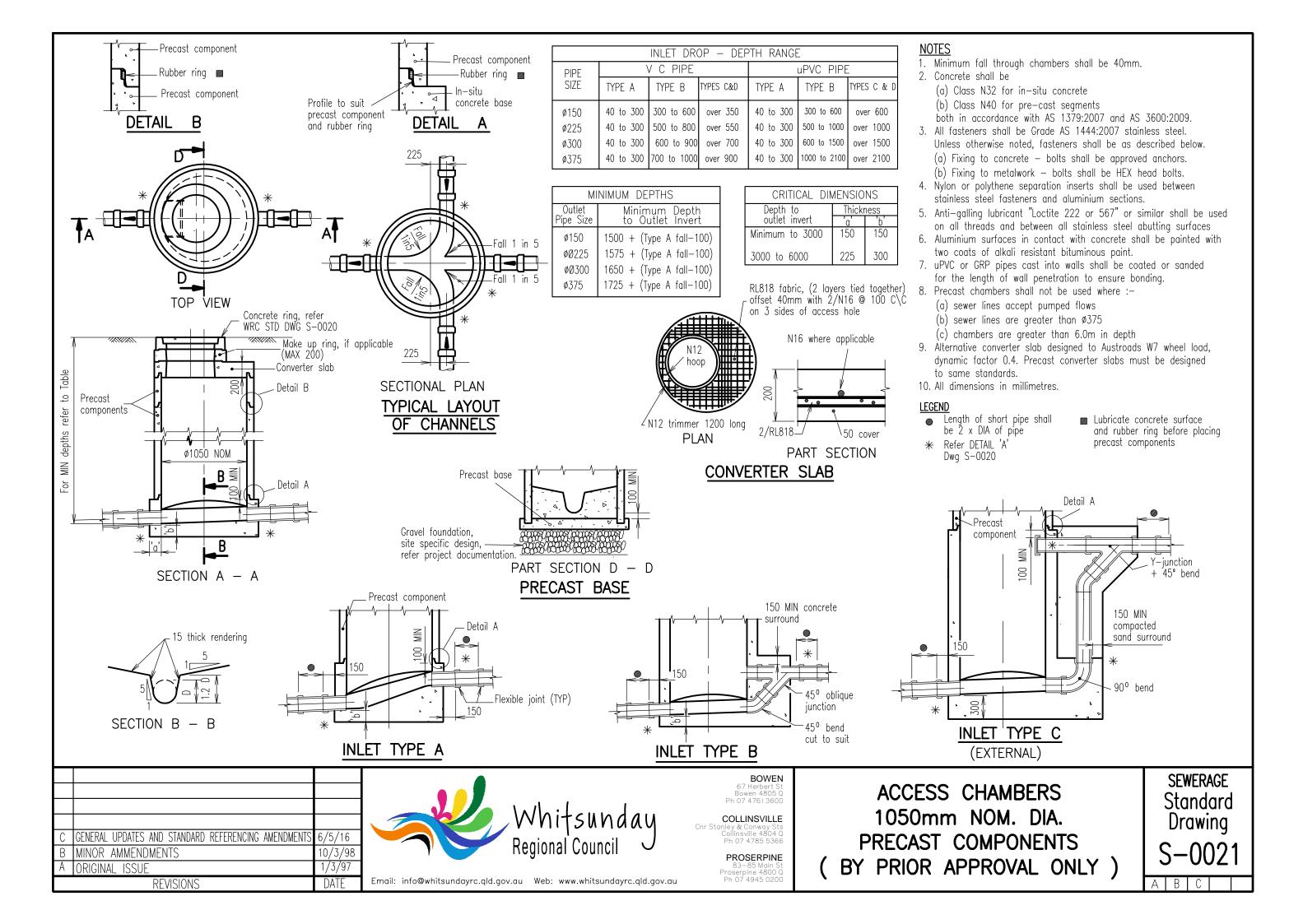
WATER
Standard
Drawing
W—0100

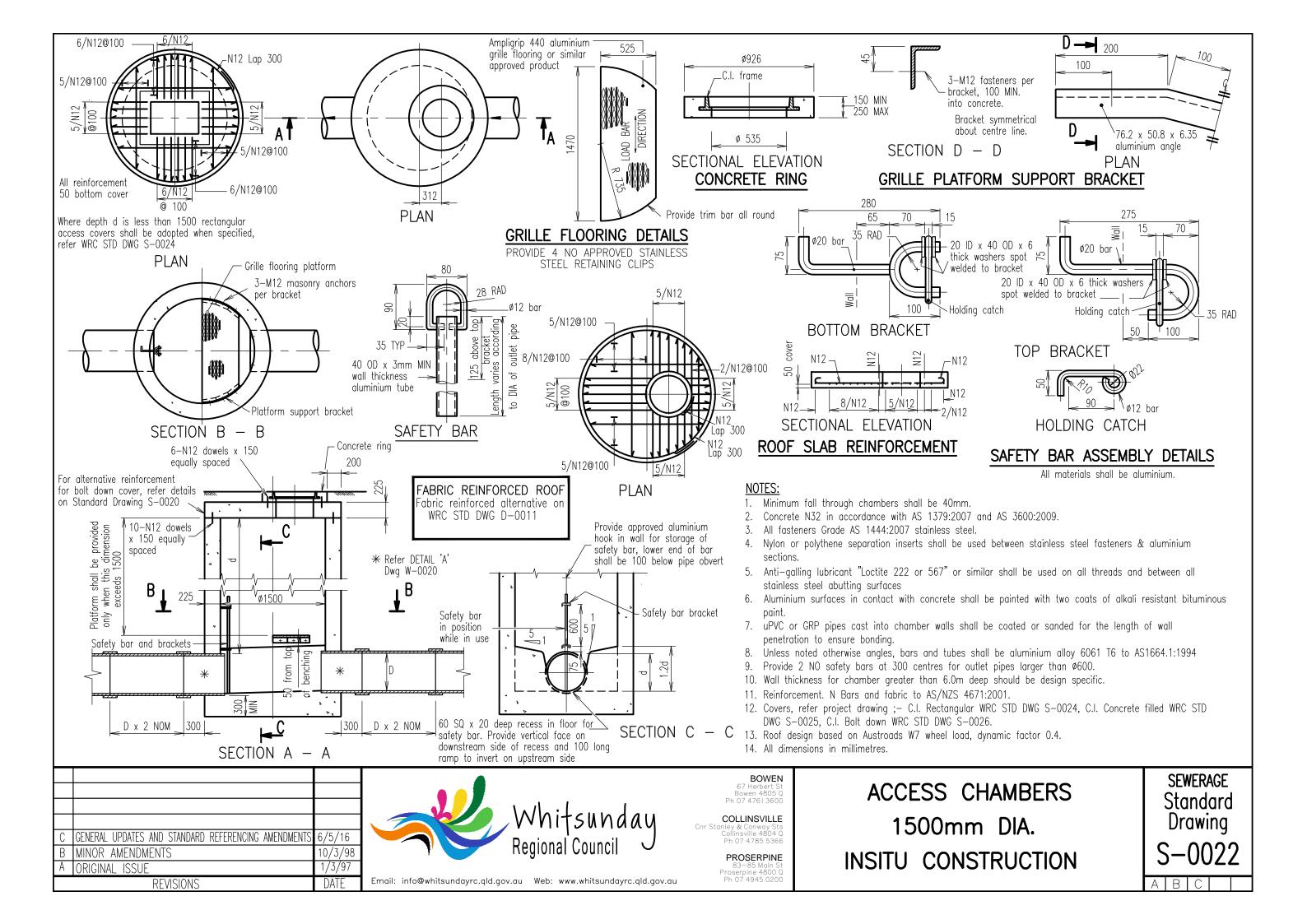
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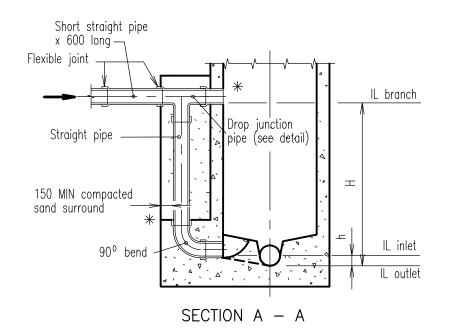
	Std. Dwg. No.	Descriptions
	S-0010	AS CONSTRUCTED SAMPLE AS CONSTRUCTED PLAN
		ACCESS CHAMBERS
	S-0020 S-0021 S-0022 S-0023 S-0024 S-0025 S-0026	ACCESS CHAMBERS 1050mm NOM DIA — INSITU CONSTRUCTION 1050mm NOM DIA — PRECAST COMPONENTS (BY PRIOR APPROVAL ONLY) 1500mm NOM DIA — INSITU CONSTRUCTION ALTERNATIVE DROPS — INSITU CONSTRUCTION RECTANGULAR INCLUDING CAST IRON COVERS AND FRAMES CAST IRON COVER AND FRAME, CAST IRON CONCRETE FILLED COVER CAST IRON COVER AND FRAME, BOLT DOWN
		HOUSE CONNECTION BRANCHES
	S-0030	HOUSE CONNECTION BRANCHES
		PUMP STATIONS
	S-0050 S-0051 S-0052 S-0057 S-0058 S-0059	SUBMERSIBLE SEWAGE PUMPING STATION 1800mm DIA & 2400mm DIA PRESSURE GAUGE ARRANGEMENT AIR RELEASE PIPEWORK DETAILS 7.2m VENT POLE TERRAIN CAT 2 AND 3 12.0m VENT POLE TERRAIN CAT 2 AND 3 LIFT STATION SUBMERSIBLE, 1800mm DIA (0-20L/sec) PUMP STATION OVERFLOW SUBMERSIBLE SEWAGE PUMPING STATION GENERAL ARRANGEMENT, REINFORCEMENT 2400mm DIA. ALUMINIUM COVERS AND FRAMES 2400mm DIA.
		PRESSURE MAINS
	S-0070	PRESSURE MAIN DISCHARGE DETAILS
		SEWER CONSTRUCTION
	S-0090 S-0091	SEWER CONSTRUCTION, PIPELINE CONSTRUCTION TYPES PIERING DETAILS FOR BUILDINGS LESS THAN 1.5m TO SEWER LINE
	BOWE 67 Herbert 9 Bowen 4805 Ph 07 4761 360	INDEX SEWERAGE
C GENERAL UPDATES AND STANDARD REFERENCING AMENDMENTS 6/5/16 Whitsunday	COLLINSVILL Cnr Stanley & Conway S Collinsville 4804 Ph 07 4785 536	Otaniaana
B S-0010, S-0020 TO 0024, S-0030, S-0050, S-0059 10/3/98 TO 0060, S-0070 & S-0091 (S-0054 TO 0056 DELETED) A ORIGINAL ISSUE 1/3/97 REVISIONS DATE Email: info@whitsundayrc.qld.gov.au Web: www.whitsundayrc.qld.gov.au	Ph 07 4785 536 PROSERPIN 83-85 Main 9 Proserpine 4800 Ph 07 4945 020	

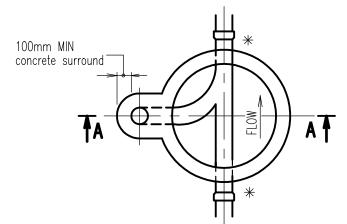






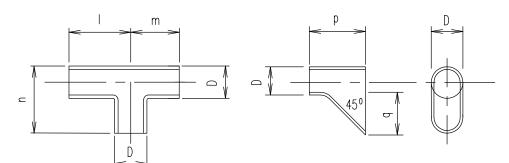








Only to be used where approved or ordered by Service Authority



DROP JUNCTION PIPE

C GENERAL UPDATES AND STANDARD REFERENCING AMENDMENT

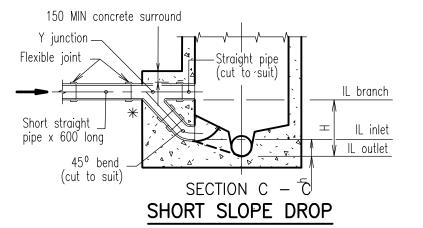
REVISIONS

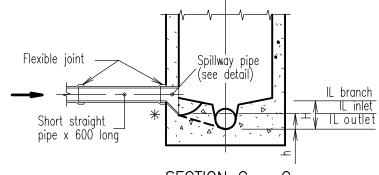
B MINOR AMENDMENTS

A ORIGINAL ISSUE

SPILLWAY PIPE

SPECIAL PIPES



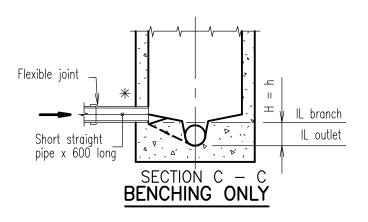


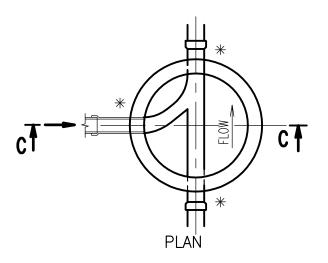


MAXIMUM DROPS				
PIPE	CHAMBER DROP 'H'			
DIA D	Normal Benching	Spillway Drop	Short Slope Drop	Vertical Drop
100	Under 250	250 to 350	350 to 600	over 600
150	Under 250	250 to 400	400 to 700	over 700
225	Under 300	300 to 500	500 to 800	over 800
300	Under 350	350 to 650	650 to 1000	over 1000

SPECIAL PIPES						
	PIPE DIA	Drop Junction		Spill	way	
	D	_	m	n	р	q
	100	380	225	300	150	100
	150	380	225	300	225	150
	225	420	350	425	325	225
	300	450	450	525	425	300

MININ	MUM DRO	PS
Angle T Chan	Minimum Drop 'h'	
_	0° to 30°	25
Branch Sewer	30°to 60°	50
30 11 01	60°to 90°	75
Main	0° to 45°	25
Sewer	45°to 90°	40





NOTES:

- 1. Unless otherwise approved for particular types of sewer pipe used or particular site conditions, short pipes (600mm MAX) to be flexibly jointed to all sections bedded on or surrounded with concrete.
- 2. All benching to be 1 in 5 MIN.
- 3. 100mm external uPVC drop to be provided where house drain connection is well above chamber invert.
- 4. Refer WRC STD DWG S-0020 for 1050 NOM. access chamber insitu construction details.
- 5. Vertical and short slope drops to be formed using special pipes and standard fittings with couplings & sealing rings.
- 6. All dimensions in millimetres.

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* Refer DETAIL 'A'

WRC STD DWG W-0020

BOWEN 67 Herbert St Bowen 4805 Q

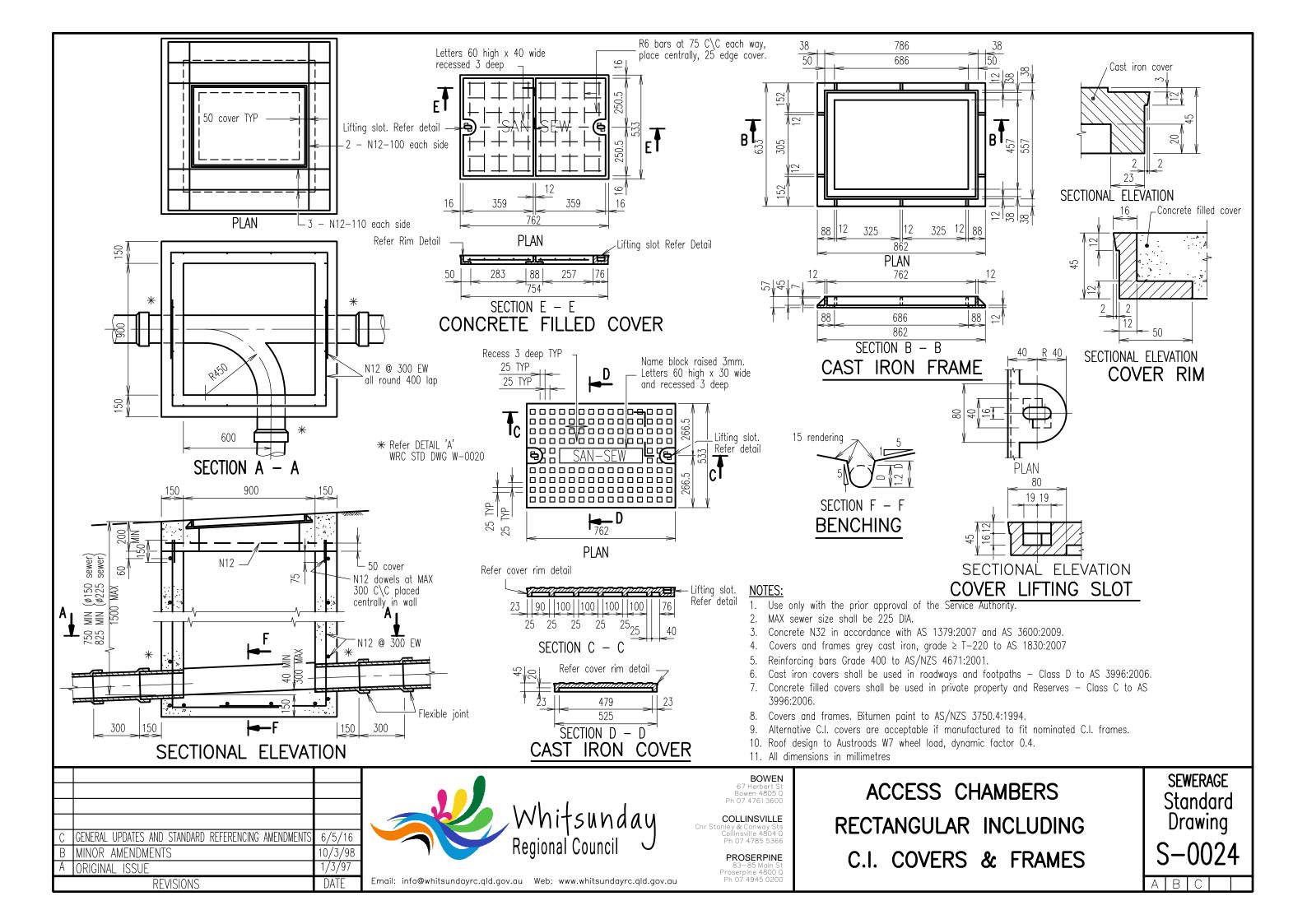
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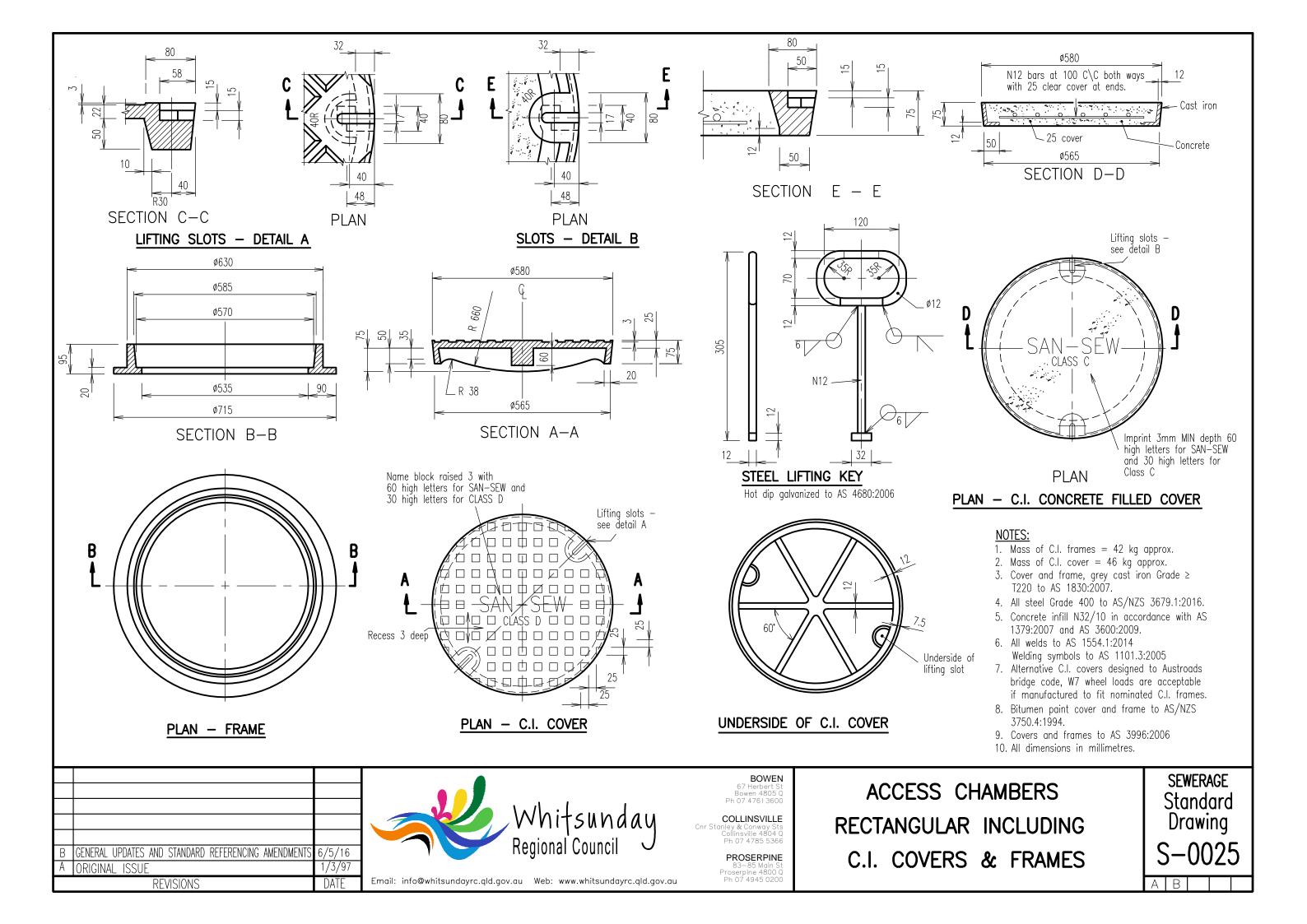
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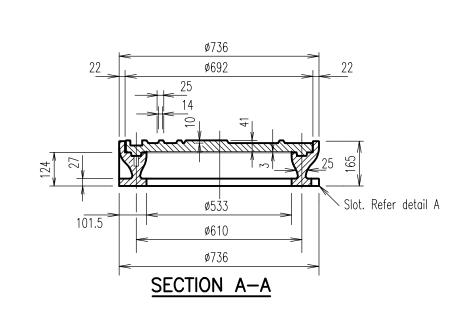
ACCESS CHAMBERS
ALTERNATIVE DROPS
INSITU CONSTRUCTION

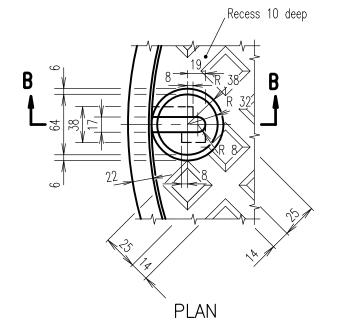
SEWERAGE
Standard
Drawing
S-0023

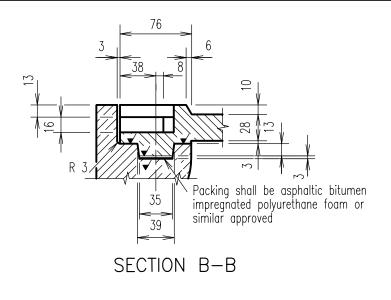
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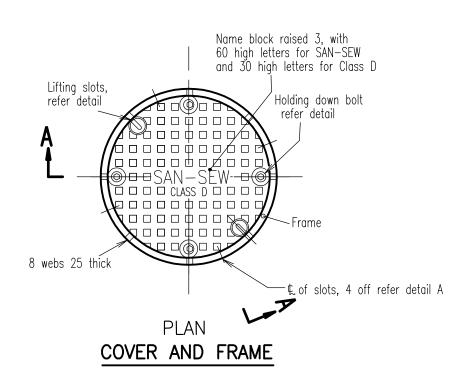


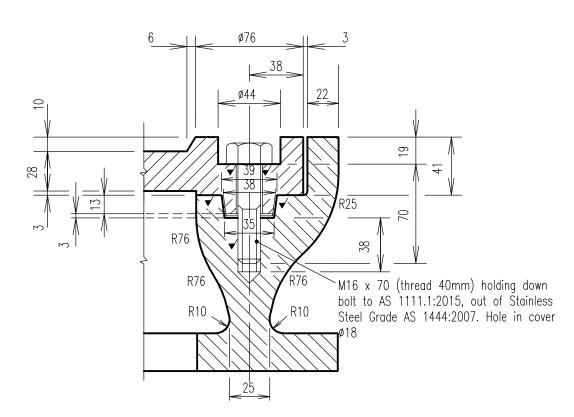




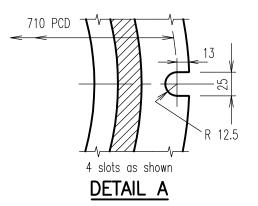


DETAIL AT LIFTING SLOTS





DETAIL OF HOLDING DOWN BOLTS



LEGEND

✓ Denotes machined surface.

NOTES:

- $\overline{1.}$ Mass of cover = 66 kg approx.
- 2. Mass of frame = 100 kg approx.
- 3. Cover and frame, grey cast iron Grade ≥ T220 to AS 1830:2007.
- 4. Cover design Class D to AS 3996:2006.
- 5. Alternative C.I. covers designed to Austroads bridge code, W7 wheel loads are acceptable if manufactured to fit nominated C.I. frames.
- 6. Bitumen paint cover & frame to AS/NZS 3750.4:1994.
- 7. All dimensions in millimetres.

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	REVISIONS	DATE



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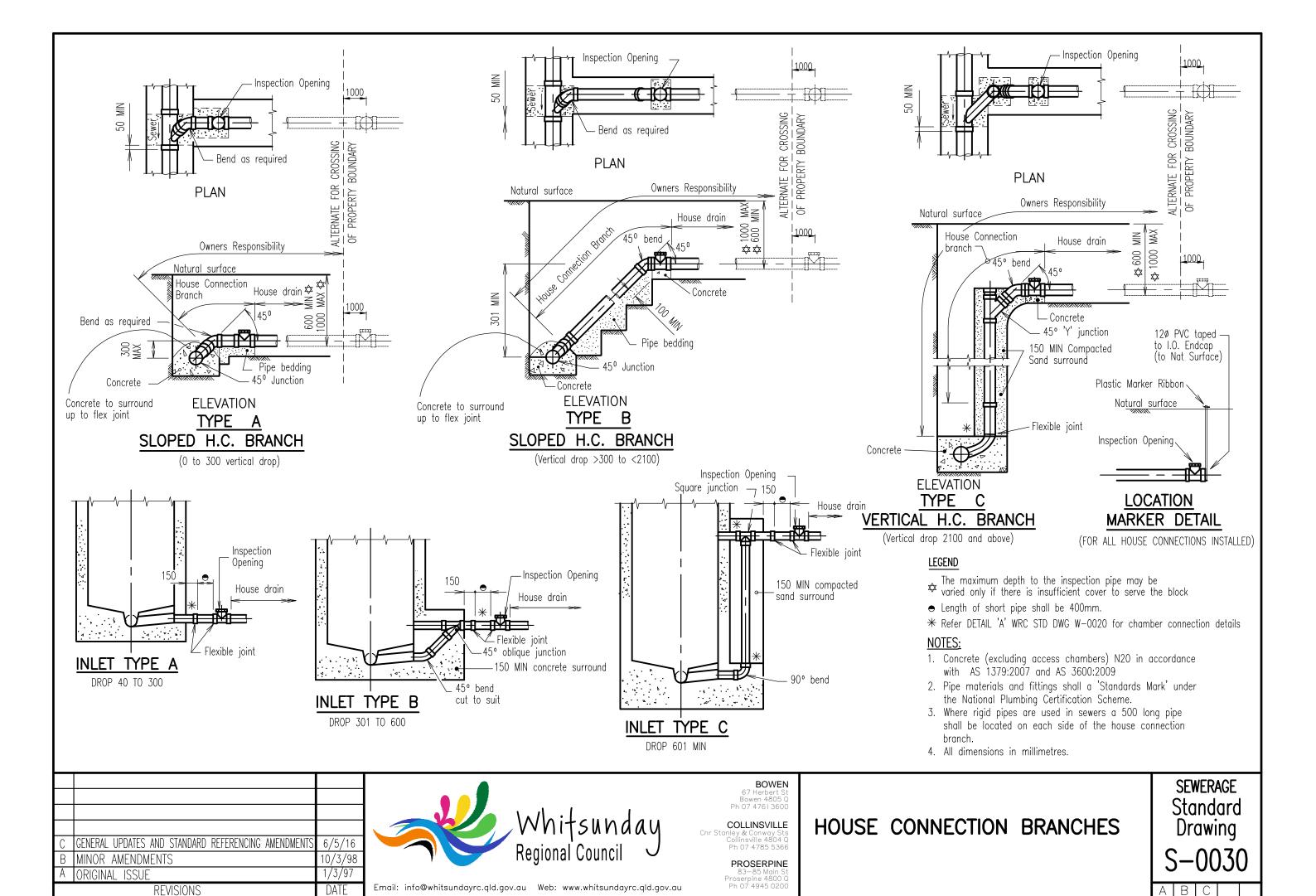
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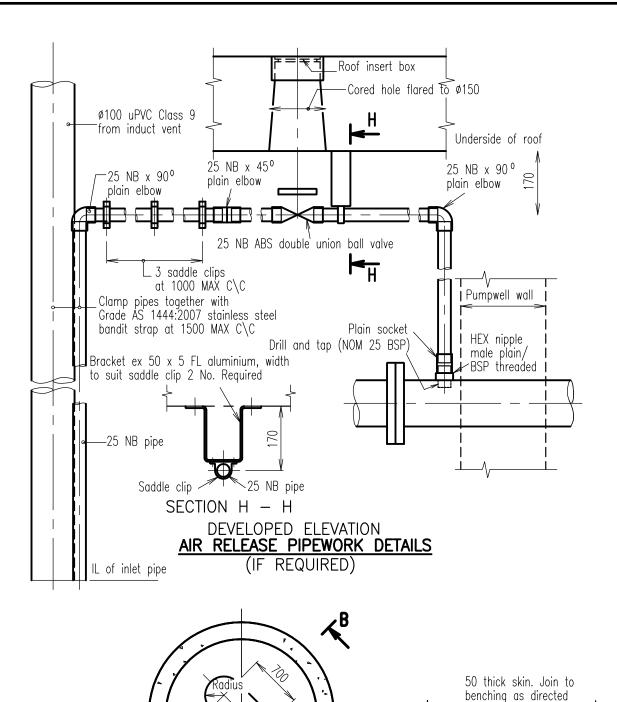
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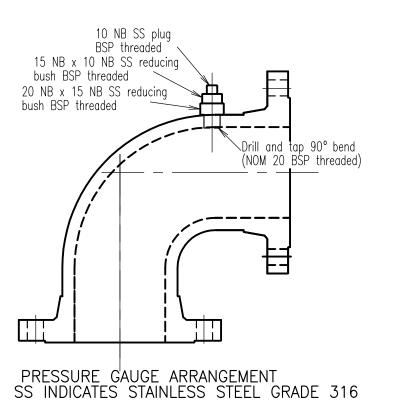
ACCESS CHAMBERS CAST IRON COVER AND FRAME BOLT DOWN

SEWERAGE
Standard
Drawing
S-0026

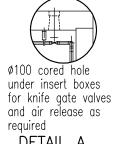
AB



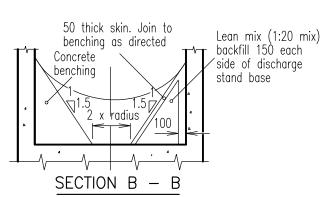


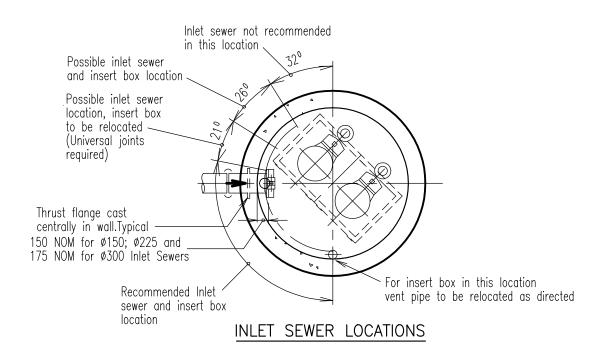


- Benching dimensions shall be as directed by the Superintendent. The "Radius" at floor level shall be equal to the pump's volute radius with concurrent centre lines. The 700* dimension shall be adjusted to suit the pump unit spacing. The 50mm thick skin shall be 2:1 fine sand and cement mortar.
- (a) The isolating valve on the inlet sewer shall be a fully Grade AS 1444:2007 stainless steel lugged knife gate valve including stainless steel superstructure and non-rising spindle adaptor with stainless steel metal to metal seat.
 - (b) Reflux valves shall be coated internally and externally with a fusion bonded epoxy and shall be counter weighted.
- All dimensions in millimetres.



DETAIL A





С	GENERAL UPDATES AND STANDARD REFERENCING AMENDMENTS	6/5/16
В	COMBINED PARTS OF S-0050 & S-0054	10/3/98
Α	ORIGINAL ISSUE	1/3/97
	REVISIONS	DATE

PUMPWELL FLOOR

Showing benching only Refer note 1



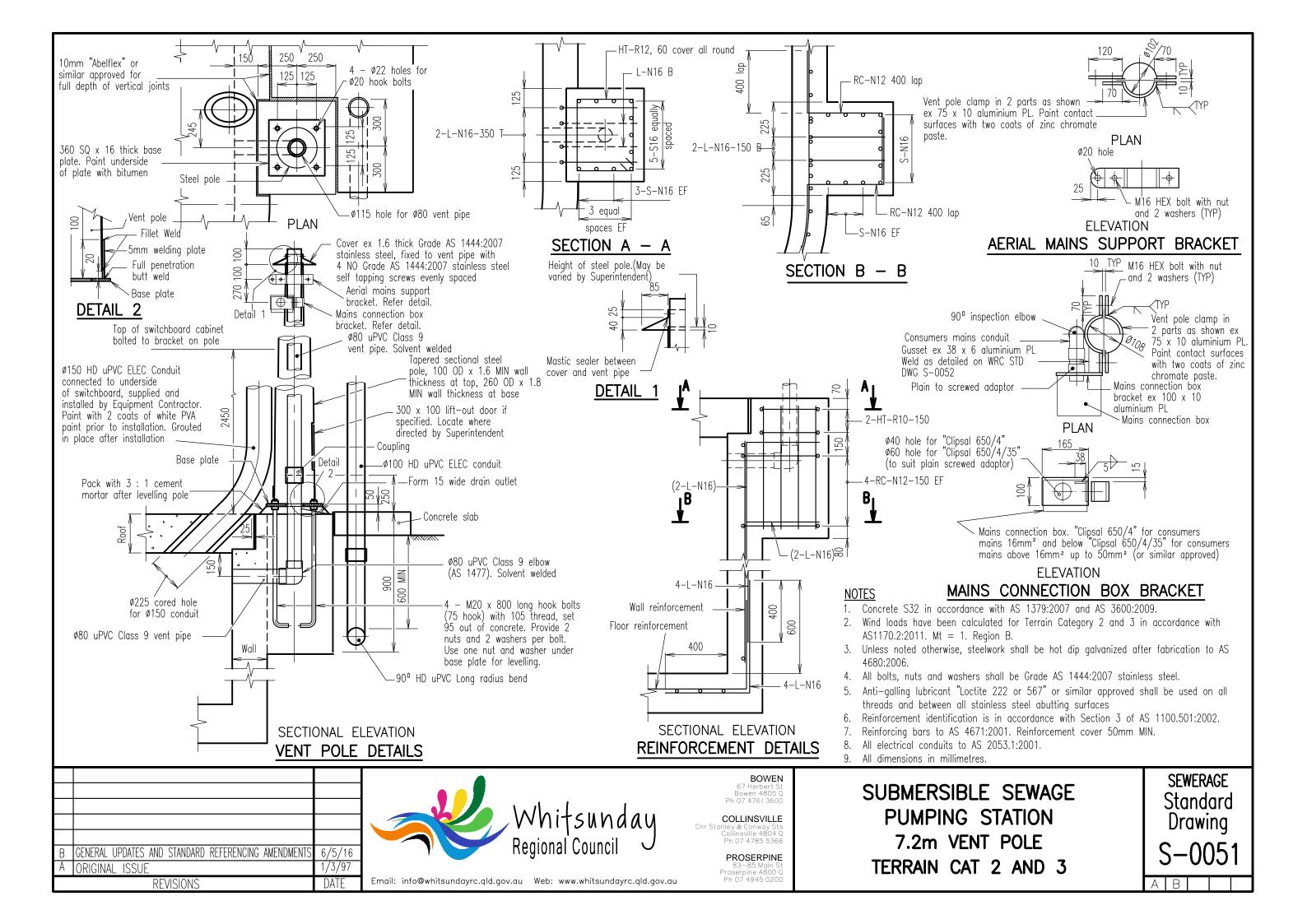
BOWEN 67 Herbert St Bowen 4805 C

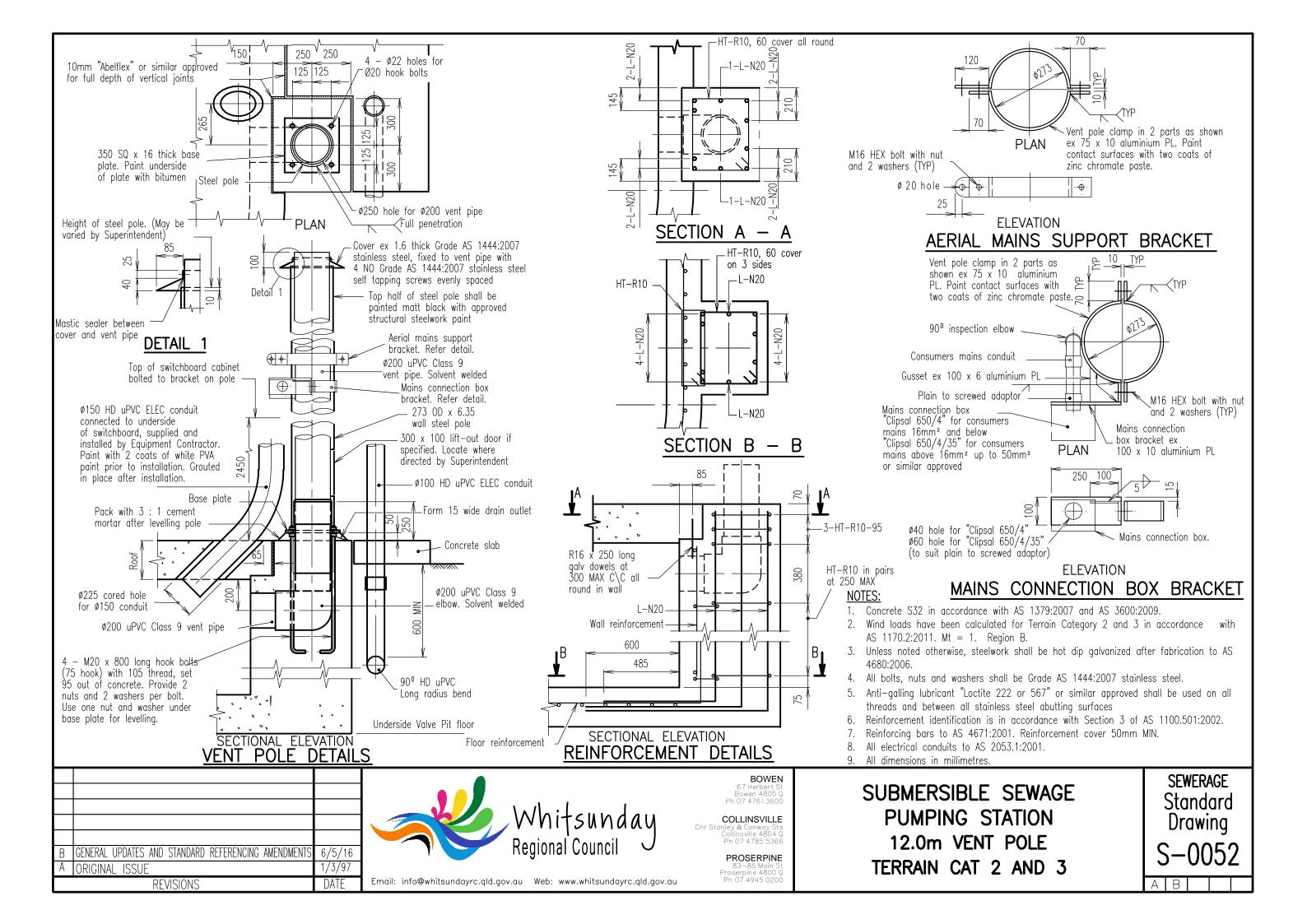
COLLINSVILLE Ph 07 4785 5366

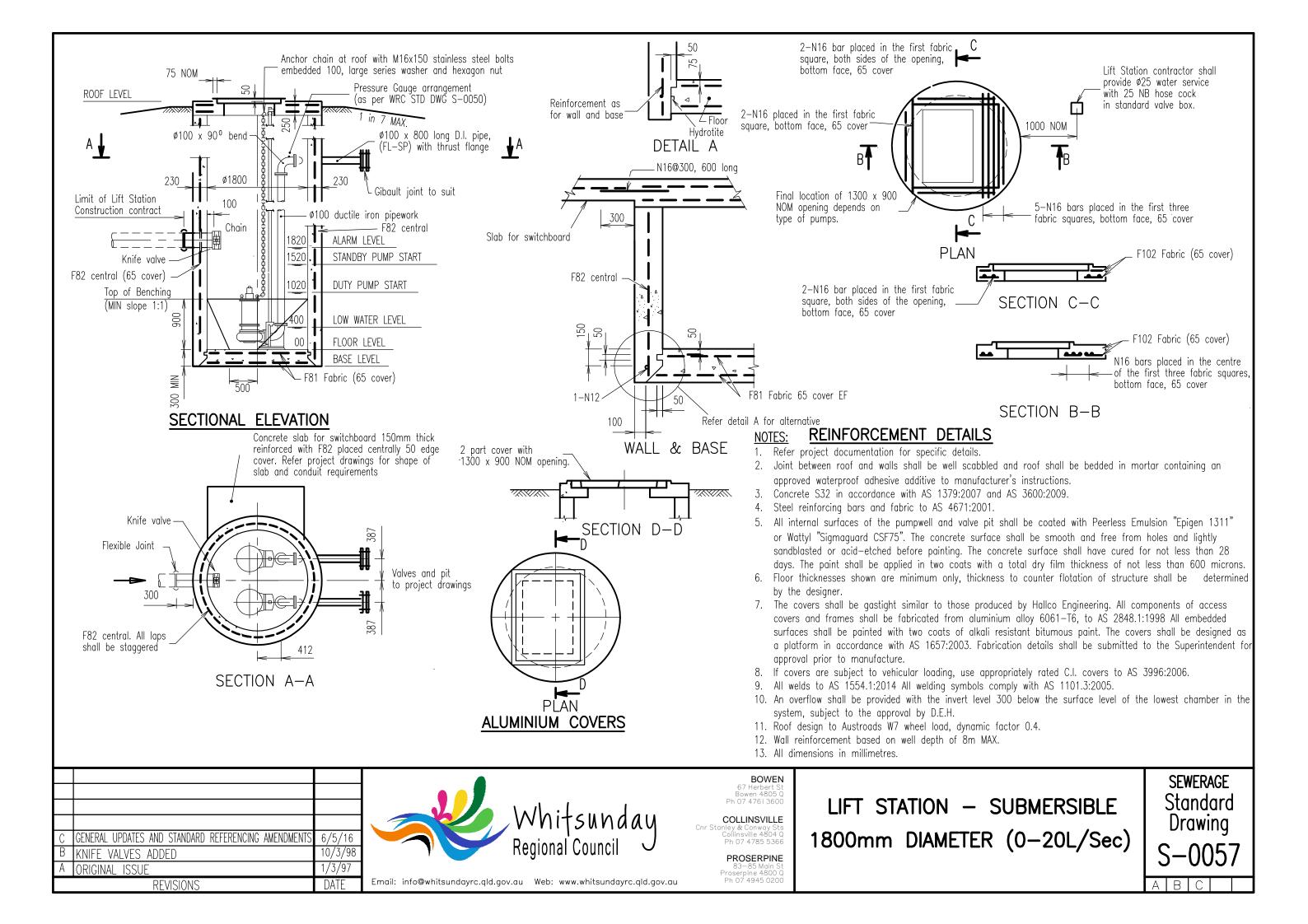
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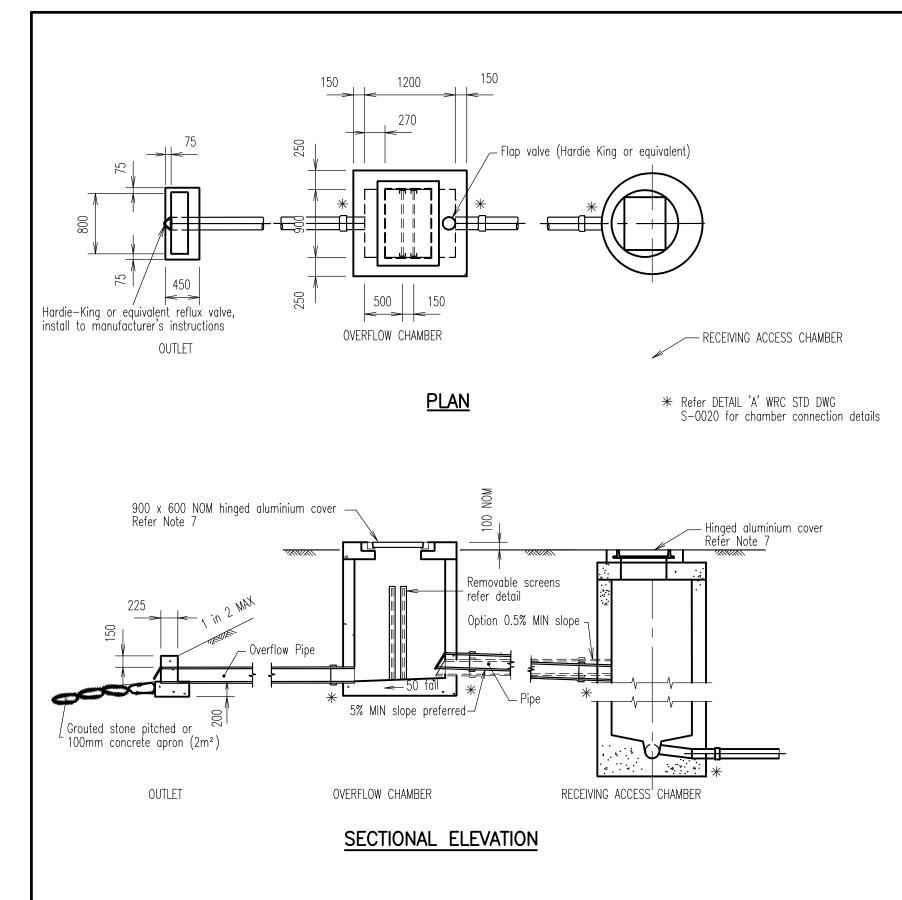
SUBMERSIBLE SEWAGE **PUMPING STATION** 1800 mm DIA. & 2400 mm DIA PRESSURE GAUGE ARRANGEMENT AIR RELEASE PIPEWORK DETAILS

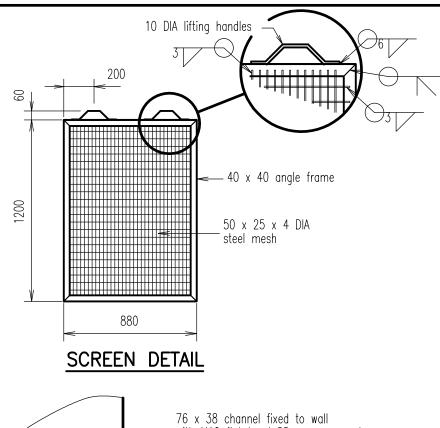
SEWERAGE Standard Drawing

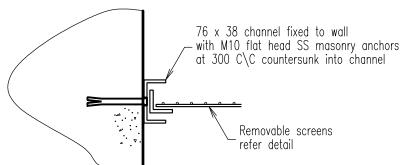












SCREEN GUIDE RAIL

NOTES:

- 1. Pipes shown are diagrammatic only, refer project drawings for layout and levels.
- 2. Concrete N32 in accordance with AS 1379:2007 and AS 3600:2009.
- 3. All steelwork hot dip galvanised to AS/NZS 4680:2006 after fabrication.
- 4. All bars and angles Grade 250 to AS/NZS 3679.1:2016.
- 5. All bolts, nuts and washers shall be Grade AS 1444:2007 stainless steel with approved anti-galling compound.
- 6. All welds to AS 1554.1:2014 All welding symbols comply with AS 1101.3:2005.
- 7. The covers shall be gastight similar to those produced by Hallco Engineering. All components of access covers and frames shall be fabricated from aluminium alloy 6061—T6, to AS 2848.1:1998. All embedded surfaces shall be painted with two coats of alkali resistant bitumous paint. The covers shall be designed as a platform in accordance with AS 1657:2003. Fabrication details shall be submitted to the Superintendent for approval prior to manufacture.
- 8. If covers are subject to vehicular loading, use appropriately rated C.I. covers.
- 9. All dimensions in millimetres.

В	GENERAL UPDATES AND STANDARD REFERENCING AMENDMENTS	6/5/16
A	ORIGINAL ISSUE	1/3/97
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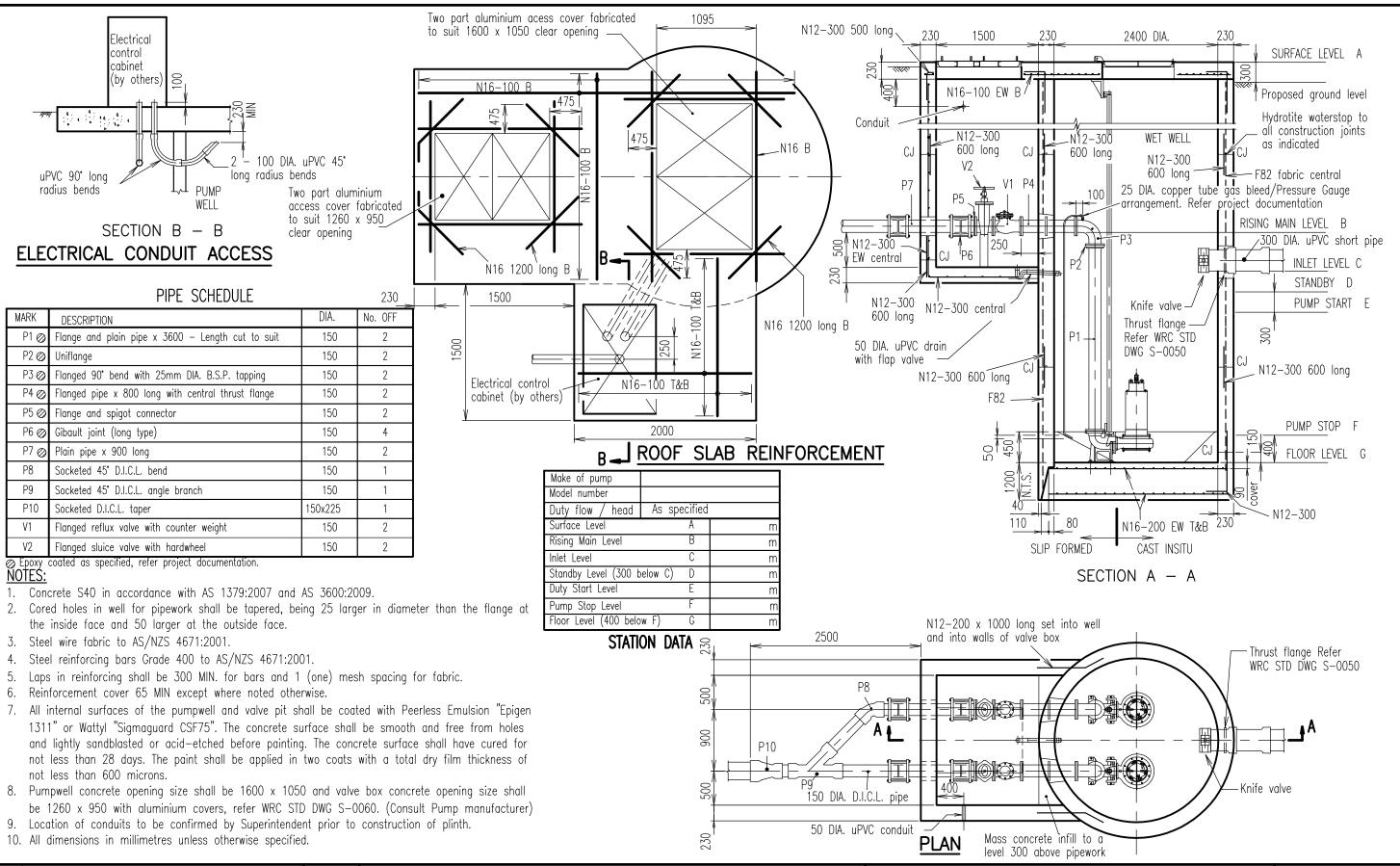
BOWEN 67 Herbert St Bowen 4805 Q Ph 07 4761 3600

COLLINSVILLE Cnr Stanley & Conway Sts Collinsville 4804 Q Ph 07 4785 5366

> PROSERPINE 83-85 Main St Proserpine 4800 Q Ph 07 4945 0200

PUMP STATION OVERFLOW

SEWERAGE
Standard
Drawing
S-0058



С	GENERAL UPDATES AND STANDARD REFERENCING AMENDMENTS	6/5/16
В	KNIFE VALVES ADDED	10/3/98
A	ORIGINAL ISSUE	1/3/97
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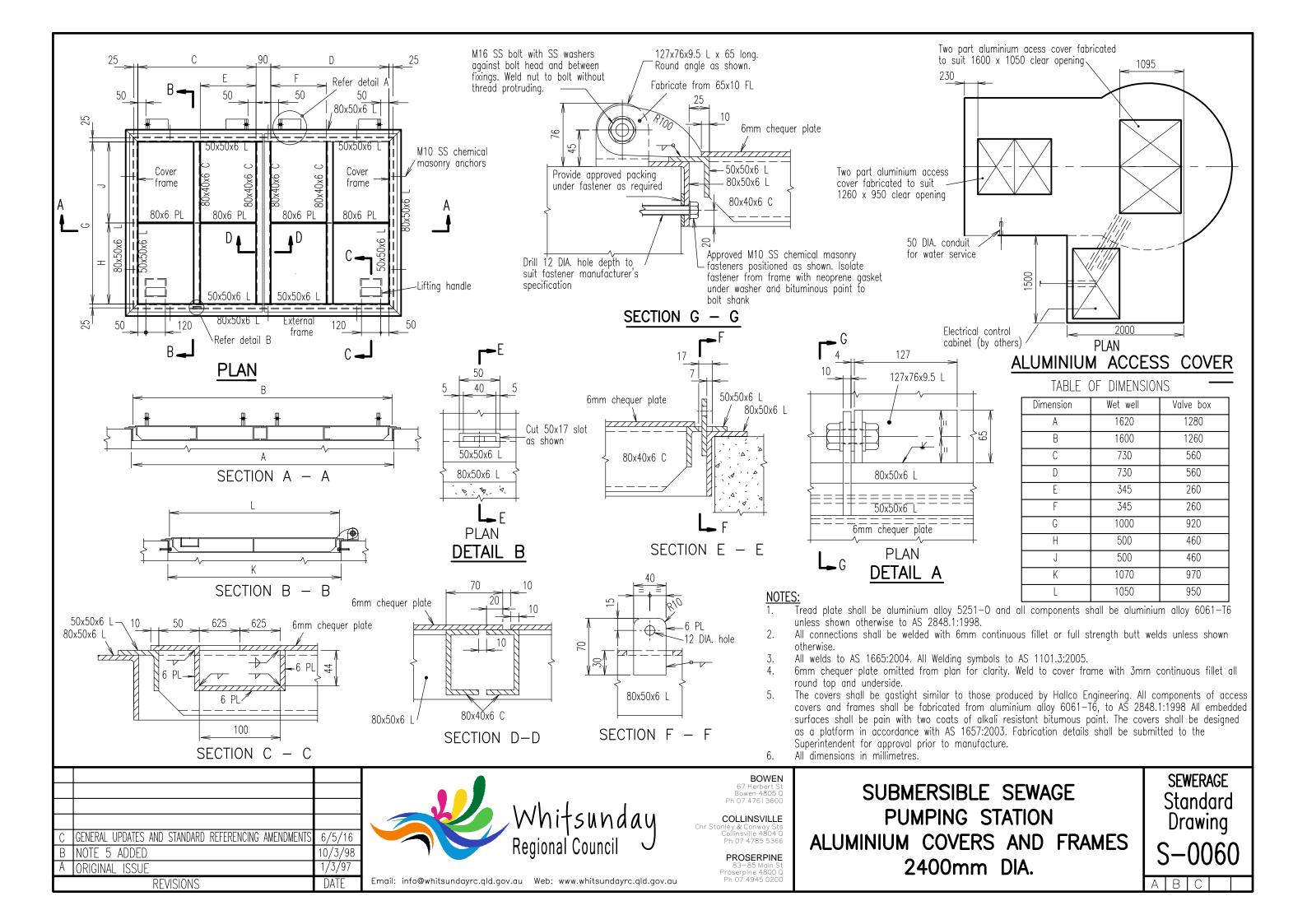
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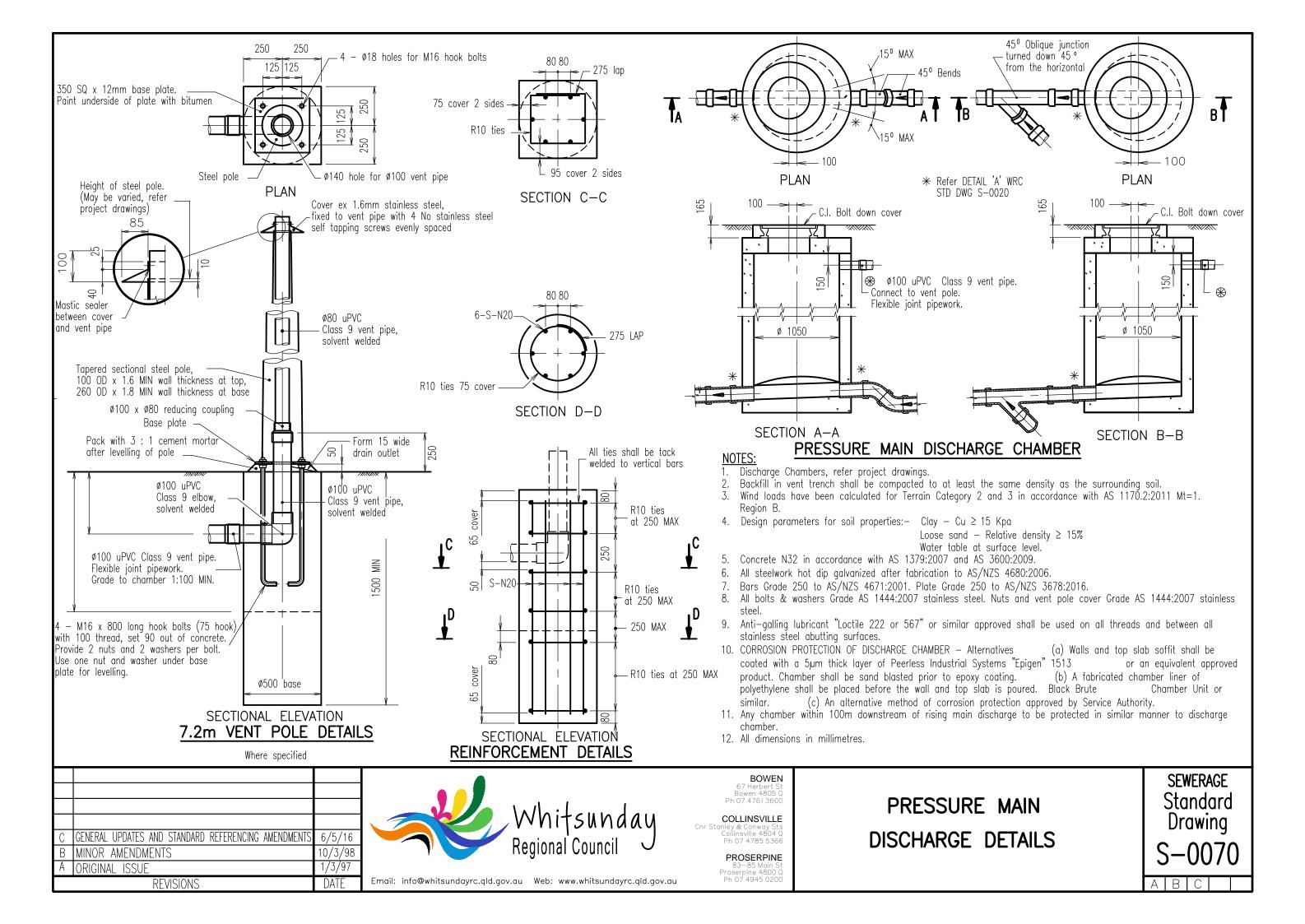
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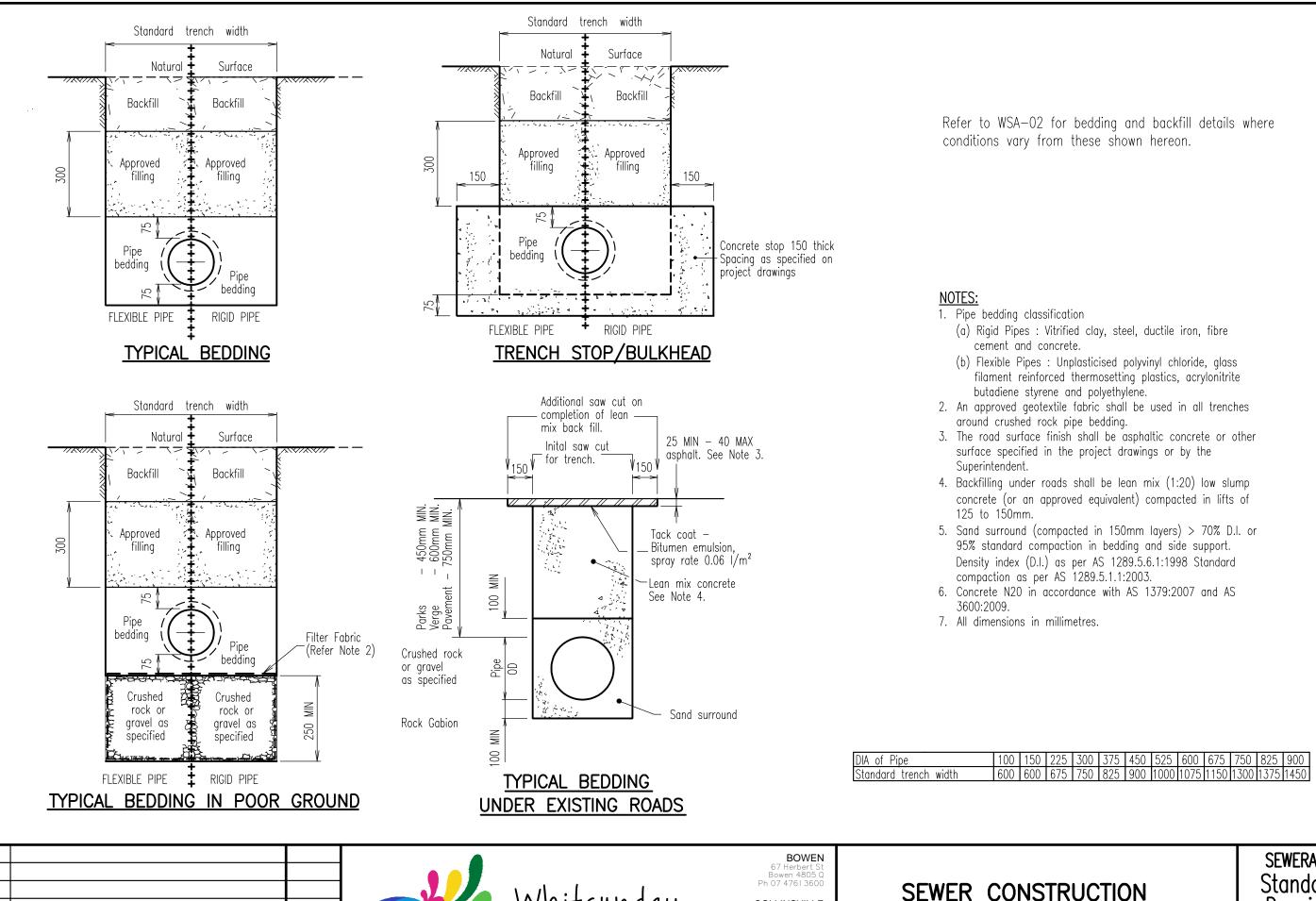
SUBMERSIBLE SEWAGE
PUMPING STATION
GENERAL ARRANGEMENT —
REINFORCEMENT 2400mm DIA.

SEWERAGE Standard Drawing

A B C







B GENERAL UPDATES AND STANDARD REFERENCING AMENDMENTS 6/5/16
A ORIGINAL ISSUE 1/3/97
REVISIONS DATE



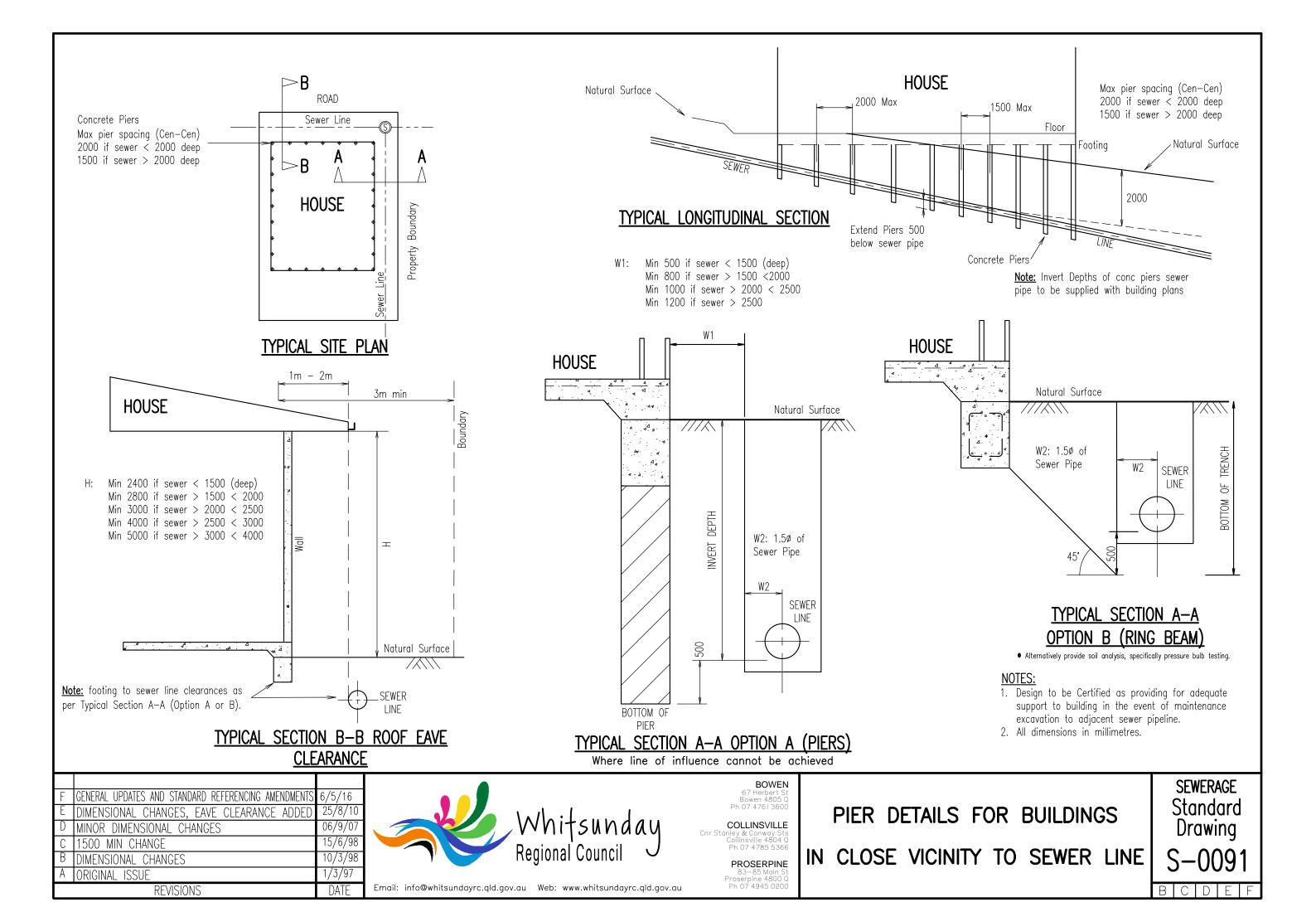
COLLINSVILLE Cnr Stanley & Conway Sts Collinsville 4804 Q Ph 07 4785 5366

> PROSERPINE 83-85 Main St Proserpine 4800 Q Ph 07 4945 0200

PIPELINE CONSTRUCTION TYPES

SEWERAGE Standard Drawing

AIRI



Std. Dwg. No.	Descriptions
P-0010 P-0012 P-0013 P-0014 P-0015	BIKEWAYS BIKEPATH ENTRANCE TO ROAD RESERVE PAVEMENT JOINTS SLOWDOWN CONTROL, REVERSE CURVE SLOWDOWN CONTROL, Z CHICANE SLOWDOWN CONTROL, OFFSET CHICANE

Α	ORIGINAL ISSUE	8/12/95
	REVISIONS	DATE
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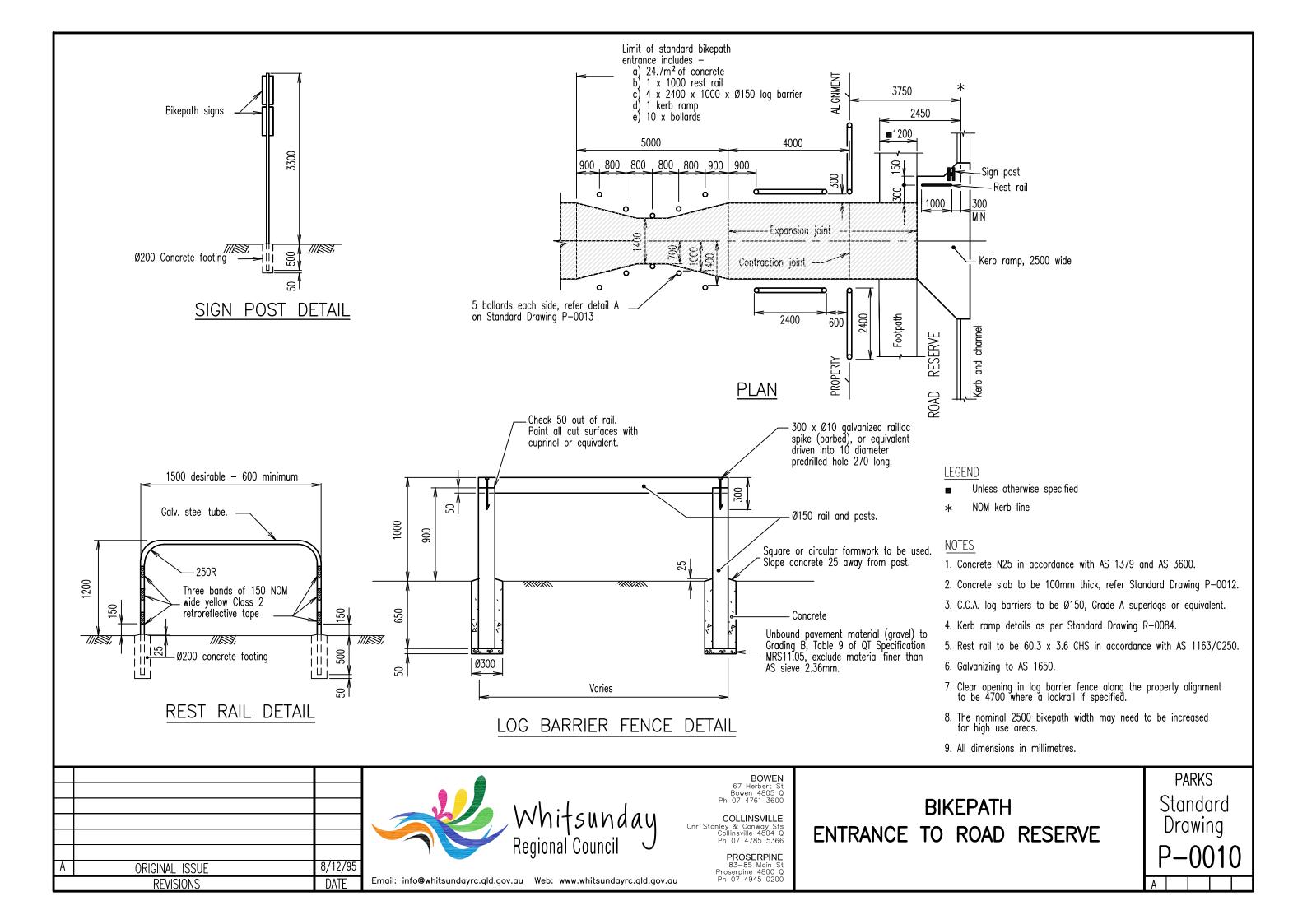
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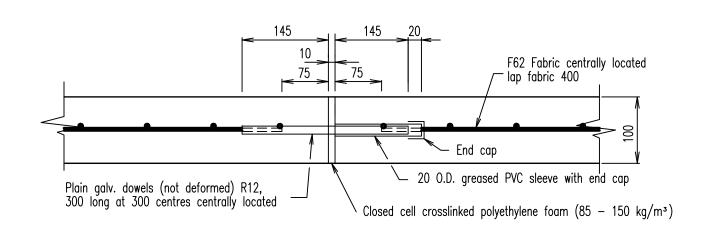
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PROSERPINE 83-85 Main St Proserpine 4800 Q Ph 07 4945 0200

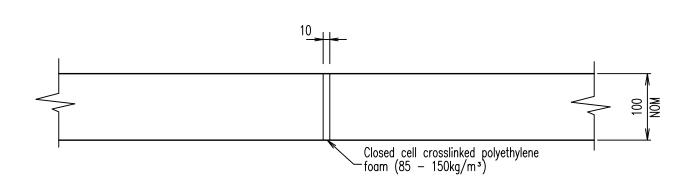
INDEX STANDARD DRAWINGS PARKS

PARKS
Standard
Drawing
P-0001

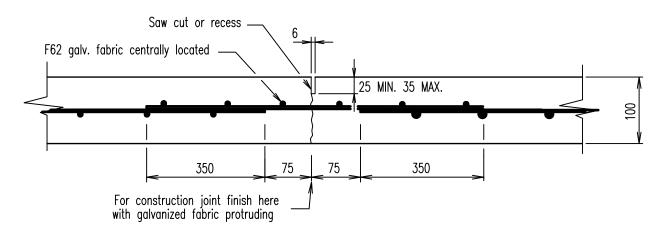




EXPANSION JOINT
Spacing 16m

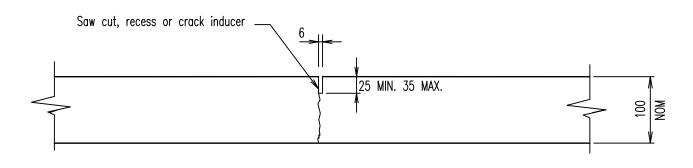


EXPANSION JOINT Spacing 16m



CONTRACTION JOINT Spacing 4m

REINFORCED



CONTRACTION JOINT
Spacing 2m

NON REINFORCED

NOTES:

- 1. Concrete N25 in accordance with AS 1379 and AS 3600.
- 2. Reinforcement and dowels to be used, if specified, when bikepath is placed on fill or on poor subgrade.
- 3. Bikepath thickness may be reduced to 75mm in good ground conditions.
- 4. Dowels Grade 250 steel to AS 1302. Fabric to AS 1304.
- 5. Galvanizing to AS 1650.
- 6. All dimensions in millimetres.

Α	ORIGINAL ISSUE	8/12/95
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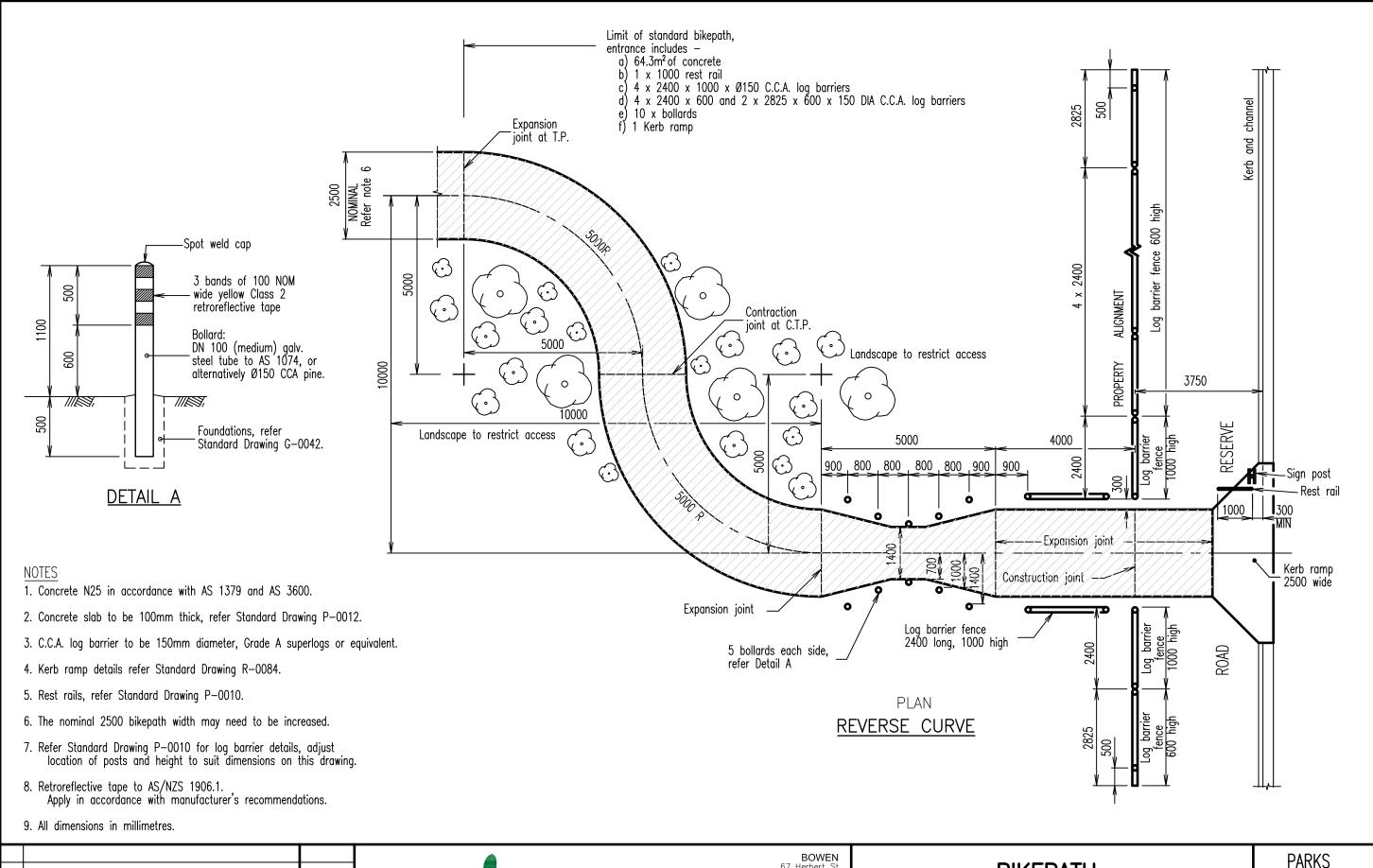
BOWEN 67 Herbert St Bowen 4805 Q Ph 07 4761 3600

COLLINSVILLE Cnr Stanley & Conway Sts Collinsville 4804 Q Ph 07 4785 5366

> PROSERPINE 83-85 Main St Proserpine 4800 Q Ph 07 4945 0200

BIKEPATH PAVEMENT JOINTS

PARKS
Standard
Drawing
P-0012



Α	ORIGINAL ISSUE	8/12/95
	REVISIONS	DATE



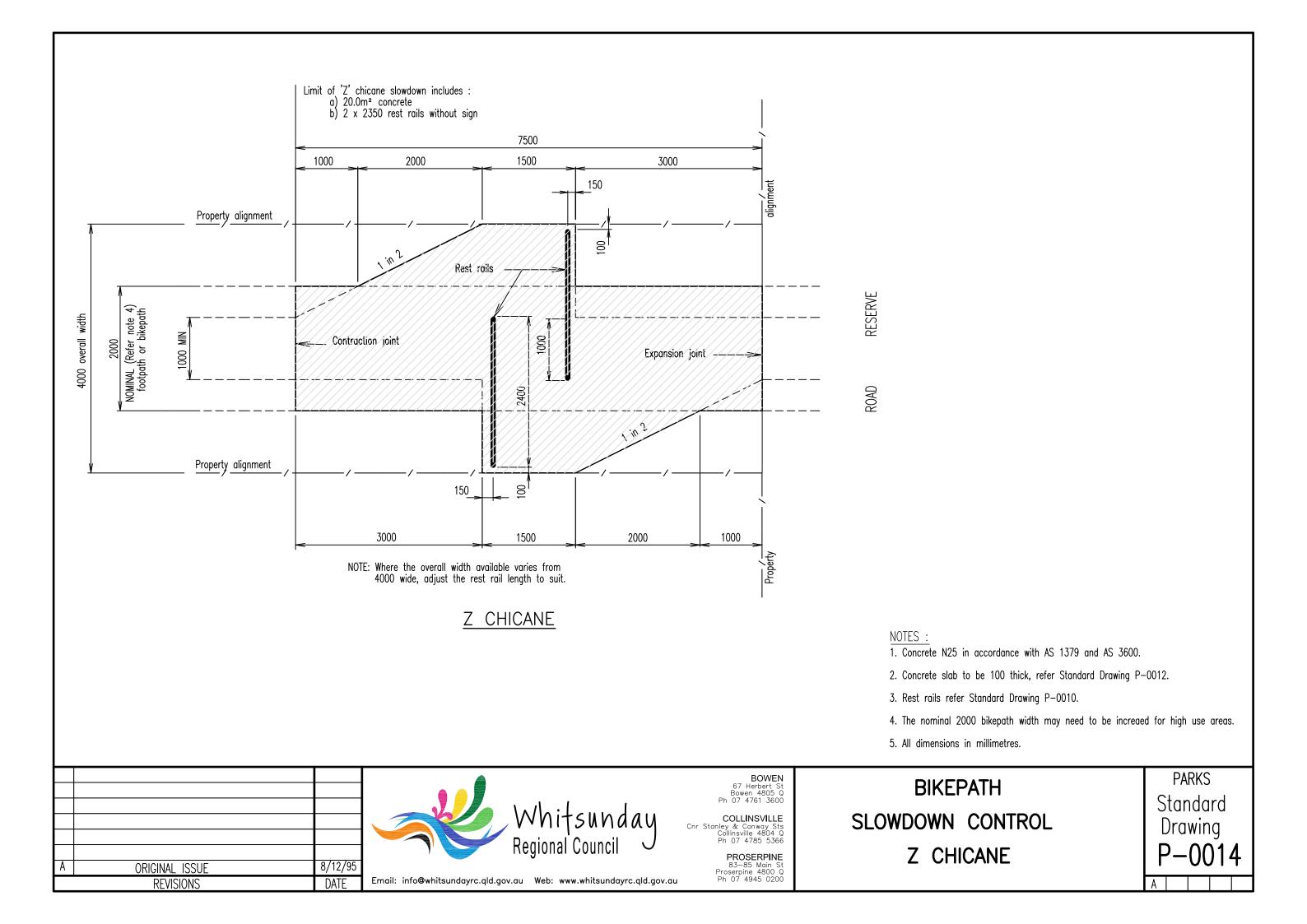
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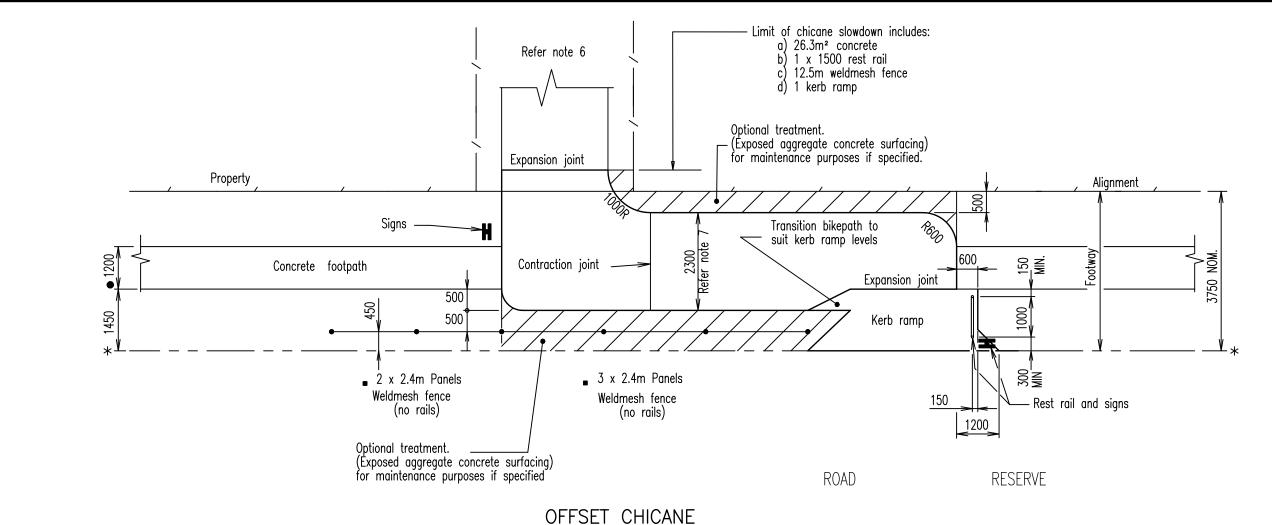
COLLINSVILLE Cnr Stanley & Conway Sts Collinsville 4804 Q Ph 07 4785 5366

PROSERPINE 83-85 Main St Proserpine 4800 Q Ph 07 4945 0200 BIKEPATH
SLOWDOWN CONTROL
REVERSE CURVE

Standard Drawing P-0013

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- For use where reverse curve is not practical
- Recommended for areas with high primary school traffic

LEGEND

- * NOM. kerb line
- Each section may be reduced by 1 panel, refer project drawings
- Unless otherwise specified

NOTES

- 1. Concrete N25 in accordance with AS 1379 and AS 3600.
- 2. Concrete slab to be 100mm thick, refer Standard Drawing P-0012.
- 3. Weldmesh fence details as per Standard Drawing G-0045.
- 4. Kerb ramp details as per Standard Drawing R-0084.
- 5. Rest rails, refer Standard Drawing P-0010.
- 6. The NOMINAL 2500 bikepath width may need to be increased for high use areas.
- 7. Bikepath width may need to be reduced to suit available footway. The preferred width is 2500; the absolute minimum width is 2000.
- 8. All dimensions in millimetres, unless shown otherwise.

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BIKEPATH SLOWDOWN CONTROL OFFSET CHICANE

PARKS Standard Drawing

Std. Dwg. No.	Descriptions
G-0030	ELECTRICAL CONDUIT DRAWING PITS
G-0040 G-0041 G-0042 G-0043 G-0044 G-0045 QT 938	FENCING 4 & 6 STRAND BARBED WIRE FENCE CHAIN WIRE SECURITY FENCING LOG BARRIER FENCING LOCKING RAIL TUBULAR STEEL, WITH AND WITHOUT CHAIN WIRE WELDMESH FENCING AND CONTROL FENCE 3700 STEEL GATE, INSTALLATION OF GATE AND POSTS
G-0080 G-0081	LEGENDS LEGENDS SHEET 1 SHEET 2 TREE PLANTING
G-0100	TREE PLANTING INCLUDING ROOT BARRIERS

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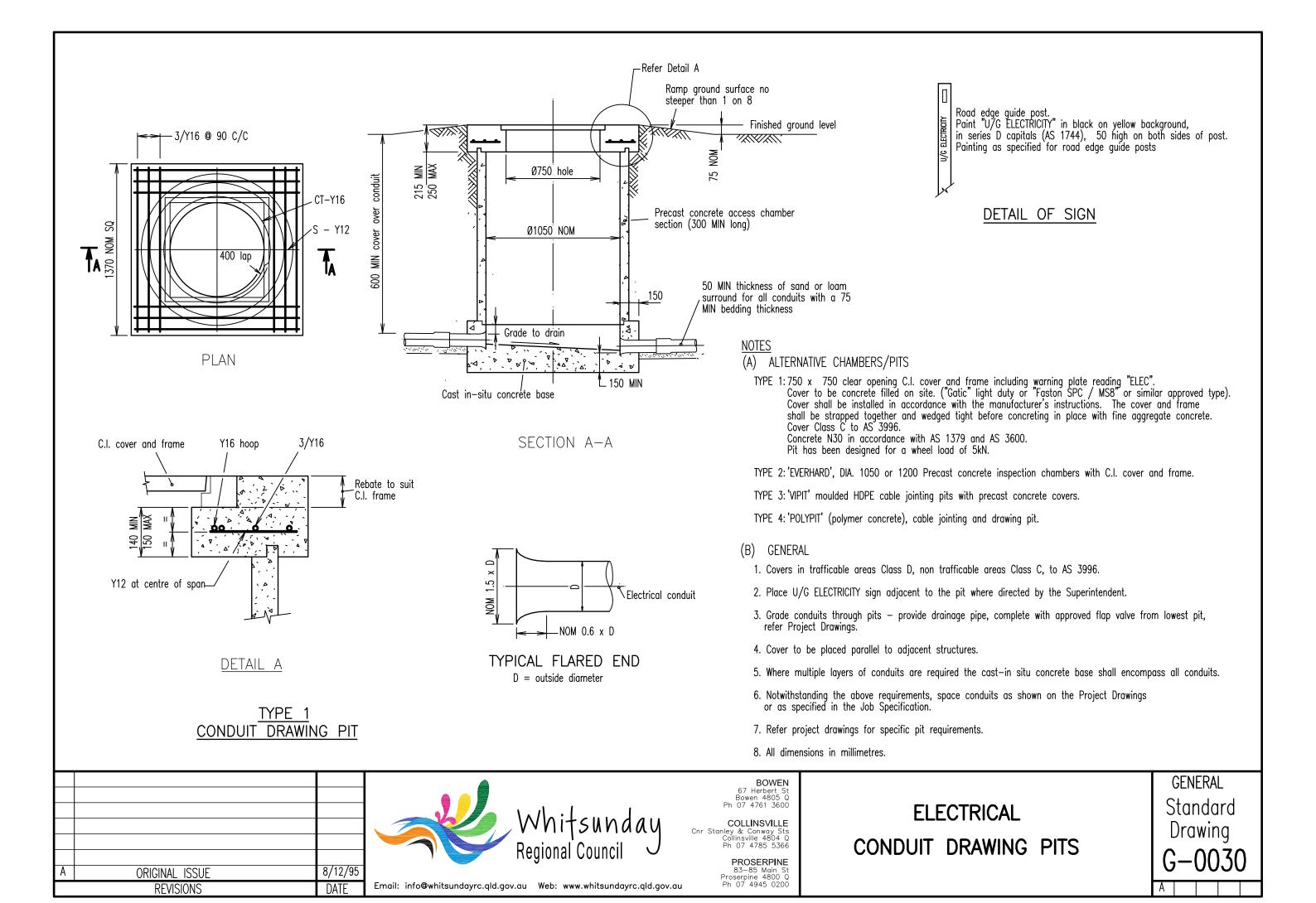
Email: info@whitsundayrc.qld.gov.au Web: www.whitsundayrc.qld.gov.au

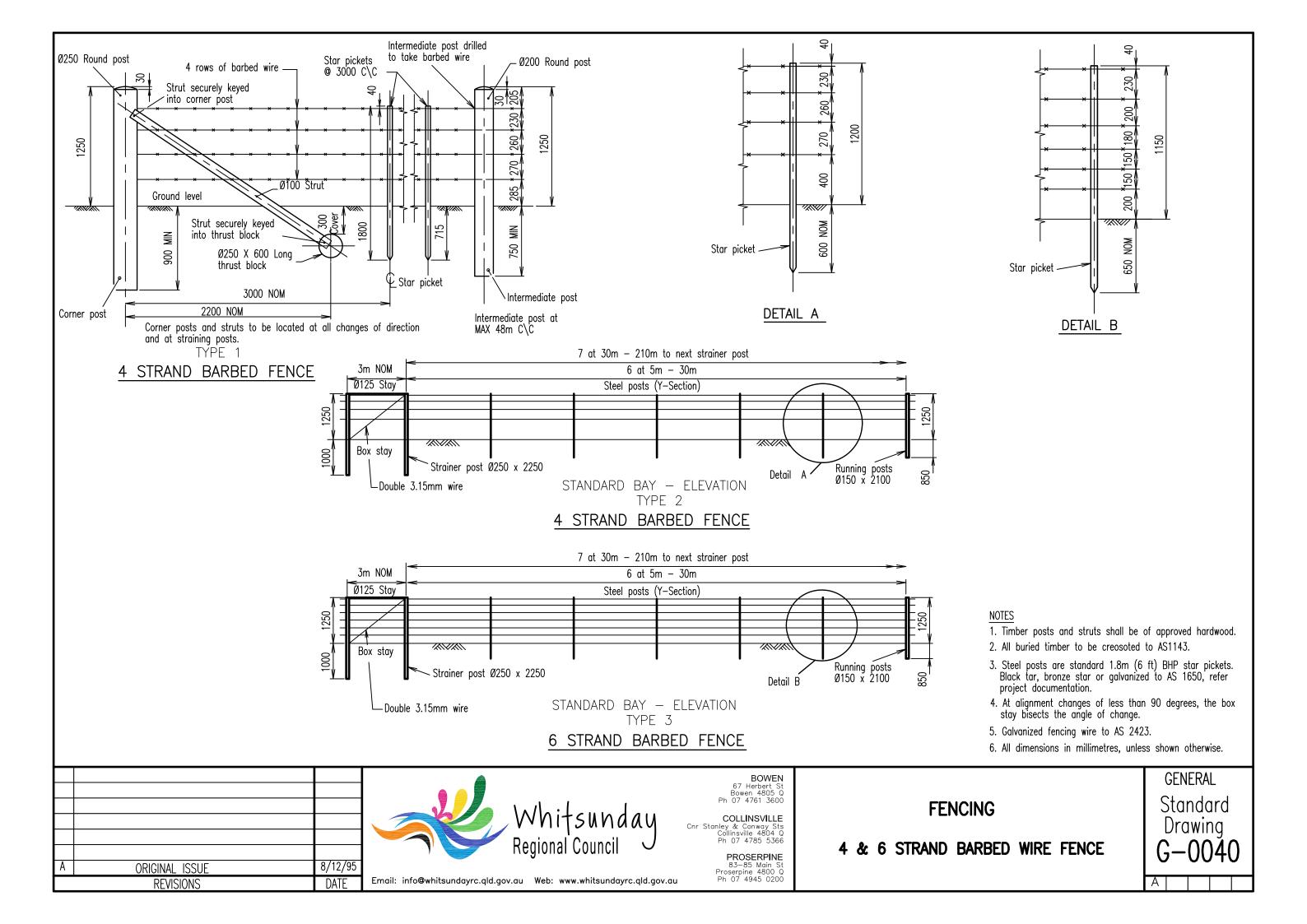
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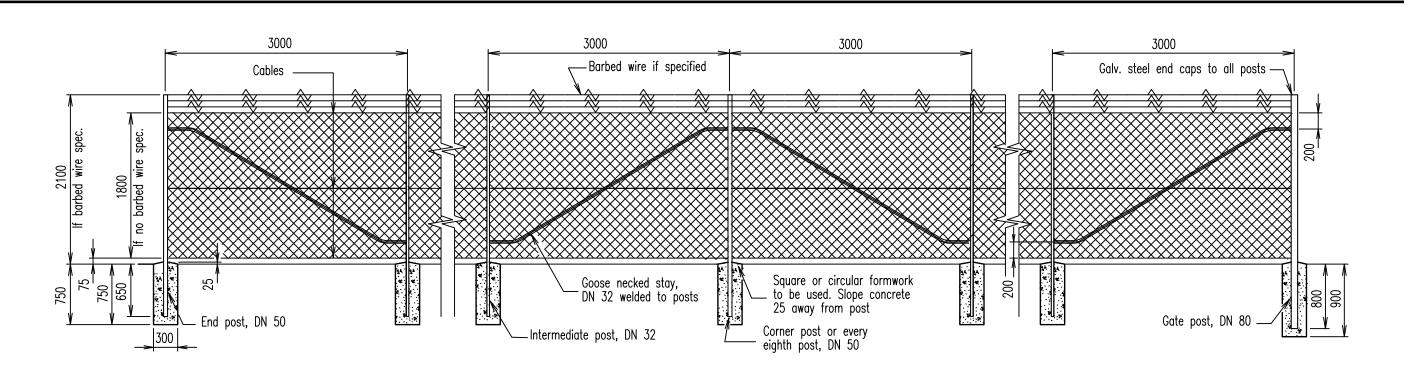
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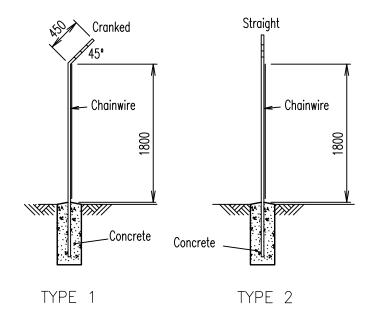
INDEX STANDARD DRAWINGS GENERAL







TYPICAL SECTION



NOTES:

- 1. POSTS: Gate posts to be DN 80 (light) galvanized steel tube, to AS 1074.

 Corner, end and every eighth post to be DN 50 (light) galvanized steel tube to AS 1074.

 Intermediate posts and goose necked stays to be DN 32 (light) galvanized steel tube to AS 1074.

 Galvanized steel end caps to be provided to all posts.

 All posts to be vertical.
- 2. Corner posts to be adopted where the change in angle in horizontal alignment exceeds 20 degrees.
- 3. Stays to be provided at end posts, gate posts, corner posts and every eighth post.
- 4. Standard couplings (down—ee fittings) may be used as an alternative to welds. For all connections except goose necked stays which shall be welded to posts.
- 5. All welds to be 5 thick continuous fillet welds to AS 1554. with cold galvanizing treatment to completed welds.
- 6. Cables to be formed from two 3.15mm diameter wires twisted together and installed in accordance with AS 1725.
- 7. All posts, stays and cables are to be galvanized in accordance with AS 1650.
- 8. All concrete N25 in accordance with AS 1379 and AS 3600.
- 9. Chain wire to be fixed using 1.6 wire ties as follows:
 Intermediate posts at 3 locations
 End posts at 3 locations
 Horizontal cable at 375 centres to top cable
 Horizontal cable at 600 centres to middle cable
 Horizontal cable at 450 centres to bottom cable.
- 10. Barbed wire to AS 2423.
- 11. All dimensions in millimetres.

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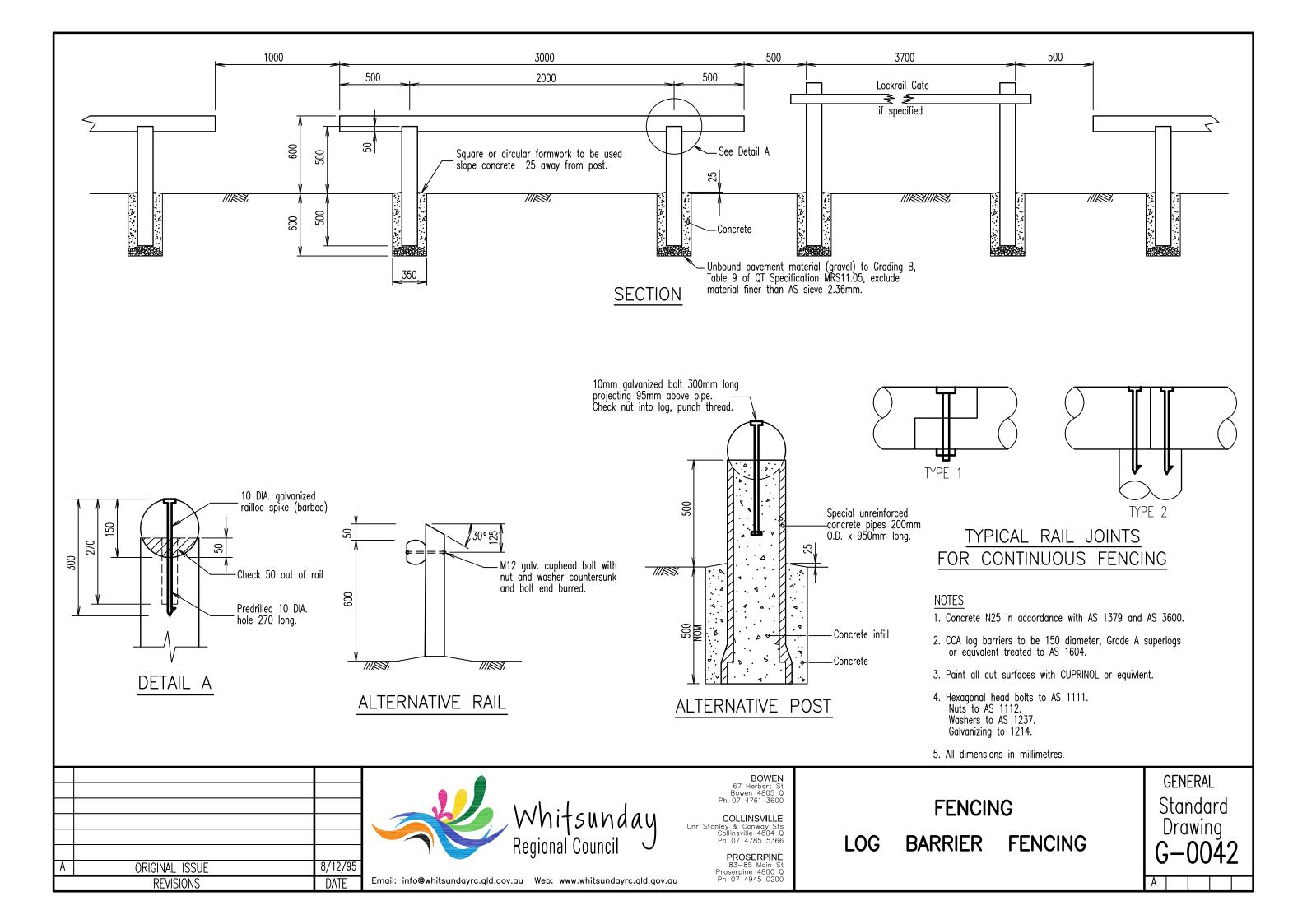
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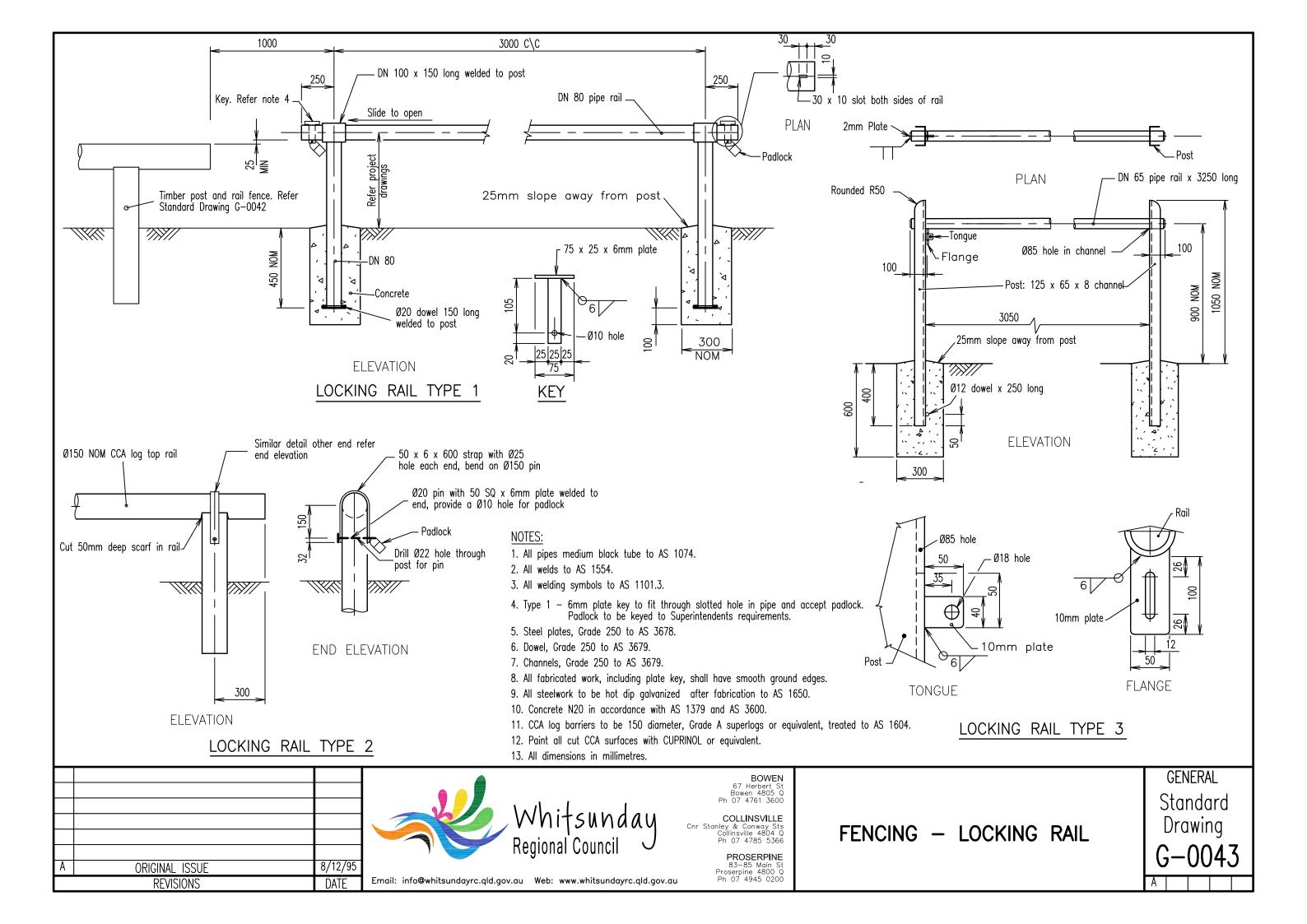
r Stanley & Conway Sts Collinsville 4804 Q Ph 07 4785 5366 PROSERPINE

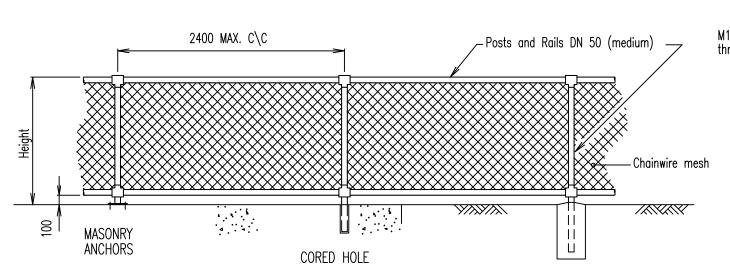
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BOWEN 67 Herbert St Bowen 4805 Q

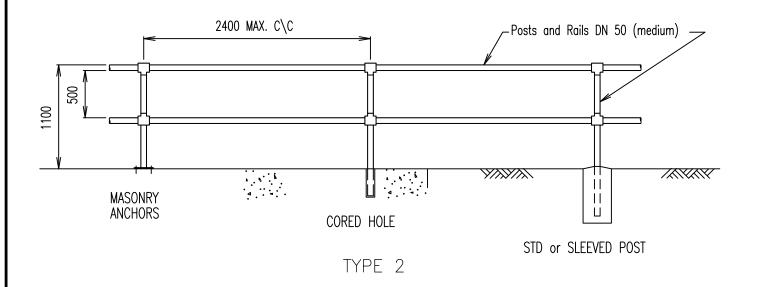
FENCING CHAIN WIRE SECURITY FENCING

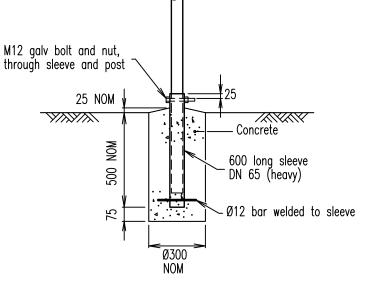






STD or SLEEVED POST TYPE 1 - A (Height - 1100) TYPE 1 - B (Height - 1350)

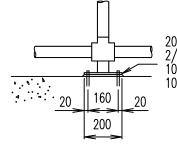




25 NOM YXXXX $\frac{M}{M}$ 500 Ø300 NOM

SLEEVED POST

STD. POST



200 x 150 x 10mm galv. baseplate, 2/M12 galv. masonry anchors 100 MIN into concrete 10mm NOM cement mortar packing

1:3 cement mortar - after aligning horizontally & vertically. Ø100 CORED HOLE

-DN 50

- Concrete

MASONRY ANCHORS

NOTES

FOOTING DETAILS

- 1. Refer project drawings for type of fence to be installed and type of footing to be adopted.
- 2. Construction of posts & rails shall be done using standard coupling connections only. (no welds).
- 3. Galvanized chainwire to be 2.6mm thick x 50 mesh to AS 2423.
- 4. Ø12 bars, Grade 250 steel to AS 1302.
- 5. Hexagonal head bolts to AS 1111. Nuts to AS 1112. Washers to AS 1237. Galvanizing to AS 1214.
- 6. All rails and posts galvanized steel tube to AS 1074.
- 7. Concrete N25 in accordance with AS 1379 and AS 3600.
- 8. All dimensions in millimeters.

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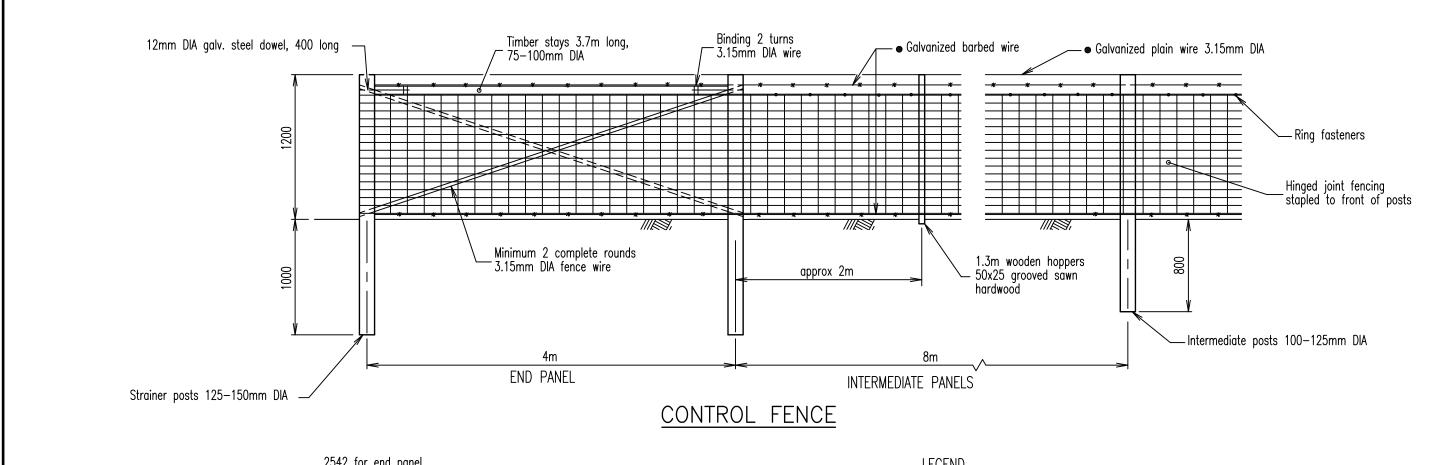
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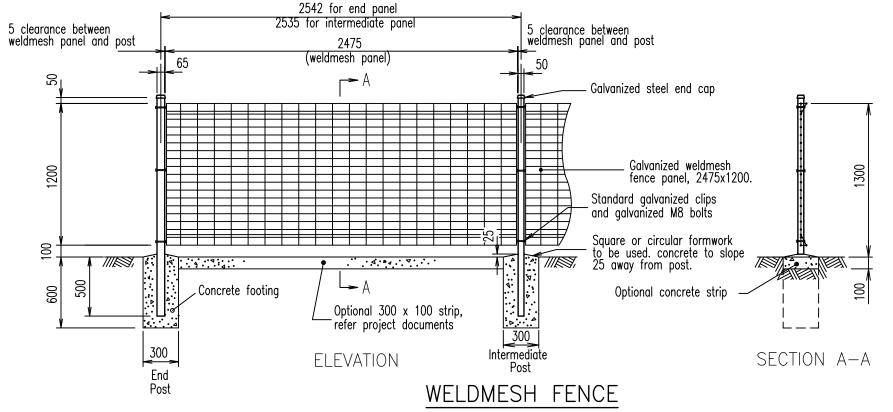
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FENCING TUBULAR STEEL FENCE WITH & WITHOUT CHAIN WIRE





LEGEND

Wire fixed to back of posts

NOTES

- 1. Gate and end posts to be 65x65x2 galvanized steel section to AS 1163.
- 2. Intermediate posts to be 50x50x2 galvanized steel section to AS 1163.
- Panels to be fixed to posts using standard galvanized clips and galvanized M8 bolts.
- Galvanizing to AS 1214 and AS 1650.
- 5. Concrete N25 in accordance with AS 1379 and AS 3600.
- 6. Posts are to be vertical.
- Raked panels are available for slopes up to 1 in 5.
- 8. Nuts to be spot welded to bolts as an anti-theft deterent.

B - Control Fence

- 1. All barbed wire, plain wire, hinged joint fencing, staples and ring fasteners to be galvanized
- 2. Provide strainer panels at 100 to 140m spacing. Panels to be as for 'End Panels' with an extra 2/3.15mm wire brace as indicated by broken lines.
- 3. Posts may be tea-tree, split hardwood or sawn timber.
- 4. Where fences turn 90° adopt an end panel going away in each direction.
- 5. Dowels, Grade 250 to AS 3679.

C - General

1. All dimensions in millimetres, unless shown otherwise.

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FENCING WELDMESH FENCING AND CONTROL FENCE

GFNFRAI Standard Drawing

	<u>LINEWORK</u>		
DESCRIPTION	SYMBOL	LINE THICKNESS	REMARKS
Shire boundaries		1.0	Name – Shire
Parish boundaries	· — · —	1.0	Name — Parish
Real property alignment		0.25	
Fence not on boundary (exist - new)	/	0.25 / 0.35	Name fencing
Fence on boundary (new - exist)		0.25 0.35	Name fencing
Existing easement Pegged traverse line		0.35	
Control line		0.35	
Grade line	90 90	0.35	
Driving line		0.35	At irregular intersections
Existing concrete kerb and channel	<u> </u>	0.35	The irregular intersections
New concrete kerb and channel		0.7	
New concrete kerb and channel			
showing lip levels		0.7 / 0.35	
Future kerb and channel		0.35	Name - FKC
Existing kerb		0.35	
New kerb		0.7	
Future kerb		0.35	Name - FK
Existing unsealed surface edge		0.35	
Existing edge of bitumen surface	<u> </u>	0.35	
New bitumen — A.C. surface edge		0.5	
New road shoulder edge		0.5	
Entrance to property	-/	0.35	
Entrance to property	Entrance to Entrance to remain open be closed	0.7	
Creek — open drain invert	_	0.35	
Top of bank (exist — new)	-V 1/ V 1/	0.35 / 0.7	Name - Bank
Toe of bank (exist — new´)			
Building line `		0.35	Name-BL
Edge of concrete slab	[6] \$0.00 (\$1.50 (\$1.30 (\$1.50 (\$1.70 (\$1.70 (\$1.5	0.35	
Steel beam guardrail (exist — new)		0.35 / 0.7	Guard rail
Railway line	 	0.35	Name - Railway
Handrail new	•	0.7	
Contours — existing		0.35	Major and intermediate
- new	25	0.5	Major and intermediate
	BIKEWAY PLANS		
T. 13 II		T	Τ
Future bikepath	/////////////	0.5	
Proposed bikepath	///////	0.7	
Existing bikepath	/////////	0.35	
Proposed bikeroute Existing bikeroute		1.0	Name - Bikeroute
		0.35	Name - Bikeroute

|--|

DESCRIPTION	SYMBOL	LINE THICKNESS	REMARKS
Maximum height guage	•	0.35	Stream recordings
Gate	\triangleright	0.35	Shown as actual width
Bore hole	⊗ ⊙	0.25	
Shrubs	\bigcirc	0.25	
Tree small (Trunk <Ø300)		0.25	
Tree large (Trunk >Ø300)	(\circ)	0.25	
Australia post	□ AP	0.25	Mail box
Buildings		0.35 / 0.25	
Telephone Box	O™L	0.35	
SUR	VEY AND CADASTRAL		
Permanent survey mark		0.35	Brass plaque, deep mark, etc.
Bench mark	<o bm<="" td=""><td>0.35</td><td>Temporary, existing mark</td></o>	0.35	Temporary, existing mark
Cadastral survey mark	⊗ CS	0.25	Existing R.P. tie
Traverse line	<u> </u>	0.25	Engineering survey station
Survey control point	<u></u> ← CP	0.25	Engineering survey station
Surveyed spot height	×2724i	0.25	Spot height located at cross
FLO FLO	OD MITIGATION PLANS		
Top of channel works		0.7	
Toe of channel works		0.5	
Centreline of proposed channel Flood regulation line	FRLFRL	0.35 0.35	Name - FRL.

LETTERING

DESCRIPTION	EXAMPLE	LINE THICKNESS	TEXT HEIGHT
Street names Chainages control/peg Stations (Point No.) Table headings Table sub—headings Parish / portion details R.P. Description numbers Notes Longitudinal section block	GEORGE ST. 200 105.983 5004 LAYOUT CHAINAGE POR 351 6 R.P. 135987 NOTES INVERT LEVEL	0.5 or 0.7 0.7 / 0.5 0.35 0.5 0.35 0.5 or 0.7 0.35 0.35 0.5	5 5 / 3.5 2.5 4 2.5 5 2.5 2.5 4

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PUBLIC UTILITIES

DESCRIPTION	SYMBOL	LINE THICKNESS	REMARKS
Water Main (exist — new) Water meter (Exist — new) Fire hydrant (exist — new) Water valve (exist — new) Telecommunications	150 W	0.25 / 0.35 0.25 / 0.35 0.25 / 0.35 0.25 / 0.35 0.25 0.25	Pipe diameter Underground Overhead
Telecommunications	P C C	0.35	Underground conduits
Telecommunication pillar Telecommunication pit (exist - new) Telecommunication pole (exist-new) Gas (exist - new) Gas (exist - new) Moonie oil pipe line Moonie oil pipe line Electricity (exist-new) Electricity pillar (exist - new) Electricity pit (exist - new) Street lighting conduit (single) Street lighting conduit (double)	C C C C C C C C C C C C C C C C C C C	0.35 0.25 / 0.35 0.25 / 0.35 0.25 / 0.35 0.25 / 0.35 0.25 / 0.35 0.25 / 0.35 0.25 / 0.35 0.25 / 0.35 0.25 / 0.35 0.25 / 0.35 0.25 / 0.35 0.25 / 0.35 0.35 0.35	Underground conduits Concrete, metal, wood. Overhead Under ground Valve, gas main, hp gas. Under ground Booster, sign, valve Underground Underground Underground Concrete, metal, wood poles
Light pole	—×———×—	0.35	Concrete, metal, wood poles
Sewerage Main (exist — new)	S	0.25 / 0.35	Gravity below ground
Sewerage Main (exist — new)	RS	0.25 / 0.35	Rising Main below ground
Sewerage access chamber (exist—new) Stormwater Pipe (Existing) Stormwater Pipe (New) Stormwater Pipe (Future) Stormwater access chamber (exist—new) Stormwater gully (exist — new) Traffic Signals conduit (New)	S — S — S — S — S — S — S — S — S — S —	0.25 / 0.35 0.25 0.35 0.7 / 1.0 0.35 / 0.7 0.35 0.35	NOM. I Dia. Nominal pipe size Drain diameter to scale Drain diameter to scale

STREET LIGHTING

DESCRIPTION	SYMBOL	LINE THICKNESS	REMARKS		
Proposed S50 luminaire at 6.5m mounting height	<u>—</u> ф	0.35	Can be mounted on EP or LP		
Proposed S70 luminaire at 7.5m mounting height		0.35	Can be mounted on EP or LP		
Proposed S100 luminaire at 9.0m mounting height	I — ■ □	0.35	Can be mounted on EP or LP		
Proposed S150 luminaire at 9.0m mounting height	─ □	0.35	Can be mounted on EP or LP		
Proposed S250 luminaire at 10.5m mounting height		0.35	Can be mounted on EP or LP		
Existing light (MV)	-	0.35			
Existing light (HPS)	-	0.35			
Existing light to be removed	─ ,	0.35 / 0.5			
No. 4 preformed pit		0.35	QT pit		
Highmast		0.35	Size and light type to be nominated.		
Proposed m50 luminaire at 6.5m mounting height		0.35	Can be mounted on EP or LP		
Proposed nostalgia Luminaire on 4.5m column	♦ _{P3}	0.35	Underground supply only. Size and light type to be nominate		
Proposed post top Luminaire on 4.5m column	ф _Р	0.35	Underground supply only. Size and light type to be nominate		
TRAFFIC FURNITURE					
Traffic pit and conduit	TRP	0.25 / 0.35			
Traffic control box	TCB	0.25			
Traffic light	<i>σ</i> TRL	0.25	Boom, pillar		
Guide sign (Exist — new)	-	0.25 / 0.7	Add sign number with details at advance direction series.		
Standing sign (Exist — new)		0.25 / 0.7	Add sign number 👝		
Regulatory sign (Exist — new)	-0	0.25 / 0.7	Add sign number 👝		
Parking meter	♦ PKM	0.25			

Sign numbers are detailed in AS 1742.

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